2013

Liddell Coal Annual Environmental Management Report

CLIBBORN
ENVIRONMENTAL CONSULTING

Liddell Coal Annual Environmental Management Report – Revision 1

January - December 2013

Prepared for

Liddell Coal Operations Pty Ltd

Prepared by

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29 August 2014

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2013 AEMR

Name of mine:	Liddell Colliery		
Titles/Mining Leases	ML1597		
MOP Commencement Date	31/01/2008	**MOP Completion date**	31/05/2014
AEMR Commencement Date	01/01/2013	**AEMR End date**	31/12/2013
Name of leaseholder	Liddell Coal Operations Pty Ltd		
Name of mine operator (if different)			
Reporting Officer:	David Foster		
Title:	Operations Manager		

Signature:

Date: 24 March 2014

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1 Introduction

Liddell Coal, located in the Upper Hunter Valley, is operated by Liddell Coal Operations Pty Limited (LCO) under the conditions of development consent DA 305-11-01. This Annual Environmental Management Report (AEMR) has been prepared by Clibborn Environmental Consulting on behalf of LCO in accordance with the *Guidelines to the Mining, Rehabilitation and Environmental Management Process* (DPI, 2006) and Schedule 5, Condition 3 of the DA 305-11-01.

The AEMR is distributed to:

- the Department of Planning and Environment (DP&E);
- Department of Trade and Investment (DTI);
- Environment Protection Agency (EPA);
- Heritage Branch, Office of Environment and Heritage (OEH);
- NSW Office of Water;
- Singleton Council;
- Muswellbrook Shire Council; and
- LCO Community Consultative Committee

The reporting period for this AEMR extends from 1 January 2013 to 31 December 2013.

1.1 Background

Liddell Coal Operations (LCO) is an established open-cut mine located at Ravensworth, approximately 25 kilometres north-west of Singleton in the Upper Hunter Valley of New South Wales. LCO is operated and managed by Liddell Coal Operations Pty Limited, a wholly owned subsidiary of Glencore Coal Pty Limited (Glencore), on behalf of a joint venture between Glencore (67.5%) and Mitsui Matsushima Australia (32.5%).

Mining operations at Liddell Coal have been continuous since the 1950s. Operations prior to the 1950s were intermittent, with underground operations commencing in 1923 and open cut operations in 1946. Current open cut operations access the coal reserves previously not mined by the underground operations. The current open cut mining operation has been in operation since 1990.

An aerial photograph of the operation is shown in Figure 2.

During the reporting period mining operations were undertaken using the excavator and truck /shovel method of operation. LCO has consent to extract no more than eight million tonnes of run-of-mine (ROM) coal per annum. Product coal, both semi-soft and thermal, is transported to Newcastle Port by rail via the Hunter Valley Rail Loop and Main Northern Railway Line, for sale to the export market.

1.2 Consents, Leases, Licences and Other Approvals

A number of consents, leases, licences and other approvals regulate mining operations at LCO. The status of development consents, licenses and relevant approvals are listed in Table 1.

LCO operates primarily under one consolidated mining lease, ML 1597, as shown in Figure 3.

Compliance with the EPL is reported annually to the Office of Environment and Heritage (OEH) in the EPL Annual Return. LCO's compliance with the EPL is also discussed in Section 3.0 of this report.

1.2.1 Mining Operations Plan

There were no changes to the current approved Mining Operations Plan during 2013. During 2014 a MOP amendment will be submitted to allow for continued operations for a further 12 months or until a new MOP is required under the DA 305-11-01 Modification 5 application.

Figure 1 **Locality Map**

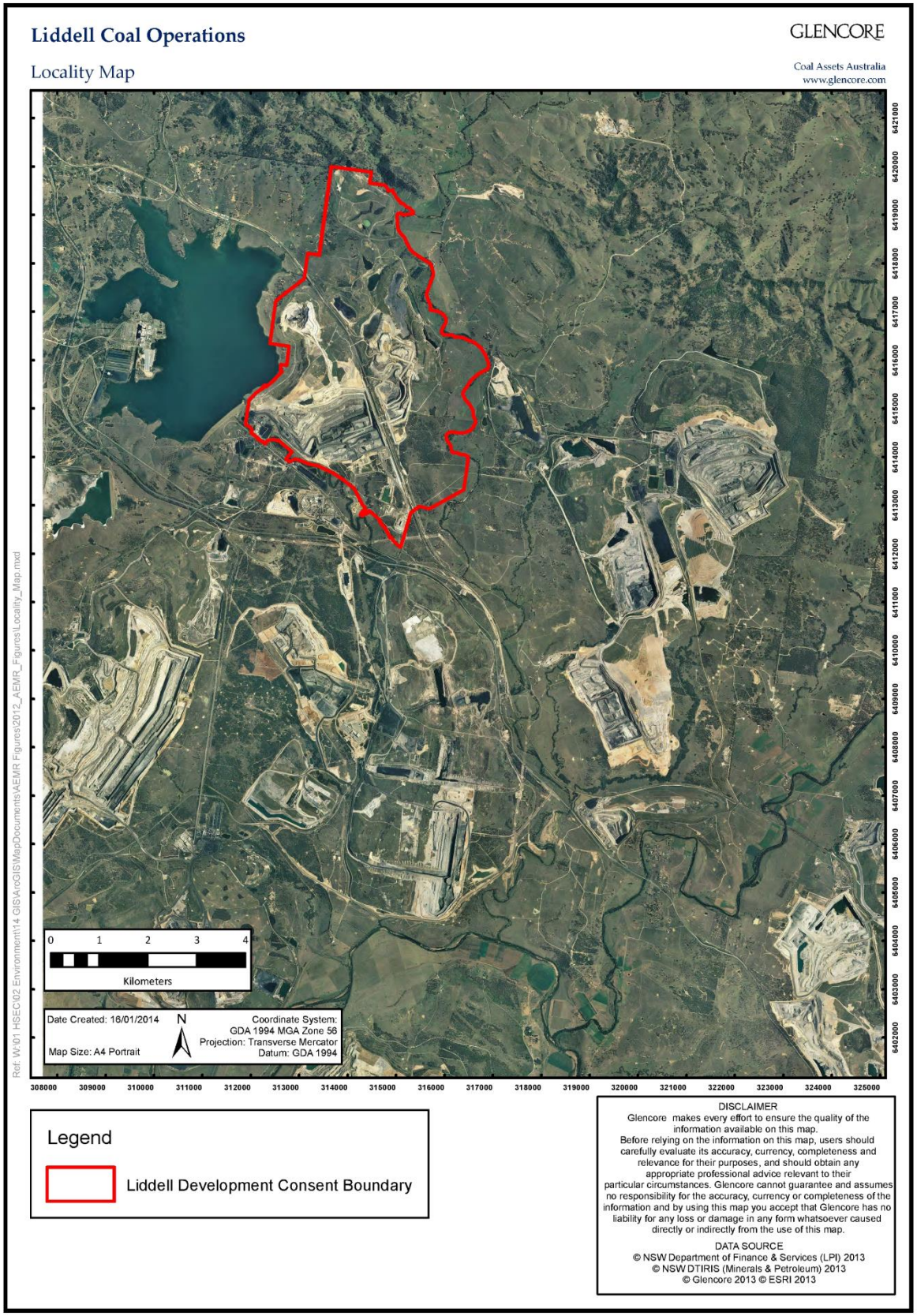

Figure 2 **Aerial Photographs of LCO 2013 –December 2013**

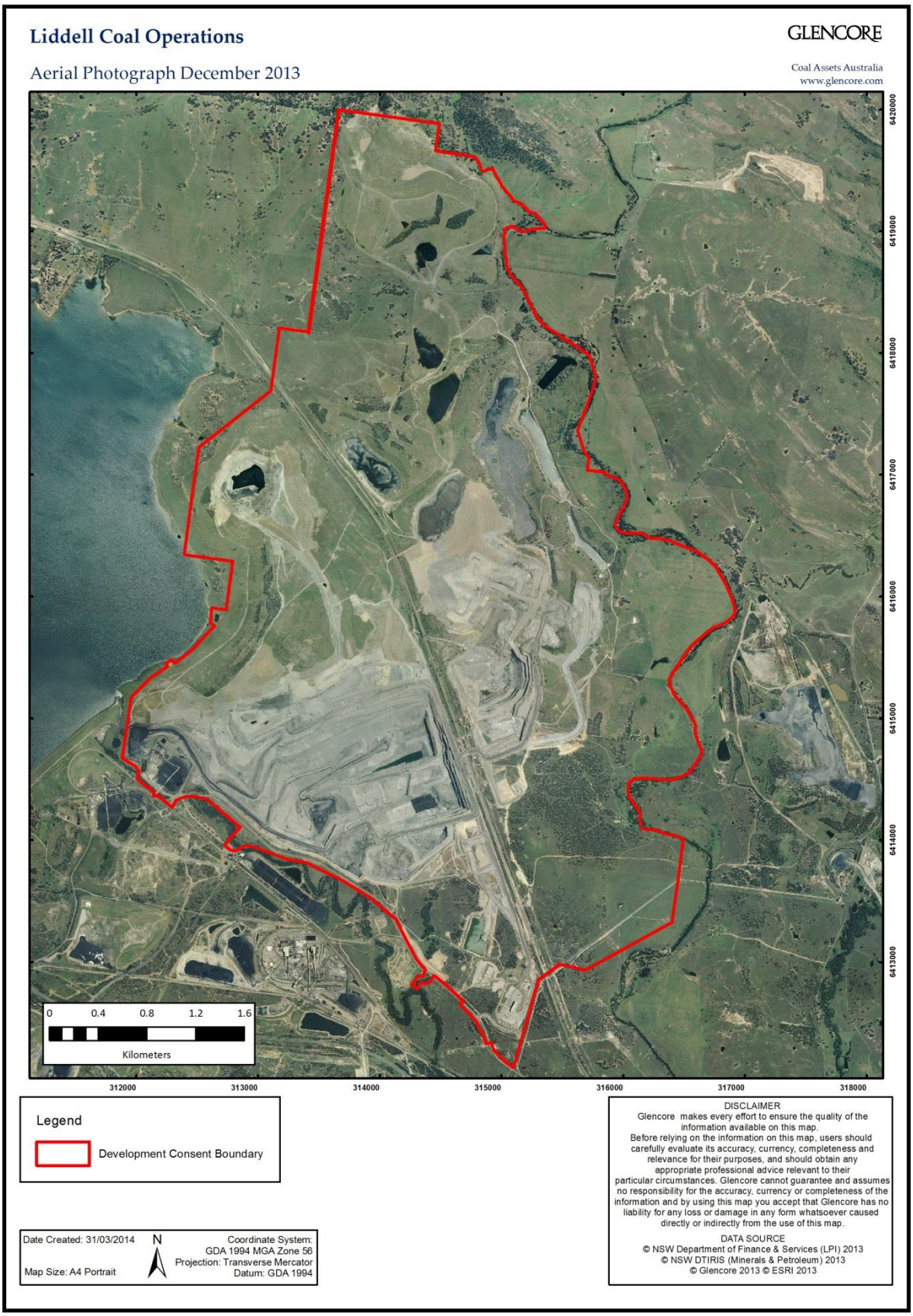

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Table 1 LCO development consents, leases, licences and other approvals

Development Consents		
Approval Number	**Description**	**Expiry Date**
DA 305-11-01	Continued operation of the Liddell Colliery	31 December 2023
DA 305-11-01 Modification	- Increase in the maximum total ROM coal production rate from 4.5 to 8 Mtpa tonnes per annum; - increase in the mining footprint within the approved South and Barrier Pits by a total of 47 hectares; - construction and operation of a new preparation section of the Coal Handling and Preparation Plant and minor upgrades to the ROM receival and product coal facility; - establishment of a new supplementary coal stockpile; - receival and delivery of up to 1.5 Mtpa of coal to and from Cumnock No. 1 Colliery; - increase in the maximum transportation rate of reclaimed tailings from 0.3 to 0.5 Mtpa to Macquarie Generation; - realignment of an already approved access road and services corridor relocation of part of the Old New England Highway; - relocation and construction of the open cut mining offices, workshops and associated infrastructure to the south eastern portion of the Liddell development consent area; - construction of a bridge over the Main Northern Railway to provide for more efficient movement of coal and overburden between open cut pits; and - modifications to the footprint and size of the already approved Dam 13B.	31 December 2023
DA 305-11-01 MOD 3	- Alterations to the approved intersection layout for the Old New England Highway/mine access road intersection; - minor realignment of the development consent boundary to accommodate the road works; - reuse of treated effluent from the office/workshop complex; and - corrections to numbering in the development consent.	31 December 2023
DA 305-11-01 MOD 4	Additions to the Mining Infrastructure Area including: - two additional high machinery workshop bays; - additional relocatable admin & workshop offices; - fuel farm extension; - storage shed and compound.	31 December 2023

Mining Leases		
Title	**Authority**	**Expiry Date**
Mining Lease 1597	DTIRIS	5 November 2028
Consolidated Coal Lease No. 708	DTIRIS	30 December 2023
Mining Lease No. 1313	DTIRIS	13 October 2023
Cumnock Sublease Mining lease No. 1552	DTIRIS	10 March 2025
Environmental Protection Licence		
Licence	**Description**	**Expiry Date**
EPL 2094	Environmental Protection Licence (File number 27051)	30 June (Anniversary Date) 7 September 2014 (Review Due Date)
Mining Operation Plan		
Name	**Commencement Date**	**Expiry Date**
Liddell Colliery Mining Operations Plan 2008 – 2015 (MOP)	31 January 2008	31 May 2014

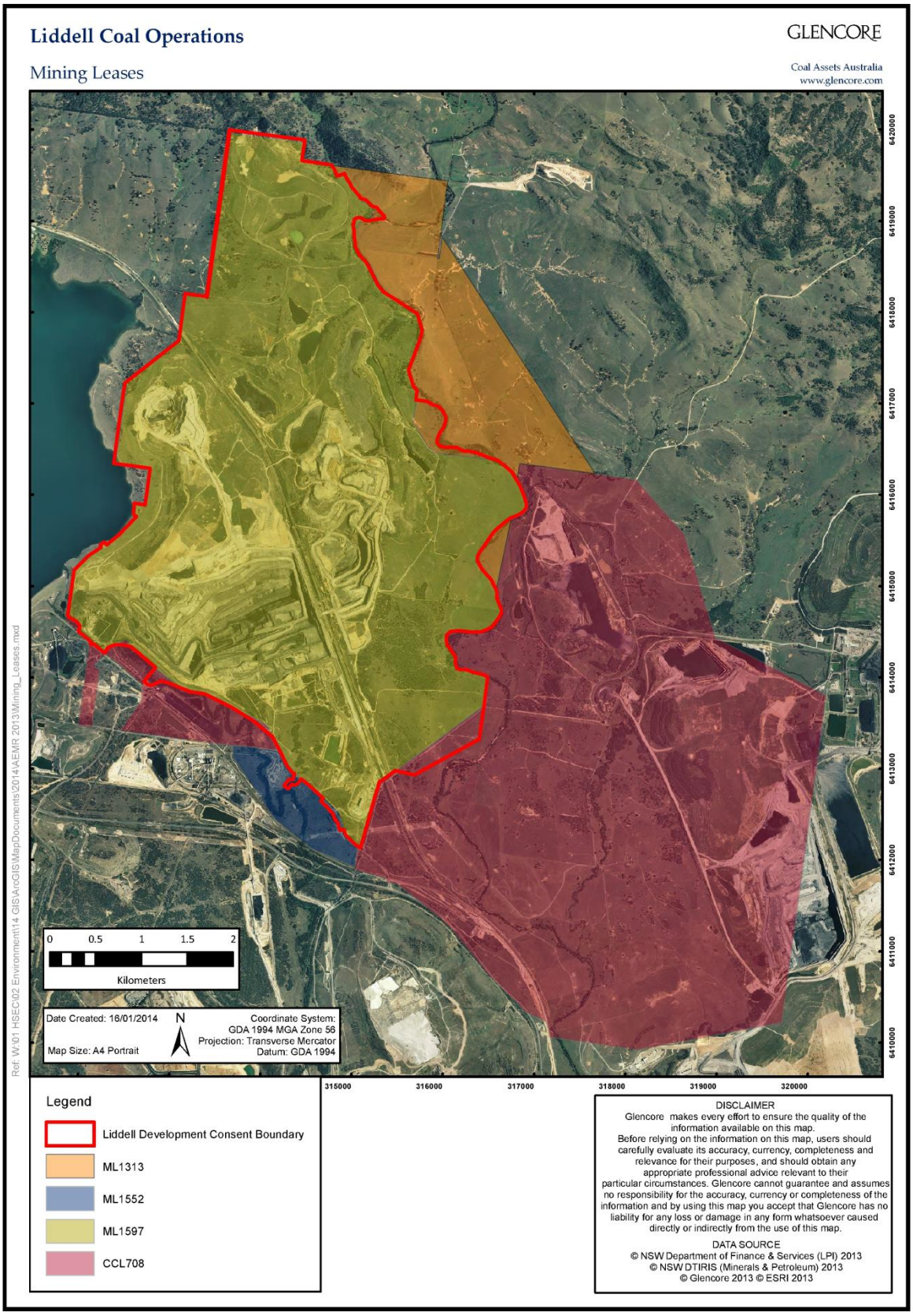
Surface Water Extraction Licences						
Locality	**Licence No.**	**Holder**	**Use**	**Water Source/ Management Zone/ Type**	**Annual Use (ML)**	**Annual Allocation (ML)**
Bowmans Creek	WAL 18320	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	Nil	50
Bowmans Creek	WAL18304	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	Nil	32
Bowmans Creek	WAL18318	Enex Foydell Pty Ltd	Irrigation	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	Nil	55
Bayswater Creek	WAL 18306	Mitsushima Australia Pty Ltd Enex Liddell Pty Ltd	Industrial (coal mining)	Jerrys Water Source/ Jerrys Management Zone/ Unregulated River	Nil	100
Hunter River via Macquarie Generation	WAL7815	Liddell Tenements Pty Ltd	Industrial	Hunter Regulated River Water Source/ Zone 1B Regulated River	Nil	20
Swamp Creek	20SL042837	LCO Pty Ltd	Monitoring		Nil	NA – Diversion Works

Groundwater Licences					
Locality	**Licence No.**	**Holder**	**Lot/DP**	**Purpose**	**Annual Extraction Allocation (ML)**
Haz 6	20BL168066	Liddell Tenements Pty Ltd	81/607296	Monitoring	N/A
Dur 3	20BL168065	Liddell Tenements Pty Ltd	31/837350	Monitoring	N/A
LC1	20BL168064	Liddell Tenements Pty Ltd	353/867083	Monitoring	N/A
Durham 1	20BL168063	Liddell Tenements Pty Ltd	33/862516	Industrial	6000
8 South 3 & 4	20BL168062	Liddell Tenements Pty Ltd	32/870789	Industrial	6000
Durham 2 & 4	20BL168061	Liddell Tenements Pty Ltd	3/237654	Industrial (2 bores)	1000
Haz 2	20BL168060	Liddell Tenements Pty Ltd	81/607296	Industrial (2 bores)	5500
ALV1, ALV2, ALV3, ALV4, ALV7, ALV8	20BL168053	LCO Pty Ltd	43/654013 201/848078	Test bore/ Monitoring	N/A
Bowmans Creek Alluvial	WAL18302	Liddell Southern Tenements Pty Ltd	32/545601	Irrigation	5
	20BL017861	Enex Foydell Limited	6/1077004	Irrigation	5
M49	20BL172293	Liddell Southern Tenements Pty Ltd	32/545601	Dewatering	2500 (Combined with 20BL168209)
Mt Owen 1	20BL168209	Mt Owen Pty Ltd	353/867083	Stock, domestic, farming and test purposes	2500 (Combined with 20BL172293)
Mt Owen 2	20BL169544	Mt Owen Pty Ltd	353/867083	Dewatering	2500
Middle Liddell	20BL172588	LCO Pty Ltd	1/237766	Dewatering	6000

Aboriginal Heritage Permits			
Licence	**Site**	**Salvage Date**	**Expiry Date**
#2348 (dated 7 August 2007)	Chain of Ponds Site Area (LID 28, 29, 30, 31, 32)	21, 22, 23 November 2006	3 October 2016
S87 #2883 S90 #2896	Bayswater Creek	March/April 2008	18 February 2010 18 March 2020

Radiation Density Gauge Licences				
Radionuclide	**EPA Registration Number**	**Nominal Activity**	**Serial Number**	**Expiry Date**
Am-241	RR1259	12 GBq	2338LG	23/06/2014
Cs-137	RR1260	370 MBq	FL542	23/06/2014
Cs-137	RR20148	370 MBq	PS838	1/12/2014
Cs-137	RR20152	7.4 GBq	PS837	1/12/2014
Cs-137	RR20153	7.4 GBq	PS836	1/12/2014
Licence #RL28136 (Possess Radioactive Apparatus & Substances)				24/06/2014

Figure 3 **Mining Leases**



1.3 Mine Contacts

The contact details for the personnel directly responsible for the environmental management of the LCO are shown in Table 2.

Table 2 Mine Contacts

Name	Position	Company	Contact Numbers
David Foster	Operations Manager	Liddell Coal Operations	(02) 6570 9919 (M) 0459 168 589
Murray Gregson	Mining Manager	Liddell Coal Operations	(02) 6570 9964 (M) 0447 886 810
Ben de Somer	Environment and Community Superintendent	Liddell Coal Operations	(02) 6570 9947 (M) 0427 936 734

1.4 Actions Required at Previous AEMR Review

DRE and DP&E conducted a site inspection on 22 July 2013 following a review of the previous AEMR. In follow up letters received from DP&E on 26 July 2013 and DRE on 19 September 2013, regarding the 2012 AEMR and the previous inspection, a number of issues were raised that required rectification in the 2013 AEMR. While general compliance was observed during the site inspection, the actions in Table 3 below were identified by DRE and DP&E as requiring attention.

Table 3 Actions required at Previous AEMR Review

Action Number	Issue/Observation	Action	Action Achieved
1	AEMR Reporting	1. Tailings management must be fully reported in the AEMR, detailing strategy, inspections and monitoring, responsibilities, operation, disposal, quantities, capacities and events. 2. The management of contaminated material and the bioremediation area must be fully reported in the AEMR detailing strategy, inspections and monitoring, responsibilities, operation, disposal, quantities, capacities and events. 3. Section 5 (Rehabilitation) must be fully addressed in the AEMR.	1. See section 2.6 of this AEMR 2. See section 2.7 of this AEMR 3. Section 5 reviewed and amended and is now in accordance with Section 5 of edg03 mremp guideline.
2	Rhodes Grass dominating rehabilitation areas	1. The company is to develop a strategy to manage Rhodes Grass which is consistent with final landuse outcomes. 2. The company is to review seed mix to prevent Rhodes Grass domination.	1. See section 5 of this AEMR 2. See table 5.1 of this AEMR
3	Rehabilitation areas damaged by vehicles	The company is to review and update procedures to prevent further damage.	See section 5
4	Liddell Workshop Area inappropriate management of a portable self bunded	The portable self bunded pallet which contained water was dewatered following the inspection. All self bunded pallets are now included as a part of the weekly waste contractor inspection to determine dewatering requirements. Where possible all self bunded pallets are kept undercover.	See section 2.7.2
5	Rehabilitation South Pit/grazing area weed management	A weed management strategy was developed and implemented during 2013 for the control of targeted weed species in both rehabilitation and grazing areas.	See section 5.5

6	Antiene Void long term liability	A number of strategies are currently being assessed for the capping of the Antiene tailing dam. During 2013, testing and monitoring program for the Antiene Tailings Emplacement Area identified it was not suitable for rehabilitation to commence.	See section 2.6.1

1.5 Compliance summary

This AEMR has been prepared to address all relevant conditions of the LCO Approval DA 305-11-01. The requirements relating to the AEMR as set out in DA 305-11-01 are summarised in Table 4, which also indicates where each condition is addressed in this AEMR.

Table 4 DA 305-11-01 Conditions relating to the AEMR

Condition	AEMR Section
Schedule 3, Condition 27 **Groundwater Monitoring** The Applicant shall regularly monitor: (a) the volume of groundwater seeping into the open cut mine workings; (b) regional groundwater levels and quality in the surrounding aquifers; (c) the groundwater pressure response in the surrounding coal measures; and (d) report the results of this monitoring in the AEMR, to the satisfaction of the Director-General.	3.8 Appendix F
Schedule 3, Condition 42 **Monitoring of Coal Transport** The Applicant shall: (a) keep records of the: • amount of coal transported from the site each year; and • number of coal haulage train movements generated by the development (on a daily basis); and (b) include these records in the AEMR.	Section 2.5 Appendix A
Schedule 3, Condition 46 **GREENHOUSE GAS** **Monitoring and Reporting** The Applicant shall: (a) monitor the greenhouse gas emissions generated by the development; (b) investigate ways to reduce greenhouse gas emissions generated by the development; and (c) report on greenhouse gas monitoring and abatement measures in the AEMR, to the satisfaction of the Director-General.	Section 3.18
Schedule 3, Condition 47 **WASTE MINIMISATION** The Applicant shall: (a) monitor the amount of waste generated by the development; (b) investigate ways to minimise waste generated by the development; (c) implement reasonable and feasible measures to minimise waste generated by the development; (d) ensure irrigation of treated wastewater is undertaken in accordance with DECC's Environmental Guideline for the Utilisation of Treated Effluent; and (e) report on waste management and minimisation in the AEMR, to the satisfaction of the Director-General.	Section 2.7

Condition	AEMR Section
Schedule 5, Condition 3 **ANNUAL REPORTING** Each year, the Applicant shall prepare an AEMR to the satisfaction of the Director-General. This report must: (a) identify the standards and performance measures that apply to the development; (b) describe the works carried out in the last 12 months; (c) describe the works that will be carried out in the next 12 months; (d) include a summary of the complaints received during the past year, and compare this to the complaints received in the previous 5 years; (e) include a summary of the monitoring results on the development during the past year, (f) include an analysis of these monitoring results against the relevant: • limits/criteria in this consent; • monitoring results from previous years; and • predictions in the EA noted in condition 2(i) of Schedule 3;	This document Section 3.0 Section 2.0 Section 6.0 Section 4.1 Section 3.0 Section 3.0
(g) identify any trends in the monitoring over the life of the development; (h) identify and discuss any non-compliance during the previous year; and (i) describe what actions were, or are being, taken to ensure compliance	Section 3.0 Section 3.0 Section 3.0
Schedule 5, Condition 10 **ACCESS TO INFORMATION** Within 3 months of the approval of any plan/strategy/program required under this consent (or any subsequent revision of these plans/strategies/programs), or the completion of the audits or AEMRs required under this consent, the Applicant shall: (a) provide a copy of the relevant document/s to the relevant agencies; (b) ensure that a copy of the relevant document/s is made publicly available at the mine; and (c) put a copy of the relevant document/s on its website.	Section 4.0
Appendix 5 Statement of Commitment 1.45 **Annual Reporting** Details of the Liddell operations including compliance with the Conditions of Consent will continue to be reported annually in an Annual Environmental Management Report (AEMR)	This document

1.6 Key Performance Indicators for Liddell Coal Operations

Table 5 provides an overview of the key performance indicators for LCO during the reporting period.

Table 5 Key Performance Indicators for LCO for the reporting period

Economic Indicators	Target	Actual
Coal ROM (Kt)	7,122	7,124
Employees	334	306
Environmental Indicators		
Land area rehabilitated during reporting period (ha)	51	61
Potable water consumed (ML)	3.9	3.85
Average annual deposited dust range (private residence)	4 g/m^2/month	<2 g/m^2/month
Total Suspended Particulate (annual average) exceedances	Nil	Nil
PM_{10} dust exceedances (annual average) due to LCO activities	Nil	Nil
Percentage of noise samples exceeding criteria	Nil	Nil
Number of blasts exceeding criteria	Nil	1 – Chain of Ponds
Social Indicators		
Complaints	5	3

2 Summary of Operations during 2013

2.1 Exploration

During 2012 and 2013, LCO undertook a drilling exploration program across Mining Lease 1597 consisting of two exploration holes during this 2013 reporting period. The primary purpose of the exploration holes was to improve the geological knowledge of the area and resources/reserves within the lease area. Table 6 provides summary details of the two exploration holes.

Table 6 Summary of exploration holes

Borehole ID	Drilling Duration		Eastings	Northings	Collar RL	Depth
	Commencement	Completion			(m)	(m)
FYC1261	14-Dec-12	10-Jan-13	314645.691	6413144.879	92.231	207.41
FYC1262	14-Jan-13	22-Jan-13	314705.216	6412796.165	100.892	213.48

The findings of the program was reported in line with the Joint Ore Reserves Committee (JORC) Code and exploration activities were carried out using LCO's exploration drilling and land clearing procedures. The sites for the exploration holes were selected to minimize clearing and disturbance impacts and upon drilling and capping completion, the site were rehabilitated.

Rehabilitation works were completed including seeding of cleared areas. See Figures 4 and 5 for pre and post drilling site photos.

Figure 4 Image of drill site FYC1261 prior to drilling works (left) and immediately after drilling operations (right)

Figure 5 Image of drill site FYC1262 prior to drilling works (left) and immediately after drilling operations (right)

2.2 Land Preparation

Land preparation at LCO is undertaken generally in accordance with the LCO MOP. Land preparation ahead of mining operations involves the construction of appropriate erosion and sediment control structures, the clearing of vegetation and stripping and stockpiling of topsoil. Clearing activities consist of flora, fauna and archaeological assessment of the area; mulching of non-habitat vegetation (the mulch is left on the ground surface and recovered during topsoil salvage works); preservation of suitable habitat features and erosion and sediment controls.

2.2.1 Clearing

Vegetation clearing is undertaken in accordance with the LCO Environmental Procedure for Site Clearing and the control measures outlined in the Environmental Assessment for Modification to Liddell Coal Development Consent (EA). The major measures implemented for controlled clearing under this Procedure are described below.

Clearing operations are planned, designed and completed with the aim of minimizing the impact to flora and fauna as much as practicable. To achieve this aim LCO completes preclearance due diligence flora and fauna survey's, stages the clearing activities to smallest practical areas, preserves suitable habitat features, utilizing appropriate erosion and sediment controls and various other measures. Land disturbance is minimized by clearing the smallest practical area of land for the shortest possible time. This is achieved by:

- limiting the cleared width to that required to accommodate excavation plus areas required for access, overburden emplacement and topsoil stockpiling; and
- programming the works so that only the areas which are actively being excavated are cleared.

Pre clearance surveys are completed of each proposed disturbance are by a suitably qualified ecologist to identify any threatened species habitat trees or other features with potential to provide habitat for threatened fauna. Potential trees/features are inspected to gain visual access to all limbs and trunks with all suitable habitat clearly demarcated and preservation/salvage opportunities determined.

Suitable habitat features such as hollow bearing tree trunks are salvaged and strategically incorporated into existing rehabilitation areas.

Clearing of vegetation was undertaken so as to minimise the likelihood of harming native fauna species and as a consequence the following procedures were followed:

- non-habitat vegetation was cleared in the days leading up to habitat tree felling so as to discourage fauna from the area;
- supervision was undertaken by a suitably qualified and experienced Ecologist;
- the identified habitat tree was shaken vigorously with heavy machinery 24hrs and immediately prior to felling to allow and encourage fauna to leave the area;
- the machinery operator pushed the tree over as slowly as possible under the instruction of the Ecologist to avoid damage caused by the intensity of impact when hitting the ground; and
- the felled tree was inspected by an ecologist for signs of trapped or injured fauna.

During the reporting period, a total of 28 potential habitat trees were felled with approximately 12 suitable for salvage. The salvaged habitat was relocated and incorporated into the Blue Billed Duck Pond Rehabilitation Area onsite. While felling these potential habitat features;

- five tree skinks (egernia striolata) were displaced of which four were relocated and one escaped;
- four juvenile common mynas (acridotheres tristis) were displaced, these were all humanely euthanized by the ecologist considering their age and unlikeliness to survive in care;
- one black shouldered kite (elanus axillaris) was displaced and flew away.

Erosion and sediment control measures are implemented in advance of, or in conjunction with clearing operations to control and manage dirty water.

The mulched vegetation product is left on the ground surface to assist in erosion protection and be incorporated into the topsoil resource. This provides excellent nutrient matter and improves the quality of the topsoil resource significantly.

2.2.2 Topsoil Stripping and Handling

Approximately 42 hectares of topsoil was removed ahead of open cut mining during the reporting period. The topsoil was stockpiled as per LCO *Land Clearing and Topsoil Stripping Procedure* (October 2012) and a portion was recovered and used in rehabilitation during the reporting period and the remaining stockpiled for future use.

To ensure topsoil is managed effectively at LCO:

- soils are stripped as much as practicable in optimum moisture conditions, not in wet or dry conditions;
- stripped material is placed directly onto reshaped overburden and spread where possible;
- soils are strategically located in stockpiles not exceeding three metres in height; and

- stockpiles are sown and fertilised as soon as possible to prevent weed growth.

2.3 Construction

During the reporting period there were a number of construction projects undertaken in accordance with the approved MOP and DA305-11-01. This included the construction of new sediment dams, known as the Entrance Pit and Chain of Ponds dams to manage dirty water runoff from pre-strip progression in the South Pit and Entrance Pit mining areas. The existing Durham Void (northern extent of the South Pit) commenced as a tailings emplacement area as per the associated s100 approval (known as the Durham Tailings Emplacement Area). As a result of the mine progression, the Licensed Discharge Point (LDP2) was relocated further downstream on Chain of Ponds Creek as per the EPL2094 license variation (1518698). Two new in pit water cart fill points were also installed to allow for mine progression.

The Entrance Pit and Chain of Ponds sediment dams were constructed as a result of a new disturbance footprint created by progression of the mine. These dams were constructed in accordance with the sites Landscape Management Plan and the *Managing Urban Stormwater: Soils and Construction Manual* (Landcom, 2004). The Entrance Pit and Chain of Ponds sediment dams have a designed capacity of 11.6ML and 29.049ML respectively.

As a part of long term mine planning the Durham void was converted into a tailings storage facility during 2013. Tailings emplacement began late 2013. The Durham Tailings emplacement is estimated to have capacity for 3.85 million m^3 of tailings through to 2018, and it will be rehabilitated in accordance with Liddell's approved MOP.

Two water cart fill points were also relocated to allow for mine progression, efficient dust control management and flexibility with fire fighting capabilities. One is located in South Pit adjacent to the coal handling preparation plant and the other is located on the southern side of South Pit adjacent to the Link Road (main haul road linking the MIA to the mining area).

2.4 Mining

DA 305-11-01 allows for the use of three mining methods at LCO; truck and excavator, dragline, and high wall mining (utilising an auger or continuous mining). Following the vegetation and topsoil stripping process discussed above, any weathered material is removed using excavators, bulldozers and trucks depending on its thickness, hardness and the competency of underlying strata. The area is then prepared for overburden blasting by creating a flat bench to permit drill rig access. Holes are drilled into the overburden in a designated pattern giving strict attention to the angle, depth and spacing of holes. Bulk explosive products are placed into the holes and detonated in a controlled sequence in order to break up the rock strata.

The blasted overburden is loaded into rear dump trucks to be transported to either out-of-pit emplacement areas or backfilling in-pit completed sections. The haul roads are maintained using dozers, graders and water carts to minimise dust generation and provide a safe working roadway. Following removal of the overburden to emplacement areas, the exposed coal is mined using hydraulic excavators. The coal is loaded into haul trucks for transport along internal haul roads to the ROM stockpile located in the CHPP area.

2.4.1 Mining Operations during 2013

Mining at LCO is primarily undertaken using hydraulic excavators and trucks, which allows the flexibility required to work within relatively small multiple pits that are constrained from expansion by the Main Northern Railway Line, Bowmans Creek and Bayswater Creek. The truck and excavator technique is also suitable for recovering multiple coal seams. Recovery of coal within previously underground mined areas is best achieved using an excavator enabling selective recovery of coal and waste from within the underground workings. Table 7 below contains a list of typical mining equipment in operation at LCO.

Mining activities were carried out generally in accordance with the Liddell Coal MOP. During the reporting period active mining areas included South Pit and the Entrance Pit. During 2013, the Durham Pit was being converted to a tailings emplacement area. Figure 6 identifies the key site features including operational area, infrastructure and other notable features.

No mining was undertaken during 2013 utilising either dragline or high extraction methods.

Table 7 LCO Mining Equipment Fleet

Type	Model	Capacity	No units	Function
Hydraulic Shovel	Hitachi EX8000	43m³	1	Overburden
Hydraulic Excavator	Liebherr R996	36m³	2	Overburden
Hydraulic Excavator	Liebherr R9400	22m³	3	Coal and Partings
Rear Dump Truck	Hitachi EH5000	300t	18	Overburden
Rear Dump Truck	Caterpillar 789C	180t	12	Coal and Partings
Rear Dump Truck	Caterpillar 793C	224t	2	Coal and Partings
Loader	Caterpillar 992G	12m³	1	Coal Handling and Prep
Track Dozer	Caterpillar D11R	N/A	3	Coal Handling and Prep
Track Dozer	Caterpillar D11R	N/A	1	Ancillary
Track Dozer	Caterpillar D11R	N/A	1	Rehabilitation
Track Dozer	Caterpillar D10T	N/A	9	Ancillary
Rubber Tyred Dozer	Caterpillar 854K	N/A	1	Ancillary
Drill	Terex Reedrill SKF50	229mm	3	Overburden, Coal and Partings
Grader	Caterpillar 24M	N/A	1	Ancillary
Grader	Caterpillar 16M	N/A	2	Ancillary
Grader	Caterpillar 16G	N/A	1	Ancillary
Water Truck	Caterpillar 777F	70kL	4	Ancillary
Service Truck	Caterpillar 775F	25kL	2	Ancillary
Service Truck	Volvo FM	24kL	1	Ancillary

LCO have approval for production of 8.0Mt of coal per year. A summary of coal production and waste material production for the previous, current and next reporting period is provided in Table 8.

Table 8 Production and Waste Summary

Material	DA 305-11-01	Previous Reporting Period		Current Reporting Period	Next Reporting Period (estimated)
	Approval limits	July 2011 – December 2011	January 2012 – December 2012	January 2013 – December 2013	January 2014 – December 2014
Topsoil stripped (m^3)	N/A	38,102	33,520	42,000	88,000
Topsoil used/spread (m^3)	N/A	53,000	33,420	51,000	60,000
Waste rock (m^3)	N/A	41,703,918	39,100,464	39,209,255	39,975,062
ROM Coal (tonnes)	8,000,000	6,824,944	6,868,258	7,123,490	6,763,365
Processing waste (coarse and fine reject) (tonnes)	N/A	2,232,414	2,227,300	2,413,377	2,353,043
Product coal (tonnes)	8,000,000	4,610,603	4,509,770	4,710,113	4,410,322

Figure 6 **Map of key site features**

2.4.2 Forecast production for 2014

Open cut operations in the 2014 reporting period are expected to produce 6,763,365 tonnes of ROM coal, producing 2,353,043 tonnes of reject and 4,410,322 tonnes of product coal with a yield of approximately 65.2%.

2.5 Coal Handling

2.5.1 Coal Stockpiles

Coal is transported from the open cut areas by truck to a ROM stockpile with an approximate capacity of 200,000 tonnes for storage prior to processing in the CHPP. Coal is also stockpiled in a supplementary stockpile, adjacent to the ROM stockpile, which has a capacity of up to 450,000 tonnes. Coal types placed on this stockpile are selected for their low propensity to spontaneously heat. Both these stockpiles are created using rear dump trucks and dozers.

2.5.2 Processing Throughput

Coal is recovered from the stockpiles using a loader or dozer to transport into the adjacent ROM dump bin. Coal is then transferred onto a feed conveyor, through a rotary breaker or sizer and then onto a conveyor, which transfers the ROM coal to the CHPP. The coal is then crushed, sized, washed, screened, rinsed and dewatered, with a product yield of approximately 70%.

The CHPP produces both semi soft coking coal and thermal coal. The CHPP operates 24 hours a day, seven days a week, with the exception of downtime due to maintenance (generally 10 to 12 hours each fortnight). The CHPP has a processing capacity of 8 Mtpa following upgrades made to the plant in 2008.

The total ROM coal processed at Liddell's CHPP during the 2013 reporting period was 7,123,490 tonnes (refer Table 8). The total product coal produced was 4,710,113 tonnes with 2,413,377 tonnes of coarse and fine rejects generated.

2.5.3 Product Coal Sale and Transport

Following processing by the CHPP, the product coal (including semi-soft coal and thermal coal) is stockpiled separately in product stockpiles, with an approximate combined capacity of 400,000 tonnes. The product coal stockpiles are formed by dumping coal off an overhead conveyor belt and coal is recovered by an underground reclaim tunnel through valves for train loading to the Port of Newcastle.

In accordance with condition 38 (b) of DA 305-11-01, transport of ROM coal to and from Cumnock No. 1 Coal is restricted to internal mine haul roads, Pikes Gully Road and Liddell Station Road. No ROM coal was received from or transported to Cumnock No. 1 Coal during this reporting period.

During the reporting period, 4,632,000 tonnes of product coal including export thermal coal and export semi soft coal were railed to the Port of Newcastle by trains along the Main Northern Railway Line.

In accordance with Schedule 3, condition 42 of DA 305-11-01, LCO monitored coal haulage movements as part of standard operations. LCO generated 510 loaded coal haulage train movements during the reporting period. Daily train haulage movements are presented in Appendix A. There was no sales of tailings during the reporting period and no truck movements for the transportation of tailings along the New England Highway.

2.6 Tailings and Rejects Management

The processing of ROM coal in the CHPP produces both tailings and coarse rejects. This section details the tailings and rejects management strategy employed by LCO.

2.6.1 Tailings and Rejects Management Strategy, Operation and Disposal

Tailings and reject production is dependent on a number of factors including the source coal seam, seam section, in-pit mining conditions, out of seam dilution, stockpile weathering prior to washing, and weather conditions during and prior to mining. The amount of tailings produced from the LCO CHPP is in the order of approximately 9% of ROM coal processed. Coarse rejects generated from the LCO CHPP are in the order of 26% of ROM coal processed, and consist of carbonaceous shale, mudstone and claystone, with minor coarser rocks such as siltstone and sandstone. Coarse rejects are co-dispersed into the overburden dumps in layers to minimise the risk of spontaneous combustion. Carbonaceous shale in the coarse rejects has a very low spontaneous combustion potential. LCO caps coarse rejects with at least 1m of inert material however have never experienced spontaneous combustion issues with this material.

Under DA305-11-01, up to 0.5 Mtpa of tailings reclaimed from LCO can be sold to Macquarie Generation, with the actual annual rate depending on the moisture content of tailings in situ, and the energy content after mining, recovery, drying and screening. The tailings are to be transported in haul trucks via Pikes Gully Road underpass and a merging lane to the New England Highway to the nearby power station at a rate of no more than 114 truck movements per day, 5 days per week. No transportation of tailings to Macquarie Generation occurred during 2013.

LCO has approval to dispose of tailings in the Antiene, Reservoir West, Reservoir South and the Railway fines (now referred to

as the Durham Tailings) emplacement areas. The Antiene tailings dam has reached capacity and use of this void as an active tailings emplacement area ceased in August 2009. A number of strategies are currently being assessed for the capping of the Antiene tailing dam. Deposition into the Reservoir South Tailings Dam will be completed in 2014. Deposition into the Reservoir West Tailings Dam was completed in December 2013.

The Durham Tailings Dam is the only active tailings dam at Liddell with approximately 2.9million m^3 of capacity remaining. The Durham Tailings emplacement is estimated to have capacity for 3.85 million m^3 of tailings through to 2018, with a potential additional 2 million m^3 available within the existing void from 2019-2020, subject to further detailed design. Tailings quantities produced at the onsite CHPP are summarised in the below Table 11.

In order to assist in settlement of the tailings, free standing water is pumped from the surface of the tailings dams when required. A trailer pump is rotated between the three inactive tailings dams and water is syphoned off when it is a suitable depth.

Water in the Durham Tailings Dam is managed through secondary flocculation and decant ponds. Flocculent is mixed with the tailings at the tailings pipe outlet to increase solids density. Water then filters through the decant structures and is then pumped to the mine water storage dams.

Table 9 below shows indicative timeframes for capping and final rehabilitation for each facility. Yellow cells indicate active deposition.

Table 9 Capping and Rehabilitation Time Frames

	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
RTEA (Res Sth & Res West)					Rehab	Rehab				
Durham									Rehab	Rehab
Antiene North			Rehab	Rehab						

Liddell Coal Operations has been liaising with the Department of Trade and Investment since November 2012 regarding the development and submission of detailed decommissioning plans for approval relating to the Antiene Tailings Dam. LCO has met with Tim Martin (Mine Safety Officer) to discuss and inspect tailings emplacement facilities. At that meeting LCO tabled a draft proposal to complete geotechnical analysis and develop detailed decommissioning plans for approval. LCO has committed to submit decommissioning plans for the Antiene Tailings Dam to the NSW DTI by the end of 2014 with an intention to commence work in 2016.

2.6.2 Inspections, Monitoring and Responsibilities

The tailings emplacement and associated infrastructure are managed to NSW Dams Safety Committee (DSC) Guidelines relating to mine and tailings dams and relevant legislation such as The Mining Act 1992, Dam Safety Act 1978, Environmental Planning and Assessment Act 1979.

Tailings dams, pipelines and associated infrastructure are inspected and monitored frequently to ensure integrity and operation effectiveness. Pipeline flow meters provide leak detection in real time.

The structural integrity of the dam is inspected routinely by competent persons holding accreditation under the NSW Dams Safety Committee. Further, geotechnical surveys and assessments are completed regularly.

See Table 10 for a brief outline of the roles and responsibilities of key personnel involved with tailings management.

Table 10 Outline of Tailings Management Key Personnel

Role	Responsibilities
Operations Manager	Overall operation, maintenance and integrity of the facility. Allocate appropriate resources to implement appropriate emplacement management.
Manager Mining Engineering	Development and implementation of safe systems of work. Establish competency criteria.
Technical Services Manager	Conduct six monthly assessments on emplacement activities. Arrange independent engineering assessments as required.
Coal Preparation Plant Manager	Ensure adequate resources are available to monitor the operation and maintenance of the tailings pipeline and emplacement area.
Competent Persons	Coordinate and complete activities in accordance with the safe systems of work. Complete and record inspections as required. Facilitate inspections by suitably qualified personnel as required.

2.6.3 Tailings Quantities and Capacities

Table 11 Tailings Quantities

Tailings Quantities	Current Reporting Period	Next Reporting Period
	January 2013 – December 2013	January 2014 – December 2014
Coarse Rejects (tonnes)	1,729,231	2,3543,043
Fine Rejects (Tailings) (tonnes)	991,795	

2.6.4 Tailings Events

There were no reportable tailings incidents during 2013.

2.7 Waste Management

LCO implement the waste management hierarchy established under the Waste Avoidance and Resource Recovery Act 2001. The hierarchy is recognised both nationally and internationally as the desired approach to waste management. The hierarchy focuses on developing resource management options against the following priorities, from most desirable to least desirable:

1. Avoidance - including actions and best practice environmental options to reduce the amount of waste generated by LCO.
2. Resource recovery - including best available techniques reuse, recycling, reprocessing and energy recovery, consistent with the most efficient use of the recovered resources.
3. Disposal - including management of all disposal options in the most environmentally responsible manner.

Reusable and recyclable material that can be found at LCO includes, but isn't limited to:

- Waste oil and grease;
- Comingled Recyclables (paper, cardboard, aluminium cans, plastic);
- Scrap steel and G.E.T. (Ground Engaging Tools);
- Timber pallets;
- Oil and Air filters;
- Tyres;
- Batteries; and
- Effluent.

LCO identified a recycling target of 86% of waste recycled for 2012, with an aim to increase this to 91% of waste recycled by the end of 2014. During 2013, 88.60% of waste was recycled.

2.7.1 Sewage Treatment and Disposal

Sewage generated by the CHPP and associated workshop and offices is collected in the CHPP sewage treatment tanks, and pumped to the aerated sewage treatment plant prior to disposal at the designated effluent irrigation area. Where required from the results of a regular inspection program, deactivated sludge from the treatment plant is periodically removed by a licensed contractor for disposal.

Sewage generated by the office and workshop complex is treated by a waste water treatment system to a quality suitable for human contact. The treated effluent is pumped to the sites main mine water storage (Raw Water Transfer Void) for re- use in the mine water system (see Section 2.7). The Liddell Coal Crib Huts are serviced on a weekly basis.

Both waste water treatment plants are regularly maintained and sampled by a qualified contractor and maintenance reports submitted to local government authorities as required.

2.7.2 Fuel and other Chemical Containment

Fuel, lubricants and waste oil for the open cut operations are stored in a bulk fuel area at the new office and workshop complex, which consists of five tanks with capacities up to 110 kL. The bulk fuel storage area is bunded and linked to an oil water separator located nearby.

The fuel, lubricants and waste oil for the CHPP is stored within two tank farms located adjacent to the CHPP workshop. Both tank farms are contained within a concrete bund.

Minor storages of chemicals and fuels in the workshop area may be temporarily stored on bunded pallets for accessibility and short term storage purposes. These self bunded pallets are inspected weekly by a licensed waste contractor and maintained as required.

The waste oil tanks located on site are also inspected weekly and are emptied by licensed contractors as required. All storage of fuels and chemicals is conducted in accordance with LCO's Sustainable Development Procedure Hazardous Substances and Dangerous Goods LCO SD PRO 0071.

2.7.3 Oil and Grease Containment and Disposal

Oil and grease containment and disposal is managed by two different systems, one system at the open cut operations and the second system at the CHPP workshop washdown facilities.

Rainfall runoff from the re-fuelling bays and tank farm bund at the open cut operations site is directed into a large capacity first flush holding tank and through a small secondary oil water separator. The treated water released from the oil water separator is stored in a designated on site dam. The oil refuse is disposed of by a licensed contractor on a monthly basis.

The second oil water separator is located adjacent to the workshop wash down and refuelling area at the CHPP. The rainfall and wash down runoff is reticulated via grit traps to a first flush holding tank prior to controlled flow through the oil water separator. If excess runoff overflows from the first flush tank, the water passes directly to the retention dam adjacent to the diesel workshop before being reused by the CHPP.

Oily water collected on site is removed by a licensed waste reduction and disposal contractor.

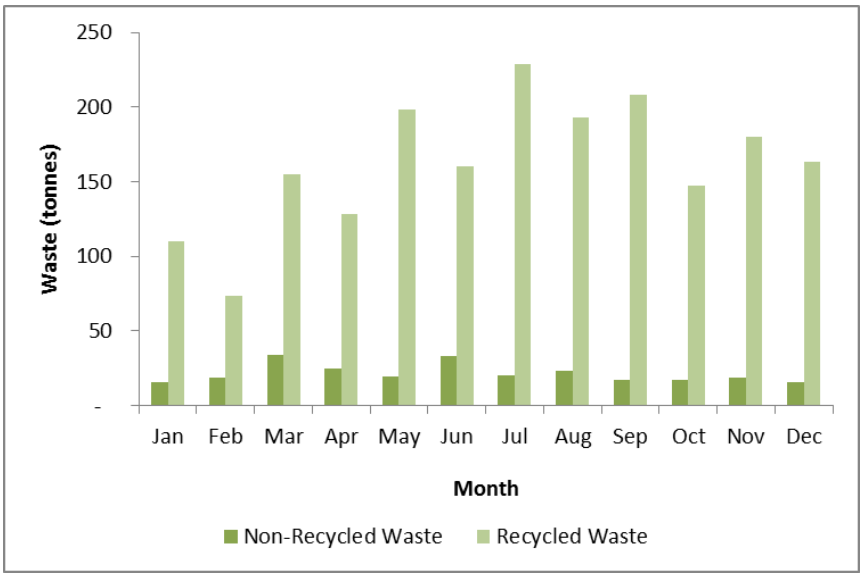
2.7.4 Rubbish Disposal

The main sources of waste at LCO include:

- fuel and fuel filters;
- tyres;
- batteries;
- scrap metal;
- paper and cardboard; and
- domestic waste.

All waste generated by LCO is stored onsite and removed for recycling or disposal by licensed contractors. During the reporting period, LCO sent 250 tonnes of non-recyclable waste to landfill and recycled 1,946 tonnes of waste Figure 7 shows non-recycled waste versus recycled waste during 2013.

Figure 7 Total monthly non-recycled waste vs recycled waste 2013



2.8 Management of Hydrocarbon Contaminated Material

Hydrocarbon contaminated material resulting from spillages are cleaned up using oil absorbent material. Contaminated material is stockpiled onsite in a contained area in pit for soil testing to determine remediation requirements. Where required, contaminated material is then placed into 205 litre drums and taken offsite by appropriately licensed transporters to a licensed facility for treatment and disposal in accordance with site procedures as part of the EMS. In the event of accidental contamination of on-site dams, contaminated water is sucked up into a truck and disposed of off-site by an appropriately licensed contractor.

During 2013, LCO had one Category 2 Incident involving 2500 litres of hydraulic oil spilling to an open cut work area. The spill was contained and approximately 30 cubic metres of contaminated overburden was placed into a designated contained area. The material was then laboratory tested and found to have a C10-C36 Fraction measurement of 6,960 mg/k. With this measurement being under 10,000 mg/kg the waste is classified as general solid waste in accordance with the Waste Classification Guidelines issued by the EPA. The material was disposed of in-pit and the location of disposed waste was surveyed for record keeping purposes. .

A log of all hydrocarbon related incidents is detailed below.

Table 12 **Hydrocarbon incident log**

Detail	Learnings
Hydraulic oil leak on machine causing 2500 litres of oil to spill to the ground. Spill was contained. Contaminated material was sampled and found to be within General Waste Classification Guidelines and disposed of accordingly.	Maintenance fitter error causing the failure of an O-Ring causing the hydraulic pump to release oil. A TBT was given to maintenance crews on the importance of maintaining machines in accordance with procedures.
Machines main hydraulic return tube hold down bracket failed allowing a pipe cluster to spring free. This movement broke the coupling connection causing approx. 100 litres to spill to the ground.	Issues with the travel motor pressure circuit main relief's were found (relieving early and dumping through the return circuit). All of these units were replaced and regular inspections increased (every 2000 hours).
A 10 weight flow meter on the service station in bay 4 of the workshop failed a gasket which allowed oil to escape as mist. The majority of oil was contained by the catch tray underneath however some oil fell to the workshop floor.	A faulty seal was identified to have caused the leak. Workshop continued to implement maintenance programs to ensure that issues are identified and addressed as soon as possible.
Diesel spill of approx. 80 litres caused by the detainer that holds the gun off the bulk diesel refuelling gun releasing. This allowed diesel to flow under gravity through the connector into the drain container which overflowed approximately 80 litres onto the floor of the workshop. The spill was cleaned up using absorbent material.	A blank fuel gun fittings were engineered onto the service truck to ensure that no fuel can pass through the fitting into the waste oil tube.
Diesel spill of approx. 140 litres to concrete pad from service cart when refuelling a haul truck. The spill was contained and cleaned up using absorbent material and a sucker truck.	The connection from the service truck to the haul truck was not connected properly and the shut off valves did not function. Corrosion of coupling was found to be the failure mode. The coupling was replaced and the service provider was instructed to ensure coupling condition is reported on maintenance reports.
Diesel spill from contractors diesel tanker when unloading. Approx. 15 litres spilled to the hardstand area. The area was cleaned up using absorbent spill products.	An operator error caused an incorrect valve on one of the unloading compartments to be left open allowing diesel to spill from the compartment from which the refuelling hose was not attached. The operator was retrained and a maintenance check was completed on the diesel tanker.

Detail	Learnings
A large rock fell over the backboard of EX101 and crushed the LH clam cylinder hose causing approximately 150 litres of oil to spill to the ground.	Operator error causing material to spill over the back of the bucket. Operator was re-trained on operating procedures.
Front end loader rolled over whilst loading a DT. Diesel dripped from the machine causing approx. 200 litres to spill to the ground over a 24 hour period.	TBT – TMP was re-iterated. TBT – hazard awareness. A procedure was developed and implemented for the appropriate operation of the loader.
Refuelling completed on lube truck and when re-placing fuel gun back onto manifold the operator accidently opened the engine oil dispensing tap spilling approx 150-200ltrs of engine oil to the bunded area. Oil was cleaned up appropriately.	The redundant one way valves were removed from the system. A set of isolation gate valves were engineered and placed at the end of the system to prevent recurrence of this issue
Oil hose blew on a contractors 20T Franna Crane.	Contractor removed crane offsite for repair in accordance with their maintenance system.
Hydraulic oil leak on excavator causing approximately 1000 litres to spill to the ground. Contaminated overburden was stockpiled in a contained area in pit and appropriate testing was undertaken.	A coupling had failed and required repair. Continue to undertake maintenance checks on couplings and replace when required.

2.9 Water Management

2.9.1 Water Management System

Water management is one of the key operational constraints at LCO and is managed through the LCO *Water Management Plan.* The current integrated water management system at LCO has been designed to address four main issues:

1) surface water runoff to existing pits and operational areas;

2) groundwater seepage in open cut and old underground workings;

3) provision of mine operation water for the coal handling and preparation plant (CHPP) and dust suppression; and

4) off-site discharges and water sharing arrangements.

The groundwater environment in the vicinity of LCO is complex due to both the local geology and historical seam dewatering that has occurred during previous and current mining operations. Clean water diversion banks and sediment ponds provide a segregated system for the handling of clean and dirty water.

Excess water is:

- stored in on-site dams;
- discharged under the Hunter River Salinity Trading Scheme (HRSTS);
- transferred to other neighboring mining operations.

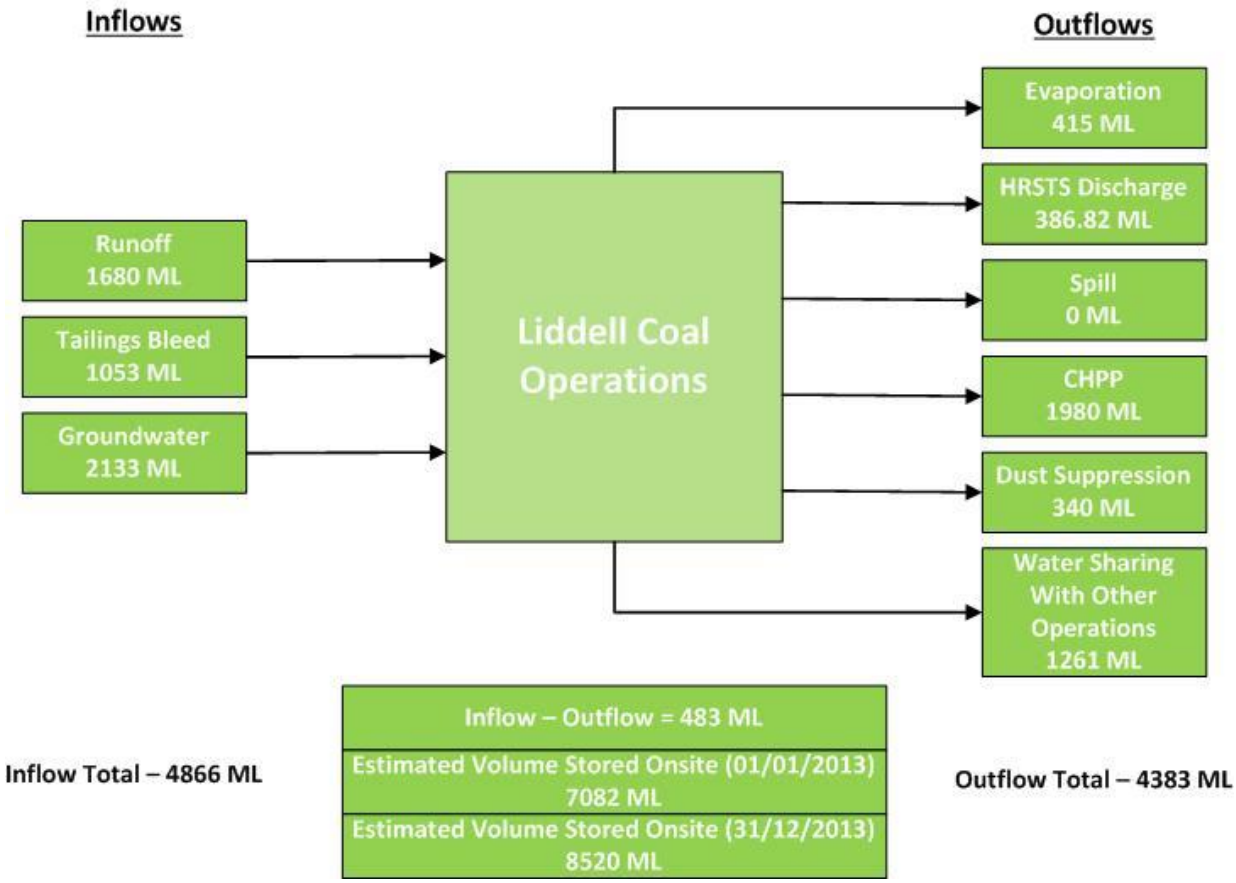
The existing water management system at LCO operates as follows:

- clean water runoff is diverted away from disturbed areas;
- sediment laden runoff is collected in pit floors or sedimentation dams;
- water from all storages is transferred to Dam 13, Dam 4, Dam 17 and RWTV (Raw Water Transfer Void) which provide central storage for the site, via a number of staging dams and pumps;
- RWTV is the main mine water dam which supplies the LCO CHPP and from time to time the Howick and Newdell CHPPs as well as other allied operations;
- excess mine water from Liddell Coal Operations can be transferred to Mt Owen complex;
- water is supplied to the RWTV from underground storage in the Liddell seam workings of the former Hazeldene and Liddell underground coal mines.
- surplus water in the RWTV may be discharged into Chain of Ponds Creek at a current maximum rate of 100 ML/day in accordance with the HRSTS regulations;
- surplus water can also be pumped back into the underground workings when discharge opportunities under the HRSTS are unavailable;

- coarse rejects are dewatered and co-disposed in pit spoils;
- tailings from the LCO CHPP are pumped to onsite Tailings emplacements;
- tailings supernatant migrates northward and is decanted into the Decant Dam which is pumped into Dam 4. Water recovered from Dam 4 is transferred to Dam 17 and either pumped back to the RWTV for use onsite or to the Mt Owen CHPP;
- excess water is held in Dam 4 where a portion percolates downward into the old Hazeldene underground workings;
- runoff in the LCO CHPP area is contained in a local sump and then recycled into the CHPP for use as process water in a closed operating loop.

Stored water volumes during the reporting period are provided in Figure 8.

Figure 8 LCO Water Balance January – December 2013



2.9.2 Water Consumption

The water uses at LCO include CHPP uses, tailings export, dust suppression (haul roads and stockpiles), equipment wash down and potable water usage.

Water is also lost on site through evaporation from dam water surfaces. Measures

implemented by LCO to minimise water use include:

- regular monitoring and review of the potable water used on site, taking into account the increase in mine personnel due to an expansion of operations;
- rainwater storage and reuse in the toilet system;
- reduced flow showerheads are used in the bathhouse; and
- water efficient design in the CHPP.

Monthly consumption data for the reporting period is provided in Table 13.

Table 13 Water Consumption 2013

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	TOTAL
Raw Water (ML)	182.20	139.54	213.59	278.89	275.03	140.06	180.07	219.32	246.42	262.33	170.09	189.28	2496.81
Export (ML)	35.64	0.00	167.51	390.48	197.04	389.36	41.60	34.00	0.00	5.49	0.00	0.00	1261.11
Potable (ML)	0.3135	0.311	0.2995	0.4195	0.4055	0.2578	0.2848	0.3495	0.3155	0.2815	0.303	0.3115	3.8526
Discharge (ML)	21.07	167.3	93.25	0	0	0	0	0	0	0	0	0	281.62

A total 3.85ML of potable water and 2,496.81ML of raw water were used during the reporting period. 1261.11ML was exported to other mining operations, and 281.62ML was discharged from LCO during the reporting period.

The water consumption at LCO was generally consistent with previous reporting periods.

2.10 Hazardous Material Management

The LCO *Explosives Management Plan* (LCO 2010) defines a system to ensure the safe handling and use of explosives on site.

2.10.1 Inventory of Material Data Sheets

Hazardous materials at LCO are managed by the site's ChemAlert data management system. Hard copies of the Material Safety Data Sheets are held at each site and in locations nominated by the respective Safety Management Plans.

2.11 Other Infrastructure Management

There is no additional infrastructure at LCO that is not included in the management of the CHPP or Open Cut.

2.12 Modifications to Development Consent

LCO currently has approval to conduct mining operations until the end of 2023 within an approved mining footprint. However, open cut mining activities will reach this approved boundary in 2014. Coal reserves have been identified outside of this footprint, within the development consent boundary. As reported in the 2012 AEMR, LCO therefore propose to extend the existing open cut mining operations outside the approved mining area to enable continuity of mining and maximise recovery of coal resources within the existing development consent boundary. The proposed extension of mining is within both the existing development consent (DA 305-11-01) boundary and LCO's mining lease (ML 1597).

To recap, the primary components of the Project are:

- Extension of the South and Entrance Pits to the south east and, upon completion of mining in these pits, the mining of coal resources under the Mine Infrastructure Area (MIA) during which time the MIA will be relocated to temporary facilities. The extension will enable the recovery of approximately 38 million tonnes (Mt) of Run of Mine (ROM) coal.

- The extension of open cut mining activities will lead to an associated extension of the life of mine at LCO from 2023 to 2028.

- A tailings emplacement area will be constructed within the final void of the South Pit to dispose of the additional tailings associated with the extension of open cut mining activities.

- Coal will continue to be processed at the LCO Coal Handling and Preparation Plant (CHPP) at the approved rate of up to 8 Mt per annum (Mtpa). Coal will however no longer be received from, or sent to, the Cumnock CHPP for processing as currently approved under DA 305-11-01, as this CHPP has been demolished following the cessation of mining operations at Cumnock No. 1 Colliery. LCO seeks to maintain a contingency for coal processing by delivery of up to 1.5 Mtpa of ROM coal to Ravensworth Central Coal Processing facility (RCCP) for washing via a new connection to the existing overland conveyor or by road transport route to RCCP. In addition, up to 2 Mtpa may be received at the LCO CHPP from the Mt Owen Complex for processing via the same existing overland conveyor.

- Minor additional infrastructure as follows:

    - Construction and commissioning of a transfer point and conveyor connected to the existing Mt Owen/Glendell/Macquarie Generation conveyor is proposed, enabling LCO to send coal to Ravensworth, and receive coal and crushed gravel from Mt Owen, via the existing conveyor system. The new conveyor will deliver/take material to/from a new 50,000 tonne stockpile; and

    - Infrastructure and ancillary surface disturbance to support the new mining areas will be required, including but not limited to, powerlines, water management infrastructure and haul roads.

LCO proposes to continue to employ approximately 360 full time personnel and approximately 100 contractors as required.

No changes are proposed to the approved operating hours, annual production levels, mining methods, or mining equipment, which will remain as approved under DA 305-11-01, as modified.

During 2013, the Environmental Assessment to support the application was completed and placed on public exhibition during September and October. Following public exhibition of the EA, 14 submissions were received. Of these, 11 submissions were from government agencies, three from special interest groups, and one was a submission received from the general public in support of the Project, as summarised below in Table 14.

Table 14 Submissions received

Government Agencies	Department of Primary Industries - NSW Office of Water
	Department of Primary Industries - Office of Agricultural Sustainability and Food Security

	Department of Trade and Investment, Regional Infrastructure and Services (DTIRIS) – Division of Resources and Energy (DRE)
	Office of Environment and Heritage
	Environment Protection Authority
	NSW Health – Hunter New England Local Health District
	NSW Heritage Council
	Muswellbrook Shire Council
	Singleton Council
	Dams Safety Committee
	Rural Fire Service
Special Interest Groups	Construction, Forestry, Mining and Energy Union (CFMEU)
	Rio Tinto Coal Australia
	Economists at Large
Public	Anonymous

The public submission received in support of the Project stated that:

"I support investment in NSW and the continuation of this project for ongoing job security."

The Environmental Assessment, including discussion of environmental impacts and findings, as well as all submissions can be viewed on the Department of Planning and Infrastructure's website at the following address: http://majorprojects.planning.nsw.gov.au/index.pl?action=view_job&job_id=5165. LCO have since lodged a "Response to Submissions" during February 2014 and this is also available on the website.

LCO also referred the Project to the Federal Department of the Environment (DoE) in June 2013 due to the likelihood of significant impact on matters of National Environmental Significance (NES) prescribed by the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act). In summary, the likely significant impacts include:

- The removal, fragmentation and/or isolation of potential habitat for three EPBC Act listed endangered species; the Spotted Tailed Quoll, Swift Parrot and Regent Honeyeater; and

- A likely significant impact on water resources including Bowmans and Bayswater Creeks, as a result of surface and/or groundwater impacts.

In a letter dated 21 October 2013, LCO were advised by DoE that the Minister's delegate determined the Proposed Action (EPBC 2013/6908) to be a controlled action, and as such requires assessment and a decision on approval under the EPBC Act before it can proceed. The Minister's delegate also decided that the project will need to be assessed through preliminary documentation. This report was compiled and submitted in February 2014, and is currently under assessment by DoE.

During the remainder of 2014, LCO expect the project to move through the remaining regulatory assessment process to determination.

3 Environmental Management and Performance

3.1 Environmental Management System

LCO has developed and implemented an Environmental Management System (EMS) generally in accordance with ISO 14001. The principle focus of LCO's EMS is on continual environmental improvement. The EMS was reviewed and updated during the reporting period following the Independent Environmental Audit. The EMS was updated to reflect current operations and also include Glencore PLC Sustainable Development requirements.

The EMS includes management plans and system procedures to manage activities on site and hence minimise the risk of impact to the environment. These plans and procedures are prepared and regularly updated to ensure compliance with both development consent, and EPL conditions.

The LCO *Environmental Management Strategy* was developed in accordance with Schedule 5, Condition 1 of DA 305-11-01 and updates the LCO EMS. The LCO *Environmental Management Strategy* provides the framework for environmental management during the construction and operation of LCO to ensure compliance with development consent conditions and other legal requirements. The LCO *Environmental Management Strategy* builds on the environmental management controls outlined in the EA prepared for the project.

The LCO *Environmental Management Strategy* was developed generally in accordance with ISO 14001, the international standard for environmental management systems and is consistent with the Glencore Sustainable Development Management Framework. The LCO *Environmental Management Strategy* applies to all components of the operations.

Implementation of the EMS assists in minimising the environmental impacts of LCO by facilitating continual improvement in environmental performance.

3.2 Environmental Risk Identification

Glencore utilises a common methodology in accordance with ISO 31000:2009 to ensure that business associated risks are identified, analysed and evaluated, treated as appropriate, and then monitored and reviewed. The standard ensures an appropriate risk assessment is performed for all business activities identifying controls critical to the achievement of the overall objectives of the relevant activity.

In June 2009 a Broad Brush Risk Assessment (BBRA) was completed by Umwelt Australia Pty Limited. The BBRA was reviewed and updated in 2010, and again during 2012 and 2013. The BBRA Review is presented in Appendix B.

3.3 Environmental Incidents

3.3.1 Environmental Management

During the reporting period, LCO recorded 2 reportable environmental incidents.

Both reportable incidents were in relation to blasting.

On 11 July 2013, a blast was fired that resulted in an elevated overpressure of 134.1dB being recorded at the Chain of Ponds Hotel. The approved overpressure limit for this site is 133dB. An investigation into the incident indicated that the air blast overpressure exceedance was primarily caused by bridging of stemming in at least three of the loaded blast holes. The bridging prevented the design depth of stemming being achieved, resulting in inadequate confinement of the explosives. An independent review of the potential effects of the elevated overpressure on the Chain of Ponds Hotel concluded that and airblast overpressure of 134.1dB would not have a detrimental effect on the Hotel and outbuildings. An incident report was submitted to the DP&I, with no further action being required.

A blast was fired on 4 September 2013 that resulted in blast fume crossing over the site boundary. The post blast fume was observed to cross over the Old New England Highway at height to a point above unoccupied mine owned land in the vicinity of Bayswater Creek as it dissipated. The blast video, load sheets and product specifications were reviewed, and shot firers were interviewed regarding the incident. The blast fume was found to be caused by cavities in the strata that led to the deflagration of 700kg of product. The cavity had been identified during loading and the hole was bagged off and stemmed in order to minimise the generation of fume. As a result of the investigation into the event, LCO reviewed and updated the relevant procedures and implemented a number of actions to reduce the likelihood of a repeat incident. Actions included that drill records will be reviewed in future to place airbags down the boreholes at least four meters above the cracked substrata, where this exists, and that column rise of product placement will be more closely monitored to limit the amount of product runaway if a loss is observed. An incident report was submitted to the DP&I and a response received 9 December 2013 acknowledging the measures being implemented and requiring no further action from LCO.

In addition to the two externally reportable incidents, LCO recorded nineteen incidents during 2013 that were defined as Category 1 or less and two incidents that were defined as Category 2 on Glencore's Environmental Incident Category Matrix (Table 15) and did not require external reporting. Of these, thirteen related to minor oil, coolant and diesel spills, two related to blasting, four relating to water (a penalty notice received for equipment failure at the HRSTS discharge point, a treated water leak, sewage spill and tailings overflow), one regarding a haul truck driving on a rehabilitated area and one regarding a Front End Loader roll over. The penalty notice received for HRSTS equipment failure related to the non-compliance of LCO's EPL 2094 condition which requires continuous operation and maintenance of communication equipment which makes the

conductivity and flow measurements at the LCO HRSTS monitoring point available during discharge events to the Hunter Integrated Telemetry System (HITS), within one hour of those measurements being taken. The communication had not been operating since approximately May 2011. The communication equipment was reinstated and commissioned and has been fully functional since this incident.

Table 15 Glencore's Environmental Incident Category Matrix

Category	Definition
Nil	Potential environmental incident, hazard, near miss or actual incident resulting in no environmental harm.
Category 1	An incident that has caused negligible, reversible environmental impact requiring very minor or no remediation.
Category 2	An incident that has caused minor, reversible environmental impact requiring minor remediation.
Category 3	An incident that has caused moderate, reversible environmental impact with short-term effect requiring moderate remediation.
Category 4	An incident that has caused serious environmental impact, with medium-term effect requiring significant remediation.
Category 5	An incident that has caused disastrous environmental impact, with long-term effect requiring major remediation.

3.4 Meteorological Monitoring

3.4.1 Environmental Management

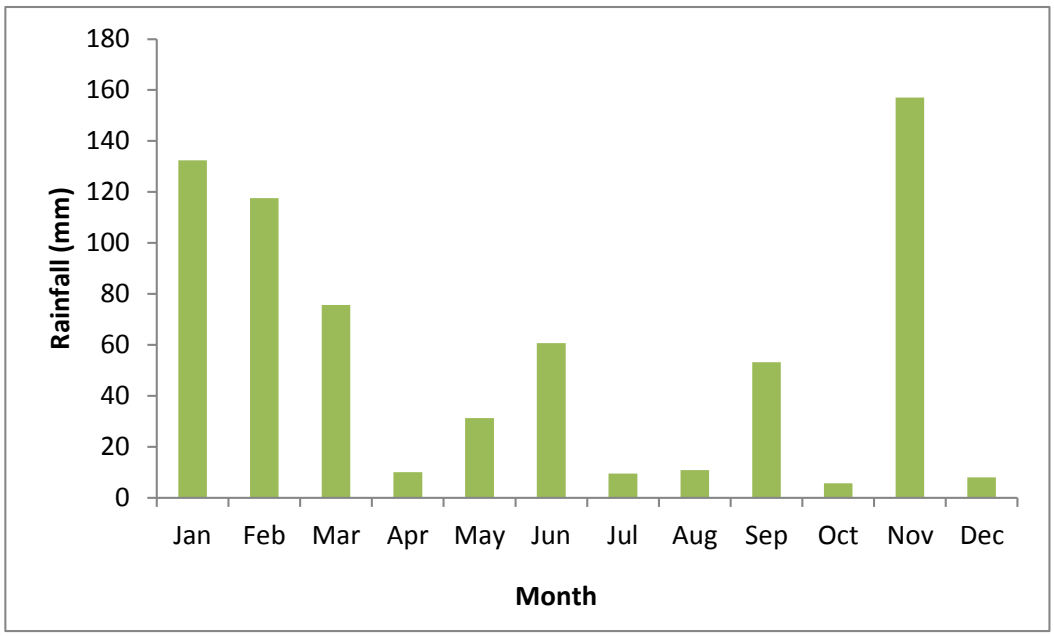
The meteorological station established at the office and workshop complex was installed and is operated in accordance with the *Approved Methods for Sampling of Air Pollutants in New South Wales* (Department of Environment and Climate Change (DECC), 2007) and the requirements outlined in the DECC submission for the Environmental Assessment for the Liddell Coal Modification to Development Consent. Meteorological conditions at LCO are continuously monitored on site.

3.4.2 Environmental Performance

3.4.2.1 Rainfall

Total annual rainfall for the reporting period was 671.4mm. The highest daily rainfall of 71mm was recorded in November 2013. The wettest month was November, with 157mm of rainfall recorded, while the driest month was October, recording only 5.6mm of rainfall. The total monthly rainfall data for the monitoring period is shown on Figure 9.

Figure 9 Total monthly rainfall January – December 2013

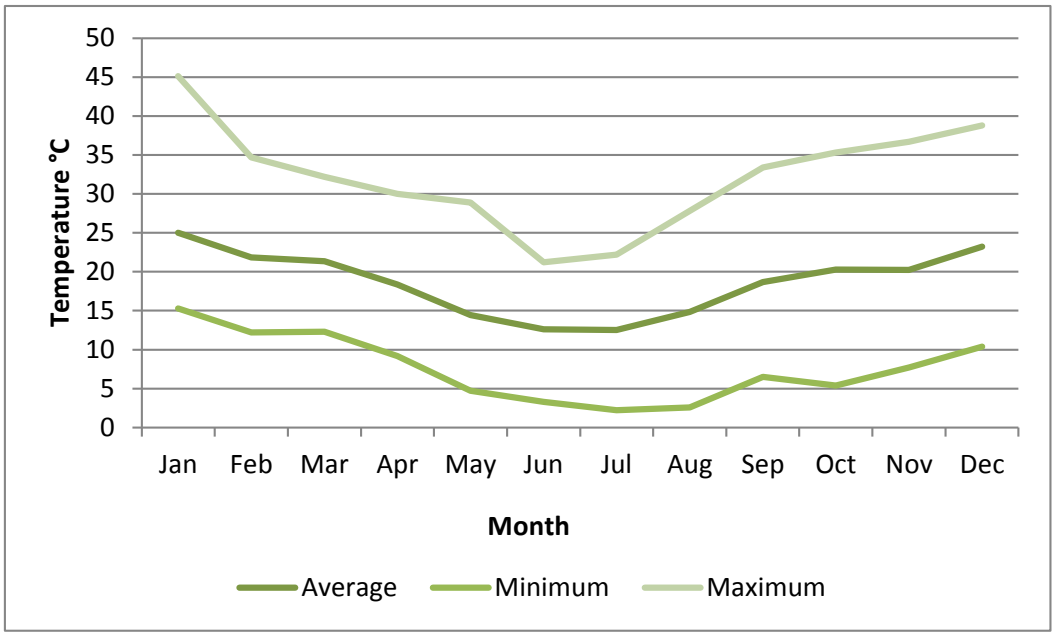


3.4.2.2 Temperature

The average daily temperature recorded at the meteorological station varied from 12.5°C to 25.0°C during the reporting period. On average, July 2013 was the coolest month, and January 2013 was the warmest month. The temperature data was consistent with standard seasonal patterns.

The annual temperature data is presented in Figure 10.

Figure 10 Minimum, average and maximum monthly temperatures January – December 2013

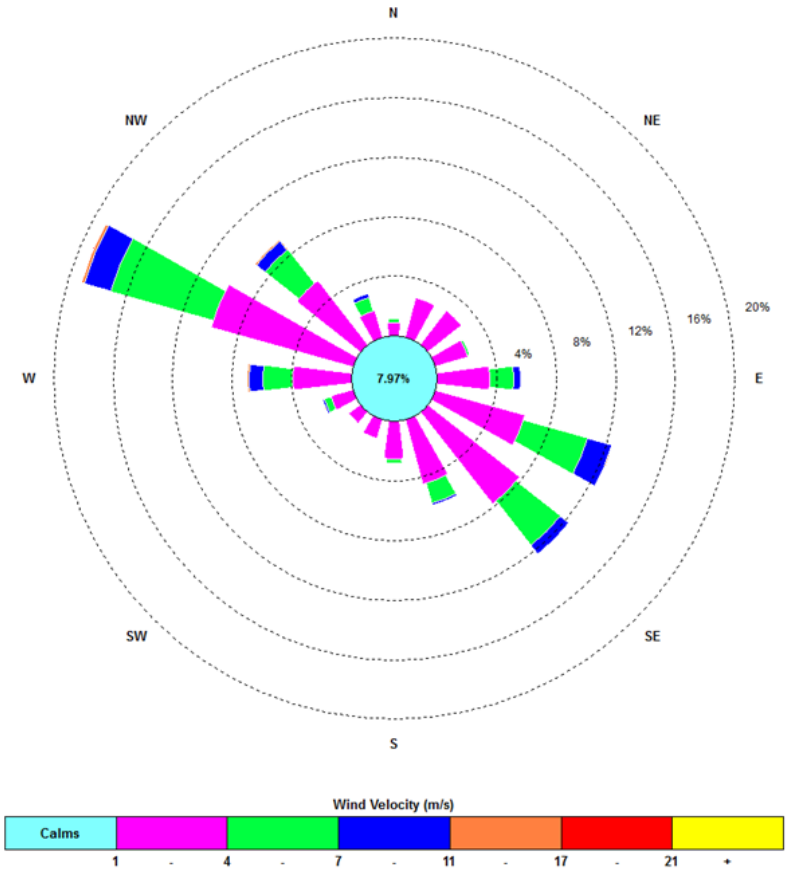


3.4.2.3 Wind Speed and Wind Direction

Seasonal patterns for wind direction are evident at LCO. During the summer and autumn months (November to April) wind direction is predominantly south east. In comparison, during the winter and spring months (May to September) the prevailing wind direction is north-west. Wind directions are referenced to magnetic north.

The annual wind rose for 2013 is presented in Figure 11. The monthly wind roses for 2013 are presented in Appendix C.

Figure 11 Annual Wind Rose 2013



3.5 Air Quality

3.5.1 Environmental Management

Air quality monitoring is undertaken in accordance with the Liddell Coal Air Quality Monitoring Program. In addition, the LCO *Environmental Monitoring Program* (November 2009), LCO *Dust Management TARP* and LCO *Spontaneous Combustion Management Plan* are used for the ongoing management of air quality.

The Air Quality Monitoring Program (AQMP) was developed in accordance with Schedule 3 Condition 19 of DA-305-11-01. In accordance with this condition, the AQMP includes a combination of deposited dust gauges and high volume air samplers (HVAS) to monitor any dust emissions, and an air quality monitoring protocol for evaluation of compliance with the air quality impact assessment and land acquisition criteria. The AQMP was reviewed and updated during 2012 following the Independent Environmental Audit and was approved by DP&I during May 2013.

The LCO air quality monitoring network is shown in Figure 12. The LCO air quality monitoring network comprises ten deposited dust gauges and six high volume air samplers (HVAS).

Suspended particulate dust was measured in the reporting period by six HVAS, including three TSP samplers and three PM_{10} samplers. Each HVAS was run for 24 hours on a six-day cycle in accordance with OEH requirements.

Control measures undertaken to minimise potential impact on air quality at LCO include:

- Regular dust inspections are carried out and excavation and tipping activities may be ceased or modified if excessive dust is observed;
- Real time dust monitoring is undertaken to assist with the management of dust on-site;
- disturbance of the minimum area necessary for construction and prompt rehabilitation of construction areas;
- watering of roads and trafficked areas to minimise the generation of dust; permanent roads are constructed from hard non-friable material and have defined marker posts to prevent vehicle deviations;
- long term topsoil stockpiles are vegetated to reduce dust generation;
- overburden emplacements are shaped to 10 degrees or less and seeded;
- dust suppression sprays situated on the ROM dump hopper and transfer conveyor points are actuated to reduce potential dust generation; and
- all equipment is maintained in good working order to reduce emissions.

Air Quality Criteria

Schedule 3, Condition 16 of DA 305-11-01 requires that LCO manage their operations so as to satisfy the relevant OEH air quality criteria for deposited dust and dust concentration emitted to privately owned land not owned by LCO.

Deposited dust levels refer to the quantity of dust particles that settle out from the air as measured in grams per square meter per month (g/m^2/month) at a particular location. The LCO Air Quality Impact Assessment Criteria for deposited dust is summarised in Table 16.

Table 16 Impact Assessment Criteria for Deposited Dust

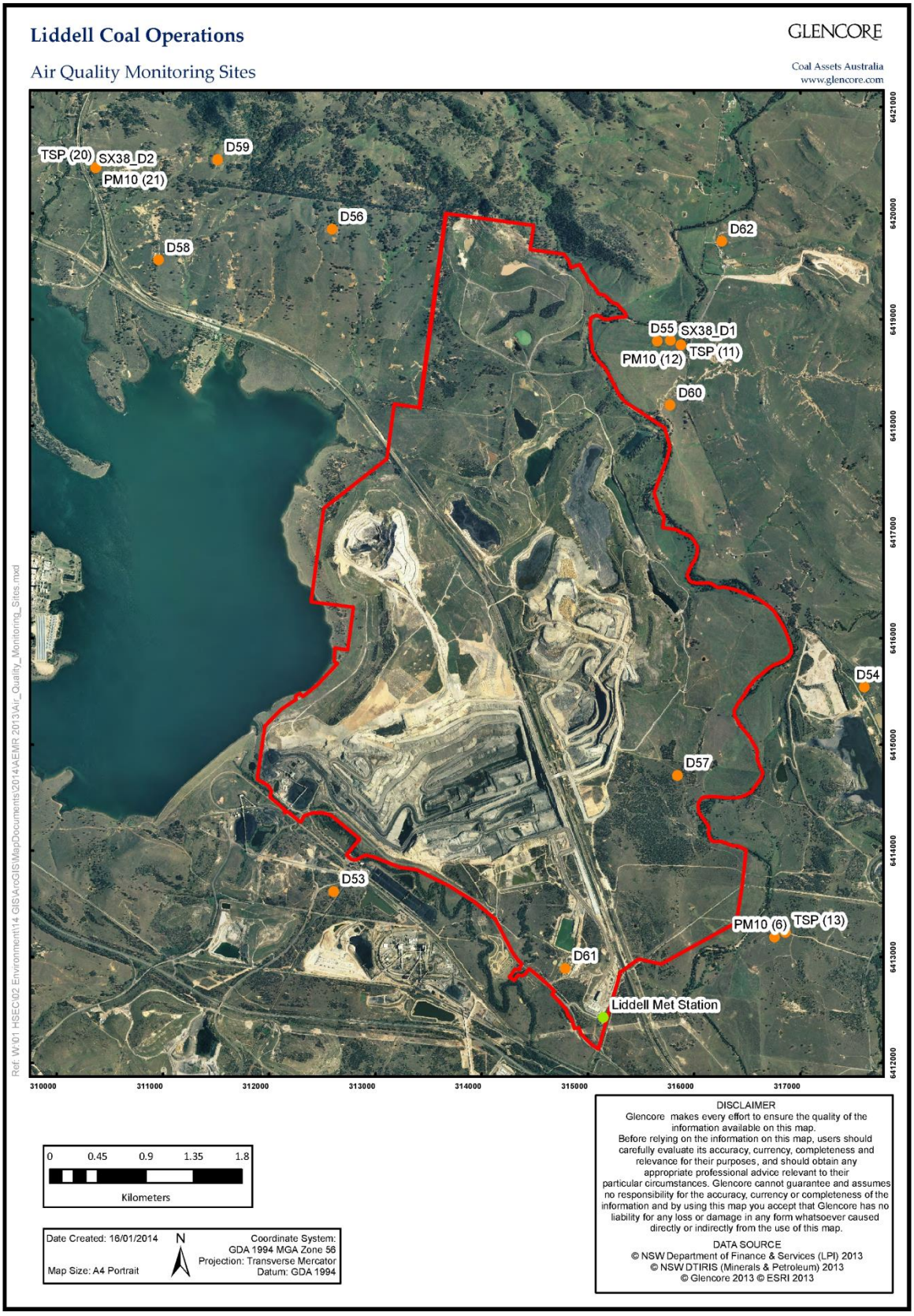
Pollutant	Averaging Period	Maximum increase in deposition dust level	Maximum total deposition dust level
Deposited dust	Annual	2 g/m^2/month	4 g/m^2/month

Dust concentration refers to airborne dust and is measured in micrograms per cubic meter ($\mu g/m^3$). Dust concentration is measured as total suspended particulate matter (TSP) and particulate matter of less than 10 microns in diameter (PM_{10}). TSP relates to all suspended particles, which are usually in size range of zero to 50 micrometres (µm). TSP measurements include PM_{10} particles. TSP and PM_{10} are compared to long term (annual average) and short term (24 hour maximum) goals. Particle sizes larger than 50 µm are measured as deposited dust. The LCO Air Quality Impact Assessment Criteria for dust concentration (particulate matter) is summarised in Table 17.

Table 17 Impact Assessment Criteria for Particulate Matter

Pollutant	Standard/Goal	Averaging Period
Total Suspended Particulate Matter (TSP)	90 $\mu g/m^3$ (Long-term goal)	Annual
Particulate Matter <10µg (PM_{10})	50 $\mu g/m^3$ (Short-term goal)	24 hour maximum
	30 $\mu g/ m^3$ (Long-term goal)	Annual

Figure 12 **LCO Air Quality Monitoring Sites**



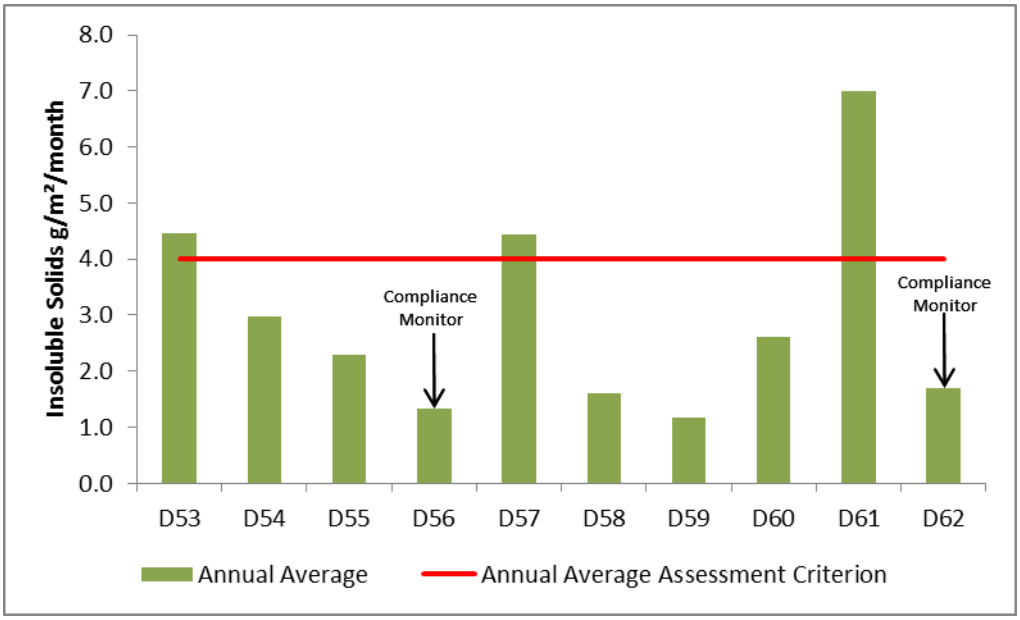
3.5.2 Environmental Performance

Deposited Dust

The location of LCO's deposited dust gauges are shown on Figure 12.

In accordance with the EPL and Air Quality Monitoring Program, monitoring results are collected from all deposited dust gauges on a monthly basis. Deposited dust monitoring results are provided in Appendix D. Figure 13 shows the average deposited dust results for the reporting compared with the deposited dust impact assessment criterion of 4 g/m^2/month (maximum total deposited dust).

Figure 13 Deposited Dust - Annual Average Insoluble Matter



Two dust gauges maintained by LCO are representative of private residences (D56, and D62). During the reporting period both monitoring sites met the annual average criteria. The remaining eight dust gauges are representative of mine owned residences and are used for internal management purposes.

Data recovery for the ten dust deposition gauges varied between 16% and 100%. Gauges that had high levels of contamination throughout the reporting period included D57 and D60. Gauges can become contaminated with organic material such as bird droppings, insects, vegetation or algae growth and the contamination of gauges is determined on the basis of field observations and laboratory analysis. The contaminated results were not included when calculating the annual average results.

Comparison of the annual average deposited dust levels to the previous two reporting periods is presented in Table 18. Three of these locations (D53, D57 & D61) are above the annual average deposited dust criteria of 4 g/m^2/month. These gauges are not representative of residential properties, are located on mine owned land and are heavily impacted by the nearby mining operations. The results are used for internal management purposes only and, as predicted, the increases in deposited dust levels are predominantly related to the mine progressing towards these monitoring sites.

Table 18 Annual Average Deposited Dust (g/m2/month) Comparisons

Monitoring Location	January 2011 – December 2011	January 2012 – December 2012	January 2013 – December 2013
D53	3.1	4.2	4.5
D54	2.4	3.5	3.0
D55	1.3	1.7	2.3
D56	1.0	1.8	1.3
D57	5.5	5.4	4.4
D58	1.3	2.0	1.6
D59	1.0	1.5	1.2
D60	2.0	2.4	2.6
D61	5.3	5.0	7.0
D62	1.8	2.2	1.7

Comparison to EA Predictions

The *Liddell Coal Modification to Development Consent Environmental Assessment* (EA) (Umwelt, 2006) makes predictions that the modifications will not result in exceedances of the relevant deposited dust criteria at any private residence in the surrounding area. This is an annual average criterion.

A summary of annual average deposited dust predictions is given in the EA. Annual average dust deposition predictions from Liddell operations considered in isolation are above 2 g/m^2/month with no residences affected. Annual average dust deposition predictions from Liddell operations and other sources combined are above 4 g/m^2/month with no private residences affected.

All annual averages at dust gauges representative of private residences were below the maximum annual average deposited dust level of 4 g/m^2/month, as the modelling predicted.

High Volume Air Sampling - TSP

LCO operates three High Volume Air Samplers (HVAS) which sample Total Suspended Particulates (TSP), as shown in Figure 12. In accordance with the Air Quality Monitoring Program and EPL requirements, TSP is measured by the samplers every six days.

TSP monitoring results are presented in Figure 14 to Figure 16 and provided in Appendix D.

Figure 14 Annual Average HVAS TSP Results – Scrivens (HVAS11)

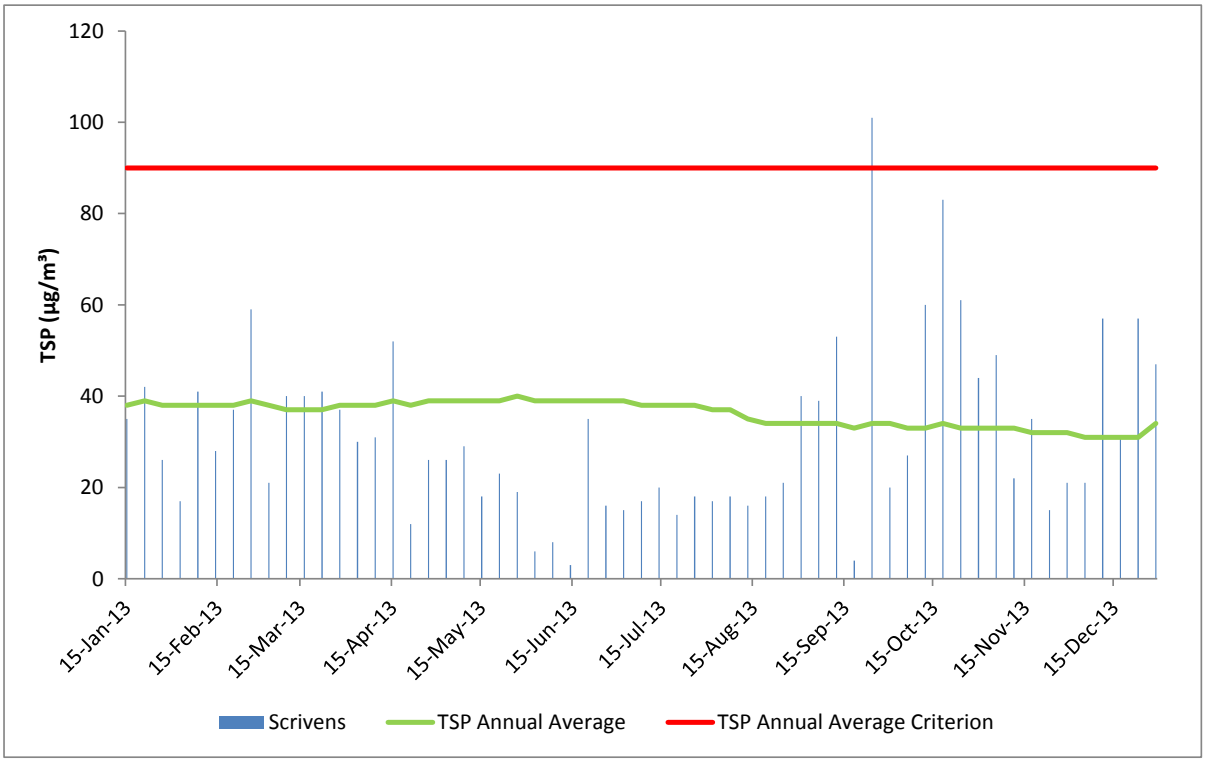


Figure 15 Annual Average HVAS TSP Results – Ravensworth Farm (HVAS13)

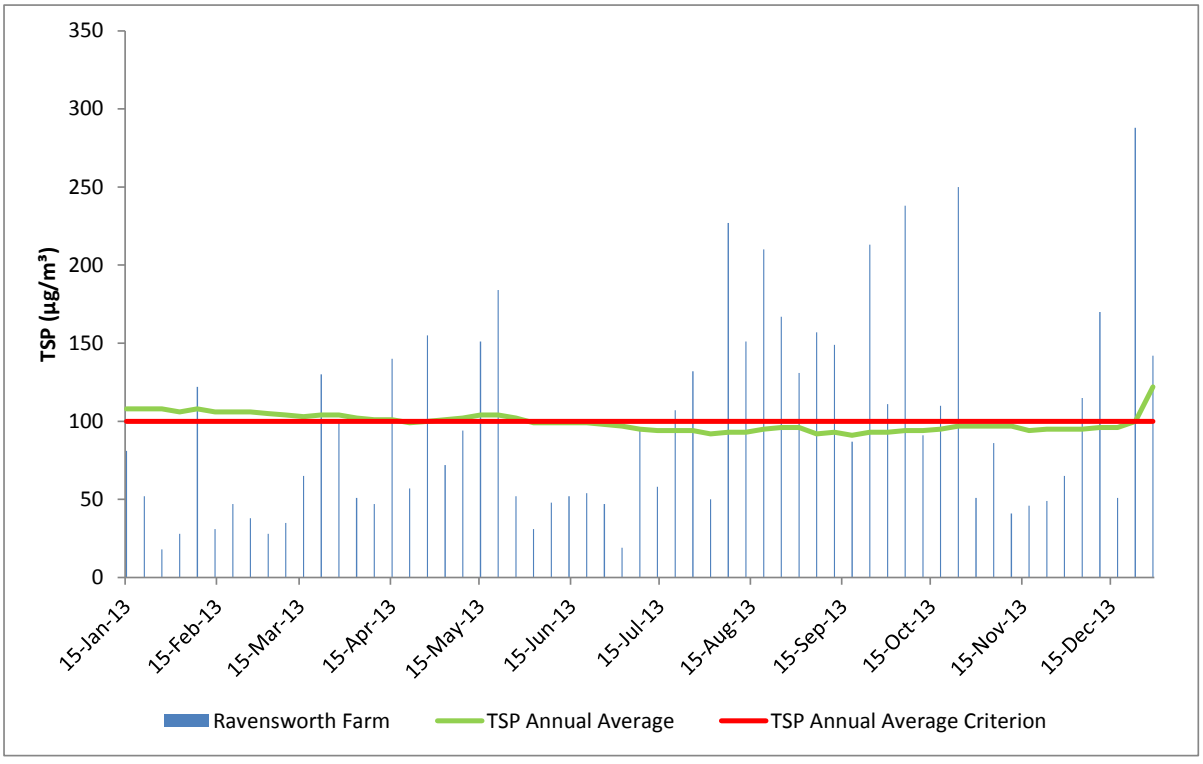
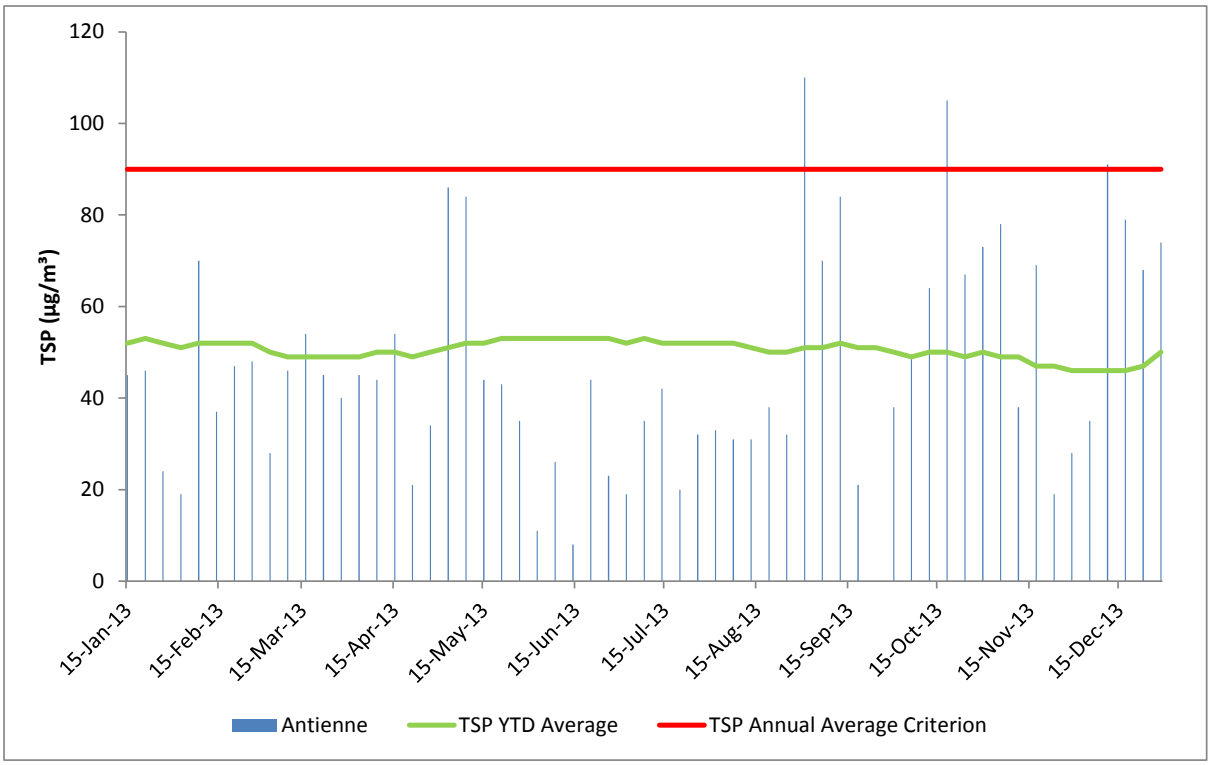


Figure 16 Annual Average HVAS TSP Results – Antiene (HVAS20)



During the reporting period LCO complied with the TSP annual average goal (90µg/m^3) at the Scrivens property (HVAS 11) and Antiene (HVAS20). The Scrivens property is privately owned land. The annual average TSP at HVAS 11 was 34µg/m^3 with a maximum concentration of 101µg/m^3 (recorded on 24 September 2013). HVAS20 (owned by LCO) was commissioned in May 2010. The annual average TSP at HVAS 20 was 50µg/m^3 with a maximum concentration of 110µg/m^3 (recorded on 31 August 2013).

Ravensworth Farm, located on mine owned land (HVAS 13) is not a compliance monitor and is used for on-site management purposes only. To date, there has been a private Licence Agreement with the tenant to allow an alternative air quality criterion of 100µg/m^3. This criterion was exceeded during the 2012 reporting period, with an annual average of 120 µg/m^3 being recorded. As a result of ongoing monitoring indicating that dust levels were approaching agreed trigger levels, the rental agreement was terminated during 2012 and the property is now vacant. The maximum TSP concentration recorded at HVAS 13 during the reporting period was 288µg/m^3 on 23 December 2013. This result is likely to have been due to a regional scale air quality event as the Upper Hunter Air Quality Monitoring Network (UHAQMN) monitors at Camberwell, Maison Dieu, Singleton and Mt Thorley also showed elevated results on this day.

Comparison of annual average TSP levels to the previous two reporting periods is presented in Table 19. HVAS 11 and HVAS 20 both display a decrease in TSP levels from the previous reporting period.

Table 19 Annual Average TSP (µg/m^3) Monitoring Results Comparison

Monitoring Location	July 2010 – December 2011	January – December 2012	January – December 2013
HVAS 11 (Scrivens)	30.0	44.0	34.0
HVAS 13 (Ravensworth Farm)	85.0	120.0	122.0
HVAS 20 (Antiene)	43.0	56.0	50.0

Comparison to EA Predictions

Predictions made in the EA (2006) indicate that when considered in isolation Liddell operations is unlikely to result in exceedances of the air quality goals for annual average TSP at any private properties in the vicinity of the site. Exceedances of annual average TSP above 90 µg/m^3 due to LCO and other sources combined were identified with no privately owned residence predicted to be affected. Monitoring results during the reporting period confirm these predictions.

High Volume Air Sampling – PM_{10}

LCO operates three HVAS which sample fine particulates with an aerodynamic diameter of less than 10 microns (PM_{10}), as shown in Figure 12. In accordance with the Air Quality Monitoring Program and EPL requirements, PM_{10} is measured by the samplers every six days.

PM_{10} monitoring results are presented in Figure 17 to Figure 19 and provided in Appendix D. These results are compared against daily meteorological data (wind speed and direction) to determine whether dust levels are attributable to Liddell Coal Operations.

During the reporting period, LCO complied with the PM_{10} long term (annual average) goal (30µg/m^3) at Scrivens and Antiene. Ravensworth Farm is not a compliance monitor and has a private Licence Agreement with alternative air quality criterion of 40 µg/m^3, and this criterion was also complied with.

The short term (24 hour) goal of 50µg/m^3 was exceeded at HVAS 6 on four occasions during the reporting period (19 August, 24 September, 24 October and 23 December). An investigation based on a review of the meteorological data for these days indicates that the most likely source of the elevated results was LCO as the wind was predominantly from a west to north westerly direction. However, these results are also likely to have been due to a regional scale air quality event as the UHAQMN monitors at Camberwell, Maison Dieu, Singleton and Mt Thorley also showed elevated results on these days.

Comparison of annual average PM_{10} levels to the previous two reporting periods is presented in Table 20. Results have increased for HVAS 6 and remained relatively steady for HVAS 12 and for HVAS 21. The annual average for all locations is below the relevant annual average criteria.

Table 20 Annual Average PM 10 (µg/m3) Monitoring Results Comparison

Monitoring Location	July 2010 – December 2011	January – December 2012	January – December 2013
HVAS 6 (Ravensworth Farm)	25	36	38
HVAS 12 (Scrivens)	11	15	13
HVAS 21 (Antiene)	14	17	19

Figure 17 Annual Average HVAS PM 10 Results – Ravensworth Farm (HVAS6)

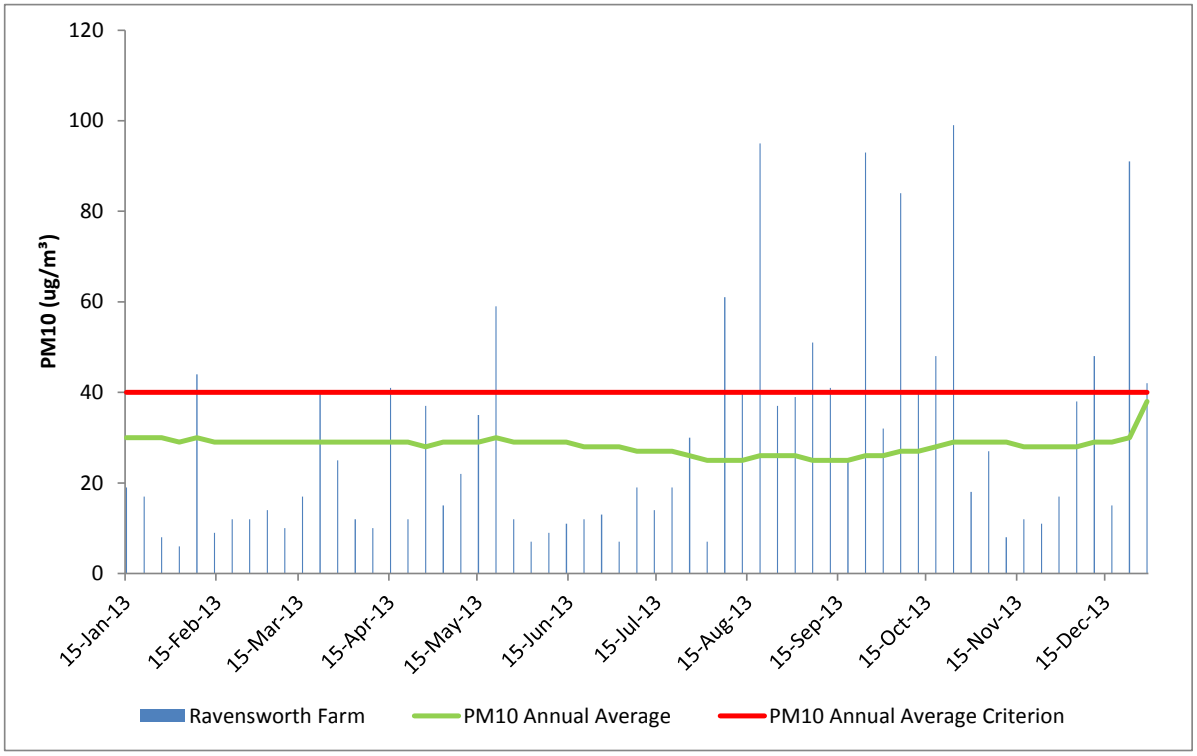


Figure 18 Annual Average HVAS PM 10 Results – Scrivens (HVAS12)

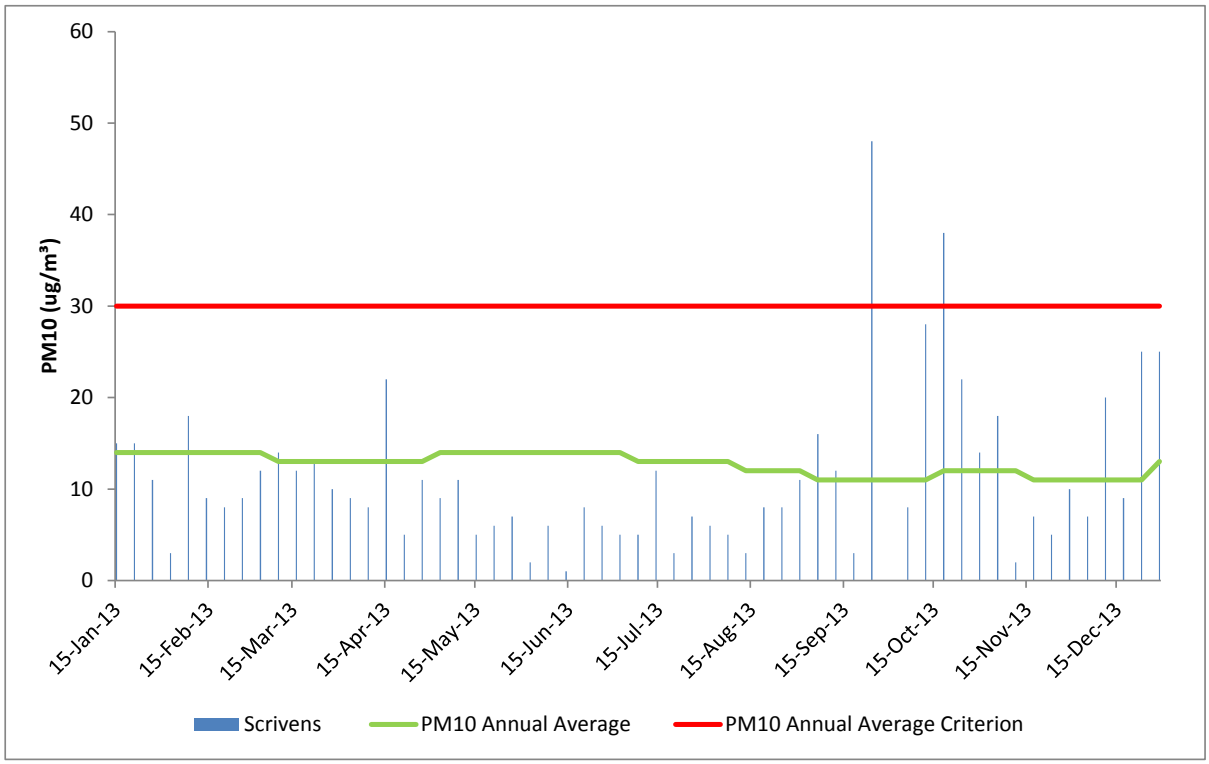
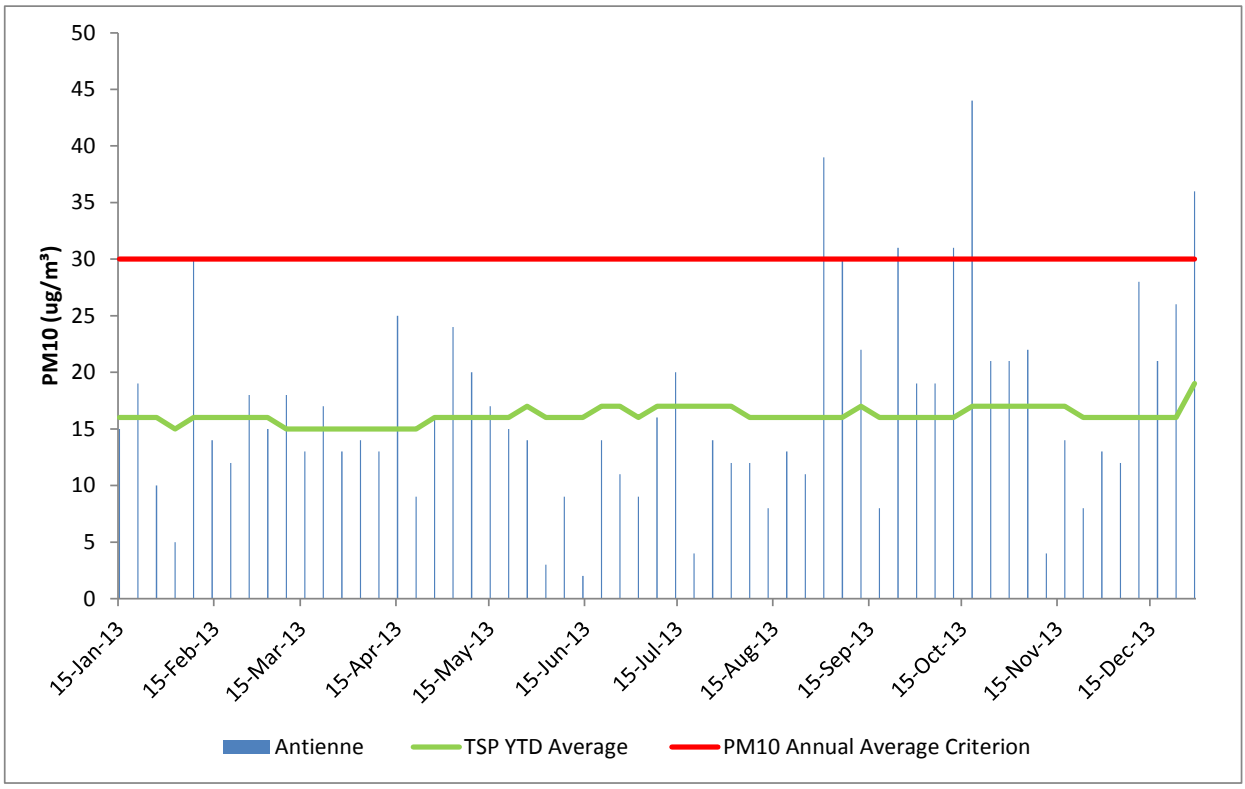


Figure 19 Annual Average HVAS PM 10 Results – Antiene (HVAS21)



Comparison to EA Predictions

The Liddell Coal EA (2006) predicts that when considered in isolation, Liddell operations is unlikely to result in exceedances of the air quality goals for annual average PM_{10} at any privately owned properties in the vicinity of the site. However, when considering Liddell operations and other sources combined, annual average PM_{10} exceedances above 30 µg/m^3 and 24-hour PM_{10} exceedances above 50 g/m^3 are identified, with mine owned properties 23 and 25 most affected. HVAS 6 is located at mine owned property 23 (Ravensworth Farm) which has a private Licence Agreement with alternative air quality criteria. The PM_{10} monitoring results for the reporting period generally confirm these predictions with no exceedance at the monitors located on privately owned land.

Pollution Reduction Programs

LCO undertake dust management in accordance with a Pollution Reduction Program (PRP) approved by the EPA. This PRP is based on best practice dust management procedures, consistent with the published Katestone report. In 2011 the NSW EPA published the *NSW Coal Benchmarking Study International Best Practice Measures to Prevent and/or Minimise Emission from Coal Mining* [Katestone Report] (Donnelly et al 2011). One of the key recommendations of the Katestone report was that mining operations should carry out a site-specific determination of best management practice.

The Dust Stop program was then implemented with the aim to ensure that the most reasonable and feasible particulate control options are implemented by coal mining operations. Under a Pollution Reduction Program (PRP) placed on EPL 2094, LCO prepared a report, *LCO Coal Mine Particulate Matter Control Best Management Practice Determination* (Xstrata Coal Liddell, 2012) comparing the operation with international best practice. The PRP also required LCO to report on the practicability of implementing each best practice measure. At present, LCO is completing three further PRPs requiring the implementation of identified best practice measures involving control efficiency measures for haul roads, alterations to the operation during adverse weather conditions, and trialling of dust suppression technology. Further information regarding LCO's air quality management measures is documented within the current *Air Quality Management and Monitoring Program* (LCO, 2013f), including source specific control measures and site wide management and monitoring measures.

3.6 Erosion and Sediment Control

3.6.1 Environmental Management and Performance

LCO undertakes erosion and sediment control in accordance with the LCO *Erosion and Sediment Control Plan*. The *Erosion and Sediment Control Plan* forms part of the LCO *Water Management Plan* required under Schedule 3, Condition 23 of DA 305-11-01.

Furthermore, in accordance with Schedule 3, Condition 25, LCO implements a range of standard erosion and sediment controls during both construction and operational phases. Controls are generally implemented in accordance with the requirements of the *Managing Urban Stormwater: Soils and Construction Manual* (Landcom, 2004). The requirements outlined under Schedule 3, Condition 25 are contained in the *Erosion and Sediment Control Plan*.

In accordance with the plan, control measures are implemented at LCO to limit erosion and sediment issues arising from construction and mining operations and include:

- catch drains;
- clean water diversion banks and drains;
- sediment dams; and
- silt fences.

In addition to the abovementioned controls, management of sediment and erosion is achieved through the implementation of the following measures:

- minimising all disturbed areas and stabilisation by progressive rehabilitation as soon as practicable;
- construction of catch drains to capture runoff from disturbed areas and direct runoff into sediment dams;
- other erosion and sediment controls are constructed, such as silt fences and sediment basins, prior to construction works commencing within the catchment area;
- construction of drainage controls such as table drains at roadsides and on hardstand areas;
- construction of sediment dams to capture runoff from the office and workshop facility and roadside table drains;
- placement of geotextile liners and rock check dams in drains where appropriate to reduce water velocities and prevent scouring;
- regular maintenance of all controls is undertaken and inspections of all works are regularly conducted to ensure erosion and sediment controls are performing adequately;
- earthworks stockpiles are maintained in a condition that minimised wind blown dust;
- road and earthworks cut and fill batters are constructed at appropriate slope angles, to maximise long term stability; and
- erosion and sediment controls that were not performing adequately are repaired or redesigned.

In addition, the construction plans for the site detailed the specific inspection, maintenance and revegetation requirements for each works area.

3.7 Surface Water

3.7.1 Environmental Management

The LCO *Surface Water Monitoring Program* outlines the surface water monitoring required to be undertaken by Liddell Coal to ensure compliance with statutory requirements. The program addresses the requirements contained in DA 305-11- 01 and the LCO EPL 2094.

LCO also participates in the Hunter River Salinity Trading Scheme (HRSTS), allowing it to discharge from licensed discharge point located on Chain of Ponds Creek. These discharges take place during high flow periods in compliance with strict HRSTS regulations.

3.7.2 Environmental Performance

Surface water quality was monitored on a monthly basis at 11 sites, as shown in Figure 20. All

surface water samples were collected and analysed according to:

- The *Approved Methods for Sampling and Analysis of Water Pollutants in New South Wales* (Department of Environment, Climate Change and Water (DECCW) 2004);
- *AS/NZS 5667.1. 1998. Water Quality – Sampling – Guidance on the Design of Sampling Programs, Sampling Techniques and the Preservation and Handling of Samples*; and
- *AS/NZS 5667.6. 1998. Water Quality – Sampling – Guidance on the Sampling of Rivers and Streams*.

Due to the highly disturbed nature of the site, as recommended by *ANZECC Water Quality Guidelines* (ANZECC, 2000) and

adopted in the LCO *Water Management Plan,* site-specific historic monitoring data has been used to define the trigger values for electrical conductivity (EC), total dissolved solids (TDS) and the upper bound value for pH. Furthermore, an 80th percentile value has been applied to these values to account for the highly disturbed nature of the ecosystem, with the objective of improving water quality. 80th percentile upper bound refers to the value below which 80% of all sample values fall. The trigger values for the total suspended solids (TSS) and the lower bound for pH have been adopted from the default trigger value defined by *ANZECC Water Quality Guidelines* (ANZECC, 2000).

The trigger values based on the historic site-specific monitoring data and ANZECC (2000) guidelines are outlined in Table 21.

Table 21 Trigger Values for Surface Water Quality

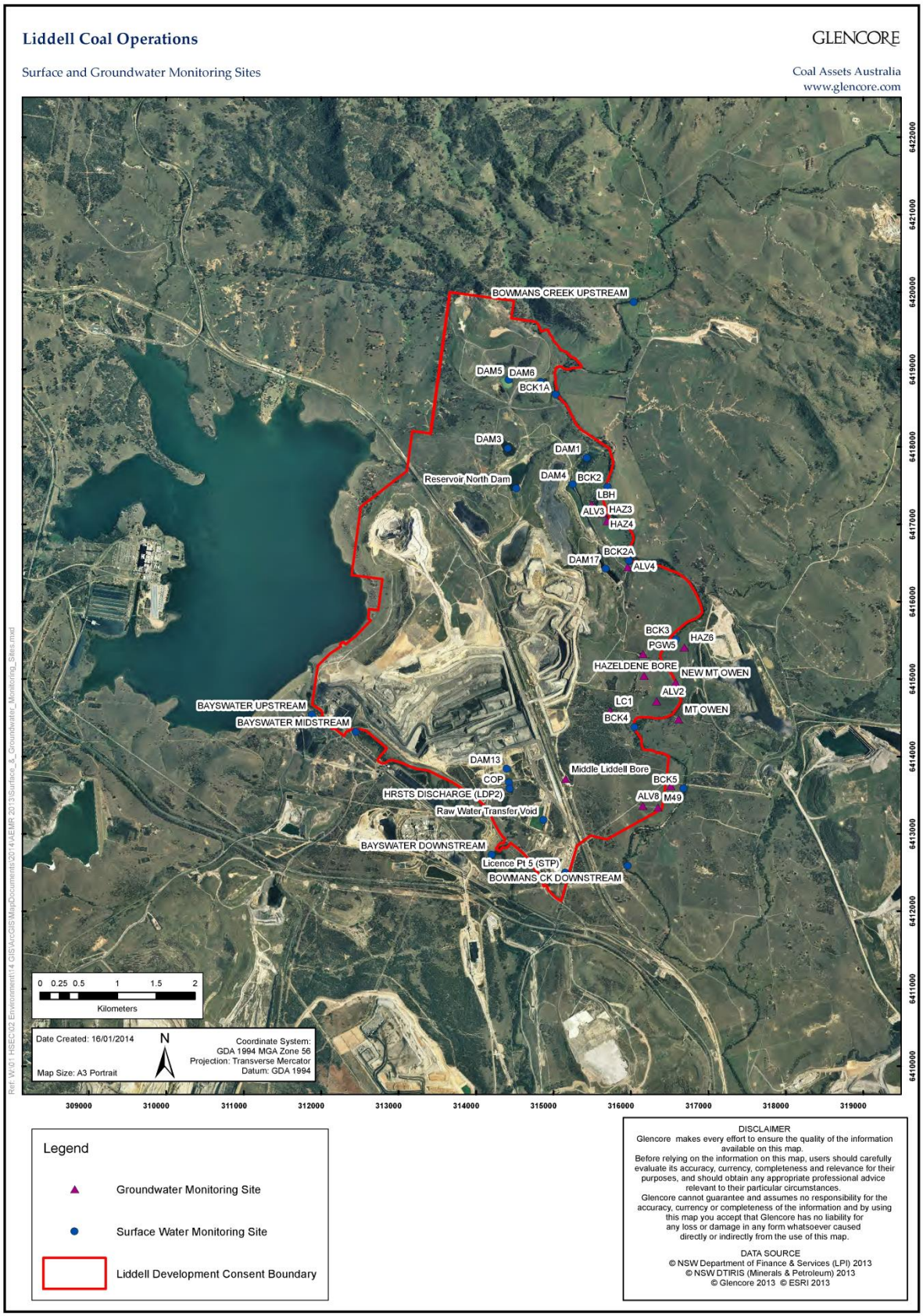
Analyte	Bayswater Creek Surface Water		Bowmans Creek Surface Water		Onsite Dams Surface Water	
	80th %ile	Maximum	80th %ile	Maximum	80th %ile	Maximum
pH[1]	6.5 – 8.3	6.5 – 8.7	6.5 – 8.0	6.5 – 7.9	6.5 – 9.2	6.5 – 10.2
Conductivity (µS/cm)	5024	7110	2270	2450	6180	12 000
TSS (mg/L)	50[2]	235	50[2]	50[2]	50[2]	386
TDS (mg/L)	3460	6845	1420	1168	3880	10 500

[1] - ANZECC criteria for pH lower limit. 80th percentile used for upper limit.

[2] - ANZECC criteria for TSS upper limit

These guideline trigger values are the concentrations (or loads) of the key performance indicators, below which there is a low risk of adverse biological effects. The physical and chemical trigger values are not designed to be used as 'magic numbers' or threshold values at which an environmental problem is inferred if they are exceeded. Rather they are designed to be used in conjunction with professional judgment, to provide an initial assessment of the state of the water body regarding the issue in question.

Figure 20 LCO Surface and Ground Water Monitoring Sites



Condition L2.4 of EPL 2094 contains criteria for Surface Water Quality; however these criteria apply only to water to be discharged via Licensed Discharge Point 2. These limits are:

- pH: 6.5 - 9.0; and
- TSS: 120 mg/L.

Surface Water Monitoring - Bayswater Creek

Surface water quality was monitored on a monthly basis at three sites along Bayswater Creek:

- Bayswater Creek Upstream;
- Bayswater Creek Midstream;
- Bayswater Creek Downstream.

All surface water samples were analysed for pH, EC, TSS and TDS. These sites are also analysed on a bi-annual basis for chemical species present. Full surface water monitoring results are presented in Appendix E.

Bayswater Creek pH

The monitoring results for pH for Bayswater Creek are shown on Figure 21.

pH levels for Bayswater ranged from 7.6 (upstream) to 8.4 (upstream and midstream). Two readings lie outside the 80th percentile trigger value of 8.3. These were recorded during January at both the upstream and midstream sites. Bayswater Creek is a highly modified watercourse and regularly experiences periods of low or no flow. These levels are likely a result of stagnant water being sampled.

There were no exceedances of the maximum trigger value (pH 8.7) during the reporting period.

Bayswater Creek Electrical Conductivity (EC)

The monitoring results for EC for Bayswater Creek are shown on Figure22.

Monthly EC results vary between 2070 µS/cm (upstream) and 4240 µS/cm (midstream). There were no exceedances of EC trigger values during the reporting period.

Bayswater Creek Total Suspended Solids (TSS)

The monitoring results for TSS for Bayswater Creek are shown on Figure 23.

Monitoring results for the TSS ranged between <5 mg/L (midstream and downstream) and 54 mg/L (upstream) for the reporting period. There was 1 exceedance of the 80th percentile trigger value during the reporting period. These were recorded in April at the upstream sampling site. Bayswater Creek is a highly modified watercourse and regularly experiences periods of low or no flow. These levels are likely a result of stagnant water being sampled.

There were no exceedances of the maximum trigger level during the reporting period.

Bayswater Creek Total Dissolved Solids (TDS)

The monitoring results for TDS for Bayswater Creek are shown on Figure 24.

Monitoring results for Bayswater Creek TDS generally correlate with the EC results. TDS results ranged between 1300 mg/L and 2630 mg/L. All results lie below the 80th percentile trigger value (3460 mg/L) for TDS.

Bayswater Creek Chemical Speciation

Biannual chemical speciation monitoring was carried out during January and July 2013. There are no site specific trigger values available for comparison with the results, and the majority of results returned fell below the limit of reporting for each element.

LCO proposes to continue to monitor the catchment so that site specific long term monitoring trigger values can be established.

Figure 21 Bayswater Creek Surface Water pH 2013

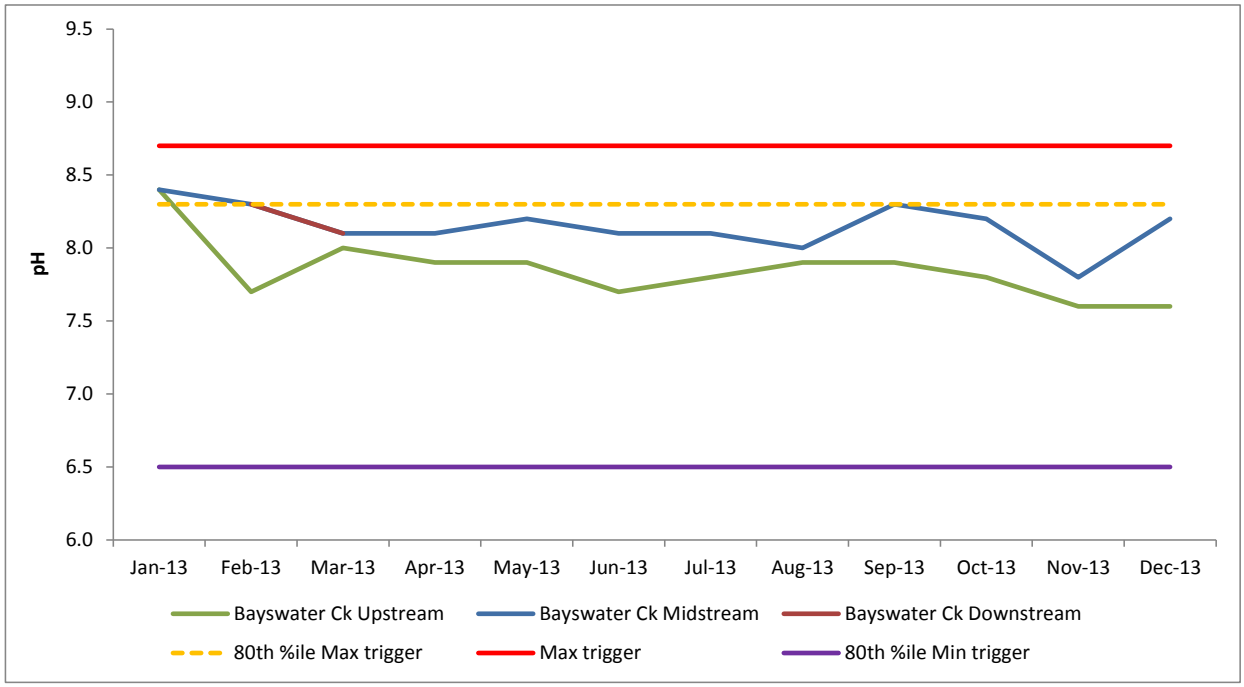


Figure 22 Bayswater Creek Surface Water Electrical Conductivity 2013

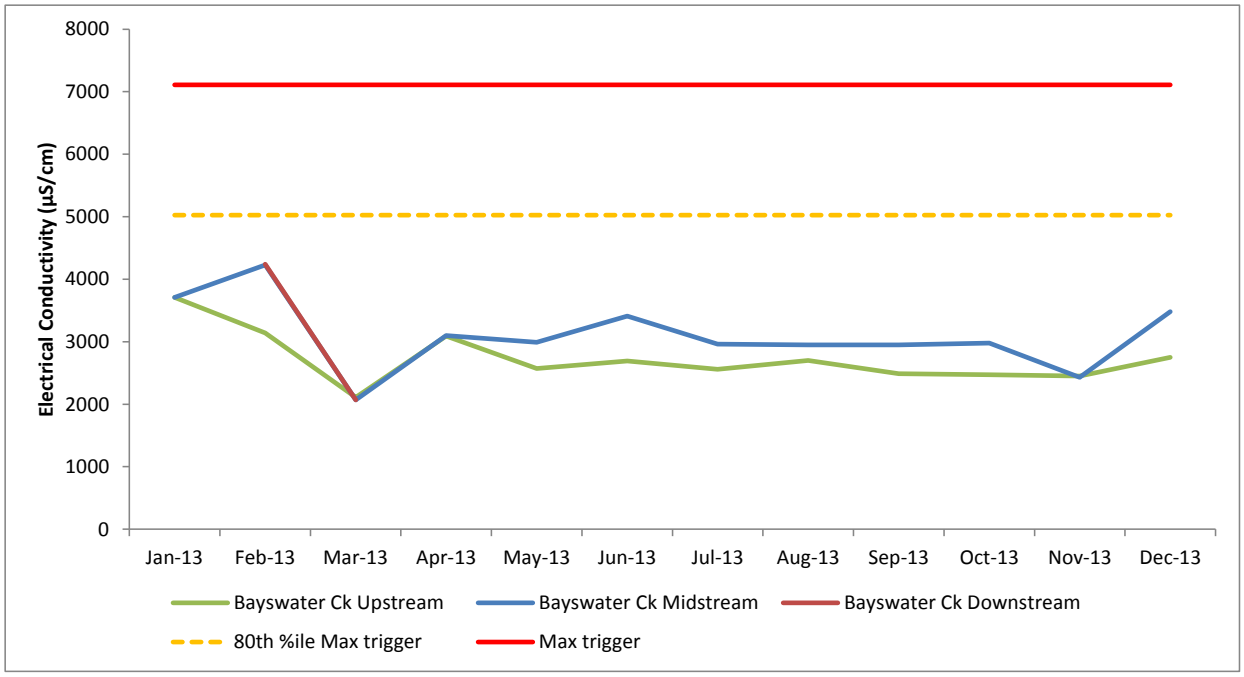


Figure 23 Bayswater Creek Surface Water TSS 2013

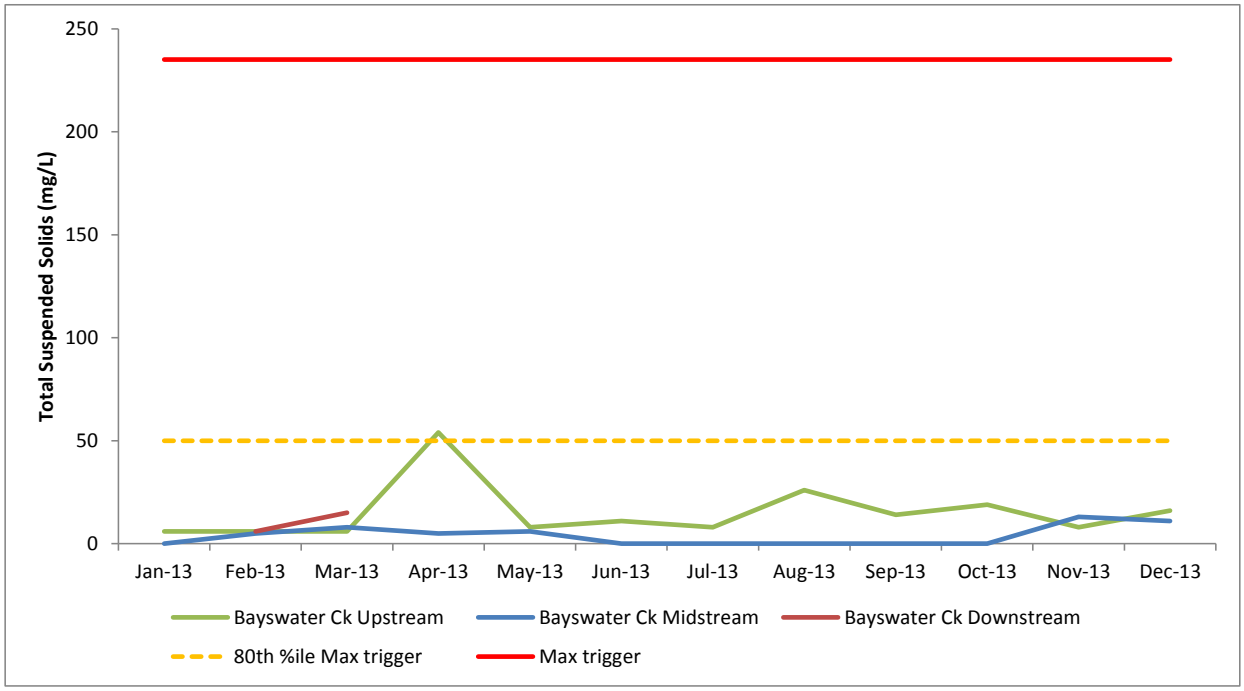
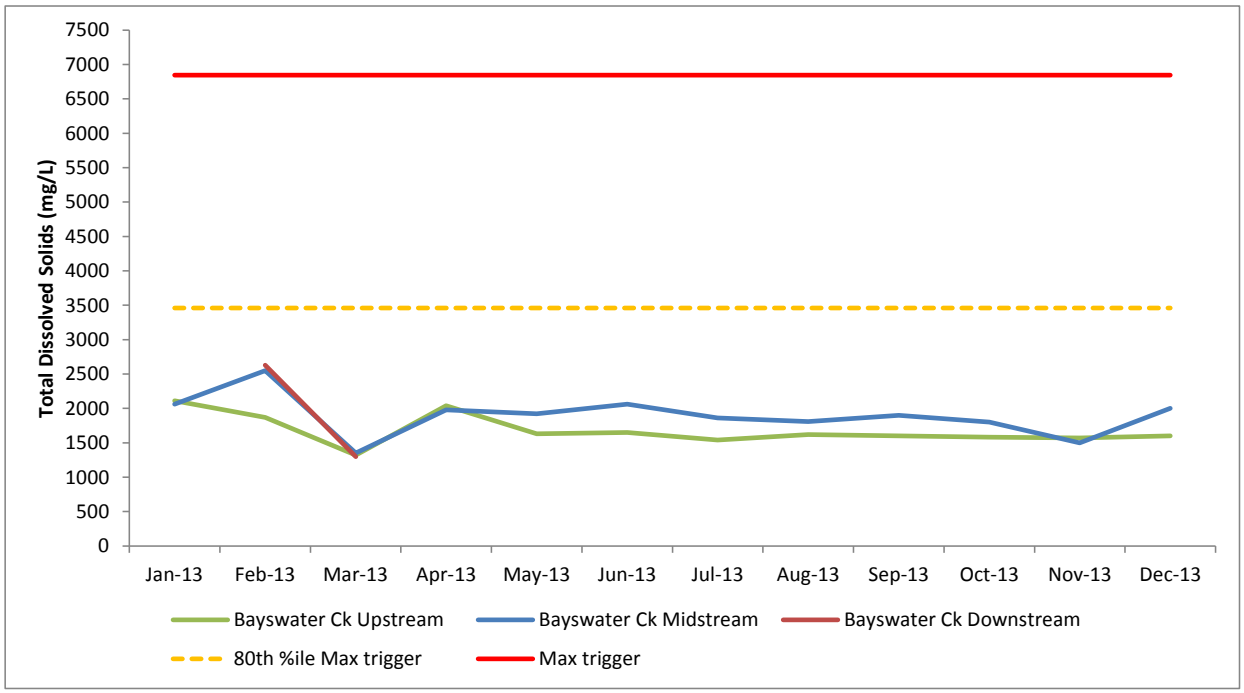


Figure 24 Bayswater Creek Surface Water TDS 2013



Bayswater Creek Three Year Comparison

Comparison of annual average pH, EC, TSS and TDS levels to the previous two reporting periods is presented in Table 22. Annual average results for pH remained relatively steady at all Bayswater Creek monitoring locations over the three year comparison period. Electrical conductivity, TSS and TDS levels have decreased at all sites since 2012.

No long term trends were detailed in the EA, so no comparison between the predicted and observed surface water quality can be provided.

Surface Water Monitoring – Bowmans Creek

Surface water quality was monitored on a monthly basis at two sites along Bowmans Creek:

- Bowmans Creek Upstream (BCK1);
- Bowmans Creek Downstream (BCK6).

All surface water samples were analysed for pH, EC, TSS and TDS. These sites are also analysed on a bi-annual basis for chemical species present. Six additional sites along Bowmans creek (BCK1A, BCK2, BCK2A, BCK3, BCK4 and BCK5) were sampled quarterly and analysed for pH, EC, TSS and TDS. Full surface water monitoring results are presented in Appendix E.

Bowmans Creek pH

The monitoring results for pH for Bowmans Creek are shown on Figure 25 and Figure 26.

Monthly pH levels for Bowmans Creeks ranged from 7.4 (downstream) to 8 (upstream). There were 5 exceedances of the pH 80th percentile trigger value during the reporting period; three at the upstream sampling site (January, May and August) and two at the downstream site (April and August).

Bowmans Creek EC

The monitoring results for EC for Bowmans Creek are shown on Figure 27 and Figure 28.

Monthly EC results vary between 351 µS/cm (upstream) and 1560 µS/cm (downstream) for the reporting period. There were no exceedances of EC trigger values during the reporting period.

Bowmans Creek TSS

The monitoring results for TSS for Bowmans Creek are shown on Figure 29 and Figure 30.

Monthly monitoring results for the TSS range between <5 mg/L and 55 mg/L for the reporting period. There were no exceedances of the TSS trigger values during the reporting period.

Bowmans Creek TDS

The monitoring results for TDS for Bowmans Creek are shown on Figure 31 and Figure 32.

Monthly monitoring results for TDS generally correlate with the EC results. TDS results ranged between 188 mg/L (upstream) and 940 mg/L (downstream). There were no exceedances of trigger values during the reporting period.

Table 22 Annual Average Surface Water Comparisons of Bayswater Creek for pH, EC, TSS and TDS

	Bayswater Creek Upstream				Bayswater Creek Midstream				Bayswater Creek Downstream			
	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	Conductivity (µS/cm)	TSS (mg/L)	TDS (mg/L)
January 2011 – December 2011	7.7	3101	13	2037	8.1	3451	13	2020	7.8	3780	10	2395
January 2012 – December 2012	8	3000	24	1960	8	3517	147	2274	8	3425	28	2287
January 2013 – December 2013	8	2728	15	1678	8	3105	8	1899	8	3155	11	1965

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Figure 25 Bowmans Creek Surface Water pH (Monthly) 2013

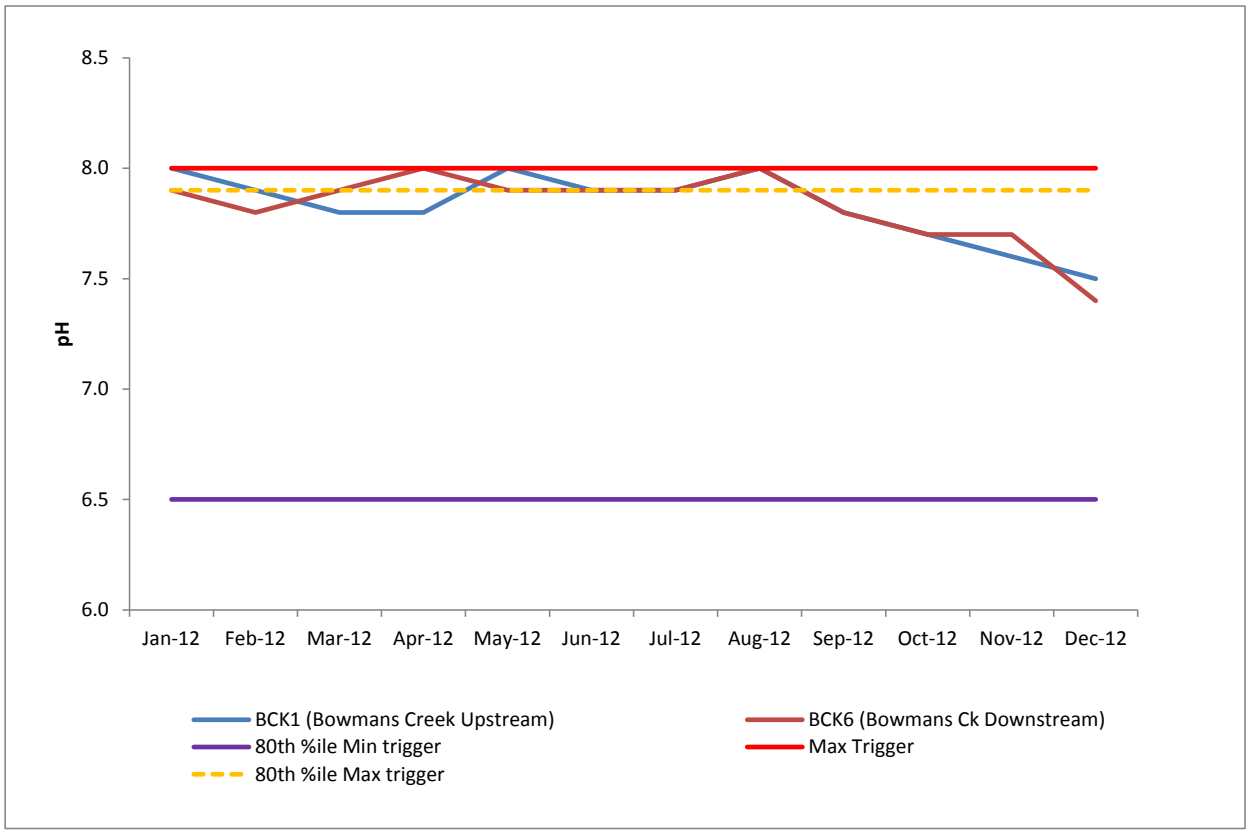


Figure 26 Bowmans Creek Surface Water pH (Quarterly) 2013

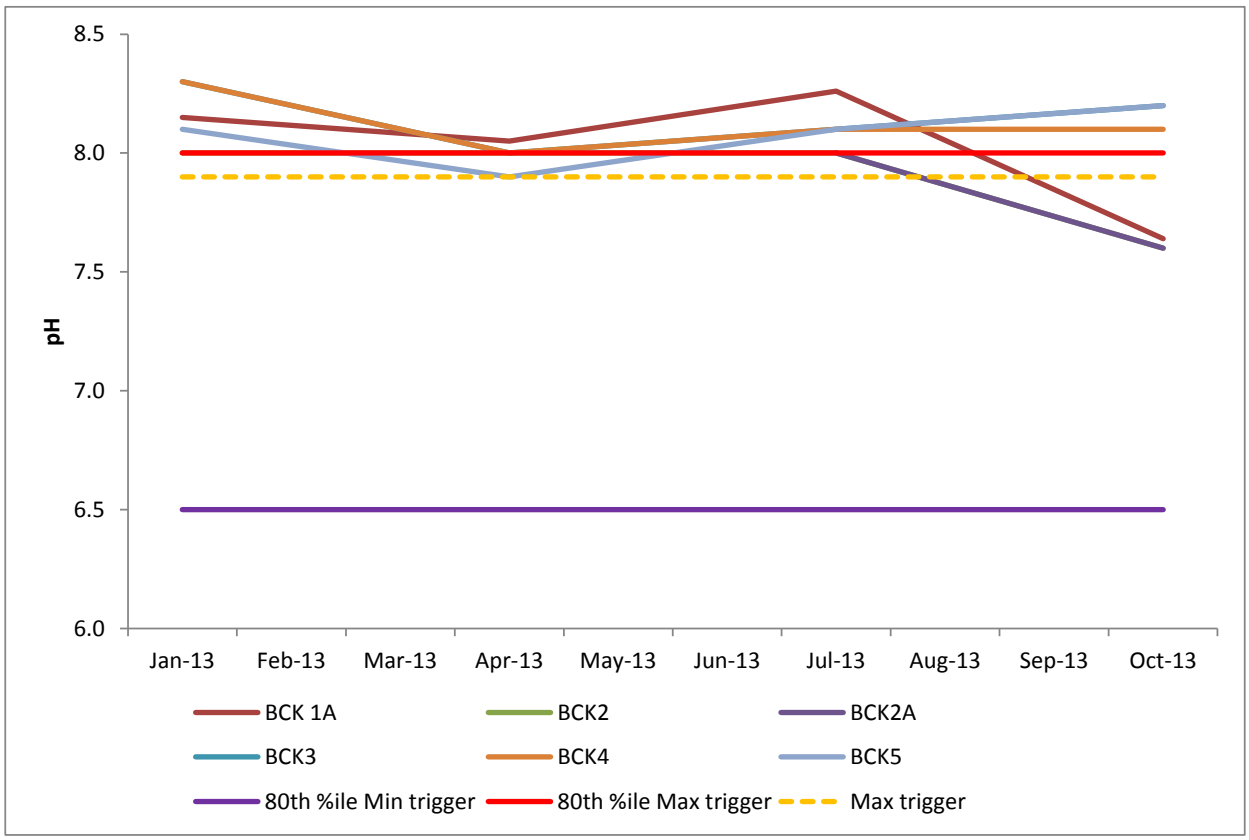


Figure 27 Bowmans Creek Surface Water EC (Monthly) 2013

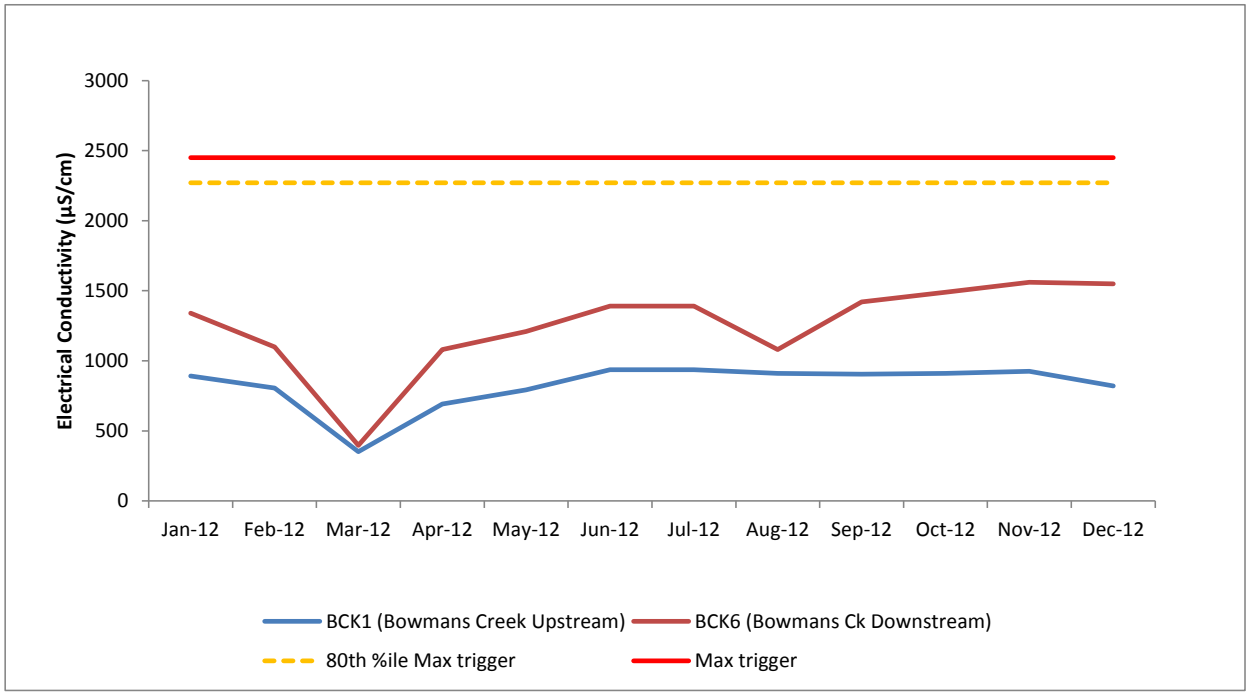


Figure 28 Bowmans Creek Surface Water EC (Quarterly) 2013

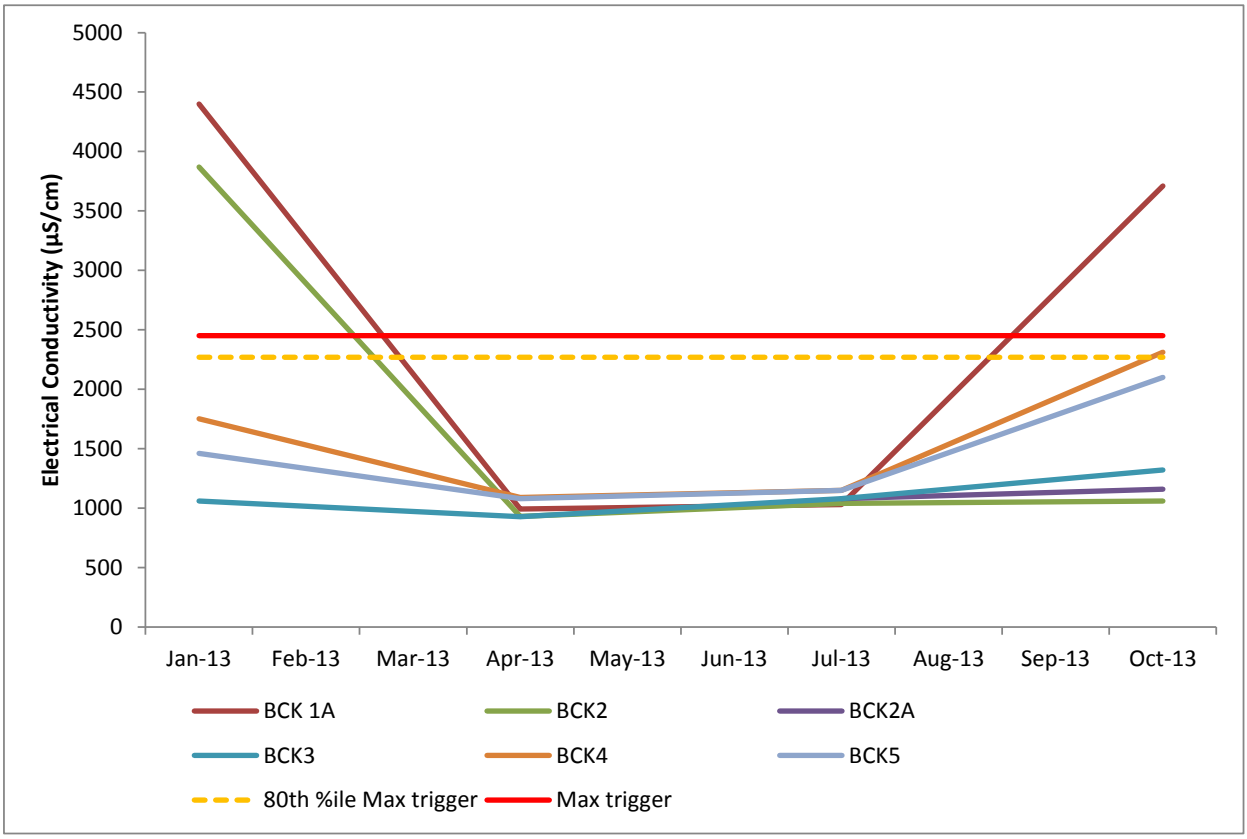


Figure 29 Bowmans Creek Surface Water TSS (Monthly) 2013

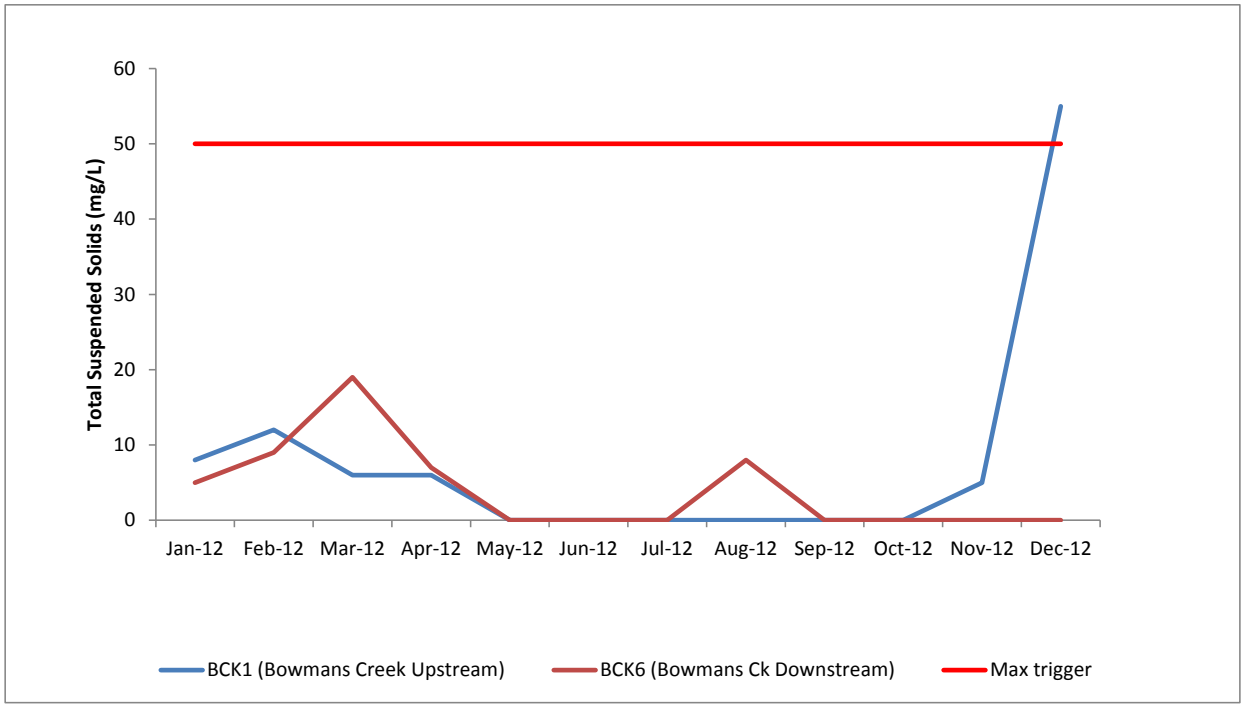


Figure 30 Bowmans Creek Surface Water TSS (Quarterly) 2013

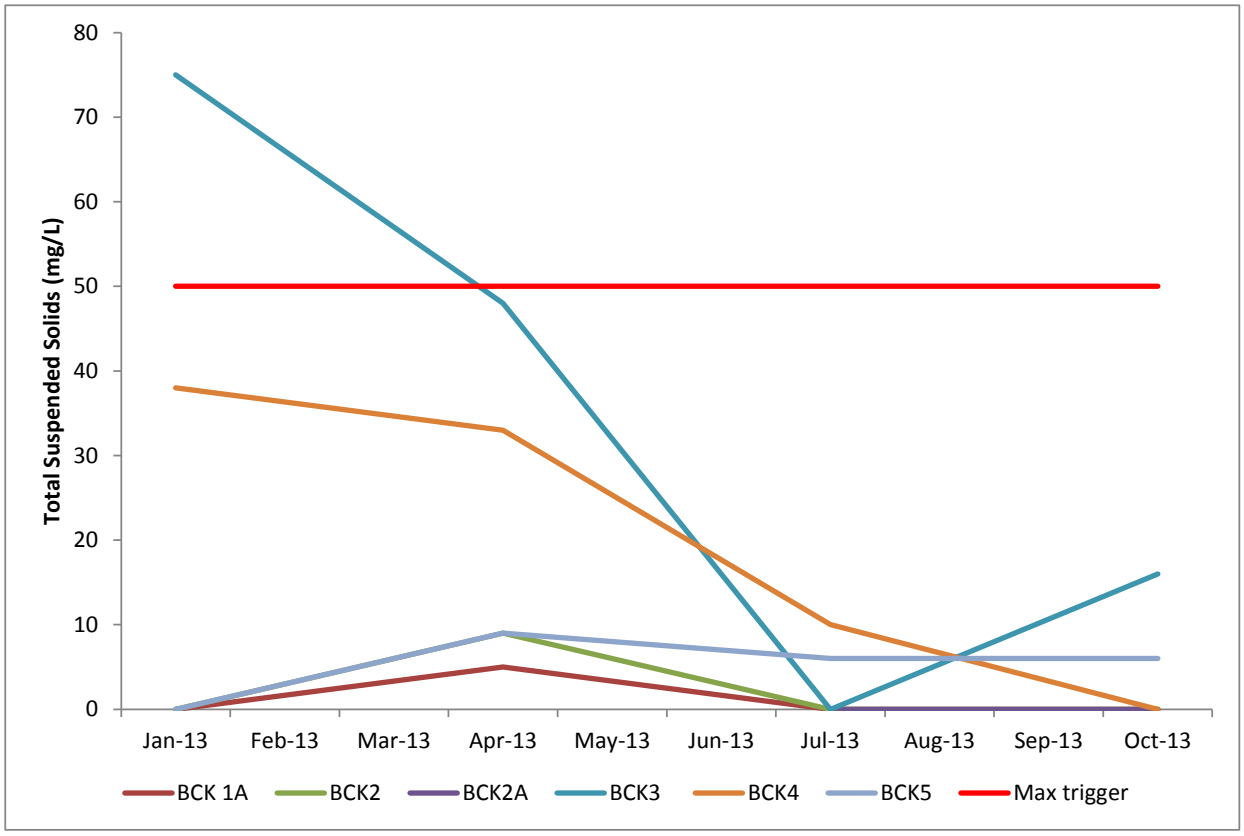


Figure 31 Bowmans Creek Surface Water TDS (Monthly) 2013

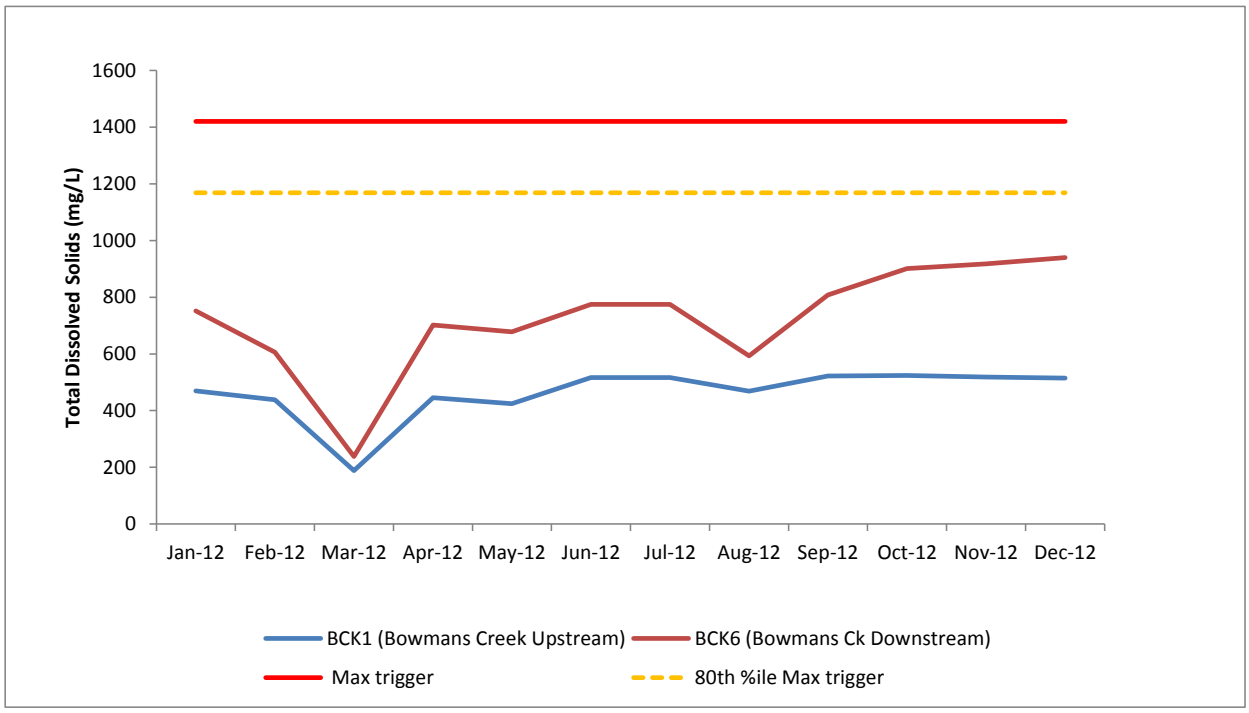
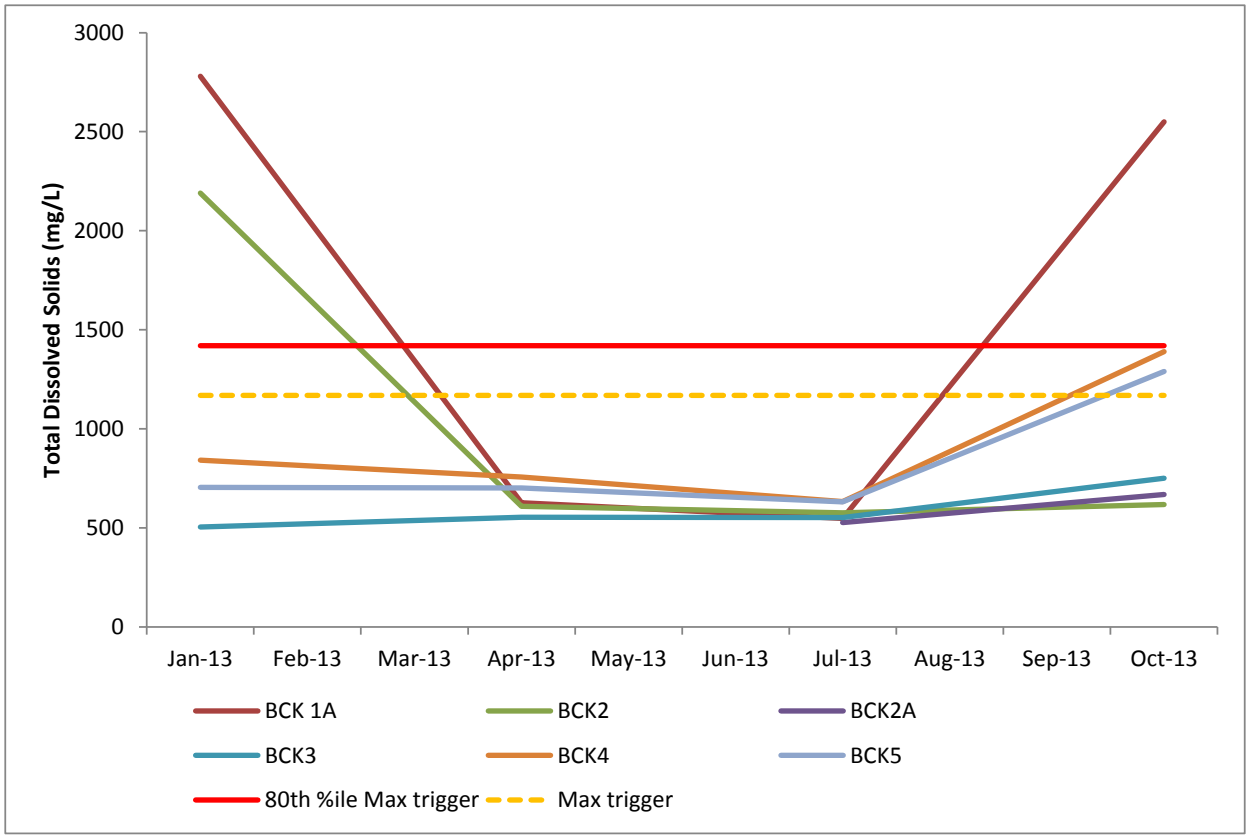


Figure 32 Bowmans Creek Surface Water TDS (Quarterly) 2013



Bowmans Creek Chemical Speciation

Biannual chemical speciation monitoring was carried out during January and July 2013. There are no site specific trigger values available for comparison with the results, and the majority of results returned fell below the limit of reporting for each element.

LCO proposes to continue to monitor the catchment so that site specific long term monitoring trigger values can be established.

Bowmans Creek Three Year Comparison

Comparison of annual average pH, EC, TSS and TDS levels to the previous two reporting periods is presented in Table 23. Annual average pH results remained relatively consistent over the three reporting periods. Annual average conductivity, TSS and TDS results are varied and no significant trends are identifiable over the three reporting periods.

No long term trends were detailed in the Environmental Assessment, so no comparison between the predicted and observed surface water quality can be provided.

Surface Water Monitoring Results for On-site Dams

Surface water quality was monitored on a monthly basis at eight on-site dams – Dam 1, Dam 3, Dam 4, Dam 13, Dam 17, the Mount Owen Transfer Dam, the Reservoir Tailings Dam and Raw Water Transfer Void (RWTV).

All surface water samples were analysed for pH, EC, TSS and TDS. These sites are also analysed on a bi-annual basis for chemical species present. Full surface water monitoring results are presented in Appendix E.

On-site Dams pH Results

The monitoring results for pH for On Site Dams are shown on Figure 30.

Monthly pH testing for the annual reporting period shows variations between pH 7.7 (Dam 17) and pH 9.5 (Dam 13). There were 2 80th percentile trigger value (pH 6.5-9.2) exceedances during the reporting period, 1 at Dam 13 in January and (9.5) and 1 at Dam 3 in February (pH 9.3). The maximum trigger value was not exceeded during the reporting period.

On-site Dams EC Results

The monitoring results for EC for On Site Dams are shown on Figure 34.

The EC results for the on-site dams shows variations between 619 µS/cm (Dam 3) and 12,400 µS/cm (Dam 13). There were 4 exceedances of the 80th percentile trigger value during the reporting period. Two of these results were recorded at the Reservoir Tailings Dam in July and August (6,170 µS/cm and 7,800 µS/cm), and two were at the Raw Water Transfer Void in September and October (6240 µS/cm and 6230 µS/cm). There was one exceedance of the maximum trigger value recorded at Dam 13 in January (12,400 µS/cm).

Table 23 Annual Average Surface Water Comparisons of Bowmans Creek for pH, EC, TSS and TDS

	BCK1 (Bowmans Creek Upstream)				BCK1A				BCK2				BCK2A			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
January 2011 – Dec	7.8	1019.5	10	653.2	7.9	1667.8	8.3	1087	8	871.5	39.3	490	8	775.3	19.3	417.3
January 2012 – Dec 2012	8	762	21	441	8	1324	5	804	8	877	6	517	8	877	21	502
January 2013 – Dec 2013	8	823	15	462	8	2533	5	1626	8	1725	9	998	8	1120	<5	598
	BCK3				BCK4				BCK5				BCK6 (Bowmans Creek Downstream)			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
January 2011 – Dec	8	880.5	23	501.5	8	1094	12	630	8.1	1036	18	600.5	7.8	903.2	13.1	772
January 2012 – Dec 2012	8	1022	24	599	8	1061	35	609	8	1084	21	643	8	991	22	572
January 2013 – Dec 2013	8	1097	46	590	8	1560	35	936	8.1	1448	7	832	7.8	2151	10	724

Figure 33 On Site Dams Surface Water pH 2013

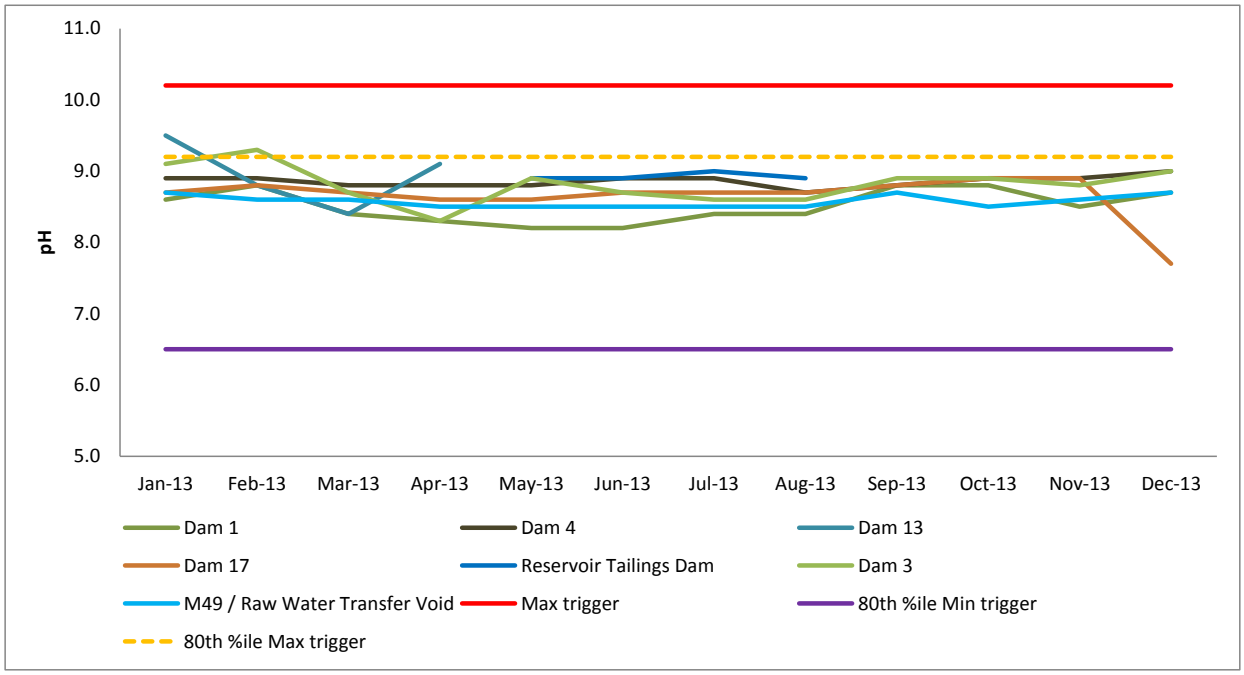


Figure 34 On Site Dams Surface Water EC 2013

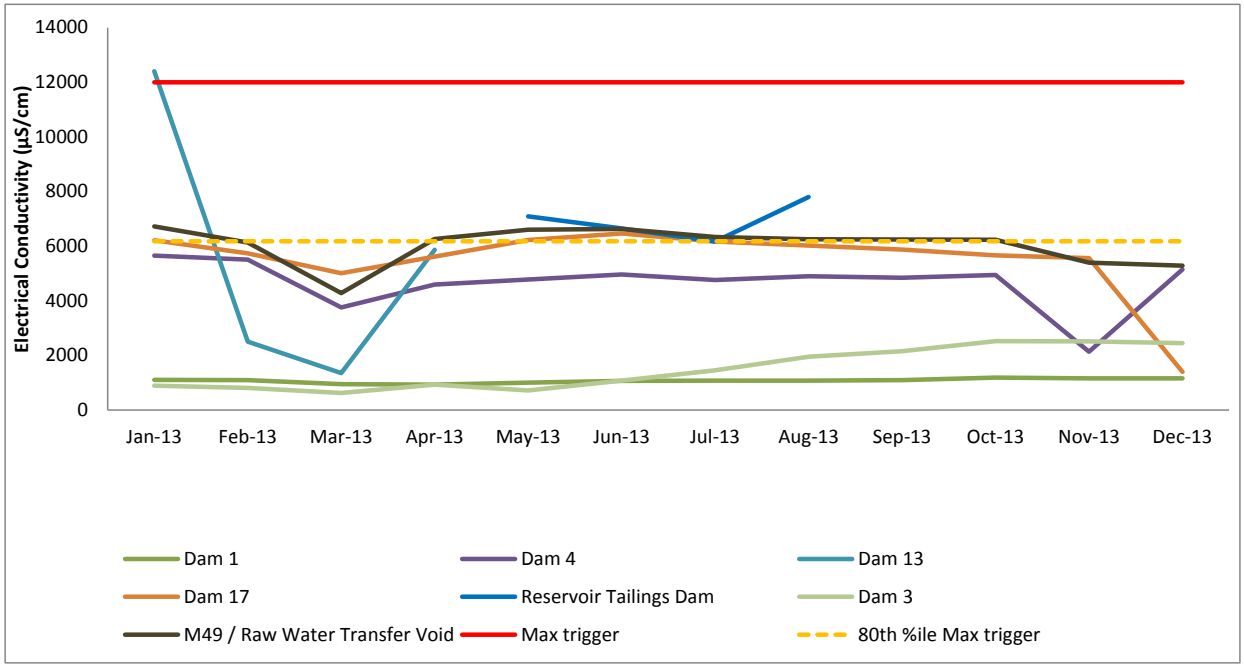


Figure 355 **On Site Dams Surface Water TDS 2013**

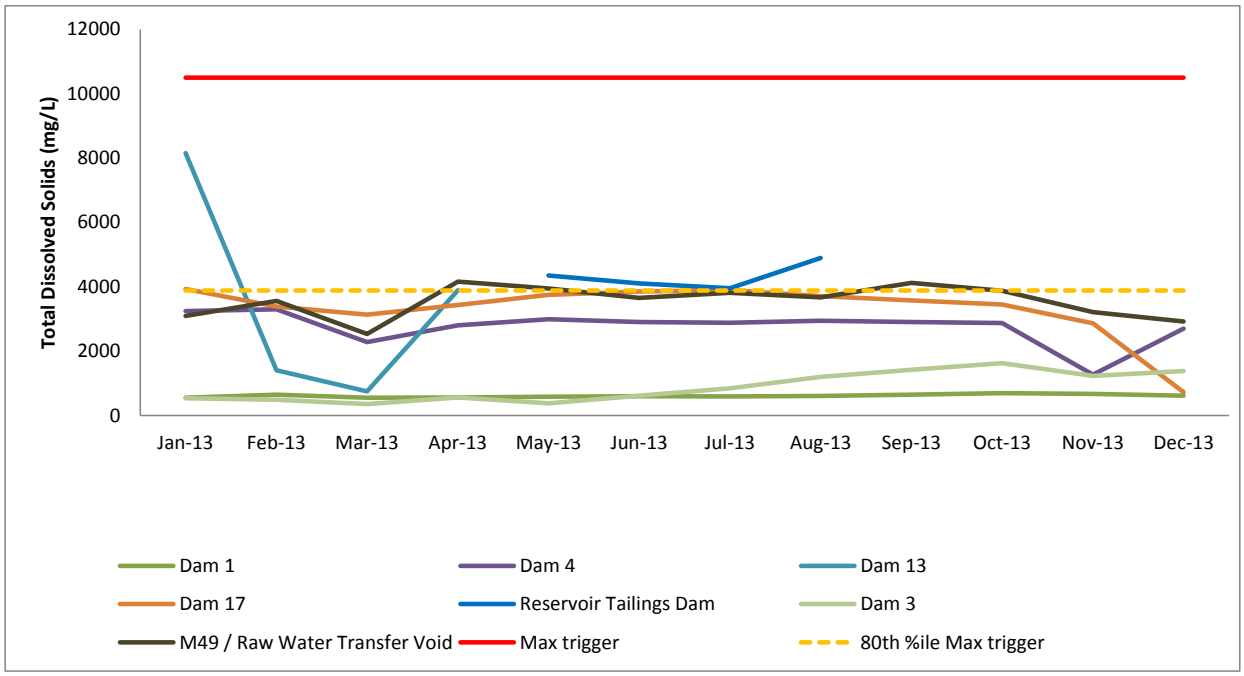
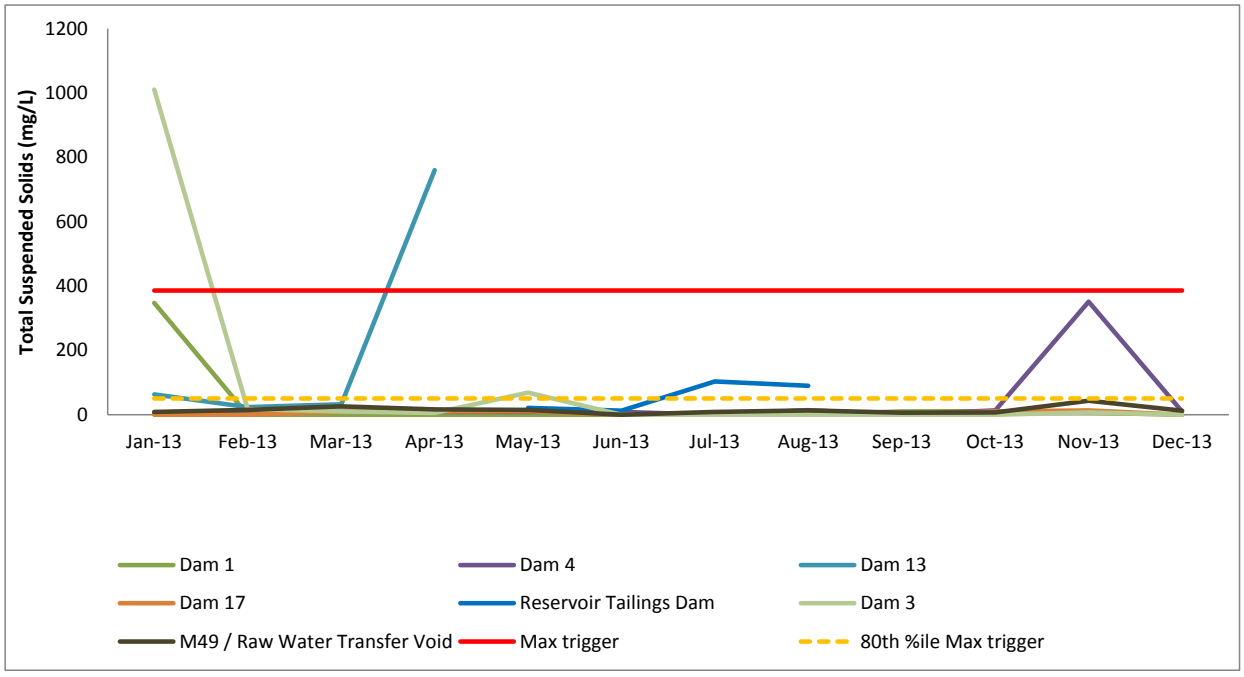


Figure 366 **On Site Dams Surface Water TSS 2013**



On-site Dams TDS Results

The monitoring results for TDS for On Site Dams are shown on Figure 35.

Monitoring results for the Total Dissolved Solids (TDS) for the on-site dams correlate with the EC results. During the reporting period, there were 11 exceedances of the 80th percentile trigger limit (3880 mg/L) during the reporting period, including:

- 2 occasions at Dam 13 in January (8150 mg/L) and April (3890 mg/L).
- 2 occasions at Dam 17 in January (3930 mg/L), and July (3900 mg/L).
- 4 occasions at the Reservoir Tailings Dam in May, June, July and August (4350 mg/L, 4100 mg/L, 3950 mg/L and 4890 mg/L).
- 3 occasions at the Raw Water Transfer Void in April, May and September (4160 mg/L, 3940 mg/L and 4120 mg/L).

No result exceeded the maximum trigger value for TDS (10500 mg/L).

On-site Dams TSS Results

The monitoring results for EC for On Site Dams are shown on Figure 36.

There were 11 exceedances of the 80th percentile trigger limit (50 mg/L) during the reporting period, including:

- One occasion at Dam 1 in January (347 mg/L).
- Two occasions at Dam 3 in January (1010 mg/L) and May (68 mg/L).
- One occasion at Dam 4 in November (351 mg/L).
- Two occasions at Dam 13 in January (63 mg/L) and April (760 mg/L).
- Three occasions at the Reservoir Tailings Dam in March (86 mg/L), July (103 mg/L) and August (90 mg/L).

There were two exceedances of the maximum trigger value (386 mg/L) during the reporting period, one at Dam 13 during April (760 mg/L) and one during January at Dam 3 (1010 mg/L).

On-site Dams Chemical Speciation Results

Biannual chemical speciation monitoring was carried out during January and July 2012. There are no site specific trigger values available for comparison with the results, and the majority of results returned fell below the limit of reporting for each element.

LCO proposes to continue to monitor the catchment so that site specific long term monitoring trigger values can be established.

On-site Dams Three Year Comparison

Comparison of annual average pH, EC, TSS and TDS levels to the previous two reporting periods is presented in Table 24. Annual average pH and EC levels remained generally constant at all dams over the three year reporting periods. Annual Average TSS has increased at Dams 1, 3, 4 and 13, and decreased at Dam 17, the Raw Water Transfer Void, Reservoir Tailings Dam and Mt Owen Transfer Dam. The annual average TDS remained stable at all sites.

No long term trends were detailed in the environmental assessment, and as such, no comparison between the predicted and observed surface water quality can be provided.

Table 24 Annual Average Surface Water Comparisons of Onsite Dams for pH, EC, TSS and TDS

	Dam 1				Dam 3				Dam 4				Dam 13			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	E C	TSS (mg/L)	TDS (mg/L)
January 2011 – Dec	8.5	1006	7	605	8.8	1206	15	750	8.9	5693	16	3623	8.9	4925	78	3086
January 2012 – December	8.5	833	15	479	9	745	10	438	9	5076	19	3239	9	5479	55	3591
January – December 2013	8.5	1070	94	606	9	1504	186	885	9	4662	44	2756	9	5528	220	3548
	Dam 17				Reservoir Tailings Dam				Mt Owen Transfer Dam				Raw Water Transfer Void			
	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)	pH	EC (µS/cm)	TSS (mg/L)	TDS (mg/L)
January 2011 – Dec	8.8	6122	120	3836	8.8	6432	414	4086	9.3	4744	57	2819	8.5	5767	21	3570
January 2012 – December	9	5543	23	3568	9	7648	47	5126	9	3704	23	2276	9	5833	23	3739
January – December 2013	9	5493	10	3307	9	6378	62	3970	Sampling Ceased				9	6028	15	3544

HRSTS Discharge Monitoring

Any discharges from the Liddell Colliery must be undertaken in accordance with the Hunter River Salinity Trading Scheme (HRSTS). 20 discharges occurred during the reporting period. Monitoring results at the Stilling Basin during the discharge events are presented in Table 25. The EPL discharge license stipulates criteria for pH and TSS during discharge events. All discharge monitoring results were within the criteria outlined in the EPL.

Table 25 HRSTS Discharge Events 2013

Date	Discharge Volume (ML)	pH (Stilling Basin)	EC (µS/cm) (Stilling Basin)	TDS (Stilling Basin)
30/01/13	12.8	8.6	5765	15.6
31/01/13	28.2	8.6	568	13.9
01/02/13	23.7	8.6	528	49.6
02/02/13	4.9	8.6	5013	107.5
04/2/13	26.4	8.6	4648	19.8
03/02/13	12.0	8.6	4687	32.3
04/02/13	26.4	8.6	4647	25.4
5/2/13	20.1	8.6	4715	21.3
6/2/13	12.3	8.4	5701	18.3
25/2/13	17.0	8.4	5624	19.72
26/2/13	28.7	8.4	5739	12.8
27/02/13	21.8	8.4	5867	12.1
28/02/13	11.4	8.4	5934	9.0
1/03/13	5.1	8.4	455	60.4
03/03/13	15.0	8.4	492	39.3
04/03/13	29.1	8.4	493	31.1
05/03/13	37.7	8.4	482	44.8
06/03/13	38.3	8.4	466	76.2
07/03/13	27.4	8.3	493	57.4
08/03/13	14.7	8.3	503	50.4

3.8 Groundwater

3.8.1 Environmental Management

The Liddell Colliery – Groundwater Monitoring Program outlines the groundwater monitoring required to be undertaken by LCO to ensure compliance with statutory requirements and is part of a set of documents prepared to support the Liddell Colliery – Water Management Plan. The monitoring program addresses the requirements specified in Development Consent DA 305-11-01 MOD 4 and LCO's Environmental Protection Licence EPL 2094. The monitoring program specifically satisfies schedule 3, condition 27 of the development consent, which requires the development of a groundwater monitoring program as a component of the overall Water Management Plan prepared for the development.

LCO is located within an area of the Upper Hunter Valley subject to extensive underground and open cut mining activities since the early 20th century. Current and historical mining operations have extensively altered the physical features and environmental setting of the local area, including the region's surface water and groundwater systems. Mining operations to the west, south and east of LCO, Lake Liddell to the west, and the major geological feature Hunter Thrust to the north, all
have major influence on groundwater levels in the region. Due to such operations and features regional groundwater levels largely reflect current and past mining activities, with water levels varying with time and location according to local mining activities.

LCO has an established groundwater monitoring program comprising a network of 19 piezometers (refer to Figure 20) that target both the surrounding alluvial aquifer associated with Bowmans Creek and the regional hard rock aquifer associated with the coal measures. All of the piezometers in the monitoring network are located outside the current open cut pits at LCO, and as such are considered appropriate locations for providing data on groundwater levels and pressures and groundwater quality for surrounding aquifers, including both alluvial aquifer systems and the regional hard rock aquifers associated with the coal measures. Piezometers targeting the alluvium are paired and monitor both the alluvial aquifer and the adjacent underlying shallow bedrock strata (where the bore name suffix L = alluvium and S = shallow bedrock or overburden). The piezometers are monitored monthly for groundwater level and every two months for water quality parameters pH and electrical conductivity. Eleven of the piezometers are also sampled biannually and analysed for a range of inorganic species.

3.8.2 Environmental Performance

Groundwater sampling was conducted in accordance with the Groundwater Monitoring Guidelines for Mine Sites within the Hunter Region (Department of Infrastructure, Planning and Natural Resources (DIPNR), 2003), as adapted from AS 5667.11 (1998).

As described in the Liddell Colliery – Groundwater Monitoring Program and as recommended in the ANZECC (2000) Water Quality Guidelines, historic monitoring data has been used to define the default assessment criteria for groundwater at the site. Due to the highly disturbed nature of the site, an 80th percentile value has been applied to the default trigger values for the water quality parameters pH and electrical conductivity (EC). The trigger values based on historical monitoring data for the alluvial and hard rock aquifers are summarized in Table 26.

Table 26 Trigger Values for Groundwater Quality

Analyte	Alluvial Aquifer		Hard Rock Aquifer	
	80th percentile[1]	Maximum	80th percentile[1]	Maximum
pH	6.5 – 7.8	3.2 – 9.6	6.5 – 8.2	6.5 – 10.7
Electrical Conductivity (µS/cm)	2791	5480	5356	5840

[1] - ANZECC criteria for pH lower limit; 80th percentile of historical monitoring data used for upper limit.

The trigger values for pH in the alluvial aquifer defined in the Liddell Colliery – Groundwater Monitoring Program comprise a smaller pH range than the default trigger values for pH for south-east Australia for slightly disturbed lowland river ecosystems (pH range 6.5 to 8; ANZECC, 2000). As such the trigger values defined in the monitoring program are conservative in comparison to default guideline values provided in the ANZECC (2000) Water Quality Guideline. Re- evaluation of the groundwater assessment criteria adopted is considered worthwhile in the next revision of the LCO groundwater monitoring program.

The trigger values adopted for the groundwater monitoring program are intended to provide an indication of potential impacts to groundwater resources as a result of mining operations. Further investigations into such potential impacts are to be conducted if monitoring results suggest significant and continuous deviation from historical or background trends in water quality parameters.

In addition to pH and EC, the other key parameter measured as part of the groundwater monitoring program is groundwater level. Monitoring of these parameters provides an indication of pressures / water levels and groundwater quality within the coal measures and the alluvial aquifer associated with Bowmans Creek and its shallow underlying strata (i.e. overburden).

Groundwater Quality Monitoring Results

Groundwater quality is monitored at seven locations targeting the alluvial aquifer associated with Bowmans Creek using dual piezometers penetrating the alluvium and the underlying hard rock strata (ie. overburden). Piezometers ALV1L through ALV8L and LBH target the Bowmans Creek alluvium while piezometers ALV1S through ALV8S target the hard rock strata immediately beneath the alluvium. Groundwater quality in the deeper hard rock aquifer associated with the coal measures is monitored at six other locations (PGW5L, PGW5S, HAZ 3/4, HAZ 6, LC1 and Mt Owen 2).

Location PGW5 includes a dual piezometer targeting the overburden (PGW5L) and Pikes Gully coal seam (PGW5S).

Groundwater at each of these locations is monitored monthly for depth to water and in situ pH and EC readings using a field pH/EC probe. In addition, every six months groundwater samples are collected and analysed for TSS, TDS, heavy metals, cations and anions. Groundwater quality monitoring results for the reporting period are shown in Figure 34 to Figure 40 and in Appendix F, and a summary of these results is provided below.

Alluvial and Shallow Bedrock Aquifers

During the reporting period (January 2013 to December 2013), the 80th percentile trigger value for pH (pH 6.5 to 7.8) was just exceeded on 6 separate occasions and only for shallow bedrock bores:

- Once at ALV1S in October (7.87);
- Twice at ALV2S in October (7.83) and December (7.97); and
- Three times at ALV4S in February (7.91), March (7.98) and April (7.82).

The ANZECC (2000) Water Quality Guideline (pH=8), and the minimum pH (pH 3.2) and maximum upper limit trigger value for pH (pH 9.6) were not exceeded during the reporting period. The range in observed values is within the long-

term variability of measurements and suggests a revision of the 80% trigger value should be undertaken based on the longer period of data now collected.

Electrical conductivity measurements provide a proxy for groundwater salinity. Based on the measured data (Appendix E), an approximation can be made that total dissolved solids (TDS) ≈ 0.58 x EC.

The EC for piezometer ALV4S exceeded the 80th percentile trigger value (2791 µS/cm) for the entire reporting period (also exceeded the maximum trigger value (5480 µS/cm) in May 2013 (6430 µS/cm)). The long-term (2003-2013) average EC at this bore is 5,200 EC, hence the values observed during the reporting period are not anomalous.

Other monitoring results above the 80th percentile trigger value for EC included:

- Six exceedances at ALV2S in January (2810 µS/cm), June (2830 µS/cm), July (2980 µS/cm), August (3040 µS/cm), October (2910 µS/cm) and November (2850 µS/cm);

- Two exceedances at ALV3S in October (2820 µS/cm) and November (4340 µS/cm); and

- Five exceedances at ALV2L in July (3150 µS/cm), August (3430 µS/cm), October (3010 µS/cm), November (3480 µS/cm) and December (3000 µS/cm).

The pH and EC monitoring data collected between January 2013 and December 2013 for all alluvium and shallow bedrock bores is consistent with historical monitoring data recorded for these locations (AECOM, 2012).

Hard Rock Aquifer (Coal Measures)

Sampling equipment limitations prevented LCO from monitoring bores LC1 and Mt Owen 2 as the water level was beyond the depth at which it could be sampled, hence there was no chemistry data collected at these locations. Over the reporting period Haz4 had been damaged (bent) and therefore no sampling data could be obtained during this period. Piezometers PGW5L and PGW5S were intermittently dry during the reporting period, hence an incomplete record is recorded. A complete record was available for Haz 6.

pH values recorded at PGW5L and PGW5S were within the minimum and 80th percentile pH trigger value range for the entire reporting period. One pH measurement at Haz 6 during December 2013 (8.21) exceeded the 80th percentile trigger value (pH = 6.5 to 8.2).

The pH data collected for the hard rock aquifer during the monitoring period is consistent with historical monitoring data recorded for these locations (AECOM, 2012).

Electrical conductivity measurements for PGW-5S exceeded the 80th percentile trigger value (5356 µS/cm) for the entire reporting period, except for September 2013. Three EC measurements exceeded the 80th percentile trigger value for Haz 6 in May (5780 µS/cm), July (5750 µS/cm) and August (5590 µS/cm), and two exceeded for PGW5-L in May (6060 µS/cm) and August (5450 µS/cm).

The maximum trigger value (5840 µS/cm) was also exceeded on the following occasions:

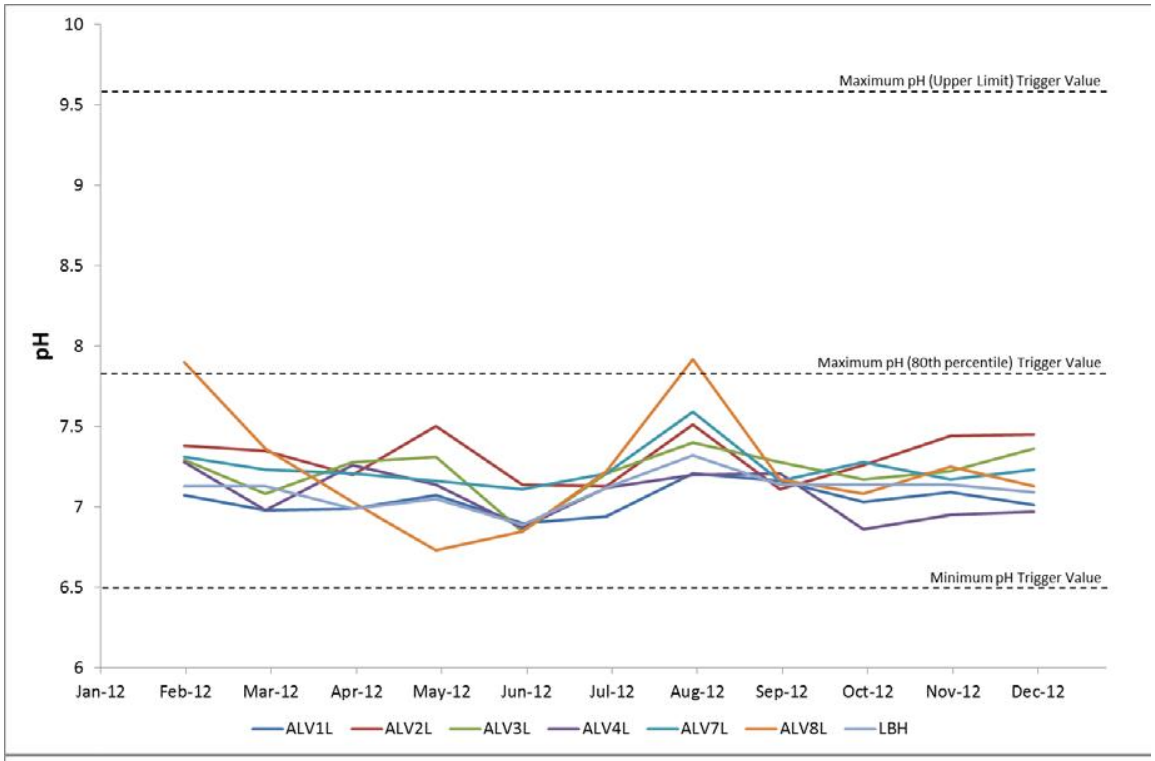
- Twice at PGW5-S in July (6160 µS/cm) and August (6280 µS/cm); and

- Once at PGW5-L in May (6060 µS/cm).

PGW5-L and PGW5-S show similar EC levels and trends where data is present, suggesting connectivity between the overburden and the Pikes Gully coal seam.

The EC data collected for the hard rock aquifer during the monitoring period is consistent with historical monitoring data recorded for these locations (AECOM, 2012).

Figure 377 **pH Data for Alluvial and Shallow Bedrock (ie. overburden) Piezometers – January to December 2012**



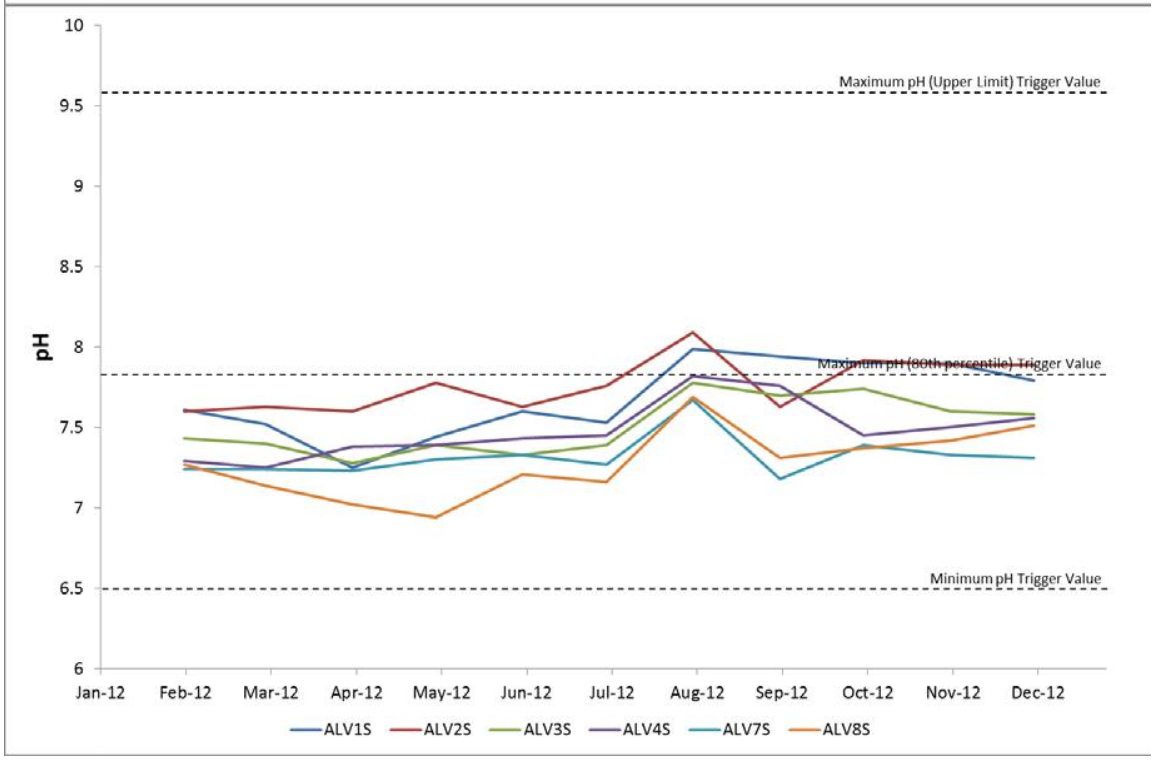


Figure 388 **EC Data for Alluvial Piezometers – January to December 2013**

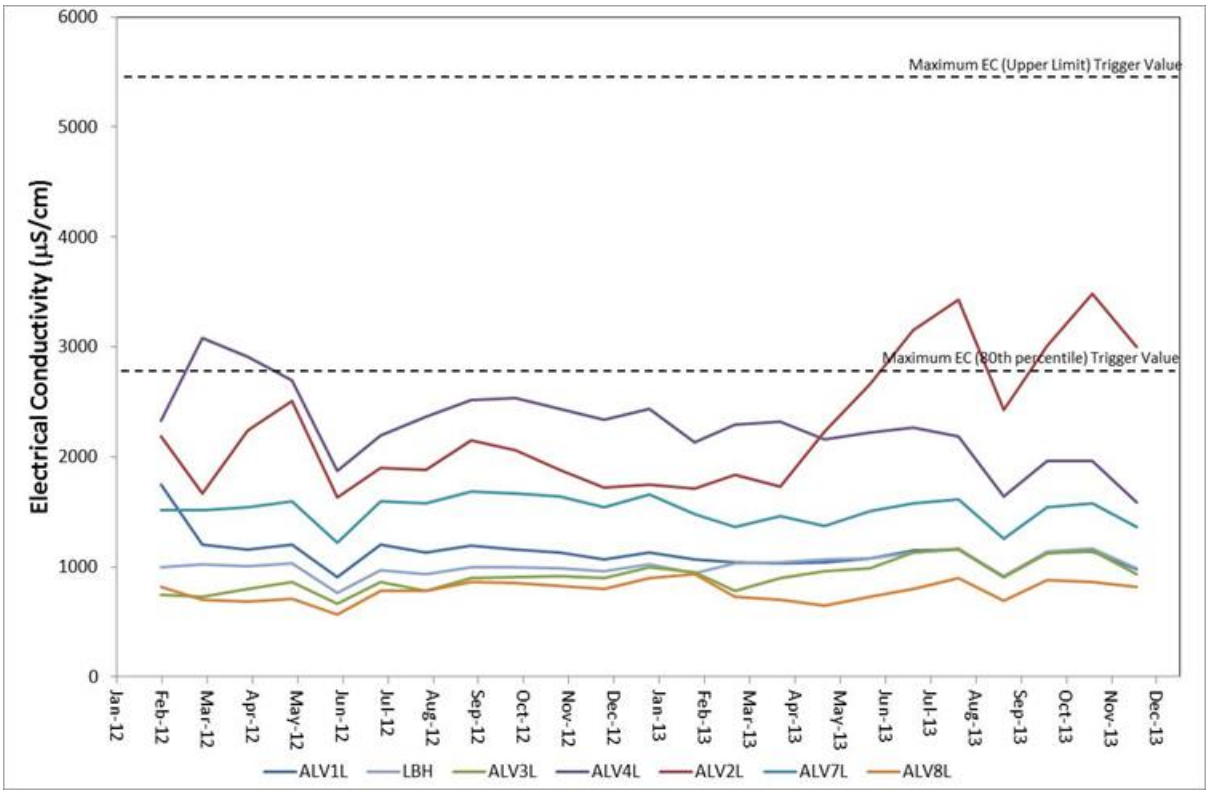


Figure 39 EC Data for Shallow Bedrock Piezometers – January to December 2013

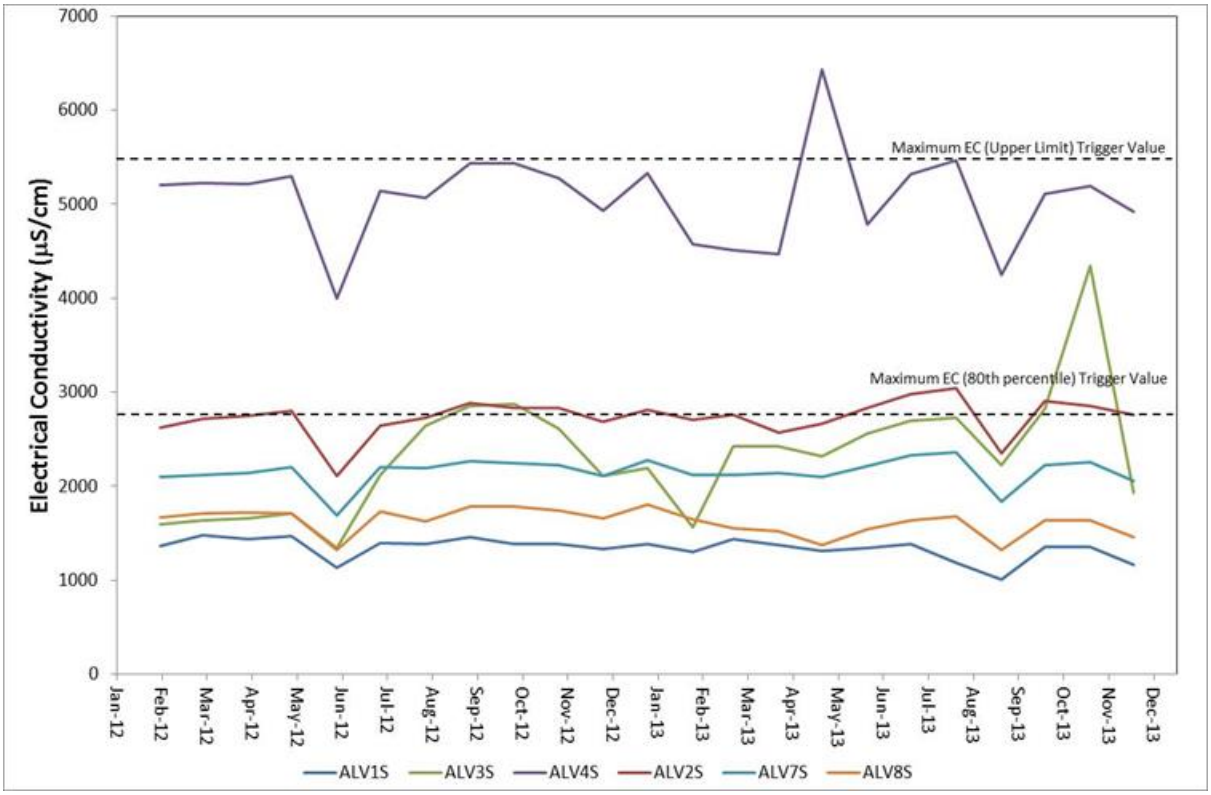


Figure 40 EC Data for Hardrock (Coal Measures) Bores – January 2012 to December 2013

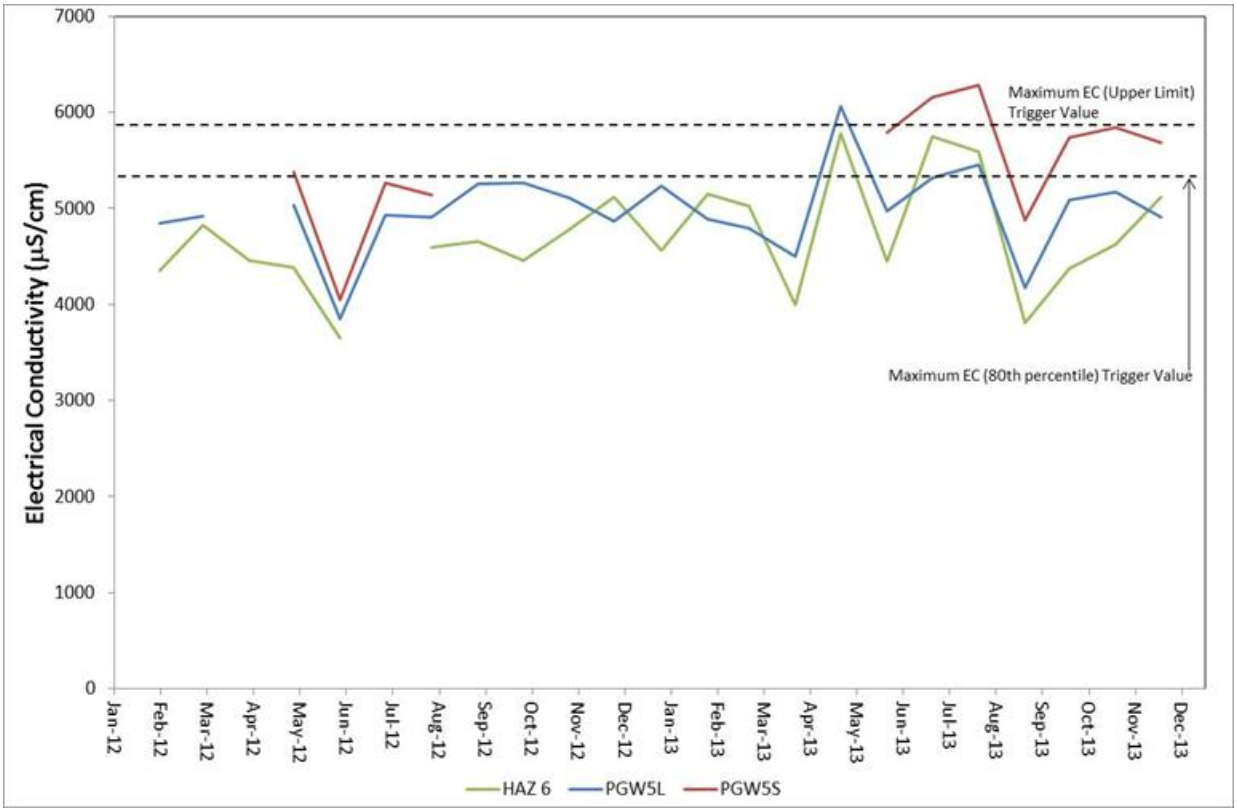


Figure 41 pH Data for Alluvial Bores – January to December 2013

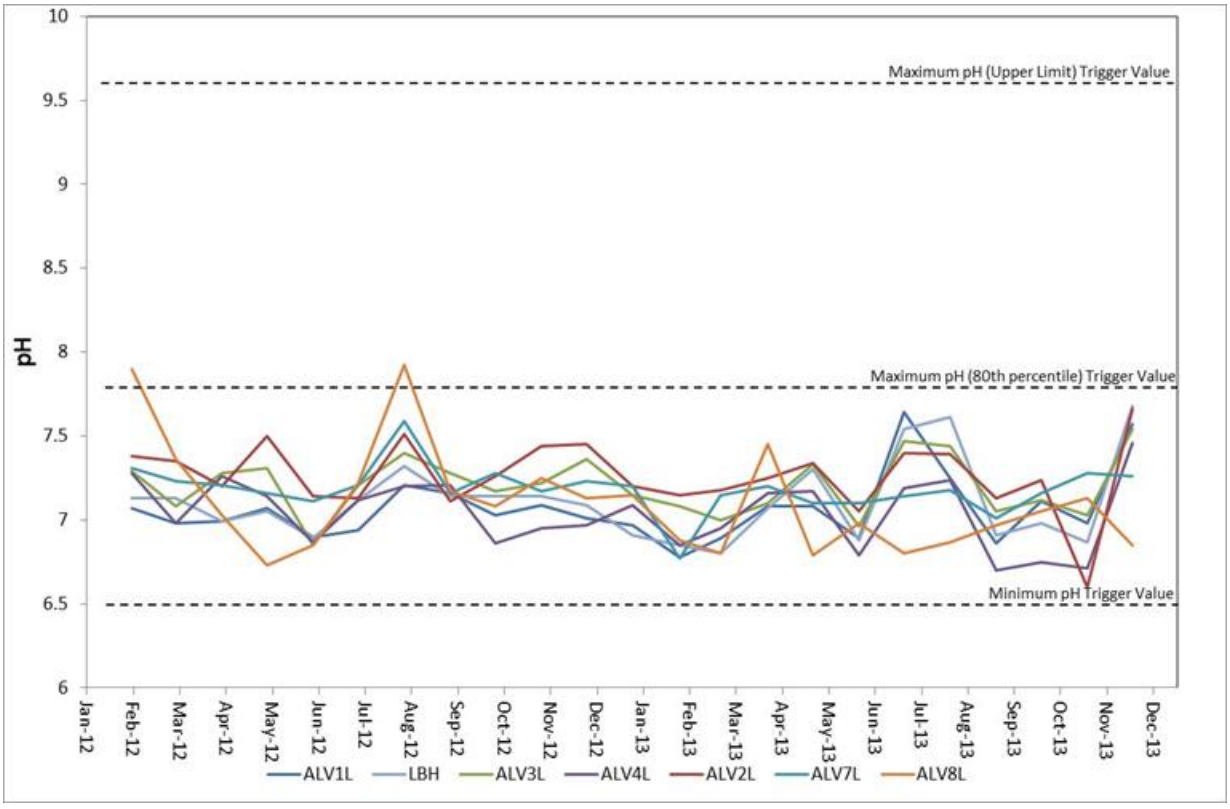


Figure 42 pH Data for Shallow Bedrock (overburden) Bores – January to December 2013

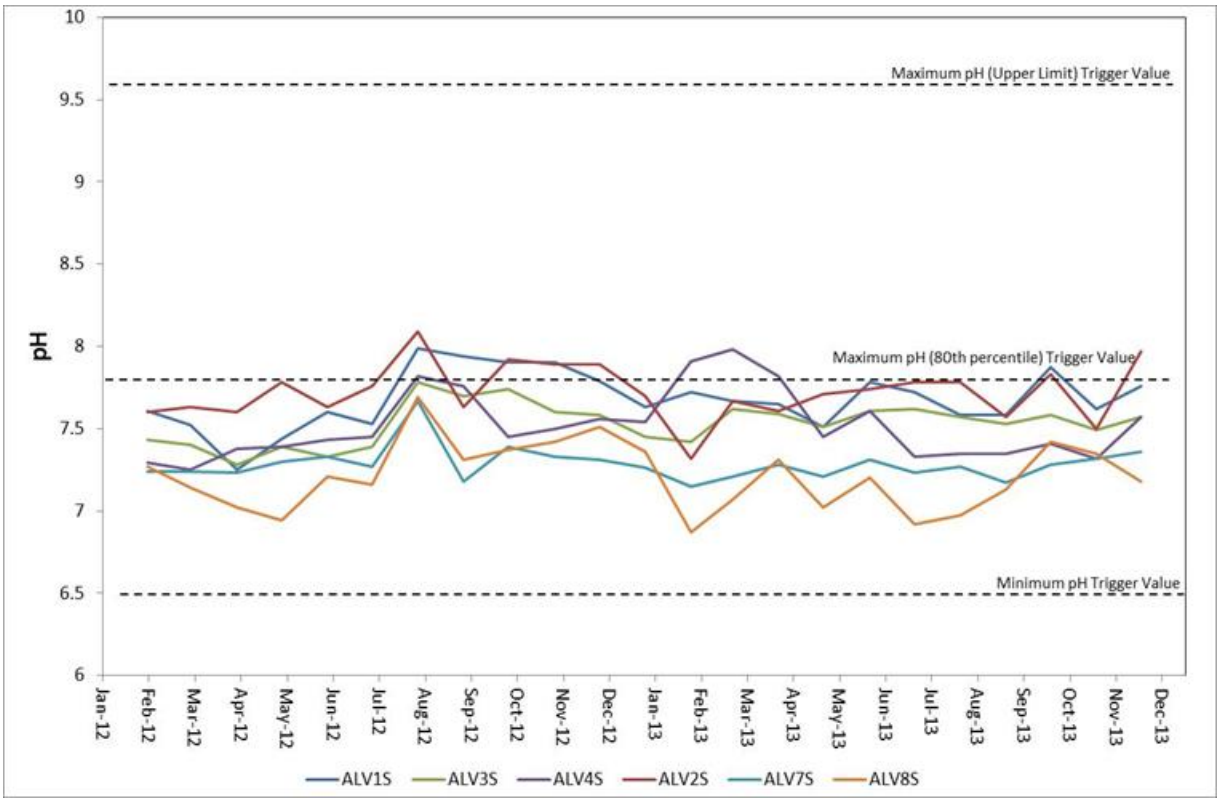
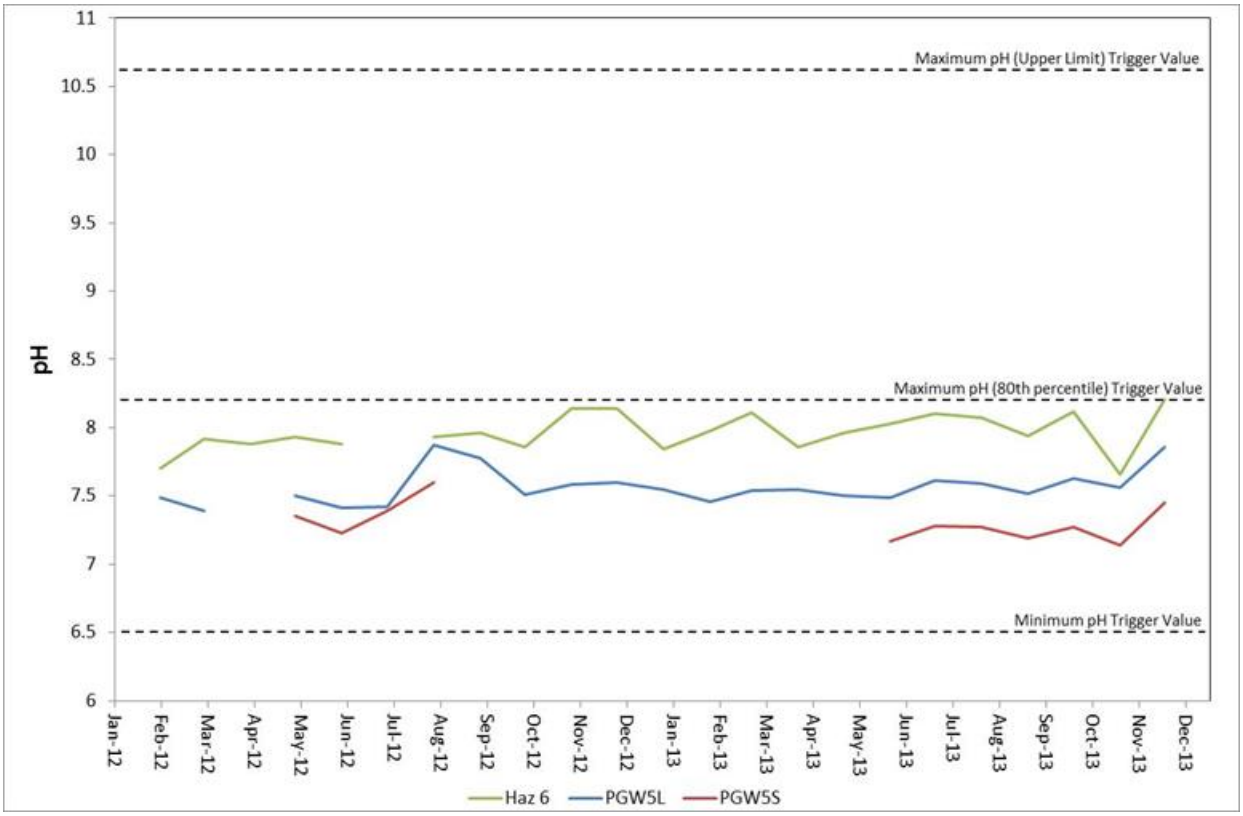


Figure 43 pH Data for Bedrock (Coal Measures) Bores – January to December 2013



Groundwater Levels

Groundwater level trends are shown in Figure 44 to Figure 46 for all of the piezometers monitored as part of LCO's groundwater monitoring program.

Alluvial and Shallow Bedrock Aquifers

Hydrographs for piezometers targeting the alluvium and shallow bedrock are displayed in Figure 37, 38, 39,41,42 & 43.**Error! Reference source not found.** Also shown is the cumulative deviation from mean monthly rainfall to compare changes in water levels to changes in rainfall. Historic rainfall data from weather station 061397, located at Singleton was obtained from the Bureau of Meteorology (BoM) website. Periods of greater than average rainfall are indicated by upward trends; lower than average as downward trends. Thus, the drought conditions that extended across NSW can be seen in the predominantly downward trajectory of the cumulative deviation through to 2007. This was followed by a period of average rainfall conditions (horizontal trend), with a wetter period starting at the end of 2010. Conditions have oscillated since then.

Groundwater elevations decrease with distance downstream. The sympathetic water levels and responses observed in the paired bores indicate hydraulic connectivity between the alluvium and shallow bedrock. Water level relationships show a shift from slight upward pressures (gaining stream) upstream (ALV1), through to equal pressures adjacent to LCO (ALV3, ALV4, ALV2) to slight downward pressures (losing stream) to the south (ALV7, ALV8). Rainfall (recharge) appears to be the dominant driver for groundwater level variability for the Bowmans Creek alluvium.

Groundwater levels generally decreased from 2001 to 2006 (during drought conditions) before rebounding to 2001 levels following the 2007 floods. Since then groundwater levels have remained relatively stable, with muted responses to changes in rainfall regime.

Hard Rock Aquifer (Coal Measures)

Hydrographs for piezometers targeting the regional hard rock aquifer associated with the coal measures are shown in Figure 40. The groundwater elevations shown vary significantly between the piezometers monitored, reflecting differences in groundwater levels between stratigraphic layers and due to current and historical mining and dewatering operations.

Groundwater levels observed for the paired piezometers PGW5L and PGW5S, which target the overburden and Pikes Gully coal seam, respectively, have been very consistent since 2006. PGW5 is located above the Hazeldene underground workings, which have been subject to periodic dewatering operations to accommodate mining operations at LCO. Hydrographs for Haz 3/4 and Haz 6 reflect such dewatering (and subsequent recovery) operations for the Hazeldene workings. The lack of response in groundwater levels for PGW5L and PGW5S indicates the intervening strata between the deeper Hazeldene underground workings and the Pikes Gully seam and overburden effectively confines any depressurization (and recovery) to the deeper strata, with little impact to the overlying strata or aquifers. The similar hydrographs for Haz 3/4 and Haz 6 also indicate these bores or hydraulically connected, presumably via the Hazeldene underground workings.

Hydrographs for piezometers LC1 and Mt Owen 2 are also similar, suggesting these bores are hydraulically connected through the former Liddell underground workings. Groundwater levels in the Liddell underground workings are subject to depressurization due to dewatering activities to accommodate current open cut mining operations at LCO. Piezometer LC1 has been dry since July 2010 as a result of these dewatering activities.

Groundwater Extraction Summary

Reduced groundwater levels are observed in the open cut pit due to dewatering ahead of mining from M49 bore (20BL172293), Middle Liddell Bore (20BL172588) and Mt Owen bore (20BL168209). Groundwater extraction is summarised as per Table 27 below.

Table 27 Groundwater extraction summary 2013

Groundwater Extraction Licences								
Locality	Licence No.	Holder	Lot/DP	Purpose	Relevant legislation	Annual Allocation (ML)	Annual direct extraction (ML)	Annual indirect extraction (ML)*
Haz 6	20BL168066	Liddell Tenements Pty Ltd	81/607296	Monitoring	Water Act 1912	n/a	n/a	n/a
Dur 3	20BL168065	Liddell Tenements Pty Ltd	31/837350	Monitoring	Water Act 1913	n/a	n/a	n/a
LC1	20BL168064	Liddell Tenements Pty Ltd	353/867083	Monitoring	Water Act 1914	n/a	n/a	n/a
Durham 1	20BL168063	Liddell Tenements Pty Ltd	33/862516	Industrial	Water Act 1915	6000	nil	nil
8 South 3 & 4	20BL168062	Liddell Tenements Pty Ltd	32/870789	Industrial	Water Act 1916	6000	552	2257
Middle Liddell (MLB)	20BL172588	LCO pty Ltd	1/237767	Dewatering	Water Act 1917			
Durham 2 & 4	20BL168061	Liddell Tenements Pty Ltd	3/237654	Industrial (2 bores)	Water Act 1918	1000	nil	nil
Haz 2	20BL168060	Liddell Tenements Pty Ltd	81/607296	Industrial (2 bores)	Water Act 1919	5500	nil	nil
ALV1, ALV2, ALV3, ALV4, ALV7, ALV8	20BL168053	LCO Pty Ltd	43/654013, 201/848078, 4/255403, 81/607296, 6/255403, 32/545601	Test bore / monitoring	Water Act 1920	n/a	n/a	n/a
M49	20BL172293	Liddell Southern Tenements Pty	32/545601	Dewatering	Water Act 1921	2500	1029	1000
Mt Owen 1	20BL168209	Mt Owen Pty Ltd	353/867083	Stock, domestic, farming and test purposes	Water Act 1922			
Mt Owen 2	20BL169544	Mt Owen Pty Ltd	353/867083	Dewatering	Water Act 1923			
Bowmans Creek Alluvium	WAL 18302 (ex: 20BL017861	Liddell Southern (ex: Enex Foydell Pty Ltd)	32/545601, 6/1077004	Irrigation	Hunter Unregulated and Alluvium Water Sharing Plan	5	nil	5
Note: * indirect extraction includes inflow and other passive take as determined through numerical modelling by Jacobs (2014)								

Figure 44 Groundwater Levels for Alluvial Piezometers – 2006 to 2013

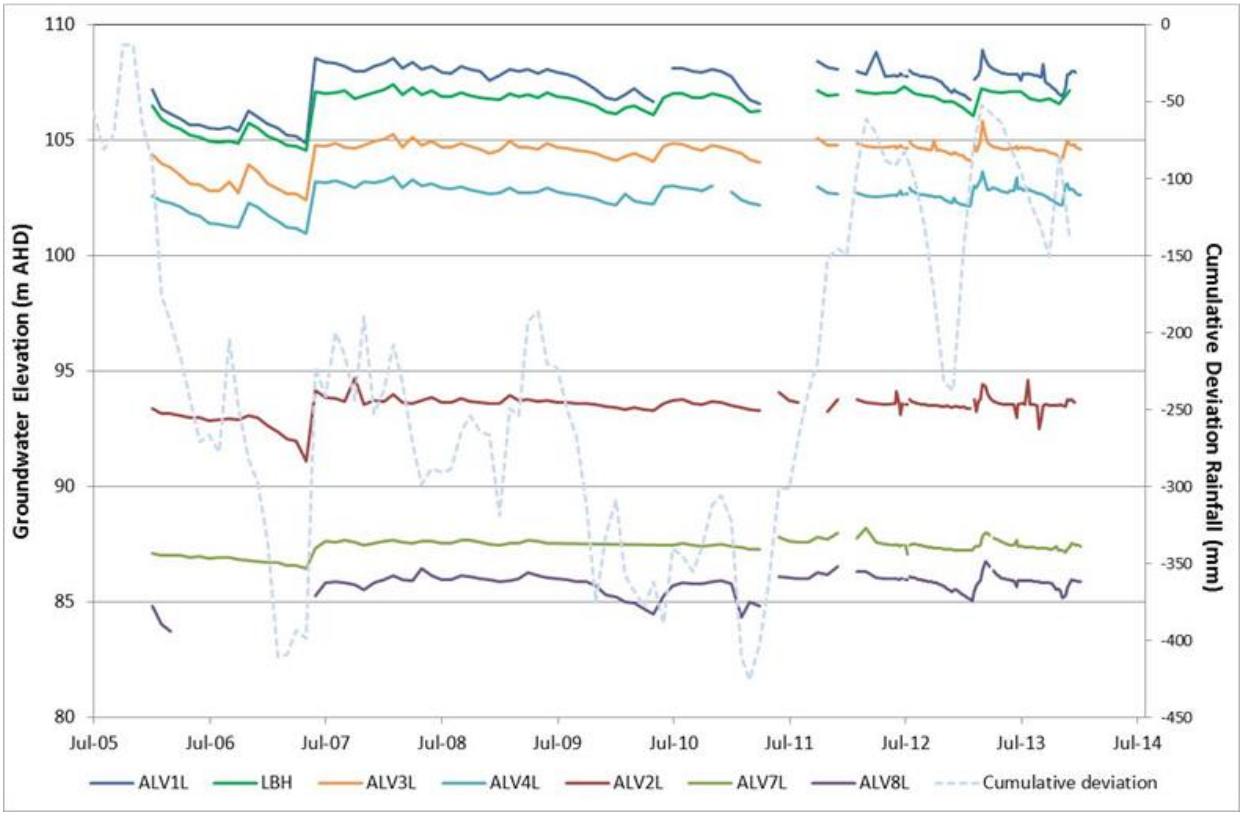


Figure 45 Groundwater Levels for Shallow Bedrock Piezometers – 2006 to 2013

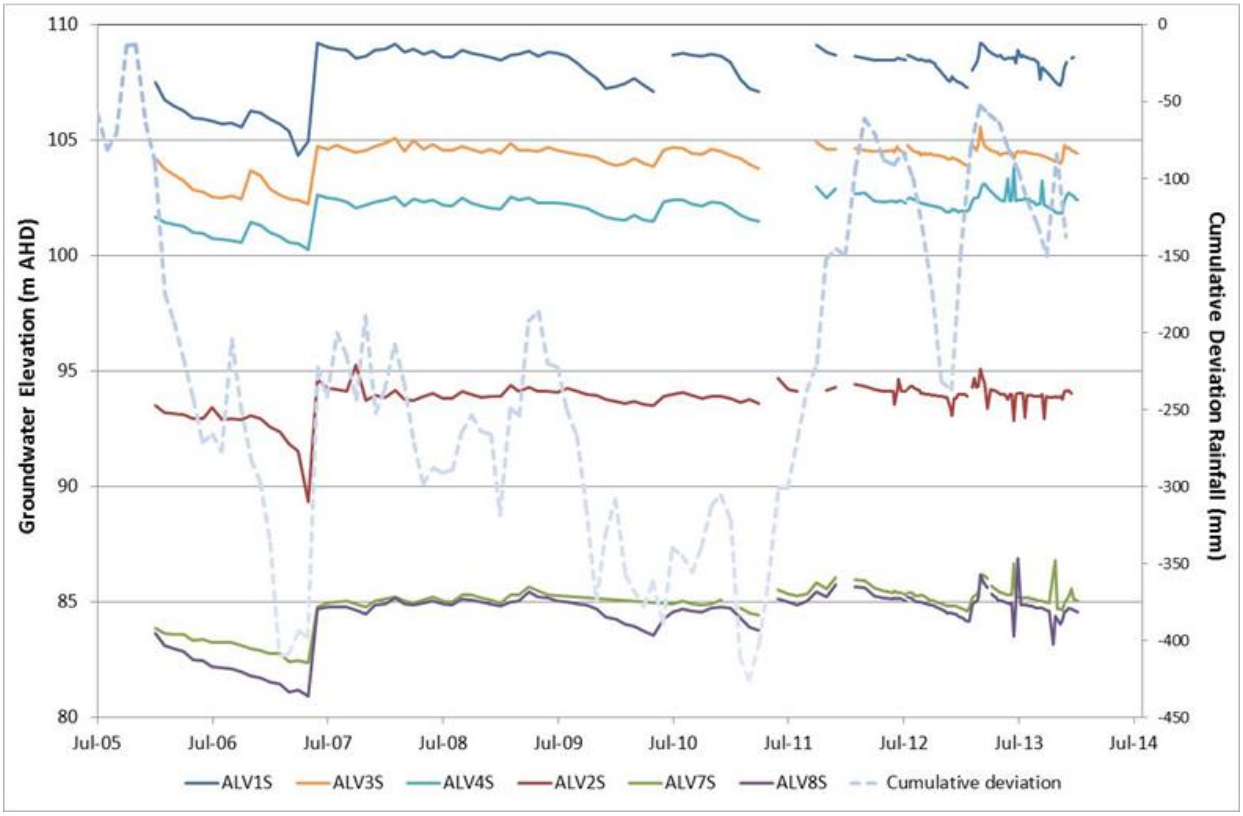
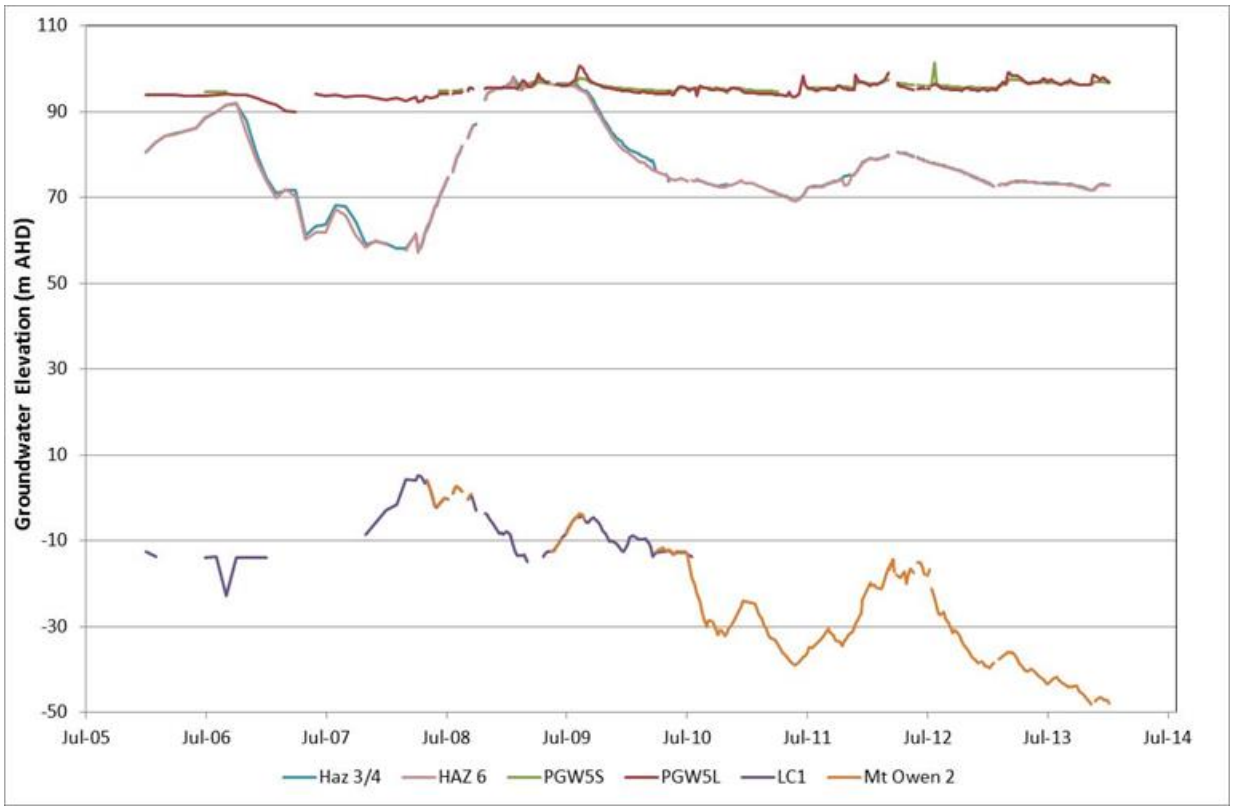


Figure 46 Groundwater Levels for Hard Rock Piezometers – 2006 to 2013



3.9 Contaminated Land

3.9.1 Environmental Management and Performance

Operations at LCO are conducted with the aim of minimising the potential for land contamination. In accordance with the LCO *Waste Management Plan*, all contaminated waste, with the exception of hydrocarbon contaminated soil is removed from site by a licensed contractor.

3.10 Flora and Fauna

3.10.1 Environmental Management and Performance

A review of the flora and fauna monitoring program was undertaken in 2012 and a revised program has been implemented. The revised program is based on 6 specific objectives, as listed below:

1. Implement functional Blue-billed Duck habitat.
2. Avoid impacts from mining operations on remnant vegetation within Liddell Colliery.
3. Avoid impacts from mining operations on native fauna that utilise habitat within Liddell Colliery (especially threatened fauna).
4. Implement revegetation program to restore disturbed areas designated for native vegetation to pre-mining condition.
5. Native revegetation supports native fauna (especially threatened species) at similar diversity and abundance to pre-mining condition.
6. Implement revegetation program to restore pasture land to reference condition.

The flora and fauna monitoring survey was undertaken from 25 – 29 November 2013.

The 2013 monitoring survey collected year two and baseline flora and fauna data for riparian (R01, R02) and woodland habitat (W01, W02) and woodland revegetation (WR01, WR02). Flora data for pasture rehabilitation (Objective 6) has now been included into the Annual Rehabilitation Inspection and associated report (see Section 5).

No threatened flora species were recorded during the 2013 monitoring surveys at LCO. Threatened fauna species recorded during the 2013 survey included *Circus assimilis* (Spotted Harrier), *Chthonicola sagittatus* (Speckled Warbler), *Pomatostomus temporalis temporalis* (Grey-crowned Babbler – eastern subspecies), *Mormopterus norfolkensis* (East Coast Freetail-bat), *Miniopterus schreibersii oceanensis* (Eastern Bentwing Bat), *Falsistrellus tasmaniensis* (Eastern falsistrelle) and

Myotis macropus (Large-footed Myotis). Two other fauna species observed during the monitoring, *Merops ornatus* (Rainbow Bee-eater) and *Haliaeetus leucogaster* (White-bellied Sea Eagle) are listed as migratory under the EPBC Act.

Objective 1 – Implement functional Blue-billed Duck Habitat

Despite planting vegetation in 2011 at Dam 3 to encourage the species, the Blue-billed Duck was not observed during the waterbird surveys at these sites. Dam 3 contained the largest number and highest diversity of waterbirds of all the dams surveyed during 2013.

Objective 2 – Avoid impacts from mining operations on remnant vegetation within Liddell Colliery

Results of the remnant vegetation plot surveys indicated that there were no direct mining impacts to the vegetation within and immediately surrounding the five control monitoring plots, as no obvious clearing or plant and equipment incursions or subsidence is obvious. No evidence of natural dieback was noticed at any of the five sites, although damage from cattle was evident, particularly in regard to W02 and to an extent both R01 and R02. Results of the flora monitoring at these sites, compared with 2012 monitoring results, are detailed in Table 28.

Objective 3 - Avoid impacts from mining operations on native fauna that utilise habitat within Liddell Colliery (especially threatened fauna).

The overall number of woodland bird species detected at woodland and n sites remained relatively constant with a slight decrease from thirty six species recorded in 2012 to thirty three species in 2013.

Threatened bat activity varied substantially between annual surveys and between sites. Future monitoring will build on this data and begin to draw conclusions as to trends in diversity and bat activity. In total, thirteen species of bat from three different families were detected, including four threatened species listed as Vulnerable under Schedule 2 of the NSW TSC Act.

The Spotted-tailed Quoll was not detected during the 2013 monitoring period. Previously a number of Spotted-tailed Quolls, including a den site and two juveniles, were discovered in a log jam along Bowmans Creek. These animals generally have a large home range and often a low detectability, thus this result is not unexpected. Repeat surveys over a number of years are likely to be required to gather evidence as to whether this lack of detection was simply due to chance or other biological reasons, such as low population size or local extinction.

In general, there were no obvious adverse impacts to fauna and fauna habitat areas directly attributable to mining activities.

Objective 4 - Implement revegetation program to restore disturbed areas designated for native vegetation to pre-mining condition

Both rehabilitation monitoring sites have not yet reached the performance targets, with native plant species richness, native canopy mid-storey and grass cover all below 75% of woodland scores (Table 29). Exotic plant cover within the rehabilitation area is much higher than woodland areas and conversely, leaf litter cover was much reduced. This result is not unexpected as canopy species are generally less than 2 metres in height.

Objective 5 - Native revegetation supports native fauna (especially threatened species) at similar diversity and abundance to pre-mining condition

Revegetation works are currently at an early stage and support a different fauna assemblage to that of nearby woodland areas. Twenty native fauna species were detected within both rehabilitation sites, including twelve bird species, four bat species, three frogs and one mammal. Two exotic species were also detected, *Vulpes vulpes* (Red Fox) and *Lepus europaeus* (European Brown Hare).

In comparison, Woodland sites 1 and 2 combined had more than double the diversity of birds and bats detected than the rehabilitation sites combined.

The rehabilitation area is in an early stage of growth, with trees reaching 2 metres in height. At this early stage in the rehabilitation process, meeting the set performance target is not realistic.

Table 28 Flora Monitoring Results at Woodland and Riparian Sites 2013

Site	Native Species Count 2012	Native Species Count 2013	Introduced Species Count 2012	Introduced Species Count 2013
W01	25	28	11	15

W02	26	26	7	9
W03	Site added 2013	28	Site added 2013	7
R01	11	10	25	11
R02	25	13	30	23

Table 29 Comparison of species diversity and structure between rehabilitation area, performance target and remnant woodland areas

	Woodland rehabilitation site 1 (WR01)	Woodland rehabilitation site 2 (WR02)	Performance Target (75% of mean woodland score)	Woodland site 2 (W02)	Woodland site 3 (W03)
Number of native plant species	12	7	20	26	28
Native overstorey (projected foliage cover %)	0	0	19	28	21.5
Native mid-story (projected foliage cover %)	0	2	4.5	12	0
Native grasses (% cover)	6	0	22	26	32
Exotic plant cover (% cover)	68	86	2	2	0
Leaf litter cover (% cover)	8	4	59	62	56

As a result of the 2013 monitoring, a number of recommendations were developed in order to meet LCO's environmental objectives. These include:

- Restricting access by cattle at strategic locations, including in the vicinity of certain waterbodies and Bowmans Creek, as well as remnant and naturally regenerating woodland areas.
- Continue to enhance fauna habitat and native vegetation areas for Blue-billed Duck around and within dams, riparian and woodland habitats for threatened species such as Spotted-Tail Quoll and woodland birds and microchiropteran bats.
- Increase the functionality of revegetated woodland vegetation (ie structure and native flora diversity) to provide a wider habitat value for a greater diversity of fauna species. This includes placement of wood debris, increasing flora species cover utilising local native species and continued targeted weed control.

3.11 Blasting

3.11.1 Environmental Management

Blasting criteria for LCO are prescribed in Schedule 3, Conditions 6 and 7 of DA 305-11-01. The consent condition covers criteria for overpressure, ground vibration and vibration limits at designed structures.

The development consent stipulates that the air blast overpressure level from blasting operations must not exceed 115 dB(L) for more than 5% of the total number of blasts over a period of 12 months and never exceed 120 dB(L) at any residence on privately owned land. Limits for ground vibration caused by blasting have also been specified in the development consent, and should not exceed a peak velocity of 5 mm/s for more than 5% of the total number of blasts over a period of 12 months and must never exceed 10 mm/s at any time, at any residence on privately owned land. Limits for blast overpressure and ground vibration at the Chain of Ponds Hotel have been set as 133 dB(L) and 10 mm/s respectively.

Blasting activities can only be undertaken at LCO between 9 am and 5 pm Monday to Saturday, inclusive. No blasting is allowed to be undertaken on Sundays, public holidays, or at any other time without the written approval of OEH.

LCO operates a combined 24 hour blasting information and community complaints hotline (1800 037 317).

3.11.2 Environmental Performance

Blast monitoring locations are presented in Figure 48 and monitoring results for the reporting period are provided in Appendix G.

Blast monitoring was undertaken at two privately owned residences and the Chain of Ponds Hotel throughout the reporting

period. There were 133 blasts fired throughout the reporting period.

During the reporting period, there were no levels above the ground vibration limit of 5mm/s or the overpressure limit of 115dB(L) recorded at privately owned residences.

No levels above the ground vibration limit of 10 mm/s were recorded at the Chain of Ponds Hotel during the reporting period. However, there was one exceedance of the overpressure limit of 133dB(L) recorded at the Chain of Ponds Hotel during the reporting period.

On 11 July 2013, a blast was fired that resulted in an elevated overpressure of 134.1dB being recorded at the Chain of Ponds Hotel. The approved overpressure limit for this site is 133dB. An incident report was submitted to the DP&I, with no further action being required.

All blasts were conducted within the hours of 09:00 and 17:00 and on Monday to Saturday No blasts were undertaken on Public Holidays.

The blast monitoring system recorded 100% blast data at all sites.

A comparison of blast monitoring compliance for the last three reporting periods is presented in Table 30.

Table 30 Three Year Blast Monitoring Compliance Comparison

Reporting Period	Number of Blasts	Criteria Exceedances	Non-compliance
January 2011 – December 2011	106	Two blasts (1.9%) above 115dB(L) (within 5% criteria) and one result above 120dB(L) at 'Scrivens' which	1 (Overpressure >120dB(L) – wind affected)
January 2012 – December 2012	150	One blast (0.67%) above 115dB(L) (within 5% criteria) at 'Scrivens'	1 (Overpressure >115dB(L) – wind affected)
January 2013 – December 2013	133	Nil	1 (Overpressure >133db(L) at Chain of Ponds Hotel)

3.12 Operational Noise

3.12.1 Environmental Management

The *Noise Monitoring Program* outlines the noise monitoring required to be undertaken by LCO to ensure compliance with statutory requirements at LCO. The program addresses the requirements contained in DA 305-11-01 and the LCO EPL 2094.

Regular attended noise monitoring is undertaken at representative locations surrounding LCO (refer to Figure 47). Monitoring also consists of unattended continuous noise logging over a minimum 72 hour period on a biannual basis during the mining operations at LCO. Operator attended noise measurements over 15 minute periods are also undertaken during the bi-annual monitoring which is undertaken at representative periods of the summer and winter seasons.

Long term noise monitoring is undertaken for a period of at least three days using loggers programmed to measure and store average (LAeq) noise levels every second. Short term noise monitoring is attended by a noise consultant, at each location, noise levels are surveyed for two minute periods during the day and evening.

Noise criteria for LCO are prescribed in Schedule 3, Condition 1 of DA 305-11-01. LCO are required to ensure that noise generated by the development does not exceed the noise impact criteria in Table 31 at any residence on, or on more than 25 percent of, any privately owned land. The criteria do not apply to mine owned residences.

Table 31 Noise Criteria

Assigned Residential Location Number	Noise Criteria LAeq (15 minute)	Sleep Disturbance Noise Criteria LA (1 min)
1, 2, 4, 5, 6, 7, 8, 9, 10, 11, 12, 13, 14	35 dB(A) Day	-
	35 dB(A) Evening	-
	35 dB(A) Night	45 dB(A) Night

Day – 7 am to 10 pm Monday to Saturday; 8 am to 10 pm Sundays and Public Holiday

Night – 10 pm to 7 am Monday to Saturday; 10 pm to 8 am Sundays and Public Holidays

The noise emission limits identified in Table 27 applies under meteorological conditions of:

- wind speeds up to 3 m/s at 10 metres above ground level; or
- temperature inversion conditions of up to 3°C/100 metres, and wind speeds of up to 2 m/s at 10 metres above ground level.

3.12.2 Environmental Performance

All monitoring is undertaken in accordance with the LCO procedure for environmental monitoring and evaluation.

Noise monitoring during the reporting period was undertaken in March and September 2013 by a specialist noise consultant (Global Acoustics). Results of attended noise monitoring during the reporting period show that LCO complied with the noise limits applicable at all monitoring locations.

Wind speed and/or estimated temperature inversion conditions resulted in development consent criteria not always being applicable.

Results summaries are presented in Table 32 and Table 33 below.

Figure 47 Noise Monitoring Locations

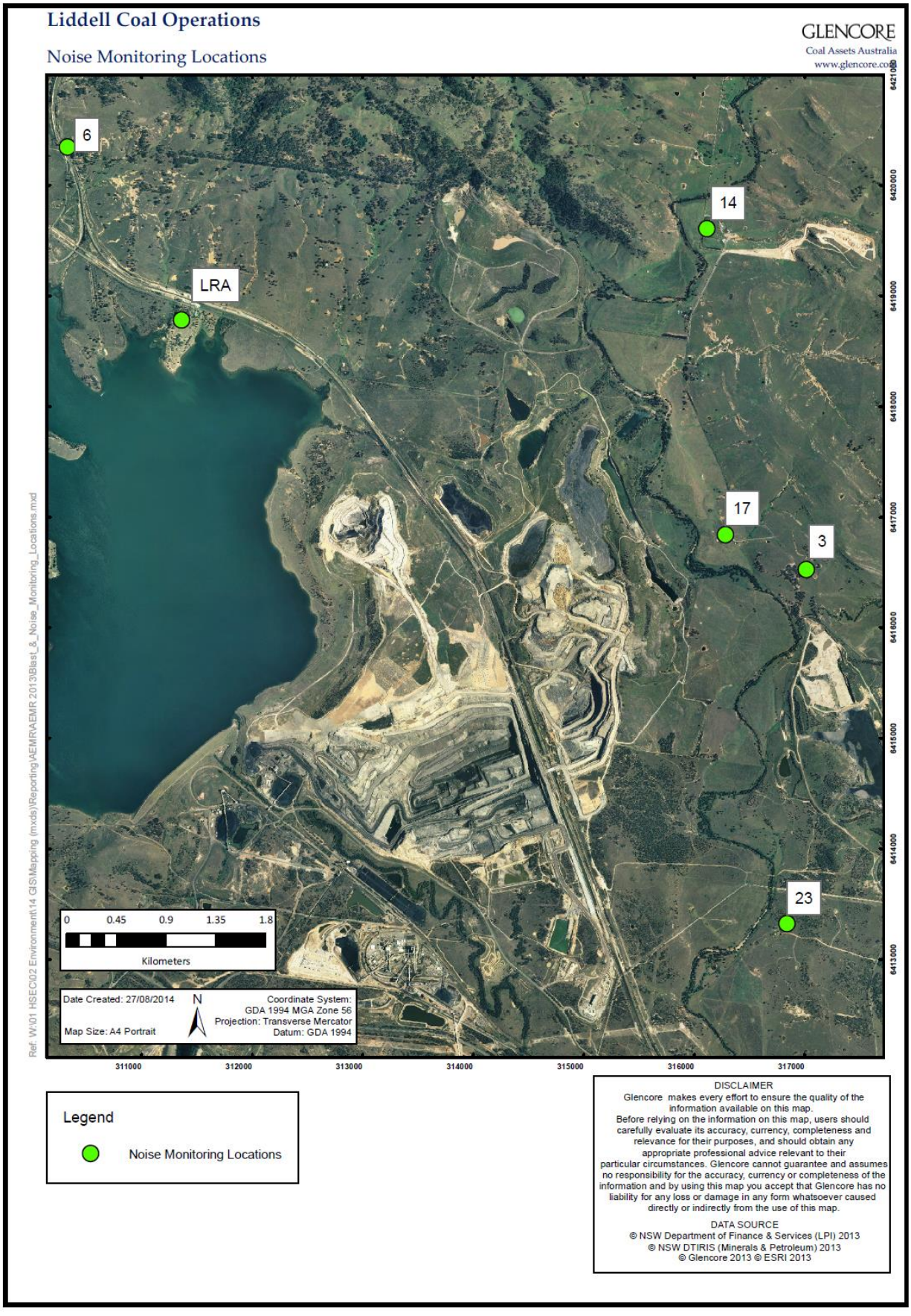


Figure 48 LCO Blast and Noise Monitoring Locations

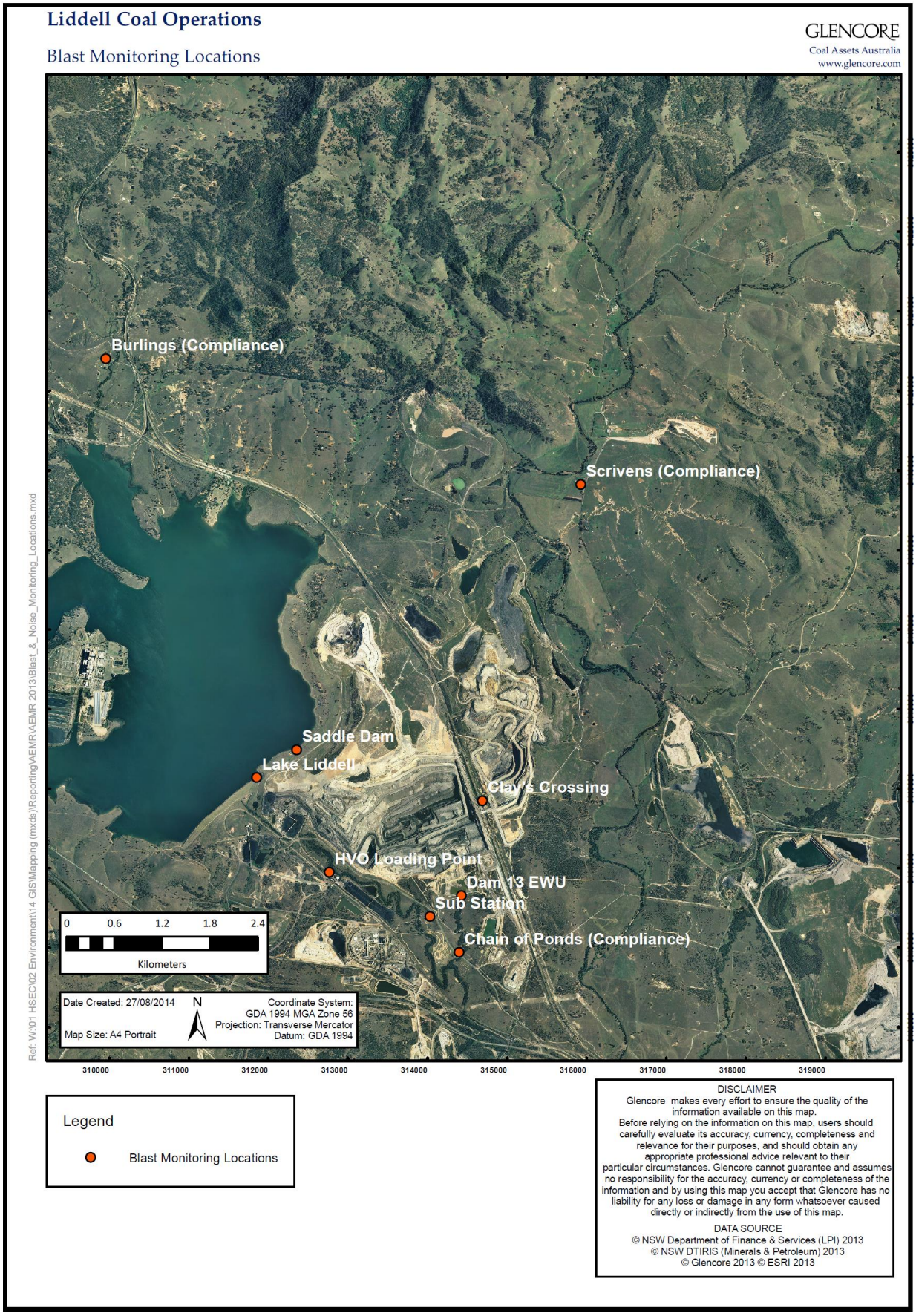


Table 32 Attended Noise Monitoring Results March 2013

Location	Date	Wind Speed (m/s)	LCO LAeq (15 min) dB(A)
3 (Day)	25/3/13	2.6	Inaudible
6 (Day)	25/3/13	4.9	Inaudible
14 (Day)	25/3/13	3.8	Inaudible
17 (Day)	25/3/13	2.6	Not Measurable
23 (Day)	25/3/13	2.3	Inaudible
LRA (Day)	25/3/13	5.3	Inaudible
3 (Evening)	25/3/13	3.0	Not Measurable
6 (Evening)	25/3/13	6.4	Inaudible
14 (Evening)	25/3/13	4.5	Inaudible
17 (Evening)	25/3/13	3.4	Not Measurable
23 (Evening)	25/3/13	3.6	Inaudible
LRA (Evening)	25/3/13	5.6	Inaudible
3 (Night)	25/3/13	1.5	<25
6 (Night)	25/3/13	2.0	Inaudible
14 (Night)	25/3/13	2.9	Inaudible
17 (Night)	25/3/13	2.5	27*
23 (Night)	25/3/13	1.8	Inaudible
LRA (Night)	25/3/13	3.1	Inaudible

** denotes atmospheric conditions outside conditions specified in development consent and so criterion is not applicable*

Table 33 Attended Noise Monitoring Results September 2013

Location	Date	Wind Speed (m/s)	LCO LAeq (15 min) dB(A)
3 (Day)	25/9/13	3.4	25*
6 (Day)	25/9/13	1.7	Inaudible
14 (Day)	25/9/13	3.2	Inaudible
17 (Day)	25/9/13	3.8	20*
23 (Day)	25/9/13	4.8	Not Measurable
LRA (Day)	25/9/13	3.9	Inaudible
3 (Evening)	25/9/13	1.5	28*
6 (Evening)	25/9/13	1.8	Inaudible
14 (Evening)	25/9/13	0.7	Not Measurable
17 (Evening)	25/9/13	1.6	Not Measurable
23 (Evening)	25/9/13	2.0	41*
LRA (Evening)	25/9/13	1.7	Inaudible
3 (Night)	25/9/13	1.4	31*
6 (Night)	25/9/13	0.7	Inaudible
14 (Night)	25/9/13	1.1	Inaudible
17 (Night)	25/9/13	0.6	Not Measurable
23 (Night)	25/9/13	0.4	37*
LRA (Night)	25/9/13	0.5	Inaudible

** denotes atmospheric conditions outside conditions specified in development consent and so criterion is not applicable*

Comparison to EA Predictions

The Liddell Coal EA (2006) proposes that modifications to the development consent would not produce an exceedance of the LCO operational specific noise criteria at any surrounding privately owned residence, however, noise levels were expected to exceed criteria at a number of mined owned residences. The noise monitoring for 2013 and previous reporting periods confirm these predictions.

3.13 Visual and Stray Light

3.13.1 Environmental Management

Visual impact management is undertaken in accordance with the practices outlined in the Liddell Coal MOP (LCO, 2008) and the LCO *Landscape Management Plan*. Under these plans, visual impacts are managed through:

- prompt rehabilitation;
- prioritisation of rehabilitation, focusing effort on areas that are most visually prominent from off-site private residences and public transport routes; and
- directing of light away from residences.

3.13.2 Environmental Performance

During the reporting period, flood lighting in mining areas was located to minimise direct light emitted to Hebden Road, Antiene Road, the New England Highway, the Main Northern Railway, or towards any dwellings. Lighting louvers or shields are fitted to equipment lights to minimise peripheral illumination of the night sky. Night inspections of the mining areas are undertaken by the Mining Supervisor and mobile lighting plants are located to reduce the offsite impact of lighting where ever possible.

3.14 Aboriginal Heritage

3.14.1 Environmental Management and Performance

The LCO development consent area has been the subject of a number of archaeological investigations. A total of 40 sites have been recorded within the LCO development consent area, consisting of 27 artefact scatters and 13 isolated finds. The approximate location of the sites are shown in Figure 49.

The most extensive sites (both in terms of areal extent and numbers of artefacts) were identified along the major drainage lines within the development consent area, namely Bayswater Creek, Chain of Ponds Creek and Bowmans Creek. Three site complexes were identified in 2001 and consisted of separate artefact exposures (recorded as loci or sites) bordering these watercourses. The site complexes were the Bayswater Creek site area (containing Brayshaw Site A, Brayshaw Site B, Brayshaw Site C, Brayshaw Site D and LID4), the Bowmans Creek site area (containing sites PL1, Davies' Site 5) and the Chain of Ponds site area (containing LID29, LID31 and LID32).

Artefact salvage and management at Liddell has occurred under eight Section 90 and three section 87 Aboriginal Heritage Impact Permits issued under the *National Parks and Wildlife Act 1974*. During the reporting period artefact management was covered by three of these permits (2348, 2896 and 2883). Section 90 Permit 2348 provides consent for the destruction of Aboriginal objects during dam infrastructure works in the Chain of Ponds Area and covers Aboriginal sites LID29, LID 30, LID 31 and LID 32. Section 90 Permit 2896 has been issued to enable surface collection and salvage in the Bayswater Creek area which includes Aboriginal sites LID 5, LID 23, LID 24, LID 25, SP 1, SP 2, SP 3, and Liddell Fines 1. Section 87 Permit 2883 permits the carrying out of preliminary research ahead of coal mining at Brayshaw Site B.

Schedule 3, Condition 35 of DA 305-11-01 required LCO to revise the *Aboriginal Cultural Heritage Management Plan* in consultation with relevant Aboriginal stakeholders and to the satisfaction of the Director-General. This revision was undertaken by Umwelt (Australia) Pty Limited and approved by the Director-General in January 2008

Works completed during 2013

During 2013 LCO engaged OzArk Environmental & Heritage Management (OzArk) to enact surface collection over two sites, LID 30 (AHIMS #37-3-0426) and LID 32 (AHIMS #37-3-0464), that had been approved for salvage under an existing valid AHIP #2348 (Appendix 2).

Extensive archaeological investigations have occurred within the Subject Area since mining was initiated, and these studies have identified a large number of archaeological sites. In 2011, OzArk was engaged to undertake Aboriginal and Historic Heritage Assessments towards the Environmental Assessment for the proposed modification # 5 to Development Consent DA 305-11-01. The Aboriginal sites identified during this assessment were placed into management groups based on the proposed project impacts. Sites along Chain of Ponds Creek were included in these management groupings, despite the fact that they had already undergone previous salvage in 2006, under AHIP #2348 (issued Oct 2, 2006 and enacted 21-23 Nov 2006). This was specifically because two sites, LID 30 and LID 32, still exhibited surface artefacts during the 2011 survey, because the permitted project impacts to these sites had not yet occurred. As a result, these sites were placed into Management Group 2 (surface collection and/or relocation) in reference to the proposed development modification #5. This was management was agreed upon with the Registered Aboriginal Parties (RAPs) for the project, but it is noteworthy that LCO were not specifically required to undertake further salvage at these sites, due to the fact that the AHIP remained active. Nonetheless, in good faith, and because it had been agreed to in reference to the newly proposed modification, LCO

supported the further surface salvage of these two sites, and as AHIP #2348 was still active a surface collection of remaining artefacts was recommended prior to Development Modification 5 being approved.

The surface artefacts within these sites were collected on 30 September 2013 by the following people:

- Nick Harrop (OzArk)
- Wayne French (Ungooroo Aboriginal Corporation)
- Steve Verrey (Tocumwall)

Wonnarua Nation were also offered a position on the collection team but were unable to provide a representative on the day.

The sites were thoroughly investigated, with particular attention given to exposures and areas where artefacts had been previously located. The sites are briefly described below, but OzArk's assessment report (2013) should be referred to for more detail. All artefacts collected were photographed and recorded in the field, and were labelled and bagged prior to handing them over to Liddell Coal Operations for interim secure storage. Many of the broken artefacts at both sites were likely damaged by the salvage grader scrapes, and some of the smaller flakes and 'debitage' may have been created in this process.

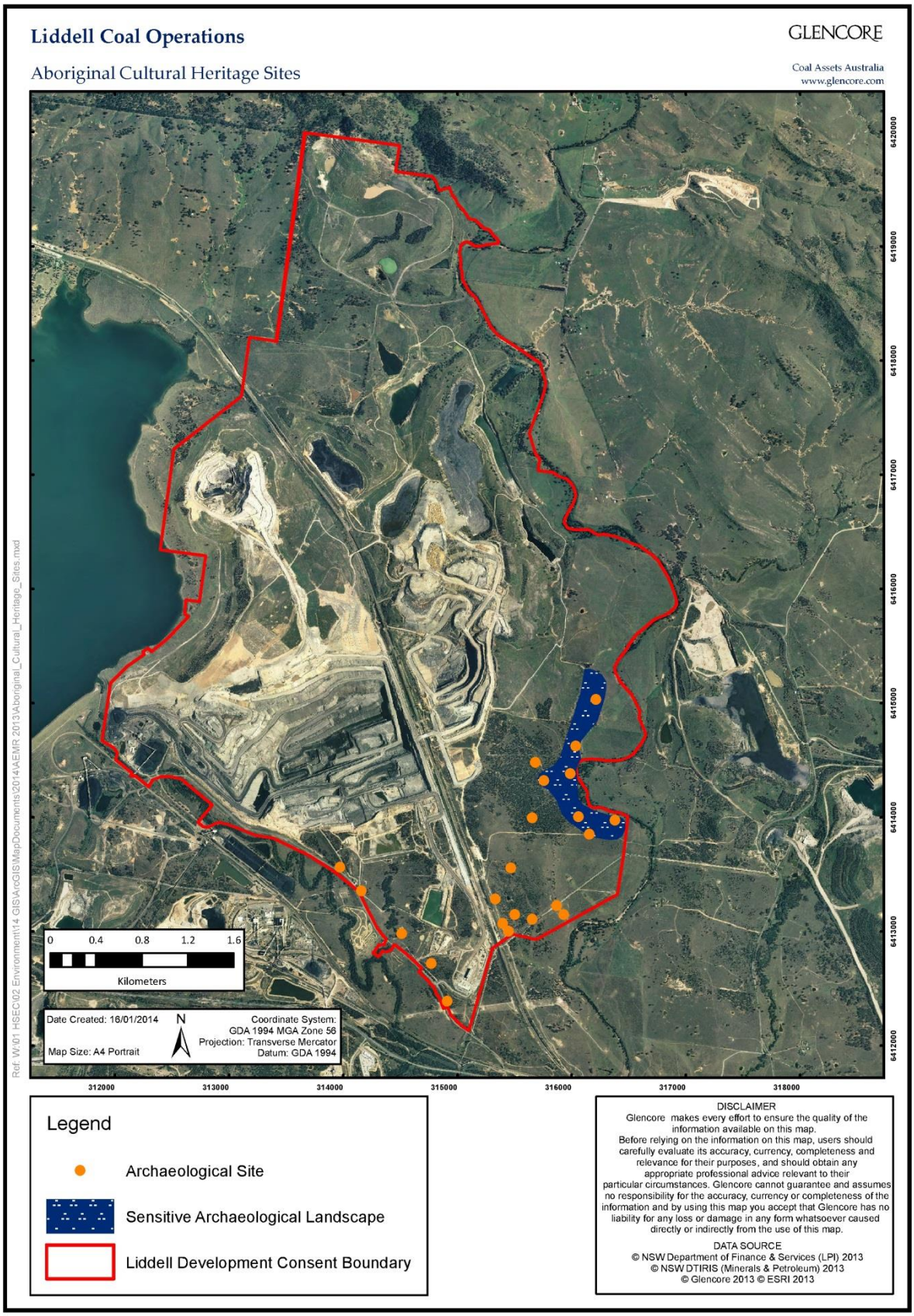
LID 30
This site is an artefact scatter located on a small ridge crest 180 m west above Chain of Ponds Creek. It was evident on a sheetwash erosion scar in a small stand of trees to the southeast of an access track that crosses Chain of Ponds Creek. Lithic materials recorded at the site included silcrete and indurated mudstone. The site has been impacted by a vehicle track and a surface pipeline that both run through the northern portion of the site. LID 30 is listed as destroyed according to a recent ASIRF for the site and on AHIMS. Eight artefacts were collected from the remnants of LID 30. They were located in two main exposures, including a former grader scrape an embankment also created by machinery.

LID 32
This site consists of artefacts eroding out of a cut terrace bank to the east above Chain of Ponds Creek. The site has been impacted significantly by development works since initial salvage which is best illustrated by the presence of a partially buried pipeline that passes through the southern portion of the site. LID 32 is listed as destroyed according to a recent ASIRF for the site and on AHIMS. Seven artefacts were retrieved from LID 32. All were protruding from the eroding bank of an ephemeral creek line.

No further archaeological investigation or salvage is required at sites LID 30 (AHIMS #37-3-0426) and LID 32 (AHIMS #37-3-0464). The following recommendations are made:

1. The artefacts collected from the salvage should remain in the custody of Liddell Coal Operations until their long-term management is resolved through the development of an Aboriginal Cultural Heritage Management Plan (ACHMP) in consultation with Registered Aboriginal Parties (RAPs).

Figure 49 Archaeological Sites within the LCO Consent Area



3.15 Historic Sites

3.15.1 Environmental Management and Performance

Chain of Ponds Hotel

The Chain of Ponds Hotel is located adjacent to the project area and approximately 40 metres south-west of the development consent boundary. The Chain of Ponds Hotel is listed on the Register of the National Estate maintained by the Australian Heritage Commission and is also listed on the State Heritage Register maintained by the NSW Heritage Commission.

Schedule 3 Condition 36 of DA 305-11-01 required LCO to prepare a photographic record of the condition and integrity of the accessible sections of the Chain of Ponds Hotel site. An updated photographic record was prepared by EJE Heritage in accordance with this condition and was provided to DoP on 28 March 2013. These records are to be updated every five years until the cessation of mining to the satisfaction of the DG. The next review is due to occur during 2018. As at the end of the reporting period, there have been no development activities at Chain of Ponds Hotel site. Of the 133 blasts fired throughout the reporting period, none were recorded above the ground vibration limit of 10 mm/s, but one exceedance of the overpressure limit of 133dB(L) was recorded (as established by the Department of Planning).

Former Police Lock-up Site

The Police Lock-up is located approximately 40 metres south-west of the development consent boundary. Schedule 3 Condition 37 of DA 305-11-01 required LCO to prepare an archival record of the former Police Lock Up precinct, prior to any activity associated with the development that may disturb this site. An archival record prepared in accordance with this condition was provided to the DoP on 11 February 2011. There was no development during the reporting period that impacted this site.

3.16 Spontaneous Combustion

3.16.1 Environmental Management and Performance

Fine coal along the ribs of exposed pillars in old underground workings associated with the Liddell coal seam have been historically linked to spontaneous combustion at LCO. To manage spontaneous combustion the mine plan aims to keep the underground workings full of water to limit coal exposure to oxygen for as long as possible. Once exposed, the mine design then incorporates benches for sealing off the highwall, which minimises the ingress of oxygen. Where areas of spontaneous combustion are exposed, the affected material is removed where possible, dumped low in spoil areas and covered with at least 5 m of inert material. If removal is not feasible, care is taken to minimise potential dust generation, and the coal is processed in the CHPP as soon as practicable to minimise ROM stockpile time. Spontaneous combustion of stockpiled product coal at LCO is rare due to the moisture introduced during the washing process and the regular transfer of coal to the Port of Newcastle for export. In the event that stockpiles start to generate heat due to delays in transportation, coal in the stockpiles is spread out and soaked to allow the heat to dissipate. Measures to control spontaneous combustion are documented in the LCO Spontaneous Combustion Management Plan, which is reviewed and updated regularly.

During the Independent Environmental Audit completed in 2012, a recommendation was provided by Joncris Sentinel Services for LCO to undertake a trial in consultation with DRE and Macquarie Generation to source fly ash product from the neighbouring Power Stations to cover spontaneous combustion affected overburden material and reduce emissions from such sources onsite. LCO proposed to investigate the feasibility of trialling fly ash product as a capping material, noting that further planning approval may be needed.

Since the audit, a review of spontaneous combustion management at LCO has been conducted with a view to eliminate its occurrence rather than engineer a solution once it is present. This review has led to a change in the overall mining methodology which was successfully implemented in 2013.

Historically, underground workings in the Liddell seam were de-watered a number of months prior to mining. This allowed the coal to be exposed to oxygen, facilitating spontaneous combustion. The revised mining process sees a just-in-time methodology, where by an increased pumping network has enabled the workings to be de-watered just prior to excavation. By eliminating the coal's exposure to the atmosphere and propensity to combust, rather than relying on an engineering treatment once exposed, a significant reduction in the environmental hazard has been realised.

During 2013, the revised methodology has proven successful with a considerable reduction of spontaneous combustion in the Liddell Seam workings in South Cut Strip 15 and 16. Whilst there have been, occurrences of spontaneous combustion within these working areas, the extent and duration of these affected areas has reduced.

Given that our alternate strategy has proven successful to date, pursuing the fly ash trial was viewed and agreed with the Dept Planning & Infrastructure as unnecessary. Furthermore, Liddell has consulted other operations that have trialled fly ash treatments and feel that the conditions at Liddell particularity the seam depth and saturation of the seam, precludes the use of this method.

LCO remains committed to developing and improving environmental management strategies. If the adopted spontaneous

combustion strategy exhibits unsatisfactory performance, then the methodology will be reassessed and an effective strategy implemented to achieve acceptable outcomes.

3.17 Bushfire

Bushfire management is undertaken in accordance with the LCO *Landscape Management Plan.* There were no incidents of bushfire at LCO during the reporting period.

3.18 Greenhouse Gas and Energy

3.18.1 Environmental Management and Performance

LCO continuously seeks ways of reducing emissions through mine planning, revision of current practices, regular monitoring, and the reduction of fuel consumption through the efficient operation and regular maintenance of machinery.

LCO monitors the greenhouse gas emissions generated by the development and investigates ways to reduce greenhouse gas emissions. Greenhouse gas emission monitoring and investigation is covered by Glencore Hunter Valley (GHV) on a Group- wide basis. Greenhouse emissions are estimated on coal production, electricity usage and diesel consumption.

During the reporting period, a revised Energy Savings Action Plan (ESAP) was completed as required by Schedule 3, Condition 46 of DA 305-11- 01. At the time of reporting, the revised ESAP was still being finalised. Recommendations from the report will be implemented as required throughout the 2014 reporting period, and progress will be reported in the 2014 AEMR.

3.19 Public Safety

3.19.1 Environmental Management and Performance

LCO has perimeter fencing to exclude unauthorised personnel entry. All visitors to LCO are required to report to the main offices and log in as a visitor indicating who they are visiting. When visitors leave the site, they are required to log out. All contractors and employees working on site are inducted in mine safety and environmental management issues prior to working within the mine area. During blasting activities sentries are posted to prevent unauthorised entry. LCO also has a standard in place to ensure the safe storage of blast materials in magazines that are kept safe and secure at all times.

During the reporting period, there were no incidents involving members of the general public being detected in vehicles on the LCO site.

4 Community Relations

4.1 Environmental Complaints

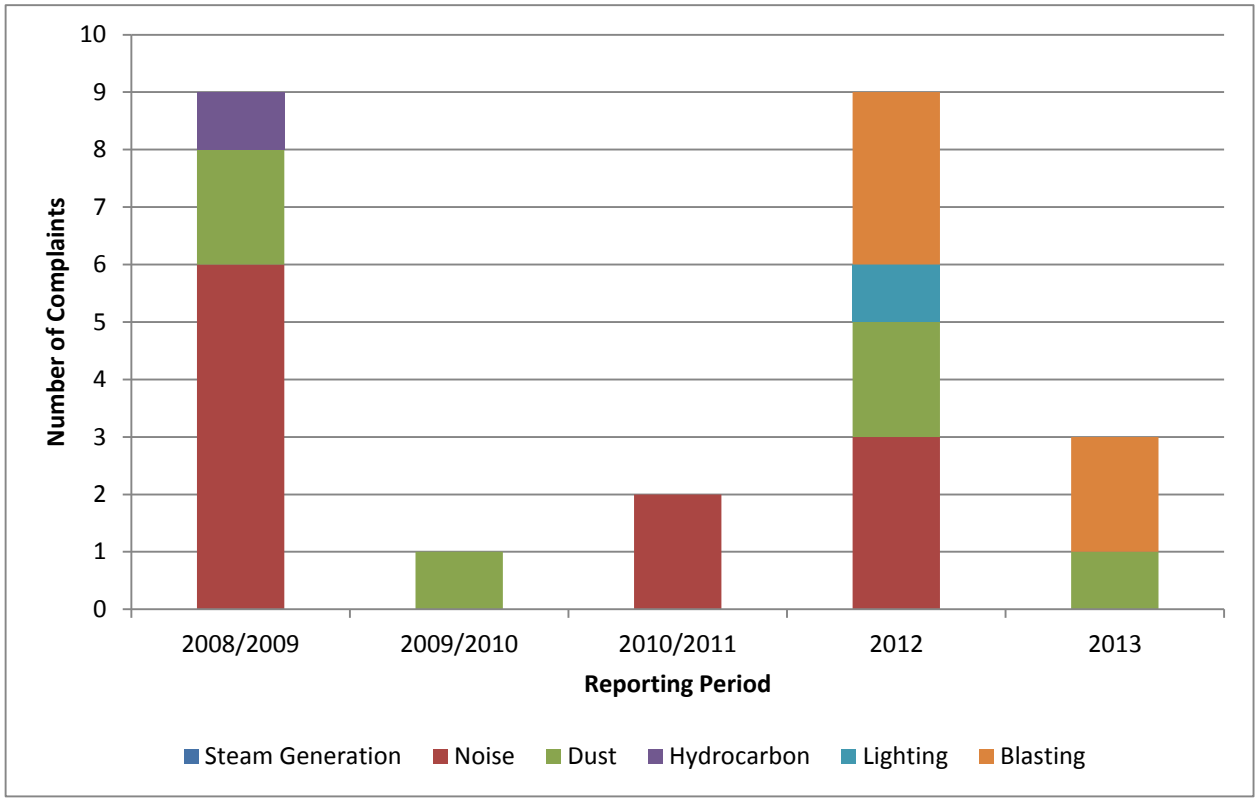
The management of complaints is undertaken in accordance with EMS procedures and Schedule 5, Condition 1 of DA 305- 11-01. LCO operates a combined 24 hour community complaints and blasting information hotline (1800 037 317) which is advertised in the community newsletter and on the LCO website.

Three environmental complaints were received during the reporting period, and are summarised in Table 34. A complaints comparison summary for the previous five reporting periods is presented in Figure 50.

Table 34 Summary of Complaints January 2013 – December 2013

Date	Source	Management
12/3/13	Blasting	Complainant called regarding vibration from the blast. The blast results were reviewed and the complainant's call was returned. The complainant was informed that the results were in compliance (GV 0.17mm/s and OP 100.36dB(L)). The complainant acknowledged that the results were quite low and stated that no further action was required. The complainant noted that they had also contacted DP&I to register the complaint.
28/3/13	Blasting	Complainant called regarding vibration from the blast. The blast results were reviewed and the complainant's call was returned. The complainant was informed that the results were in compliance (GV 0.22mm/s and OP 97.88dB(L)). The complainant acknowledged that the results were quite low and stated that no further action was required.
19/5/13	Dust	Complainant called whilst driving past the site to report that there was a lot of dust coming from site. The Mining Supervisor contacted the E&C Superintendent immediately after the complaint was received and advised that wind speeds onsite had increased prior to the call and a considerable amount of dust was being blown off exposed areas where water carts were unable to access (i.e. shot ground, and dump faces). He also advised that he was making alterations to the operation to reduce dust generation, including the shutdown of the EX112 work area until conditions improved due to its elevated position. Four water carts were in operation at the time and the Mining Supervisor advised that he would continue to monitor the operation and make changes as necessary, as per the site dust management TARP. The site weather station recorded a peak wind speed of 30.7km/hr at 11.35am, and wind speeds generally began to decline from 11.45am onwards. No dust alarms were received from the site real time dust monitoring network. E&C Superintendent attempted to contact the caller on two occasions, but could only leave a message.

Figure 50 Environmental complaints current and previous reporting periods



4.2 Community Liaison

4.2.1 Community relations

LCO undertakes community liaison activities in accordance with the *Social Involvement and Community Engagement Plan* which was developed in consultation with the Community Consultative Committee (CCC). The plan identifies the objectives for consultation and community engagement, methods of consultation for the various stakeholder groups and priorities for community enhancement.

LCO personnel regularly engage with the community in person and over the phone regarding a range of issues.

During 2013 LCO held a Community Open Day during May to offer the local community members an opportunity to experience the inside workings of Liddell's open cut operation.

4.2.2 Community Consultative Committee

Schedule 5 Condition 7 of DA 305-11-01 requires LCO maintain a CCC comprising of:

- two representatives from LCO, including the person responsible for environmental management at the mine;
- at least one representative from each of Muswellbrook Shire Council and Singleton Shire Council (if available); and
- at least three (or as otherwise agreed with the Director-General) representatives from the local community whose appointment has been approved by the Director-General

The LCO CCC provides a forum for local community, local government and mine management to meet and discuss key environmental issues. CCC meetings are held every six months in accordance with Liddell Coal's development consent. The CCC met on two occasions during the reporting period May 2013 and November 2013.

CCC Meeting Minutes are available to download from the LCO website.

4.2.3 Liddell Coal Operations Website

In accordance with Schedule 5, Condition 9 of DA 305-11-01, LCO has established a website (www.liddellcoal.com.au) to provide access to information on the operation including environmental, community and operational updates.

Copies of all relevant plans, programs and strategies (once approved by DP&I or other relevant agencies) are available on the website. In addition, environmental monitoring results are uploaded to the website quarterly.

4.2.4 Donations and Sponsorships

LCO aims to provide support for local projects relating to the community, health, education and the environment, in the form of cash donations, sponsorship, and in-kind support for a range of community, educational and environmental initiatives.

During the reporting period LCO made donations to the following organisations and charities:

- Cancer Council NSWSingleton Amatuer Theatrical Society
- Singleton Heights Pre-school
- Lake Liddell Trust
- MS - Sydney to Gong Ride
- Muswellbrook Public School - Award Sponsorship
- Muswellbrook High School - Awards night sponsorship
- Singleton Primary School - Award Sponsorship
- Singleton High School - Awards night sponsorship
- Variety Special Children's Christmas Party
- Singleton High School – Tommy's Day
- Muswellbrook High School - 2013 welfare programs

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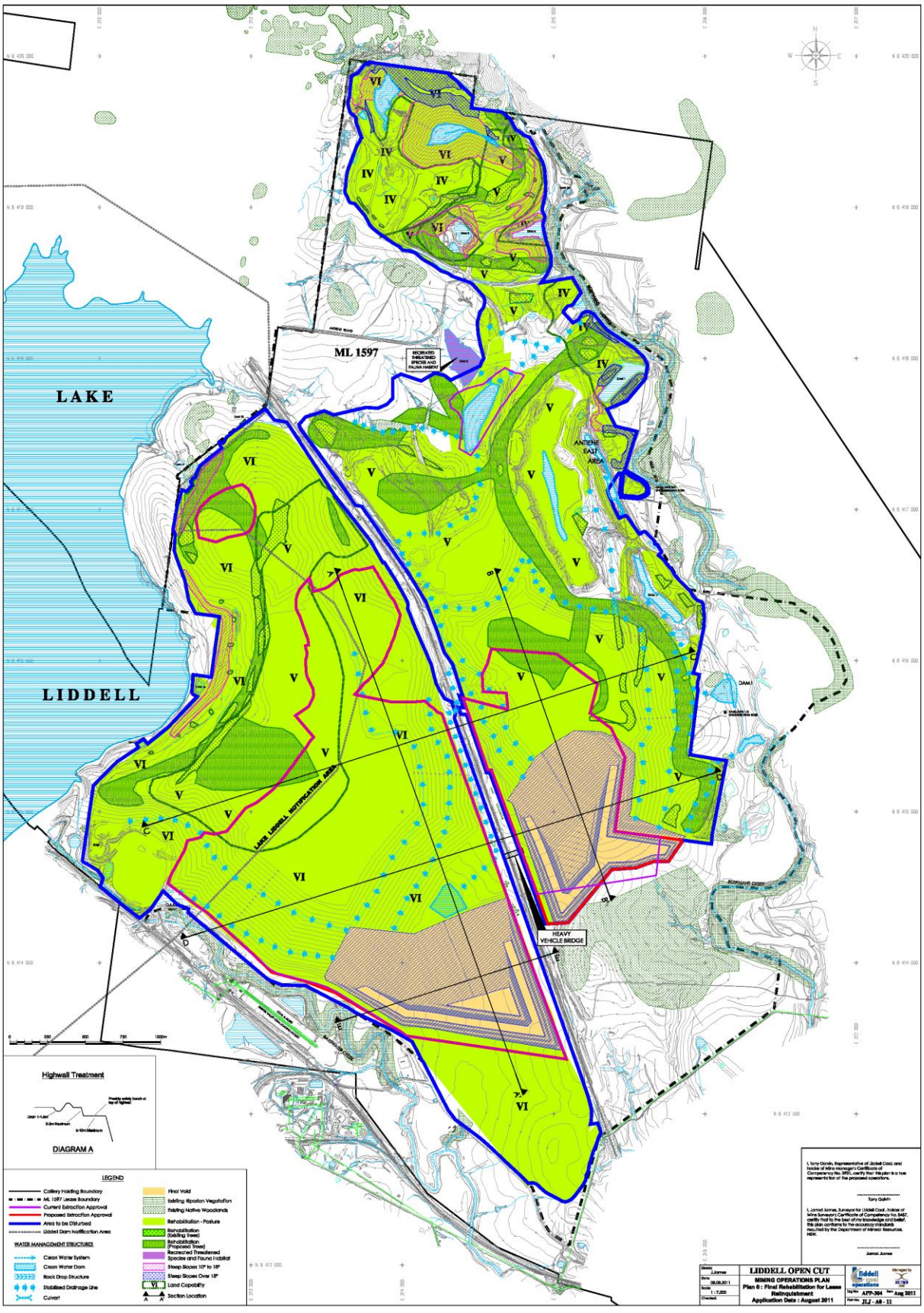
5 Rehabilitation

The principle objective for rehabilitation of mined land at Liddell is to return the site to a condition where its landforms, soils, hydrology, and flora and fauna are self-sustaining and compatible with the surrounding land uses. The proposed end land use for the site includes a combination of grazing and bushland/wildlife habitat. The post mining landscape will be dominated by a land capability of Class VI grazing land and Class VI and VII bushland habitat. See Figure 51 for the current approved MOP Final Landform design. Rehabilitation of the overburden emplacement areas and backfilled pits will be conducted progressively over the life of LCO, as an integral component of mining operations. Rehabilitation of infrastructure areas will occur as soon as practical following cessation of mining.

Figure 51 Current Approved MOP Final Landform



5.1 Buildings & Other Infrastructure

No buildings or other infrastructure were removed, installed or renovated during the reporting period at LCO.

5.2 Rehabilitation of Disturbed Land

The post-mining landform design of LCO has been generally undertaken in accordance with the DPI's 'Synoptic Plan: Integrated Landscapes for Coal Mine Rehabilitation in the Hunter Valley of NSW'.

Overburden dumps will be reshaped to around 10 degrees slope with a maximum of 18 degrees. Where steep slopes are constructed, suitable erosion control structures such as contour banks, drop structures may be utilised to provide for stability.

Elements such as drainage paths, contour drains, ridgelines, and emplacements are shaped into undulating informal profiles in keeping with natural landforms of the surrounding environment and allowing for a greater diversity of plant species over time.

The drainage characteristics for the site have been developed in accordance with the Draft Guidelines for Designing Stable Drainage Lines on Rehabilitated Mine Sites formulated by the former NSW Department of Land and Water Conservation (1999). The drainage system at LCO provides for the combination of a connected surface drainage network and distributed storage/infiltration. The system integrates surface storage during periods of high runoff and manages deep infiltration to levels which can be safely tolerated and at the same time reduced size surface drainage conveyances to remove excess water safely from the system.

Surface preparation activities for rehabilitated areas are commenced as soon as possible following the completion of mining activities. A general overview of surface preparation activities undertaken at LCO include:

- prior to revegetation activities, spoils and topsoils will be characterised to determine the type and application rate that may be required for the addition of soil ameliorants (e.g. gypsum, lime, fertiliser, organic growth medium.);
- The shaped landform surface is ripped along the contour to remove surface compaction by machinery and raked with rocks removed and buried in current dumping areas;
- appropriate soil ameliorants will be applied for incorporation into the final shaped surface;
- topsoil will be applied, where available, at a nominal depth of 100-150mm in thickness.
- where direct tree seeding is planned, final shaped surfaces will be deep ripped parallel with the contour prior to the application of seed to provide for an adequate seed bed is obtained;
- where pasture seeding is planned the surface will be cultivated across the contour to provide for an adequate seed bed;
- suitable erosion control measures (e.g. silt fences, mulches etc.) will be implemented to minimise soil loss from areas undergoing rehabilitation; and
- where appropriate and practical, structures such as tree hollows/logs and rock piles may be incorporated into the final landform to augment the habitat value of proposed habitat corridors.

After surface soil amelioration and tillage is completed for any given area, revegetation will commence as soon as practicable. Primarily, revegetation will involve sowing of pasture species and direct seeding of native tree species; see Tables 34, 35 & 36 below. A range of other techniques may also be utilised where appropriate over isolated areas associated with steep slopes. Revegetation techniques will be continually developed and refined over the life of the mine through a continual process of research, trialling, monitoring and improvement.

The establishment of the proposed habitat corridors will be undertaken using a native species seed mix. The habitat corridors will be developed with the aim of providing a functional and sustainable ecosystem which will be consistent with the rehabilitation closure criteria. Tree and shrub seed will be applied at a rate determined appropriate to site conditions. Where required, seed will be appropriately pre-treated to enhance germination and will be evenly mixed and spread.

Table 35 lists pasture species and application rates to be used for stabilisation of the final landform. This seed mix has been developed by a local Agronomist following spoil and topsoil testing after being requested to review the seed mix by DRE during the AEMR inspection, with the view to removing Rhodes Grass from the mix. All legumes will be inoculated and lime pelleted prior to seeding.

Tables 36 and 37 list tree, shrub and groundcover species selected in consultation with an Ecologist to represent native forest and woodland endangered ecological communities found in the area.

Application rates for any rehabilitation are indicative only and may vary according to site conditions or other variables.

Table 35 Pasture seed mix

Species	Rate (kg/ha)	
	Spring / Summer	Autumn / Winter
Japanese Millet	15	0
Oats	0	25
Green Panic	3	2
Premier Digit Grass	5	3
Setaria	2	1
Kikuyu	5	3
Couch Grass	5	3
Tall Fescue	2	5
Cocksfoot	0	2
Wimmera Ryegrass	2	6
Lucerne (Aurora)	6	8
White Clover (Haifa)	2	2
Medic (Sephi)	0	5
Chicory	2	2
Plantain (Tonic)	1	3
Woolly Pod Vetch (Namoi)	0	5
TOTAL	**50**	**75**

Table 36 Grey Box – Ironbark woodland community seed mix

Species	Application rate
Acacia pendula	0.3 kg/ha
Allocasuarina luehmanii	0.3 kg/ha
Angophora floribunda	0.3 kg/ha
Austrostipa scabra	1.0 kg/ha
Bothriochloa decipiens	0.3 kg/ha
Brachychiton populneus subsp. Populneus	0.3 kg/ha
Bursaria spinosa subsp. Spinosa	0.4 kg/ha
Calotis lappulacea	0.3 kg/ha
Callitris endlicheri	0.3 kg/ha
Cassinia quinquefaria	0.3 kg/ha
Chrysocephalum apiculatum	0.3 kg/ha
Cyperus gracilis	0.3 kg/ha
Dodonaea viscosa	0.3 kg/ha
Eragrostis leptostachya	0.4 kg/ha
Einadia nutans	0.4 kg/ha
Eremophila debilis	375 seeds/ha
Eucalyptus crebra	1.0 kg/ha
Eucalyptus moluccana	1.0 kg/ha
Glycine tabacina	0.4 kg/ha
Microlaena stipoides var. stipoides	0.4 kg/ha

Table 37 Ironbark - Spotted Gum - Grey Box forest community seed mix

Species	Application rate
Acacia falcate	0.3 kg/ha
Acacia parvipinnula	0.2 kg/ha
Allocasuarina luehmanii	0.2 kg/ha
Bursaria spinosa subsp. Spinosa	0.5 kg/ha
Corymbia maculate	1.0 kg/ha
Daviesia ulicifolia subsp. ulicifolia	310 seeds/ha
Dianella revoluta var. revoluta	375 seeds/ha

5.3 Rehabilitation Performance

During 2013, at total of 51ha was shaped and re-contoured as per final landform requirements. The entire 51ha of shaped land was rehabilitated. A further 10ha of land shaped late 2012 was also rehabilitated early 2013 once climatic conditions more favourable to the successful growth of vegetation set in. The total of 61ha of rehabilitated land included the construction of water management structures, topsoil application and seeding. The MOP rehabilitation target for 2013 was 51ha. Tables 38 and 39 present a summary of the rehabilitation undertaken by LCO during the reporting period.

During 2013, LCO undertook a reconciliation of all historical land management GIS data. Through this reconciliation it became apparent that errors in GIS rehabilitation measurement and reporting had been carried over numbers of years; multiple minor rounding and double counting errors had developed into approximately 18ha of discrepancy from actual. The reconciliation involved a complete review and correction of all historical GIS data culminating in an accurate representation of current land management status. LCO have taken this reporting opportunity to set the current benchmark rehabilitation status; Table 38 below contains the reconciled rehabilitation data.

Table 38 Summary of Disturbed and Rehabilitation areas

Area	Area Affected (ha)		
	To Date (31 December 2013)	Last Report (31 December 2012)	At Next report (estimated) (31 December 2014)
A: MINE LEASE AREA			
A1 Mine Lease(s) Area	2084	2084	2084
B: DISTURBED AREAS			
B1 Infrastructure area (other disturbed areas to be rehabilitated at closure including facilities, roads)	103.1	128.1	68
B2 Active mining area (excluding items B3-B5 below)	170.4	164.6	189.2
B3 Waste emplacements (active/unshaped/uncapped)	415.25	321.9	277.3
B4 Tailings emplacements (active/unshaped/uncapped)	78.5	49	78.5
B5 Shaped waste emplacement (awaits final vegetation)	0	0	0
TOTAL DISTURBED AREA	676.5	663.6	630.4
C1 Total rehabilitated area (except for maintenance)	697.25	635.27	
D: REHABILITATION ON SLOPES			
D1 10 to 18 degrees	62.2	62.2	74.2
D2 Greater than 18 degrees	10.0	10.0	12.0
E: SURFACE OF REHABILITATED LAND			
E1 Pasture and grasses		549.82	
E2 Native forest/ecosystems	65.2	65.2	65.2
E3 Plantations and crops	0.0	0.0	0.0
E4 Other (include non-vegetative outcomes)	0.0	0.0	0.0

Table 39 Summary of Rehabilitation Quantities

Material	DA 305-11-01	Previous Reporting Period		Current Reporting Period	Next Reporting Period (estimated)
	Approval limits	January 2011 – December 2011	January 2012 – December 2012	January 2013 – December 2013	January 2014 – December 2014
Topsoil stripped (m^3)	N/A	38,102	33,520	42,000	88,000
Topsoil used/spread (m^3)	N/A	53,000	33,420	51,000	60,000
Waste rock (m^3)	N/A	41,703,918	39,100,464	39,209,255	39,975,062
ROM Coal (tonnes)	8,000,000	6,824,944	6,868,258	7,123,490	6,763,365
Processing waste (coarse and fine reject) (tonnes)	N/A	2,232,414	2,227,300	2,413,377	2,353,043
Product coal (tonnes)	8,000,000	4,610,603	4,509,770	4,710,113	4,410,322

Areas rehabilitated shaped and rehabilitated during 2013 are also presented in AEMR Plan 4 – Mining Activities and Rehabilitation. The following tables outline rehabilitation undertaken for each area completed in 2012.

The rehabilitation undertaken can be broken down into eight specific areas based on location and time of rehabilitation. The following Tables 40 to 47 provide a summary of the rehabilitation works completed in these areas.

Table 40 2013 Area 1

Domain	D4	Reveg Date:	13 Sept. 2013	Area:	3.8ha

Name: Durham 210 Plateau
Land Use: Temporary rehabilitation
Seed/Plant Mix: Liddell summer pasture seed mix

It is anticipated that this rehabilitation will be largely re-disturbed during capping operations of the final Durham tailings emplacement to the North West. Landform shaping completed in Quarter 2 2013 comprising flat plateau area rolling off short 8-10 degree slope on south western side. Surface water drainage for the area comprises of graded contour banks directing flow into 8% conveyance channel, an energy dissipation basin and then into a level spreader onto grassed area. Area rock raked, gypsum applied at 10T/ha (50% recycled and 50% natural mined) and area ripped to approx. 400mm over clay areas, no ripping of rocky areas. Chisel ploughed entire area prior to seeding which was undertaken immediately following site preparation. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha and organic Growth Medium (OGM) spread at 100t/ha.
Status/Progress: Good strike rate and germination of cover crops. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 41 2013 Area 2

Domain	D4	Reveg Date:	28 March 2013	Area:	4.5ha

Name: Durham 210 Eastern slope
Land Use: Temporary Rehabilitation
Seed/Plant Mix: Pasture seed mix (Cocksfoot (9kg/Ha), Wimmera Rye (10.8kg/Ha), Kangaroo Valley Rye (10.8kg/Ha), Setaria (9kg/Ha), Rhodes (5.4kg/Ha), Couch (5.4kg/Ha), Lucerne (9kg/Ha), Haifa Clover (9kg/Ha), Sephic medic (3.6kg/Ha), Seaton Park clover (5.4kg/Ha), Vetch (5.4kg/Ha), Puna Chickory (3.6kg/Ha), Plantain tonic (3.6kg/Ha).

It is anticipated that this rehabilitation will be largely re-disturbed during capping operations of the final Durham tailings emplacement to the West. The area had previously been rehabilitated (topsoil, pasture seed) however not at final emplacement design height. The topsoil and vegetation on the area was stripped and stockpiled for rehabilitation immediately after final shaping was completed. Landform shaping completed in Quarter 1 2013 comprising 8-10 degree eastern facing slope. Surface water drainage for the area comprises of graded contour banks directing flow into 8% conveyance channel, an energy dissipation basin and then into a level spreader onto grassed area. Area rock raked and topsoil spread at 100mm thick; since the topsoil had already been ameliorated with gypsum during initial rehabilitation, no additional gypsum was required. Chisel ploughed entire area prior to seeding which was undertaken immediately following site preparation. A locally sourced pasture seed mix was applied (as above) with Granulock 15 fertilizer applied at 360kg/ha).
Status/Progress: Grass cover crops have established well after laying dormant for a short period of time. Good strike rate and germination of cover crops. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 42 2013 Area 3

Domain	D4	Reveg Date:	30 Sept. 2013	Area:	9.9ha

Name: Durham 210 South Eastern slope
Land Use: Temporary Rehabilitation
Seed/Plant Mix: Liddell summer pasture seed mix

It is anticipated that this rehabilitation will be partly re-disturbed during capping operations of the final Durham tailings emplacement to the North West. Surface water drainage for the area comprises of graded contour banks directing flow into 8% conveyance channel, an energy dissipation basin and then into a level spreader onto grassed area. Area rock raked and topsoil spread at 100mm thick; Gypsum spread at 10t/ha (50% recycled and 50% natural mined). Chisel ploughed entire area prior to seeding which was undertaken immediately following site preparation. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha

Status/Progress: Grass cover crops have established well after laying dormant for a short period of time. Good strike rate and germination of cover crops. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 43 2013 Area 4

Domain	D4	Reveg Date:	25 Sept. 2013	Area:	3.7ha

Name: Durham 210 South Facing Slope
Land Use: Temporary rehabilitation
Seed/Plant Mix: Liddell summer pasture seed mix

It is anticipated that this rehabilitation will be partly re-disturbed during capping operations of the final Durham tailings emplacement to the North West. Landform shaping completed in Quarter 3 2013 comprising of a short 8-10 degree slope between the RL210 and RL195 elevations. Surface water drainage for the area comprises of graded contour banks directing flow into 8% conveyance channel, an energy dissipation basin and then into a level spreader onto grassed area. Substrate and Topsoil have high levels of clay material (30-40%). Area rock raked with topsoiled spread at 100mm thick. Gypsum applied at 10T/ha (50% recycled and 50% natural mined) and area ripped to approx. 400mm over clay areas. Chisel ploughed entire area prior to seeding which was undertaken immediately following site preparation. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha .
Status/Progress: Grass cover crops have established well after laying dormant for a short period of time.. Good strike rate and germination of cover crops. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 44 2013 Area 5

Domain	D3	Reveg Date:	4 April 2013	Area:	3.3ha

Name: South Cut RL195
Land Use: Habitat Corridor
Seed/Plant Mix: Pasture seed mix (Cocksfoot (9kg/Ha), Wimmera Rye (10.8kg/Ha), Kangaroo Valley Rye (10.8kg/Ha), Setaria (9kg/Ha), Rhodes (5.4kg/Ha), Couch (5.4kg/Ha), Lucerne (9kg/Ha), Haifa Clover (9kg/Ha), Sephic medic (3.6kg/Ha), Seaton Park clover (5.4kg/Ha), Vetch (5.4kg/Ha), Puna Chickory (3.6kg/Ha), Plantain tonic (3.6kg/Ha).

This current final landform use for this area is largely part of a habitat corridor across the landscape. This is often achieved in two stages by firstly establishing a cover crop then establishing native tree communities. Landform shaping completed in Quarter 2 2013 comprising of a softly undulating plateau. Substrate consists of typical rocky overburden. Area rock raked with local topsoil spread at 100mm thick. Recycled gypsum applied at 10T/ and area ripped to approx. 400mm. Chisel ploughed entire area prior to seeding which was undertaken immediately following site preparation. A locally sourced pasture seed mix was applied (as above) with Granulock 15 fertilizer applied at 360kg/ha) and organic growth medium applied at 100t/ha. Once suitably advance and climatic conditions favourable, a tree seed mix will be spread to develop the habitat corridor community.
Status/Progress: Excellent development of Lucerne crops. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 45 2013 Area 6

Domain	D3	Reveg Date:	15 Nov. 2013	Area:	9.0ha

Name: South Cut RL195
Land Use: Class V Pasture
Seed/Plant Mix: Liddell summer pasture seed mix

Landform shaping completed in Quarter 4 2013 comprising of gently undulating plateau along the RL195 elevation. Area rock raked and chisel ploughed prior to seeding which was undertaken immediately following site preparation with gypsum applied at 10T/ha. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha and organic Growth Medium (OGM) spread at 100t/ha.

Status/Progress: Good strike rate and germination of cover crops with rain shortly after seeding. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Table 46 2013 Area 7

Domain	D3	Reveg Date:	8 Feb. 2013	Area:	1.9ha

Name: South Cut RL195 Eastern Slope
Land Use: Class V Pasture
Seed/Plant Mix: Liddell summer pasture seed mix

Landform shaping completed in Quarter 1 2013 comprising of east facing slope from the RL195 elevation down to RL180. Topsoil applied at 100mm thick and ripped to 400mm along the contours. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha.

Status/Progress: Heavy rain shortly after seeding created minor rill erosion along the short slope. Established vegetation This reduced the plant strike rate considerably. Continue monitor and apply maintenance measures as necessary.

Table 47 2013 Area 8

Domain	D6	Reveg Date:	9 Aug. 2013	Area:	25.2ha

Name: Entrance Northern Slope 160-192RL
Land Use: Temporary Rehabilitation
Seed/Plant Mix: Liddell summer pasture seed mix

It is anticipated that this rehabilitation will be largely re-disturbed during capping operations of the final Antiene and Reservoir tailings emplacement to the North. Landform shaping completed in Quarter 2 2013 comprising of stable north facing slope from RL160 level (adjacent two tailings emplacements) to RL192. Contour banks were constructed to control surface water drainage and will connect with a proposed drop structure to the west once landform shaping in that area is complete. Substrate consists of typical rocky overburden. Area rock raked with local topsoil spread at 100mm thick. The area was ripped to 400mm then shallow contour ripped to 150mm prior to seeding which was undertaken immediately following site preparation. Liddell summer pasture seed mix applied using locally sourced seed (see Table 5.1 for details) with Granulock 15 fertilizer applied at 360kg/ha.

Status/Progress: Good strike rate and germination of cover crops with rain late November 2013. No significant erosion evident. Continue monitor and apply maintenance measures as necessary.

Figure 52 2013 Rehabilitated Areas

5.4 Other Infrastructure

No infrastructure sites were decommissioned for rehabilitation.

5.5 Rehabilitation Maintenance

Rehabilitation areas are inspected monthly as part of the routine environmental inspection regime for LCO. Any identified issues such as weed infestations, erosion for example, is recorded and actions tracked as appropriate. LCO also engages a consultant to complete an annual inspection of all rehabilitation areas to assist in prioritising maintenance activities for the coming year. Rehabilitated areas are demarcated and signage is erected to ensure that they are clearly defined to prevent disturbance from plant and equipment working in close proximity to rehabilitation areas. Ground disturbance Permits are the management tool in place to prevent impact to rehabilitation areas when ground disturbing activities are taking place in close proximity to rehabilitation areas.

Rehabilitation management and maintenance activities undertaken in the reporting period are summarised in Table 8.

Table 48 Maintenance Activities on Rehabilitated Land

Nature of Treatment	Area Treated (ha)		
	This Reporting Period	Next Reporting Period	Comment/control strategies/ treatment detail
Additional erosion control works (drains re-contouring, rock protection)	0	As required	Erosion and sediment control works completed on an as required basis.
Re-covering (detail - further topsoil, subsoil sealing etc)	0	As required	Recovering works completed on an as required basis.
Soil treatment (detail - fertiliser, lime, gypsum etc)	14	0	As identified through annual monitoring program of the Biodiveristy Trail Tree Areas (see section 5.7), Organic Growth Medium was applied to encourage flora development.
Treatment/Management (detail - grazing, cropping, slashing etc)	123	123	Mountain Block fenced and rotational grazing conducted. Reservoir block fenced with grazing trials currently being conducted.
Re-seeding/Replanting (detail - species density, season etc)	0	As required	Reseeding works completed as required.
Adversely Affected by Weeds (detail - type and treatment)	25	25	Primarily targeting *Galenia pubescens* using foliar spray application of Glyphosate and Picloram based herbicide (refer below)
Feral animal control (detail - additional fencing, trapping, baiting etc)	200	200	Wild dog baiting, pig trapping and open range shooting as per the Vertebrate Pest Control Program (refer below)

Weed Management

During 2013, Liddell Coal Operations undertook site weed management activities as a continuation of the 2012 Liddell Weed Action Plan 2012. During the development of the plan, a day long weed survey was undertaken across Liddell's mining operation prior to the prioritising of weed management activities and the development of a detailed treatment schedule. LCO undertakes the weed control program in accordance with the site Rehabilitation Management Plan that was prepared in accordance with Schedule 3, Condition 30, of DA 305-11-01.

To improve effectiveness of the weed management activities; it was determined that a more strategic approach to weed

management across the entire LCO operational and buffer lands (including trial grazing areas) should be developed. Therefore, a site wide approach to weed management was developed to ensure consistent and strategic weed management for native and pasture/agricultural areas. Ecological Australia (ELA) was engaged to develop a Weed Management Strategy (WMS) with practical information relating to strategic weed management across LCO managed lands.

The WMS involves the following:

- The Weed Management Strategy (WMS) will incorporate both long term objectives (~20 years), and short-term weed control goals, and will be reviewed every 3 to 5 years.
- Weed management issues / processes on rehabilitation areas (both native and pasture), remnant areas, and areas marked for future clearance
- Identification of priority areas for weed control
- Discussion / research in regard to best practice weed control and trials or experimental methods
- Vehicle and equipment hygiene and control
- Assessment of whether the project is complying with the relevant standards, performance measures and statutory requirements
- Review the adequacy of any existing strategies / plans or recommendations to improve the environmental outcomes

Weed control works were undertaken at LCO by Enright Land Management Pty Limited during the reporting period and are summarised in Table 49.

Table 49 Weed control – target species 2013

Weed species	Scientific Name	Legislative Listing	Target Area
African Boxthorn	*Lycium ferrocissimum*	Class 4 Noxious Weed	Sporadic across the LCO site
African Olive	*Olea europaea*	Environmental Weed	Bowmans Creek
Blackberry	*Rubus fruiticosus*	Class 4 Noxious Weed	Hillcrest
Bitou Bush	*Chrysanthemoides monilifera*	Class 4 Noxious Weed	Slopes facing Lake Liddell
Castor Oil Plant	*Ricinus communis*	Environmental Weed	Old New England Hwy
Coolatai Grass	*Hyparrhenia hirta*	Class 3 Noxious Weed	Workshop and office areas
Galenia	*Galenia pubescens*	Environmental Weed	Sporadic across the LCO site Bowmans Creek
Green Cestrum	*Cestrum parquai*	Class 3 Noxious Weed	Bowmans Creek
Inkbush	*Phytolacca octandra*	Environmental Weed	Bowmans Creek
Juncus	*Juncus acutus*	Class 4 Noxious Weed	Bowmans Creek and Antiene dams
Kei Apple	*Dovyalis caffra*	Class 4 Noxious Weed	Bowmans Creek
Lantana	*Lantana species*	Class 4 Noxious Weed	Bowmans Creek
Mother of Millions	*Bryophyllum delagoense*	Class 3 Noxious Weed	Bowmans Creek and Chain of Ponds Creek
Noogoora Burr	*Xanthium occidentale*	Class 4 Noxious Weed	Bowmans Creek
Pampas Grass	*Cortaderia selloana*	Class 4 Noxious Weed	Sporadic across the LCO site
Patersons Curse	*Echium plantagineum*	Class 4 Noxious Weed	Bowmans Creek
Prickly Pear	*Opuntia species*	Class 4 Noxious Weed	Bowmans Creek

Weed species	Scientific Name	Legislative Listing	Target Area
St John's Wort	*Hypericum perforatum*	Class 4 Noxious Weed	Bowmans Creek
Tiger Pear	*Opuntia aurantiaca*	Environmental Weed	Bowmans Creek
Tree tobacco	*Nicotiana glauca*	Environmental Weed	CHPP and Antiene dams
White Cedar	*Melia azedarach*	Special Interest	Sporadic across the LCO site
Willows	*Salix species*	Class 5 Noxious Weed	Bowmans Creek

Vertebrate Pest Control

Vertebrate pest control is undertaken in consultation with the NSW Local Land Services, the Hebden Wild Dog Association and neighbouring landholders. Programs to control vertebrate pests include the determination of appropriate control practices, consultation with appropriate authority, obtaining appropriate approvals, implementing control practice and undertaking follow-up monitoring and control as required.
LLS

If monitoring shows a substantial increase in the density of any known vertebrate pest species or the occurrence of a previously unrecorded species is discovered, LCO will seek expert advice on the management and control options for that species and endeavour to minimise its impact on native flora and fauna.

A Vertebrate Pest Control Program was carried out on a seasonal basis (Winter, Autumn and Spring) by Enright Land Management Pty Limited during the reporting period. Each season, the results from the previous program (along with any focused control required) are considered to plan the following control program. As with previous control programs, the 2013 vertebrate pest control program was based on a comprehensive baiting program to target wild dogs and foxes using meat baits injected with sodium monoflouroacetate (commonly known as 1080) traps were utilised for both feral pigs and cats in the area. Open range shooting was also used to control pest species including kangaroos, foxes, wild dogs, pigs, cats, rabbits and hares.

Table 50 summarises the vertebrate pest control undertaken at LCO during the reporting period.

Table 50 2013 Vertebrate Pest Control Summary

Season	Total lethal baits laid	Wild dog takes	Fox takes/Open Range	Non-target species takes	Pig trapping results	Cat trapping results	Kangaroo Open Range	Rabbit/Hare Open Range
Autumn	175	8	40	12	22	0	0	30
Winter	0	0	1	0	8	2	178	25
Spring	152	10	20	2	2	0	22	0
TOTAL	327	18	61	14	32	2	200	55

5.6 Rehabilitation Trials and Research

Biodiversity Rehabilitation Trial (Carbon Based Environmental, August 2012)

This rehabilitation project aims to establish two ecological communities over a 16 ha area of overburden, at Liddell Coal Mine. Of the 16 ha, 8 ha was seeded with a Central Ironbark, Spotted Gum, Grey Box Forest community seed mix (Area 1). The second 8 ha was seeded with a Central Hunter Grey Box, Ironbark Woodland community seed mix (Area 2). Both areas received the same preparation treatments which included the application of 5 t/ha of Gypsum, 2 t/ha of Cal-S, 2 t/ha of lime and 120 t/ha of the composted soil conditioner Organic Growth Medium (OGM).

Initial monitoring of the rehabilitation areas conducted in 2012, six months after seeding to assess germination, found that germination rates of the tree species for both ecological communities were promising (Biodiversity Rehabilitation Trial at Liddell Coal, 2012). Grass species included in respective seed mixes were evident at both sites, however there appeared to be a lack of shrub species establishing.

At the time of the 2012 monitoring, Area 1 was dominated by Japanese Millet. Area 2 appeared sparser with respect to vegetation establishment, yet species diversity was higher at this site than for Area 1.

Monitoring of the same sites was conducted in 2013. Results from the 2013 monitoring showed an increase in tree numbers and growth for both Area 1 and Area 2. The majority of tree species for both seed mixes had germinated and were establishing. Some, but not all shrub, herb and grass species from both seed mixes were also establishing.

Area 1 was no longer dominated by Japanese Millet, and tree growth and establishment had increased significantly since 2012. In 2012, 31 tree seedlings were observed within the monitoring quadrat. This had increased to 132 in 2013, of which 127 were eucalypts (*Corymbia maculata*, *Eucalyptus tereticornis*, *Eucalyptus moluccana*, and *Eucalyptus fibrosa*. A few *Eucalyptus citriodora* were also observed) and 5 were acacias (*Acacia parvipinnula* and *Acacia falcata*). No acacia seedlings had been observed within the quadrat in 2012, although they were present within the trial area adjacent to the monitoring plot. The shrub *Bursaria spinosa subsp. Spinosa* which had not previously been observed was observed within the monitoring quadrat in 2013. Of the 17 species in the seed mix, 8 were confirmed to have established within the monitoring quadrat.

The location of the monitoring quadrat for Area 2 was on a slope that had become colonised with the perennial weed galenia since last monitored in 2012. The area of the trial on the flat land, adjacent the monitoring, site had established to a greater extent than the area on the slope where the monitoring site was located. However, despite the infestation of galenia, tree growth and establishment had increased within the monitoring quadrat since 2012. In 2013, 168 trees were observed within the monitoring quadrat compared with 48 in 2012. Of the 168 trees/seedlings observed, 123 were eucalypts (*Eucalyptus moluccana*, *Eucalyptus crebra* and *Angophora floribunda*) and 45 were acacias (predominately *Acacia pendula*, however a number of *Acacia saligna* were present). The shrub *Dodonaea viscosa*, which was not obseverd in 2012, was also establishing well in 2013. Although not observed in the monitoring quadrat, a Kurrajong seedling (*Brachychiton populeneus*) was observed in the surrounding trial area. Of the 20 species in the seed mix, 9 were observed within the motioning quadrat, and 2 others were confirmed to be within the surrounding trial area.

Initial soil analyses for both Areas 1 and 2 indicated that the growth mediums (soils) of both areas were sodic, alkaline and slightly saline. Following treatment with soil ameliorants, the CEC increased along with the levels of available phosphorous and organic matter in the soil. Conductivity also increased, most probably due to the increased levels of calcium and sulphur in the soil as a result of application of gypsum and Cal-S and the addition of the organic ameliorant OCM. Results from the 2013 soil analyses show that the soil chemistry is moving back towards pre-treatment levels, with pH being slightly alkaline, and conductivity and CEC decreasing slightly, and ESP moving towards more desirable levels. (Soil nitrate and phosphorous levels have decreased since 2012.

LFA indices for stability, infiltration and nutrient recycling all remain relatively unchanged since 2012, and are low. As the sites are immature rehabilitation sites on relatively fresh overburden from mining activities, the low LFA results were not unexpected. It is hoped that over time as the sites mature, the LFA indices will improve.

Overall, germination rates of the tree species are promising for both seed mixes with 7 of the 8 tree species included in the Area 1 seed mix being observed, and 5 of the 7 tree species in the Area 2 seed mix observed. *Allocasuarina luehmannii* (Bulloak) was included in both seed mixes, and has yet to be observed within either of the trial areas. It is the only tree species included in the Area 1 seed mix to have not yet been observed. *Callitris endlicheri* (Black Cypress Pine) was included in the Area 2 seed mix and has yet to be observed. However, *Brachychiton populeneus* (Kurrajong) which was included in the Area 2 seed mix, has not been observed within the Area 2 monitoring quadrat, although a small seedling was observed within the wider Area 2 trial area. Germination of the understory shrub, grass and herb species was not as prevalent as for the tree species.

Figure 53 Area 1 in 2012 (left) and 2013 (right)

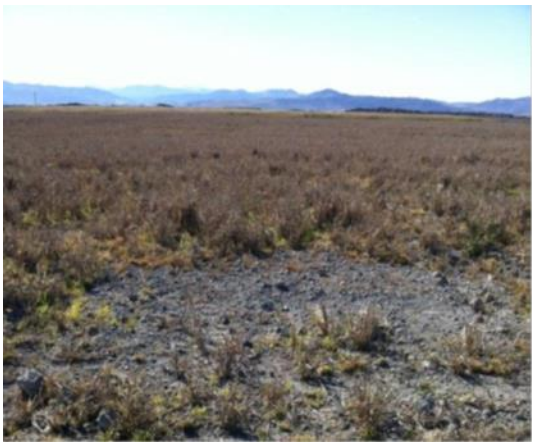


Figure 54 Area 2 in 2012 (left) and 2013 (right)

5.7 Further Development of the Final Rehabilitation Plan

LCO currently operates under an approved Mining Operations Plan including a final landform design.

LCO is in the process of a modification to DA305-11-01 to extend the mining footprint within the current DA and Mining Lease 1597 boundaries. An environmental assessment to support the application has been prepared and is going through the necessary approval process. Due to obvious changes associated with extending the open cut, a new final landform and associated rehabilitation strategy has been developed for approval as part of the modification. The proposed rehabilitation strategy for the Project, is being developed in consideration of a number of factors including site opportunities and constraints, ecological and rural land use values and existing strategic land use objectives. In particular, the strategy considers the integration of rehabilitation at LCO with the strategies developed for surrounding operations within the Greater Ravensworth Area.

The overall objectives of the proposed post-mining land use design are:

- to contribute to effective native corridors through the area which promote fauna movements between Ravensworth Operations, Mt Owen Complex, Lake Liddell and the Ravensworth Operations Hillcrest Offset Area;
- to maintain and provide additional suitable habitat for the spotted-tailed quoll (*Dasyurus maculatus maculatus*) identified during fauna monitoring programs in 2012, particularly around the Bowmans Creek area;
- to provide opportunities for future agricultural activities such as sustainable grazing;
- to improve the visual amenity of the area; and
- not to preclude other potential post mining land use options should they be determined to be viable and preferable as part of the detailed mine closure planning process that commences at least five years prior to the planned cessation of mining.

Pending the outcome of the DA modification approval, the final landform design may change and will be reported in detail in a revised Mine Operations Plan for the site.

6 Activities Proposed in Next AEMR Period

All activities proposed in the next AEMR period will be consistent with the MOP that was approved by DPI on 24th April 2008. According to the guidelines for AEMRs (Department of Trade & Investment, undated), three plans are required for submission with the AEMR. The plans are to be current at the end date of the reporting period, of the same scale and with equivalent information to Plan 3 Land Preparation, Plan 4 Proposed Mining Activities and Plan 5 Proposed Rehabilitation of the current MOP. These plans are included in Appendix I, with the Proposed Mining Activities and Proposed Rehabilitation Plans being displayed as one consolidated plan.

6.1 Targets for Next Reporting Period

Consistent with the Liddell Coal SD Plan, key targets for the next reporting period include but are not limited to:

- compliance with regulatory requirements during mine operation;
- continued improvement of the current real time dust and noise monitoring network for improved operational control;
- conduct Noise Management and Dust Management TARP training with appropriate personnel onsite;
- continued Implementation of the site energy savings action plan (ESAP);
- continual review and update of the mine's EMS;
- continue progressing approval of modification to DA 305-11-01 to allow for the extension of mining activities;
- continue pipeline monitoring and inspection system;
- design and construct a new bioremediation area in pit for the containment and treatment of contaminated waste;
- continued implementation and improvements to Water Management TARP;
- continued implementation of site weed management strategy with a focus on systematic weed management within, but not limited to rehabilitated areas;
- continue site wide vertebrate pest management program;
- develop an additional 61 hectares of rehabilitated pasture and grassland;
- review and update final landform design and mine closure criteria for Life Of Mine;
- develop and implement hydrocarbon spill control training program;
- conduct CCC meetings as scheduled;
- distribute LCO community newsletters as scheduled;
- implement recommendations from environmental inspections and audits; and
- continue to support community initiatives in accordance with LCO's Social Involvement Plan.

The continual review of environmental performance is critical to ensuring on-going improvement in environmental performance. Environmental performance is assessed in the following manner:

- annual planning and budgeting;
- annual review and development of environmental targets and improvement programs by management team and other key personnel;
- development of key environmental performance indicators aligned with overall business objectives;
- continual review of environmental monitoring data;
- environmental inspections;
- a scheduled program of internal and external environmental auditing; and
- participation in a variety of environmental and community forums

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7 References

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Umwelt (2008) *Liddell Colliery Groundwater Monitoring Program***

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*LCO document available on public website (www.liddellcoal.com.au)

**LCO document not publicly available

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Appendix A

Daily Train Haulage Movements

Appendix A Daily Train Haulage Movements

Train Loading Report

Date: 1/01/2013 to 31/12/2013

Site: Liddell Coal Marketing Pty Limited

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD276	OKINAWA	1/1/2013	12:00 a	01:00 a	8,690	60	8,690
LD338	OKINAWA	2/1/2013	12:19 a	02:35 a	8,913	136	3,932
LD258	NORD SATURN	7/1/2013	05:24 p	07:27 p	7,997	123	3,901
LD336	NORD SATURN	7/1/2013	11:25 p	01:32 a	8,761	127	4,139
LD296	NORD SATURN	8/1/2013	09:19 p	11:19 p	8,389	120	4,195
LD384	NORD SATURN	9/1/2013	02:50 a	04:59 a	8,358	129	3,887
LD166	NORD SATURN	9/1/2013	09:09 a	11:23 a	8,432	134	3,776
LD208	NORD SATURN	9/1/2013	03:07 p	05:23 p	8,507	136	3,753
LD240	NORD SATURN	9/1/2013	06:04 p	08:09 p	8,552	125	4,105
LD344	NORD SATURN	9/1/2013	10:05 p	12:10 a	8,626	125	4,140
LD130	UNITED ADVENTURE	10/1/2013	05:51 a	07:58 a	8,347	127	3,943
LD186	SUNRISE SALUTE	10/1/2013	12:13 p	02:22 p	8,467	129	3,938
LD376	UNITED ADVENTURE	11/1/2013	02:48 a	04:57 a	8,245	129	3,835
LD166	UNITED ADVENTURE	11/1/2013	10:42 a	12:52 p	8,651	130	3,993
LD264	UNITED ADVENTURE	11/1/2013	05:36 p	07:51 p	8,678	135	3,857
LD318	UNITED ADVENTURE	11/1/2013	10:35 p	12:43 a	8,487	128	3,978
LD180	SUNRISE SALUTE	12/1/2013	01:23 p	04:07 p	8,311	164	3,041
LD274	UNITED ADVENTURE	12/1/2013	09:17 p	11:38 p	8,592	141	3,656
LD364	UNITED ADVENTURE	13/1/2013	02:17 a	04:23 a	8,696	126	4,141
LD388	UNITED ADVENTURE	13/1/2013	06:17 a	08:22 a	8,427	125	4,045
LD210	SINCERE PISCES	13/1/2013	01:55 p	04:04 p	8,526	129	3,966
LD268	UNITED ADVENTURE	13/1/2013	04:59 p	07:06 p	8,575	127	4,051
LD328	MATSUURA	14/1/2013	10:19 p	12:44 a	8,837	145	3,657
LD260	STELLAR NAVIGATOR	15/1/2013	05:10 p	07:20 p	8,760	130	4,043
LD330	STELLAR NAVIGATOR	15/1/2013	09:22 p	11:38 p	9,282	136	4,095
LD130	CORONA QUEEN	16/1/2013	05:00 a	07:52 a	9,279	172	3,237
LD198	CORONA QUEEN	16/1/2013	12:40 p	02:55 p	9,252	135	4,112
LD240	CORONA QUEEN	16/1/2013	04:01 p	06:19 p	8,583	138	3,732
LD302	HOUYO	16/1/2013	07:54 p	10:12 p	8,853	138	3,849
LD338	HOUYO	16/1/2013	11:34 p	01:40 a	8,634	126	4,112
LD132	CORONA QUEEN	17/1/2013	07:45 a	10:06 a	8,640	141	3,676
LD114	GLOBAL SPLENDOUR	19/1/2013	05:14 a	07:37 a	9,273	143	3,891
LD206	PRETTY	19/1/2013	02:57 p	05:14 p	8,821	137	3,863
LD276	PRETTY	19/1/2013	07:12 p	09:20 p	8,469	128	3,970
LD234	SUIGO	21/1/2013	03:05 p	05:16 p	8,807	131	4,034
LD310	SUIGO	22/1/2013	12:00 a	01:00 a	8,779	60	8,779
LD250	CORONA ACE	23/1/2013	12:00 a	01:00 a	9,264	60	9,264
LD310	HOKURIKU MARU		12:00 a	01:00 a	8,525	60	8,525
LD188	HOKURIKU MARU	24/1/2013	12:00 a	01:00 a	8,554	60	8,554
LD144	CORONA ACE	24/1/2013	05:58 a	08:24 a	9,263	146	3,807
LD258	CORONA ACE	24/1/2013	05:07 p	07:32 p	9,301	145	3,849
LD354	STALO	26/1/2013	02:41 a	04:44 a	8,156	123	3,978
LD216	RAIJU	27/1/2013	03:41 p	06:09 p	8,760	148	3,551
LD162	TARUMAESAN MARU	2/2/2013	09:14 a	11:38 a	8,656	144	3,607
LD216	TWINKLE SALUTE	3/2/2013	12:31 p	02:37 p	8,538	126	4,066
LD352	TWINKLE SALUTE	4/2/2013	02:50 a	05:03 a	8,345	133	3,765
LD174	TARUMAESAN MARU	4/2/2013	09:37 a	11:49 a	8,736	132	3,971
LD356	SAIKO	6/2/2013	12:00 a	01:00 a	8,648	60	8,648
LD304	SAIKO	7/2/2013	12:00 a	01:00 a	8,844	60	8,844
LD344	SHIRARA	10/2/2013	12:00 a	02:41 a	9,272	161	3,456
LD142	SAIKO	12/2/2013	07:50 a	09:58 a	8,846	128	4,147
LD112	FRONTIER AMBITION	18/2/2013	04:44 a	07:06 a	9,122	142	3,854
LD186	FRONTIER AMBITION	18/2/2013	12:17 p	02:27 p	8,522	130	3,933
LD298	FRONTIER AMBITION	18/2/2013	07:31 p	09:46 p	8,696	135	3,865
LD256	SHIN SANYO MARU	26/2/2013	12:00 a	01:00 a	8,636	60	8,636
LD102	SHIN SANYO MARU	26/2/2013	04:16 a	06:36 a	8,574	140	3,675
LD176	NSS ENDEAVOR	27/2/2013	12:50 p	03:08 p	8,663	138	3,767
LD250	NSS ENDEAVOR	27/2/2013	04:23 p	06:40 p	9,047	137	3,962
LD286	NSS ENDEAVOR	27/2/2013	08:46 p	11:11 p	8,552	145	3,539
LD314	NSS ENDEAVOR	3/3/2013	12:37 a	02:41 a	8,097	124	3,918
LD368	NSS ENDEAVOR	3/3/2013	05:31 a	08:35 a	8,697	184	2,836
LD296	HOKURIKU MARU	3/3/2013	06:30 p	08:54 p	9,447	144	3,936
LD380	NSS ENDEAVOR	4/3/2013	03:16 a	04:38 a	8,274	82	6,054
LD148	MIZUNAGI II	4/3/2013	08:25 a	09:30 a	8,099	65	7,476
LD326	MIZUNAGI II	4/3/2013	09:27 p	10:27 p	7,955	60	7,955
LD198	MIZUNAGI II	5/3/2013	02:53 p	05:17 p	8,541	144	3,559
LD366	HOKURIKU MARU	6/3/2013	01:00 a	03:16 a	9,133	136	4,029
LD122	MIZUNAGI II	6/3/2013	06:16 a	08:28 a	8,735	132	3,970
LD318	DYNA CRANE	6/3/2013	10:24 p	12:37 a	8,638	133	3,897

Train Loading Report

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Site: Liddell Coal Marketing Pty Limited

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD154	DYNA CRANE	7/3/2013	11:22 a	01:37 p	8,285	135	3,682
LD330	CORONA JOYFUL	7/3/2013	03:31 a	05:55 a	9,259	144	3,858
LD126	EIGEN	9/3/2013	12:00 a	01:00 a	9,216	60	9,216
LD354	CORONA JOYFUL		12:00 a	01:00 a	8,790	60	8,790
LD186	CORAL RING	16/3/2013	11:32 a	01:42 p	9,055	130	4,179
LD218	CORAL RING	16/3/2013	02:02 p	04:19 p	8,808	137	3,858
LD306	CORAL RING	16/3/2013	09:28 p	11:41 p	9,391	133	4,237
LD322	CORAL RING	17/3/2013	12:00 a	01:00 a	8,198	60	8,198
LD174	CORAL RING	17/3/2013	11:53 a	02:19 p	9,268	146	3,809
LD294	CORAL RING	17/3/2013	09:24 p	11:45 p	8,571	141	3,647
LD374	CORAL RING	18/3/2013	03:46 a	06:16 a	9,796	150	3,918
LD122	H S C	18/3/2013	08:59 a	01:42 p	8,476	283	1,797
LD254	C. S. OLIVE	18/3/2013	07:14 p	09:27 p	9,393	133	4,237
LD284	H S C	18/3/2013	10:01 p	12:14 a	8,405	133	3,792
LD326	H S C	19/3/2013	02:00 a	04:07 a	7,805	127	3,687
LD214	SAGE SAGITTARIUS	19/3/2013	07:15 p	09:27 p	9,049	132	4,113
LD356	SAGE SAGITTARIUS	20/3/2013	01:27 a	03:39 a	8,957	132	4,071
LD386	SAGE SAGITTARIUS	20/3/2013	05:22 a	10:40 a	9,046	318	1,707
LD172	NANAUMI	20/3/2013	01:07 p	03:40 p	9,596	153	3,763
LD266	HAKUYO	20/3/2013	04:51 p	07:07 p	8,955	136	3,951
LD380	HAKUYO	21/3/2013	02:47 a	05:03 a	8,925	136	3,937
LD164	HAKUYO	21/3/2013	10:40 a	01:30 p	8,991	170	3,173
LD194	MAPLE WAVE	23/3/2013	12:00 a	01:00 a	8,681	60	8,681
LD160	C. S. OLIVE	23/3/2013	07:49 a	10:22 a	8,922	153	3,499
LD282	C. S. OLIVE	23/3/2013	07:40 p	10:01 p	9,256	141	3,939
LD326	SAIKO	24/3/2013	11:11 p	01:20 a	8,490	129	3,949
LD192	SAIKO	25/3/2013	12:50 p	03:03 p	8,293	133	3,741
LD360	MAPLE WAVE	25/3/2013	11:58 p	02:09 a	8,926	131	4,088
LD258	MAPLE WAVE	26/3/2013	05:18 p	07:31 p	9,104	133	4,107
LD374	NSS GRANDEUR	30/3/2013	03:14 a	05:33 a	8,408	139	3,629
LD192	NSS GRANDEUR	30/3/2013	11:25 a	01:35 p	8,494	130	3,920
LD250	NSS GRANDEUR	30/3/2013	04:41 p	06:48 p	8,523	127	4,027
LD104	RIN YO	6/4/2013	12:00 a	01:00 a	8,669	60	8,669
LD236	RIN YO		12:00 a	01:00 a	8,752	60	8,752
LD174	RIN YO	6/4/2013	10:27 a	12:48 p	8,780	141	3,736
LD282	RIN YO	7/4/2013	12:00 a	01:00 a	8,818	60	8,818
LD318	RIN YO	7/4/2013	12:47 a	02:21 a	8,772	94	5,599
LD140	RIN YO	7/4/2013	07:34 a	09:48 a	8,726	134	3,907
LD234	RIN YO	7/4/2013	02:33 p	04:47 p	9,265	134	4,148
LD364	RIN YO	8/4/2013	02:27 a	04:48 a	8,649	141	3,680
LD284	KATSURA	8/4/2013	06:21 p	08:33 p	8,802	132	4,001
LD332	KATSURA	8/4/2013	11:44 p	01:54 a	8,954	130	4,133
LD372	KATSURA	9/4/2013	03:15 a	05:35 a	8,903	140	3,815
LD284	PACIFIC KINDNESS	9/4/2013	06:29 p	09:03 p	9,283	154	3,617
LD152	PACIFIC KINDNESS	10/4/2013	10:42 a	12:56 p	9,321	134	4,173
LD256	PACIFIC KINDNESS	10/4/2013	03:05 p	05:29 p	8,647	144	3,603
LD310	MIZUNAGI II	10/4/2013	09:44 p	11:46 p	8,786	122	4,321
LD140	BULK TITAN	11/4/2013	07:11 a	09:21 a	8,987	130	4,148
LD316	CORAL RUBY	11/4/2013	09:29 p	11:39 p	8,894	130	4,105
LD322	CORAL RUBY	12/4/2013	09:11 p	11:33 p	9,350	142	3,951
LD126	CORAL RUBY	13/4/2013	06:16 a	08:28 a	8,592	132	3,905
LD374	MIZUNAGI II	14/4/2013	02:14 a	04:30 a	9,213	136	4,065
LD124	MIZUNAGI II	14/4/2013	08:12 a	10:39 a	8,807	147	3,595
LD202	MIZUNAGI II	14/4/2013	12:32 p	02:52 p	9,000	140	3,857
LD276	MIZUNAGI II	14/4/2013	06:45 p	08:57 p	8,774	132	3,988
LD302	SHIN SANYO MARU	15/4/2013	12:00 a	01:00 a	8,734	60	8,734
LD164	SHIN SANYO MARU	15/4/2013	10:44 a	12:54 p	8,986	130	4,147
LD204	SHIN SANYO MARU	15/4/2013	01:41 p	04:10 p	8,799	149	3,543
LD286	SHIN SANYO MARU	15/4/2013	06:18 p	08:42 p	9,215	144	3,840
LD388	SHIN SANYO MARU	16/4/2013	06:41 a	09:08 a	8,457	147	3,452
LD186	SHIN SANYO MARU	16/4/2013	12:20 p	02:29 p	8,751	129	4,070
LD264	SHIN SANYO MARU	16/4/2013	06:35 p	08:50 p	8,836	135	3,927
LD316	MAHA ANOSHA	16/4/2013	10:31 p	01:32 a	8,613	181	2,855
LD378	CHINA STEEL INVESTO	19/4/2013	02:59 a	05:20 a	8,900	141	3,787
LD386	CHINA STEEL INVESTO	20/4/2013	04:15 a	06:27 a	9,227	132	4,194
LD180	SHIRAKUMO	21/4/2013	09:11 a	11:37 a	8,808	146	3,620
LD142	NEW STAGE	23/4/2013	06:21 a	08:36 a	8,716	135	3,874
LD198	NEW STAGE	23/4/2013	12:12 p	02:27 p	8,984	135	3,993
LD250	MAIZURU DAIKOKU	24/4/2013	08:18 p	10:49 p	8,375	151	3,328

Train Loading Report

Date: 1/01/2013 to 31/12/2013

Site: Liddell Coal Marketing Pty Limited

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD166	MAIZURU DAIKOKU	25/4/2013	09:15 a	11:18 a	8,669	123	4,229
LD228	SHIRAKUMO	26/4/2013	01:48 p	04:05 p	8,672	137	3,798
LD274	SHIRAKUMO	26/4/2013	06:56 p	09:15 p	8,994	139	3,882
LD192	TACHIBANA	27/4/2013	10:50 a	12:56 p	8,751	126	4,167
LD256	TACHIBANA	27/4/2013	03:40 p	05:56 p	9,160	136	4,041
LD350	TACHIBANA	27/4/2013	11:40 p	01:48 a	8,709	128	4,083
LD388	TACHIBANA	28/4/2013	03:36 a	05:56 a	9,276	140	3,975
LD142	NSS FORTUNE	29/4/2013	06:32 a	08:56 a	8,632	144	3,597
LD208	CORAL TOPAZ	29/4/2013	01:18 p	04:34 p	8,580	196	2,627
LD350	CORAL TOPAZ	29/4/2013	12:08 a	02:19 a	8,778	131	4,020
LD140	NSS FORTUNE	30/4/2013	07:16 a	09:35 a	8,721	139	3,764
LD210	CORAL TOPAZ	30/4/2013	12:14 p	02:27 p	8,808	133	3,974
LD278	CORAL TOPAZ	30/4/2013	05:44 p	08:03 p	8,965	139	3,870
LD328	NSS FORTUNE	1/5/2013	12:00 a	01:00 a	9,245	60	9,245
LD182	NSS FORTUNE	1/5/2013	09:58 a	12:16 p	9,389	138	4,082
LD232	NSS FORTUNE	1/5/2013	04:18 p	06:35 p	8,561	137	3,749
LD286	NSS FORTUNE	1/5/2013	07:36 p	09:57 p	9,203	141	3,916
LD188	NSS FORTUNE	2/5/2013	12:30 p	02:50 p	8,960	140	3,840
LD300	NSS FORTUNE	2/5/2013	07:19 p	09:31 p	8,875	132	4,034
LD378	NSS FORTUNE	3/5/2013	02:54 a	05:22 a	8,951	148	3,629
LD136	NSS FORTUNE	3/5/2013	08:01 a	10:36 a	8,929	155	3,456
LD300	SOYO	3/5/2013	11:01 p	01:44 a	9,301	163	3,424
LD354	SOYO	4/5/2013	02:29 a	04:38 a	8,905	129	4,142
LD326	SUNRISE SALUTE	4/5/2013	11:12 p	02:03 a	9,497	171	3,332
LD168	SANTA LUCIA	5/5/2013	08:34 a	10:57 a	8,847	143	3,712
LD252	PARAPOLA	5/5/2013	05:26 p	07:42 p	8,907	136	3,929
LD292	SANTA LUCIA	5/5/2013	09:48 p	12:18 a	8,963	150	3,585
LD112	SANTA LUCIA	6/5/2013	05:41 a	07:57 a	9,251	136	4,081
LD228	SANTA LUCIA	6/5/2013	03:04 p	05:25 p	9,154	141	3,895
LD288	SANTA LUCIA	6/5/2013	08:44 p	11:13 p	9,273	149	3,734
LD340	SANTA LUCIA	6/5/2013	12:00 a	02:16 a	9,247	136	4,080
LD162	HERMES ISLAND	7/5/2013	08:07 a	10:17 a	8,825	130	4,073
LD216	HERMES ISLAND	7/5/2013	03:25 p	05:46 p	9,265	141	3,943
LD208	SANTA LUCIA	7/5/2013	06:18 p	09:03 p	8,913	165	3,241
LD358	HERMES ISLAND	8/5/2013	12:46 a	03:00 a	9,312	134	4,170
LD230	PARAPOLA	8/5/2013	02:33 p	04:42 p	8,515	129	3,961
LD266	PARAPOLA	8/5/2013	05:50 p	08:03 p	8,917	133	4,023
LD126	PARAPOLA	9/5/2013	05:00 a	07:13 a	9,338	133	4,212
LD344	CORONA FRONTIER	9/5/2013	11:47 p	01:57 a	9,021	130	4,164
LD278	TENYO	10/5/2013	06:54 p	09:25 p	9,259	151	3,679
LD102	TENYO	11/5/2013	02:19 a	04:28 a	8,542	129	3,973
LD282	CORONA FRONTIER	12/5/2013	07:14 p	10:07 p	9,218	173	3,197
LD104	YURITAMOU	19/5/2013	12:00 a	01:00 a	8,956	60	8,956
LD166	YURITAMOU		12:00 a	01:00 a	9,164	60	9,164
LD122	KEY HUNTER	20/5/2013	06:19 a	08:30 a	9,223	131	4,224
LD142	CORONA ACE	20/5/2013	09:17 a	11:33 a	9,336	136	4,119
LD218	KEY HUNTER	20/5/2013	01:54 p	04:35 p	8,520	161	3,175
LD378	KEY HUNTER	21/5/2013	03:44 a	06:05 a	9,484	141	4,036
LD206	CORONA INFINITY	21/5/2013	12:17 p	02:24 p	8,494	127	4,013
LD158	CORONA INFINITY	22/5/2013	09:08 a	11:20 a	9,346	132	4,248
LD170	CORONA HORIZON	23/5/2013	11:38 a	02:11 p	8,771	153	3,440
LD268	KEY HUNTER	23/5/2013	04:17 p	06:53 p	9,561	156	3,677
LD140	WAKAYAMA MARU	24/5/2013	08:21 a	11:15 a	9,067	174	3,127
LD204	WAKAYAMA MARU	24/5/2013	01:12 p	03:53 p	8,664	161	3,229
LD170	WAKAYAMA MARU	25/5/2013	10:07 a	12:23 p	9,285	136	4,097
LD222	WAKAYAMA MARU	25/5/2013	01:27 p	03:51 p	9,104	144	3,794
LD358	WAKAYAMA MARU	26/5/2013	03:17 a	05:23 a	8,903	126	4,240
LD138	WAKAYAMA MARU	26/5/2013	07:14 a	09:48 a	8,727	154	3,400
LD248	WAKAYAMA MARU	26/5/2013	02:58 p	05:17 p	8,851	139	3,821
LD362	WAKAYAMA MARU	27/5/2013	12:33 a	02:40 a	8,737	127	4,128
LD140	WAKAYAMA MARU	27/5/2013	10:51 a	01:11 p	9,098	140	3,899
LD214	NORTH FORTUNE III	27/5/2013	01:59 p	04:13 p	8,657	134	3,876
LD270	SHIN SAPPORO MARU	3/6/2013	08:07 p	10:18 p	9,289	131	4,255
LD308	SHIN SAPPORO MARU	3/6/2013	10:43 p	12:51 a	8,616	128	4,039
LD194	HEBEI UNIVERSE	8/6/2013	11:31 a	01:37 p	8,746	126	4,165
LD240	HEBEI UNIVERSE	8/6/2013	04:34 p	06:57 p	9,173	143	3,849
LD354	HEBEI UNIVERSE	8/6/2013	01:20 a	03:40 a	8,866	140	3,800
LD222	HEBEI UNIVERSE	9/6/2013	01:17 p	03:55 p	8,978	158	3,410
LD142	HEBEI UNIVERSE	10/6/2013	06:57 a	09:23 a	9,405	146	3,865

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Date: 1/01/2013 to 31/12/2013

Site: Liddell Coal Marketing Pty Limited

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD374	HEBEI UNIVERSE	13/6/2013	01:39 a	03:51 a	8,839	132	4,018
LD126	HERODOTUS	13/6/2013	04:59 a	07:12 a	9,279	133	4,186
LD200	HERODOTUS	13/6/2013	11:02 a	01:16 p	8,981	134	4,022
LD252	HERODOTUS	13/6/2013	06:37 p	09:15 p	9,199	158	3,493
LD280	SUNRISE SALUTE	13/6/2013	09:46 p	12:26 a	9,182	160	3,443
LD374	HERODOTUS	14/6/2013	01:24 a	03:46 a	8,453	142	3,572
LD108	HERODOTUS	14/6/2013	08:24 a	10:40 a	8,590	136	3,790
LD234	HERODOTUS	14/6/2013	03:52 p	06:20 p	8,966	148	3,635
LD322	HERODOTUS	15/6/2013	01:26 a	03:50 a	9,447	144	3,936
LD120	HERODOTUS	15/6/2013	04:54 a	07:15 a	9,037	141	3,846
LD180	HERODOTUS	15/6/2013	12:05 p	02:21 p	8,460	136	3,732
LD384	KASHIMA MARU	16/6/2013	02:50 a	05:09 a	9,259	139	3,997
LD166	KASHIMA MARU	16/6/2013	09:14 a	11:40 a	9,647	146	3,965
LD234	KASHIMA MARU	16/6/2013	02:11 p	04:35 p	9,056	144	3,773
LD314	KASHIMA MARU	16/6/2013	09:15 p	11:30 p	8,363	135	3,717
LD144	KASHIMA MARU	17/6/2013	08:18 a	10:27 a	8,465	129	3,937
LD178	KASHIMA MARU	17/6/2013	10:54 a	01:05 p	8,372	131	3,835
LD294	KASHIMA MARU	17/6/2013	07:01 p	09:19 p	8,897	138	3,868
LD224	CHINA STEEL DEVELOP	18/6/2013	02:25 p	04:39 p	8,233	134	3,686
LD316	CHINA STEEL DEVELOP	18/6/2013	12:18 a	02:28 a	9,031	130	4,168
LD366	CHINA STEEL DEVELOP	19/6/2013	03:33 a	05:48 a	9,019	135	4,008
LD226	TTM HARVEST	22/6/2013	03:05 p	05:31 p	9,563	146	3,930
LD322	TTM HARVEST	22/6/2013	09:17 p	11:31 p	8,891	134	3,981
LD384	TTM HARVEST	27/6/2013	04:10 a	06:40 a	9,211	150	3,684
LD234	TIAN FU HAI	27/6/2013	01:27 p	03:45 p	9,463	138	4,114
LD120	TIAN FU HAI	28/6/2013	12:00 a	01:00 a	9,577	60	9,577
LD378	TIAN FU HAI	28/6/2013	03:09 a	05:30 a	8,767	141	3,731
LD222	TIAN FU HAI	28/6/2013	02:49 p	05:45 p	9,249	176	3,153
LD286	TIAN FU HAI	28/6/2013	07:48 p	10:04 p	9,225	136	4,070
LD328	TIAN FU HAI	28/6/2013	12:04 a	02:39 a	9,767	155	3,781
LD304	NSS FORTUNE	29/6/2013	08:51 p	11:06 p	8,828	135	3,924
LD204	NSS FORTUNE	30/6/2013	10:59 a	01:17 p	8,569	138	3,726
LD354	NSS FORTUNE	1/7/2013	12:34 a	03:08 a	8,580	154	3,343
LD272	NSS FORTUNE	1/7/2013	05:39 p	07:58 p	9,042	139	3,903
LD286	SUIGO	1/7/2013	10:34 p	12:57 a	9,188	143	3,855
LD200	SUIGO	2/7/2013	01:26 p	04:15 p	8,913	169	3,164
LD278	SUIGO	2/7/2013	05:42 p	07:52 p	8,918	130	4,116
LD324	SUIGO	2/7/2013	10:59 p	01:28 a	8,695	149	3,501
LD384	SUIGO	3/7/2013	04:46 a	07:14 a	9,350	148	3,791
LD198	SUIGO	3/7/2013	03:14 p	05:36 p	8,773	142	3,707
LD302	SUIGO	3/7/2013	07:19 p	10:01 p	9,399	162	3,481
LD378	SINCERE PISCES	4/7/2013	02:21 a	04:31 a	8,904	130	4,109
LD266	SINCERE PISCES	4/7/2013	07:14 p	10:11 p	9,512	177	3,224
LD112	CAPE ASTER	7/7/2013	12:00 a	01:00 a	8,987	60	8,987
LD188	CAPE ASTER		12:00 a	01:00 a	9,039	60	9,039
LD194	CAPE ASTER		12:00 a	01:00 a	9,019	60	9,019
LD252	CAPE ASTER	7/7/2013	08:20 p	10:56 p	9,310	156	3,581
LD222	DARYA JYOTI	9/7/2013	12:00 a	01:00 a	8,802	60	8,802
LD142	DARYA JYOTI	9/7/2013	07:13 a	09:23 a	8,470	130	3,909
LD252	KEY KNIGHT	14/7/2013	04:26 p	07:04 p	9,557	158	3,629
LD386	CORAL TOPAZ	17/7/2013	12:00 a	01:00 a	8,906	60	8,906
LD310	CORAL TOPAZ	17/7/2013	08:58 p	11:40 p	9,429	162	3,492
LD232	CORAL TOPAZ	18/7/2013	12:00 a	01:00 a	8,835	60	8,835
LD374	CORAL TOPAZ		12:00 a	01:00 a	9,335	60	9,335
LD218	BRIGHT WIND	19/7/2013	02:49 p	05:10 p	9,148	141	3,893
LD258	BRIGHT WIND	19/7/2013	06:25 p	09:08 p	8,268	163	3,043
LD300	BRIGHT WIND	19/7/2013	09:35 p	12:20 a	8,946	165	3,253
LD116	BRIGHT WIND	20/7/2013	05:14 a	07:26 a	9,085	132	4,129
LD198	MAIZURU BENTEN	20/7/2013	11:01 a	01:27 p	9,872	146	4,057
LD254	MAIZURU BENTEN	20/7/2013	04:23 p	06:43 p	9,379	140	4,019
LD168	MAIZURU BENTEN	21/7/2013	09:35 a	11:53 a	9,269	138	4,030
LD264	EMIL	21/7/2013	05:07 p	08:15 p	8,886	188	2,836
LD112	ALAM PADU	22/7/2013	05:00 a	07:54 a	9,485	174	3,271
LD164	ALAM PADU	22/7/2013	09:40 a	11:55 a	9,090	135	4,040
LD274	ALAM PADU	22/7/2013	05:37 p	07:53 p	8,280	136	3,653
LD190	ALAM PADU	23/7/2013	02:45 p	05:03 p	9,240	138	4,017
LD240	EMIL	23/7/2013	07:36 p	09:35 p	8,357	119	4,214
LD342	EMIL	24/7/2013	03:46 a	06:01 a	9,013	135	4,006
LD198	EMIL	24/7/2013	12:24 p	02:40 p	9,056	136	3,995

Train Loading Report

Date: 1/01/2013 to 31/12/2013

Site: Liddell Coal Marketing Pty Limited

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD276	EMIL	24/7/2013	06:30 p	08:54 p	9,515	144	3,965
LD344	EMIL	24/7/2013	12:20 a	02:43 a	9,029	143	3,788
LD376	BULK HARVEST	25/7/2013	03:06 a	05:34 a	8,919	148	3,616
LD122	BULK HARVEST	25/7/2013	06:31 a	08:49 a	8,786	138	3,820
LD370	BULK HARVEST	26/7/2013	12:00 a	01:00 a	9,035	60	9,035
LD168	BULK HARVEST	26/7/2013	08:25 a	10:44 a	9,674	139	4,176
LD210	JIN LANG	26/7/2013	12:22 p	02:37 p	8,378	135	3,724
LD354	BULK HARVEST	27/7/2013	01:24 a	04:02 a	8,744	158	3,320
LD380	BULK HARVEST	27/7/2013	04:52 a	07:24 a	8,928	152	3,524
LD196	JIN LANG	27/7/2013	10:31 a	12:55 p	8,991	144	3,746
LD274	JIN LANG	27/7/2013	11:07 p	01:18 a	8,541	131	3,912
LD342	JIN LANG	28/7/2013	02:10 a	09:35 a	9,196	445	1,240
LD216	BULK INDIA	29/7/2013	01:15 p	03:40 p	9,591	145	3,969
LD352	BULK INDIA	29/7/2013	11:53 p	02:32 a	9,279	159	3,501
LD380	BULK INDIA	31/7/2013	02:59 a	05:30 a	9,400	151	3,735
LD266	KUROTAKISAN MARU	1/8/2013	04:20 p	06:36 p	9,640	136	4,253
LD378	KUROTAKISAN MARU	4/8/2013	04:34 a	07:00 a	9,548	146	3,924
LD388	MINAMI	11/8/2013	04:11 a	06:22 a	9,151	131	4,191
LD176	CSE HARMONY EXPRE	11/8/2013	10:12 a	12:31 p	9,069	139	3,915
LD304	CSE HARMONY EXPRE	11/8/2013	09:22 p	11:31 p	8,470	129	3,940
LD166	MINAMI	12/8/2013	07:32 a	09:48 a	9,560	136	4,218
LD184	NEW HORIZON	16/8/2013	12:26 p	03:19 p	9,416	173	3,266
LD262	NEW HORIZON	16/8/2013	04:54 p	07:19 p	8,724	145	3,610
LD180	SUIGO	17/8/2013	09:02 a	11:04 a	8,090	122	3,979
LD154	SUIGO	18/8/2013	08:40 a	11:21 a	9,266	161	3,453
LD218	SUIGO	18/8/2013	01:50 p	04:04 p	8,561	134	3,833
LD154	SUIGO	19/8/2013	08:15 a	10:38 a	8,752	143	3,672
LD254	SUIGO	19/8/2013	05:40 p	08:04 p	9,123	144	3,801
LD130	LEGATO II	20/8/2013	07:06 a	09:33 a	9,606	147	3,921
LD226	TACHIBANA	20/8/2013	01:35 p	03:59 p	9,630	144	4,012
LD252	TACHIBANA	20/8/2013	04:41 p	07:07 p	8,950	146	3,678
LD168	LEGATO II	21/8/2013	08:53 a	11:19 a	8,603	146	3,536
LD236	LEGATO II	21/8/2013	02:07 p	04:19 p	8,899	132	4,045
LD316	LEGATO II	21/8/2013	09:01 p	11:29 p	8,484	148	3,440
LD366	E.R. BRANDENBURG	22/8/2013	01:46 a	04:10 a	9,454	144	3,939
LD190	LEGATO II	22/8/2013	11:51 a	02:06 p	8,613	135	3,828
LD250	LEGATO II	22/8/2013	03:24 p	05:57 p	8,791	153	3,447
LD332	CORONA KINGDOM	22/8/2013	10:16 p	12:35 a	9,178	139	3,962
LD170	E.R. BRANDENBURG	23/8/2013	12:00 a	01:00 a	9,506	60	9,506
LD240	E.R. BRANDENBURG	23/8/2013	02:26 p	04:45 p	9,512	139	4,106
LD318	E.R. BRANDENBURG	23/8/2013	09:50 p	12:11 a	9,414	141	4,006
LD344	E.R. BRANDENBURG	24/8/2013	01:10 a	03:44 a	8,793	154	3,426
LD128	CORONA KINGDOM	24/8/2013	05:23 a	07:45 a	8,907	142	3,763
LD186	CORONA KINGDOM	24/8/2013	10:13 a	12:41 p	8,988	148	3,644
LD248	E.R. BRANDENBURG	24/8/2013	04:11 p	06:26 p	9,290	135	4,129
LD322	E.R. BRANDENBURG	24/8/2013	09:09 p	11:27 p	8,714	138	3,789
LD204	AQUACHARM	26/8/2013	12:00 a	01:00 a	9,483	60	9,483
LD266	AQUACHARM		12:00 a	01:00 a	8,997	60	8,997
LD348	AQUACHARM		12:00 a	01:00 a	8,333	60	8,333
LD166	AQUACHARM	27/8/2013	10:34 a	01:01 p	8,815	147	3,598
LD372	AQUACHARM	28/8/2013	02:06 a	05:18 a	8,747	192	2,733
LD134	MIZUNAGI II	28/8/2013	06:38 a	09:14 a	9,371	156	3,604
LD234	MIZUNAGI II	28/8/2013	03:31 p	06:07 p	9,446	156	3,633
LD342	MIZUNAGI II	28/8/2013	11:21 p	01:48 a	8,964	147	3,659
LD158	MIZUNAGI II	29/8/2013	07:39 a	10:02 a	9,583	143	4,021
LD226	MIZUNAGI II	29/8/2013	01:34 p	03:52 p	8,939	138	3,886
LD280	CORAL TOPAZ	29/8/2013	06:55 p	09:05 p	8,532	130	3,938
LD168	MIZUNAGI II	30/8/2013	10:44 a	12:53 p	8,315	129	3,868
LD204	MIZUNAGI II	30/8/2013	01:29 p	03:51 p	9,417	142	3,979
LD240	CORAL TOPAZ	30/8/2013	04:31 p	06:47 p	8,812	136	3,888
LD156	SOMA MARU	31/8/2013	07:54 a	10:22 a	8,746	148	3,546
LD238	SOMA MARU	31/8/2013	02:16 p	04:33 p	8,933	137	3,912
LD218	SOMA MARU	1/9/2013	12:20 p	02:32 p	9,295	132	4,225
LD258	SOMA MARU	1/9/2013	04:06 p	06:37 p	9,264	151	3,681
LD152	SPRING PRIDE	2/9/2013	07:40 a	09:55 a	9,252	135	4,112
LD262	SPRING PRIDE	2/9/2013	03:48 p	06:30 p	9,342	162	3,460
LD168	SPRING PRIDE	3/9/2013	08:50 a	11:02 a	8,503	132	3,865
LD252	SPRING PRIDE	3/9/2013	04:24 p	06:33 p	8,637	129	4,017
LD156	SPRING PRIDE	4/9/2013	08:14 a	10:38 a	8,697	144	3,624

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD232	NEW STAGE	4/9/2013	03:45 p	06:09 p	8,830	144	3,679
LD162	NEW STAGE	5/9/2013	10:56 a	01:22 p	8,790	146	3,612
LD254	NEW STAGE	5/9/2013	04:51 p	07:13 p	9,113	142	3,851
LD174	NEW STAGE	6/9/2013	09:27 a	11:43 a	9,128	136	4,027
LD228	NEW STAGE	6/9/2013	02:05 p	04:20 p	8,656	135	3,847
LD186	NEW STAGE	8/9/2013	11:50 a	02:16 p	9,194	146	3,778
LD200	NEW STAGE	9/9/2013	12:43 p	03:32 p	8,469	169	3,007
LD170	OCEAN WIND	10/9/2013	09:27 a	11:54 a	8,493	147	3,467
LD178	OCEAN WIND	11/9/2013	09:03 a	11:15 a	9,204	132	4,184
LD150	PACIFIC TRIANGLE	12/9/2013	07:31 a	09:47 a	8,794	136	3,880
LD216	PACIFIC TRIANGLE	12/9/2013	02:22 p	04:25 p	8,300	123	4,049
LD250	PACIFIC TRIANGLE	13/9/2013	12:00 a	01:00 a	9,497	60	9,497
LD154	PACIFIC TRIANGLE	13/9/2013	08:01 a	10:25 a	9,063	144	3,776
LD206	PACIFIC TRIANGLE	14/9/2013	11:55 a	02:11 p	8,777	136	3,872
LD264	PACIFIC TRIANGLE	14/9/2013	04:41 p	07:38 p	9,497	177	3,219
LD160	PACIFIC TRIANGLE	15/9/2013	08:20 a	10:37 a	8,830	137	3,867
LD258	PACIFIC TRIANGLE	15/9/2013	04:05 p	06:52 p	9,516	167	3,419
LD148	CORONA ACE	16/9/2013	08:03 a	10:27 a	9,550	144	3,979
LD202	CORONA ACE	16/9/2013	11:42 a	02:04 p	9,193	142	3,884
LD180	CORONA ACE	17/9/2013	11:09 a	01:34 p	9,648	145	3,992
LD186	CORONA ACE	19/9/2013	10:29 a	12:57 p	9,336	148	3,785
LD218	CORONA ACE	19/9/2013	01:22 p	03:50 p	8,964	148	3,634
LD192	NOBLE HALO	20/9/2013	10:56 a	01:18 p	9,300	142	3,930
LD254	CORONA ACE	20/9/2013	03:53 p	08:14 p	8,813	261	2,026
LD172	NOBLE HALO	21/9/2013	08:45 a	11:41 a	9,384	176	3,199
LD192	NOBLE HALO	22/9/2013	10:48 a	02:26 p	8,858	218	2,438
LD204	ZAMPA BLUE	23/9/2013	01:43 p	03:53 p	8,415	130	3,884
LD366	ZAMPA BLUE	24/9/2013	01:57 a	02:57 a	9,278	60	9,278
LD148	ZAMPA BLUE	24/9/2013	07:59 a	10:31 a	8,739	152	3,450
LD220	CHINA STEEL CHALLEN	24/9/2013	01:02 p	03:13 p	9,012	131	4,127
LD212	CHINA STEEL CHALLEN	25/9/2013	12:14 p	02:07 p	7,603	113	4,037
LD148	KASHIMA MARU	27/9/2013	07:10 a	09:31 a	8,657	141	3,684
LD210	KASHIMA MARU	27/9/2013	12:54 p	03:19 p	8,627	145	3,570
LD278	KASHIMA MARU	28/9/2013	06:02 p	08:29 p	9,289	147	3,791
LD200	KASHIMA MARU	29/9/2013	11:55 a	02:14 p	9,001	139	3,885
LD322	KASHIMA MARU	29/9/2013	09:23 p	11:55 p	9,499	152	3,750
LD222	SUIGO	3/10/2013	01:43 p	03:54 p	8,685	131	3,978
LD208	SUIGO	4/10/2013	11:03 a	01:17 p	8,941	134	4,003
LD304	SHOHAKU	4/10/2013	08:31 p	10:38 p	8,724	127	4,121
LD364	SHOHAKU	5/10/2013	01:44 a	03:46 a	8,507	122	4,184
LD200	ORANGE TRUTH	5/10/2013	12:22 p	02:37 p	9,002	135	4,001
LD252	ORANGE TRUTH	5/10/2013	03:18 p	05:34 p	8,485	136	3,743
LD370	SHOHAKU	6/10/2013	12:00 a	01:00 a	8,278	60	8,278
LD118	ORANGE TRUTH	6/10/2013	06:08 a	08:40 a	9,166	152	3,618
LD174	NEW MIGHTY	7/10/2013	12:00 a	01:00 a	8,515	60	8,515
LD260	NEW MIGHTY		12:00 a	01:00 a	8,682	60	8,682
LD288	NEW MIGHTY	8/10/2013	12:00 a	01:00 a	8,616	60	8,616
LD356	NEW MIGHTY		12:00 a	01:00 a	9,290	60	9,290
LD240	SHIN-SAKAIDE	9/10/2013	12:00 a	01:00 a	8,889	60	8,889
LD332	SHIN-SAKAIDE	9/10/2013	10:03 p	12:25 a	8,694	142	3,673
LD128	NEW MIGHTY	10/10/2013	05:58 a	08:21 a	9,503	143	3,987
LD216	SHIN-SAKAIDE	10/10/2013	01:43 p	04:05 p	8,619	142	3,642
LD130	SHIN-SAKAIDE	11/10/2013	05:50 a	08:12 a	9,314	142	3,935
LD218	SHIN-SAKAIDE	11/10/2013	01:32 p	03:53 p	8,645	141	3,679
LD278	ISHIZUCHI	12/10/2013	06:56 p	09:23 p	9,356	147	3,819
LD358	ISHIZUCHI	13/10/2013	01:22 a	03:37 a	8,870	135	3,942
LD138	CHINA STEEL EXPRESS	13/10/2013	08:14 a	10:34 a	9,182	140	3,935
LD270	CHINA STEEL EXPRESS	13/10/2013	06:03 p	10:04 p	9,299	241	2,315
LD386	CHINA STEEL EXPRESS	14/10/2013	02:41 a	05:39 a	8,482	178	2,859
LD278	TACHIBANA	15/10/2013	07:32 p	10:07 p	9,330	155	3,612
LD326	TACHIBANA	16/10/2013	10:26 p	12:33 a	8,632	127	4,078
LD128	TACHIBANA	18/10/2013	04:50 a	07:03 a	8,745	133	3,945
LD180	CENTURY WAVE	18/10/2013	08:40 a	10:48 a	8,735	128	4,095
LD228	CENTURY WAVE	18/10/2013	01:11 p	03:32 p	9,380	141	3,992
LD162	CENTURY WAVE	19/10/2013	09:00 a	11:08 a	8,926	128	4,184
LD204	CENTURY WAVE	19/10/2013	12:01 p	02:27 p	9,293	146	3,819
LD130	UNITED ADVENTURE	20/10/2013	06:02 a	08:45 a	9,277	163	3,415
LD204	UNITED ADVENTURE	20/10/2013	11:45 a	01:55 p	8,501	130	3,924
LD320	UNITED ADVENTURE	20/10/2013	07:54 p	10:29 p	8,791	155	3,403

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD130	UNITED ADVENTURE	21/10/2013	06:18 a	09:09 a	8,806	171	3,090
LD168	UNITED ADVENTURE	21/10/2013	10:36 a	01:02 p	9,227	146	3,792
LD310	UNITED ADVENTURE	21/10/2013	09:07 p	11:30 p	9,348	143	3,922
LD132	SHIN SAPPORO MARU	22/10/2013	06:58 a	09:18 a	8,889	140	3,810
LD176	SHIN SAPPORO MARU	22/10/2013	10:57 a	01:19 p	9,507	142	4,017
LD256	SHIN SAPPORO MARU	22/10/2013	04:14 p	06:27 p	8,730	133	3,938
LD370	SHIN SAPPORO MARU	23/10/2013	03:54 a	06:49 a	9,604	175	3,293
LD146	SHIN SAPPORO MARU	23/10/2013	10:31 a	01:13 p	9,127	162	3,381
LD120	SHIN SAPPORO MARU	24/10/2013	04:12 a	06:40 a	9,336	148	3,785
LD158	SHIN SAPPORO MARU	24/10/2013	07:53 a	10:20 a	9,422	147	3,846
LD226	SHIN SAPPORO MARU	24/10/2013	02:16 p	04:29 p	8,881	133	4,006
LD154	MAIZURU KICHIJO	27/10/2013	07:07 a	09:45 a	9,511	158	3,612
LD342	GLOBAL GALAXY	27/10/2013	11:39 p	02:55 a	9,302	196	2,848
LD142	MAIZURU KICHIJO	28/10/2013	06:45 a	09:09 a	8,927	144	3,720
LD274	YUYO	30/10/2013	06:29 p	09:21 p	8,787	172	3,065
LD240	YUYO	31/10/2013	05:02 p	07:25 p	8,902	143	3,735
LD256	SAPPHIRE	2/11/2013	04:35 p	07:36 p	8,982	181	2,978
LD332	SAPPHIRE	2/11/2013	10:07 p	12:24 a	8,771	137	3,841
LD162	SAPPHIRE	3/11/2013	09:48 a	12:11 p	8,630	143	3,621
LD270	SAPPHIRE	3/11/2013	05:55 p	08:19 p	9,638	144	4,016
LD144	SAPPHIRE	4/11/2013	06:46 a	09:16 a	9,536	150	3,814
LD262	SAPPHIRE	4/11/2013	07:07 p	09:44 p	9,092	157	3,475
LD144	SAPPHIRE	5/11/2013	08:08 a	10:27 a	8,975	139	3,874
LD170	SAPPHIRE	6/11/2013	09:09 a	11:27 a	9,197	138	3,999
LD242	ENERGY PRIMAVERA	6/11/2013	02:34 p	04:53 p	9,363	139	4,042
LD142	ENERGY PRIMAVERA	7/11/2013	06:25 a	09:15 a	8,751	170	3,088
LD304	GLORY ACE	11/11/2013	08:29 p	11:12 p	9,306	163	3,426
LD378	CHINA STEEL EXPRESS	13/11/2013	03:32 a	05:49 a	9,175	137	4,018
LD134	CHINA STEEL EXPRESS	13/11/2013	07:48 a	10:27 a	9,176	159	3,463
LD326	SPRING PRIDE	13/11/2013	08:55 p	11:26 p	9,712	151	3,859
LD212	SPRING PRIDE	14/11/2013	12:15 p	03:22 p	8,772	187	2,815
LD298	SPRING PRIDE	15/11/2013	06:41 p	09:18 p	9,236	157	3,530
LD344	SPRING PRIDE	15/11/2013	11:05 p	01:24 a	8,787	139	3,793
LD162	SPRING PRIDE	16/11/2013	08:07 a	10:29 a	9,391	142	3,968
LD284	SPRING PRIDE	16/11/2013	05:49 p	08:10 p	9,069	141	3,859
LD198	KUROTAKISAN MARU	22/11/2013	12:00 a	01:00 a	9,264	60	9,264
LD336	KUROTAKISAN MARU	22/11/2013	02:37 a	05:09 a	9,144	152	3,609
LD126	KUROTAKISAN MARU	22/11/2013	07:49 a	10:16 a	9,009	147	3,677
LD258	C. S. SUNSHINE	22/11/2013	06:14 p	09:37 p	8,777	203	2,594
LD126	KAIEN	23/11/2013	05:41 a	08:44 a	9,206	183	3,018
LD250	KAIEN	23/11/2013	03:51 p	06:22 p	8,681	151	3,449
LD320	KAIEN	23/11/2013	09:56 p	12:38 a	9,474	162	3,509
LD386	C. S. SUNSHINE	24/11/2013	04:25 a	06:58 a	9,308	153	3,650
LD164	SAIYO	24/11/2013	11:14 a	01:28 p	8,282	134	3,708
LD226	C. S. SUNSHINE	24/11/2013	02:18 p	04:47 p	9,349	149	3,765
LD162	SAIYO	25/11/2013	08:06 a	10:43 a	9,339	157	3,569
LD232	SAIYO	25/11/2013	02:18 p	04:29 p	8,770	131	4,017
LD154	SAIYO	26/11/2013	12:00 a	01:00 a	9,689	60	9,689
LD206	SAIYO		12:00 a	01:00 a	8,855	60	8,855
LD388	SAIYO	28/11/2013	05:06 a	07:39 a	9,124	153	3,578
LD142	SUIGO	28/11/2013	09:15 a	11:42 a	9,189	147	3,751
LD210	SUIGO	28/11/2013	01:05 p	03:20 p	8,752	135	3,890
LD280	SUIGO	28/11/2013	06:11 p	08:44 p	8,937	153	3,505
LD128	SUIGO	29/11/2013	06:33 a	09:02 a	8,375	149	3,373
LD178	GLOBAL GALAXY	3/12/2013	04:01 p	06:59 p	8,631	178	2,909
LD112	SOYO	4/12/2013	06:11 a	08:38 a	8,620	147	3,518
LD362	SOYO	5/12/2013	12:58 a	03:15 a	8,767	137	3,840
LD338	CORONA INFINITY	10/12/2013	11:39 p	01:53 a	8,915	134	3,992
LD362	CORONA INFINITY	12/12/2013	02:01 a	04:35 a	9,466	154	3,688
LD344	HERMES ISLAND	16/12/2013	12:34 a	02:53 a	9,004	139	3,887
LD360	NORTH FORTUNE III	17/12/2013	03:10 a	05:44 a	9,323	154	3,632
LD142	NORTH FORTUNE III	17/12/2013	08:06 a	10:25 a	8,802	139	3,800
LD282	NORTH FORTUNE III	17/12/2013	08:17 p	10:33 p	8,850	136	3,904
LD546	HERMES ISLAND	18/12/2013	01:11 a	03:39 a	9,600	148	3,892
LD154	CORAL TOPAZ	18/12/2013	07:26 a	09:48 a	9,037	142	3,819
LD304	CORAL TOPAZ	18/12/2013	07:50 p	10:24 p	9,404	154	3,664
LD376	CORAL TOPAZ	19/12/2013	01:48 a	06:59 a	9,522	311	1,837
LD184	CORAL TOPAZ	19/12/2013	11:47 a	02:23 p	9,221	156	3,547
LD232	CORAL TOPAZ	19/12/2013	03:15 p	05:34 p	8,709	139	3,759

Train No	Vessel Name	Arrival Time	Load Start	Load End Time	Qty	Duration (min	Load Rate (T/Hr)
LD338	GREEN POWER	19/12/2013	12:23 a	02:35 a	9,274	132	4,216
LD134	GREEN POWER	20/12/2013	12:00 a	01:00 a	8,902	60	8,902
LD372	CORAL TOPAZ	20/12/2013	03:23 a	05:49 a	9,543	146	3,922
LD192	GREEN POWER	20/12/2013	11:29 a	01:58 p	8,703	149	3,504
LD246	GREEN POWER	20/12/2013	03:37 p	06:47 p	8,836	190	2,790
LD118	GREEN POWER	21/12/2013	04:29 a	06:50 a	9,136	141	3,888
LD176	SOUTHERN WISDOM	21/12/2013	10:01 a	12:11 p	8,355	130	3,856
LD262	GREEN POWER	21/12/2013	05:03 p	07:38 p	9,204	155	3,563
LD322	SOUTHERN WISDOM	21/12/2013	10:30 p	12:44 a	8,482	134	3,798
LD374	SOUTHERN WISDOM	22/12/2013	01:44 a	04:08 a	9,699	144	4,041
LD166	SOUTHERN WISDOM	22/12/2013	10:10 a	12:35 p	8,970	145	3,712
LD258	OHSHU MARU	22/12/2013	04:48 p	07:17 p	9,277	149	3,736
LD128	OHSHU MARU	23/12/2013	05:59 a	08:24 a	8,681	145	3,592
LD304	OHSHU MARU	23/12/2013	08:55 p	11:49 p	9,270	174	3,196
LD174	SHOHAKU	24/12/2013	11:28 a	01:58 p	9,301	150	3,720
LD342	SHOHAKU	26/12/2013	10:48 p	01:09 a	9,340	141	3,974
LD380	SHOHAKU	27/12/2013	03:03 a	05:37 a	8,835	154	3,442
LD228	SHOHAKU	27/12/2013	03:26 p	05:50 p	9,632	144	4,013
LD324	KAIEN	27/12/2013	09:47 p	11:59 p	9,234	132	4,197
LD332	KAIEN	28/12/2013	12:00 a	01:00 a	9,248	60	9,248
LD380	KAIEN	28/12/2013	02:34 a	04:56 a	9,183	142	3,880
LD160	KAIEN	28/12/2013	08:01 a	10:31 a	8,607	150	3,443
LD210	KAIEN	28/12/2013	12:38 p	02:58 p	9,377	140	4,019
LD132	KAIEN	29/12/2013	06:35 a	09:08 a	8,800	153	3,451
LD268	KAIEN	29/12/2013	06:12 p	08:28 p	9,342	136	4,122
LD202	SPRING PRIDE	30/12/2013	11:15 a	01:39 p	9,373	144	3,905
LD298	KAIEN	30/12/2013	08:12 p	10:27 p	8,867	135	3,941

Summary

Number of Trains: 510

Total Nett Weight: 4,565,178.0

Average Nett Weight: 8,951.3

Average Load Rate: 3,914.7

Average Load Duration: 137.2

Total Tonnes Railed

LID10	554,587
LID10.5	394,115
LID11	1,044,867
LID12	596,452
LID12.5	441,063
LID14	530,856
LID22	85,010
LID35	10,718
LID8	115,909
LID9	205,882
LID9.5	585,718

Stockpile (t's) 31/12/2013

LID10	27,291
LID11	9,686
LID12	39,114
LID14	2,970
LID22	8,135
LID35	0
LID8	2,540
LID9	27,780
LID9.5	32,943
LID12.5	0
LID10.5	0

Appendix B

Risk Assessment Review

Appendix B Risk Assessment Review

Key Element (CURA Context/Category)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Treatment plans/tasks (Description)	Task Owner	Due Date	Stage of Completion Percentage% (Projects Only)	Comments
Noise	Mine generated noise that exceeds criteria or results in a complaint	Non-compliance Community complaint Compulsory acquisition Delayed/constrained/no approvals Business interruption Loss of reputation Prosecution Loss of future opportunity	Mobile equipment (mining) Cumulative Impact (other mines) Construction Drilling Washery Climatic Conditions Changed Community expectations Blasting	LCO SD PRO 0014 - Noise Management Procedure LCO SD PLN 0009 - Noise Monitoring Program LCO MIN PLN 0008 - Explosives Management Plan Real time noise monitoring network (alarms) Attended monitoring In pit measures Attenuated equipment Work Permits LCO SD PLN 0001 - TRAINING AND COMPETENCY MANAGEMENT Sound Power testing on the fleet EPL Conditions Blasting/ complaints Hotline Blast Monitoring Community Liaison (CCC, Newsletters, informal) LCO TS PRO 0010 Meterological Assessment, Blast Monitoring and Reporting OCE Inspections	Satisfactory	Community / Reputation	2	C	8	2	Review and adjust real time noise monitoring locations as required.	Ben de Somer	31-Dec-12	100%	Completed and noise management training undertaken with key personnel.
Dust/Air Quality (particulates)	Mine generated dust that exceeds criteria or results in a complaint	Non-compliance Community complaint (visible dust, health, aesthetics) Potential health impacts Compulsory acquisition Delayed/constrained/no approvals Business interruption Cumulative impacts Air Pollution Prosecution Loss of reputation Loss of future opportunity	Mine activities that generate dust Traffic on unsealed roads Exposed areas Ineffective topsoil management Excavation Climatic Conditions Changed Community expectations Blasting	LCO SD FWK 0002 - Environmental Management Strategy MOP Work Permits Complaints hotline Use of water surfactant LCO SD PLN 0001 - TRAINING AND COMPETENCY MANAGEMENT Erosion and Sediment Control Plan Air Quality Monitoring Program (cameras, etc) Topsoil Stripping and Land Clearing Procedure LCO MIN PRO 0001 - Dumping Procedure Hours of blasting LCO MIN PLN 0008 - Explosives Management Plan LCO MIN PLN 0007 - Spontaneous Combustion Management Plan LCO SD PRO 0061 - Monthly Environmental Inspection Procedure Tool box talks - environmental interactions Annual Rehab Plans LCO MIN PRO 0003 - Dust Suppression & Road Watering LCO CHP PRO 0002 - ROM Stockpile Management Procedure Dust Management Inspections LCO SD PRO 0069 - Liddell Dust Management TARP LCO TS PRO 0010 Meterological Assessment, Blast Monitoring and Reporting OCE Inspections Ongoing compliance with EPL 2094 Pollution	Satisfactory	Community / Reputation	2	D	12	2					Completed actions from Coal Mine Particulate Matter Control Best Practice Air Quality Determination. Ongoing compliance with EPL 2094 Pollution Studies and Reduction Programs.
Blasting	Blasting at the mine exceeds criteria or results in a complaint	Community complaints Non-compliance Poor community perception Damage to property Potential health impacts Increased regulator attention Increased media attention Loss of resource	Vibration / Overpressure as a result of blasting Fumes as a result of blasting	LCO MIN PLN 0008 Explosives Management Plan Blast monitoring LCO MIN PRO 0057 Post Blast Fume Procedure LCO SD PLN 0031 Air Quality Management and Monitoring Plan LCO SD EXT 0071 Air Quality Monitoring Program LCO TS PRO 0009 Drill Pattern and Blast Design Community education (CCCs, Newsletters) Blasting/ Complaints hotline Exclusion zones / road closure EPL Conditions LCO MIN PRO 0030 Road Closure LCO MIN FRM 0023 Blasting Checklist LCO TS PRO 0010 Meterological Assessment, Blast Monitoring and Reporting LCO TS PRO 0012 Communication of Blasting Including Sensitive Areas	Satisfactory	Community / Reputation	2	C	8	2	Development of Blast Management Strategy for Chain of Ponds Hotel as part of the DA for the MOD 5 project.	Ben de Somer	01-Nov-13	100%	Completed as a part of the EIS.
Blasting	Damage to heritage listed buildings (CoP)	Poor community perception Increased regulator attention Increased media attention Non compliance with DA	Vibration / Overpressure as a result of blasting	LCO MIN PLN 0008 - Explosives Management Plan Blast Monitoring LCO TS PRO 0009 Drill Pattern and Blast Design LCO MIN FRM 0023 Blasting Checklist LCO TS PRO 0010 Meterological Assessment, Blast Monitoring and Reporting LCO TS PRO 0012 Communication of Blasting Including Sensitive Areas	Satisfactory	Community / Reputation	2	C	8	2					

Key Element (CURA Context/Category)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Treatment plans/tasks (Description)	Task Owner	Due Date	Stage of Completion Percentage% (Projects Only)	Comments
Blasting	Damage to other infrastructure (roads, powerlines, conveyors, railway, fibre optic cable, C&A infrastructure, Newdell Sub Station)	Poor community perception Increased regulator attention Increased media attention Non compliance with DA Loss of reputation with infrastructure owner Loss of power to neighbouring mining activites Potential financial implications	Vibration / Overpressure / fly rock damage as a result of blasting	EPL/DA Conditions LCO MIN PLN 0008 - Explosives Management Plan Blasting, design and loading procedures Complaints hotline LCO TS PRO 0010 Meterological Assessment, Blast Monitoring and Reporting LCO TS PRO 0012 Communication of Blasting Including Sensitive Areas LCO TS PRO 0009 Drill Pattern and Blast Design	Require Improvement	Financial	3	C	13	4	Action in place as per LOM RA				
Spontaneous Combustion	Spon com causing smoke and dust emissions, odour &/or visual impacts	Fire/explosion Non compliance of DA/EPL Increased regulator attention Increased media attention Community Compliant	Gassy underground workings Excavation, transport and emplacement of overburden Handling of hot material	LCO Dust Camera Network Sprays in hopper Sealing of exposed tunnels Spontaneous Combustion Management Plan Water pipelines in close proximity Complaints hotline MOP LCO MIN PRO 0047 - Mining and Handling of Hot Material Soaker line in pit Covering/wetting material Community Liaison OCE Inspections	Satisfactory	Community / Reputation	2	C	8	2					
Lighting	Mine generated light that exceeds criteria or results in a complaint	Loss of Reputation Non-compliance Community Complaint	Poor placement of lighting plant Non compliant fixed lighting	Fit for purpose equipment Operating procedures OCE Inspections Complaints Hotline LCO SD PRO 0020 Lighting Management LCO MIN PRO 0007 Lighting Plants	Satisfactory	Community / Reputation	2	B	5	2					
Flora and Fauna	Breach of legislation	Non-compliance Prosecution	Clearing of land without approval Surface disturbance outside areas that are approved Changes in legislation (EEC) LTA planning of the works Lack of awareness	Ground Disturbance Permit Training and awareness GIS Mapping of flora and fauna LCO SD PLN 0034 - Landscape Management Plan LCO SD PRO 0007 - Land Clearing and Topsoil Stripping	Satisfactory	Legal & Compliance	2	B	5	2					
Water / Erosion & Sediment Control	Pollution of surface or ground water	Community dis-satisfaction Non-compliance & fines Licence Breach Business interruption Soil Erosion Water pollution	Flooding/ significant rainfall LTA design Erosion/sedimentation Pipeline failure Dam failure Tailings spill (dam and/or pipelines) Construction activities LTA monitoring Unauthorised discharge	Site Water Management Plan Erosion and Sediment Control Plan XCN Pipeline Management Standard Tailings Management Strategy Environmental Monitoring Program Monthly Environmental Inspections Water Licences Water Balance Training and awareness Permits EMS MOP Clean water diversions Minimise cleared land Mine Water Discharge Procedure	Satisfactory	Environment	2	C	8	3					
Stakeholders (Community)	Increased community concerns Changes in community expectations Community dis-satisfaction	Community complaints Increased regulator attention Objections to approvals No/constrained approvals Private property access Loss of trust with community Requests for unecessary acquisitions	Increased focus on the industry Other non XCN approvals and activities Poor performance Media attention Lack of understanding in the community Lack of consultation Planning process Modification to DA	CCC SIP Website Newsletters Sponsorship Public notices Permit system Environmental monitoring AEMR Complaints procedure Approvals Environmental Management Strategy	Satisfactory	Community / Reputation	2	B	5	2					
Stakeholders (Government)	Delays in future approvals Increase scrutinity by regulators	No/constrained approval Non-compliance Increased regulator attention Prosecution Changes in policy and legislation	Increased community expectations Poor environmental compliance	XC SD policy Environmental Management Strategy CMO Approvals procedure External audits Internal audits Monthly environmental inspection AEMR Reporting (other) SIP XCN / Liddell existing relationships	Satisfactory	Legal & Compliance	2	B	5	3					
Stakeholders (non Glencore mining, C&A, MacGen, ARTC, Wild Quarries, Telstra, etc)	Negative perception towards the Liddell Coal - impact on reputation Restricted Access Lack of support for DA Modifications/ Lack of cooperation	No/constrained approval Increased regulator attention Increased community concern Loss of trust	Cumulative impacts (percieved or real) LTA performance by non XCN mining (includes others) Different criteria Different approach in community engagement/interactions	Commercial Agreements Environmental Monitoring SIP XCN Sustainable Development Policy	Satisfactory	Community / Reputation	2	B	5	2					

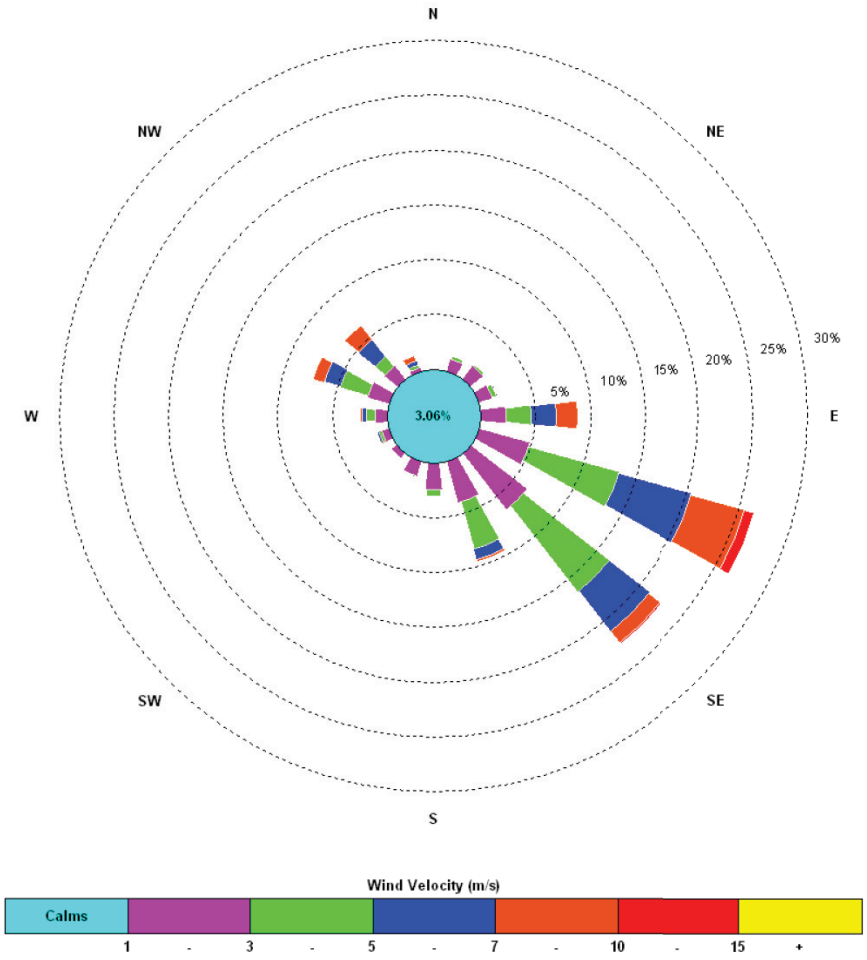
Key Element (CURA Context/Category)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Treatment plans/tasks (Description)	Task Owner	Due Date	Stage of Completion Percentage% (Projects Only)	Comments
Traffic	Increased community concerns about mine related traffic	Breach of road rules Damage to public roads Sediment on public roads Community complaints Traffic accident	Use of public roads for mine access Speeding vehicles Mine use of public roads Equipment to and from the mine (float)	DA (describes use of roads) Road rules Site inductions Signage Education Restrict the number of entrances that are used Washdown Bay Light Vehicle Training Assessment Loading/Unloading Procedure	Satisfactory	Community / Reputation	1	C	4	4					
Aboriginal Cultural Heritage	Damage/destruction of Aboriginal heritage known / unknown sites (prosecution) Delay in mining activities/construction where clearance is required Unauthorised clearance of archaeological site	Damage or loss to items of Aboriginal cultural heritage Objections from Aboriginal community Prosecution / Fines Lack of trust from the Community More onerous conditions in Mgt Plans	LTA planning and awareness for known sites LTA complaince with the work permit requirements LTA procedures with respect to Aboriginal sites	EMS Aboriginal Cultural Heritage Management Plan Consultation with Aboriginal community Section 90 approvals DA/EIS Training and awareness of workforce GIS On-ground barriers Contractor MP Ground Disturbance Permit	Satisfactory	Legal & Compliance	2	C	8	2	Update Aboriginal Cultural Heritage Management Plan	Ben de Somer	31-Dec-14		
Historic (European) Heritage	Damage/destruction of European heritage known / unknown sites (prosecution)	Damage or loss of european heritage. Loss of community trust	LTA planning for known sites LTA complaince with the work permit requirements LTA procedureswith respect to European sites	GIS DA/EIS Work authorisations EMS Contractor MP Ground Disturbance Permit	Satisfactory	Legal & Compliance	2	A	3	2					
Waste Management	Inappropriate waste disposal resulting in a liability for LCO Increased cost associated with waste management Water Pollution Land Contamination	Breach of the EPL requirements Pollution/contamination	LTA training and awareness People bringing waste in from off site Not providing appropriate waste bins/equipment	Training and awareness Waste contract (pre-qualification) Waste Tracking MSDS (ChemAlert) Purchasing, storage and handling procedures. Waste Management Plan Bunded waste storage facility Spill Response Procedure EPL Conditions Weekly inspections by waste contractor	Satisfactory	Legal & Compliance	2	A	3	2					
Hazardous Materials and Dangerous Goods	Contamination and/or pollution Hydrocarbon Spill	Non-compliance Prosecution Requirement to report to EPA Remediation cost Damage to infrastructure/property/ environment/people	Inappropriate storage Spills and Leaks LTA construction of bunded facilities LTA awareness, procedures, competency, equipment	EMS Audits Dedicated storage areas/security keys Dangerous Goods Notifications Bunding Spill management procedure/Environmental spill response/Spill Kits XCN Hydrocarbon Management Standard Monthly Environmental Inspection Training and Awareness Spill Response Procedure Explosive magazine (included in the explosive Mgt Plan) Emergency MP PIRMP	Satisfactory	Environment	2	B	5	3	AS1940 Gap Analysis for CHPP diesel tanks Review containment for bulk grease at MIA CHPP Manager to review diesel storage at CHPP Compliance with AS	NG			
Land & Property Management	Loss of reputation with neighbours and community Degradation of the land	Decreased land value Poor community perception Decreased ecological diversity Security/public safety	LTA property management (includes properties that are rented) The need to acquire land Natural Hazard (flood) Lack of resources to management Limited weed and pest management	LCO SD PLN 0034 - Landscape Management Plan Liddell EMS Rental/lease agreements Firefighting equipment/personnel Contractor Management Plan Mine Inspection System Monthly Environmental Inspections Fit for purpose equipment Permits MOP Emergency Management Plan	Satisfactory	Community / Reputation	2	B	5	2					Include substancial weed and pest management project in the budget.
Land & Property Management	Bushfire	Environmental impact Personal Injury Loss of reputation Damage to Infrastructure/property Loss of assets on the properties owned/managed by XCN Loss of life or injury to personnel or community	Poor bushfire control Vehicle fire Spontaneous combustion Hot surfaces Lightning strink Others working in rail corridor	Permits Mine Inspection System Fit for purpose equipment Spontaneous Combustion Management Plan Landscape Management Plan Emergency Management Plan Bushfire preparedness audit	Satisfactory	Community / Reputation	1	C	4	1					
Climate Change	Legislation changes relating to climate change impacting operations. Community perception is that LCO is not addressing the climate change issue Non-compliance with the abatement requirements in the approval Excessive GHG emissions	Delayed/constrained/no approval Business interruption Non-compliance with EIS predictions/commitments Non-compliance with reporting scheme	Greater than expected gas make Further changes in the legislation relating to CO2 Changes in XC mitigation expectations Excessive use of electricity/power consumption	Energy Saving Action Plan (ESAP) projects National Pollution Inventory EEO Reporting Sustainability database Increased focus on issue when engaging the community Change from method 1 to method 2 emissions calculations National Greenhouse & Energy Reporting Scheme Cost and Budget Tracking Use of Biodiesel	Satisfactory	Community / Reputation	2	B	5	2					
Monitoring and Reporting	LTA monitoring and reporting	Non compliance with the reporting requirements Non-compliance with regulatory requirements Difficulty in demonstrating compliance when comparing to baseline.	LTA review of the monitoring results and monitoring locations LTA resourcing Increased internal and external monitoring and reporting requirements Failure to report Inappropriate limits	Environmental Monitoring Program Consultants EMD CMO Website reporting AEMR Annual Return (EPL) Monthly Environmental Inspections Newsletters	Satisfactory	Legal & Compliance	2	C	8	3					

Key Element (CURA Context/Category)	Risk Description - Something happens.....	Consequence - resulting in:	Causes - Caused by	Existing Control Description	Risk Control Effectiveness	Consequence Category	Expected Risk Consequence	Risk Likelihood	Current Risk Rating	Potential Maximum Consequence	Treatment plans/tasks (Description)	Task Owner	Due Date	Stage of Completion Percentage% (Projects Only)	Comments
Rehabilitation & Mine Closure	Poor Community and regulator perception towards rehabilitation and final landuse Rehabilitation closure criteria agreement with stakeholders not achieved	Decreased land value Poor community perception Decreased ecological diversity Failed lease relinquishment Ongoing liabilities Reduced land capacity/capability Unstable landform Poor drainage Delayed sign-off on rehabilitation Degradation of rehabilitated lands Cost implications to reach mine closure criteria	Not achieving rehabilitation targets LTA rehabilitation strategy integrated into the mine plan LTA landform design Mine plan change Insufficient accrual for mine closure Poor quality/quantity of rehab results in failure to reach agreement Overgrazing Uncontrolled feral animals Weed infestation	MOP Annual Rehabilitation Plan LCO SD PLN 0034 - Landscape Management Plan Ecological monitoring DA/EIS Flora and Fauna Management Plan Rehabilitation Monitoring Glencore Mine Closure Standard Mine Closure Plan Water Management Plan Monitoring and Management requirements Survey Control	Satisfactory	Legal & Compliance	2	B	5	3					
Approvals (all)	Delay/constrained/no approval Onerous conditions	Increased costs Discontinuity of mining	Changes in legislation Changes in government Governments inability to turn around approvals Poor Site performance Late submission LTA planning LTA engineering Lack of ownership of the approval(s) Poor consultant project management Prolonged public opposition	Planning Project Approvals procedures EMS LOM process SIP CCC Consultation with state government	Satisfactory	Community / Reputation	3	C	13	3					
Visual Impact	Poor community and regulatior perception	Increased complaints Increased scrutinity Increased costs	Increased disturbance by mining Industrialisation of the landscape Inability to complete rehab due to future mining options Poor rehabilitation of ground disturbance Rehabilitation Legacy Emissions Proximity of mine to train/highway	Progressive rehabilitation Tree screening Temporary rehabilitation Visual Bunding Emissions management Visual ammenity commitments in DA Monthly Environmental Inspections	Satisfactory	Community / Reputation	2	B	5	2					

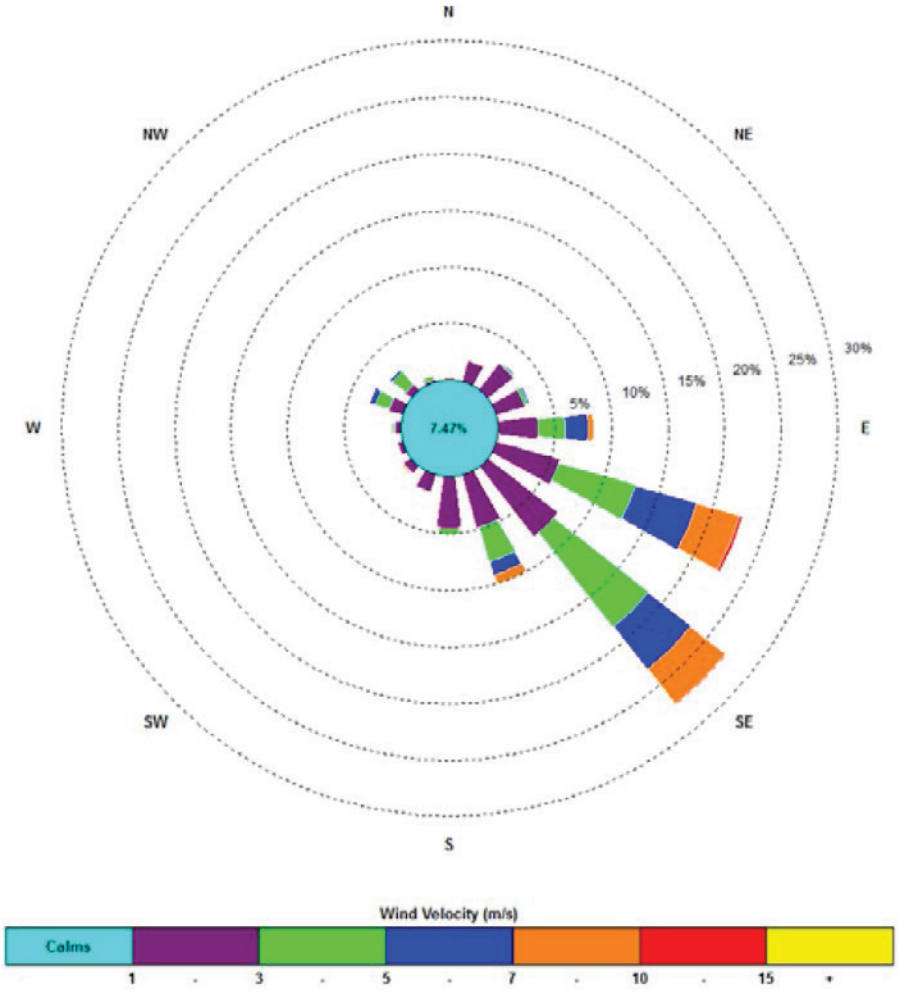
Appendix C

Monthly Windroses

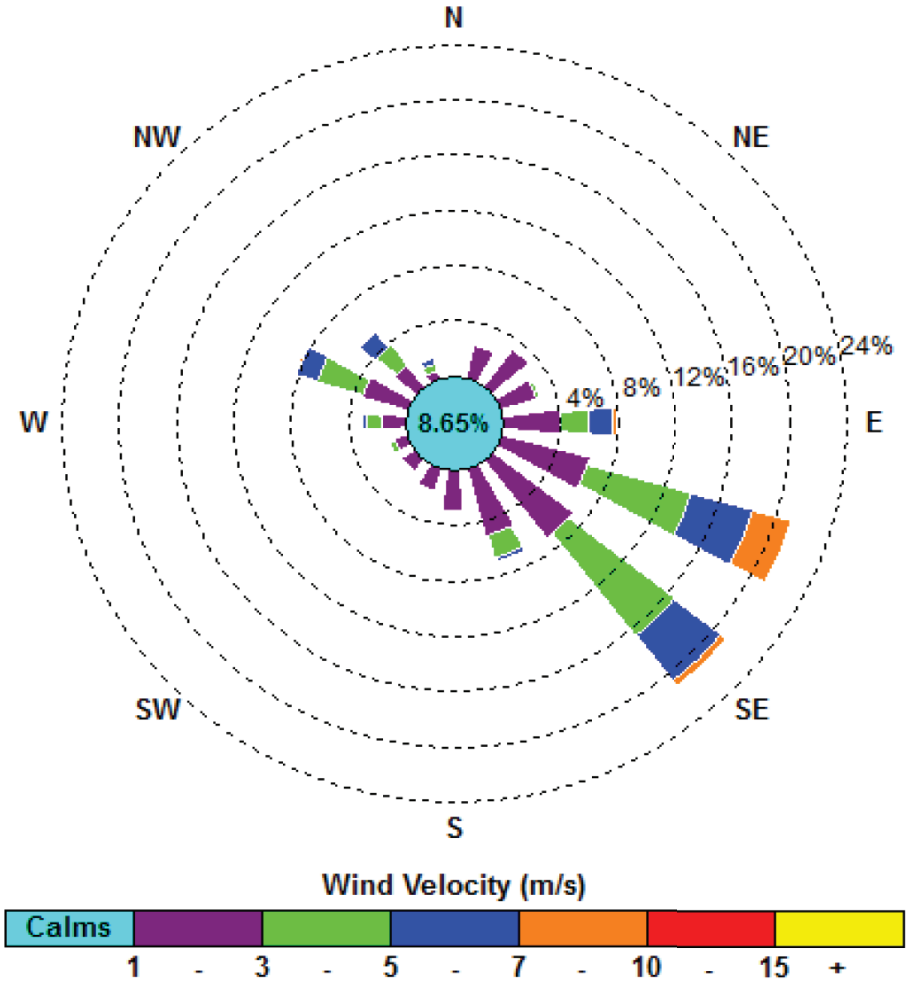
Appendix C Monthly Windroses



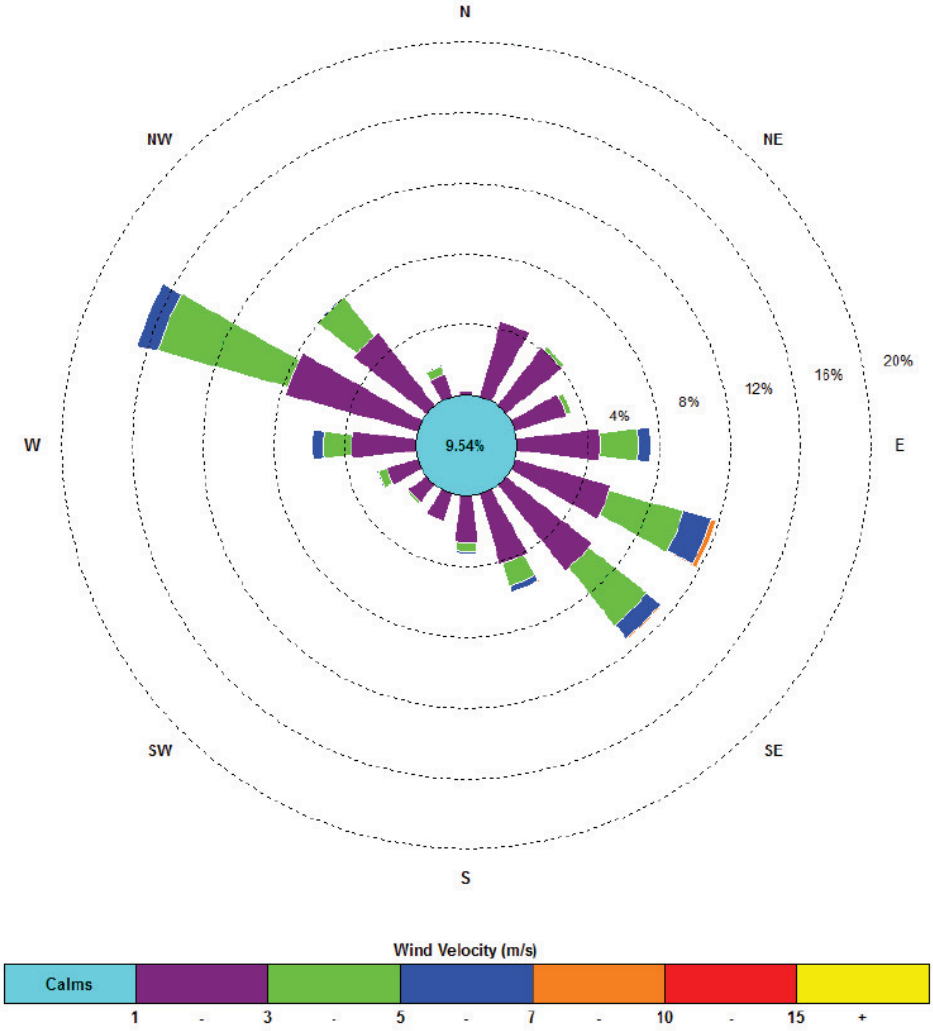
Liddell Coal wind rose – January 2013



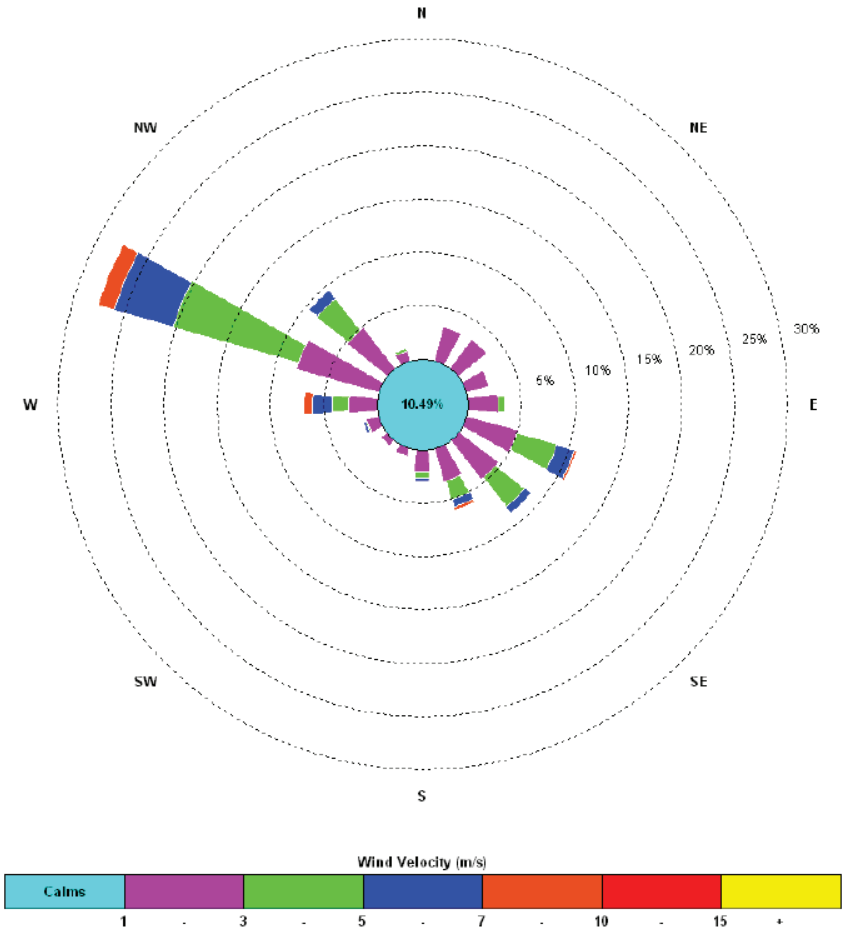
Liddell Coal wind rose – February 2013



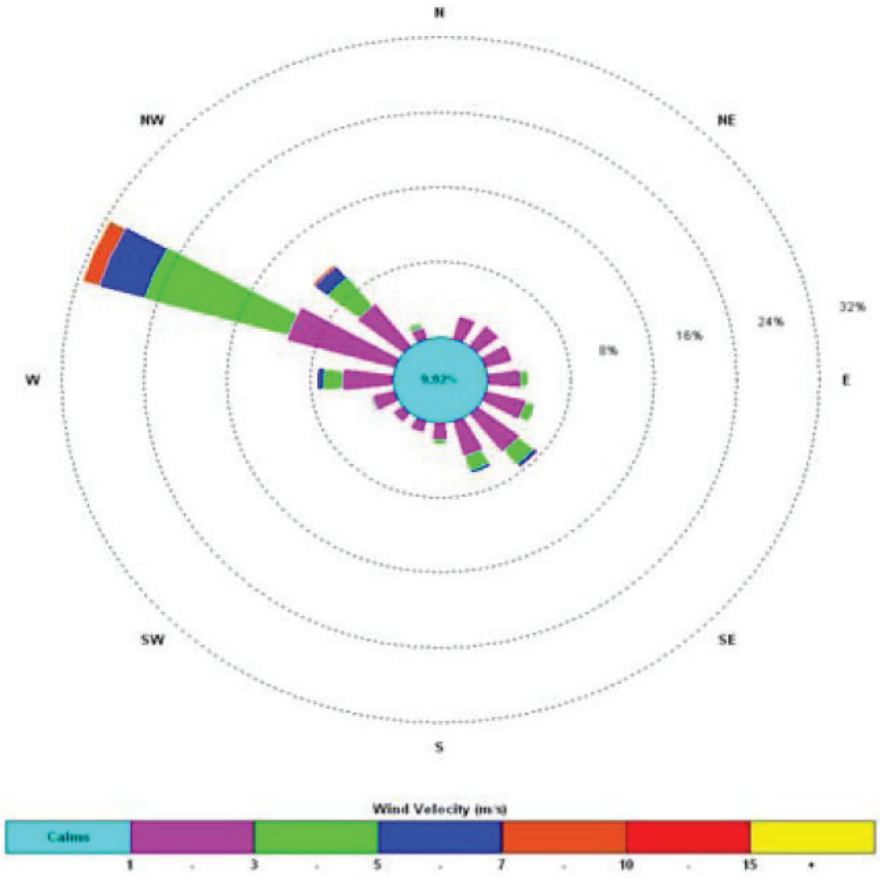
Liddell Coal wind rose – March 2013



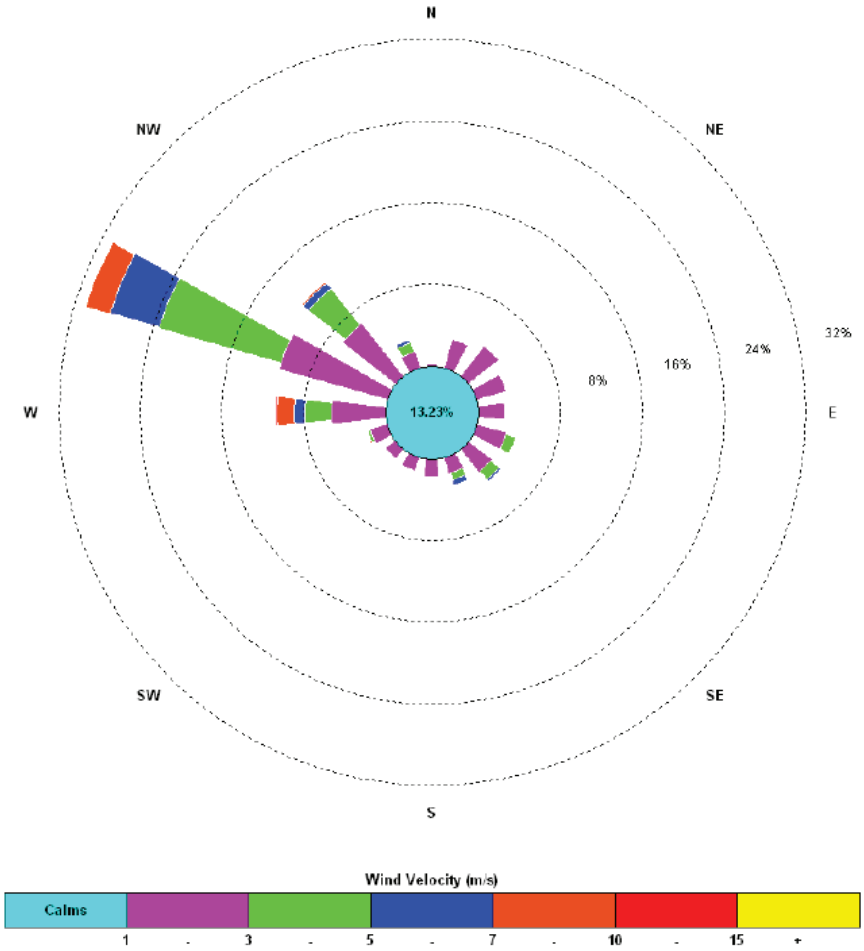
Liddell Coal wind rose – April 2013



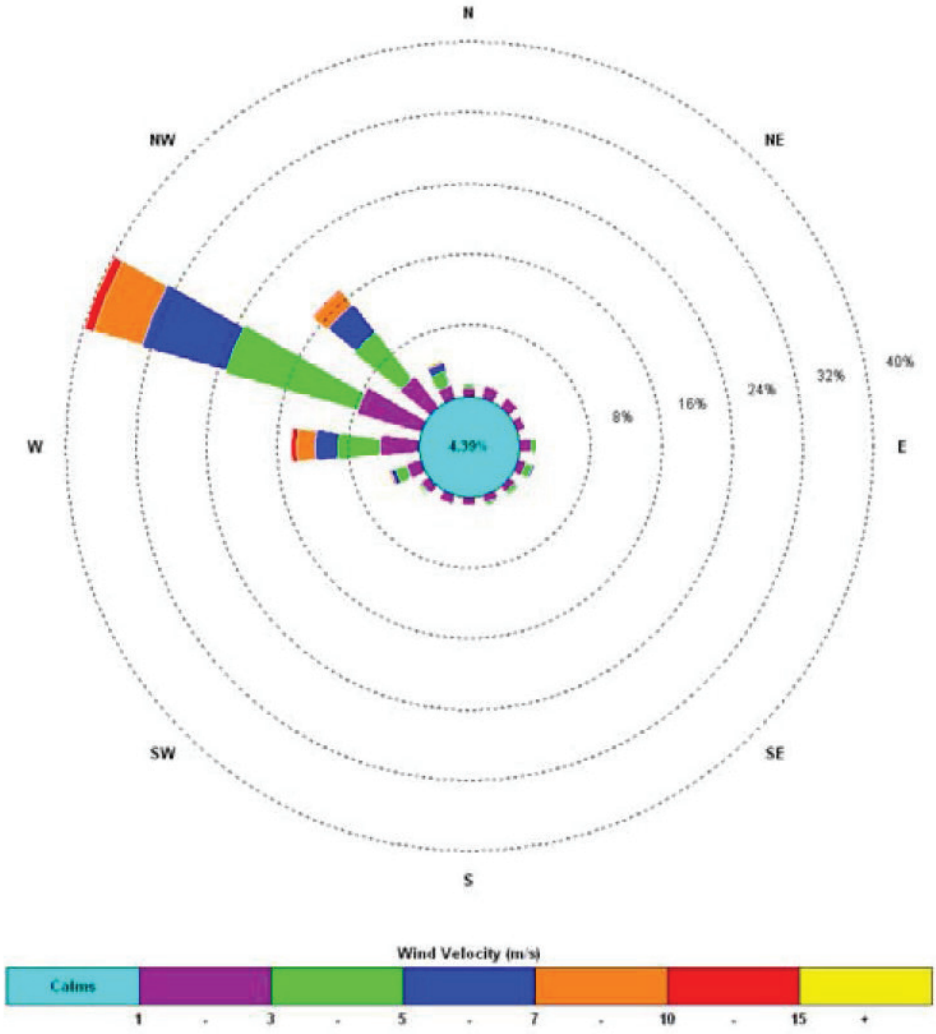
Liddell Coal wind rose – May 2013



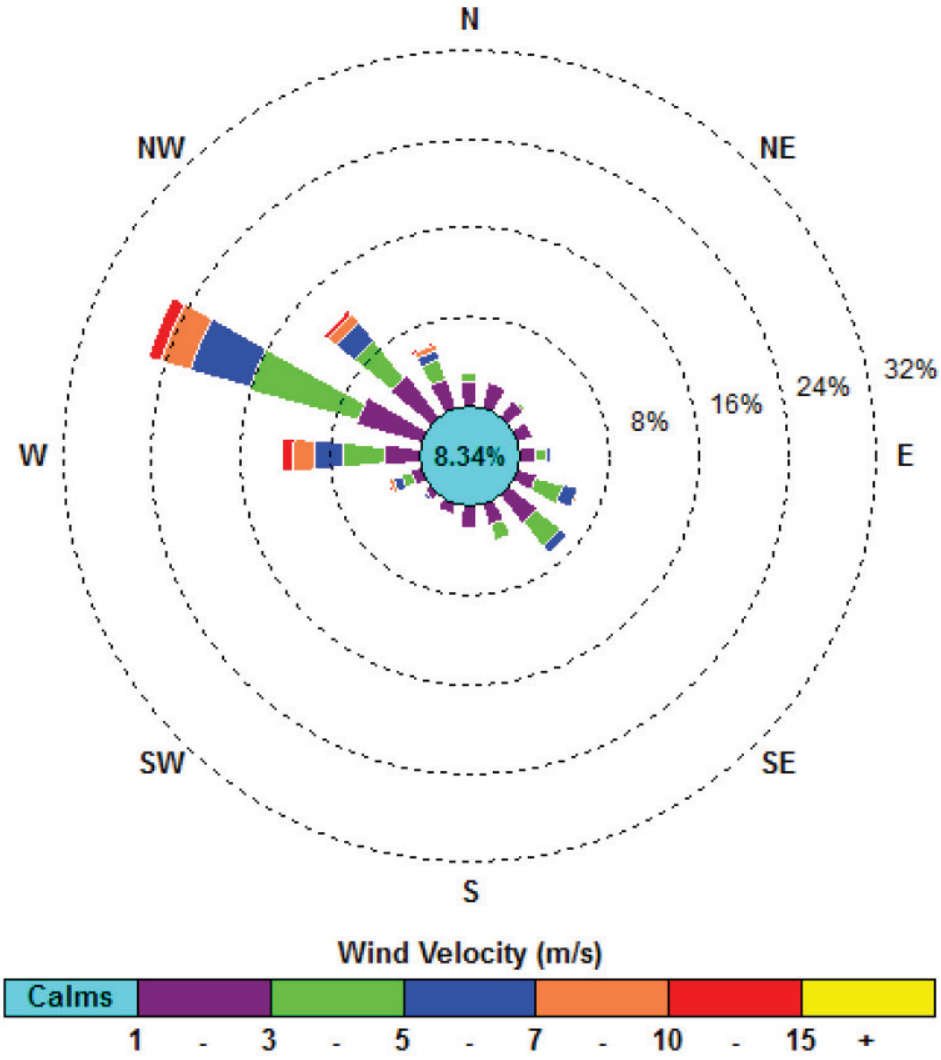
Liddell Coal wind rose – June 2013



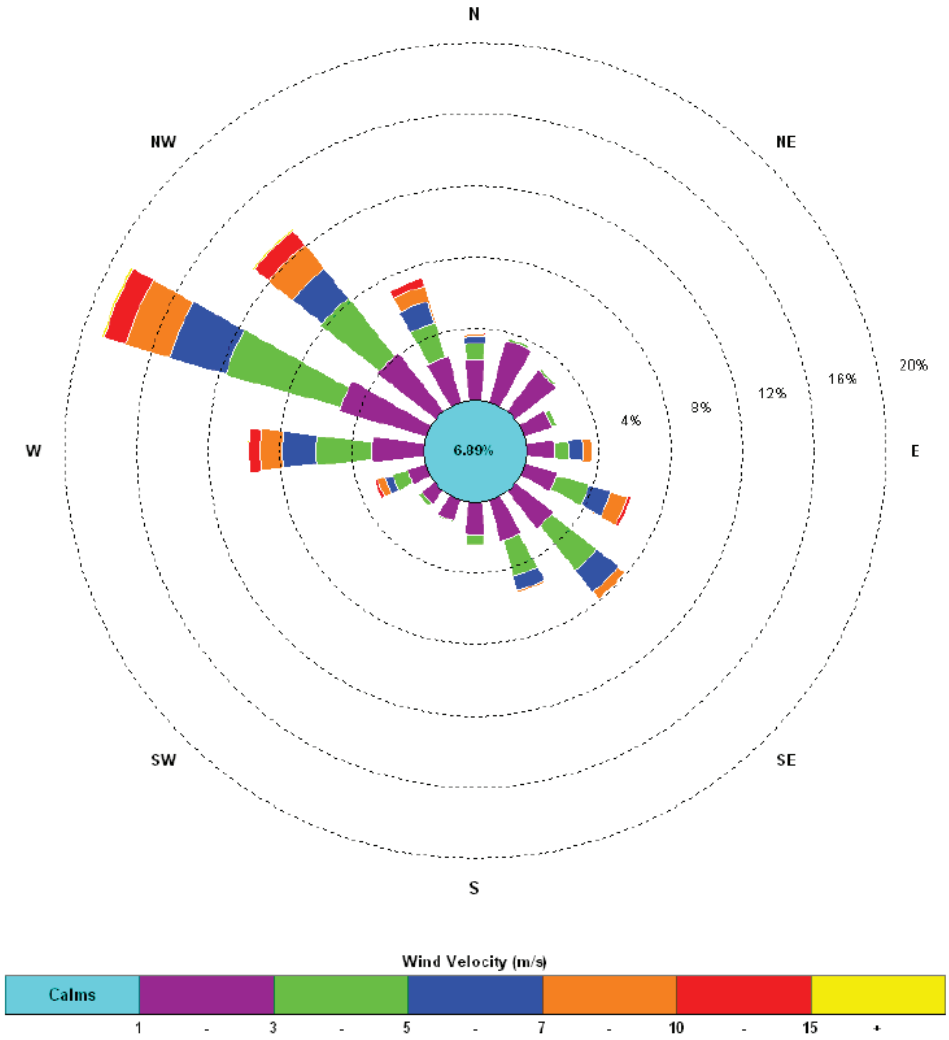
Liddell Coal wind rose – July 2013



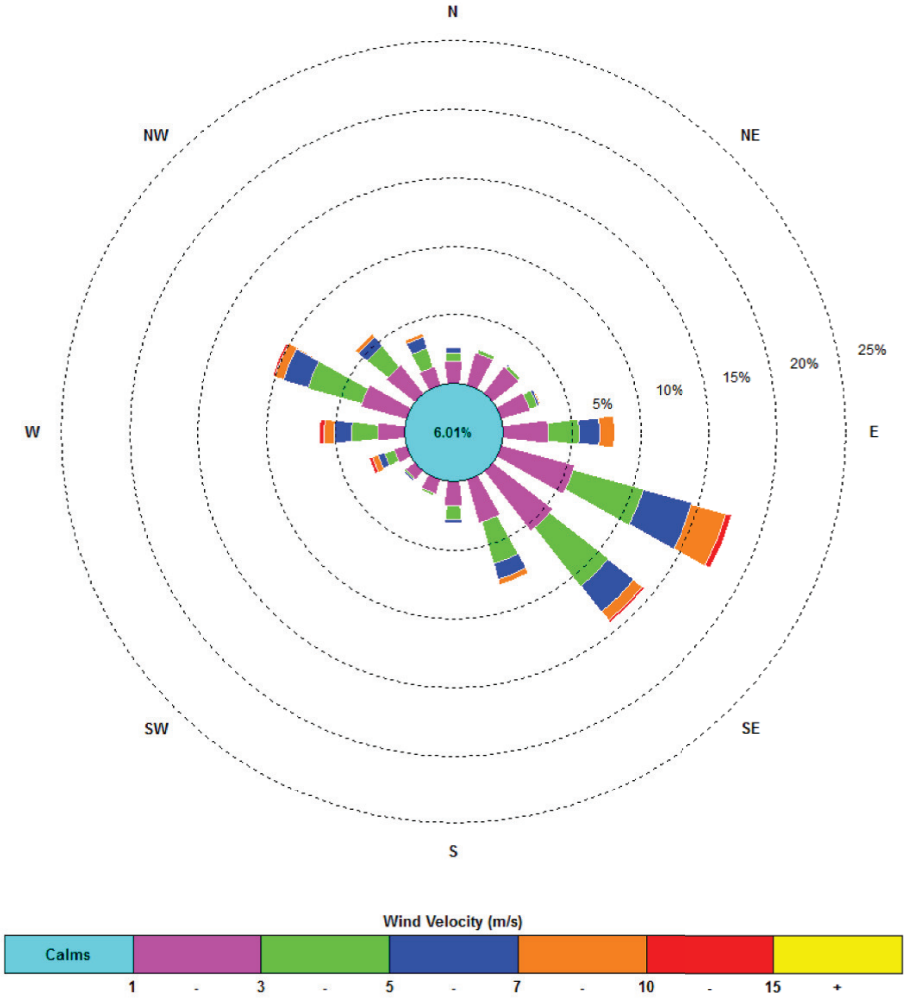
Liddell Coal wind rose – August 2013



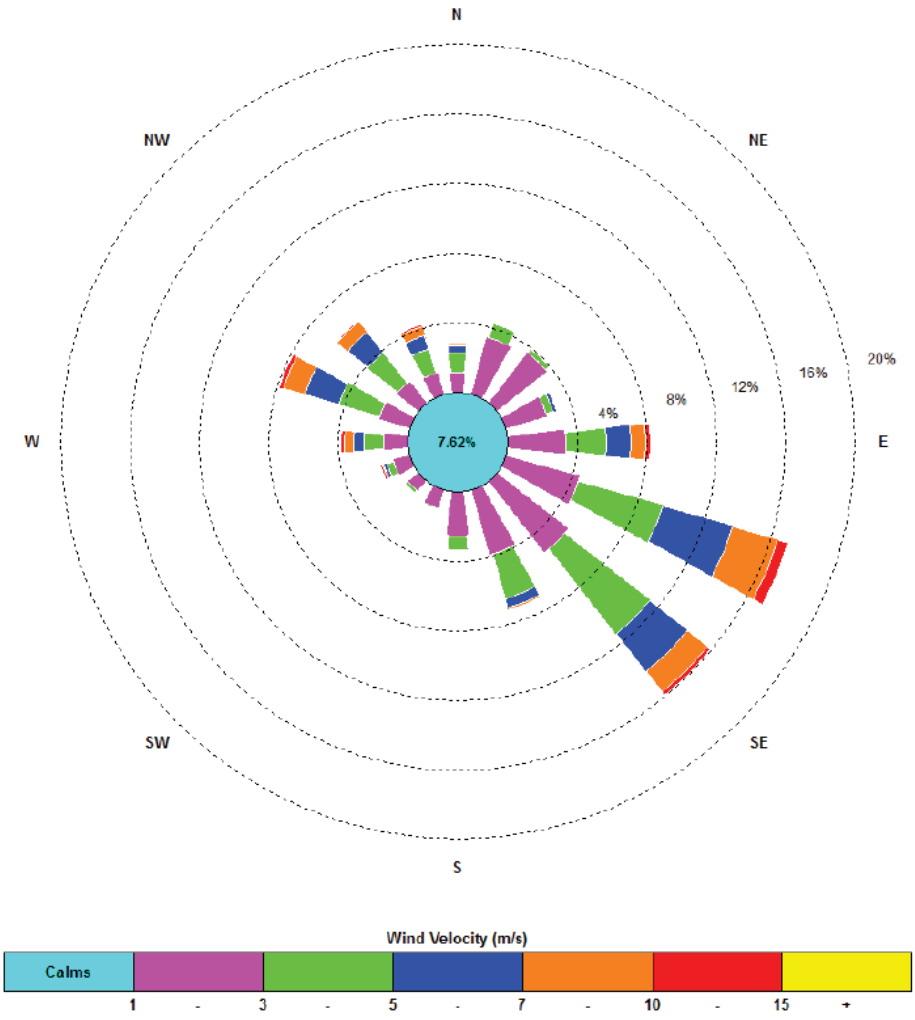
Liddell Coal wind rose – September 2013



Liddell Coal wind rose – October 2013



Liddell Coal wind rose – November 2013



Liddell Coal wind rose – December 2013

Appendix D

Air Quality Monitoring Results

Appendix D Air Quality Monitoring Results

Deposited Dust Results

Month	D53		D54		D55		D56		D57		D58		D59		D60		D61		D62	
	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average	Insoluble Solids	Annual Average
Jan-13	4.9	4.4	5.2	3.6	2	1.5	3.5	1.9	3	5.2	1.6	2.1	1.4	1.6	11.70c	2.5	2.7	4.9	0.9	1.8
Feb-13	7.5	4.7	4.1	3.7	1.3	1.5	1.5	1.8	2.7	5.1	1.7	2.1	2	1.6	7.60c	1.8	4.5	5.1	3.6	1.9
Mar-13	2.4	4.7	3	3.7	0.8	1.5	1.0	1.8	1.3	4.6	0.9	2.1	1	1.6	19.00c	2.0	1.7	5.0	1.6	2.0
Apr-13	6.5	4.8	**4.3**	3.8	10.00c	1.4	1.2	1.7	6.70c	3.5	2.3	2.1	1.4	1.6	**14.70c**	2.0	**7.8**	5.3	**2**	2.0
May-13	5.3	4.9	3.1	3.8	3.2	1.6	1.2	1.7	**12.90c**	3.5	2.5	2.1	0.9	1.7	**16.90c**	2.0	**10.9**	5.7	1.3	2.0
Jun-13	3.1	5.0	1.8	3.9	4.60c	1.7	0.9	1.8	**12.20c**	3.5	0.9	2.1	0.9	1.4	28.60c	2.0	7.9	6.0	1	2.0
Jul-13	4.6	5.0	2.4	4.0	1.8	1.8	0.8	1.8	**8.40c**	3.5	1.2	1.8	0.8	1.4	**21.60c**	2.0	10.5	6.5	1.2	2.0
Aug-13	3.8	5.0	1.8	3.9	3.9	2.2	0.8	1.8	**14.00c**	3.5	**2.8**	1.9	0.7	1.4	**11.00c**	2.0	8	6.6	0.7	1.9
Sep-13	4.1	4.9	2.5	3.8	1.9	2.1	1.2	1.7	**12.10c**	4.0	1.3	1.9	0.9	1.4	**4.00c**	2.6	6.6	6.6	2.8	1.9
Oct-13	4.2	4.8	2	3.4	2.7	2.2	1.5	1.5	10.20c	4.0	**1.5**	1.9	1.4	1.4	1.4	1.4	10.8	7.1	1.3	1.8
Nov-13	4.6	4.6	3.6	3.1	1.8	2.2	1.5	1.4	**6.7**	3.4	1.6	1.7	1.7	1.2	3.8	2.6	9.3	7.3	0.3	1.5
Dec-13	2.5	4.5	2	3.0	**3.5**	2.3	0.9	1.3	8.5	4.4	0.9	1.6	1	1.2	**8.80c**	2.6	3.4	7.0	3.7	1.7

	Total Suspended Particulates						Scrivens/Antienne Assessment Criteria	Ravensworth Farm Assessment Criteria
	Ravensworth Farm		Scrivens		Antienne			
Date	TSP (ug/m^3)	TSP Annual Average	TSP (ug/m^3)	TSP Annual Average	TSP (ug/m^3)	TSP YTD Average	TSP Annual Average Criterion	TSP Annual Average Criterion
3-Jan-13	110	106	66	37	71	51	90	100
9-Jan-13		107	66	38	103	52	90	100
15-Jan-13	81	108	35	38	45	52	90	100
21-Jan-13	52	108	42	39	46	53	90	100
27-Jan-13	18	108	26	38	24	52	90	100
2-Feb-13	28	106	17	38	19	51	90	100
8-Feb-13	122	108	41	38	70	52	90	100
14-Feb-13	31	106	28	38	37	52	90	100
20-Feb-13	47	106	37	38	47	52	90	100
26-Feb-13	38	106	59	39	48	52	90	100
4-Mar-13	28	105	21	38	28	50	90	100
10-Mar-13	35	104	40	37	46	49	90	100
16-Mar-13	65	103	40	37	54	49	90	100
22-Mar-13	130	104	41	37	45	49	90	100
28-Mar-13	100	104	37	38	40	49	90	100
3-Apr-13	51	102	30	38	45	49	90	100
9-Apr-13	47	101	31	38	44	50	90	100
15-Apr-13	140	101	52	39	54	50	90	100
21-Apr-13	57	99	12	38	21	49	90	100
27-Apr-13	155	100	26	39	34	50	90	100
3-May-13	72	101	26	39	86	51	90	100
9-May-13	94	102	29	39	84	52	90	100
15-May-13	151	104	18	39	44	52	90	100
21-May-13	184	104	23	39	43	53	90	100
27-May-13	52	102	19	40	35	53	90	100
2-Jun-13	31	99	6	39	11	53	90	100
8-Jun-13	48	99	8	39	26	53	90	100
14-Jun-13	52	99	3	39	8	53	90	100
20-Jun-13	54	99	35	39	44	53	90	100
26-Jun-13	47	98	16	39	23	53	90	100
2-Jul-13	19	97	15	39	19	52	90	100
8-Jul-13	94	95	17	38	35	53	90	100
14-Jul-13	58	94	20	38	42	52	90	100
20-Jul-13	107	94	14	38	20	52	90	100
26-Jul-13	132	94	18	38	32	52	90	100
1-Aug-13	50	92	17	37	33	52	90	100
7-Aug-13	227	93	18	37	31	52	90	100
13-Aug-13	151	93	16	35	31	51	90	100
19-Aug-13	210	95	18	34	38	50	90	100
25-Aug-13	167	96	21	34	32	50	90	100
31-Aug-13	131	96	40	34	110	51	90	100
6-Sep-13	157	92	39	34	70	51	90	100
12-Sep-13	149	93	53	34	84	52	90	100
18-Sep-13	87	91	4	33	21	51	90	100
24-Sep-13	213	93	101	34		51	90	100
30-Sep-13	111	93	20	34	38	50	90	100
6-Oct-13	238	94	27	33	49	49	90	100
12-Oct-13	91	94	60	33	64	50	90	100
18-Oct-13	110	95	83	34	105	50	90	100
24-Oct-13	250	97	61	33	67	49	90	100
30-Oct-13	51	97	44	33	73	50	90	100
5-Nov-13	86	97	49	33	78	49	90	100
11-Nov-13	41	97	22	33	38	49	90	100
17-Nov-13	46	94	35	32	69	47	90	100
23-Nov-13	49	95	15	32	19	47	90	100
29-Nov-13	65	95	21	32	28	46	90	100
5-Dec-13	115	95	21	31	35	46	90	100
11-Dec-13	170	96	57	31	91	46	90	100
17-Dec-13	51	96	31	31	79	46	90	100
23-Dec-13	288	100	57	31	68	47	90	100
29-Dec-13	142	122	47	34	74	50	90	100

	PM_{10}						Scrivens/Antienne Assessment Criteria		Ravensworth Farm Assessment Criteria	
	Ravensworth Farm		Scrivens		Antienne					
Date	PM_{10} (ug/m^3)	PM_{10} Annual Average	PM_{10} (ug/m^3)	PM_{10} Annual Average	PM_{10} (ug/m^3)	TSP YTD Average	PM_{10} Individual Event Criterion	PM_{10} Annual Average Criterion	PM_{10} Individual Event Criterion	PM_{10} Annual Average Criterion
3-Jan-13	15	29	14	13	15	15	50	30	90	40
9-Jan-13		30	38	14	30	16	50	30	90	40
15-Jan-13	19	30	15	14	15	16	50	30	90	40
21-Jan-13	17	30	15	14	19	16	50	30	90	40
27-Jan-13	8	30	11	14	10	16	50	30	90	40
2-Feb-13	6	29	3	14	5	15	50	30	90	40
8-Feb-13	44	30	18	14	30	16	50	30	90	40
14-Feb-13	9	29	9	14	14	16	50	30	90	40
20-Feb-13	12	29	8	14	12	16	50	30	90	40
26-Feb-13	12	29	9	14	18	16	50	30	90	40
4-Mar-13	14	29	12	14	15	16	50	30	90	40
10-Mar-13	10	29	14	13	18	15	50	30	90	40
16-Mar-13	17	29	12	13	13	15	50	30	90	40
22-Mar-13	40	29	13	13	17	15	50	30	90	40
28-Mar-13	25	29	10	13	13	15	50	30	90	40
3-Apr-13	12	29	9	13	14	15	50	30	90	40
9-Apr-13	10	29	8	13	13	15	50	30	90	40
15-Apr-13	41	29	22	13	25	15	50	30	90	40
21-Apr-13	12	29	5	13	9	15	50	30	90	40
27-Apr-13	37	28	11	13	16	16	50	30	90	40
3-May-13	15	29	9	14	24	16	50	30	90	40
9-May-13	22	29	11	14	20	16	50	30	90	40
15-May-13	35	29	5	14	17	16	50	30	90	40
21-May-13	59	30	6	14	15	16	50	30	90	40
27-May-13	12	29	7	14	14	17	50	30	90	40
2-Jun-13	7	29	2	14	3	16	50	30	90	40
8-Jun-13	9	29	6	14	9	16	50	30	90	40
14-Jun-13	11	29	1	14	2	16	50	30	90	40
20-Jun-13	12	28	8	14	14	17	50	30	90	40
26-Jun-13	13	28	6	14	11	17	50	30	90	40
2-Jul-13	7	28	5	14	9	16	50	30	90	40
8-Jul-13	19	27	5	13	16	17	50	30	90	40
14-Jul-13	14	27	12	13	20	17	50	30	90	40
20-Jul-13	19	27	3	13	4	17	50	30	90	40
26-Jul-13	30	26	7	13	14	17	50	30	90	40
1-Aug-13	7	25	6	13	12	17	50	30	90	40
7-Aug-13	61	25	5	13	12	16	50	30	90	40
13-Aug-13	40	25	3	12	8	16	50	30	90	40
19-Aug-13	95	26	8	12	13	16	50	30	90	40
25-Aug-13	37	26	8	12	11	16	50	30	90	40
31-Aug-13	39	26	11	12	39	16	50	30	90	40
6-Sep-13	51	25	16	11	30	16	50	30	90	40
12-Sep-13	41	25	12	11	22	17	50	30	90	40
18-Sep-13	25	25	3	11	8	16	50	30	90	40
24-Sep-13	93	26	48	11	31	16	50	30	90	40
30-Sep-13	32	26		11	19	16	50	30	90	40
6-Oct-13	84	27	8	11	19	16	50	30	90	40
12-Oct-13	40	27	28	11	31	16	50	30	90	40
18-Oct-13	48	28	38	12	44	17	50	30	90	40
24-Oct-13	99	29	22	12	21	17	50	30	90	40
30-Oct-13	18	29	14	12	21	17	50	30	90	40
5-Nov-13	27	29	18	12	22	17	50	30	90	40
11-Nov-13	8	29	2	12	4	17	50	30	90	40
17-Nov-13	12	28	7	11	14	17	50	30	90	40
23-Nov-13	11	28	5	11	8	16	50	30	90	40
29-Nov-13	17	28	10	11	13	16	50	30	90	40
5-Dec-13	38	28	7	11	12	16	50	30	90	40
11-Dec-13	48	29	20	11	28	16	50	30	90	40
17-Dec-13	15	29	9	11	21	16	50	30	90	40
23-Dec-13	91	30	25	11	26	16	50	30	90	40
29-Dec-13	42	38	25	13	36	19	50	30	90	40

Appendix E

Surface Water Monitoring Results

Appendix E Surface Water Monitoring Results

Bayswater Creek Quarterly Results

Month	BCK 1A				BCK2				BCK2A				BCK3				BCK4				BCK5			
	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-13	8	892	470	8	8.15	4400	2780	<5.00	8	3870	2190	<5.00	Dry				8.3	1060	504	75	8.3	1750	842	38
Apr-13	7.8	691	446	6	8.05	991	626	5	8	929	608	9					8	927	554	48	8	1090	756	33
Jul-13	8	911	469	<5.00	8.26	1030	547	<5.00	8	1040	576	<5.00	8	1080	527	<5.00	8.1	1080	552	<5.00	8.1	1150	632	10
Oct-13	7.6	926	518	5	7.64	3710	2550	<5.00	7.6	1060	618	<5.00	7.6	1160	668	<5.00	8.2	1320	750	16	8.1	2310	1390	<5.00
Average		**855**	**476**	**6**		**2533**	**1626**	**5**		**1725**	**998**	**9**		**1120**	**598**			**1097**	**590**	**46**		**1575**	**905**	**27**

Bayswater Creek Monthly Results

Month	Bayswater Ck Upstream				Bayswater Ck Midstream				Bayswater Ck Downstream			
	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-13	8.4	3710	2110	6	8.4	3710	2060	<5.00				
Feb-13	7.7	3140	1870	6	8.3	4230	2550	5	8.3	4240	2630	6
Mar-13	8	2110	1320	6	8.1	2070	1350	8	8.1	2070	1300	15
Apr-13	7.9	3090	2040	54	8.1	3100	1980	5	Dry			
May-13	7.9	2570	1630	8	8.2	2990	1920	6				
Jun-13	7.7	2690	1650	11	8.1	3410	2060	<5.00				
Jul-13	7.8	2560	1540	8	8.1	2960	1860	<5.00				
Aug-13	7.9	2700	1620	26	8	2950	1810	<5.00				
Sep-13	7.9	2490	1600	14	8.3	2950	1900	<5.00				
Oct-13	7.8	2470	1580	19	8.2	2980	1800	<5.00				
Nov-13	7.6	2450	1570	8	7.8	2430	1500	13				
Dec-13	7.6	2750	16	1600	8.2	3480	11	2000				
Average	**8**	**2728**	**15**	**1678**	**8**	**3105**	**8**	**1899**	**8**	**3155**	**1965**	**11**

Bowmans Creek Monthly Results

Month	BCK1 (Bowmans Creek Upstream)				BCK6 (Bowmans Ck Downstream)			
	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-13	8	892	470	8	7.9	1340	752	5
Feb-13	7.9	806	438	12	7.8	1100	606	9
Mar-13	7.8	351	188	6	7.9	397	238	19
Apr-13	7.8	691	446	6	8	1080	702	7
May-13	8	792	424	<5.00	7.9	1210	678	<5.00
Jun-13	7.9	936	517	<5.00	7.9	1390	775	<5.00
Jul-13	7.9	936	517	<5.00	7.9	1390	775	<5.00
Aug-13	8	911	469	<5.00	8	1080	593	8
Sep-13	7.8	904	522	<5.00	7.8	1420	808	<5.00
Oct-13	7.7	910	524	<5.00	7.7	1490	901	<5.00
Nov-13	7.6	926	518	5	7.7	1560	918	<5.00
Dec-13	7.5	821	515	55	7.4	1550	940	<5.00
Average	**8**	**823**	**462**	**15**	**8**	**1251**	**724**	**10**

Onsite Dams Monthly Results

Month	Dam 1				Dam 4				Dam 6			
	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-13	8.6	1100	548	347	8.9	5650	3240	6	8.5	6370	4020	<5.00
Feb-13	8.8	1090	640	<5.00	8.9	5500	3300	7	8.5	6110	4260	11
Mar-13	8.4	940	550	<5.00	8.8	3750	2280	12	8.1	5530	4230	10
Apr-13	8.3	926	554	<5.00	8.8	4590	2800	8	8.2	5430	3900	10
May-13	8.2	999	583	<5.00	8.8	4780	2990	8	8	6270	4610	16
Jun-13	8.2	1060	595	<5.00	8.9	4960	2900	8	7.5	6240	4320	<5.00
Jul-13	8.4	1070	590	<5.00	8.9	4760	2880	<5.00	7.4	6280	4780	16
Aug-13	8.4	1070	602	<5.00	8.7	4900	2940	14	7.8	6460	4940	8
Sep-13	8.8	1090	640	10	8.8	4840	2900	<5.00	8.1	6290	5010	11
Oct-13	8.8	1180	692	11	8.9	4940	2870	13	7.9	6480	5060	<5.00
Nov-13	8.5	1160	665	6	8.9	2130	1270	351	8.1	1450	911	129
Dec-13	8.7	1160	<5.00	612	9	5140	10	2700	8	6480	8	4150
Average	**9**	**1070**	**94**	**606**	**9**	**4662**	**44**	**2756**	**8**	**5783**	**24**	**4183**

Month	Dam 13								Dam 17				Reservoir Tailings Dam			
	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	Total Phosphorus (mg/L)	Total Nitrogen (mg/L)	Total Coliforms (Col/100 mL)	Faecal Coliforms (Col/100 mL)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)	pH	Conductivity (µS/cm)	TDS (mg/L)	TSS (mg/L)
Jan-13	9.5	12400	8150	63	<0.01	3	73080	<17.00	8.7	6210	3930	<5.00	Too low to sample			
Feb-13	8.8	2500	1400	23	0.08	21.4	8960	17.00 est.	8.8	5730	3380	<5.00				
Mar-13	8.4	1350	750	32	<0.02	8	19200	33.00 est.	8.7	5010	3130	9	9	4180	2560	86
Apr-13	9.1	5860	3890	760	0.44	4.5	>48392.00	45.00 est.	8.6	5610	3430	10	No access			
May-13	Sampling Ceased								8.6	6220	3750	11	8.9	7090	4350	21
Jun-13									8.7	6460	3850	<5.00	8.9	6650	4100	12
Jul-13									8.7	6170	3900	<5.00	9	6170	3950	103
Aug-13									8.7	6020	3710	5	8.9	7800	4890	90
Sep-13									8.8	5870	3570	<5.00	Too low to sample			
Oct-13									8.9	5660	3450	10				
Nov-13									8.9	5560	2860	13				
Dec-13									7.7	1400	<5.00	724				
Average	**9**	**5528**	**3548**	**220**	**0**	**9**	**33747**		**9**	**5493**	**10**	**3307**	**9**	**6378**	**3970**	**62**

Appendix F

Groundwater Monitoring Results

Appendix F Groundwater Monitoring Results

Liddell Coal Monthly Groundwater Monitoring Data - January 2013 to December 2013

	ALV1 Large						ALV1 Small						ALV2 Large						ALV2 Small					
Month	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-13	6.97	1.13	4.39	Clear	Nil	Clear	7.63	1.39	3.9	Clear	Nil	Clear	7.2	1.75	4.48	Clear	Nil	Clear	7.7	2.81	3.9	Clear	Nil	Clear
Feb-13	6.78	1.07	3.44	Clear	Nil	Clear	7.72	1.31	2.98	Clear	Nil	Clear	7.15	1.71	4.16	Clear	Nil	clear	7.32	2.71	3.63	clear	Nil	dear
Mar-13	6.89	1.04	3.01	Clear	Nil	Clear	7.67	1.44	2.35	Clear	Nil	Clear	7.18	1.84	4.05	Clear	Nil	clear	7.67	2.76	3.58	clear	nil	dear
Apr-13	7.08	1.03	3.25	Clear	Nil	Clear	7.65	1.38	2.58	Clear	Nil	Clear	7.25	1.73	4.27	Clear	Nil	clear	7.61	2.57	3.78	clear	nil	dear
May-13	7.08	1.04	3.36	Clear	Nil	Clear	7.51	1.31	2.67	Clear	Nil	Clear	7.34	2.23	4.29	Clear	Nil	Clear	7.71	2.67	3.86	clear	nil	dear
Jun-13	6.89	1.08	3.33	Clear	h2s	Clear	7.78	1.34	2.63	Clear	Nil	Clear	7.05	2.66	4.28	clear	nil	clear	7.74	2.83	3.85	clear	nil	dear
Jul-13	7.64	1153	3.33	Clear	Nil	Clear	7.72	1392	2.63	Clear	Nil	Clear	7.40	3150	4.29	Clear	Nil	Clear	7.78	2980	3.82	Clear	Nil	Clear
Aug-13	7.25	1166	3.42	Clear	Nil	Clear	7.58	1198	2.75	Clear	Nil	Clear	7.39	3430	4.32	Clear	Nil	Clear	7.78	3040	3.94	Clear	Nil	Clear
Sep-13	6.86	912	3.65	Orange	Nil	Clear	7.58	1094	3.05	Clear	Nil	Clear	7.13	2430	4.30	Clear	Nil	Clear	7.57	2350	3.89	Clear	Nil	Clear
Oct-13	7.11	1127	3.90	Orange	Nil	Slight	7.87	1352	3.37	Clear	Nil	Clear	7.24	3010	4.32	Clear	Nil	Clear	7.83	2910	4.00	Clear	Nil	Clear
Nov-13	6.98	1140	4.30	Clear	Nil	Slight	7.62	1350	3.81	Clear	Nil	Slight	6.60	3480	4.34	Orange	Nil	Slight	7.50	2850	3.98	Clear	Nil	Slight
Dec-13	7.57	982	3.20	Brown	Nil	Slight	7.76	1169	2.61	Clear	Nil	Clear	7.66	3000	4.14	Brown	Nil	Slight	7.97	2760	3.76	Clear	Nil	Clear

	ALV3 Large						ALV3 Small						ALV4 Large						ALV4 Small					
Month	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-13	7.15	1.00	5.31	Clear	Nil	Clear	7.45	2.19	5.55	Clear	Nil	Clear	7.09	2.44	5.57	Clear	Nil	Clear	7.54	5.33	5.76	Clear	Nil	Clear
Feb-13	7.08	0.95	4.73	Clear	Nil	Clear	7.42	1.57	4.92	clear	Nil	clear	6.85	2.13	4.8	Clear	Nil	Clear	7.91	4.57	5.2	Clear	Nil	Clear
Mar-13	7	0.78	4.68	Clear	Nil	Clear	7.62	2.42	4.87	Clear	Nil	Clear	6.95	2.29	4.71	Brown	Nil	Slight	7.98	4.51	4.8	Clear	Nil	Clear
Apr-13	7.1	0.90	4.86	Clear	Nil	Clear	7.59	2.42	5.07	Clear	Nil	Clear	7.16	2.32	4.67	Clear	Nil	Clear	7.82	4.47	5.22	Clear	Nil	Clear
May-13	7.33	0.96	4.85	Clear	Nil	clear	7.51	2.32	5.04	clear	nil	clear	7.17	2.16	4.93	Clear	nil	Clear	7.45	6.43	5.33	clear	nil	dear
Jun-13	6.96	0.99	4.81	clear	nil	clear	7.61	2.56	5	clear	nil	clear	6.79	2.22	4.87	Brown	nil	slight	7.61	4.78	5.29	Clear	Yes	dear
Jul-13	7.47	1131	5.00	Clear	Nil	Clear	7.62	2700	5.00	Clear	Nil	Clear	7.19	2269	4.87	Clear	Nil	Clear	7.33	5320	5.29	Clear	Yes	Clear
Aug-13	7.44	1170	4.85	Clear	Nil	Clear	7.57	2730	5.07	Clear	Nil	Clear	7.24	2196	4.99	Clear	Nil	Clear	7.35	5470	5.41	Clear	Yes	Clear
Sep-13	7.05	907	4.90	Clear	Nil	Clear	7.53	2126	5.13	Clear	Nil	Clear	6.70	1644	5.09	Clear	Nil	Slight	7.35	4240	5.45	Clear	Yes	Clear
Oct-13	7.12	1121	4.98	Clear	Nil	Clear	7.58	2820	5.23	Clear	Nil	Clear	6.75	1958	5.30	Clear	Nil	Clear	7.41	5110	5.63	Clear	Yes	Clear
Nov-13	7.03	1146	5.23	Clear	Nil	Clear	7.49	4340	5.49	Clear	Nil	Slight	6.71	1957	5.49	Orange	Nil	Slight	7.32	5190	5.63	Clear	Yes	Clear
Dec-13	7.54	934	4.67	Clear	Nil	Clear	7.57	1934	4.85	Clear	Nil	Clear	7.46	1585	4.87	Brown	Nil	Slight	7.57	4920	4.99	Clear	Nil	Clear

	PGW5 Large (Overburden)						PGW5 Small (Pikes Gully Seam)						ALV7 Large						ALV7 Small					
Month	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-13	7.55	5.23	10.79	10.79	Clear	Nil	No Sample	N/A	10.31	N/A	N/A	N/A	7.2	1.66	6.55	Clear	Nil	Slight	7.26	2.28	9.1	Clear	Nil	Clear
Feb-13	7.46	4.89	9.69	9.69	clear	Nil	No Sample	N/A	9.79	N/A	N/A	N/A	6.77	1.48	6.35	clear	Nil	Slight	7.15	2.12	8.47	Clear	Nil	dear
Mar-13	7.54	4.79	7.72	7.72	Clear	Nil	7.28	5.56	8.49	Brown	Nil	Slight	7.15	1.36	5.88	Brown	Nil	Slight	7.21	2.12	7.81	Clear	Nil	Clear
Apr-13	7.55	4.50	9.34	9.34	Clear	Nil	No Sample	N/A	9.37	N/A	N/A	N/A	7.2	1.46	6.14	Clear	Nil	Slight	7.28	2.14	8.27	Clear	Nil	Slight
May-13	7.5	6.06	9.12	9.12	clear	nil	No Sample	N/A	9.1	N/A	N/A	N/A	7.1	1.37	6.24	Brown	nil	slight	7.21	2.10	8.39	Clear	H2S	Clear
Jun-13	7.49	4.97	8.98	8.95	clear	nil	7.17	5.79	9.07	clear	h2s	clear	7.1	1.51	6.32	Brown	nil	slight	7.31	2.21	8.44	clear	h2s	dear
Jul-13	7.61	5320	8.54	Clear	Nil	Clear	7.28	6160	8.94	Brown	Nil	Slight	7.14	1584	6.37	Brown	Nil	Slight	7.23	2330	8.55	Clear	Yes	Clear
Aug-13	7.59	5450	8.82	Clear	Nil	Clear	7.27	6280	9.25	Clear	Nil	Slight	7.18	1611	6.42	Brown	Nil	Slight	7.27	2369	8.65	Clear	Yes	Clear
Sep-13	7.52	4180	8.89	Clear	Nil	Clear	7.19	4880	9.18	Brown	Nil	Slight	7.01	1263	6.44	Clear	Nil	Clear	7.17	1839	8.72	Clear	Yes	Clear
Oct-13	7.63	5090	9.47	Clear	Nil	Clear	7.27	5740	9.53	Clear	Yes	Slight	7.16	1540	6.46	Clear	Nil	Clear	7.28	2231	8.74	Clear	Yes	Clear
Nov-13	7.56	5170	9.33	Clear	Nil	Clear	7.14	5840	9.58	Clear	Yes	Slight	7.28	1579	6.52	Clear	Nil	Clear	7.32	2259	9.09	Clear	Yes	Slight
Dec-13	7.86	4910	8.54	Clear	Nil	Clear	7.45	5690	9.04	Grey	Yes	Slight	7.26	1365	6.25	Brown	Nil	Slight	7.36	2055	8.57	Clear	Yes	Clear

	ALV8 Large						ALV8 Small						LBH (Alluvium)						LC1 (Coal Measures)					
Month	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-13	7.15	0.90	6.86	Clear	Nil	Clear	7.36	1.81	7.84	Clear	Nil	Clear	6.91	1.02	4.38	Clear	Nil	Clear			100+			
Feb-13	6.88	0.93	6.32	clear	Nil	clear	6.87	1.65	7.05	clear	Nil	clear	6.85	0.95	4.75	Clear	Nil	Clear			100+			
Mar-13	6.8	0.73	5.56	Brown	Nil	Slight	7.07	1.55	6.46	Clear	Nil	Clear	6.8	1.03	3.56	Clear	Nil	Clear			100+			
Apr-13	7.45	0.70	5.96	Clear	Nil	Slight	7.31	1.52	6.92	Clear	Nil	Slight	7.07	1.04	3.69	Clear	Nil	clear			100+			
May-13	6.79	0.65	6.55	Brown	nil	Slight	7.02	1.38	6.87	clear	nil	clear	7.3	1.07	3.71	clear	nil	clear			100+			
Jun-13	6.98	0.73	6.09	clear	nil	clear	7.2	1.54	7.08	clear	nil	clear	6.88	1.08	3.69	clear	nil	clear	No Sample Too Deep		100+			
Jul-13	6.80	802	6.11	Clear	Nil	Clear	6.92	1640	7.16	Clear	Yes	Clear	7.54	1133	3.70	Clear	Nil	Clear			100+			
Aug-13	6.87	903	6.16	Clear	Nil	Clear	6.97	1681	7.27	Clear	Yes	Clear	7.61	1165	3.98	Clear	Nil	Clear			100+			
Sep-13	6.96	692	6.17	Clear	Nil	Clear	7.13	1319	7.30	Clear	Yes	Clear	6.91	919	4.09	Clear	Nil	Clear			100+			
Oct-13	7.05	883	6.24	Clear	Nil	Clear	7.42	1639	7.39	Clear	Nil	Clear	6.98	1144	3.99	Clear	Nil	Clear			100+			
Nov-13	7.13	865	6.85	Brown	Nil	Slight	7.35	1637	7.98	Clear	Yes	Clear	6.87	1169	4.23	Clear	Nil	Clear			100+			
Dec-13	6.85	821	6.09	Clear	Nil	Clear	7.18	1425	7.32	Clear	Nil	Clear	7.68	999	3.63	Clear	Nil	Clear			100+			

	Haz 4 (Coal Measures)						Haz 6 (Coal Measures)						Mt Owen 2 (Coal Measures)					
Month	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity	pH	Conductivity (uS.cm-1)	Depth to Water (m)	Colour	Odour	Turbidity
Jan-13							7.84	4.56	29.55	Clear	Nil	Clear			100+			
Feb-13							7.98	5.15	28.24	Clear	H2S	Clear			100+			
Mar-13							8.11	5.02	27.68	Clear	H2S	Clear			100+			
Apr-13	No Sample Pipe Bent						7.86	4.00	27.67	Clear	Nil	Clear			100+			
May-13							7.96	5.78	27.86	clear	H2S	clear			100+			
Jun-13							8.03	4.45	27.98	clear	h2s	clear			100+			
Jul-13			36.99				8.10	5750	28.14	Clear	Yes	Clear	No Sample Too Deep		100+			
Aug-13			37.15				8.07	5590	28.31	Clear	Yes	Clear			100+			
Sep-13			37.27				7.94	3810	28.43	Clear	Nil	Clear			100+			
Oct-13			37.72				8.12	4380	28.86	Clear	Yes	Clear			100+			
Nov-13			38.47				7.66	4630	29.63	Clear	Yes	Slight			100+			
Dec-13			37.22				8.21	5120	28.38	Clear	Nil	Clear			100+			

Liddell Coal - Six Monthly Groundwater Samples (June 2013)

Date Sampled: **14/06/2013**

ANALYSIS DESCRIPTION	UNIT	LOR	ALV 1 - Large	ALV 1 - Small	ALV 2 - Large	ALV2 - Small	ALV 3 - Large	ALV 3 - Small	ALV 4 - Large	ALV 4 - Small	PGW5 - Large	PGW5 - Small	ALV 7 - Large	ALV 7 - Small	ALV8 - Large	ALV 8 - Small	HAZ 4	HAZ 6	LBH	Mt Owen Bore	LC1
pH Value	pH Unit	0.01	6.77	7.74	7.15	7.72	7.11	7.66	6.76	7.57	7.53	7.22	7.14	7.29	7.03	7.26		8.09	6.96		
Electrical Conductivity @ 25°C	µS/cm	1	1100	1360	2690	2840	1020	2550	2270	5110	5070	5920	1540	2250	758	1580		4730	1100		
Total Dissolved Solids @180°C	mg/L	1	580	758	1620	1350	601	1620	1300	2690	3010	3870	889	1100	444	839		2710	580		
Suspended Solids (SS)	mg/L	1	13	17	48	16	26	11	418	106	10	266	306	28	352	53		34	46		
Chloride	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1		
Sulfate	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1		
Hydroxide Alkalinity as CaCO3	mg/L	1	171	222	364	418	178	362	209	562	839	1080	264	355	155	297		622	194		
Carbonate Alkalinity as CaCO3	mg/L	1	171	222	364	418	178	362	209	562	839	1080	264	355	155	297		622	194		
Bicarbonate Alkalinity as CaCO3	mg/L	0.05	22.9	18.5	22.5	12.9	23.5	22.4	27.5	18.7	0.2	27.8	25.3	28	51.5	33.5		16.7	21.8		
Total Alkalinity as CaCO3	mg/L	0.5	90	134	416	109	123	256	186	350	995	884	137	122	83	116		751	133		
Silicon	mg/L	1	157	185	382	526	133	441	512	1100	619	730	252	426	85	267		770	160		
Calcium	mg/L	1	58	49	124	22	45	34	79	68	76	104	75	69	22	52		36	42		
Magnesium	mg/L	1	24	37	72	29	24	39	71	109	138	190	36	60	14	35		65	23		
Sodium	mg/L	1	133	169	344	558	128	512	318	932	989	1050	212	336	109	226		1080	188		
Potassium	mg/L	1	2	3	4	4	2	4	4	10	12	7	2	5	2	4		10	3		
Aluminium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01		0.01	<0.01		
Arsenic	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	0.002	<0.00	0.004	<0.00	0.003	0.001	<0.00	<0.00	<0.00		<0.00	<0.00		
Beryllium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Barium	mg/L	0.001	0.078	0.139	0.123	0.047	0.032	0.1	0.133	0.177	0.046	0.087	0.042	0.078	0.017	0.061	Elbow in pipe	0.077	0.034	Too Deep to Sample	Too Deep to Sample
Cadmium	mg/L	0.0001	<0.0001	<0.00	<0.00	<0.00	<0.00	0.0001	<0.00	<0.00	0.0001	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Caesium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Chromium	mg/L	0.001	<0.001	0.002	<0.00	0.002	<0.00	0.004	<0.00	0.003	0.062	<0.00	0.001	<0.00	<0.00	0.001		<0.00	<0.00		
Cobalt	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Copper	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	0.002	<0.00	0.002	0.001	<0.00	<0.00	0.001		<0.00	<0.00		
Lead	mg/L	0.001	<0.001	<0.00	<0.00	0.002	<0.00	0.005	<0.00	0.006	0.005	<0.00	0.005	<0.00	<0.00	0.002		0.003	<0.00		
Lithium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Manganese	mg/L	0.005	0.009	0.027	0.012	0.053	0.007	0.159	0.011	0.133	0.312	0.013	0.056	<0.00	0.011	0.009		0.006	0.016		
Nickel	mg/L	0.001	0.007	0.047	0.008	0.139	0.006	0.094	0.026	0.168	0.243	0.177	0.007	0.051	0.002	0.019		0.204	0.002		
Rubidium	mg/L	0.001	0.204	0.002	0.001	0.003	<0.00	0.005	0.269	0.174	0.002	0.103	0.146	0.093	<0.00	0.105		0.077	0.006		
Selenium	mg/L	0.001	0.002	0.005	<0.00	0.015	<0.00	0.007	0.004	0.011	0.018	0.01	0.001	0.01	<0.00	0.005		0.014	<0.00		
Strontium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		
Zinc	mg/L	0.001	0.801	4.72	2.68	2.87	0.568	3.06	1.95	6.24	9.33	9.26	0.882	3.43	0.275	1.03		6.68	0.485		
Boron	mg/L	0.05	0.05	0.1	0.08	0.1	0.08	0.11	0.06	0.16	0.1	0.09	0.07	0.07	0.05	0.06		0.13	0.08		
Iron	mg/L	0.05	1.78	<0.05	<0.05	<0.05	<0.05	<0.05	1.8	0.2	<0.05	1.97	<0.05	0.8	<0.05	1.05		0.46	<0.05		
Mercury	mg/L	0.0001	<0.0001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Total Anions	meq/L	0.01	9.72	12.4	26.7	25.5	9.87	25	22.5	49.6	54.9	60.6	15.2	21.6	7.22	15.9		49.8	11.2		
Total Cations	meq/L	0.01	10.7	12.9	27.2	27.9	9.84	27.3	23.7	53.2	58.5	66.7	16	23.1	7.04	15.4		54.4	12.2		
Ionic Balance	%	0.01	4.82	1.85	0.86	4.47	0.16	4.32	2.65	3.49	3.08	4.76	2.37	3.27	1.29	1.53		4.37	4.61		

Liddell Coal - Six Monthly Groundwater Samples (December 2013)

Date Sampled: **17/12/2013**

ANALYSIS DESCRIPTION	UNIT	LOR	ALV 1 - Large	ALV 1 - Small	ALV 2 - Large	ALV2 - Small	ALV 3 - Large	ALV 3 - Small	ALV 4 - Large	ALV 4 - Small	PGW5 - Large	PGW5 - Small	ALV 7 - Large	ALV 7 - Small	ALV8 - Large	ALV 8 - Small	HAZ 4	HAZ 6	LBH	Mt Owen Bore	LC1
pH Value	pH Unit	0.01	7.59	8.03	7.87	8.23	7.69	7.94	7.55	8	8.19	7.9	7.78	7.88	7.65	7.82		8.39	7.58		
Electrical Conductivity @ 25°C	µS/cm	1	1170	1390	3210	2980	1100	2230	1760	5450	5380	6250	1580	2340	969	1640		5540	1180		
Total Dissolved Solids @180°C	mg/L	1	685	753	1730	1450	586	1120	937	2620	3120	3430	823	1140	519	830		3050	614		
Suspended Solids (SS)	mg/L	1	9	11	22	10	<5	18	40	30	6	1060	384	60	35	55		18	13		
Chloride	mg/L	1	154	176	453	546	138	374	287	1120	628	776	217	423	106	237		820	152		
Sulfate	mg/L	0.5	130	165	435	149	117	177	175	286	947	1060	154	110	99	115		770	126		
Hydroxide Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		<1	<1		
Carbonate Alkalinity as CaCO3	mg/L	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1		27	<1		
Bicarbonate Alkalinity as CaCO3	mg/L	1	196	251	480	469	205	353	253	612	952	1160	288	400	189	328		784	219		
Total Alkalinity as CaCO3	mg/L	1	196	251	480	469	205	353	253	612	952	1160	288	400	189	328		810	219		
Silicon	mg/L	0.05	10.5	9.23	10.1	5.82	10.5	12.1	12.8	9.43	610	12.1	11.4	13.7	23.1	14.3		7.81	10.2		
Calcium	mg/L	1	56	45	156	21	45	36	66	78	76	184	72	79	27	51		39	39		
Magnesium	mg/L	1	24	38	91	30	26	45	53	130	146	197	35	63	18	34		72	24		
Sodium	mg/L	1	137	183	430	589	132	376	216	890	972	1000	206	320	140	245		1110	164		
Potassium	mg/L	1	3	4	5	5	3	4	4	11	13	8	3	6	2	5		10	3		
Aluminium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		0.02	<0.01		
Arsenic	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	0.001	<0.00	0.003	0.001	<0.00	<0.00	<0.00		<0.00	<0.00		
Beryllium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Barium	mg/L	0.001	0.088	0.132	0.147	0.053	0.036	0.032	0.096	0.096	0.051	0.085	0.064	0.077	0.028	0.066	Elbow in pipe	0.07	0.041	Too Deep to Sample	Too Deep to Sample
Cadmium	mg/L	0.0001	<0.0001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.000	0.000	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Caesium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Chromium	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Cobalt	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.001	<0.00	0.001	0.005	<0.00	<0.00	<0.00		<0.00	<0.00		
Copper	mg/L	0.001	0.001	0.003	0.002	0.002	0.001	0.002	0.001	0.002	0.056	0.002	0.002	0.001	0.003	0.006		0.001	0.001		
Lead	mg/L	0.001	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Lithium	mg/L	0.001	0.008	0.046	0.023	0.142	0.006	0.049	0.025	0.14	0.254	0.173	0.007	0.051	0.003	0.019		0.246	0.002		
Manganese	mg/L	0.001	0.226	0.013	0.048	0.01	0.002	0.039	0.29	0.21	<0.00	0.09	0.234	0.146	0.003	0.101		0.039	0.002		
Nickel	mg/L	0.001	<0.001	<0.00	<0.00	0.001	<0.00	<0.00	<0.00	0.001	0.006	<0.00	0.006	<0.00	<0.00	0.003		0.003	<0.00		
Rubidium	mg/L	0.001	0.002	0.005	0.002	0.016	<0.00	0.005	0.003	0.01	0.019	0.011	0.001	0.01	<0.00	0.005		0.016	<0.00		
Selenium	mg/L	0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01		<0.01	<0.01		
Strontium	mg/L	0.001	0.906	4.67	3.9	3.13	0.764	3.79	1.67	10.2	10.2	10.3	0.993	3.77	0.421	1.16		8.07	0.58		
Zinc	mg/L	0.005	0.009	0.027	0.015	0.053	0.009	0.027	0.018	0.02	0.331	0.009	0.033	<0.00	0.072	0.171		<0.00	0.01		
Boron	mg/L	0.05	0.06	0.09	0.07	0.11	0.08	0.09	0.06	0.2	0.12	0.09	0.07	0.07	0.05	0.06		0.15	0.09		
Iron	mg/L	0.05	2.01	<0.05	0.08	<0.05	<0.05	0.24	1.14	0.85	<0.05	2.24	<0.05	0.08	<0.05	<0.05		0.18	<0.05		
Mercury	mg/L	0.0001	<0.0001	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00	<0.000	<0.00	<0.00	<0.00	<0.00	<0.00	<0.00		<0.00	<0.00		
Total Anions	meq/L	0.01	11	13.4	31.4	27.9	10.4	21.3	16.8	49.8	56.4	67.1	15.1	22.2	8.83	15.6		55.4	11.3		
Total Cations	meq/L	0.01	10.8	13.4	34.1	29.3	10.2	22	17.2	53.6	58.4	69.1	15.5	23.2	8.97	16.1		56.4	11.1		
Ionic Balance	%	0.01	0.75	0.05	4.08	2.4	1.09	1.52	1.04	3.66	1.68	1.41	1.39	2.15	0.77	1.53		0.91	0.71		

Appendix G

Blast Monitoring Results

Appendix G Blast Monitoring Results

						Chain of Ponds			Burlings			Scrivens		
Date	Time	Event	Location	ID	Source/Trigger	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture
3/1/2013	13:23	LDL127	South Pit	S1503_RL5_270	Dam Wall 13 EWU	1.38	112.40	Yes	0.16	100.30	Yes	0.08	101.6	Yes
3/1/2013	13:25	LDL128	South Pit	S1502_BAR_267C	Dam Wall 13 EWU	1.23	97.70	Yes	0.15	94.40	Yes	0.11	101.5	Yes
7/1/2013	13:28	LDL12A	South Pit	S1603_UPG_278_277_274	Dam Wall 13 EWU	1.02	107.70	Yes	0.05	93.90	Yes	0.06	104.8	Yes
7/1/2013	13:30	LDL12B	South Pit	S1702_LEMC_276	Dam Wall 13 EWU	0.46	103.20	Yes	0.01	104.50	Yes	0.02	90	Yes
10/1/2013	13:10	LDL12I	South Pit	S1602_UPG_273	Dam Wall 13 EWU	0.85	110.30	Yes	0.03	98.30	Yes	0.02	108	Yes
10/1/2013	13:12	LDL12J	South Pit	S1702_LEMD_262_LEMF279	Dam Wall 13 EWU	0.86	109.80	Yes	0.03	114.10	Yes	0.04	101.9	Yes
14/1/2013	13:27	LDL12M	South Pit	S1502_BAR_280	Dam Wall 13 EWU	1.50	112.50	Yes	0.14	107.00	Yes	0.09	99.9	Yes
15/1/2013	16:35	LDL12O	South Pit	S1703_LEMF300A	Dam Wall 13 EWU	0.25	100.80	Yes	0.02	99.70	Yes	0.01	88.2	Yes
18/1/2013	13:18	LDL12Q	South Pit	S1603_UPG_281	Dam Wall 13 EWU	1.61	115.10	Yes	0.06	106.20	Yes	0.06	111.7	Yes
21/1/2013	12:51	LDL12T	South Pit	S1703_LEMF_300B	Dam Wall 13 EWU	0.44	107.00	Yes	0.01	94.00	Yes	0.02	89.5	Yes
23/1/2013	13:22	LDL12V	South Pit	S1501_LIDB_284	Dam Wall 13 EWU	0.27	100.70	Yes	0.03	98.30	Yes	0.02	92.3	Yes
24/1/2013	11:55	LDL12X	South Pit	S1502_BAR_285	Dam Wall 13 EWU	1.50	106.10	Yes	0.08	96.60	Yes	0.08	100.8	Yes
24/01/2013	12:24	LDL12Y	South Pit	S1603_UPG_282	Dam Wall 13 EWU	1.26	106.10	Yes	0.08	90.20	Yes	0.07	89.3	Yes
25/01/2013	13:22	LDL131	South Pit	S1501_LIDB_288	Dam Wall 13 EWU	0.42	100.80	Yes	0.03	92.23	Yes	0.02	90.79	Yes
25/01/2013	13:20	LDL130	South Pit	S1603_UPG_283	Dam Wall 13 EWU	0.63	101.50	Yes	0.02	90.30	Yes	0.02	88	Yes
30/01/2013	13:31	LDL134	South Pit	S1702_LEMF_263	Dam Wall 13 EWU	2.38	113.60	Yes	0.03	93.20	Yes	0.02	97.3	Yes
1/02/2013	12:54	LDL138	South Pit	S1503_RL4_287. 286	Dam Wall 13 EWU	1.83	113.50	Yes	0.11	90.20	Yes	0.09	93.4	Yes
6/02/2013	13:15	LDL13A	South Pit	S1603_UPG_283_273B	Dam Wall 13 EWU	1.31	104.30	Yes	0.04	93.80	Yes	0.04	93.6	Yes
8/02/2013	13:17	LDL13C	South Pit	S1601_MPG_290	Dam Wall 13 EWU	1.80	112.30	Yes	0.10	87.20	Yes	0.05	91.5	Yes
12/02/2013	12:43	LDL13I	South Pit	S1703_LEMD_291	Dam Wall 13 EWU	0.59	106.50	Yes	0.02	97.50	Yes	0.03	94.9	Yes
15/02/2013	13:41	LDL13L	South Pit	S1702_LEMC_293	Dam Wall 13 EWU	0.81	104.30	Yes	0.02	99.20	Yes	0.03	95.1	Yes
15/02/2013	13:43	LDL13M	South Pit	S1503_RL4_298	Dam Wall 13 EWU	0.28	103.80	Yes	0.02	90.20	Yes	0.03	88	Yes
19/02/2013	13:15	LDL13O	South Pit	S1703_LEMD_295	Dam Wall 13 EWU	0.67	115.00	Yes	0.02	92.00	Yes	0.03	99.2	Yes
21/02/2013	14:27	LDL13R	South Pit	S1502_BAR_285_289	Dam Wall 13 EWU	2.19	107.00	Yes	0.12	114.20	Yes	0.1	111.6	Yes
25/02/2013	13:15	LDL13T	South Pit	S1703_LEMD_294	Dam Wall 13 EWU	0.79	112.60	Yes	0.02	94.00	Yes	0.02	96.2	Yes
27/02/2013	12:04	LDL13W	South Pit	S1601_MPG_292/297	Dam Wall 13 EWU	1.61	111.50	Yes	0.12	103.10	Yes	0.06	99.4	Yes
27/02/2013	12:05	LDL13X	South Pit	S1702_LEMC_296	Dam Wall 13 EWU	1.16	114.50	Yes	0.02	85.60	Yes	0.02	92.5	Yes
6/03/2013	12:22	LDL140	South Pit	S1503_LIDB_305	Dam Wall 13 EWU	0.87	104.30	Yes	0.05	88.60	Yes	0.05	93.4	Yes
7/03/2013	13:13	LDL142	South Pit	S1702_LEMC_304	Dam Wall 13 EWU	1.18	107.70	Yes	0.02	85.60	Yes	0.02	92.2	Yes
8/03/2013	13:20	LDL144	Entrance Pit	E03_RL90_303	Dam Wall 13 EWU	1.42	107.50	Yes	0.16	106.30	Yes	0.15	103.7	Yes
12/03/2013	16:18	LDL146	South Pit	S1503_LIDB_306	Dam Wall 13 EWU	1.98	102.60	Yes	0.12	96.70	Yes	0.17	100.4	Yes
14/03/2013	13:21	LDL14B	South Pit	DAM01_LEMF_301/302	Dam Wall 13 EWU	3.71	132.20	Yes	0.08	98.00	Yes	0.05	99.2	Yes
14/03/2013	13:22	LDL14C	South Pit	S1501_LIDB_312	Dam Wall 13 EWU	0.54	92.10	Yes	0.02	82.10	Yes	0.02	92.6	Yes
15/03/2013	13:12	LDL14E	South Pit	S1702_LEMC_308	Dam Wall 13 EWU	1.03	113.20	Yes	0.04	95.00	Yes	0.03	97.1	Yes
15/03/2013	13:13	LDL14F	South Pit	S1501_BAR_299	Dam Wall 13 EWU	1.44	109.50	Yes	0.17	93.40	Yes	0.06	100.6	Yes
20/03/2013	13:19	LDL14L	South Pit	S1703_LEMC_314	Dam Wall 13 EWU	1.41	102.90	Yes	0.06	102.00	Yes	0.04	87.4	Yes
22/03/2013	13:19	LDL14O	South Pit	S1501_BAR_310	Dam Wall 13 EWU	1.91	108.30	Yes	0.13	108.50	Yes	0.07	104.1	Yes
22/03/2013	13:21	LDL14P	South Pit	S1602_MPG_309	Dam Wall 13 EWU	1.45	113.30	Yes	0.04	98.90	Yes	0.03	88.4	Yes
25/03/2013	13:19	LDL14S	South Pit	S1601_ART_313	Dam Wall 13 EWU	2.28	107.20	Yes	0.12	98.30	Yes	0.04	89.4	Yes
25/03/2013	13:20	LDL14T	South Pit	S1702_LEMC_317	Dam Wall 13 EWU	0.16	97.30	Yes	0.01	91.10	Yes	0.01	83.6	Yes
28/03/2013	12:53	LDL14X	South Pit	S1603_MPG_315_318_320	Dam Wall 13 EWU	1.02	108.00	Yes	0.06	101.50	Yes	0.05	110.1	Yes
28/03/2013	13:26	LDL14Y	South Pit	S1503_LIDB_319	Dam Wall 13 EWU	1.79	106.10	Yes	0.19	98.80	Yes	0.16	108.7	Yes
4/04/2013	13:28	LDL154	South Pit	S1501_BAR_322	Dam Wall 13 EWU	3.23	97.40	Yes	0.15	102.40	Yes	0.07	94.9	Yes
5/04/2013	12:38	LDL158	South Pit	S1703_LEMC_323	Dam Wall 13 EWU	1.03	110.80	Yes	0.05	101.50	Yes	0.03	94.8	Yes
8/04/2013	13:23	LDL15A	South Pit	S1503_LIDB_325	Dam Wall 13 EWU	1.12	113.60	Yes	0.08	97.80	Yes	0.05	99.9	Yes
10/04/2013	13:26	LDL15C	South Pit	S1603_MPG_316	Dam Wall 13 EWU	0.72	108.30	Yes	0.03	99.70	Yes	0.03	90.4	Yes
10/04/2013	13:29	LDL15D	South Pit	S1503_LIDB_321	Dam Wall 13 EWU	2.16	107.70	Yes	0.15	90.70	Yes	0.12	88.3	Yes
11/04/2013	13:20	LDL15F	South Pit	S1602_MPG_331_330	Dam Wall 13 EWU	2.21	105.80	Yes	0.05	90.70	Yes	0.04	92	Yes
17/04/2013	13:27	LDL15K	South Pit	DAM01_LEMF_333	Dam Wall 13 EWU	4.60	125.40	Yes	0.08	94.60	Yes	0.05	98.4	Yes
18/04/2013	13:18	LDL15M	South Pit	S1603_MPG_334/336	Dam Wall 13 EWU	1.15	114.10	Yes	0.05	94.20	Yes	0.04	89.5	Yes
19/04/2013	13:22	LDL15O	South Pit	S1503_LIDB_335	Dam Wall 13 EWU	3.35	108.00	Yes	0.15	94.70	Yes	0.12	100.4	Yes
24/04/2013	13:11	LDL15U	South Pit	S1601_ART_332/338	Dam Wall 13 EWU	1.47	90.40	Yes	0.06	86.00	Yes	0.02	92.3	Yes
30/04/2013	12:00	LDL161	South Pit	S1601_MPG_346	Dam Wall 13 EWU	1.72	106.30	Yes	0.08	94.30	Yes	0.03	100.4	Yes
30/04/2013	12:02	LDL162	South Pit	S1602_MPG_347	Dam Wall 13 EWU	1.26	109.10	Yes	0.06	92.60	Yes	0.03	94.9	Yes
2/05/2013	13:21	LDL165	South Pit	S1503_LIDB_348	Dam Wall 13 EWU	1.65	102.20	Yes	0.13	100.20	Yes	0.12	92.6	Yes
6/05/2013	13:16	LDL169	South Pit	S1602_MPG_350	Dam Wall 13 EWU	0.44	107.20	Yes	0.03	100.00	Yes	0.02	99.7	Yes
7/05/2013	13:22	LDL16B	South Pit	S1702_UPG_341	Dam Wall 13 EWU	5.05	108.90	Yes	0.11	93.10	Yes	2.23	95.5	Yes
8/05/2013	13:25	LDL16E	South Pit	Dam03_LEMFG_344/345	Dam Wall 13 EWU	4.67	120.90	Yes	0.13	92.70	Yes	0.07	99.4	Yes

						Chain of Ponds			Burlings			Scrivens		
Date	Time	Event	Location	ID	Source/Trigger	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture
9/05/2013	13:14	LDL16G	South Pit	DAM01_LEMF_342/351	Dam Wall 13 EWU	4.06	111.10	Yes	0.05	90.00	Yes	0.03	93	Yes
16/05/2013	13:39	LDL16M	South Pit	DAM02_LEMF_352	Dam Wall 13 EWU	5.16	117.70	Yes	0.09	89.50	Yes	0.04	100.4	Yes
21/05/2013	13:15	LDL16R	South Pit	S1702_UPG_349	Dam Wall 13 EWU	1.84	111.40	Yes	0.08	91.80	Yes	0.07	108.3	Yes
23/05/2013	13:25	LDL16T	South Pit	DAM02_LEMF_355	Dam Wall 13 EWU	4.73	125.40	Yes	0.09	103.40	Yes	0.05	107.9	Yes
3/06/2013	12:27	LDL17O	South Pit	S1601_ART_356	Dam Wall 13 EWU	2.63	108.50	Yes	0.02	95.90	Yes	0.06	99.4	Yes
7/06/2013	13:33	LDL173	South Pit	DAM01_LEMD_359	Dam Wall 13 EWU	1.98	121.60	Yes	0.04	93.50	Yes	0.02	92.5	Yes
7/06/2013	14:08	LDL174	South Pit	DAM01_LEMC_D_360_361	Dam Wall 13 EWU	0.27	110.50	Yes	0.01	98.30	Yes	0.01	100.1	Yes
14/06/2013	13:18	LDL178	South Pit	S1601_ART_357	Dam Wall 13 EWU	2.62	113.50	Yes	0.15	108.30	Yes	0.05	114.2	Yes
18/06/2013	13:07	LDL17C	South Pit	DAM02_LEMF_362	Dam Wall 13 EWU	3.18	116.90	Yes	0.06	99.10	Yes	0.04	93	Yes
21/06/2013	13:18	LDL17G	South Pit	DAM01_LEMD_364/368	Dam Wall 13 EWU	2.05	115.80	Yes	0.04	92.50	Yes	0.03	98	Yes
27/06/2013	13:14	LDL17M	South Pit	DAM01_LEMC_365/363(missfire)	Dam Wall 13 EWU	1.78	107.30	Yes	0.08	96.50	Yes	0.04	96	Yes
1/07/2013	13:19	LDL17O	South Pit	S1702_MPG_363B	Dam Wall 13 EWU	0.42	98.00	Yes	0.01	82.40	Yes	0.01	90.1	Yes
5/07/2013	12:40	LDL17S	South Pit	S1703_UPG_343	Dam Wall 13 EWU	1.83	123.80	Yes	0.06	112.50	Yes	0.07	106	Yes
5/07/2013	12:42	LDL17T	South Pit	DAM03_LEMD_369	Dam Wall 13 EWU	2.14	113.90	Yes	0.06	113.80	Yes	0.04	110.3	Yes
11/07/2013	13:16	LDL17X	South Pit	DAM02_LEMF_370	Dam Wall 13 EWU	3.25	134.10	Yes	0.06	98.90	Yes	0.05	102.3	Yes
12/07/2013	13:25	LDL17Z	South Pit	S1602_ART_366	Dam Wall 13 EWU	2.39	114.10	Yes	0.10	86.20	Yes	0.07	93	Yes
16/07/2013	13:18	LDL184	South Pit	S1602_ART_372	Dam Wall 13 EWU	2.01	116.10	Yes	0.08	92.70	Yes	0.06	91.4	Yes
19/07/2013	13:22	LDL189	South Pit	DAM01_LEMC_376/375	dlam	2.00	122.10	Yes	0.04	86.40	Yes	0.03	93.5	Yes
23/07/2013	13:21	LDL18H	South Pit	DAM03_LEMF_379	Dam Wall 13 EWU	2.01	115.00	Yes	0.05	106.60	Yes	0.03	97.9	Yes
23/07/2013	13:22	LDL18I	South Pit	S1602_ART_374	Dam Wall 13 EWU	0.67	106.50	Yes	0.05	108.70	Yes	0.02	105.4	Yes
25/07/2013	13:18	LDL18L	South Pit	S1503_BAR_371	Dam Wall 13 EWU	1.88	106.90	Yes	0.14	94.70	Yes	0.12	94	Yes
25/07/2013	13:19	LDL18M	South Pit	S1703_MPG_382	Dam Wall 13 EWU	0.75	102.00	Yes	0.04	86.60	Yes	0.02	89.8	Yes
30/07/2013	13:20	LDL18Q	South Pit	S1503_BAR_377	Dam Wall 13 EWU	1.92	107.70	Yes	0.17	89.70	Yes	0.09	97.6	Yes
31/07/2013	13:13	LDL18T	South Pit	DAM01_LEMD_385	Dam Wall 13 EWU	1.73	110.20	Yes	0.03	101.10	Yes	0.02	93.1	Yes
1/08/2013	13:14	LDL18W	South Pit	S1602_ART_373/380	Dam Wall 13 EWU	2.23	106.10	Yes	0.08	86.20	Yes	0.08	91.5	Yes
8/08/2013	13:20	LDL193	South Pit	S1602_ART_386/383	Dam Wall 13 EWU	2.28	111.60	Yes	0.15	108.60	Yes	0.05	110.9	Yes
14/08/2013	13:18	LDL197	South Pit	DAM01_UPG_378	Dam Wall 13 EWU	3.13	119.80	Yes	0.10	102.40	Yes	0.04	107	Yes
20/08/2013	9:49	LDL19H	South Pit	MPG_392_S1703	Dam Wall 13 EWU	0.87	108.50	Yes	0.05	100.50	Yes	0.03	97	Yes
22/08/2013	13:21	LDL1A3	South Pit	BAR_388_S1503	Dam Wall 13 EWU	1.97	99.80	Yes	0.11	92.00	Yes	0.16	112	Yes
22/08/2013	13:23	LDL1A4	South Pit	LEMB_395_DAM02	Dam Wall 13 EWU	1.08	120.30	Yes	0.02	111.40	Yes	0.01	113.4	Yes
28/08/2013	13:21	LDL1AA	South Pit	S1601_LIDA_396	Dam Wall 13 EWU	2.37	107.20	Yes	0.15	99.50	Yes	0.05	99.3	Yes
28/08/2013	13:23	LDL1AB	South Pit	S1702_MPG_397	Dam Wall 13 EWU	0.97	103.30	Yes	0.03	92.20	Yes	0.02	105.6	Yes
30/08/2013	13:10	LDL1AE	South Pit	DAM03_LEMF_394	Dam Wall 13 EWU	1.55	113.20	Yes	0.05	109.00	Yes	0.03	110.4	Yes
4/09/2013	13:22	LDL1AG	South Pit	LIDA_398_S1601	Dam Wall 13 EWU	3.39	104.50	Yes	0.15	92.40	Yes	0.14	98.8	Yes
6/09/2013	13:15	LDL1AJ	South Pit	mpg_402_s1702	Dam Wall 13 EWU	1.67	107.10	Yes	0.04	97.80	Yes	0.03	98.3	Yes
11/09/2013	13:18	LDL1AL	South Pit	LEMD_400_DAM02	Dam Wall 13 EWU	2.94	121.20	Yes	0.04	101.10	Yes	0.03	100	Yes
12/09/2013	13:21	LDL1AO	South Pit	S1601_LIDB_403	Dam Wall 13 EWU	4.01	104.30	Yes	0.12	99.50	Yes	0.06	102.1	Yes
17/09/2013	13:13	LDL1AR	South Pit	DAM01_UPG_391	Dam Wall 13 EWU	4.08	117.30	Yes	0.09	110.20	Yes	0.05	113	Yes
19/09/2013	13:15	LDL1AU	South Pit	S1503_BAR_389	Dam Wall 13 EWU	2.61	105.70	Yes	0.18	104.90	Yes	0.09	106.9	Yes
23/09/2013	13:20	LDL1AX	South Pit	S1601_LID_403/405	Dam Wall 13 EWU	2.86	106.10	Yes	0.16	109.90	Yes	0.08	102.6	Yes
25/09/2013	13:16	LDL1B2	South Pit	DAM03_LEMD_411	Dam Wall 13 EWU	1.58	127.40	Yes	0.03	93.70	Yes	0.02	98	Yes
27/09/2013	12:56	LDL1B5	South Pit	S1603_ART_406	Dam Wall 13 EWU	2.44	108.40	Yes	0.13	95.50	Yes	0.08	93.7	Yes
2/10/2013	13:24	LDL1B8	South Pit	DAM02_LEMC_413	Dam Wall 13 EWU	1.34	125.70	Yes	0.02	103.80	Yes	0.01	110	Yes
4/10/2013	13:24	LDL1BC	South Pit	S1601_LID_408	Dam Wall 13 EWU	3.51	107.00	Yes	0.19	96.70	Yes	0.18	95	Yes
4/10/2013	13:26	LDL1BD	South Pit	DAM03_LEMD_411B	Dam Wall 13 EWU	0.12	103.20	Yes	0.01	95.30	Yes	0	96.4	Yes
9/10/2013	13:13	LDL1BH	South Pit	DAM02_UPG_412	Dam Wall 13 EWU	8.32	113.90	Yes	0.19	105.70	Yes	0.1	95	Yes
11/10/2013	13:16	LDL1BL	South Pit	LEMD_416_DAM03	Dam Wall 13 EWU	0.13	102.50	Yes	0.01	99.40	Yes	0	109.1	Yes
15/10/2013	13:25	LDL1BO	South Pit	DAM01_MPG_417	Dam Wall 13 EWU	3.01	113.50	Yes	0.11	86.40	Yes	0.04	94.3	Yes
18/10/2013	12:42	LDL1BQ	South Pit	S1703_ART_414	Dam Wall 13 EWU	3.15	107.30	Yes	0.11	103.10	Yes	0.07	107.6	Yes
22/10/2013	16:01	LDL1BT	South Pit	LEMC_422_DAM03	Dam Wall 13 EWU	1.33	111.60	Yes	0.04	87.40	Yes	0.02	82.40	Yes
24/10/2013	10:13	LDL1BV	South Pit	MPG_417B_DAM01	Dam Wall 13 EWU	2.50	117.20	Yes	0.10	110.40	Yes	0.04	111.00	Yes
24/10/2013	10:15	LDL1BW	South Pit	LIDB_424_S1601	Dam Wall 13 EWU	1.37	115.40	Yes	0.07	104.90	Yes	0.04	110.70	Yes
30/10/2013	13:19	LDL1BY	South Pit	UPG_427_DAM02	Dam Wall 13 EWU	4.47	110.60	Yes	0.09	97.80	Yes	0.05	102.00	Yes
6/11/2013	13:18	LDL1C1	South Pit	LID_ART_428_418_421	Dam Wall 13 EWU	2.70	108.00	Yes	0.15	95.80	Yes	0.09	94.60	Yes
7/11/2013	13:28	LDL1C3	South Pit	UPG_427C_DAM02	Dam Wall 13 EWU	2.78	114.60	Yes	0.04	103.80	Yes	0.02	89.20	Yes
8/11/2013	13:15	LDL1C5	South Pit	LID_432_S1601	Dam Wall 13 EWU	1.80	107.20	Yes	0.12	100.70	Yes	0.05	106.60	Yes
14/11/2013	13:24	LDL1C8	South Pit	MPG_425_DAM01	Dam Wall 13 EWU	2.77	116.50	Yes	0.11	100.30	Yes	0.05	90.60	Yes
14/11/2013	13:26	LDL1C9	South Pit	LIDB_433_S1601	Dam Wall 13 EWU	0.54	103.50	Yes	0.03	98.80	Yes	0.01	112.40	Yes
22/11/2013	13:16	LDL1CD	South Pit	MPG_425C_DAM01	Dam Wall 13 EWU	1.39	108.90	Yes	0.04	86.80	Yes	0.02	90.20	Yes
27/11/2013	13:16	LDL1CG	South Pit	ART_423_S1703	Dam Wall 13 EWU	2.47	102.60	Yes	0.08	85.80	Yes	0.04	89.10	Yes
29/11/2013	13:39	LDL1CI	South Pit	LIDB_438_S1601	Dam Wall 13 EWU	1.15	101.20	Yes	0.10	89.30	Yes	0.03	90.00	Yes

						Chain of Ponds			Burlings			Scrivens		
Date	Time	Event	Location	ID	Source/Trigger	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture	Ground Vibration (mm/s)	Over pressure (dBL)	Waveform Capture
4/12/2013	13:25	LDL1CL	South Pit	LID_431_S1601	Dam Wall 13 EWU	3.24	112.30	Yes	0.18	103.00	Yes	0.08	99.40	Yes
6/12/2013	13:24	LDL1CN	South Pit	BAR_436_S1601	Dam Wall 13 EWU	3.10	102.90	Yes	0.32	85.80	Yes	0.07	99.20	Yes
9/12/2013	13:15	LDL1DG	South Pit	MPG_437_DAM02	Dam Wall 13 EWU	3.12	108.40	Yes	0.06	102.00	Yes	0.03	103.10	Yes
11/12/2013	13:17	LDL1DL	South Pit	LID_443_S1602	Dam Wall 13 EWU	2.77	105.80	Yes	0.20	99.90	Yes	0.05	102.20	Yes
11/12/2013	13:15	LDL1DK	South Pit	BAR_444_S1601	Dam Wall 13 EWU	2.28	99.50	Yes	0.11	106.00	Yes	0.04	107.00	Yes
13/12/2013	13:21	LDL1DM	South Pit	MPG_UPG_440_435	Dam Wall 13 EWU	3.97	113.20	Yes	0.09	88.20	Yes	0.05	88.30	Yes
13/12/2013	13:23	LDL1DN	South Pit	PS_439_S1603	Dam Wall 13 EWU	2.19	102.90	Yes	0.12	81.90	Yes	0.07	95.80	Yes
16/12/2013	13:15	LDL1DP	South Pit	RL-18_441_S1602	Dam Wall 13 EWU	1.99	98.80	Yes	0.13	90.60	Yes	0.08	94.50	Yes
17/12/2013	13:15	LDL1DQ	South Pit	MPG_442_DAM02	Dam Wall 13 EWU	4.18	115.50	Yes	0.08	94.20	Yes	0.03	96.90	Yes
23/12/2013	13:19	LDL1DU	South Pit	LID_449_S1603	Dam Wall 13 EWU	0.71	105.00	Yes	0.04	106.00	Yes	0.03	99.50	Yes
23/12/2013	13:22	LDL1DV	South Pit	ART_447_S1702	Dam Wall 13 EWU	4.42	109.20	Yes	0.12	103.50	Yes	0.05	101.00	Yes
24/12/2013	12:09	LDL1DX	South Pit	MPG_450_S1802	Dam Wall 13 EWU	2.12	103.90	Yes	0.03	105.90	Yes	0.03	90.80	Yes
31/12/2013	13:17	LDL1E1	South Pit	MPG_445_S1801	Dam Wall 13 EWU	2.73	104.80	Yes	0.05	86.70	Yes	0.03	88.90	Yes
31/12/2013	13:21	LDL1E2	South Pit	LMF_453_S1803	Dam Wall 13 EWU	0.92	111.70	Yes	0.03	93.20	Yes	0.03	91.50	Yes

Appendix H

Statutory Plans

Appendix H Statutory Plans

E 312 000 E 313 000 E 314 000 E 315 000 E 316 000 E 317 000

N 6 420 000 N 6 419 000 N 6 418 000 N 6 417 000 N 6 416 000 N 6 415 000 N 6 414 000 N 6 413 000

LAKE LIDDELL

ML 1313

ML 1597

ML 1552

CCL 708

CL 708

CC 708

ANTIENE ROAD

ANTIENE EAST AREA

ANTIENE TAILINGS VOID

SMU1

SMU4

DAM 1 DAM 2 DAM 3 DAM 4 DAM 5 DAM 17 DAM 22 DAM 23 DAM 24

COAL PREPARATION PLANT

ADMIN. OFFICE

ROAD/RAIL LOCOMOTIVE AREA

HUNTER VALLEY COAL LOADING FACILITY

LIDDELL WORKSHOP

OPEN CUT ADMINISTRATION OFFICE

N

W E

S

0 250 500 750 1000m

LEGEND

- Liddell Colliery Holding Boundary
- Mining Lease Boundary
- Soil Observation Site
- X26 Soil Profile Site
- Area Stripped January 2013 to December 2013
- Topsoil Removed January 2013 to December 2013

SOIL STRIPPING DEPTHS

- 0 - 10cm Suitable
- 0 - 15cm Suitable
- Nil Suitable
- SMU1 Soil Mapping Unit

Drawn:	J. Dunlop
Date:	25.03.2014
Scale:	1:25,000
Checked:	C. Desmond

LIDDELL OPEN CUT

AEMR
Land Preparation

liddell coal operations

Managed by xstrata coal

Drg No: 09565A

Plan No. Plan 3

N

W E

S

E 312 000 E 313 000 E 314 000 E 315 000 E 316 000 E 317 000

N 6 420 000

N 6 419 000

N 6 418 000

N 6 417 000

N 6 416 000

N 6 415 000

N 6 414 000

N 6 413 000

LAKE

LIDDELL

MOUNTAIN BLOCK AREA

ANTIENE ROAD

DAM 1

DAM 2

DAM 3

DAM 4

DAM 5

DAM 6

DAM 17

DAM 22

DAM 23

DAM 24

ANTIENE EAST AREA

ANTIENE TAILINGS VOID

DURHAM TAILINGS EMPLACEMENT AREA

RESERVOIR AREA

RAILWAY AREA

ENTRANCE BLOCK

SOUTH CUT

2014

COAL PREPARATION PLANT

ADMIN OFFICE

PRODUCT STOCKPILE AREA

ROM

HUNTER VALLEY COAL LOADING FACILITY

GLENNIES CREEK ROAD

LIDDELL WORKSHOP

OPEN CUT ADMINISTRATION OFFICE

ML 1313

ML 1597

ML 1552

CCL 708

CL 708

CC 708

0 250 500 750 1000m

LEGEND

- Liddell Colliery Holding Boundary
- Mining Lease Boundary
- Active Mining Areas
- Unshaped Emplacement Areas
- Shaped Emplacement Areas
- Topsoil Stockpile
- Existing Rehabiltated Areas
- Current Period Rehabiltated Areas
- Steep Slopes (10-18°)
- Steep Slopes (>18°)
- Infrastructure Areas
- Treed Areas
- Proposed Rehabilitation 2014
- Proposed Disturbance 2014

Drawn:	C. Desmond
Date:	27.03.2014
Scale:	1:25,000
Checked:	J. Dunlop

LIDDELL OPEN CUT

AEMR
Mining Activities and Rehabilitation

liddell coal operations

Managed by xstrata coal

Drg No: 09566B

Plan No. Plan 4