



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 010
Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

## APPENDIX F

# UPLAND SWAMP MANAGEMENT PLAN

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

Russell Vale Colliery  
Russell Vale East – Longwalls 6 & 7

UPLAND SWAMP MANAGEMENT PLAN





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## GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	Description
µm	micro metres
µS/cm	micro Siemens per centimetre
Al	Aluminium
ANZECC	Australian and New Zealand Environment and Conservation Council
As	Arsenic
Ba	Barium
BHPBIC	BHP Billiton Illawarra Coal
BMP	Biodiversity Management Plan
Commonwealth Approval	Part 9, EPBC Act approval (EPBC 2014/7259)
Ca	Calcium
Cl	Chloride
Cu	Copper
DoE	Commonwealth Department of the Environment
DO	Dissolved Oxygen
DP&E	Department of Planning & Environment
DRE	NSW Department of Trade and Investment, Regional Infrastructure and Services, Division of Resources and Energy, Industry Co-ordination Unit
EC	Electrical conductivity
EEC	Endangered Ecological Community
EP	Extraction Plan
EP&A Act	<i>Environmental Planning and Assessment Act 1979 (NSW)</i>
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act, 1999 (Commonwealth)</i>
F	Fluorine
Fe	Iron
Ha	hectares
K	Potassium
km	kilometre
LGA	Local Government Area
Li	Lithium
LW	Longwall
m	metre

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Abbreviations	Description
mbgl	metres below ground level
Mg	Magnesium
mm/m	millimetre per metre
Mn	Manganese
Na	Sodium
Ni	Nickel
NOW	NSW Office of Water
NSW	New South Wales
NSW Project Approval	Part3A, EP&A Act Major Project approval MP10_0046 (as modified)
OEH	Office of Environment and Heritage
ORP	Oxygen Reduction Potential
PAC	Planning Assessment Commission
Pb	Lead
pH	A figure expressing the acidity or alkalinity of a solution
PPR	Preferred Project Report
ROM	Run of Mine
SCA	Sydney Catchment Authority
SO <sub>4</sub>	Sulfate
Sr	Strontium
Study Area	400m from the edge of secondary extraction (LWs 4 - 7)
TARP	Trigger Action Response Plan
TSC Act	NSW <i>Threatened Species Conservation Act, 1995</i>
UEP	Underground Expansion Project
USMP	Upland Swamp Management Plan
VWP	Vibrating wire piezometer
WCL	Wollongong Coal Limited
Zn	Zinc



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## 1 INTRODUCTION

### 1.1 Project Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) located in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale, approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

The Russell Vale Colliery operates under NSW Project Approval 10\_0046 granted by the NSW Planning Assessment Commission (PAC) on 13 October 2011. The NSW Project Approval was modified (MOD1) by the PAC in 2012 to allow:

- extraction of coal using longwall mining techniques in the Wongawilli Seam for longwalls 4 and 5 (LW4 and LW5); and
- development of the main gate roads for longwall 6 (LW6).

A second modification (MOD2) to the project approval (MP 10\_0046) was made in 2014 to authorise:

- extraction of coal using longwall mining techniques in the first 365 m of longwall 6; and
- extension of the duration of mining until 31 December 2015.

Prior to this, a third modification (MOD 3) to MP 10\_0046 was approved on 10 October 2014. MOD 3 authorised the continuation of mining operations until 31 December 2014. This modification has effectively been superseded by MOD 2, which allows mining operations to be undertaken until 31 December 2015.

Approval for the extraction of LW6 was granted by the Commonwealth Department of the Environment on the 24 December 2014 (EPBC 2014/7259).

WCL has lodged separate applications (MP 09\_0013 and EPBC 2014/7268) for its Underground Expansion Project (UEP) to facilitate further mining operations at Russell Vale Colliery. In October 2013, WCL lodged a Preferred Project Report (PPR) which proposed significant amendments to the UEP (as originally proposed). The amended UEP would facilitate the continued operation of the colliery for five years and would allow extraction of 4.7 million tonnes of Run of Mine (ROM) coal. The mine plan for the amended UEP consists of 8 longwall panels (including longwalls 6 & 7). The environmental impact assessment for the UEP has been protracted based on the complex environment of the Russell Vale Colliery in proximity to the Cataract Reservoir and sensitive upland swamps, and the high level of community and stakeholder interest in the UEP. It is unlikely that determination of the application will be made before early 2015.

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This Upland Swamp Management Plan (USMP) has been prepared in support of an Extraction Plan, as required by **Condition 7/Schedule 3** and **Condition 29/Schedule 3** of the NSW Project Approval (MP 10\_0046). The USMP also serves as a component of the monitoring program required under **Condition 12** of the Commonwealth Approval.

## 1.2 Purpose and Scope

**Condition 29/Schedule 3** of the NSW Project Approval requires the preparation of a BMP. Given the sensitive nature of upland swamps, this USMP has been prepared as a separate management plan. Management of biodiversity is outlined within the BMP (WCL 2014d).

In addition, this USMP supports the Extraction Plan prepared in accordance with **Condition 7/Schedule 3** of the NSW Project Approval.

This plan coalesces monitoring required under the conditions listed above that are relevant to upland swamps into one management plan. This includes:

- subsidence monitoring in upland swamps;
- monitoring of shallow (colluvial and weathered sandstone) groundwater systems, including water levels and water quality;
- monitoring of outflow from upland swamps; and
- monitoring of ecological features of upland swamps.

The purpose and scope of this USMP is to:

- outline statutory requirements, including any performance measures to be achieved;
- summarise environmental impact assessments undertaken to date and provide baseline data;
- detail the methodology for the upland swamp monitoring program, including baseline monitoring;
- describe measures that will be implemented to ensure compliance with any statutory requirements or performance measures;
- develop specific performance indicators to ensure compliance with the specific performance measures;
- outline an upland swamp monitoring program to assess the environmental impacts of mining and assess effectiveness of any management measures;

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- develop remedial or contingency plans and outline rehabilitation measures to manage any impacts that exceed performance measures; and
- outline reporting structures.

In addition, **Condition 12** of the Commonwealth Approval requires the preparation of a monitoring program. This USMP outlines the swamp monitoring components of the monitoring program.

The study area for this USMP is defined as 400 metres from the edge of secondary extraction for the completed longwall panels (LW4 and LW5) and the proposed longwall panels (LW6 and LW7).

This management plan only covers monitoring relevant to upland swamps, and brings together monitoring from other management plans, including the Subsidence Monitoring Plan (WCL, 2014), Groundwater Management Plan (WCL 2014b) and Stream Management Plan (WCL 2014c). Other biodiversity related monitoring can be found in the Biodiversity Management Plan (WCL 2014d).

### 1.3 Consultation and Distribution

**Condition 29/Schedule 3** of the NSW Project Approval and **Condition 12b** of the Commonwealth Approval require the BMP to be prepared by a suitably qualified ecologist/expert. In accordance with these requirements this BMP has been prepared by Nathan Garvey of Biosis Pty Ltd. Nathan's qualifications include a Bachelor of Science and Graduate Diploma (Biological Science) from the University of New South Wales. Nathan has over ten years experience in ecological consulting, is a Certified Environmental Practitioner (CEnvP) and is an accredited BioBanking assessor. Nathan has prepared numerous management plans for major projects throughout Australia, including the preparation and approval of multiple management plans for the mining industry in the Southern Coalfield.

In accordance with **Condition 29/Schedule 3** of the NSW Project Approval, this USMP has been prepared in consultation with, and copies will be distributed to the:

- Commonwealth Department of the Environment;
- Department of Planning and Environment (DP&E); and
- Office of Environment and Heritage (OEH).

In accordance with **Condition 10/Schedule 5** of the NSW Project Approval and **Condition 12(f)** of the Commonwealth Approval, WCL will make this Plan publicly available on the WCL website and will be responsible for its maintenance. A hard copy will also be kept at the Russell Vale Colliery, 7 Princes Highway, Corrimall, NSW 2518.

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Any revisions undertaken will be the responsibility of WCL and any notifications will be sent accordingly. WCL will not be responsible for maintaining uncontrolled copies, beyond ensuring the most recent version is maintained on WCL's computer system, website, and hard copy at the Russell Vale Colliery, 7 Princes Highway, Corrimal, NSW 2518.

In accordance with **Condition 29/Schedule 3** of the NSW Project Approval, consultation was undertaken as part of the LW4 and LW5 BMP. This USMP includes additional monitoring requirements for LW6 and LW7 and brings together various monitoring requirements for upland swamps. Additional consultation is currently being undertaken with OEH and DoE. Details of consultation are provided in **Table 1** below.

**Table 1 – Project Consultation**

Agency	Consultation
Office of Environment and Heritage	Meeting, 10 November 2014 Provision of this USMP (via DP&E) Development of the Upland Swamp Network Monitoring Plan Provision of LW5 BMP (via DP&E) Provision of LW4 BMP and receipt of comments, 6 April 2012 (via DRE) Meeting, 26 April 2012 Meeting, 12 September 2012 Meeting, 24 October 2012 Meeting, 10 November 2014
Division of Resources and Energy	Provision of this USMP (via DP&E) Development of the Upland Swamp Network Monitoring Plan Provision of LW5 BMP (via DP&E) Provision of LW4 BMP and receipt of comments, 6 April 2012 (via DRE)
Sydney Catchment Authority	Provision of this USMP (via DP&E) Development of the Upland Swamp Network Monitoring Plan Provision of LW5 BMP (via DP&E) Provision of LW4 BMP and receipt of comments, 6 April 2012 (via DRE)
Commonwealth Department of the Environment	Provision of this USMP (via DP&E) Meeting, 8 August 2014 Meeting, 9 May 2014



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## 1.4 Report Structure

The remainder of this USMP is structured as follows:

**Section 2:** Outlines the statutory requirements applicable to the Plan.

**Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.

**Section 4:** Details the performance measures and indicators that will be used to assess the impacts of mining.

**Section 5:** Describes the monitoring program.

**Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.

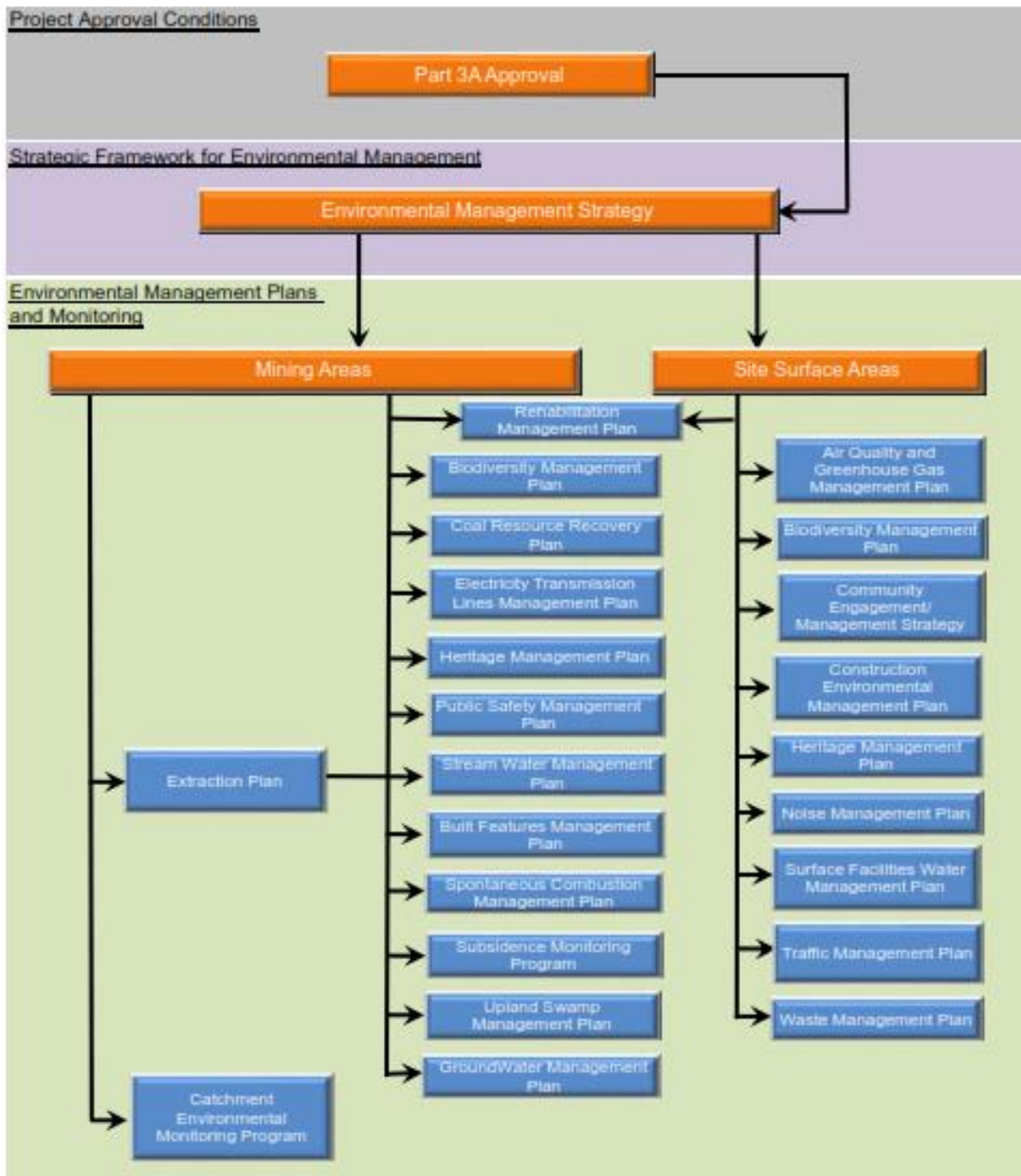
**Section 7:** Describes the protocols for the handling of incidents, complaints and non-conformances.

**Section 8:** Details how the Plan will be implemented, managed, reviewed and updated and managed.

**Figure 1** shows this Plan's position within the WCL Environmental Management Structure.

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## Environmental Management Structure



**Figure 1 – Environmental Management Structure**

## 2 STATUTORY REQUIREMENTS

### 2.1 Approval

#### 2.1.1 NSW Project Approval

**Condition 7/Schedule 3** of the NSW Project Approval requires the preparation of a BMP as a component of an Extraction Plan for second workings. NSW Project Approval **Condition 7(h1)** states:

#### **Extraction Plan**

*7. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. This plan must:*

*...  
(h1) include appropriate references to:*

- ...*
- water resources, biodiversity values and heritage values managed under the Water Management, Biodiversity and Heritage Management Plans required under Conditions 29, 35 and 36 of Schedule 3 and;*
  - programs, procedures, management measures and the like required under those plans;*

**Condition 29/Schedule 3** of NSW Project Approval outlines the requirements that are applicable to the preparation and performance of this USMP. **Table 2** indicates where each component of the condition is addressed within this Plan.

**Table 2 – Upland Swamp Management Plan Requirements**

NSW Project Approval Condition	Plan Section
Condition 29/ Schedule 3 The Proponent shall prepare and implement a Biodiversity Management Plan for the project to the satisfaction of the Secretary. This Plan must:	This Plan
(a) be prepared by a suitably qualified expert in consultation with OEH;	Section 1.3
(b) be submitted for approval to the Secretary within 6 months of this approval;	Compliant
(c) include: <ul style="list-style-type: none"> <li>management measures;</li> <li>monitoring procedures;</li> </ul>	Section 6 Section 5

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NSW Project Approval Condition	Plan Section
<ul style="list-style-type: none"> <li>performance indicators; and</li> <li>reporting frameworks,</li> </ul> with particular reference to the Green and Golden Bell Frog, the Red-crowned Toadlet, Giant Burrowing Frog, Littlejohn's Tree Frog and Giant Dragonfly; and	Section 4 Section 5
(d) demonstrate achievement of the relevant performance measures in Table 1	Section 4

In addition, **Condition 1/Schedule 3** of the NSW Project Approval sets out the Subsidence Impact Performance Measures for upland swamps (see **Table 8**).

**Condition 2/Schedule 5** of the NSW Project Approval outlines the requirements that are applicable to the preparation and performance of all Management Plans.

**Table 3** indicates where each component of the condition is addressed within this Plan.

**Table 3 – Management Plan Requirements**

NSW Project Approval Condition	Plan Section
<b>Condition 2/Schedule 5</b>	
2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3.1, Appendix C and Appendix D
(b) a description of: <ul style="list-style-type: none"> <li>the relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>any relevant limits or performance measures/criteria;</li> <li>the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;</li> </ul>	Section 2  Section 4  Section 6.2
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5 and Appendix B
(d) a program to monitor and report on the: <ul style="list-style-type: none"> <li>impacts and environmental performance of the project;</li> </ul>	Section 5



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NSW Project Approval Condition	Plan Section
<ul style="list-style-type: none"> <li>effectiveness of any management measures (see c above);</li> </ul>	Section 6 and Appendix B
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.3
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 7.5.1 of the Extraction Plan
(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and</li> <li>exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	Section 6 of the Extraction Plan
(h) a protocol for periodic review of the plan.	Section 7.5 of the Extraction Plan

## 2.1.2 Commonwealth Approval

**Conditions 12 to 17** of the Commonwealth Approval outline monitoring requirements to determine whether negligible environmental consequences have occurred to Matters of National Environmental Significance (MNES). **Table 4** indicates where these requirements have been addressed within this Plan.

**Table 4 – Biodiversity Management Plan Requirements**

Commonwealth Approval Condition	Plan Section
<b>Condition 12</b> In order to demonstrate that only negligible environmental consequences have occurred, in order to meet the requirements of Conditions 11 and 15, the approval holder must undertake a monitoring program of all potential short and long-term impacts to MNES from the action, including the nature, extent, area and location of impacts.	This plan
(a) include baseline data, baseline ecological characteristics and monitoring methods;	Section 3 and Appendices C and D
(b) be undertaken by a suitably qualified ecologist/expert;	Section 1.3
(c) be undertaken for a sufficient period of time and at sufficient frequency and intensity, as certified by an independent expert, to ascertain the natural variability of the MNES monitored and to verify	Section 5

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Commonwealth Approval Condition	Plan Section
compliance with Conditions 11 and 15;	
(d) be submitted to the Minister for approval prior to commencement;	Condition Satisfied
(e) The approval holder must not commence until the monitoring program is approved by the Minister; and	Condition Satisfied
(f) be made publicly available on the approval holder's website within 5 days of its approval by the Minister and remain on the approval holder's website for the life of the approval.	Section 1.3
<b>Condition 13</b> Within 3 months of approval of the monitoring program required by Condition 12 (above), the approval holder must ensure the monitoring program is reviewed and certified by a second independent expert, who must verify in writing to the Department that the proposed monitoring program is adequate to detect any impacts in Condition 11 and 15. As a result of this review, the Minister may require amendments to the monitoring program. These amendments must be implemented within 3 months of this advice being provided.	Section 1.3
<b>Condition 14</b> The approval holder must: <ul style="list-style-type: none"> <li>(a) implement the approved monitoring program required by Condition 12, commencing its implementation within two months of its approval by the Minister;</li> </ul>	Condition Satisfied
(b) have all monitoring results reviewed by a suitably qualified ecologist/expert;	Section 5.2
(c) report the results of the program to the Minister annually for the life of the approval; and	Section 5.2
(d) make the monitoring program's results publicly available on the approval holder's website within 5 days of their provision to the Minister;	Section 5.2
(e) must remain on the approval holder's website for the life of the approval.	Section 5.2
<b>Condition 17</b> The approval holder must publish the management plans required by Condition 11, 29 and 35-37 of the NSW Government Consolidated Condition of Approval for Application 10_0046 on its website. These plans must remain on the approval holder's website for the life of the approval.	Section 1.3

In addition, **Conditions 3 and 5** of the Commonwealth Approval set out the Subsidence Impact Performance Measures for Biodiversity (see **Section 4**).

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## 2.2 Licences and Leases

In addition to the requirements of the NSW Project Approval and Commonwealth Approval, all activities at or in association with the Russell Vale Colliery will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

**Table 5 – Licences, Permits and Leases**

<b>Licence/Approval</b>	<b>Document No.</b>	<b>Issue Date/</b>	<b>Expiry Date</b>
Consolidated Coal Lease Renewal	745	27 Dec 1990	30 Dec 2023
Mining Purposes Lease	271	09 May 1991	09 May 2033
Mining Lease	1575	22 Mar 2012	22 Mar 2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31 Oct 2001 23 Jan 2002 28 Jun 2001	-
Approval to mine P&O Panels (first workings)	10.123.081	7 Jan 2005	-
DC for Thin Seam Mining P/L	D1096/01	19 Sep 2001	-
Environmental Protection Licence	12040	Current	-
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10 Aug 1992	-
DC for Storm Water Control Dam and Water Treatment	D91/551	17 Jun 1992	-
Dangerous Goods Licence	NDG021269	Application Pending	Application Pending
Licence to Store Explosives	XSTR100114	21 Oct 2012	3 Oct 2017
SPCC Approval for Stage 3	90/4711 (280021C/20)	04 Sep 1992	-
DC for Russell Vale Waste Emplacement	D89/839	11 Apr 1990	-
DC for Demolition of Washery	D2004/32	14 Dec 2004	-
Mining operations Plan (MOP)		1 Jan 2008	31 Dec 2017
Bore Licence	10BL602992	29 Jan 2013	28 Jan 2018

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## 3 IMPACT ASSESSMENT

### 3.1 Baseline Data

A number of environmental assessments relating to the Russell Vale East area have been undertaken in the course of assessments for the UEP and LW4 and LW5 applications. A list of assessments used to inform this USMP are outlined below.

- ERM (2011a). NRE No. 1 Colliery Terrestrial Flora and Fauna Assessment.
- ERM (2012). NRE No. 1 Colliery Proposed Wongawilli Seam Longwalls 4 & 5: Ecological Assessment.
- Biosis (2012). NRE No. 1 Colliery Major Expansion. Upland Swamp Assessment.
- Biosis (2013). Wonga East and V Mains Ecological Monitoring Program: Autumn 2011 through to Autumn 2013.
- Biosis (2014a). Russell Vale Colliery – Underground Expansion Project: Preferred Project Report – Biodiversity.
- Biosis (2014b). Russell Vale Colliery – Underground Expansion Project: EPBC Act Matters of National Environmental Significance Report – Ecology.
- Biosis (2014c). Underground Expansion Project EPBC Referral (EPBC2014/7268): Coastal Upland Swamp Impact Assessment Report.

A full and comprehensive assessment of the upland swamp values present in the study area can be found in these reports. Relevant information is summarised below.

#### 3.1.1 Upland Swamp Descriptions

Mapping and characterisation of upland swamps in the study area was undertaken by Biosis (2012). This assessment identified seven upland headwater swamps within the study area for this USMP, with a total area of 21 ha and an average size of 2.96 ha (**Figure 2**). No valley fill swamps are present. These upland swamps are representative of the Coastal Upland Swamps in the Sydney Basin Bioregion Endangered Ecological Community (EEC), listed under the TSC Act and EPBC Act.

Six of these Upland Swamps (CCUS3, CCUS4, CCUS5, CCUS6, CCUS23 and CRUS1) are located above or adjacent to the proposed extraction area. The location of these swamps in relation to LW6 and LW7 is shown in **Figure 2**. A description of each upland swamp is provided in **Table 6** below.



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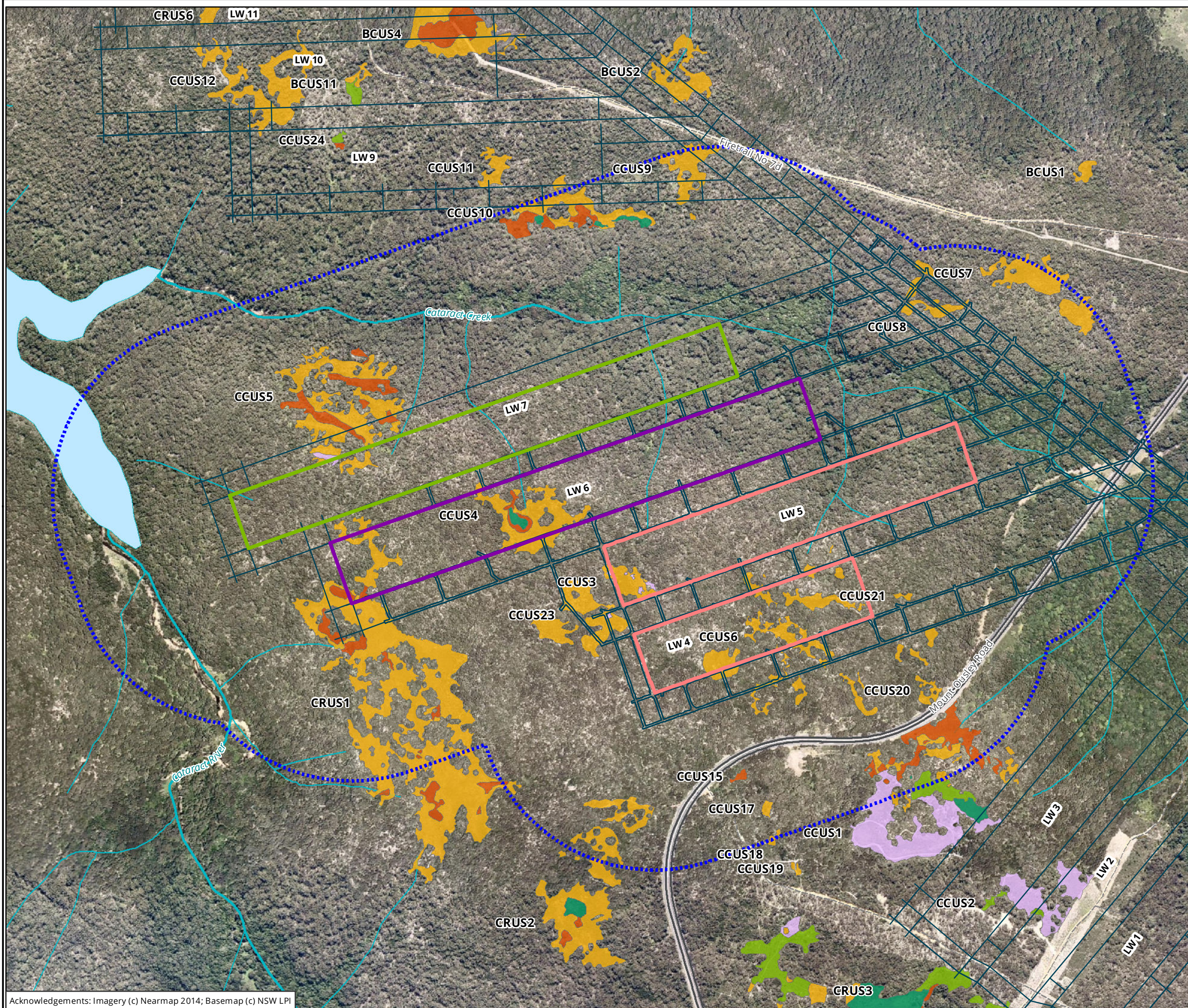
**Table 6 – Upland Swamps within the Study Area**

Swamp	Size (ha)	Soils	Vegetation sub-communities	Located above longwall	Predicted Subsidence (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CCUS3	0.55	A shallow weathered sandy clay colluvial soil over shallow weathered sandstone. Essentially has no development of a moist humic layer with numerous sandstone outcrops.	Banksia Thicket (MU42) Sedgeland - HeathComplex: Sedgeland (MU44a)	Western end of LW 5	1	6.7	13.4	22
CCUS4	1.77	Up to 1.2m deep humic/sandy clay profile over weathered sandstone, with sandstone outcrops.	Banksia Thicket (MU42) Tea-tree Thicket (MU43) Sedgeland-Heath Complex: Cyperoid Heath (MU44c)	Centre of LW6	1.4	9.2	18.5	31
CCUS5	3.45	A highly variable profile up to 1.1m deep with highly variable humic content in a sandy clay profile over weathered sandstone with numerous "stepped" sandstone outcrops.	Banksia Thicket (MU42) Tea-tree Thicket (MU43) Sedgeland-HeathComplex: Sedgeland (MU44a)	Largely located over the pillar for LW7	1.2	7.3	14.7	24
CCUS6	2.05	A relatively shallow sandy clay soil profile, with humic material.	Banksia Thicket (MU42)	Centre of LW4	2	9.4	18.8	31
CCUS2 3	1.44	A shallow weathered sandy clay colluvial soil over shallow weathered sandstone. Essentially has no development of a moist humic layer with numerous sandstone outcrops.	Banksia Thicket (MU42) Sedgeland-HeathComplex: Restioid Heath (MU44b)	Located west of LW5	< 0.2	0.4	0.9	1

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Swamp	Size (ha)	Soils	Vegetation sub-communities	Located above longwall	Predicted Subsidence (m)	Max Tensile Strain (mm/m)	Max Comp Strain (mm/m)	Max Tilt (mm/m)
CRUS1	9.84	Highly variable predominantly very shallow profile of up to 0.5m deep with highly variable to absent humic content in a sandy clay profile over weathered sandstone with numerous "stepped" sandstone outcrops.	Banksia Thicket (MU42) Tea-tree Thicket (MU43)	Upper margins located over LW6	0.2	6.5	13	22





### Legend

#### Russell Vale Swamp Boundaries

- MU42, Upland Swamps: Banksia Thicket
- MU43, Upland Swamps: Tea-Tree Thicket
- MU44, Upland Swamps: Sedgeland-Heath Complex
- MU44a, Upland Swamps: Sedgeland-Heath Complex (Sedgeland)
- MU44b, Upland Swamps: Sedgeland-Heath Complex (Restioid Heath)
- MU44c, Upland Swamps: Sedgeland-Heath Complex (Cyperoid Heath)

#### Survey Area

- Previously Mined Longwalls
- Longwall 6
- Longwall 7
- Longwall Layout
- Study Area

**Figure 2: Upland swamps in the study area**

0 80 160 240 320 400  
Metres

Scale: 1:8,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18643  
Date: 06 December 2014,  
Checked by: NMG, Drawn by: ANP, Last edited by: ngarvey  
Location: P:\18600s\18643\Mapping\18643\_MP\_F2\_CUS



### 3.1.2 Swamp and Shallow Groundwater Monitoring Piezometers

Swamp and shallow groundwater piezometers have been installed at the locations shown in **Figure 3**. Details of these piezometers are presented in **Table 7**.

**Table 7 – Russell Vale East Swamp Piezometers**

Bore	Swamp	Installed	E	N	Total Depth (mbgl)	Intake Screen (m)	Intake Lithology
PCc2	CCUS2	May 12	303745	6146080	1.60	1.1 – 1.6	Humic sandy clay / weathered sandstone
PCc3	CCUS3	Mar 12	302820	6196810	1.2	0.7 – 1.2	Sandy clay / weathered sandstone
PCc4A	CCUS4	Oct 14	302678	6196900	1.61	1.11 – 1.61	Humic sandy clay / weathered sandstone
PCc4B	CCUS4	Oct 14	302604	6196877	1.84	1.34 – 1.84	Humic sandy clay / weathered sandstone
PCc4C	CCUS4	Oct 14	302579	6196931	1.27	0.77 – 1.27	Humic sandy clay / weathered sandstone
PCc4D	CCUS4	Mar 12	302615	6196925	0.9	0.4 – 0.9	Humic sandy clay / weathered sandstone
PCc5A	CCUS5	May 12	302110	6197150	1.24	0.7 – 1.2	Humic sandy clay / weathered sandstone
PCc5B	CCUS5	May 12	302245	6197250	1.31	0.8 – 1.3	Humic sandy clay / weathered sandstone
PCc5C	CCUS5	Oct 14	302234	6197073	0.85	0.5 – 0.85	Humic sandy clay / weathered sandstone
PCc5D	CCUS5	Oct 14	302296	6197168	1.23	0.73 – 1.73	Humic sandy clay / weathered sandstone
PCc6	CCUS6	Mar 12	303165	6196790	1.2	0.7 – 1.2	Weathered sandstone
PCr1A	CRUS1	Mar 12	302330	6196625	0.55	0.3 – 0.55	Humic sandy clay / weathered sandstone
PCr1B	CRUS1	Oct 14	302247	6196655	0.69	0.44 – 0.69	Humic sandy clay / weathered sandstone
PCr1C	CRUS1	Oct 14	302229	6196762	1.15	0.65 – 1.15	Humic sandy clay / weathered sandstone
PCr1D	CRUS1	Oct 14	302263	6196879	0.37	0.22 – 0.37	Sandy clay / weathered sandstone
PB4	BCUS4	May 12	302485	6198060	0.6	0.25 – 0.6	Humic sandy clay / weathered sandstone
SP1	No swamp	Mar 12	303245	6196955	0.60	0.1 – 0.6	Sandy clay / weathered sandstone
SP2	No swamp	Mar 12	302830	6196905	1.05	0.55 – 1.05	Sandy clay / weathered sandstone

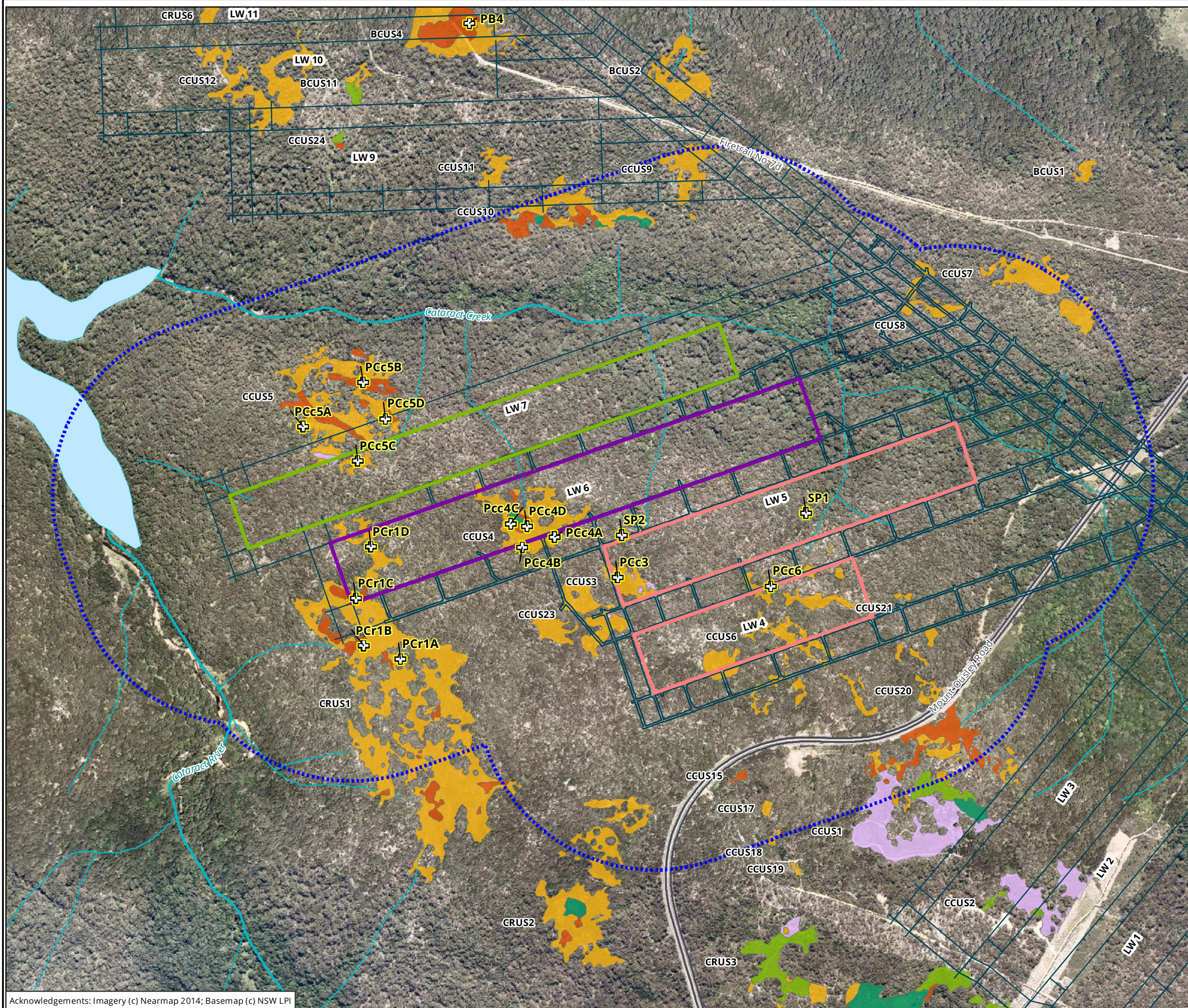


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**NOTES:** AMG coordinates based on GPS readings.  
Shading indicates dry bore with no piezometer  
SP1 shallow soil / weathered sandstone piezometer No.1

The open standpipe swamp piezometers PCc2, PCc3, PCc4D, PCc5A, PCc5B, PCc6 and PCr1A were installed by GeoTerra from March to May 2012, and the shallow colluvium / weathered sandstone open standpipe piezometers SP1 and SP2 were installed by GeoTerra in March 2012. Additional open standpipe swamp piezometers were installed by GeoTerra in October 2014. Ongoing management and the implementation of the field work and monitoring is conducted by WCL.





#### Legend

Swamp piezometers

#### Russell Vale Swamp Boundaries

- MU42, Upland Swamps: Banksia Thicket
- MU43, Upland Swamps: Tea-Tree Thicket
- MU44, Upland Swamps: Sedgeland-Heath Complex
- MU44a, Upland Swamps: Sedgeland-Heath Complex (Sedgeland)
- MU44b, Upland Swamps: Sedgeland-Heath Complex (Restioid Heath)
- MU44c, Upland Swamps: Sedgeland-Heath Complex (Cyperoid Heath)

#### Survey Area

- Previously Mined Longwalls
- Longwall 6
- Longwall 7
- Longwall Layout
- Study Area

**Figure 3: Swamp piezometers**

0 80 160 240 320 400  
Metres

Scale: 1:8,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne, Newcastle, Sydney, Wangaratta & Wollongong

Matter: 18643  
Date: 06 December 2014,  
Checked by: NMG, Drawn by: ANP, Last edited by: ngarvey  
Location: P:\18600s\18643\Mapping\18643\_MP\_F3\_Piezos

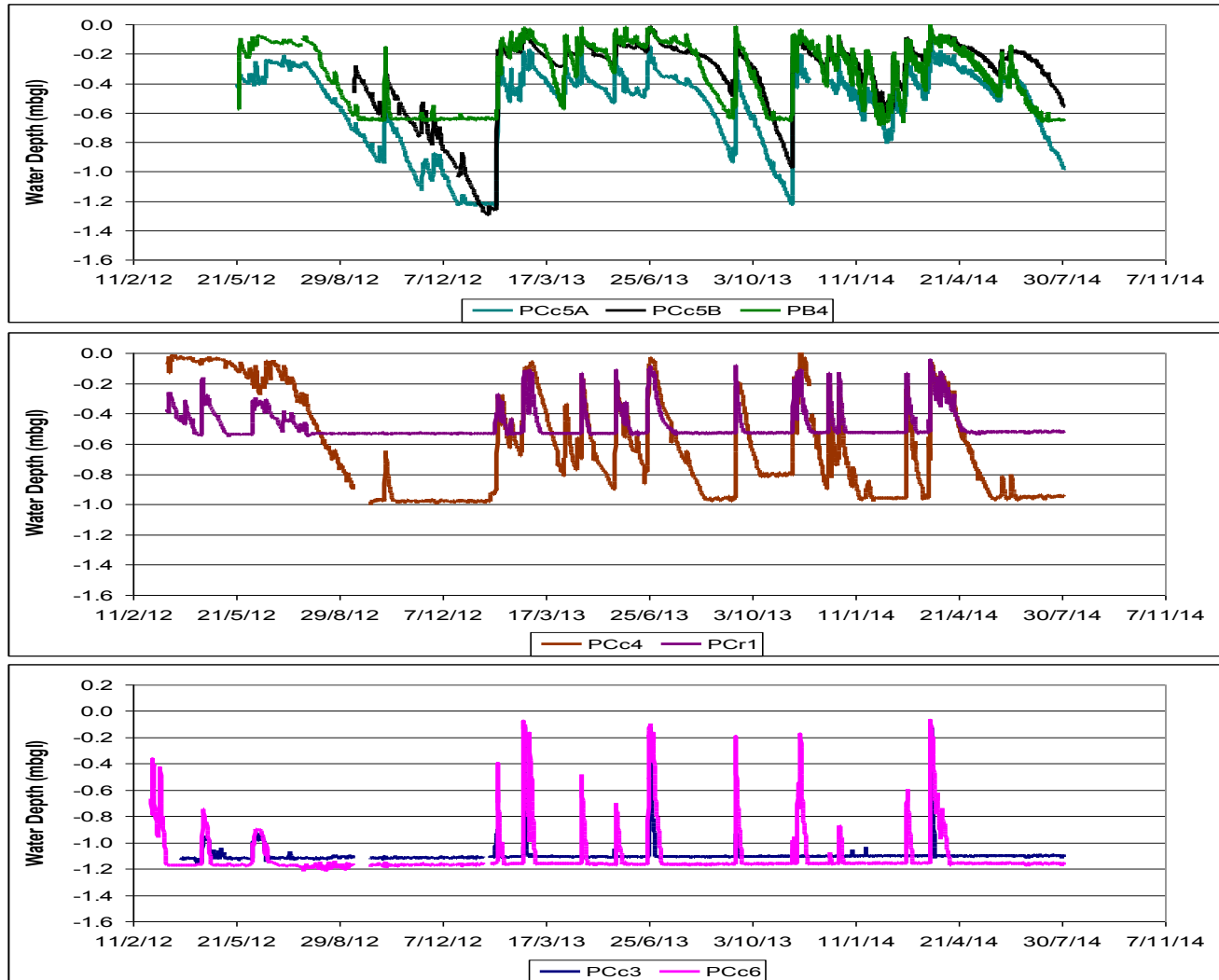


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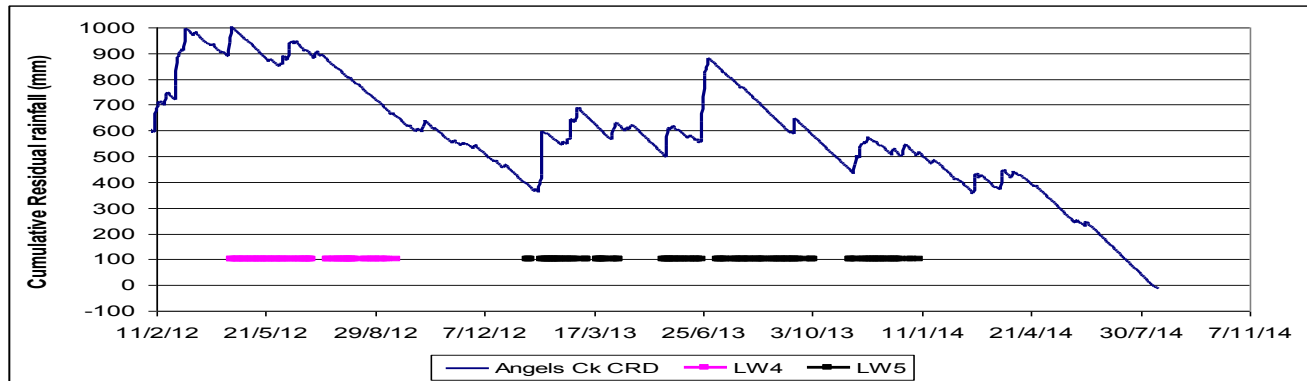
### 3.1.3 Groundwater Level

#### Upland Swamps

Upland Swamp water levels monitored since mid March 2012 in the vicinity of LW6 and LW7 are shown in **Figure 4**.



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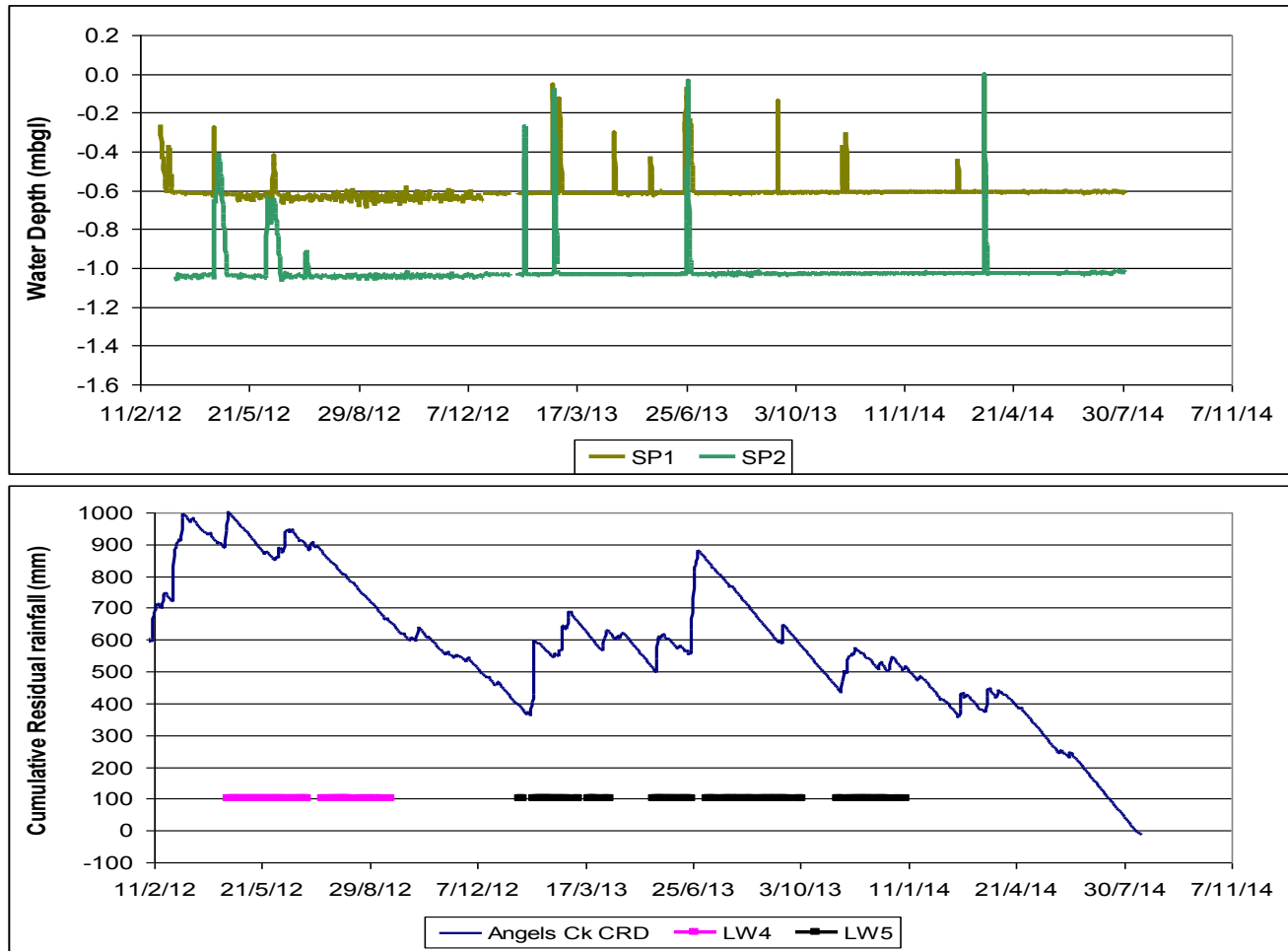
**Figure 4 – Russell Vale East Swamp Water Levels**

Drill logs and water level monitoring indicates that some upland swamps, or portions there-in, that have been assessed as upland swamps from an ecological perspective are actually behaving a sandy clay colluvium, rather than moist humic “swamps”. The presence of colluvium, rather than moist humic sandy clay, is observed at sites PCc3, PCc6 and PCr1D (which directly overlies LW6).

Observations of the lithological or hydrological characteristics of the shallow PCr1D piezometer are significant, as it means that the soil directly within the potential subsidence area over the centre of LW6 is not “hydrologically” a swamp, and therefore is not likely to show the generally assumed adverse effects of reduced water levels and reduced swamp outflow, as it is generally dry anyway. This also means that the length of the monitoring record is not as significant as the location over LW6 is established to be a dry colluvial soil developed over weathered sandstone, not a swamp at that location.

## Shallow Groundwater

Shallow groundwater levels monitored since mid March 2012 in the vicinity of LW6 and LW7 are shown in **Figure 5**.



**Figure 5 – Russell Vale East Shallow Sandstone Water Levels**

## Paired Upland Swamp and Basement Water Levels

A paired swamp/ groundwater piezometer installed in swamp CRUS1 (PCr1C and PCr1D) are compared to the shallow basement piezometer RV18, which was located as close as possible to the swamp without having to clear significant swamp vegetation in September and October 2014.

Since installation, PCR1C water levels have varied from 0.95 – 0.2mbgl, PCR1D has been dry (at less than 0.4mbgl), and RV18 varies from 8.6 – 9.0 mbgl as shown in **Figure 7**.

The plots shows that PC1rD, which overlies LW6 does not act hydrologically as a swamp as previously discussed, whilst PCr1C does, and PCr1C water level varies similarly with rainfall to RV18.

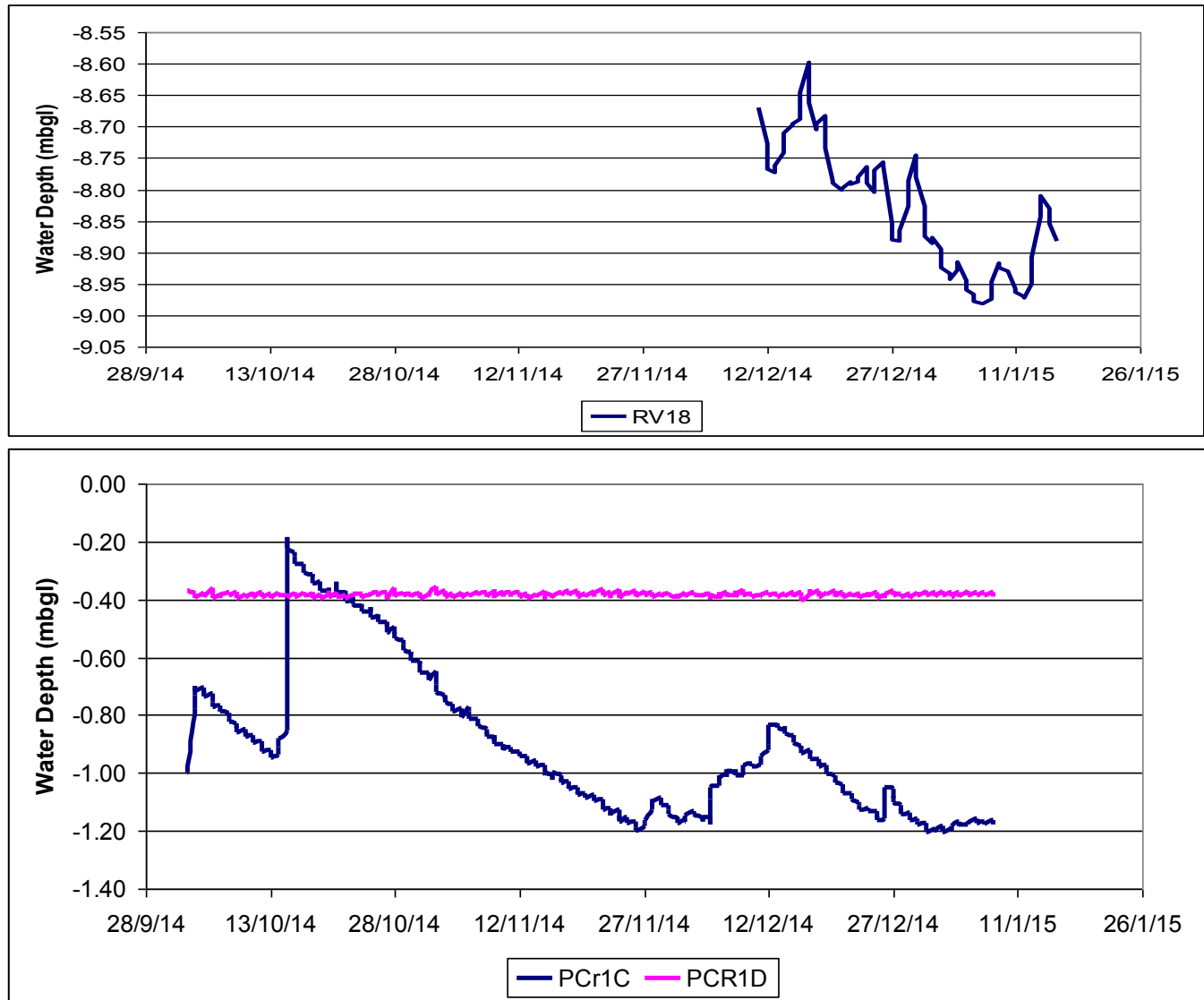
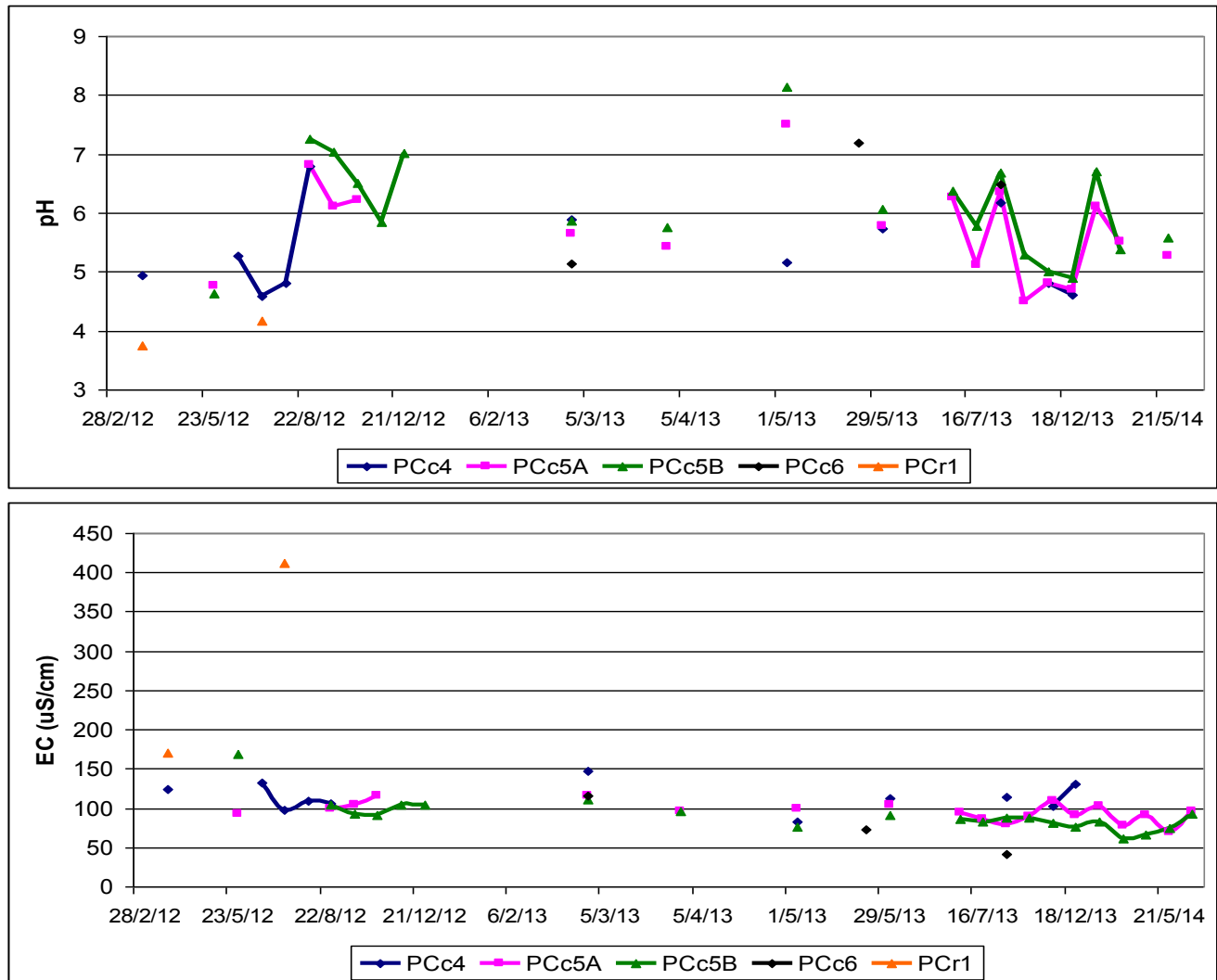


Figure 6 – Upland Swamp CRUS1 and Hawkesbury Sandstone RV18 Water Levels

### 3.1.4 Groundwater Quality

#### Swamp and Shallow Groundwater Quality

The groundwater quality (electrical conductivity and pH) of Cataract Creek and Cataract River are shown in **Figure 7**, whilst the laboratory water analyses are shown in **Appendix C**.



**Figure 7 – Upland Swamp and Shallow Sandstone Field Water Quality**

### 3.2 Potential Impacts

Potential impacts to upland swamps in the study area may result from the following mechanisms:

- Fracturing of bedrock beneath upland swamps, resulting in increased secondary porosity and permeability, with potential to drain into deeper sandstone strata.
- Tilting in upland swamps resulting in the re-distribution of perched water levels and surface run-off. This may result in changes in in-flow to upland swamps and / or changes in saturation of vegetation sub-communities.
- Tiltling in upland swamps resulting in increased potential for development of nick points, scouring and erosion.
- Changes in baseflow discharge to and from upland swamps.

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Subsidence could affect upland swamps directly overlying the proposed longwalls due to either transient and/or spatial changes in secondary porosity and permeability of a swamp or its underlying weathered sandstone substrate through generation of cracks or differential displacement of the perched aquifer. If a swamp overlies an extracted panel, it may undergo temporary extensional “face line” cracking (perpendicular to the long axis of the panel) as a panel advances, followed by re-compression as the maximum subsidence occurs at any one location. In addition, where a swamp overlies a longwall, it may also undergo both longer term extensional “rib line” cracking (parallel to the long axis of the panel) along the outer edge and compression within the central portion of a panel's subsidence trough. The more susceptible portions of a swamp to increased secondary porosity and / or permeability changes are where it undergoes “rib line” cracking. Any adverse effects, if they occur, would be related to the extent and degree of cracking that occurs in the underlying weathered sandstone, as cracking is unlikely to manifest in a swamp due to its saturated, clayey, humic, plastic nature, as well as the reliance of vegetation within the upland swamp on the perched water table (compared with surface water in-flow).

It should be noted that the headwater swamps in the study area have undergone up to an estimated 3.8 m of subsidence in the centre of LW4 with up to 1.0 m of subsidence estimated for mining in the Bulli Seam, 1.0 m measured during mining in Balgownie Seam and 1.8 m is predicted to occur during mining in Wongawilli Seam. This level of subsidence would be expected to cause up to an estimated 21 mm/m of tensile strain, 41 mm/m of compressive strain, and 68 mm/m of tilt. Bulli Seam mining occurred from the late 19th Century through to about 1950. Balgownie Seam longwalls were mined between 1970 and 1982. LW4 and LW5 in the Wongawilli Seam were mined in 2012 and 2013.

Where a swamp overlies a chain pillar, or is on the edge of the subsidence bowl, it could experience temporary, localised, re-distribution of perched water levels through differential subsidence of the ground. Tilting of a swamp could also potentially re-distribute surface runoff, resulting in a re-distribution of water flow and storage, thereby causing changes to the saturation characteristics which may alter the vegetation associations within a swamp.

Tilts due to subsidence may result in changes in flow regimes within swamps. Tilts may result in changed flow paths or runoff characteristics within a swamp, with the potential for development of nick points, scouring and erosion. Dewatering and drying of swamps due to subsidence fracturing of the bedrock may increase the erosion potential of swamps. Negative environmental consequences may be caused by erosion and drying out of the swamp via channel erosion, by redistribution of water, or by water diversion through connected pathways exposed by buckling or shearing of the underlying sandstone. The swamps, however, contain sediment and organic material that may either seal or reduce water loss into the underlying fracture network. Drying, in conjunction with fire and substantial rainfall, can increase the susceptibility of swamps, particularly valley fill swamps, to erosion. However, it is often the case that no single factor can be directly implicated in enhanced erosion of upland swamps. The



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only swamp at Russell Vale Colliery that has undergone noticeable erosion is the valley fill swamp LCUS4 at Wonga West, which is outside the study area for this assessment.

Upland swamps rely on water stored within the shallow, perched, ephemeral groundwater system, whilst regional water is contained within the deeper Hawkesbury Sandstone aquifers. Empirical observation and field mapping (Biosis, 2012, 2013) indicates that past undermining of swamps in the Wollongong Coal lease area has not generated any noticeable adverse ecological effects on swamps. It is therefore anticipated that observable reduction of swamp discharge to the study area catchments will not occur following subsidence across the subject catchment areas, although generation of potentially enhanced leakage from the base of the swamps may occur. Seepage from the swamp is currently highly ephemeral, with the volume and duration of baseflow being directly related to the degree of rainfall recharge and stream flow in the catchment.

SCT Operations (2013) has prepared revised predictions of subsidence impacts (subsidence, tilt and strain) associated with the proposed extraction of longwall panels in the Wongawilli seam. Reassessment of subsidence predictions following monitoring of LW4 and LW5 indicates that past mining has resulted in the softening of the underlying rock strata, and that subsidence is occurring over a much shorter distance than has previously occurred in un-mined areas, with subsidence largely restricted to immediately above the goaf. Whilst this means that subsidence movements occur over a smaller area, it also means that tilts and strains are greater than previously predicted (SCT Operations 2013).

CCUS3 and CCUS23 overlie the extracted LW5, whilst CCUS6 overlies the extracted LW4. Neither swamp has undergone any observable change in swamp groundwater levels since they were undermined. On this basis, no direct effects from extraction of LW6 and LW7 are anticipated on CCUS3, CCUS23 or CCUS6. As a result, it is considered the risk of adverse effects to groundwater water levels, drainage, reduction of discharge to downstream gullies and water quality is low for upland swamps CCUS5 and CRUS1, and that the total volume of water entering Cataract Creek from the headwater swamps will not be observably affected due to the proposed workings. These upland swamps are considered to be at a low risk of impact.

In addition to fracturing of the base of CCUS4, there is potential for impacts to the sandstone formation that forms a rockbar at the downstream extent of this upland swamp. Any rockfall that impacts on the integrity of this rockbar has potential to result in an impact to the water holding capacity of CCUS4. CCUS4 is considered to be at a moderate risk of impact.

## 4 PERFORMANCE MEASURES AND CRITERIA

### 4.1 NSW Planning Approval

Performance Measures for Subsidence Impact are outlined in **Condition 1/ Schedule 3** of the NSW Project Approval. The Performance Measures relevant to upland swamps are outlined in **Table 8**.

**Table 8 – Subsidence Impact Performance Measures for Upland Swamps**

Upland Swamps	
Upland swamps adjacent to Wallandoola and Lizard Creeks (including valley fill swamp WCvfs1) Cataract River Upland Swamp 1 (CRUS1)	Negligible environmental consequences including: <ul style="list-style-type: none"> <li>negligible change in the size of swamps;</li> <li>negligible change in the functioning of swamps;</li> <li>negligible change to the composition or distribution of species within swamps; and,</li> <li>negligible drainage of water from swamps, or redistribution of water within swamps.</li> </ul>
Cataract Creek Upland Swamp 3 (CCUS3)	No greater subsidence impact or environmental consequences than predicted in EA – Mod 1.
Biodiversity	
Threatened species, populations or their habitats and endangered ecological communities (except CCUS3 and CCUS4)	Negligible environmental consequences

"Negligible" is defined within the NSW Project Approval as: *Small and unimportant, such as to be not worth considering.*

**Condition 3A/Schedule 3** states:

*"If mining under this approval causes impacts to Cataract Creek Upland Swamp 4 (CCUS4) which exceed a standard of 'minor environmental consequences', and the Secretary determines that:*

- a) it is not reasonable or feasible to remediate the impact or environmental consequence; or*
- b) remediation measures implemented by the Proponent have failed to satisfactorily remediate the impact or environmental consequence;*

*then the Proponent shall provide a suitable offset to compensate for the impact or environmental consequence in accordance with the requirements of condition 3 above, to the satisfaction of the Secretary.*

*'Minor environmental consequence' is defined as:*

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- negligible erosion of the surface of the swamps;
- minor changes in the size of the swamps;
- minor changes in the ecosystem functionality of the swamp; and
- maintenance of restoration of the structural integrity of controlling rockbars."

The performance criteria relevant to this performance measure are outlined in Trigger Action Response Plan (TARP) in **Section 6.2** and **Appendix A**. Performance criteria for the triggers listed above are outlined in **Table 9** below:

**Table 9 – Upland Swamp Performance Criteria**

Performance Measure	Performance Criteria and Trigger
Negligible change in the size of swamps	<p>Measured using detailed mapping of the boundaries of upland swamps and the vegetation sub-communities within upland swamps. One baseline survey and additional surveys at 2 to 5 year intervals following mining if impacts to piezometric data are observed.</p> <p>Impacts less than those outlined under Within prediction (Level 2), as defined in the TARP:</p> <ul style="list-style-type: none"> <li>• Minor reduction in the size of upland swamps, as illustrated by statistically significant (<math>p \leq 0.15</math>) decline in the size of upland swamps (pre- to post-mining) when compared to control sites.</li> <li>• Minor change in sub-community composition within an upland swamp, as illustrated by statistically significant (<math>p \leq 0.15</math>) decline in the extent of Tea-Tree Thicket or Cyperoid Heath within an upland swamp when compared to control sites.</li> </ul>
Minor changes in the size of the swamps	<p>Impacts less than those outlined under Exceeding prediction), as defined in the TARP:</p> <ul style="list-style-type: none"> <li>• A reduction in the size of upland swamps, as illustrated by statistically significant (<math>p \leq 0.1</math>) decline in the size of upland swamps (pre- to post-mining) when compared to control sites.</li> <li>• A change in sub-community composition within an upland swamps when compared with control sites, as illustrated by statistically significant (<math>p \leq 0.1</math>) decline in the extent of Tea-Tree Thicket or Cyperoid Heath within an upland swamp when compared to control sites.</li> </ul>
Negligible change in the functioning of swamps	<p>Measured using a combination of groundwater levels and swamp discharge.</p> <p>Groundwater is measured using piezometers in upland swamps. Swamp discharge is measured by weirs measuring volumetric water flow and water quality located in or downstream of upland swamps.</p> <p>For groundwater, impacts less than those outlined under Within prediction (Level 2) , as defined in the TARP:</p> <ul style="list-style-type: none"> <li>• Short term (less than one month) increase in the rate of water level reduction and decrease in total water level. Effect not related to climatic variability.</li> </ul>

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
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Performance Measure	Performance Criteria and Trigger
	For swamp discharge, impacts less than those outlined under Within prediction (Level 2), as defined in the TARP: <ul style="list-style-type: none"> <li>&lt;2 month lowering of swamp seepage discharge reduction outside of baseline variability and climatic variability.</li> </ul>
Minor changes in the ecosystem functionality of the swamp	For groundwater, impacts less than outlined under Exceeding prediction, as defined in the TARP: <ul style="list-style-type: none"> <li>Piezometer becomes, or stays, dry (where it has not done so previously) or the rate of water level reduction increases where the effect is not related to climatic variability.</li> </ul> For swamp discharge, impacts less than those outlined under Exceeding prediction, as defined in the TARP: <ul style="list-style-type: none"> <li>Redirection of surface flows with &gt;2 month reduction of swamp discharge outside of baseline variability and climatic variability.</li> </ul>
Negligible change to the composition or distribution of species within swamps	Impacts less than those outlined under Exceeding prediction, as defined in the TARP: <ul style="list-style-type: none"> <li>Change to the composition or distribution of species, as illustrated by a long term (greater than one year) significant statistical difference between control and impact sites or between before and after mining at the impact sites.</li> <li>Significant dieback in more than one area recorded during observational monitoring.</li> </ul>
Negligible erosion of the surface of the swamps	Erosion will be monitored during visual inspections undertaken as part of the Subsidence Monitoring Plan (WCL, 2014a).
Maintenance of restoration of the structural integrity of controlling rockbars	Maintenance of the rockbar will be monitored during visual inspection of the rock formation at the base of upland swamp. Impacts less than those outlined under Exceeding prediction, as defined in the TARP: <ul style="list-style-type: none"> <li>Observable impacts to the rock formation at the base of upland swamp CCUS4, including collapse or increase in seepage.</li> </ul>

## 4.2 Commonwealth Approval

Performance Measures for Subsidence Impact are outlined in **Conditions 5 and 15** of the Commonwealth Approval. **Condition 5** states:

*"The approval holder must ensure that surface subsidence generated by the action, within 30 metres of the boundaries of Coastal Upland Swamps in the Sydney Basin Bioregion (Coastal Upland Swamps) CCUS3, CCUS5 and CCUS23 (as mapped in Appendix 1), does not exceed the subsidence limits in Table 1, unless otherwise agreed in writing by the Minister based on demonstration by the approval holder of no adverse impacts to CCUS3, CCUS5 and CCUS23.*

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Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

The approval holder must ensure and demonstrate that the monitoring required by Condition 12 is adequate to verify compliance with this Condition."

**Table 10 - Subsidence Limits for Upland Swamps**

Swamp	Subsidence (mm)	Tilt (mm/m)	Strain (mm/m)
CCUS3	50	0	0
CCUS5	50	0	0
CCUS23	50	0	0

**Condition 12** states:

*In order to demonstrate that only negligible environmental consequences have occurred, in order to meet the requirements of Conditions 11 and 15, the approval holder must undertake a monitoring program of all potential short and long-term impacts to MNES from the action, including the nature, extent, area and location of impacts.*

**Condition 15** states:

*If at any time during the life of the approval, the approval holder cannot demonstrate negligible environmental consequences to Coastal Upland Swamps . . . in accordance with Conditions 11 and 12, the approval holder must, within 6 months of that time, register a legally binding conservation mechanism to provide long-term protection to the offsets, as approved by the Minister. The legal mechanism must prohibit any activities which are not conservation activities, including future mining from occurring in the offsets.*

Performance against **Condition 5** will be assessed as part of the Subsidence Monitoring Plan (WCL 2014d).

Performance against **Condition 12** will be assessed against the triggers outlined in Trigger Action Response Plan (TARP) in **Section 6.2** and **Appendix A**. A discussion of these triggers against the relevant significant impact criteria (Commonwealth of Australia 2013) for endangered ecological communities is provided in **Table 11**.

**Table 11 – Upland Swamp Performance Criteria**

Significant Impact Criteria	Relevant trigger
<b>Critically endangered and endangered ecological communities</b>	
reduce the extent of an ecological community	Coastal upland swamps within the study area are part of a continuous distribution of the community across the Woronora plateau. The potential for a reduction in the extent of the community will be assessed against the

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Significant Impact Criteria	Relevant trigger
	<p>following trigger:</p> <ul style="list-style-type: none"> <li>A reduction in the size of upland swamps, as illustrated by statistically significant (<math>p \leq 0.1</math>) decline in the size of upland swamps (pre- to post-mining) when compared to control sites.</li> <li>A change in sub-community composition within an upland swamp when compared with control sites, as illustrated by statistically significant (<math>p \leq 0.1</math>) decline in the extent of Tea-Tree Thicket or Cyperoid Heath within an upland swamp when compared to control sites.</li> </ul>
fragment or increase fragmentation of an ecological community, for example by clearing vegetation for roads or transmission lines	Coastal upland swamps within the study area are part of a continuous distribution of the community across the Woronora plateau. The extraction of LW6 (365m) does not include clearing of any vegetation and it is unlikely to result in fragmentation of this community. No trigger is warranted.
adversely affect habitat critical to the survival of an ecological community	Coastal upland swamps within the study area are part of a continuous distribution of the community across the Woronora plateau. The extraction of LW6 (365m) does not include clearing of any vegetation and it is unlikely to adversely affect habitat critical to the survival of this community. No trigger is warranted.
modify or destroy abiotic (non-living) factors (such as water, nutrients, or soil) necessary for an ecological community's survival, including reduction of groundwater levels, or substantial alteration of surface water drainage patterns	<p>The extraction of LW6 (365m) is likely to result in a reduction in the perched water table in one upland swamp, CCUS4, and there is potential for consequent impacts to two of the vegetation communities in CCUS4, MU43 Tea-tree Thicket and MU44c Cyperoid Heath, which are reliant on this perched water table. Other upland swamps are unlikely to have a reduction in groundwater levels. The potential for a reduction in groundwater levels and consequent impacts to this community will be assessed against the following trigger:</p> <ul style="list-style-type: none"> <li>Piezometer becomes, or stays, dry (where it has not done so previously) or</li> </ul>



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Significant Impact Criteria	Relevant trigger
	<i>the rate of water level reduction increases where the effect is not related to climatic variability.</i>
cause a substantial change in the species composition of an occurrence of an ecological community, including causing a decline or loss of functionally important species, for example through regular burning or flora or fauna harvesting	<p>There is some potential for a change in the distribution of upland swamp vegetation communities in upland swamp CCUS4 due to changes in water availability, with a transition to drier variants of the EEC (e.g. MU42 Banksia Thicket, MU44a Sedgeland or MU44b Restioid Heath). Other upland swamps are considered unlikely to undergo any change. The potential for a substantial change in the species composition of the community will be assessed against the following trigger:</p> <ul style="list-style-type: none"> <li>• <i>Change to the composition or distribution of species, as illustrated by a long term (greater than one year) significant statistical difference between control and impact sites or between before and after mining at the impact sites.</i></li> <li>• <i>Significant dieback recorded during observational monitoring. Dieback not restricted to single area.</i></li> </ul>
<p>cause a substantial reduction in the quality or integrity of an occurrence of an ecological community, including, but not limited to:</p> <ul style="list-style-type: none"> <li>• assisting invasive species, that are harmful to the listed ecological community, to become established, or</li> <li>• causing regular mobilisation of fertilisers, herbicides or other chemicals or pollutants into the ecological community which kill or inhibit the growth of species in the ecological community</li> </ul>	<p>Coastal upland swamps within the study area are part of a continuous distribution of the community across the Woronora plateau. The extraction of LW6 (365m) does not include clearing of any vegetation, and activities associated with the extraction of LW6 (365m) are unlikely to result in increased invasion of exotic species, or release of any chemicals or pollutants in upland swamps in the study area. No water discharges are proposed. It is unlikely that any activities associated with the proposed action will result in a substantial reduction in the quality or integrity of this EEC. No trigger is warranted.</p>
interfere with the recovery of an ecological community	<p>Recovery actions for these two species are to be outlined under the NSW Saving our Species program. However, to date no management actions have been developed. No trigger is</p>

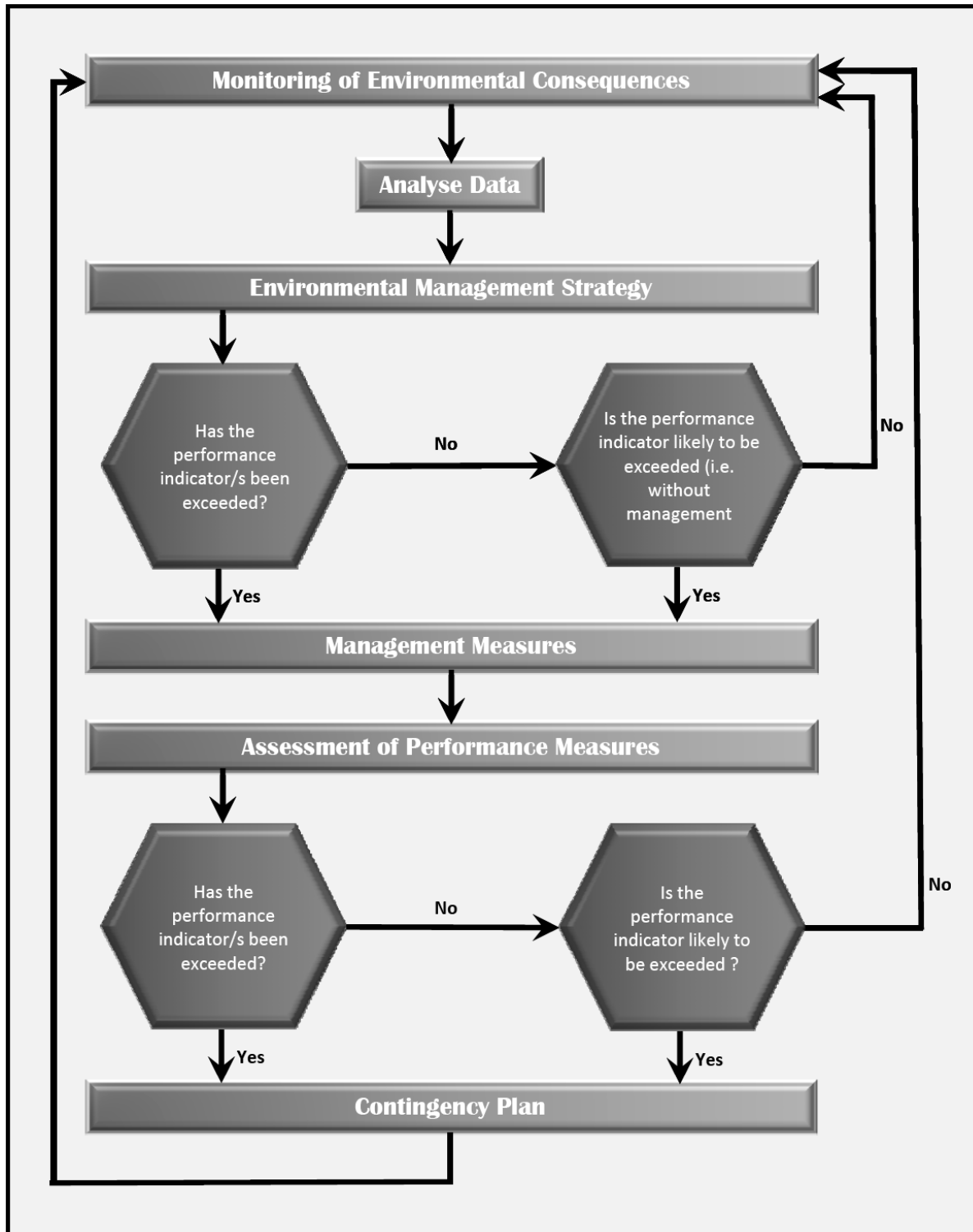


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Significant Impact Criteria	Relevant trigger
	warranted.

**Condition 15** will be implemented as part of the Biodiversity Offset Strategy (in prep.) if greater than negligible environmental consequences, as outlined above, occur.

Environmental management will be undertaken in accordance with the process described in **Figure 8**.



**Figure 8 – Environmental Management Process**

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## 5 MONITORING AND REPORTING

### 5.1 Monitoring

The Upland Swamp monitoring program is outlined below.

This monitoring program, and the Trigger Action Response Plan (TARP) outlined in **Section 6.2** and **Appendix B**, consolidates monitoring previously undertaken as a part of the Subsidence Monitoring Plan (WCL 2014a), Groundwater Management Plan (WCL 2014b) and Stream Management Plan (WCL 2014c) where relevant to upland swamps.

This integrated monitoring program includes monitoring of the following:

- 3D subsidence surveys in upland swamps CCUS4, CCUS5 and CRUS1 to gain an understanding of the lateral extent of subsidence effects on upland swamps;
- A network of shallow groundwater piezometers in upland swamps to gain a better understanding of the distribution of water and water balance in upland swamps and gain a better understanding of subsidence hydrogeological dynamics;
- Soil moisture probes, paired with swamp piezometers, to gain a better understanding of the influence of rainfall recharge versus groundwater movement on soil moisture in upland swamps;
- Installation of weirs (flow gauges) to document baseflow from upland swamps and inflows into Cataract Creek, to improve understanding of subsidence effects on the water balance of upland swamp dependant sub-catchments and systems;
- Installation of local weather stations to obtain local climate data;
- Visual inspections and photographic monitoring to record qualitative change;
- Detailed mapping and characterisation of upland swamps to assess changes in size and composition of upland swamps; and
- Quantitative visual monitoring of upland swamp vegetation to assess changes in the distribution of species within upland swamps.

This integration of management plans and monitoring will allow a more rapid response to potential impacts, a better approach to adaptive management and a greater understanding of potential impacts to upland swamps.

Subsidence effects (subsidence, tilts and strains) and associated subsidence impacts (e.g. fracturing of bedrock) are likely to occur within a short timeframe, with the majority of subsidence observed immediately upon the goaf passing beneath a site and some minor additional settling over the short term (e.g. within six months). Negative environmental consequences to groundwater, swamp discharge and soil moisture are also likely to be observed over the short term, with negative environmental consequences shown through changes in piezometric data occurring rapidly following mining beneath a piezometer. For this reason, monitoring is conducted intensively during mining, with data collected either fortnightly or monthly during mining.

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These two short term impacts may result in changes to the ecology of upland swamps; however, these changes are likely to occur over much longer timeframes, possible decades. There has been very limited detailed monitoring of the negative environmental consequences arising from subsidence in the Southern Coalfield. Recent evidence suggest that some changes are beginning to manifest in upland swamps five years after subsidence impacts and changes in groundwater levels have been observed, with some evidence of changes in species composition over this timescale and recruitment of species associated with drier woodland communities occurring (Biosis pers. obs). It is unknown whether these species will persist.

For this reason, the USMP has taken a hierarchical approach to monitoring. If data from subsidence monitoring indicates that upland swamps are at risk of negative environmental consequences (Commonwealth of Australia 2014, OEH 2012), this will trigger will increase scrutiny of data collected as part of the groundwater management plan (WCL 2014b). If changes in these parameters are observed, particularly changes in groundwater levels, this will result in increased interrogation of ecological data.

However, the timeframes for impacts to the ecology of upland swamps is unknown. For this reason, if amber or red level triggers are reached, monitoring will continue for a timeframe to be determined in consultation with DP&E, OEH and DoE. Ecological monitoring is conducted bi-annually during mining to detect any step changes in vegetation or ecological parameters, such as dieback of vegetation. If long term monitoring is warranted, the intensity of monitoring may be reduced.

A comprehensive analysis and reporting of all monitoring data relevant for each swamp will be provided in the Annual Review.

### 5.1.1 Subsidence

3D subsidence monitoring will be conducted in upland swamps CCUS4, CCUS5 and CRUS1, with subsidence monitoring through each swamp. In addition, detailed subsidence monitoring of CCUS4 will be undertaken including along the upper section of the rock formation that forms part of the rockbar at the base of this swamp and around the swamp.

The location of all subsidence monitoring lines is shown in **Figure 9**.

Visual inspection of the rock formation that forms the base of CCUS4 will also be undertaken during routine monitoring.

Further details on monitoring frequency and duration are provided in the TARP (see **Appendix A**).

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### 5.1.2 Groundwater

Monitoring of groundwater levels within the upland swamps of the Russell Vale East area has been undertaken since 2012.

Monitoring water levels in the shallow sandstone open standpipe piezometers SP1, SP2, as well as piezometers in upland swamps CCUS2, CCUS3, CCUS4, CCUS5, CCUS6 and CRUS1 will be used to assess surface water/shallow groundwater interactions and to monitor water depth in surficial lithologies in the Cataract Creek and Cataract River catchments.

The paired swamp piezometers, shallow sandstone piezometers, as well as gully flow and/or pool level monitoring will be used to assess the dynamic response to swamp water levels, outflow and rainfall, and any water level reduction in the perched and ephemeral aquifers (hydraulically isolated from the regional Hawkesbury Sandstone) as a result of mining. The piezometers have been installed with pressure transducers to monitor water depth at a minimum of every six hours, and will be downloaded monthly prior to mining and fortnightly during mining. The data will enable correlation between upland swamp or shallow sandstone water levels and any direct leakage, if any, from a swamp or humic soils to the underlying sandstone, and/or direct rain recharge to adjacent sandstone followed by lateral groundwater flow to beneath a swamp or shallow soils.

During the logger downloads, the field pH and EC will be measured with calibrated hand held meters, whilst regular sampling will be conducted for laboratory analysis where water samples are available. Monitoring will be conducted for the following parameters:

- Field pH and electrical conductivity;
- Total dissolved solids and total suspended solids;
- Na / Ca / Na / K / SO<sub>4</sub> /Mg / Cl / F;
- Total alkalinity;
- Dissolved organic carbon;
- Total / filterable Fe, Mn, Al;
- Total / filterable Ni, As, Li, Ba, Sr, Cu, Pb, Zn; and
- Total nitrogen and total phosphorous.

All samples will be collected in appropriately cleaned and prepared equipment, stored in appropriately cleaned and rinsed sample containers, then transported and analysed according to ANZECC (2000) standards, with 0.45µm filtering and nitric acid preservation to less than pH 2 for metals samples.

Groundwater quality monitoring will be conducted before, during and after the period of extraction of LW6 and 7.

Swamp and shallow groundwater piezometers have been installed as detailed in **Table 7**, at locations shown in **Figure 3**. For further details see the Groundwater Management Plan (WCL 2014c).

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## Results to Date

The results of groundwater data from shallow piezometers and water quality data are presented in **Appendix C**. A brief summary of these results is provided below.

Upland swamps CCUS4 and CCUS5 are acting as humic, moist/ saturated peat swamps. Groundwater levels in both swamps show that following significant rainfall groundwater reaches near surface before receding to basement levels.

Lower sections of CRUS1 behave similarly to CCUS4 and CCUS5, but with much shallower lithology. However, the portion of CRUS1 located above LW6 is acting as weathered sandstone and sandy clay colluvial soil and does not behave hydrologically like a swamp.

Upland swamps CCUS3, CCUS6 and CCUS10 are acting as weathered sandstone and sandy clay colluvial soil, not swamps.

### 5.1.3 Soil Moisture

Dataflow soil moisture probes have been installed to collect data on soil moisture in upland swamps, with soil moisture recorded at 6-hour intervals and downloaded on a weekly basis. This data will be used to relate changes in water levels in upland swamps with soil moisture and determine whether changes in the perched water table in upland swamps result in changes in soil moisture and assist in understanding the relationship between rainfall recharge, groundwater and soil moisture.

Soil moisture probes have been installed with all piezometers listed in **Table 7**, at locations shown in **Figure 3**.

### 5.1.4 Surface Water Monitoring

Upland swamps in the study area were assessed for their suitability for monitoring of surface water outflow. Of the six upland swamps in the study area, only CCUS4 was deemed suitable for surface outflow monitoring. In CCUS4, a box weir has been installed at the outflow point (CT3a) and a water level logger was installed. This weir is paired with a weir further downstream at the inflow into Cataract Creek (CT3). Water flow is measured at 6-hour intervals and downloaded on a weekly basis. This data will be used to determine whether subsidence associated with mining of LW6 results in a change in outflow from CCUS4, and whether this also results in any changes in inflows to Cataract Creek. Other swamps in the study area did not have a defined channel where outflow could be measured.

In addition, surface water monitoring sites have been installed in CCUS3 (CCUS3C), CCUS4 (CCUS4C) and CRUS1 (CRUS1C). At these locations, monitoring of pH, Electrical Conductivity (EC), temperature, Dissolved Oxygen (DO) and Oxidation Reduction Potential



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(ORP) is undertaken. Monitoring is conducted on a weekly basis when a swamp is being undermined and monthly at other times. Monthly laboratory analyses are undertaken.

The location of relevant surface water monitoring sites is shown in **Figure 9**. Further details of surface water monitoring is provided in the Stream Management Plan (WCL 2014c).

## Results to Date

Data from the recently installed weir at the base of upland swamp CCUS4 shows that swamp discharge from CCUS4 is negligible, with discharge drying up to non-measurable levels within six days of rainfall. This behaviour is typical of upland swamps in the study area that have smaller catchment areas than other swamps throughout the Woronora plateau.

### 5.1.5 Weather stations

Two weather stations have been installed to obtain local climate data. The location of these weather stations is shown in **Figure 9**.

### 5.1.6 Visual Inspection and Photographic Records

A comprehensive visual inspection and photographic record of each swamp monitoring site will be collected each time a site is visited, at a frequency determined by the proposed monitoring schedule, which relates to the proximity of the Longwall to a creek.

Any changes to the current state of the swamps will be visually monitored after significant rainfall events, and if adverse subsidence / uplift effects occur, a specific management and rehabilitation plan should be developed for the affected areas.

### 5.1.7 Ecological Monitoring

#### BACI Approach

Monitoring is undertaken according to a modified Before-After Control-Impact (BACI) design where data is collected before (baseline) and after impact at control and impact sites. Data collected during baseline monitoring will be used for comparison to data collected during and after mining (the before-after component) and data collected at impact sites will be compared to data collected at control sites (the control-impact component).

Monitoring will continue for the duration of mining and for a suitable period post-mining. The duration of post-mining monitoring is determined based on results of annual analysis of data as well as observed impacts to surface features and other monitoring (e.g. groundwater) but will include a minimum of one year post-mining at sites where data from all monitoring programs shows negligible impacts. Negligible impacts would be defined as all monitoring data is consistent with Level 1 triggers across all relevant management plans. If data analysis indicates changes are occurring, impacts to surface features are observed, or changes to

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other monitoring programs indicate impacts may occur, ecological monitoring will continue for a suitable period, determined in conjunction with the DP&E and OEH.

Data is collected at control (reference) sites in the same manner and for the same duration as impact sites. Control sites are sites that have not been mined beneath and will not be undermined during the monitoring period. These sites provide data for comparison against data from impact sites. The use of control sites allows us to distinguish between impacts associated with subsidence (observed only at impact sites) and those associated with broader environmental and anthropomorphic variables (observed at both control and impact sites).

### Current Upland Swamp Ecological Monitoring Program

Monitoring of upland swamps within the Russell Vale East domain has been underway since autumn 2011. The current terrestrial biodiversity monitoring program includes:

- Detailed mapping and characterisation of upland swamps;
- Vegetation monitoring in upland swamps biannually during spring and autumn; and
- Photopoint monitoring of upland swamps.

Detailed mapping and characterisation of upland swamps was undertaken by Biosis (2012). This data, on the size and extent of upland swamps, as well as the distribution of vegetation sub-communities in upland swamp, will be used to assess long term changes in the size and composition of upland swamps in relation to mining.

Detailed, quantitative monitoring of the floristic composition of upland swamps is undertaken, along with photopoint monitoring.

The type, location, seasonality and methodology for vegetation and photopoint monitoring is outlined in **Table 12** while monitoring locations are shown in **Figure 9**.

**Table 12 – Upland Swamp Ecological Monitoring Program**

Monitoring	Sites	Season commenced	Methodology
Detailed mapping and characterisation of upland swamps	All upland swamps within the study area	Initial mapping in 2012  Further assessment as required	Detailed mapping of the size, extent and distribution of vegetation sub-communities was undertaken in 2012 (see Biosis 2012).  This data will be used to determine whether subsidence effects and changes in water levels result in changes in the size and composition of upland

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Monitoring	Sites	Season commenced	Methodology
			swamps.
Vegetation - Upland Swamps	CCUS3 / CCUS23	Autumn 2012	Three 15 m transects have been established in each swamp. All flora species within 30 x 0.5 m x 0.5 m quadrats along the transect are recorded as presence only. A species can have a maximum score of 30 for any one transect, indicating it was present in all quadrats. Monitoring is undertaken once in spring and once in autumn each year.
	CCUS4	Autumn 2012	
	CCUS5	Autumn 2013	
	CRUS1	Autumn 2012	
Photopoint - Upland Swamps	All upland swamps listed above, plus CRUS2	Autumn 2012	Three permanent photo monitoring points have been established in each swamp. Photos are taken at each fixed point to the north, east, south and west. Photos are taken once in spring and once in autumn each year.

## Statistical Analysis

Data is analysed using a hierarchical approach to data analysis. The first step is to look for global patterns and trends to determine if there are any observable discrepancies or trends in the data. The second step is to look for changes in diversity as indicators of community change. For this, species richness and species diversity are analysed at all sites across all years and changes in these indicators compared between control and impact sites.

Baseline variation between sites is established by clustering sites according to the Bray-Curtis similarities using Multi-Dimensional Scaling (MDS). To determine if impacts are occurring at impact sites a variety of statistical analyses are undertaken, including test of species richness and species diversity (Shannon diversity indices) as well as estimates of population size for frogs (where data allows). Where differences are detected, either between or within sites, additional analyses are undertaken to determine where and why differences are occurring.

## Results to Date

The results of upland swamp monitoring undertaken to date are provided in **Appendix B**. A brief summary of these results is provided below, including data from past mining of LWs 4 and 5.

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
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The species richness varies from around 10 to 35-40 species per point (a single survey of a single monitoring point) with a mean richness across all sites of 21 species (standard error = 1.04). The models suggest that the richness is increasing slightly over time across all sites; however the increase in richness is only around 1% and not statistically significant ( $p \sim 0.08$ ). This rate of increase is equivalent to only one extra species per transect every five years.

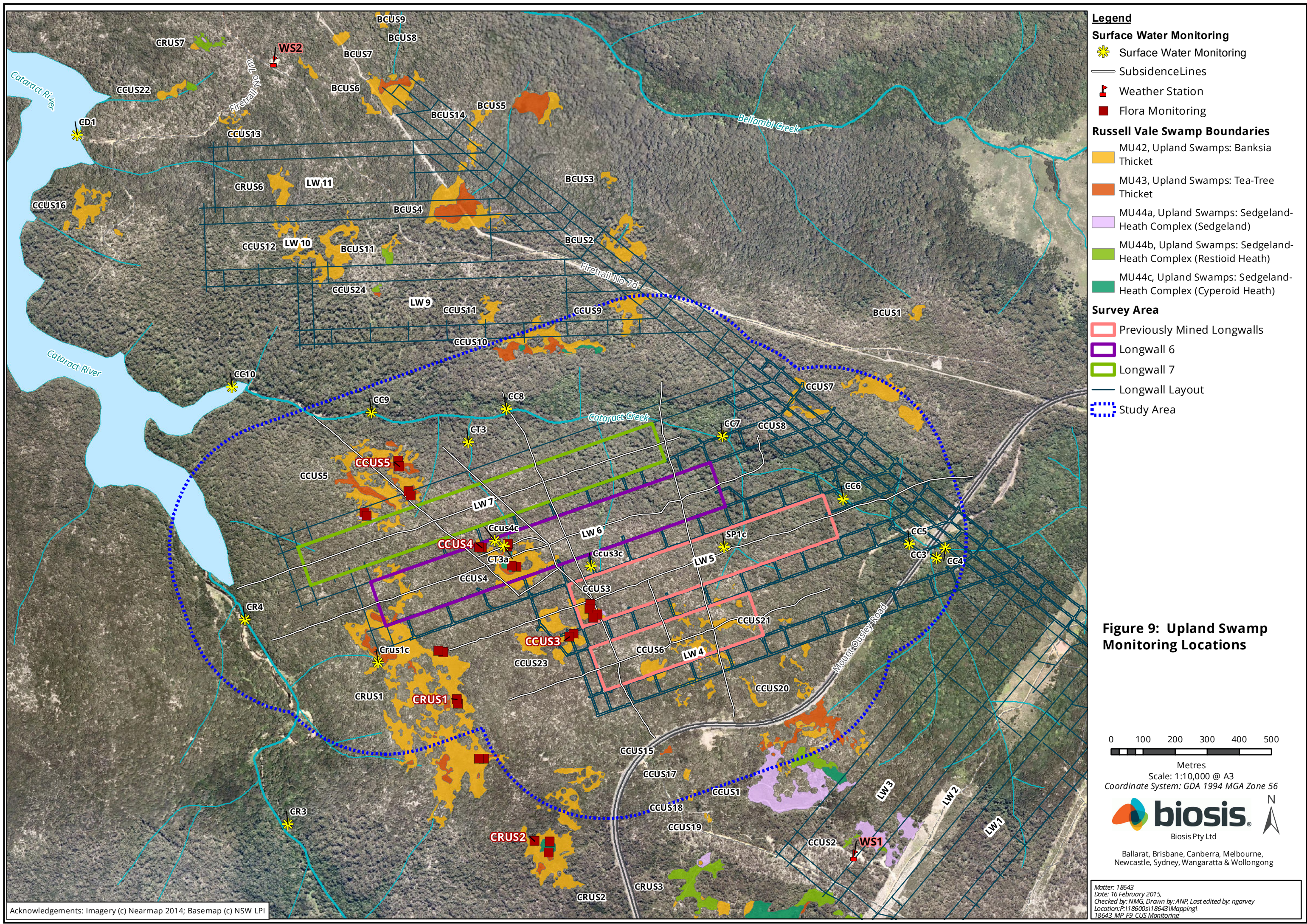
The mean Shannon diversity across all sites is 2.6 (standard deviation = 0.05). These figures show a statistically significant increase ( $p < 0.05$ ); however again the rate of increase is small (an increase of less than 1%). Overall, the richness and diversity across all sites including pre and post-mining sites, and control sites can be considered reasonably static when data from 2012, 2013 and 2014 are compared. There is no evidence of a step change in richness or diversity concurrent with mining of LWs 4 and 5. However, changes as observed above indicate that data collection and analysis methods are sensitive to changes in data. Continued monitoring of sites post-mining is required to ensure sufficient data is collected to identify subtle trends.

## 5.2 Reporting

Progress against the requirements of this Plan will be reported regularly to the DP&E and other relevant agencies as required by the NSW Project Approval and DoE as required by the Commonwealth Approval.

In accordance with the requirements of **Condition 7/Schedule 5** of the NSW Project Approval and **Condition 14(d) and 14(e)** of the Commonwealth Approval, the environmental performance of the colliery will be reported on the WCL website.







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## 6 MITIGATION AND MANAGEMENT STRATEGIES

### 6.1 General

General mitigation measures are outlined in Section 7.3 of ERM (2011a) and Section 16.6 of ERM (2011b). These measures include:

- If fracturing occurs, undertake remediation works as soon as possible;
- Prioritise remediation in areas where fracturing has resulted in a loss of surface flows;
- Implement temporary fencing in areas where surface cracking has occurred to prevent injury to fauna; and
- Seek advice from an ecologist prior to implementation of remediation works.

Additional measures to mitigate impacts to upland swamps resulting from subsidence effects include:

- Undertake monitoring as described in **Section 5**;
- Manage any impacts in accordance with the TARPs;
- If impacts are observed, these must be reported as per the contingency plan (see **Section 6.3**);
- If impacts to significant upland swamp features result from subsidence effects, immediate actions should be undertaken to remediate impacts; and
- If subsidence effects are observed in other areas, increased monitoring of these areas should be undertaken.

Rehabilitation and remediation measures to remedy subsidence impacts have been outlined in NSW Planning Assessment Commission (2010) and NSW Department of Planning (2008). In creeks or watercourses with naturally high sediment loads it is likely that fracture networks will fill naturally and require little if any intervention. However creeks, watercourses or swamps without naturally high sediment loads will require intervention.

Rehabilitation and remediation options for upland swamps are further outlined below. Should upland swamp rehabilitation be necessary, the best option will be identified and implemented (subject to consultation and approval with relevant regulators). Depending on the extent of any impacts to an upland swamp, the impacts of any potential rehabilitation measures will be risk assessed with regulator and other expert input.

#### 6.1.1 Sealing of Cracks

Where bedrock controlled channels in swamps are adversely impacted and where there is limited ability for cracks to seal naturally, the cracks can be sealed by using appropriate and approved cement (or alternative) grouts, with or without approved additives that are placed where the cracks divert flow from the channel. Grout can be used with or without fillers such as clean sand.

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The objective used to gauge the success of any remedial works will be the attainment of at least 90% of the baseline flow measured under similar climatic conditions.

Generally, remediation works will use only small quantities of grout that can be mixed on site and placed by hand held equipment.

Such operations have the potential to result in additional environmental impacts and are carefully planned to avoid contamination of watercourses. Set up and mixing areas will be restricted to cleared access tracks or other open areas.

Bunds can contain local spillage at mixing points, and where required, temporary cofferdams can be built downstream of grouting sites to collect spilled materials for appropriate disposal off-site.

The selection of grouting materials is based on ensuring that there is no significant impact to water quality or the ecology of the stream.

### 6.1.2 Injection Grouting

Injection grouting involves the delivery of grout through holes drilled into the controlling rockbar of a swamp.

A variety of grouts and filler materials can be injected into the voids with the intention being to achieve a low permeability 'layer' below any affected pool, and / or the full depth of a controlling rockbar.

Grouts may be injected through grout rods to seal voids in or under swamp sediments or peat as was used at Pool 16 and 17 in the Georges River where 2 m of loose sediment was grouted through using purpose built grouting pipes (BHPBIC, 2010).

Grouting holes are drilled in a pattern in the same manner as described for pattern grouting streams, with the equipment sited on cleared access tracks, with hoses run out to the controlling rockbar.

Once mechanical packers have been installed at the surface, grout is injected into the fracture at low pressure from a tank located at a clear access location.

All equipment can be transported with vehicles capable of travelling on the access tracks.

If necessary, equipment or materials can be flown to the seismic lines by a helicopter staging from No. 4 shaft.

No large equipment will be stationed within the swamp.



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In the Georges River, the majority of pools were sealed with two to three grout passes (BHPBIC, 2010).

If flow diversion through a swamp rockbar occurs and lowers the surrounding shallow groundwater table, it may be more appropriate to implement alternative grouting techniques such as a deep grout curtain.

Rockbar grouting should preferentially be undertaken at the completion of subsidence.

### 6.1.3 Knick Point Control

Post subsidence swamps may have incised flow lines eroded into the underlying sandstone, with any increased flow potentially continuing the vertical and headward horizontal erosion of a peaty flow line.

Subsidence may also concentrate flow in the lower swamp, leading to possible development and collapse of peat tunnels into eroding channels that eventually join with the existing incised main flow line.

Erosion channels can create preferred flow paths and dewater the surrounding swamp sediments.

Coir log dams can be installed at knick points in the channelised flow paths or at the inception of tunnel / void spaces. Square coir logs used for the construction of small dams were developed specifically for swamp rehabilitation and have been successfully used during a number of swamp rehabilitation programs in the Blue Mountains and Snowy Mountains (BHPBIC, 2010).

A trench is cut into the peat / organic soil so the first layer sits on the underlying substrate or such that the top of the first coir log is at ground level.

As the coir log dam silts up, they are regularly added to by the placement of additional logs until the pooled water is at or above the eroded channel bank level, with the logs held by wooden stakes bound with wire.

The coir log dam slows the flow in the entrenched drainage lines so they silt up, which then flows through the swamp, not around it.

The dams are constructed at intervals down the eroded or entrenched flow line, then added to until the pooled water is at or above the level of the bank of the entrenched stream, or the peatbed of the swamp. At this point the stream becomes a net contributor to the swamp and does not drain water away.

Where increased filtering of flows is required the coir logs can be wrapped in jute fibre matting.

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#### 6.1.4 Water Spreading

Maintenance of swamp moisture can be enhanced by water spreading with long coir logs and hession 'sausages' linked together across the contour so that water builds up behind them and slowly seeps through the water spreaders.

The spreaders would be installed as required within shallow trenches in the swamp and along the higher margins.

#### 6.1.5 Applicability

Should upland swamp rehabilitation be necessary, the best option will be identified and implemented (subject to approval). A site specific rehabilitation action plan detailing the location and works to be implemented will be prepared following any identification of mining induced swamp degradation that exceeds specified triggers. The plan will be circulated to relevant stakeholders for comment and approval prior to finalisation.

To date, remediation measures have been attempted at a number of sites with mixed results, and it is likely that many of these would not be applicable to natural features present in the study area. Grouting in the majority of creeks and swamps in the study area would be impractical and slope stabilisation works and drainage and erosion control would likely cause substantial damage to these natural features. The impacts of any potential rehabilitation measures should be weighed up against any potential gains if the situation arises and expert input should be sought.

Implementation of any measures to remediate impacts to biodiversity features present in the study area should be undertaken in conjunction with a suitable monitoring program to determine the success of these remediation measures.

If remediation measures are not reasonable or feasible, WCL will consider options for offsetting impacts (in lieu of remediation or rehabilitation).

### 6.2 TARPS

The Trigger Action Response Plan (TARP), as presented in **Appendix B**, has been designed specifically for this USMP to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

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The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- Trigger levels from monitoring to assess performance; and,
- Triggers that flag implementation of contingency measures.

The TARP developed as a part of this USMP incorporates monitoring measures and triggers from the Subsidence Monitoring Plan (WCL, 2014a), Groundwater Management Plan (WCL 2014b) and Stream Management Plan (WCL 2014c).

### 6.3 Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in **Section 4** of this Plan, WCL will implement the following Contingency Plan:

- The observation will be reported to the Environment Manager within 24 hours.
- The observation will be recorded.
- WCL will report any exceedance of the performance measure to the DP&E, DoE and other relevant stakeholder as soon as practicable after WCL becomes aware of the exceedance.
- WCL will assess the exceedances referred to in the TARP (outlined in **Section 6.2** of this document) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s.
- The Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary.
- WCL will develop an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- WCL will submit the proposed course of action to DP&E and DoE for approval.
- WCL will implement the approved course of action to the satisfaction of DP&E and DoE.
- WCL will continue to monitor performance with the new action plan in place and, if successful, will formalise these actions as part of the Management Plan.

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

#### 6.3.1 Offsets

**Condition 6** of the Commonwealth Approval requires WCL to submit a Biodiversity Offset Strategy to the Minister for approval within one month of the commencement of the action. This Biodiversity Offset Strategy will identify offsets to be provided if the Performance



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Measures outlined in the Commonwealth Approval and detailed in Section 4 of the USMP, are exceeded.

In accordance with **Condition 3/Schedule 3** of the NSW Project Approval, the Biodiversity Offset Strategy outlined above would be implemented if the Performance Measures, outlined in the NSW Project Approval and detailed in Section 4 of the USMP, are exceeded.

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## 8 CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	16/02/2015

### Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	06/12/14	N.Garvey (Biosis) A.Wu (Hansen Bailey) K. Prajapati (WCL)	Final Draft
2	14/12/14	N.Garvey (Biosis) A.Wu and D.Munroe (Hansen Bailey) D.Clarkson (WCL)	Final for consultation
3	19/01/2015	N.Garvey (Biosis) A.Wu (Hansen Bailey) D.Clarkson (WCL)	Updates following EPBC approval
4	06/02/2015	N.Garvey (Biosis) A.Wu (Hansen Bailey) D.Clarkson (WCL)	Updates following review by the NSW Department of Planning and Environment, NSW Trade & Investment Division of Resources and Energy, Office of Environment and Heritage, NSW Office of Water and Sydney Catchment Authority
5	16/02/2015	N.Garvey (Biosis) A.Wu (Hansen Bailey) D.Clarkson (WCL)	Updates following peer review by Dr David Robertson, Cumberland Ecology, as required by Conditions 12 and 13 of the EPBC approval





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VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
6	11/03/2015	N.Garvey (Biosis) A.Wu (Hansen Bailey) D.Clarkson (WCL)	Updates following review by the Commonwealth Department of the Environment



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## Appendix A – Trigger Action Response Plan Table

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Subsidence	Subsidence monitoring through upland swamps CCUS4, CCUS5 and CRUS1.	Qualitative monitoring of rock fall or water seepage from the rock formation.  Monitoring of vertical subsidence, tilt, strain and valley closure.  3D Survey, peg to peg strain measurements and point to point high resolution survey.	Refer to Subsidence Monitoring program Section 2.	To get specific measurements of subsidence, tensile strain and compressive strain within and around upland swamps.	<b>Within prediction (Level 1):</b>  <b>Tensile strain &lt; 0.5mm/m, compressive strain &lt; 2mm/m, valley closure &lt; 200mm.</b>  <b>No visual changes to the rock formation at the base of upland swamp CCUS4.</b>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Review piezometric data to determine whether any changes in data have occurred.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>
	Subsidence monitoring along the base of CCUS4 and the rock formation that forms the rockbar.			To determine the levels of tensile strain, compressive strain and valley closure at which changes in piezometric data are observed.				
	Subsidence monitoring around CCUS4.			To document any changes in the rock formation at the base of upland swamp CCUS4.				
	Visual inspection of the rock formation at the base of upland swamp							

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
	CCUS4.				<b>Within prediction (Level 2):</b>  Levels of subsidence, tensile strain, compressive strain and valley closure in the upland swamps within limits predicted in the EA.	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review piezometric data to determine whether any changes in data have occurred.</li><li>• Report reached predicted impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

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	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<p><b>Exceeding prediction:</b></p> <p><b>Levels of subsidence, tensile strain, compressive strain and valley closure within the upland swamps greater than predicted in the EA.</b></p> <p><b>Observable impacts to the rock formation at the base of upland swamp CCUS4, including collapse or increase in seepage.</b></p>	<ul style="list-style-type: none"><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Engage hydrogeologist to investigate and report on potential impacts to hydrology of upland swamps including rainfall, groundwater levels of outflows.</li><li>• Review of data by expert consultants.</li><li>• Inform DoE, DP&amp;E and OEH of investigation outcomes.</li><li>• Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• Investigation initiated within one week of impact detection.</li><li>• DoE, DP&amp;E and OEH informed within two business days of impact detection.</li><li>• Results of investigation reported to DoE, DP&amp;E and OEH within one week of review by expert consultants.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Swamp Groundwater Levels	Piezometers in upland swamps.	Groundwater level.	<p>Two years of baseline monitoring prior to mining.</p> <p>Minimum continuous 12 hourly readings. Bi-monthly logger download and dip meter.</p> <p>Monitoring during mining.</p> <p>Minimum continuous 6 hourly readings. Fortnightly logger download and dip meter in swamps being actively undermined.</p> <p>One year post-mining in upland swamps where data shows negligible impacts (as defined by the Trigger values). If red level triggers are reached monitoring will continue in consultation with DP&amp;E, OEH and NOW, SCA, DRE</p>	<p>To measure the swamp groundwater levels.</p> <p>To determine whether subsidence results in changes in groundwater levels within upland swamps.</p> <p>Together with subsidence data from upland swamps CCUS4, CCUS5 and CRUS1, try to determine the levels of tensile strain, compressive strain and valley closure at which changes in piezometric data are observed.</p>	<p><b>Within prediction (Level 1):</b></p> <p><b>No observable mining induced change.</b></p>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>



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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
			<p>and WCC.</p> <p>Minimum continuous 12 hourly for an agreed period (minimum 1 year) after the swamp is undermined. Bi- monthly logger download and dip meter for an agreed period (minimum 1 year) after the swamp is undermined.</p>		<p><b>Within prediction (Level 2):</b></p> <p><b>Short term (less than one month) increase in the rate of water level reduction and decrease in total water level. Effect not related to climatic variability.</b></p>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Review frequency and location of monitoring and determine if additional monitoring is required.</li> <li>Inform DoE, DP&amp;E and OEH of potential impact.</li> <li>Report potential impacts in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>DoE, DP&amp;E and OEH informed within one week.</li> <li>Monitoring plan reviewed within one month of impact.</li> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<p>Exceeding prediction:</p> <p>Piezometer becomes, or stays, dry (where it has not done so previously) or the rate of water level reduction increases where the effect is not related to climatic variability.</p>	<ul style="list-style-type: none"> <li>Immediately inform DRE Director Environmental Sustainability and Land Use, Principal Subsidence Engineer.</li> <li>Inform DoE, DP&amp;E and OEH of potential impact.</li> <li>Instigate investigation within 1 week of trigger exceedance being noted.</li> <li>Engage hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge</li> <li>Inform DoE, DP&amp;E and OEH of investigation outcomes.</li> <li>Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Investigation initiated within one week of impact detection.</li> <li>DoE, DP&amp;E and OEH informed within one week of impact detection.</li> <li>Results of investigation reported to DoE, DP&amp;E and OEH within one week of completion.</li> <li>Monitoring plan reviewed within one month of impact detection.</li> <li>Commence preparation of mitigation/action and monitoring plan within one week (if required).</li> <li>Monthly updates of investigation progress, if required by DoE, DP&amp;E and OEH.</li> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Swamp Groundwater Quality	Flow gauges installed in or below upland swamps.	Field water quality (EC, pH, Fe hydroxide).  Laboratory analysis –TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered).	Two years of baseline monitoring prior to mining.  Field water quality every 2 months. Laboratory analysis every 4 months.  Monitoring during mining.  Field water quality every fortnight. Laboratory analysis every month while the swamp is being undermined.  One year post-mining in upland swamps where data shows negligible impacts (as defined by the Trigger values). If red level triggers are reached monitoring will continue in consultation with DP&E, OEH, NOW, SCA, DRE, WCC and DoE.	To measure field and laboratory water quality changes, if any, at various locations due to undermining.  To determine whether subsidence results in changes in the quality of groundwater within upland swamps.	Within prediction (Level 1):  No observable mining induced change.	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>



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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
			Field water quality monitored every month after swamp is undermined. Laboratory analysis every 4 months.		<b>Within prediction (Level 2):</b>  <b>Minimum 2 month increase in salinity or reduction in pH outside of baseline variability within the subject or similar swamps. Effect not related to climatic variability.</b>	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review frequency and location of monitoring and determine if additional monitoring is required.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Report potential impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within one week.</li><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

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	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<b>Exceeding prediction:</b> <b>&gt; 2 month duration increase in salinity or reduction in pH outside of baseline variability observed in the subject or similar swamps, where the effect is not related to climatic variability.</b>	<ul style="list-style-type: none"><li>• Immediately inform DRE Director Environmental Sustainability and Land Use, Principal Subsidence Engineer.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Instigate investigation within 1 week of trigger exceedance being noted</li><li>• Engage hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge</li><li>• Inform DoE, DP&amp;E and OEH of investigation outcomes.</li><li>• Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• Investigation initiated within one week of impact detection.</li><li>• DoE, DP&amp;E and OEH informed within one week of impact detection.</li><li>• Results of investigation reported to DoE, DP&amp;E and OEH within one week of completion.</li><li>• Monitoring plan reviewed within one month of impact detection.</li><li>• Commence preparation of mitigation/action and monitoring plan within one week (if required).</li><li>• Monthly updates of investigation progress, if required by DoE, DP&amp;E and OEH.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Swamp Discharge	Weirs measuring volumetric water flow and water quality located in or downstream of upland swamps.	Volumetric water flow is measured at at least 6-hour intervals. Field water quality (EC, pH). Laboratory analysis –TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered).	Baseline monitoring prior to mining.  Logged at at least 6-hour intervals and downloaded on a monthly basis.  Monitoring during mining.  Logged at at least 6-hour intervals and downloaded on a fortnightly basis while the swamp is being undermined.  One year post-mining in upland swamps where data shows negligible impacts (as defined by the Trigger values). If red level triggers are reached, monitoring will continue in consultation with DP&E, OEH, NOW, SCA, DRE, WCC and DoE.  Logged at at least 6-hour	To monitor volumetric water flow and water quality discharging from the upland swamps.  To determine whether changes in piezometric data (subject to climatic variability) results in changes in outflows from upland swamps and inflows to down catchment waterways.	Within prediction (Level 1):  No observable mining induced change.	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>

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	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
			intervals and downloaded on a monthly basis.		<b>Within prediction (Level 2):</b> <b>&lt;2 month lowering of swamp seepage discharge reduction outside of baseline variability and climatic variability.</b>	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review frequency and location of monitoring and determine if additional monitoring is required.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Report potential impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within one week.</li><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>



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					<b>Exceeding prediction: Redirection of surface flows with &gt;2 month reduction of swamp discharge outside of baseline variability and climatic variability.</b>	<ul style="list-style-type: none"><li>• Immediately inform DRE Director Environmental Sustainability and Land Use, Principal Subsidence Engineer.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Instigate investigation within 1 week of trigger exceedance being noted</li><li>• Engage hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge</li><li>• Inform DoE, DP&amp;E and OEH of investigation outcomes.</li><li>• Investigation of possible mitigation measures in consultation with DoE, DP&amp;E and OEH.</li><li>• Prepare and implement a site mitigation/action plan in consultation with DoE, DP&amp;E and OEH if necessary.</li><li>• Report on mitigation as soon as practicable.</li><li>• Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• Investigation initiated within one week of impact detection.</li><li>• DoE, DP&amp;E and OEH informed within one week of impact detection.</li><li>• Results of investigation reported to DoE, DP&amp;E and OEH within one week of completion.</li><li>• Monitoring plan reviewed within one month of impact detection.</li><li>• Commence preparation of mitigation/action and monitoring plan within one week (if required).</li><li>• Monthly updates of investigation progress, if required by DoE, DP&amp;E and OEH</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Rainfall	WS1 WS2	Rainfall	Continuous daily rainfall monitoring.	Provide localized climate data.	N/A	N/A	Russell Vale Colliery (Environmental Manager)	N/A

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Vegetation Monitoring	Vegetation monitoring in upland swamps.	Collection of data on all species observed in 30 0.5m x 0.5m quadrats along three 15m transects per upland swamp.	Two years of baseline monitoring prior to mining.	To determine if changes in piezometric data result in changes to the vegetation composition or distribution of species within upland swamps.	Within prediction (Level 1):  Negligible change to the composition or distribution of species, as illustrated by no statistically significant difference between control and impact sites or between impact sites before and after mining.  No change to vegetation recorded during observational monitoring.	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery(Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>
		Analyses of data looks for changes in species richness and abundance using a hierarchical analysis.  Initially, community composition is analysed looking for changes in species composition at each site. Following this, changes in species richness and diversity are measured to determine if changes have occurred over time, or between control and impact sites.  Observational monitoring will be undertaken across	Monitoring during mining.  One year post-mining in upland swamps where data shows negligible impacts (as defined by the Trigger values). If amber or red level triggers are reached monitoring will continue in consultation with DP&E, OEH and DoE.  Vegetation monitoring is undertaken twice per year in autumn and spring.					



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	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
		the study area opportunistically during surveys. Photopoint monitoring has been set up in seven upland swamps. Any dieback will be noted.			<b>Within prediction (Level 2):</b>  <b>Negligible change to the composition or distribution of species, as illustrated by a short term (less than one year duration – first year after mining commences) significant statistical difference between control and impact sites or between before and after mining at the impact sites.</b>  <b>Minimal dieback recorded during observational monitoring. Dieback restricted to single area.</b>	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review frequency and location of monitoring and determine if additional monitoring is required.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Report potential impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within one week.</li><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

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ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<p>Exceeding prediction:</p> <p>Change to the composition or distribution of species, as illustrated by a long term (greater than one year) significant statistical difference between control and impact sites or between before and after mining at the impact sites.</p> <p>Significant dieback in more than one area recorded during observational monitoring.</p>	<ul style="list-style-type: none"> <li>Engage ecologist to investigate and report on the cause of trigger exceedences and advise of potential impacts.</li> <li>DoE, Inform DP&amp;E and OEH of investigation outcomes.</li> <li>Review monitoring program, including frequency and location, and modify if necessary.</li> <li>Develop and implement impact mitigation and remediation measures in consultation with DoE, DP&amp;E and OEH.</li> <li>Develop a monitoring plan to determine the success of mitigation / remediation measures.</li> <li>If mitigation / remediation measures are unsuccessful or not feasible, determine whether offsets will be required. An offset strategy/offset management plan will be developed in consultation with DoE, DP&amp;E and OEH.</li> <li>Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li> </ul>	<p>Russell Vale Colliery (Environmental Manager)</p>	<ul style="list-style-type: none"> <li>DoE, DP&amp;E and OEH informed within 1 week of impact detection.</li> <li>Investigation initiated within 1 week of impact detection.</li> <li>Results of investigation reported to DoE, DP&amp;E and OEH within 1 week of completion.</li> <li>Monitoring plan reviewed within one month of impact detection.</li> <li>Commence preparation of mitigation/action and monitoring plan within 1 week (if required).</li> <li>Monthly updates of investigation progress, if required by DoE, DP&amp;E and OEH.</li> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>

Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Size of upland swamps	Size is measured in all upland swamps within the study area.	Detailed mapping of the boundaries of upland swamps.	<p>One baseline survey prior to mining.</p> <p>No monitoring during mining.</p> <p>If impacts to piezometric data are detected during mining additional surveys will be undertaken at 2 to 5 year intervals, for a period to be determined in consultation with DoE, DP&amp;E and OEH.</p>	To determine if changes in piezometric data result in changes to the size of upland swamps.	<p><b>Within prediction (Level 1):</b></p> <p><b>Negligible reduction in the size of upland swamps, when compared with control sites.</b></p>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery(Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>

Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<p><b>Within prediction (Level 2):</b></p> <p><b>Minor reduction in the size of upland swamps, as illustrated by statistically significant (<math>p \leq 0.15</math>) decline in the size of upland swamps (pre- to post-mining) when compared to control sites.</b></p>	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review frequency and location of monitoring and determine if additional monitoring is required.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Report potential impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within one week.</li><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>



Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<b>Exceeding prediction:</b>  <b>A reduction in the size of upland swamps, as illustrated by by statistically significant (<math>p \leq 0.1</math>) decline in the size of upland swamps (pre- to post-mining) when compared to control sites.</b>	<ul style="list-style-type: none"><li>Engage ecologist to investigate and report on the cause of trigger exceedences and advise of potential impacts.</li><li>DoE, Inform DP&amp;E and OEH of investigation outcomes.</li><li>Review monitoring program, including frequency and location, and modify if necessary.</li><li>Develop and implement impact mitigation and remediation measures in consultation with DoE, DP&amp;E, OEH and the SCA.</li><li>Develop a monitoring plan to determine the success of mitigation / remediation measures.</li><li>If mitigation / remediation measures are unsuccessful or not feasible, determine whether offsets will be required. An offset strategy will be developed in consultation with DoE, DP&amp;E and OEH.</li><li>Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>DoE, DP&amp;E and OEH informed within 1 week of impact detection.</li><li>Investigation initiated within 1 week of impact detection.</li><li>Results of investigation reported to DoE, DP&amp;E and OEH within 1 week of completion.</li><li>Monitoring plan reviewed within one month of impact detection.</li><li>Commence preparation of mitigation/action and monitoring plan within 1 week (if required).</li><li>Monthly updates of investigation progress, if required by DoE / SCA / OEH.</li><li>Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Composition of upland swamps	Composition is measured in upland swamps CCUS4, CCUS5 and CRUS1.	Detailed mapping of the vegetation sub-communities within upland swamps.	One baseline survey prior to mining.  No monitoring during mining.  If impacts to piezometric data are detected during mining additional surveys will be undertaken at 2 to 5 year intervals, for a period to be determined in consultation with DoE, DP&E and OEH.	To determine if changes in piezometric data result in changes to the composition of upland swamps.	<b>Within prediction (Level 1):</b>  <b>Negligible change in sub-community composition within an upland swamps, particularly Tea-Tree Thicket or Cyperoid Heath, when compared with control sites.</b>	<ul style="list-style-type: none"><li>Continue monitoring.</li><li>Report negligible impact in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<p><b>Within prediction (Level 2):</b></p> <p><b>Minor change in sub-community composition within an upland swamp, as illustrated by statistically significant (<math>p \leq 0.15</math>) decline in the extent of Tea-Tree Thicket or Cyperoid Heath within an upland swamp when compared to control sites.</b></p>	<ul style="list-style-type: none"><li>• Continue monitoring.</li><li>• Review frequency and location of monitoring and determine if additional monitoring is required.</li><li>• Inform DoE, DP&amp;E and OEH of potential impact.</li><li>• Report potential impacts in six monthly reports.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within one week.</li><li>• Monitoring plan reviewed within one month of impact.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>

Site	Wollongong Coal	DOC ID	RVC EC TAR 008
Type	TARP	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
					<b>Exceeding prediction:</b>  <b>A change in sub-community composition within an upland swamps when compared with control sites, as illustrated by statistically significant (<math>p \leq 0.1</math>) decline in the extent of Tea-Tree Thicket or Cyperoid Heath within an upland swamp when compared to control sites.</b>	<ul style="list-style-type: none"><li>• Engage ecologist to investigate and report on the cause of trigger exceedences and advise of potential impacts.</li><li>• DoE, Inform DP&amp;E and OEH of investigation outcomes.</li><li>• Review monitoring program, including frequency and location, and modify if necessary.</li><li>• Develop and implement impact mitigation and remediation measures in consultation with DoE, DP&amp;E, OEH and the SCA.</li><li>• Develop a monitoring plan to determine the success of mitigation / remediation measures.</li><li>• If mitigation / remediation measures are unsuccessful or not feasible, determine whether offsets will be required. An offset strategy will be developed in consultation with DoE, DP&amp;E and OEH.</li><li>• Report in annual reviews and six monthly reports to inform relevant agencies of results of monitoring.</li></ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"><li>• DoE, DP&amp;E and OEH informed within 1 week of impact detection.</li><li>• Investigation initiated within 1 week of impact detection.</li><li>• Results of investigation reported to DoE, DP&amp;E and OEH within 1 week of completion.</li><li>• Monitoring plan reviewed within one month of impact detection.</li><li>• Commence preparation of mitigation/action and monitoring plan within 1 week (if required).</li><li>• Monthly updates of investigation progress, if required by DoE / SCA / OEH.</li><li>• Six monthly reporting in accordance with Extraction Plan approval.</li></ul>





Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

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## Appendix B – Upland Swamp Flora Monitoring Baseline Data



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

**Table 13 – Upland Swamp Ecological Monitoring Baseline Data: CCUS3/23**

Site	Year	Season	Survey Date	Acacia suaveolens	Acacia terminalis	Actinotus minor	Allocasuarina littoralis	Almaleea paludosa	Anisopogon avenaceus	Baeckea imbricata	Baeckea linifolia	Baloskion gracile	Banksia ericifolia
CCUS3-V1	2012	Aut	17/05/2012			2	1			1			
CCUS3-V1	2012	Spr	13/11/2012			6	1		1	1			
CCUS3-V1	2013	Aut	19/03/2013			7							
CCUS3-V1	2013	Spr	22/11/2013			5	1						
CCUS3-V1	2014	Aut	2/05/2014			6	1			1			
CCUS3-V1	2014	Spr	27/11/2014			12	1						
CCUS3-V2	2012	Aut	17/05/2012										
CCUS3-V2	2012	Spr	13/11/2012										
CCUS3-V2	2013	Aut	19/03/2013										
CCUS3-V2	2013	Spr	22/11/2013										
CCUS3-V2	2014	Aut	2/05/2014										
CCUS3-V2	2014	Spr	27/11/2014										
CCUS3-V3	2012	Aut	31/05/2012			8			1	4		11	
CCUS3-V3	2012	Spr	13/11/2012			7				5		16	
CCUS3-V3	2013	Aut	19/03/2013			6				9		13	
CCUS3-V3	2013	Spr	21/11/2013			6			1	3		14	
CCUS3-V3	2014	Aut	2/05/2014			2				7		13	
CCUS3-V3	2014	Spr	27/11/2014			4			1			11	

[illegible]



[illegible]

Site	Year	Season	Survey Date	Callistemon citrinus	Calytrix tetragona	Cassytha glabella f_ glabella	Chordifex fastigiatus	Chorizandra cymbaria	Chorizandra sp_	Chorizandra sphaerocephala	Comesperma defoliatum	Cryptandra ericoides	Cryptostylis erecta
CCUS3-V1	2012	Aut	17/05/2012			4							
CCUS3-V1	2012	Spr	13/11/2012			5							
CCUS3-V1	2013	Aut	19/03/2013			3							
CCUS3-V1	2013	Spr	22/11/2013			4							
CCUS3-V1	2014	Aut	2/05/2014			4							
CCUS3-V1	2014	Spr	27/11/2014										
CCUS3-V2	2012	Aut	17/05/2012			3							
CCUS3-V2	2012	Spr	13/11/2012			2							
CCUS3-V2	2013	Aut	19/03/2013			9							
CCUS3-V2	2013	Spr	22/11/2013			12							
CCUS3-V2	2014	Aut	2/05/2014			9							
CCUS3-V2	2014	Spr	27/11/2014			7							
CCUS3-V3	2012	Aut	31/05/2012			6						2	
CCUS3-V3	2012	Spr	13/11/2012			8						5	
CCUS3-V3	2013	Aut	19/03/2013			5						3	
CCUS3-V3	2013	Spr	21/11/2013			2							
CCUS3-V3	2014	Aut	2/05/2014			6						2	
CCUS3-V3	2014	Spr	27/11/2014			2							

Site	Year	Season	Survey Date	Cryptostylis subulata	Cyathochaeta diandra	Dampiera sp_	Dampiera stricta	Darwinia grandiflora	Dianella caerulea	Dillwynia floribunda	Dillwynia retorta	Dillwynia sp_	Dodonaea camfieldii
CCUS3-V1	2012	Aut	17/05/2012				4						
CCUS3-V1	2012	Spr	13/11/2012				5						
CCUS3-V1	2013	Aut	19/03/2013				2						
CCUS3-V1	2013	Spr	22/11/2013				6						
CCUS3-V1	2014	Aut	2/05/2014				7						
CCUS3-V1	2014	Spr	27/11/2014				10						
CCUS3-V2	2012	Aut	17/05/2012							6			
CCUS3-V2	2012	Spr	13/11/2012							6			
CCUS3-V2	2013	Aut	19/03/2013				1			8			
CCUS3-V2	2013	Spr	22/11/2013							3			
CCUS3-V2	2014	Aut	2/05/2014							8			
CCUS3-V2	2014	Spr	27/11/2014							2			
CCUS3-V3	2012	Aut	31/05/2012				3	7					
CCUS3-V3	2012	Spr	13/11/2012				3	9					
CCUS3-V3	2013	Aut	19/03/2013				4	9					
CCUS3-V3	2013	Spr	21/11/2013				2	9					
CCUS3-V3	2014	Aut	2/05/2014				8	14					
CCUS3-V3	2014	Spr	27/11/2014				2	11					

Site	Year	Season	Survey Date	Drosera binata	Drosera peltata	Drosera spatulata	Eleocharis pusilla	Empodisma minus	Entolasia marginata	Entolasia stricta	Epacris microphylla	Epacris obtusifolia	Eucalyptus racemosa
CCUS3-V1	2012	Aut	17/05/2012					12		1			1
CCUS3-V1	2012	Spr	13/11/2012					8		1			1
CCUS3-V1	2013	Aut	19/03/2013					11		2			
CCUS3-V1	2013	Spr	22/11/2013					10					1
CCUS3-V1	2014	Aut	2/05/2014					10		5			
CCUS3-V1	2014	Spr	27/11/2014					7		4			
CCUS3-V2	2012	Aut	17/05/2012					23		8			
CCUS3-V2	2012	Spr	13/11/2012					25		10			
CCUS3-V2	2013	Aut	19/03/2013					24		15			
CCUS3-V2	2013	Spr	22/11/2013					25		5			
CCUS3-V2	2014	Aut	2/05/2014					26		13			
CCUS3-V2	2014	Spr	27/11/2014					3		12			
CCUS3-V3	2012	Aut	31/05/2012					2		6			
CCUS3-V3	2012	Spr	13/11/2012					8		4			
CCUS3-V3	2013	Aut	19/03/2013					2		8			
CCUS3-V3	2013	Spr	21/11/2013					6		4			
CCUS3-V3	2014	Aut	2/05/2014					5		6			
CCUS3-V3	2014	Spr	27/11/2014					6		6			



Site	Year	Season	Survey Date	Eucalyptus sp_	Eurychorda complanata	Genoplesium fimbriatum	Gleichenia dicarpa	Gonocarpus micranthus subsp_ micranthus	Gonocarpus sp_	Gonocarpus tetragynus	Gonocarpus teucrioides	Goodenia dimorpha	Goodenia dimorpha var_ angustifolia
CCUS3-V1	2012	Aut	17/05/2012										
CCUS3-V1	2012	Spr	13/11/2012										
CCUS3-V1	2013	Aut	19/03/2013	1						1			
CCUS3-V1	2013	Spr	22/11/2013										
CCUS3-V1	2014	Aut	2/05/2014							4			
CCUS3-V1	2014	Spr	27/11/2014	1									
CCUS3-V2	2012	Aut	17/05/2012										
CCUS3-V2	2012	Spr	13/11/2012										
CCUS3-V2	2013	Aut	19/03/2013										
CCUS3-V2	2013	Spr	22/11/2013										
CCUS3-V2	2014	Aut	2/05/2014										
CCUS3-V2	2014	Spr	27/11/2014										
CCUS3-V3	2012	Aut	31/05/2012		2								
CCUS3-V3	2012	Spr	13/11/2012		2								
CCUS3-V3	2013	Aut	19/03/2013		3	2							
CCUS3-V3	2013	Spr	21/11/2013		3								
CCUS3-V3	2014	Aut	2/05/2014		3	3							
CCUS3-V3	2014	Spr	27/11/2014		3								

Site	Year	Season	Survey Date	Goodenia heterophylla	Goodenia heterophylla subsp_ heterophylla	Goodenia sp_	Goodenia stelligera	Grevillea oleoides	Gymnoschoenus sphaerocephalus	Haemodorum planifolium	Hakea dactyloides	Hakea teretifolia subsp_ teretifolia	Hibbertia aspera
CCUS3-V1	2012	Aut	17/05/2012				2						
CCUS3-V1	2012	Spr	13/11/2012				2						
CCUS3-V1	2013	Aut	19/03/2013				3						
CCUS3-V1	2013	Spr	22/11/2013										
CCUS3-V1	2014	Aut	2/05/2014				1						
CCUS3-V1	2014	Spr	27/11/2014				2						
CCUS3-V2	2012	Aut	17/05/2012					2					
CCUS3-V2	2012	Spr	13/11/2012					1					
CCUS3-V2	2013	Aut	19/03/2013					2					
CCUS3-V2	2013	Spr	22/11/2013					1					
CCUS3-V2	2014	Aut	2/05/2014					2					
CCUS3-V2	2014	Spr	27/11/2014										
CCUS3-V3	2012	Aut	31/05/2012				2	7					
CCUS3-V3	2012	Spr	13/11/2012				3	6					
CCUS3-V3	2013	Aut	19/03/2013				2	2					
CCUS3-V3	2013	Spr	21/11/2013				1	1					
CCUS3-V3	2014	Aut	2/05/2014				2	2					
CCUS3-V3	2014	Spr	27/11/2014				2						

Site	Year	Season	Survey Date	Hibbertia bracteata	Hibbertia riparia	Hybanthus sp_	Hypericum gramineum	Isopogon anemonifolius	Lambertia formosa	Laxmannia gracilis	Lepidosperma filiforme	Lepidosperma forsythii	Lepidosperma limicola
CCUS3-V1	2012	Aut	17/05/2012										16
CCUS3-V1	2012	Spr	13/11/2012										16
CCUS3-V1	2013	Aut	19/03/2013										16
CCUS3-V1	2013	Spr	22/11/2013										14
CCUS3-V1	2014	Aut	2/05/2014										19
CCUS3-V1	2014	Spr	27/11/2014										9
CCUS3-V2	2012	Aut	17/05/2012										20
CCUS3-V2	2012	Spr	13/11/2012										20
CCUS3-V2	2013	Aut	19/03/2013										18
CCUS3-V2	2013	Spr	22/11/2013										17
CCUS3-V2	2014	Aut	2/05/2014										17
CCUS3-V2	2014	Spr	27/11/2014				1						23
CCUS3-V3	2012	Aut	31/05/2012		6								
CCUS3-V3	2012	Spr	13/11/2012		3						8		
CCUS3-V3	2013	Aut	19/03/2013		7						7		
CCUS3-V3	2013	Spr	21/11/2013		1						4		
CCUS3-V3	2014	Aut	2/05/2014		5						6		
CCUS3-V3	2014	Spr	27/11/2014		2						1		

Site	Year	Season	Survey Date	Lepidosperma neesii	Lepidosperma sp_	Lepidosperma urophorum	Leptocarpus tenax	Leptospermum arachnoides	Leptospermum juniperinum	Leptospermum lanigerum	Leptospermum polygalifolium subsp_ Polvaalifolium	Leptospermum sp_	Leptospermum squarrosus
CCUS3-V1	2012	Aut	17/05/2012				8				1		3
CCUS3-V1	2012	Spr	13/11/2012			1	13				1		2
CCUS3-V1	2013	Aut	19/03/2013				7						4
CCUS3-V1	2013	Spr	22/11/2013				13				1		3
CCUS3-V1	2014	Aut	2/05/2014				20						5
CCUS3-V1	2014	Spr	27/11/2014			5	18				2		5
CCUS3-V2	2012	Aut	17/05/2012				5						2
CCUS3-V2	2012	Spr	13/11/2012				5						
CCUS3-V2	2013	Aut	19/03/2013				4						
CCUS3-V2	2013	Spr	22/11/2013				6						
CCUS3-V2	2014	Aut	2/05/2014				10						1
CCUS3-V2	2014	Spr	27/11/2014			3	10						1
CCUS3-V3	2012	Aut	31/05/2012			6	13				2		7
CCUS3-V3	2012	Spr	13/11/2012				13						8
CCUS3-V3	2013	Aut	19/03/2013			7	11						5
CCUS3-V3	2013	Spr	21/11/2013				12						5
CCUS3-V3	2014	Aut	2/05/2014				12				3		7
CCUS3-V3	2014	Spr	27/11/2014			6	12				1		8

[illegible]



[illegible]

Site	Year	Season	Survey Date	Microtis sp_	Mirbelia rubiifolia	Mitrasacme pilosa var_ pilosa	Mitrasacme polymorpha	Mitrasacme sp_	Monotaxis linifolia	Opercularia sp_	Panicum simile	Parsonsia straminea	Patersonia sericea
CCUS3-V1	2012	Aut	17/05/2012				10						
CCUS3-V1	2012	Spr	13/11/2012			10							2
CCUS3-V1	2013	Aut	19/03/2013				10				2		1
CCUS3-V1	2013	Spr	22/11/2013				7				2		
CCUS3-V1	2014	Aut	2/05/2014			6		1			1		
CCUS3-V1	2014	Spr	27/11/2014				3				2		
CCUS3-V2	2012	Aut	17/05/2012						3	1	2	1	1
CCUS3-V2	2012	Spr	13/11/2012				1		7		7		
CCUS3-V2	2013	Aut	19/03/2013						8		6		
CCUS3-V2	2013	Spr	22/11/2013						8	2	8	1	
CCUS3-V2	2014	Aut	2/05/2014			3			5			1	
CCUS3-V2	2014	Spr	27/11/2014						3		10	2	
CCUS3-V3	2012	Aut	31/05/2012	2	2	14							2
CCUS3-V3	2012	Spr	13/11/2012		4		11				1		1
CCUS3-V3	2013	Aut	19/03/2013		2		9				3		
CCUS3-V3	2013	Spr	21/11/2013		2	4					1		2
CCUS3-V3	2014	Aut	2/05/2014		2		5						2
CCUS3-V3	2014	Spr	27/11/2014				5						2

[illegible]

Site	Year	Season	Survey Date	Pterostylis sp_	Ptilothrix deusta	Pultenaea aristata	Pultenaea divaricata	Schizaea bifida	Schoenus brevifolius	Schoenus lepidosperma	Schoenus melanostachys	Schoenus sp_	Schoenus turbinatus
CCUS3-V1	2012	Aut	17/05/2012	1	26				30				
CCUS3-V1	2012	Spr	13/11/2012		30				30				
CCUS3-V1	2013	Aut	19/03/2013		23				30				
CCUS3-V1	2013	Spr	22/11/2013		25				29				
CCUS3-V1	2014	Aut	2/05/2014		29				30				
CCUS3-V1	2014	Spr	27/11/2014		10				27				
CCUS3-V2	2012	Aut	17/05/2012		4				30				
CCUS3-V2	2012	Spr	13/11/2012		4				30				
CCUS3-V2	2013	Aut	19/03/2013		4				30				
CCUS3-V2	2013	Spr	22/11/2013		7				30				
CCUS3-V2	2014	Aut	2/05/2014		8				30				
CCUS3-V2	2014	Spr	27/11/2014		6				30				
CCUS3-V3	2012	Aut	31/05/2012		17				26				
CCUS3-V3	2012	Spr	13/11/2012		18				21				
CCUS3-V3	2013	Aut	19/03/2013		19				26				
CCUS3-V3	2013	Spr	21/11/2013		24				26				
CCUS3-V3	2014	Aut	2/05/2014		16				24				
CCUS3-V3	2014	Spr	27/11/2014		15				22				

Site	Year	Season	Survey Date	Selaginella sp_	Selaginella uliginosa	Sowerbaea juncea	Sphaerolobium sp_	Sphaerolobium vimineum	Sprengelia incarnata	Stackhousia nuda	Stylidium graminifolium	Stylidium laricifolium	Stylidium lineare
CCUS3-V1	2012	Aut	17/05/2012		4								
CCUS3-V1	2012	Spr	13/11/2012		3								
CCUS3-V1	2013	Aut	19/03/2013		6								
CCUS3-V1	2013	Spr	22/11/2013		4								1
CCUS3-V1	2014	Aut	2/05/2014		5								
CCUS3-V1	2014	Spr	27/11/2014		3			1					2
CCUS3-V2	2012	Aut	17/05/2012										
CCUS3-V2	2012	Spr	13/11/2012										
CCUS3-V2	2013	Aut	19/03/2013										
CCUS3-V2	2013	Spr	22/11/2013										
CCUS3-V2	2014	Aut	2/05/2014										
CCUS3-V2	2014	Spr	27/11/2014										
CCUS3-V3	2012	Aut	31/05/2012		14						12		
CCUS3-V3	2012	Spr	13/11/2012		15						14		
CCUS3-V3	2013	Aut	19/03/2013		15							10	
CCUS3-V3	2013	Spr	21/11/2013		16						10		
CCUS3-V3	2014	Aut	2/05/2014		14						9		
CCUS3-V3	2014	Spr	27/11/2014		19						8		



[illegible]

Site	Year	Season	Survey Date	Viola sieberana	Xanthorrhoea media	Xanthorrhoea resinosa	Xanthorrhoea sp_	Xanthosia pilosa	Xanthosia tridentata	Xyris bracteata	Xyris complanata	Xyris gracilis	Xyris operculata
CCUS3-V1	2012	Aut	17/05/2012										
CCUS3-V1	2012	Spr	13/11/2012									1	
CCUS3-V1	2013	Aut	19/03/2013									1	
CCUS3-V1	2013	Spr	22/11/2013					2				1	
CCUS3-V1	2014	Aut	2/05/2014						2			1	
CCUS3-V1	2014	Spr	27/11/2014						1			17	
CCUS3-V2	2012	Aut	17/05/2012										
CCUS3-V2	2012	Spr	13/11/2012						2				
CCUS3-V2	2013	Aut	19/03/2013						1				
CCUS3-V2	2013	Spr	22/11/2013	1					2				
CCUS3-V2	2014	Aut	2/05/2014	2									
CCUS3-V2	2014	Spr	27/11/2014	2					1				
CCUS3-V3	2012	Aut	31/05/2012							1	13		
CCUS3-V3	2012	Spr	13/11/2012								8		
CCUS3-V3	2013	Aut	19/03/2013								10		
CCUS3-V3	2013	Spr	21/11/2013						1	1	12		
CCUS3-V3	2014	Aut	2/05/2014								12		
CCUS3-V3	2014	Spr	27/11/2014							10	2	10	

Site	Year	Season	Survey Date	Xyris sp_	Xyris species complex
CCUS3-V1	2012	Aut	17/05/2012		
CCUS3-V1	2012	Spr	13/11/2012		
CCUS3-V1	2013	Aut	19/03/2013		
CCUS3-V1	2013	Spr	22/11/2013		
CCUS3-V1	2014	Aut	2/05/2014		
CCUS3-V1	2014	Spr	27/11/2014		
CCUS3-V2	2012	Aut	17/05/2012		
CCUS3-V2	2012	Spr	13/11/2012		
CCUS3-V2	2013	Aut	19/03/2013		
CCUS3-V2	2013	Spr	22/11/2013		
CCUS3-V2	2014	Aut	2/05/2014		
CCUS3-V2	2014	Spr	27/11/2014		
CCUS3-V3	2012	Aut	31/05/2012		
CCUS3-V3	2012	Spr	13/11/2012		
CCUS3-V3	2013	Aut	19/03/2013		
CCUS3-V3	2013	Spr	21/11/2013		
CCUS3-V3	2014	Aut	2/05/2014		
CCUS3-V3	2014	Spr	27/11/2014		



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

**Table 14 – Upland Swamp Ecological Monitoring Baseline Data: CCUS4**

Site	Year	Season	Survey Date	Acacia suaveolens	Acacia terminalis	Actinotus minor	Allocasuarina littoralis	Almaleea paludosa	Anisopogon avenaceus	Baeckea imbricata	Baeckea linifolia	Baloskion gracile
CCUS4-V1	2012	Aut	18/05/2012					4				
CCUS4-V1	2012	Spr	23/11/2012					2				
CCUS4-V2	2012	Aut	18/05/2012			2						
CCUS4-V2	2012	Spr	23/11/2012			4						
CCUS4-V3	2012	Aut	18/05/2012		1	14						13
CCUS4-V3	2012	Spr	23/11/2012			9						19
CCUS4-V1	2013	Aut	22/03/2013					2				
CCUS4-V1	2013	Sum	2/12/2013									
CCUS4-V2	2013	Aut	22/03/2013			1						
CCUS4-V2	2013	Sum	2/12/2013									
CCUS4-V3	2013	Aut	22/03/2013			12						15
CCUS4-V3	2013	Sum	2/12/2013			11						24
CCUS4-V1	2014	Aut	1/05/2014					1				
CCUS4-V1	2014	Sum	1/12/2014									
CCUS4-V2	2014	Aut	1/05/2014			1						
CCUS4-V2	2014	Sum	1/12/2014			1						
CCUS4-V3	2014	Aut	1/05/2014			9						17
CCUS4-V3	2014	Sum	1/12/2014			13						21



Site	Year	Season	Survey Date	Banksia ericifolia	Banksia ericifolia subsp_ericifolia	Banksia marginata	Banksia oblongifolia	Banksia paludosa	Banksia robur	Banksia spinulosa var_ spinulosa	Bauera microphylla	Bauera rubioides
CCUS4-V1	2012	Aut	18/05/2012						5			
CCUS4-V1	2012	Spr	23/11/2012						4			
CCUS4-V2	2012	Aut	18/05/2012		5							4
CCUS4-V2	2012	Spr	23/11/2012		3							5
CCUS4-V3	2012	Aut	18/05/2012		1		2					7
CCUS4-V3	2012	Spr	23/11/2012		2		1					5
CCUS4-V1	2013	Aut	22/03/2013						4			
CCUS4-V1	2013	Sum	2/12/2013						4		1	
CCUS4-V2	2013	Aut	22/03/2013		3							7
CCUS4-V2	2013	Sum	2/12/2013		2							9
CCUS4-V3	2013	Aut	22/03/2013		1		2					7
CCUS4-V3	2013	Sum	2/12/2013		1		2					7
CCUS4-V1	2014	Aut	1/05/2014						3		1	
CCUS4-V1	2014	Sum	1/12/2014						5		3	
CCUS4-V2	2014	Aut	1/05/2014		4							6
CCUS4-V2	2014	Sum	1/12/2014		3							9
CCUS4-V3	2014	Aut	1/05/2014		3		2					7
CCUS4-V3	2014	Sum	1/12/2014		2		2					7

[illegible]

Site	Year	Season	Survey Date	Bossiaea scolopendria	Burchardia umbellata	Caesia parviflora var_ parviflora	Callistemon citrinus	Calytrix tetragona	Cassytha glabella f_ glabella	Chordifex fastigiatus	Chorizandra cymbaria	Chorizandra sp_
CCUS4-V1	2012	Aut	18/05/2012									
CCUS4-V1	2012	Spr	23/11/2012								2	
CCUS4-V2	2012	Aut	18/05/2012						4			
CCUS4-V2	2012	Spr	23/11/2012						3			
CCUS4-V3	2012	Aut	18/05/2012	1					3			
CCUS4-V3	2012	Spr	23/11/2012	1					1			
CCUS4-V1	2013	Aut	22/03/2013								1	
CCUS4-V1	2013	Sum	2/12/2013									
CCUS4-V2	2013	Aut	22/03/2013						2			
CCUS4-V2	2013	Sum	2/12/2013						1			
CCUS4-V3	2013	Aut	22/03/2013	1	2				5			
CCUS4-V3	2013	Sum	2/12/2013	1					3			
CCUS4-V1	2014	Aut	1/05/2014									
CCUS4-V1	2014	Sum	1/12/2014						1		1	
CCUS4-V2	2014	Aut	1/05/2014						1			
CCUS4-V2	2014	Sum	1/12/2014						1			
CCUS4-V3	2014	Aut	1/05/2014	1	2				3			
CCUS4-V3	2014	Sum	1/12/2014	2					3			

[illegible]

Site	Year	Season	Survey Date	Dianella caerulea	Dillwynia floribunda	Dillwynia retorta	Dillwynia sp_	Dodonaea camfieldii	Drosera binata	Drosera peltata	Drosera spatulata	Eleocharis pusilla
CCUS4-V1	2012	Aut	18/05/2012									
CCUS4-V1	2012	Spr	23/11/2012						4			
CCUS4-V2	2012	Aut	18/05/2012								1	
CCUS4-V2	2012	Spr	23/11/2012								3	
CCUS4-V3	2012	Aut	18/05/2012		5						2	
CCUS4-V3	2012	Spr	23/11/2012		4						8	
CCUS4-V1	2013	Aut	22/03/2013									
CCUS4-V1	2013	Sum	2/12/2013						4			
CCUS4-V2	2013	Aut	22/03/2013								1	
CCUS4-V2	2013	Sum	2/12/2013								1	
CCUS4-V3	2013	Aut	22/03/2013		2						1	
CCUS4-V3	2013	Sum	2/12/2013		1						2	
CCUS4-V1	2014	Aut	1/05/2014									
CCUS4-V1	2014	Sum	1/12/2014						6			
CCUS4-V2	2014	Aut	1/05/2014									
CCUS4-V2	2014	Sum	1/12/2014									
CCUS4-V3	2014	Aut	1/05/2014								3	
CCUS4-V3	2014	Sum	1/12/2014		2						2	



Site	Year	Season	Survey Date	Empodisma minus	Entolasia marginata	Entolasia stricta	Epacris microphylla	Epacris obtusifolia	Eucalyptus racemosa	Eucalyptus sp_	Eurychorda complanata	Genoplesium fimbriatum
CCUS4-V1	2012	Aut	18/05/2012	30		2						
CCUS4-V1	2012	Spr	23/11/2012	29	2	1						
CCUS4-V2	2012	Aut	18/05/2012	15		8		16			8	
CCUS4-V2	2012	Spr	23/11/2012	14	9	6		11			8	
CCUS4-V3	2012	Aut	18/05/2012	4		7	15	2			1	
CCUS4-V3	2012	Spr	23/11/2012	8		13	14	1			1	
CCUS4-V1	2013	Aut	22/03/2013	28		8						
CCUS4-V1	2013	Sum	2/12/2013	29		4						
CCUS4-V2	2013	Aut	22/03/2013	15		15		15			11	
CCUS4-V2	2013	Sum	2/12/2013	14	2	12	1	10			12	
CCUS4-V3	2013	Aut	22/03/2013	11		20	11	2			1	1
CCUS4-V3	2013	Sum	2/12/2013	15		14	11	2			2	
CCUS4-V1	2014	Aut	1/05/2014	30	1	2						
CCUS4-V1	2014	Sum	1/12/2014	28		6						
CCUS4-V2	2014	Aut	1/05/2014	14		10		11			8	
CCUS4-V2	2014	Sum	1/12/2014	13		14		11			11	
CCUS4-V3	2014	Aut	1/05/2014	7		13	16	2			1	
CCUS4-V3	2014	Sum	1/12/2014	13		16	5	2			4	

Site	Year	Season	Survey Date	Gleichenia dicarpa	Gonocarpus micranthus subsp_ micranthus	Gonocarpus sp_	Gonocarpus tetragynus	Gonocarpus teucrioides	Goodenia dimorpha	Goodenia dimorpha var_ angustifolia	Goodenia heterophylla	Goodenia heterophylla subsp_ Heterophylla
CCUS4-V1	2012	Aut	18/05/2012									
CCUS4-V1	2012	Spr	23/11/2012									
CCUS4-V2	2012	Aut	18/05/2012									
CCUS4-V2	2012	Spr	23/11/2012									
CCUS4-V3	2012	Aut	18/05/2012	2								
CCUS4-V3	2012	Spr	23/11/2012	3								
CCUS4-V1	2013	Aut	22/03/2013									
CCUS4-V1	2013	Sum	2/12/2013									
CCUS4-V2	2013	Aut	22/03/2013									
CCUS4-V2	2013	Sum	2/12/2013									
CCUS4-V3	2013	Aut	22/03/2013	2								
CCUS4-V3	2013	Sum	2/12/2013	4					4			
CCUS4-V1	2014	Aut	1/05/2014									
CCUS4-V1	2014	Sum	1/12/2014									
CCUS4-V2	2014	Aut	1/05/2014		1							
CCUS4-V2	2014	Sum	1/12/2014									
CCUS4-V3	2014	Aut	1/05/2014	4								
CCUS4-V3	2014	Sum	1/12/2014	5					4			

[illegible]

Site	Year	Season	Survey Date	Hibbertia riparia	Hybanthus sp_	Hypericum gramineum	Isopogon anemonifolius	Lambertia formosa	Laxmannia gracilis	Lepidosperma filiforme	Lepidosperma forsythii	Lepidosperma limicola
CCUS4-V1	2012	Aut	18/05/2012									27
CCUS4-V1	2012	Spr	23/11/2012									20
CCUS4-V2	2012	Aut	18/05/2012									
CCUS4-V2	2012	Spr	23/11/2012									
CCUS4-V3	2012	Aut	18/05/2012				1					
CCUS4-V3	2012	Spr	23/11/2012	2			1					
CCUS4-V1	2013	Aut	22/03/2013									28
CCUS4-V1	2013	Sum	2/12/2013									23
CCUS4-V2	2013	Aut	22/03/2013									
CCUS4-V2	2013	Sum	2/12/2013									
CCUS4-V3	2013	Aut	22/03/2013	2			1					
CCUS4-V3	2013	Sum	2/12/2013									
CCUS4-V1	2014	Aut	1/05/2014									25
CCUS4-V1	2014	Sum	1/12/2014									24
CCUS4-V2	2014	Aut	1/05/2014									
CCUS4-V2	2014	Sum	1/12/2014									
CCUS4-V3	2014	Aut	1/05/2014	2			1					
CCUS4-V3	2014	Sum	1/12/2014				1					

Site	Year	Season	Survey Date	Lepidosperma neesii	Lepidosperma sp_	Lepidosperma urophorum	Leptocarpus tenax	Leptospermum arachnoides	Leptospermum juniperinum	Leptospermum lanigerum	Leptospermum polygalifolium subsp_ Polvaalifolium	Leptospermum sp_
CCUS4-V1	2012	Aut	18/05/2012				7		2			
CCUS4-V1	2012	Spr	23/11/2012	1			7		1	7		
CCUS4-V2	2012	Aut	18/05/2012			1					1	
CCUS4-V2	2012	Spr	23/11/2012			17						
CCUS4-V3	2012	Aut	18/05/2012				2				11	
CCUS4-V3	2012	Spr	23/11/2012		24		1				8	
CCUS4-V1	2013	Aut	22/03/2013				8		4	10		
CCUS4-V1	2013	Sum	2/12/2013				9		1	3		
CCUS4-V2	2013	Aut	22/03/2013									
CCUS4-V2	2013	Sum	2/12/2013	1		12						
CCUS4-V3	2013	Aut	22/03/2013				2		1		11	
CCUS4-V3	2013	Sum	2/12/2013				1				12	
CCUS4-V1	2014	Aut	1/05/2014				9			6		
CCUS4-V1	2014	Sum	1/12/2014				6		1	6		
CCUS4-V2	2014	Aut	1/05/2014	6		16						
CCUS4-V2	2014	Sum	1/12/2014			17					1	
CCUS4-V3	2014	Aut	1/05/2014		26		2				6	
CCUS4-V3	2014	Sum	1/12/2014			4					8	

Site	Year	Season	Survey Date	Leptospermum squarrosum	Leptospermum trinervium	Lepyrodia anarthria	Lepyrodia muelleri	Lepyrodia scariosa	Lepyrodia sp_	Leucopogon microphyllus var_ microphvllus	Leucopogon sp_	Lindsaea linearis
CCUS4-V1	2012	Aut	18/05/2012		9			4				
CCUS4-V1	2012	Spr	23/11/2012									
CCUS4-V2	2012	Aut	18/05/2012	3				6				1
CCUS4-V2	2012	Spr	23/11/2012	4				6				
CCUS4-V3	2012	Aut	18/05/2012		2			22				17
CCUS4-V3	2012	Spr	23/11/2012		2			24				19
CCUS4-V1	2013	Aut	22/03/2013					3				
CCUS4-V1	2013	Sum	2/12/2013									
CCUS4-V2	2013	Aut	22/03/2013	3				8				1
CCUS4-V2	2013	Sum	2/12/2013	1			2	1				
CCUS4-V3	2013	Aut	22/03/2013		3			25				19
CCUS4-V3	2013	Sum	2/12/2013		2			21				21
CCUS4-V1	2014	Aut	1/05/2014					1				
CCUS4-V1	2014	Sum	1/12/2014									
CCUS4-V2	2014	Aut	1/05/2014	2			4					
CCUS4-V2	2014	Sum	1/12/2014	2			2	1				
CCUS4-V3	2014	Aut	1/05/2014		3			20				17
CCUS4-V3	2014	Sum	1/12/2014					19				20



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Site	Year	Season	Survey Date	Opercularia sp_	Panicum simile	Parsonsia straminea	Patersonia sericea	Patersonia sp_	Persoonia mollis subsp_ nectens	Petrophile pulchella	Petrophile sessilis	Platysace linearifolia
CCUS4-V1	2012	Aut	18/05/2012									
CCUS4-V1	2012	Spr	23/11/2012									
CCUS4-V2	2012	Aut	18/05/2012									
CCUS4-V2	2012	Spr	23/11/2012									
CCUS4-V3	2012	Aut	18/05/2012									1
CCUS4-V3	2012	Spr	23/11/2012				1					1
CCUS4-V1	2013	Aut	22/03/2013									
CCUS4-V1	2013	Sum	2/12/2013									
CCUS4-V2	2013	Aut	22/03/2013									
CCUS4-V2	2013	Sum	2/12/2013									
CCUS4-V3	2013	Aut	22/03/2013									1
CCUS4-V3	2013	Sum	2/12/2013				1					
CCUS4-V1	2014	Aut	1/05/2014									
CCUS4-V1	2014	Sum	1/12/2014									
CCUS4-V2	2014	Aut	1/05/2014									
CCUS4-V2	2014	Sum	1/12/2014									
CCUS4-V3	2014	Aut	1/05/2014									1
CCUS4-V3	2014	Sum	1/12/2014				1					

[illegible]

Site	Year	Season	Survey Date	Schizaea bifida	Schoenus brevifolius	Schoenus lepidosperma	Schoenus melanostachys	Schoenus sp_	Schoenus turbinatus	Selaginella sp_	Selaginella uliginosa	Sowerbaea juncea
CCUS4-V1	2012	Aut	18/05/2012		16						3	
CCUS4-V1	2012	Spr	23/11/2012		16						2	
CCUS4-V2	2012	Aut	18/05/2012		6							
CCUS4-V2	2012	Spr	23/11/2012		3							
CCUS4-V3	2012	Aut	18/05/2012		10						6	
CCUS4-V3	2012	Spr	23/11/2012		13						11	
CCUS4-V1	2013	Aut	22/03/2013		20						4	
CCUS4-V1	2013	Sum	2/12/2013		19						2	
CCUS4-V2	2013	Aut	22/03/2013		4							
CCUS4-V2	2013	Sum	2/12/2013		5							
CCUS4-V3	2013	Aut	22/03/2013		9						11	
CCUS4-V3	2013	Sum	2/12/2013		8						10	
CCUS4-V1	2014	Aut	1/05/2014		22						1	
CCUS4-V1	2014	Sum	1/12/2014		17						4	
CCUS4-V2	2014	Aut	1/05/2014		3							
CCUS4-V2	2014	Sum	1/12/2014		4							
CCUS4-V3	2014	Aut	1/05/2014		10						10	
CCUS4-V3	2014	Sum	1/12/2014		8						11	

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Site	Year	Season	Survey Date	Styphelia laeta subsp_ laeta	Tetraria capillaris	Tetrarrhena juncea	Tetrarrhena sp_	Tetrarrhena turfosa	Thelymitra sp_	Thysanotus juncifolius	Utricularia uniflora	Viola sieberana
CCUS4-V1	2012	Aut	18/05/2012					23				
CCUS4-V1	2012	Spr	23/11/2012					17				
CCUS4-V2	2012	Aut	18/05/2012					8				
CCUS4-V2	2012	Spr	23/11/2012					10				
CCUS4-V3	2012	Aut	18/05/2012					5				
CCUS4-V3	2012	Spr	23/11/2012					10				
CCUS4-V1	2013	Aut	22/03/2013					23				
CCUS4-V1	2013	Sum	2/12/2013					23				
CCUS4-V2	2013	Aut	22/03/2013					7				
CCUS4-V2	2013	Sum	2/12/2013					7				
CCUS4-V3	2013	Aut	22/03/2013					8				
CCUS4-V3	2013	Sum	2/12/2013					9				
CCUS4-V1	2014	Aut	1/05/2014		2			22				
CCUS4-V1	2014	Sum	1/12/2014					22				
CCUS4-V2	2014	Aut	1/05/2014			5						
CCUS4-V2	2014	Sum	1/12/2014					11				
CCUS4-V3	2014	Aut	1/05/2014					8				
CCUS4-V3	2014	Sum	1/12/2014					8				

Site	Year	Season	Survey Date	Xanthorrhoea media	Xanthorrhoea resinosa	Xanthorrhoea sp_	Xanthosia pilosa	Xanthosia tridentata	Xyris bracteata	Xyris complanata	Xyris gracilis	Xyris operculata
CCUS4-V1	2012	Aut	18/05/2012			1						9
CCUS4-V1	2012	Spr	23/11/2012			1						6
CCUS4-V2	2012	Aut	18/05/2012			1		1				
CCUS4-V2	2012	Spr	23/11/2012					1				
CCUS4-V3	2012	Aut	18/05/2012					2		2		
CCUS4-V3	2012	Spr	23/11/2012					4				
CCUS4-V1	2013	Aut	22/03/2013									5
CCUS4-V1	2013	Sum	2/12/2013			1						15
CCUS4-V2	2013	Aut	22/03/2013					1				
CCUS4-V2	2013	Sum	2/12/2013					2				
CCUS4-V3	2013	Aut	22/03/2013					2		4		1
CCUS4-V3	2013	Sum	2/12/2013					4		2		
CCUS4-V1	2014	Aut	1/05/2014			1						8
CCUS4-V1	2014	Sum	1/12/2014			1						15
CCUS4-V2	2014	Aut	1/05/2014					3				
CCUS4-V2	2014	Sum	1/12/2014					1				
CCUS4-V3	2014	Aut	1/05/2014					6		3		5
CCUS4-V3	2014	Sum	1/12/2014					5		2		

Site	Year	Season	Survey Date	Xyris sp_	Xyris species complex
CCUS4-V1	2012	Aut	18/05/2012		
CCUS4-V1	2012	Spr	23/11/2012		
CCUS4-V2	2012	Aut	18/05/2012		
CCUS4-V2	2012	Spr	23/11/2012		
CCUS4-V3	2012	Aut	18/05/2012		
CCUS4-V3	2012	Spr	23/11/2012		
CCUS4-V1	2013	Aut	22/03/2013		
CCUS4-V1	2013	Sum	2/12/2013		
CCUS4-V2	2013	Aut	22/03/2013		
CCUS4-V2	2013	Sum	2/12/2013		
CCUS4-V3	2013	Aut	22/03/2013		
CCUS4-V3	2013	Sum	2/12/2013		
CCUS4-V1	2014	Aut	1/05/2014		
CCUS4-V1	2014	Sum	1/12/2014		
CCUS4-V2	2014	Aut	1/05/2014		
CCUS4-V2	2014	Sum	1/12/2014		
CCUS4-V3	2014	Aut	1/05/2014		
CCUS4-V3	2014	Sum	1/12/2014		



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

**Table 15 – Upland Swamp Ecological Monitoring Baseline Data: CCUS5**

Site	Year	Season	Survey Date	Acacia suaveolens	Acacia terminalis	Actinotus minor	Allocasuarina littoralis	Almaleea paludosa	Anisopogon avenaceus	Baeckea imbricata	Baeckea linifolia	Baloskion gracile
CCUS5-V1	2013	Aut	22/05/2013			1						
CCUS5-V1	2013	Sum	6/12/2013			2						
CCUS5-V2	2013	Aut	22/05/2013									2
CCUS5-V2	2013	Sum	6/12/2013									4
CCUS5-V3	2013	Aut	22/05/2013					5				
CCUS5-V3	2013	Sum	6/12/2013					4				2
CCUS5-V1	2014	Aut	19/05/2014			1						
CCUS5-V1	2014	Sum	2/12/2014			1						
CCUS5-V2	2014	Aut	19/05/2014									1
CCUS5-V2	2014	Sum	2/12/2014									3
CCUS5-V3	2014	Aut	19/05/2014					3				
CCUS5-V3	2014	Sum	2/12/2014					2				

Site	Year	Season	Survey Date	Banksia ericifolia	Banksia ericifolia subsp_ ericifolia	Banksia marginata	Banksia oblongifolia	Banksia paludosa	Banksia robur	Banksia spinulosa var_ spinulosa	Bauera microphylla	Bauera rubioides
CCUS5-V1	2013	Aut	22/05/2013		3							
CCUS5-V1	2013	Sum	6/12/2013		2	1						
CCUS5-V2	2013	Aut	22/05/2013									
CCUS5-V2	2013	Sum	6/12/2013									
CCUS5-V3	2013	Aut	22/05/2013		2				5		3	
CCUS5-V3	2013	Sum	6/12/2013		1				5		4	
CCUS5-V1	2014	Aut	19/05/2014		3							
CCUS5-V1	2014	Sum	2/12/2014		5							
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CCUS5-V3	2014	Aut	19/05/2014		2				5		2	
CCUS5-V3	2014	Sum	2/12/2014		2				5		3	



Site	Year	Season	Survey Date	Baumea articulata	Baumea juncea	Baumea rubiginosa	Baumea teretifolia	Billardiera scandens var_ scandens	Blandfordia nobilis	Blandfordia sp_	Boronia parviflora	Bossiaea heterophylla
CCUS5-V1	2013	Aut	22/05/2013			5						
CCUS5-V1	2013	Sum	6/12/2013			7						
CCUS5-V2	2013	Aut	22/05/2013			8						
CCUS5-V2	2013	Sum	6/12/2013			6						
CCUS5-V3	2013	Aut	22/05/2013			9						
CCUS5-V3	2013	Sum	6/12/2013			8						
CCUS5-V1	2014	Aut	19/05/2014			6						2
CCUS5-V1	2014	Sum	2/12/2014			7						
CCUS5-V2	2014	Aut	19/05/2014			6		1				
CCUS5-V2	2014	Sum	2/12/2014			5		1				
CCUS5-V3	2014	Aut	19/05/2014			7						
CCUS5-V3	2014	Sum	2/12/2014			10						

Site	Year	Season	Survey Date	Bossiaea scolopendria	Burchardia umbellata	Caesia parviflora var_ parviflora	Callistemon citrinus	Calytrix tetragona	Cassytha glabella f_ glabella	Chordifex fastigiatus	Chorizandra cymbaria	Chorizandra sp_
CCUS5-V1	2013	Aut	22/05/2013						7			
CCUS5-V1	2013	Sum	6/12/2013						2			
CCUS5-V2	2013	Aut	22/05/2013						1		19	
CCUS5-V2	2013	Sum	6/12/2013						2		18	
CCUS5-V3	2013	Aut	22/05/2013						7			
CCUS5-V3	2013	Sum	6/12/2013						10			
CCUS5-V1	2014	Aut	19/05/2014						16			
CCUS5-V1	2014	Sum	2/12/2014		1				4			
CCUS5-V2	2014	Aut	19/05/2014						1		8	
CCUS5-V2	2014	Sum	2/12/2014								8	
CCUS5-V3	2014	Aut	19/05/2014						4			
CCUS5-V3	2014	Sum	2/12/2014						8			

[illegible]

Site	Year	Season	Survey Date	Dianella caerulea	Dillwynia floribunda	Dillwynia retorta	Dillwynia sp_	Dodonaea camfieldii	Drosera binata	Drosera peltata	Drosera spatulata	Eleocharis pusilla
CCUS5-V1	2013	Aut	22/05/2013		6						7	
CCUS5-V1	2013	Sum	6/12/2013		5				1		6	
CCUS5-V2	2013	Aut	22/05/2013			1						
CCUS5-V2	2013	Sum	6/12/2013									
CCUS5-V3	2013	Aut	22/05/2013									
CCUS5-V3	2013	Sum	6/12/2013						22			
CCUS5-V1	2014	Aut	19/05/2014		6						3	
CCUS5-V1	2014	Sum	2/12/2014		8					2	2	
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CCUS5-V3	2014	Aut	19/05/2014		1				5			
CCUS5-V3	2014	Sum	2/12/2014		1				24			

Site	Year	Season	Survey Date	Empodisma minus	Entolasia marginata	Entolasia stricta	Epacris microphylla	Epacris obtusifolia	Eucalyptus racemosa	Eucalyptus sp_	Eurychorda complanata	Genoplesium fimbriatum
CCUS5-V1	2013	Aut	22/05/2013	27	1	3	4					
CCUS5-V1	2013	Sum	6/12/2013	30		3	10					
CCUS5-V2	2013	Aut	22/05/2013	18		1						
CCUS5-V2	2013	Sum	6/12/2013	25		2						
CCUS5-V3	2013	Aut	22/05/2013	30				7				
CCUS5-V3	2013	Sum	6/12/2013	30		2		10				
CCUS5-V1	2014	Aut	19/05/2014	29		3	7					
CCUS5-V1	2014	Sum	2/12/2014	27	1		6					
CCUS5-V2	2014	Aut	19/05/2014	28		3						
CCUS5-V2	2014	Sum	2/12/2014	25		2						
CCUS5-V3	2014	Aut	19/05/2014	30				7				
CCUS5-V3	2014	Sum	2/12/2014	27				6				

Site	Year	Season	Survey Date	Gleichenia dicarpa	Gonocarpus micranthus subsp_ micranthus	Gonocarpus sp_	Gonocarpus tetragynus	Gonocarpus teucrioides	Goodenia dimorpha	Goodenia dimorpha var_ angustifolia	Goodenia heterophylla	Goodenia heterophylla subsp_ Heterophylla
CCUS5-V1	2013	Aut	22/05/2013	17								
CCUS5-V1	2013	Sum	6/12/2013	16								
CCUS5-V2	2013	Aut	22/05/2013	30							1	
CCUS5-V2	2013	Sum	6/12/2013	30								1
CCUS5-V3	2013	Aut	22/05/2013	3								
CCUS5-V3	2013	Sum	6/12/2013	4								
CCUS5-V1	2014	Aut	19/05/2014	19								
CCUS5-V1	2014	Sum	2/12/2014	17								
CCUS5-V2	2014	Aut	19/05/2014	30							1	
CCUS5-V2	2014	Sum	2/12/2014	29								
CCUS5-V3	2014	Aut	19/05/2014	6								
CCUS5-V3	2014	Sum	2/12/2014	5								



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[illegible]

Site	Year	Season	Survey Date	Lepidosperma neesii	Lepidosperma sp_	Lepidosperma urophorum	Leptocarpus tenax	Leptospermum arachnoides	Leptospermum juniperinum	Leptospermum lanigerum	Leptospermum polygalifolium subsp_ Polvaalifolium	Leptospermum sp_
CCUS5-V1	2013	Aut	22/05/2013				11				10	
CCUS5-V1	2013	Sum	6/12/2013				15				10	
CCUS5-V2	2013	Aut	22/05/2013				3		2	1		
CCUS5-V2	2013	Sum	6/12/2013				3		2	2		
CCUS5-V3	2013	Aut	22/05/2013				9		5		2	
CCUS5-V3	2013	Sum	6/12/2013				10		5		2	
CCUS5-V1	2014	Aut	19/05/2014			25	15				16	
CCUS5-V1	2014	Sum	2/12/2014			14	6				10	
CCUS5-V2	2014	Aut	19/05/2014				4		2	1		
CCUS5-V2	2014	Sum	2/12/2014				4		2	1		
CCUS5-V3	2014	Aut	19/05/2014				5		5		2	
CCUS5-V3	2014	Sum	2/12/2014				2		5		1	

Site	Year	Season	Survey Date	Leptospermum squarrosum	Leptospermum trinervium	Lepyrodia anarthria	Lepyrodia muelleri	Lepyrodia scariosa	Lepyrodia sp_	Leucopogon microphyllus var_ microphyllus	Leucopogon sp_	Lindsaea linearis
CCUS5-V1	2013	Aut	22/05/2013					3				
CCUS5-V1	2013	Sum	6/12/2013					5				
CCUS5-V2	2013	Aut	22/05/2013									
CCUS5-V2	2013	Sum	6/12/2013					2				
CCUS5-V3	2013	Aut	22/05/2013					7				
CCUS5-V3	2013	Sum	6/12/2013					11				
CCUS5-V1	2014	Aut	19/05/2014			2		7				
CCUS5-V1	2014	Sum	2/12/2014					10				
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CCUS5-V3	2014	Aut	19/05/2014					7				
CCUS5-V3	2014	Sum	2/12/2014					8				

[illegible]

[illegible]

[illegible]



[illegible]

Site	Year	Season	Survey Date	Schizaea bifida	Schoenus brevifolius	Schoenus lepidosperma	Schoenus melanostachys	Schoenus sp_	Schoenus turbinatus	Selaginella sp_	Selaginella uliginosa	Sowerbaea juncea
CCUS5-V1	2013	Aut	22/05/2013		9						7	
CCUS5-V1	2013	Sum	6/12/2013		10						10	
CCUS5-V2	2013	Aut	22/05/2013		30							
CCUS5-V2	2013	Sum	6/12/2013		30							
CCUS5-V3	2013	Aut	22/05/2013		26						4	
CCUS5-V3	2013	Sum	6/12/2013		30						4	
CCUS5-V1	2014	Aut	19/05/2014	1	11						6	
CCUS5-V1	2014	Sum	2/12/2014		14						8	
CCUS5-V2	2014	Aut	19/05/2014		26							
CCUS5-V2	2014	Sum	2/12/2014		26							
CCUS5-V3	2014	Aut	19/05/2014		27						4	
CCUS5-V3	2014	Sum	2/12/2014		24						4	

[illegible]

Site	Year	Season	Survey Date	Styphelia laeta subsp_ laeta	Tetraria capillaris	Tetrarrhena juncea	Tetrarrhena sp_	Tetrarrhena turfosa	Thelymitra sp_	Thysanotus juncifolius	Utricularia uniflora	Viola sieberana
CCUS5-V1	2013	Aut	22/05/2013		30			29				
CCUS5-V1	2013	Sum	6/12/2013		30			30		1		
CCUS5-V2	2013	Aut	22/05/2013					4				
CCUS5-V2	2013	Sum	6/12/2013					6				
CCUS5-V3	2013	Aut	22/05/2013					30				
CCUS5-V3	2013	Sum	6/12/2013					30				
CCUS5-V1	2014	Aut	19/05/2014		29			28				
CCUS5-V1	2014	Sum	2/12/2014		24			24				
CCUS5-V2	2014	Aut	19/05/2014					5				
CCUS5-V2	2014	Sum	2/12/2014					5				
CCUS5-V3	2014	Aut	19/05/2014					30				
CCUS5-V3	2014	Sum	2/12/2014					28				

[illegible]

Site	Year	Season	Survey Date	Xyris sp_	Xyris species complex
CCUS5-V1	2013	Aut	22/05/2013		
CCUS5-V1	2013	Sum	6/12/2013		
CCUS5-V2	2013	Aut	22/05/2013		
CCUS5-V2	2013	Sum	6/12/2013		
CCUS5-V3	2013	Aut	22/05/2013		
CCUS5-V3	2013	Sum	6/12/2013		
CCUS5-V1	2014	Aut	19/05/2014		3
CCUS5-V1	2014	Sum	2/12/2014		
CCUS5-V2	2014	Aut	19/05/2014		2
CCUS5-V2	2014	Sum	2/12/2014		2
CCUS5-V3	2014	Aut	19/05/2014		
CCUS5-V3	2014	Sum	2/12/2014		



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

**Table 16 – Upland Swamp Ecological Monitoring Baseline Data: CRUS1**



[illegible]

Site	Year	Season	Survey Date	Banksia ericifolia	Banksia ericifolia subsp_ ericifolia	Banksia marginata	Banksia oblongifolia	Banksia paludosa	Banksia robur	Banksia spinulosa var_ spinulosa	Bauera microphylla	Bauera rubioides
CRUS1-V1	2011	Aut	13/05/2011		3				5		3	
CRUS1-V1	2011	Spr	17/11/2011		2				6		3	
CRUS1-V2	2011	Aut	13/05/2011		3							
CRUS1-V2	2011	Spr	17/11/2011		4							
CRUS1-V3	2011	Aut	13/05/2011		2				7			
CRUS1-V3	2011	Spr	17/11/2011		3				6			
CRUS1-V1	2012	Aut	18/04/2012		5				7		1	
CRUS1-V1	2012	Spr	6/11/2012		4				7		4	
CRUS1-V2	2012	Aut	18/04/2012		2							
CRUS1-V2	2012	Spr	6/11/2012		2							
CRUS1-V3	2012	Aut	18/04/2012		4				5			
CRUS1-V3	2012	Spr	1/10/2012		3				4			
CCUS5-V1	2013	Aut	22/05/2013		3							
CCUS5-V1	2013	Sum	6/12/2013		2	1						
CCUS5-V2	2013	Aut	22/05/2013									
CCUS5-V2	2013	Sum	6/12/2013									
CRUS1-V1	2013	Aut	22/03/2013		3				5		2	
CRUS1-V1	2013	Sum	2/12/2013		6				4		2	
CRUS1-V2	2013	Aut	22/03/2013		1							
CRUS1-V2	2013	Sum	2/12/2013		1							
CRUS1-V3	2013	Aut	22/03/2013		2				2			
CRUS1-V3	2013	Sum	2/12/2013		2				2			
CCUS5-V1	2014	Aut	19/05/2014		3							
CCUS5-V1	2014	Sum	2/12/2014		5							
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CRUS1-V1	2014	Aut	1/05/2014		2				4		1	
CRUS1-V1	2014	Sum	5/12/2014		3				4		2	
CRUS1-V2	2014	Aut	1/05/2014		3							
CRUS1-V2	2014	Sum	5/12/2014		1							
CRUS1-V3	2014	Aut	1/05/2014		2				3			
CRUS1-V3	2014	Sum	5/12/2014		2				4			



Site	Year	Season	Survey Date	Bossiaea scolopendria	Burchardia umbellata	Caesia parviflora var_ parviflora	Callistemon citrinus	Calytrix tetragona	Cassytha glabella f_ glabella	Chordifex fastigiatus	Chorizandra cymbaria	Chorizandra sp_
CRUS1-V1	2011	Aut	13/05/2011				1		9			
CRUS1-V1	2011	Spr	17/11/2011				1		8			
CRUS1-V2	2011	Aut	13/05/2011		3				4			
CRUS1-V2	2011	Spr	17/11/2011		2				4			
CRUS1-V3	2011	Aut	13/05/2011						1			
CRUS1-V3	2011	Spr	17/11/2011									
CRUS1-V1	2012	Aut	18/04/2012				2		5			
CRUS1-V1	2012	Spr	6/11/2012				1		8		2	
CRUS1-V2	2012	Aut	18/04/2012						2			
CRUS1-V2	2012	Spr	6/11/2012		1							
CRUS1-V3	2012	Aut	18/04/2012									1
CRUS1-V3	2012	Spr	1/10/2012						1			
CCUS5-V1	2013	Aut	22/05/2013						7			
CCUS5-V1	2013	Sum	6/12/2013						2			
CCUS5-V2	2013	Aut	22/05/2013						1		19	
CCUS5-V2	2013	Sum	6/12/2013						2		18	
CRUS1-V1	2013	Aut	22/03/2013						8			
CRUS1-V1	2013	Sum	2/12/2013				1		5			
CRUS1-V2	2013	Aut	22/03/2013						2			
CRUS1-V2	2013	Sum	2/12/2013		1				7			
CRUS1-V3	2013	Aut	22/03/2013									
CRUS1-V3	2013	Sum	2/12/2013						1			
CCUS5-V1	2014	Aut	19/05/2014						16			
CCUS5-V1	2014	Sum	2/12/2014		1				4			
CCUS5-V2	2014	Aut	19/05/2014						1		8	
CCUS5-V2	2014	Sum	2/12/2014								8	
CRUS1-V1	2014	Aut	1/05/2014						7			
CRUS1-V1	2014	Sum	5/12/2014						8			
CRUS1-V2	2014	Aut	1/05/2014						1			
CRUS1-V2	2014	Sum	5/12/2014						1			
CRUS1-V3	2014	Aut	1/05/2014						2			
CRUS1-V3	2014	Sum	5/12/2014						5			





Site	Year	Season	Survey Date	Empodisma minus	Entolasia marginata	Entolasia stricta	Epacris microphylla	Epacris obtusifolia	Eucalyptus racemosa	Eucalyptus sp_	Eurychorda complanata	Genoplesium fimbriatum
CRUS1-V1	2011	Aut	13/05/2011	23				7				
CRUS1-V1	2011	Spr	17/11/2011	25				8			1	
CRUS1-V2	2011	Aut	13/05/2011	11		4						
CRUS1-V2	2011	Spr	17/11/2011			9						
CRUS1-V3	2011	Aut	13/05/2011	28								
CRUS1-V3	2011	Spr	17/11/2011	26								
CRUS1-V1	2012	Aut	18/04/2012	18				6				
CRUS1-V1	2012	Spr	6/11/2012	29				5				
CRUS1-V2	2012	Aut	18/04/2012	8		5						
CRUS1-V2	2012	Spr	6/11/2012			9	1					
CRUS1-V3	2012	Aut	18/04/2012	30								
CRUS1-V3	2012	Spr	1/10/2012	28								
CCUS5-V1	2013	Aut	22/05/2013	27	1	3	4					
CCUS5-V1	2013	Sum	6/12/2013	30		3	10					
CCUS5-V2	2013	Aut	22/05/2013	18		1						
CCUS5-V2	2013	Sum	6/12/2013	25		2						
CRUS1-V1	2013	Aut	22/03/2013	29				1				
CRUS1-V1	2013	Sum	2/12/2013	30				2				
CRUS1-V2	2013	Aut	22/03/2013	8		16						
CRUS1-V2	2013	Sum	2/12/2013	2		19						
CRUS1-V3	2013	Aut	22/03/2013	29		2						
CRUS1-V3	2013	Sum	2/12/2013	30		1						
CCUS5-V1	2014	Aut	19/05/2014	29		3	7					
CCUS5-V1	2014	Sum	2/12/2014	27	1		6					
CCUS5-V2	2014	Aut	19/05/2014	28		3						
CCUS5-V2	2014	Sum	2/12/2014	25		2						
CRUS1-V1	2014	Aut	1/05/2014	24				5			1	
CRUS1-V1	2014	Sum	5/12/2014	30				5				
CRUS1-V2	2014	Aut	1/05/2014	1		8	2					
CRUS1-V2	2014	Sum	5/12/2014			7					1	
CRUS1-V3	2014	Aut	1/05/2014	23								
CRUS1-V3	2014	Sum	5/12/2014	30								



Site	Year	Season	Survey Date	Gleichenia dicarpa	Gonocarpus micranthus subsp_ micranthus	Gonocarpus sp_	Gonocarpus tetragynus	Gonocarpus teucrioides	Goodenia dimorpha	Goodenia dimorpha var_ angustifolia	Goodenia heterophylla	Goodenia heterophylla subsp_ Heterophylla
CRUS1-V1	2011	Aut	13/05/2011				1					
CRUS1-V1	2011	Spr	17/11/2011									
CRUS1-V2	2011	Aut	13/05/2011									
CRUS1-V2	2011	Spr	17/11/2011									
CRUS1-V3	2011	Aut	13/05/2011									
CRUS1-V3	2011	Spr	17/11/2011									
CRUS1-V1	2012	Aut	18/04/2012									
CRUS1-V1	2012	Spr	6/11/2012									
CRUS1-V2	2012	Aut	18/04/2012									
CRUS1-V2	2012	Spr	6/11/2012									
CRUS1-V3	2012	Aut	18/04/2012									
CRUS1-V3	2012	Spr	1/10/2012		1							
CCUS5-V1	2013	Aut	22/05/2013	17								
CCUS5-V1	2013	Sum	6/12/2013	16								
CCUS5-V2	2013	Aut	22/05/2013	30							1	
CCUS5-V2	2013	Sum	6/12/2013	30								1
CRUS1-V1	2013	Aut	22/03/2013									
CRUS1-V1	2013	Sum	2/12/2013									
CRUS1-V2	2013	Aut	22/03/2013				1					
CRUS1-V2	2013	Sum	2/12/2013									
CRUS1-V3	2013	Aut	22/03/2013	1								
CRUS1-V3	2013	Sum	2/12/2013	2								
CCUS5-V1	2014	Aut	19/05/2014	19								
CCUS5-V1	2014	Sum	2/12/2014	17								
CCUS5-V2	2014	Aut	19/05/2014	30							1	
CCUS5-V2	2014	Sum	2/12/2014	29								
CRUS1-V1	2014	Aut	1/05/2014				1					
CRUS1-V1	2014	Sum	5/12/2014									
CRUS1-V2	2014	Aut	1/05/2014				2					
CRUS1-V2	2014	Sum	5/12/2014				1					
CRUS1-V3	2014	Aut	1/05/2014	2								
CRUS1-V3	2014	Sum	5/12/2014	2								

[illegible]

[illegible]

Site	Year	Season	Survey Date	Lepidosperma neesii	Lepidosperma sp_	Lepidosperma urophorum	Leptocarpus tenax	Leptospermum arachnoides	Leptospermum juniperinum	Leptospermum lanigerum	Leptospermum polygalifolium subsp_ Polvaalifolium	Leptospermum sp_
CRUS1-V1	2011	Aut	13/05/2011	4			24		12	2		
CRUS1-V1	2011	Spr	17/11/2011	17			18		14	3		
CRUS1-V2	2011	Aut	13/05/2011	4			2					
CRUS1-V2	2011	Spr	17/11/2011	1			1					10
CRUS1-V3	2011	Aut	13/05/2011	3			27		3			
CRUS1-V3	2011	Spr	17/11/2011	2			24		2			
CRUS1-V1	2012	Aut	18/04/2012	11			21		9	3		
CRUS1-V1	2012	Spr	6/11/2012	18			23		17	3		
CRUS1-V2	2012	Aut	18/04/2012								1	
CRUS1-V2	2012	Spr	6/11/2012									
CRUS1-V3	2012	Aut	18/04/2012	1			28		2			
CRUS1-V3	2012	Spr	1/10/2012				26		3			
CCUS5-V1	2013	Aut	22/05/2013				11				10	
CCUS5-V1	2013	Sum	6/12/2013				15				10	
CCUS5-V2	2013	Aut	22/05/2013				3		2	1		
CCUS5-V2	2013	Sum	6/12/2013				3		2	2		
CRUS1-V1	2013	Aut	22/03/2013				22		13			
CRUS1-V1	2013	Sum	2/12/2013				25		15	4		
CRUS1-V2	2013	Aut	22/03/2013			4						
CRUS1-V2	2013	Sum	2/12/2013				1					
CRUS1-V3	2013	Aut	22/03/2013				27		2			
CRUS1-V3	2013	Sum	2/12/2013				27		2			
CCUS5-V1	2014	Aut	19/05/2014			25	15				16	
CCUS5-V1	2014	Sum	2/12/2014			14	6				10	
CCUS5-V2	2014	Aut	19/05/2014				4		2	1		
CCUS5-V2	2014	Sum	2/12/2014				4		2	1		
CRUS1-V1	2014	Aut	1/05/2014			1	21		14	2		
CRUS1-V1	2014	Sum	5/12/2014			1	19		10	6		
CRUS1-V2	2014	Aut	1/05/2014			12						
CRUS1-V2	2014	Sum	5/12/2014	1		10						
CRUS1-V3	2014	Aut	1/05/2014			2	18		2			
CRUS1-V3	2014	Sum	5/12/2014			1	17		3			

Site	Year	Season	Survey Date	Leptospermum squarrosum	Leptospermum trinervium	Lepyrodia anarthria	Lepyrodia muelleri	Lepyrodia scariosa	Lepyrodia sp_	Leucopogon microphyllus var_ microphyllus	Leucopogon sp_	Lindsaea linearis
CRUS1-V1	2011	Aut	13/05/2011	5			5	7	18			3
CRUS1-V1	2011	Spr	17/11/2011	3			5	8				4
CRUS1-V2	2011	Aut	13/05/2011	17				30				4
CRUS1-V2	2011	Spr	17/11/2011	17				28				7
CRUS1-V3	2011	Aut	13/05/2011	4				1	1			
CRUS1-V3	2011	Spr	17/11/2011	5				2				
CRUS1-V1	2012	Aut	18/04/2012	5				6				
CRUS1-V1	2012	Spr	6/11/2012	6				10				
CRUS1-V2	2012	Aut	18/04/2012	21				28				4
CRUS1-V2	2012	Spr	6/11/2012	16				28				2
CRUS1-V3	2012	Aut	18/04/2012	4				2				
CRUS1-V3	2012	Spr	1/10/2012	3				2				
CCUS5-V1	2013	Aut	22/05/2013					3				
CCUS5-V1	2013	Sum	6/12/2013					5				
CCUS5-V2	2013	Aut	22/05/2013									
CCUS5-V2	2013	Sum	6/12/2013					2				
CRUS1-V1	2013	Aut	22/03/2013	4	1			7				
CRUS1-V1	2013	Sum	2/12/2013	4				7				
CRUS1-V2	2013	Aut	22/03/2013	15				28				4
CRUS1-V2	2013	Sum	2/12/2013	14				30				6
CRUS1-V3	2013	Aut	22/03/2013	5				2				
CRUS1-V3	2013	Sum	2/12/2013	1				2				
CCUS5-V1	2014	Aut	19/05/2014			2		7				
CCUS5-V1	2014	Sum	2/12/2014					10				
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CRUS1-V1	2014	Aut	1/05/2014	4				10				
CRUS1-V1	2014	Sum	5/12/2014	3				6	2			
CRUS1-V2	2014	Aut	1/05/2014	18			7	26				6
CRUS1-V2	2014	Sum	5/12/2014	16			13	22				13
CRUS1-V3	2014	Aut	1/05/2014	2								
CRUS1-V3	2014	Sum	5/12/2014	3								

[illegible]

[illegible]

[illegible]





Site	Year	Season	Survey Date	Schizaea bifida	Schoenus brevifolius	Schoenus lepidosperma	Schoenus melanostachys	Schoenus sp_	Schoenus turbinatus	Selaginella sp_	Selaginella uliginosa	Sowerbaea juncea
CRUS1-V1	2011	Aut	13/05/2011		26							
CRUS1-V1	2011	Spr	17/11/2011		26						4	
CRUS1-V2	2011	Aut	13/05/2011		14		6					
CRUS1-V2	2011	Spr	17/11/2011		15							
CRUS1-V3	2011	Aut	13/05/2011		24						10	
CRUS1-V3	2011	Spr	17/11/2011		20						6	
CRUS1-V1	2012	Aut	18/04/2012		23					1		
CRUS1-V1	2012	Spr	6/11/2012		27						2	
CRUS1-V2	2012	Aut	18/04/2012		18							
CRUS1-V2	2012	Spr	6/11/2012		16							
CRUS1-V3	2012	Aut	18/04/2012		28						8	
CRUS1-V3	2012	Spr	1/10/2012		21						6	
CCUS5-V1	2013	Aut	22/05/2013		9						7	
CCUS5-V1	2013	Sum	6/12/2013		10						10	
CCUS5-V2	2013	Aut	22/05/2013		30							
CCUS5-V2	2013	Sum	6/12/2013		30							
CRUS1-V1	2013	Aut	22/03/2013		27						1	
CRUS1-V1	2013	Sum	2/12/2013		30						2	
CRUS1-V2	2013	Aut	22/03/2013		18							
CRUS1-V2	2013	Sum	2/12/2013		21							
CRUS1-V3	2013	Aut	22/03/2013		21						7	
CRUS1-V3	2013	Sum	2/12/2013		20						7	
CCUS5-V1	2014	Aut	19/05/2014	1	11						6	
CCUS5-V1	2014	Sum	2/12/2014		14						8	
CCUS5-V2	2014	Aut	19/05/2014		26							
CCUS5-V2	2014	Sum	2/12/2014		26							
CRUS1-V1	2014	Aut	1/05/2014		25							
CRUS1-V1	2014	Sum	5/12/2014		28							
CRUS1-V2	2014	Aut	1/05/2014		20							
CRUS1-V2	2014	Sum	5/12/2014		20							
CRUS1-V3	2014	Aut	1/05/2014		7						7	
CRUS1-V3	2014	Sum	5/12/2014		12						8	

[illegible]

Site	Year	Season	Survey Date	Styphelia laeta subsp_ laeta	Tetraria capillaris	Tetrarrhena juncea	Tetrarrhena sp_	Tetrarrhena turfosa	Thelymitra sp_	Thysanotus juncifolius	Utricularia uniflora	Viola sieberana
CRUS1-V1	2011	Aut	13/05/2011			26						
CRUS1-V1	2011	Spr	17/11/2011					29				
CRUS1-V2	2011	Aut	13/05/2011			2						
CRUS1-V2	2011	Spr	17/11/2011									
CRUS1-V3	2011	Aut	13/05/2011					30				
CRUS1-V3	2011	Spr	17/11/2011					26				
CRUS1-V1	2012	Aut	18/04/2012				25					
CRUS1-V1	2012	Spr	6/11/2012					25		8		
CRUS1-V2	2012	Aut	18/04/2012									
CRUS1-V2	2012	Spr	6/11/2012					1				
CRUS1-V3	2012	Aut	18/04/2012					28				
CRUS1-V3	2012	Spr	1/10/2012					30				
CCUS5-V1	2013	Aut	22/05/2013		30			29				
CCUS5-V1	2013	Sum	6/12/2013		30			30		1		
CCUS5-V2	2013	Aut	22/05/2013					4				
CCUS5-V2	2013	Sum	6/12/2013					6				
CRUS1-V1	2013	Aut	22/03/2013		26			28				
CRUS1-V1	2013	Sum	2/12/2013		27			30				
CRUS1-V2	2013	Aut	22/03/2013									
CRUS1-V2	2013	Sum	2/12/2013									
CRUS1-V3	2013	Aut	22/03/2013		2			30				
CRUS1-V3	2013	Sum	2/12/2013					30				
CCUS5-V1	2014	Aut	19/05/2014		29			28				
CCUS5-V1	2014	Sum	2/12/2014		24			24				
CCUS5-V2	2014	Aut	19/05/2014					5				
CCUS5-V2	2014	Sum	2/12/2014					5				
CRUS1-V1	2014	Aut	1/05/2014		12	10		28				
CRUS1-V1	2014	Sum	5/12/2014		27	4		29				
CRUS1-V2	2014	Aut	1/05/2014					1				
CRUS1-V2	2014	Sum	5/12/2014					1				
CRUS1-V3	2014	Aut	1/05/2014					24				
CRUS1-V3	2014	Sum	5/12/2014					27				

Site	Year	Season	Survey Date	Xanthorrhoea media	Xanthorrhoea resinosa	Xanthorrhoea sp_	Xanthosia pilosa	Xanthosia tridentata	Xyris bracteata	Xyris complanata	Xyris gracilis	Xyris operculata
CRUS1-V1	2011	Aut	13/05/2011									1
CRUS1-V1	2011	Spr	17/11/2011									2
CRUS1-V2	2011	Aut	13/05/2011						2			
CRUS1-V2	2011	Spr	17/11/2011						2			
CRUS1-V3	2011	Aut	13/05/2011	5					1			1
CRUS1-V3	2011	Spr	17/11/2011	7					2			1
CRUS1-V1	2012	Aut	18/04/2012									
CRUS1-V1	2012	Spr	6/11/2012									2
CRUS1-V2	2012	Aut	18/04/2012									
CRUS1-V2	2012	Spr	6/11/2012						2			
CRUS1-V3	2012	Aut	18/04/2012	13					1			
CRUS1-V3	2012	Spr	1/10/2012	12								
CCUS5-V1	2013	Aut	22/05/2013									
CCUS5-V1	2013	Sum	6/12/2013									
CCUS5-V2	2013	Aut	22/05/2013									
CCUS5-V2	2013	Sum	6/12/2013									
CRUS1-V1	2013	Aut	22/03/2013									2
CRUS1-V1	2013	Sum	2/12/2013									1
CRUS1-V2	2013	Aut	22/03/2013									
CRUS1-V2	2013	Sum	2/12/2013									
CRUS1-V3	2013	Aut	22/03/2013			8						
CRUS1-V3	2013	Sum	2/12/2013	12								1
CCUS5-V1	2014	Aut	19/05/2014									
CCUS5-V1	2014	Sum	2/12/2014									
CCUS5-V2	2014	Aut	19/05/2014									
CCUS5-V2	2014	Sum	2/12/2014									
CRUS1-V1	2014	Aut	1/05/2014									
CRUS1-V1	2014	Sum	5/12/2014									
CRUS1-V2	2014	Aut	1/05/2014									
CRUS1-V2	2014	Sum	5/12/2014									
CRUS1-V3	2014	Aut	1/05/2014	10								
CRUS1-V3	2014	Sum	5/12/2014	8								

Site	Year	Season	Survey Date	Xyris sp_	Xyris species complex
CRUS1-V1	2011	Aut	13/05/2011		
CRUS1-V1	2011	Spr	17/11/2011		
CRUS1-V2	2011	Aut	13/05/2011		
CRUS1-V2	2011	Spr	17/11/2011		
CRUS1-V3	2011	Aut	13/05/2011		
CRUS1-V3	2011	Spr	17/11/2011		
CRUS1-V1	2012	Aut	18/04/2012	1	
CRUS1-V1	2012	Spr	6/11/2012		
CRUS1-V2	2012	Aut	18/04/2012		
CRUS1-V2	2012	Spr	6/11/2012		
CRUS1-V3	2012	Aut	18/04/2012		
CRUS1-V3	2012	Spr	1/10/2012		
CCUS5-V1	2013	Aut	22/05/2013		
CCUS5-V1	2013	Sum	6/12/2013		
CCUS5-V2	2013	Aut	22/05/2013		
CCUS5-V2	2013	Sum	6/12/2013		
CRUS1-V1	2013	Aut	22/03/2013		
CRUS1-V1	2013	Sum	2/12/2013		
CRUS1-V2	2013	Aut	22/03/2013		
CRUS1-V2	2013	Sum	2/12/2013		
CRUS1-V3	2013	Aut	22/03/2013		
CRUS1-V3	2013	Sum	2/12/2013		
CCUS5-V1	2014	Aut	19/05/2014		3
CCUS5-V1	2014	Sum	2/12/2014		
CCUS5-V2	2014	Aut	19/05/2014		2
CCUS5-V2	2014	Sum	2/12/2014		2
CRUS1-V1	2014	Aut	1/05/2014		
CRUS1-V1	2014	Sum	5/12/2014	1	
CRUS1-V2	2014	Aut	1/05/2014		
CRUS1-V2	2014	Sum	5/12/2014		
CRUS1-V3	2014	Aut	1/05/2014		
CRUS1-V3	2014	Sum	5/12/2014		



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

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## Appendix C – Swamp Piezometer Data and Shallow Groundwater Chemistry Analyses

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

Figure 10 – CCUS3 and CCUS6 Swamp water Levels





Figure 11 – CCUS4 Swamp water Levels

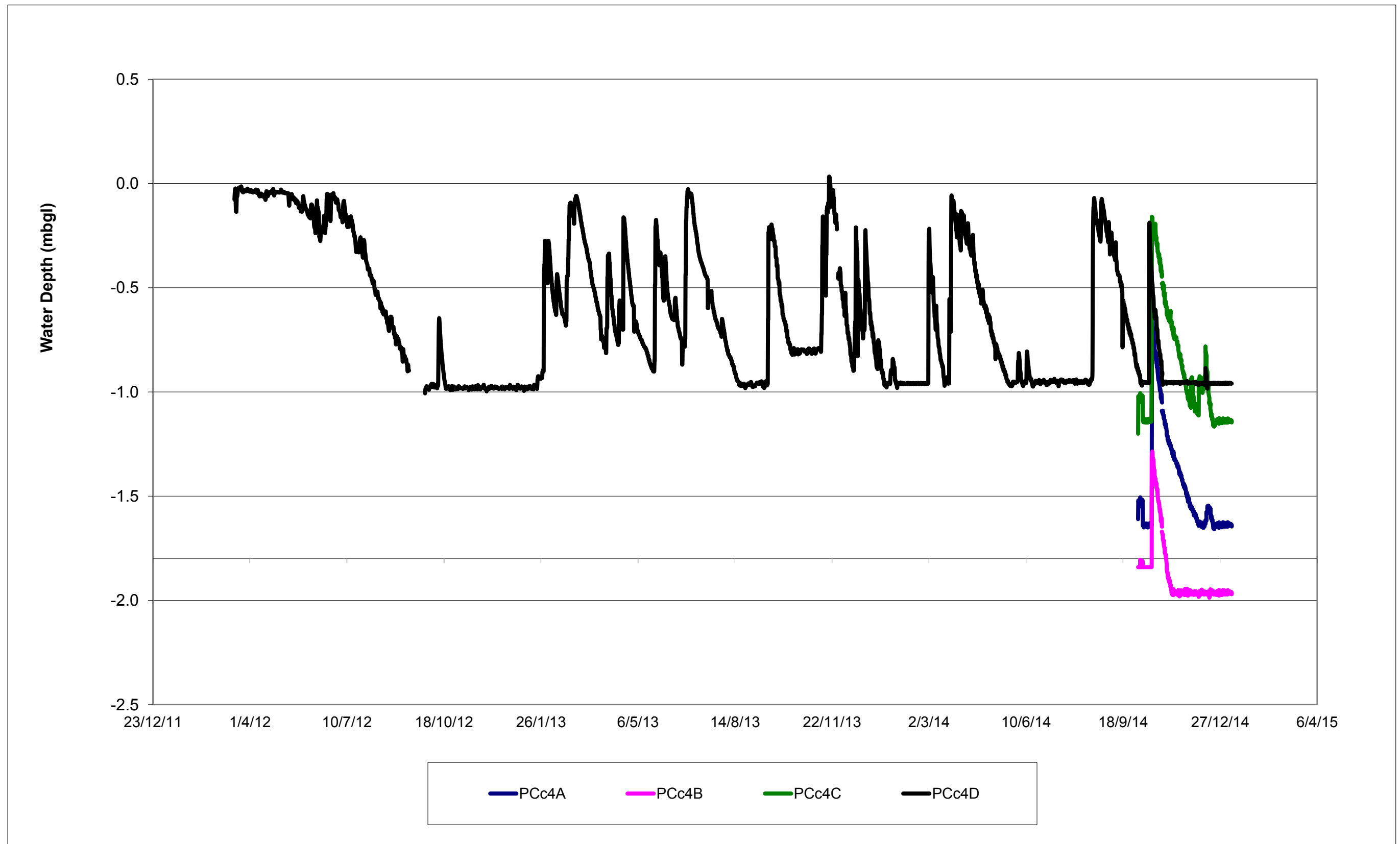
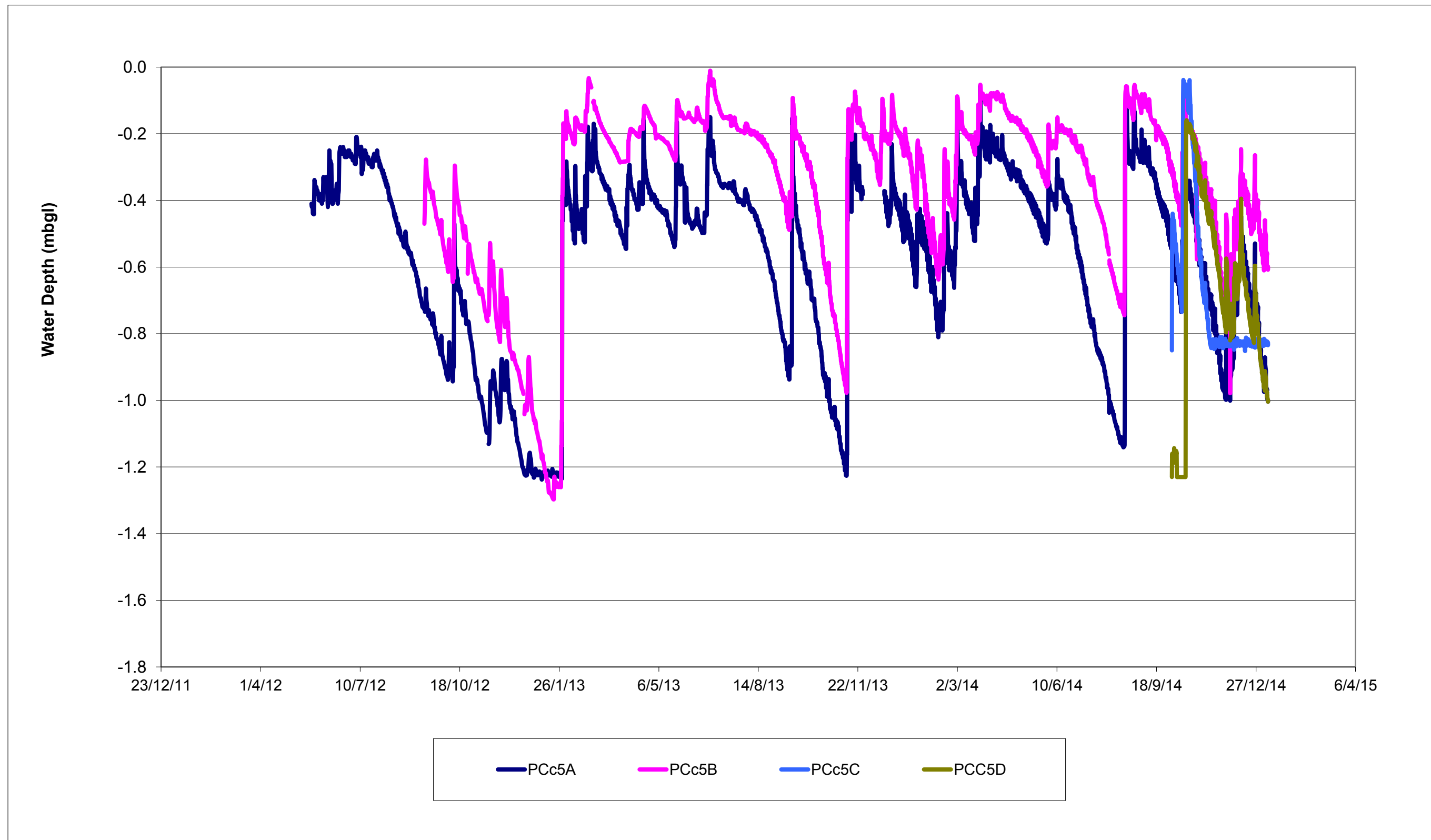


Figure 12 – CCUS5 Swamp water Levels



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

Figure 13 – CCUS10 Swamp water Levels

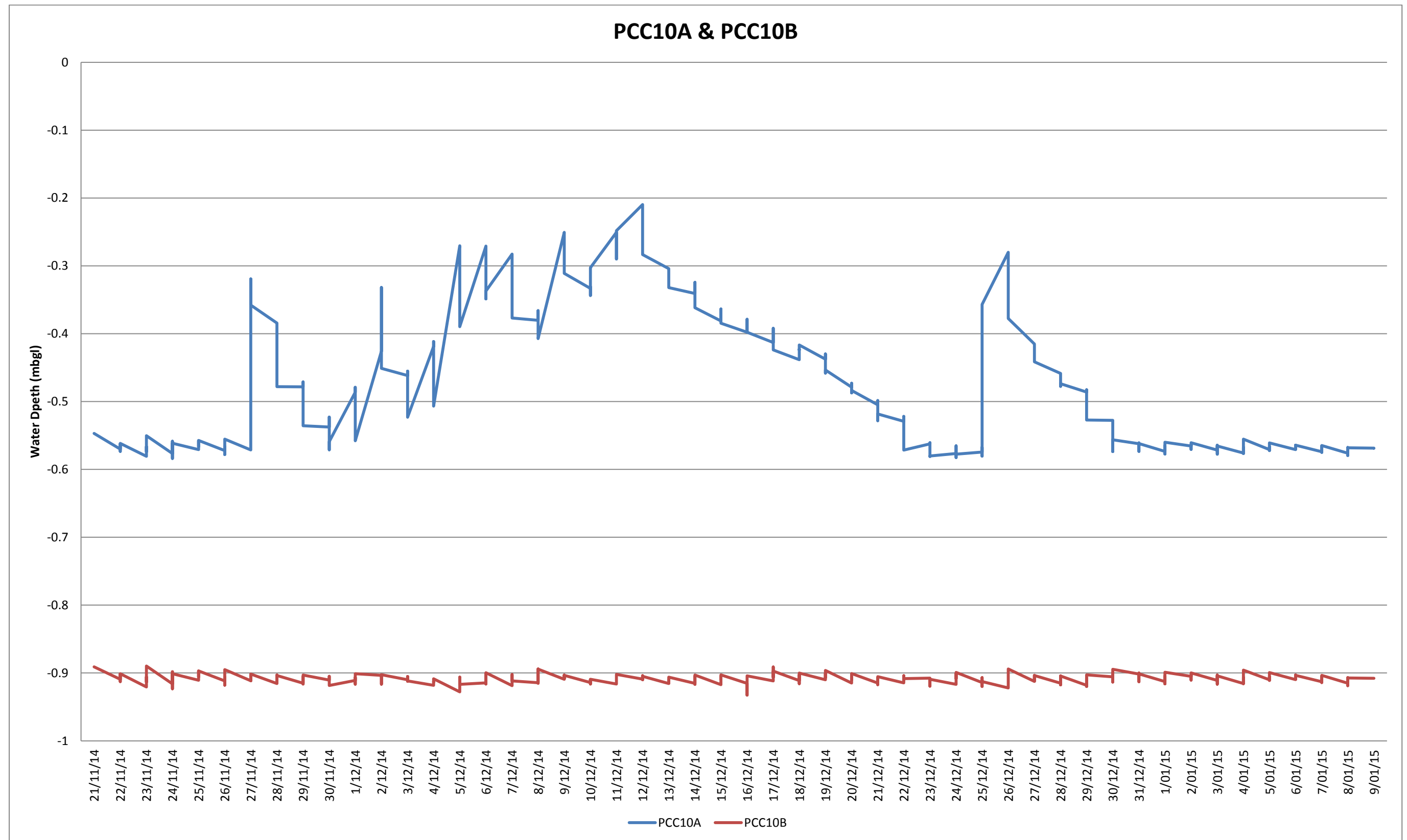


Figure 14 – CRUS1 Swamp water Levels

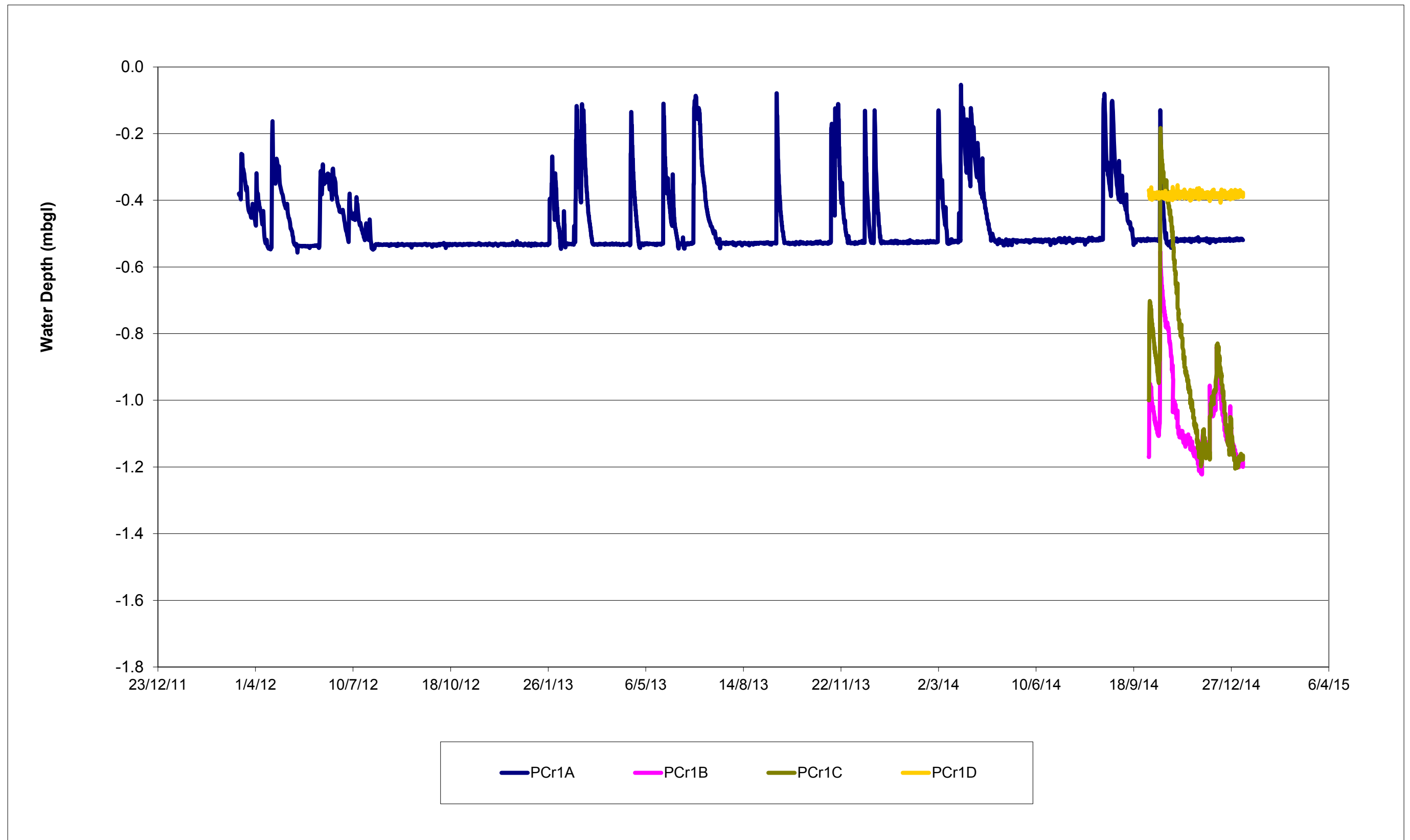
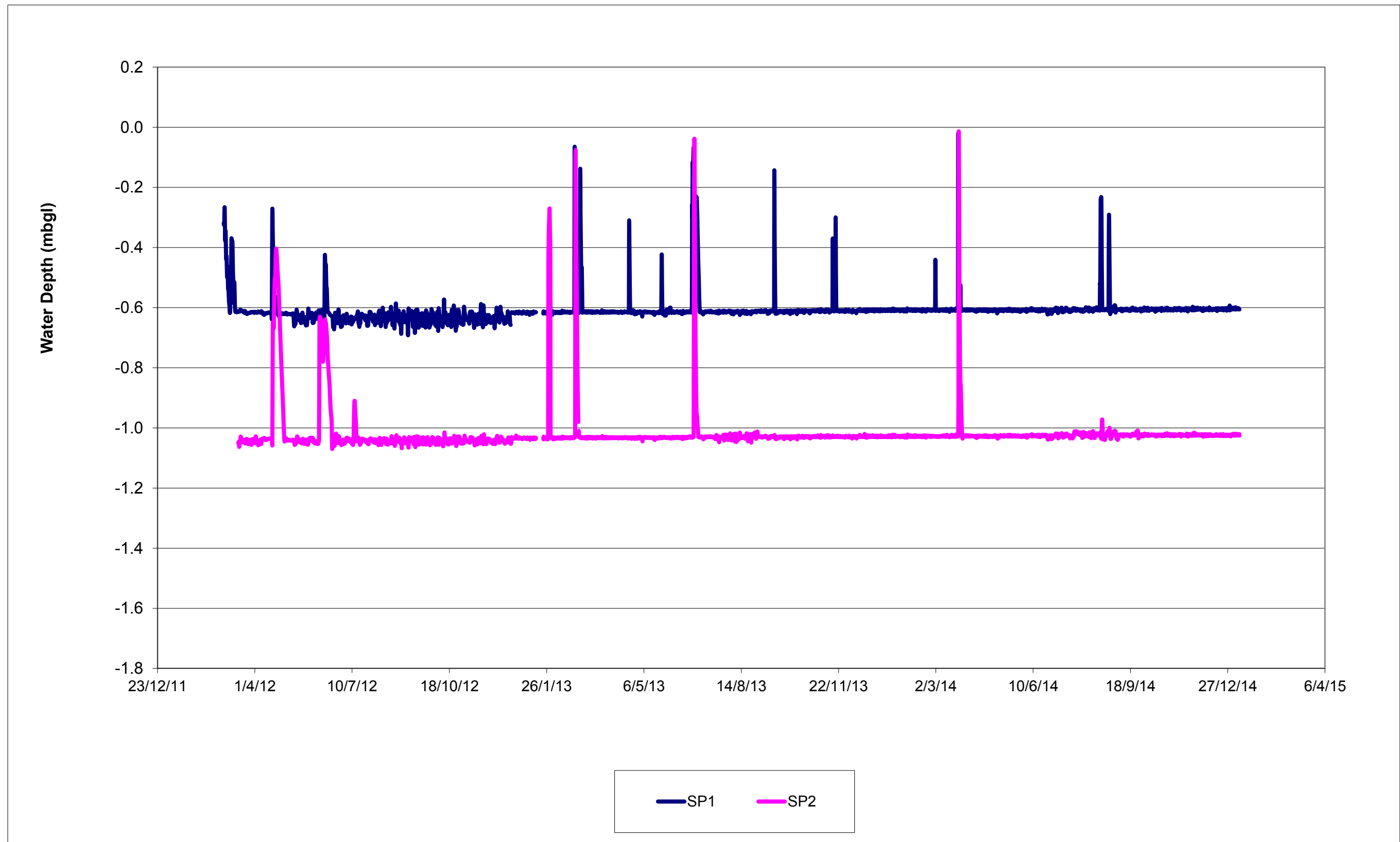


Figure 15 – Russell Vale East Shallow Sandstone Water Levels





Site	Russell Vale Colliery	DOC ID	RVC EC PLN 008
Type	Plan	Date Published	11/03/2015
Doc Title	UPLAND SWAMP MANAGEMENT PLAN		

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## Appendix D – Correspondence

19 February 2015

Principal  
Dianne Munro  
Hansen Bailey Pty Ltd  
PO Box 473  
Singleton NSW 2330

**PEER REVIEW OF ECOLOGICAL MONITORING WORK AT RUSSELL  
VALE COLLIERY MINING**

Dear Dianne,

Cumberland Ecology  
PO Box 2474  
Carlingford Court 2118  
NSW Australia  
Telephone (02) 9868 1933  
Mobile 0425 333 466  
Facsimile (02) 9868 1977  
Web: [www.cumberlandecology.com.au](http://www.cumberlandecology.com.au)

The purpose of this letter is to provide the results of the assessment of my independent peer review regarding the compliance of the Biodiversity Management Plans prepared by Biosis Pty Ltd (Biosis) on behalf of Russell Vale Colliery with regard to Conditions 12c and 13 of EPBC Approval 2014/7259.

My preliminary assessment of the Biodiversity Management Plan (BMP) and the Upland Swamp Management Plan (USMP) determined that three main amendments were required to fulfil the requirements of Condition 12c. These are summarised below.

**Amendment 1: Definition of Terms**

Clarification of what constitutes a negligible impact to MNES in accordance with the '*Matters of National Environmental Significance: Significant Impact Guidelines 1.1*' and defined timeframes for what constitutes 'short-term' or 'long-term' differ for the various MNES.

**Amendment 2: Baseline Data**

A brief summary description of the salient trends or natural variability recorded from relevant monitoring programs conducted to-date and the potential magnitude of impacts on the various MNES based on findings from the baseline data.

**Amendment 3: Justification of Monitoring Timeframes**

A brief summary on how the proposed design for monitoring of various MNES is of a sufficient intensity to pick up on differences between natural

variation and potential subsidence impacts.

Following my preliminary assessment of the BMP and USMP, I met with Nathan Garvey of Biosis and conducted an inspection of the land that will be subject to monitoring. During the site visit, I inspected the Upland Swamps above the extraction area, in particular the area known as CCUS4, as well areas of potential breeding habitat for threatened frog species listed under the EPBC Act.

I have now reviewed the updated Management Plans and have determined that all the amendments listed in my preliminary peer review assessment have been addressed. A summary of the sections where these matters have been addressed is provided in Table 1 below

<b><i>Preliminary Peer Review Requirement</i></b>	<b><i>BMP Section</i></b>	<b><i>USMP Section</i></b>
i. Definition of terms	Section 4.1, Section 4.2, Table 4.3, Section 5.1	Section 4.1, Table 9, Table 11
ii. Baseline data summary	Section 3.5, Section 5.2.5, Section 5.3.3	Section 5.1.2, Section 5.1.4, Section 5.1.7
iii. Justification of timeframes	Section 5.1	Section 5.1

I believe that the BMP and USMP are now compliant with Condition 12c of EPBC Approval 2014/7259.

As per the requirements of Condition 13 and the correspondence from the DoE (dated 4 February 2015), I am aware that I will need to conduct a further review the BMP and USMP within 3 months of approval of the monitoring program.

Yours sincerely



Dr David Robertson  
Director

[david.robertson@cumberlandecology.com.au](mailto:david.robertson@cumberlandecology.com.au)





**Australian Government**  
**Department of the Environment**

Our reference: 2014/7259

Contact Officer: Manel Samarakoon  
Telephone: (02) 6274 1080 Facsimile: (02) 6274 1878  
Email: [post.approvals@environment.gov.au](mailto:post.approvals@environment.gov.au)

Mr David Clarkson  
Group Environment Manager  
Wollongong Coal Limited  
PO Box 281  
FAIRY MEADOW NSW 2519

Dear Mr Clarkson

**Russell Vale Colliery - mining of 400m of longwall 6, Wollongong, NSW**

I write in relation to the Extraction Plan submitted on 19 February 2015 to satisfy requirements under condition 12 of the approval granted on 24 December 2014 under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) for the above project.

The Biodiversity Management Plan BMP, version 6, 11 March 2015 and Upland Swamp Management Plan, version 6, 11 March 2015 (Plans), have been reviewed by officers of the Department and have been found to meet the requirements of approval condition 12. On this basis, and as delegate of the Minister for the Environment, I have decided to approve the Plans.

In accordance with condition 12, each approved plan must be implemented. Under condition 25, if the approval holder wishes to carry out any activity otherwise than in accordance with the approved Plans, the approval holder must submit the revised version of the Plans for the Minister's/delegate's approval.

The Department has an active monitoring program which includes monitoring inspections, desk top document reviews and audits. As part of this program we will be undertaking a review of our records to ascertain the present status of this project in relation to its conditions of approval. We will contact you again if we require further information.

Please ensure that you maintain accurate records of all activities associated with, or relevant to the conditions of approval, so that they can be made available to the Department on request. Such documents may be subject to audit and used to verify compliance. Summaries of results of audits may be published by the Department. Information about the monitoring and audit program can be found on the Department's website at [www.environment.gov.au/epbc/compliance/auditing.html](http://www.environment.gov.au/epbc/compliance/auditing.html).

We would appreciate it if you would advise the Department of any changes to the project e.g. contact officer, company address, commencement date etc. It should be noted that any transfer of this approval to another person must have the consent of the Minister under section 145B of the EPBC Act.

If you have any enquiries please contact Manel Samarakoon whose details are provided above.

Yours sincerely



Shane Gaddes  
Assistant Secretary  
Compliance & Enforcement Branch  
Environment Assessment and Compliance Division

25/3/2015

Cc: Diane Munro, Hansen Bailey (consultant)

**Note:** Under s 491 of the *Environment Protection and Biodiversity Conservation Act 1999* it is an offence to knowingly provide false and/or misleading information to a departmental officer.



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 010
Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

## APPENDIX G

### HERITAGE MANAGEMENT PLAN





Site	Wollongong Coal	DOC ID	RVC EC PLN 005
Type	Plan	Date Published	06/02/2015
Doc Title	HERITAGE MANAGEMENT PLAN		

Russell Vale Colliery  
Russell Vale East – Longwalls 6 & 7

HERITAGE MANAGEMENT PLAN





Site	Wollongong Coal	DOC ID	RVC EC PLN 005
Type	Plan	Date Published	06/02/2015
Doc Title	HERITAGE MANAGEMENT PLAN		

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Site	Wollongong Coal	DOC ID	RVC EC PLN 005
Type	Plan	Date Published	06/02/2015
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## GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
AHA	Aboriginal Heritage Assessment
AHIMS	Aboriginal Heritage Information Management Service
DP&E	Department of Planning & Environment
DRE	Division of Resources and Energy
EA	Environmental Assessment
EPL	Environmental Protection Licence
EMS	Environmental Management Strategy
HHA	Historic Heritage Assessment
HMP	Heritage Management Plan
ILALC	Illawarra Local Aboriginal Land Council
KWA	Kullila Welfare and Housing Aboriginal Corporation
LGA	Local Government Area
LW	Longwall
MP	Management Plan
Mtpa	Million tonnes per annum
NIAC	Northern Illawarra Aboriginal Collective
NPWS	National Parks and Wildlife Service
OEH	Office of Environment and Heritage
PAC	Planning Assessment Commission
PPR	Preferred Project Report
PWP	Preliminary Works Project
RAP	Registered Aboriginal Party
ROM	Run of Mine
SIL	Subsidence Impact Limit
SMP	Subsidence Management Plan
TARP	Trigger Action Response Plan
UEP	Underground Expansion Project
WCC	Wollongong City Council
WCL	Wollongong Coal Limited
WWEC	Wodi Wodi Elders Corporation

Terms	
Project Approval	Part 3A Major Project approval MP10_0046 as modified



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## 1 INTRODUCTION

### 1.1 Project Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) located in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale, approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

The Russell Vale Colliery operates under a Project Approval (MP10\_0046) granted by the Planning Assessment Commission (PAC) on 13 October 2011. The Project Approval was modified (MOD1) by the PAC in 2012 to allow:

- extraction of coal using longwall mining techniques in the Wongawilli Seam for longwalls 4 and 5 (LW 4 & 5); and
- development of the main gate roads for longwall 6 (LW6).

A second modification to the project approval (PA 10\_0046 MOD2) was made in 2014 to authorise:

- secondary extraction of the first 365 m of LW6; and
- extension of the duration of mining until 31 December 2015.

Prior to this, Modification 3 (MP 10\_0046 MOD 3) was granted on 10 October 2014, enabling approved mining operations to continue until 31 December 2014. This modification has effectively been superseded by MOD 2, which allows mining operations to be undertaken until 31 December 2015.

WCL has lodged a separate application (MP 09\_0013) for its Underground Expansion Project (UEP) to facilitate further mining operations at Russell Vale Colliery. In October 2013, WCL lodged a Preferred Project Report (PPR) which proposed significant amendments to the UEP (as originally proposed). The amended UEP would facilitate the continued operation of the colliery for five years and would allow extraction of 4.7 million tonnes of Run of Mine (ROM) coal. The mine plan for the amended UEP consists of 8 longwall panels (including longwalls 6 & 7). The environmental impact assessment for the Underground Expansion Project has been protracted based on the complex environment of the Russell Vale Colliery in proximity to the Cataract Reservoir and sensitive upland swamps, and the high level of community and stakeholder interest in the project. It is unlikely that determination of the application will be made before late 2014.

This Heritage Management Plan (HMP) has been prepared in support of an Extraction Plan, as required by **Condition 7/Schedule 3** and **Condition 38/Schedule 3** of the Project Approval.





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## 1.2 Purpose and Scope

**Condition 38/ Schedule 3** of the Project Approval requires the preparation of a HMP. In addition, **Condition 7 / Schedule 3** requires the HMP to be included as a component of an Extraction Plan. The purpose and scope of this HMP is to:

- outline statutory requirements, including any performance measures to be achieved;
- present descriptions and significance assessments for Aboriginal and historical heritage sites within the LWs 6 to 7 extraction area;
- detail the methodology for a monitoring program, including baseline recording;
- detail management options for any sites that may be affected due to mining subsidence;
- present protocols for ongoing consultation with registered Aboriginal parties (RAPs);
- present contingency plans for the unexpected discovery of Aboriginal objects, sites and human remains; and
- present contingency plans for the unexpected discovery of historical relics and sites.

## 1.3 Consultation and Distribution

This Plan has been prepared in consultation with, and copies will be distributed to:

- Department of Planning and Environment (DP&E);
- Wollongong City Council (WCC);
- The Office of Environment and Heritage (OEH); and
- Registered Aboriginal parties, including:
  - Illawarra Local Aboriginal Land Council (ILALC);
  - Peter Falk Consultancy (formerly D'harawal Knowledge Holders);
  - Northern Illawarra Aboriginal Collective (NIAC);
  - Wodi Wodi Elders Corporation (WVEC); and
  - Kullila Welfare and Housing Aboriginal Corporation (KWA).

WCL will make this Plan publicly available on the WCL website and will be responsible for its maintenance. A hard copy will also be kept at the Russell Vale Colliery site office, 7 Princes Highway, Corrimal, NSW 2518.



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Any revisions undertaken will be the responsibility of WCL and any notifications sent accordingly. WCL will not be responsible for maintaining uncontrolled copies, beyond ensuring the most recent version is maintained on WCL's computer system, website, and hard copy at the Russell Vale Colliery, 7 Princes Highway, Corrimal, NSW 2518.

Consultation in accordance with **Condition 38/Schedule 3** of the Project Approval has been undertaken as part of the NRE No.1 Colliery HMP (Gujarat NRE Coking Coal Ltd, 2012) and the LW4 and LW5 HMP (Gujarat NRE Coking Coal Ltd, 2012). This HMP includes additional Aboriginal heritage sites that were not included in the NRE No.1 Colliery HMP or LW4 and LW5 HMP. Additional consultation has been undertaken with OEH and registered Aboriginal stakeholders in regards to these sites. Details of consultation are provided below. A consultation log and copies of correspondence are provided in **Appendix B**.

### 1.3.1 OEH

A copy of the Draft HMP was provided to the OEH Planning & Aboriginal Heritage Conservation and Regulation team for comment on the 15 December 2014. A copy of the OEH Planning & Aboriginal Heritage Conservation and Regulation team response is provided in **Appendix B**.

### 1.3.2 Registered Aboriginal Parties

Consultation with Aboriginal stakeholders for the Project is described in ERM (2012a). Five Aboriginal parties registered for consultation:

- Illawarra Local Aboriginal Land Council (ILALC);
- Peter Falk Consultancy (formerly D'harawal Knowledge Holders);
- Northern Illawarra Aboriginal Collective (NIAC);
- Wodi Wodi Elders Corporation (WVEC); and
- Kullila Welfare and Housing Aboriginal Corporation (KWHAC).

The outcomes of consultation with RAPs is detailed below.

#### Illawarra Local Aboriginal Land Council

A copy of the Draft HMP was provided to ILALC for comment on 20 January 2015.

#### Peter Falk Consultancy

A copy of the Draft HMP was provided to Peter Falk Consultancy for comment on 20 January 2015.

#### Northern Illawarra Aboriginal Collective

A copy of the Draft HMP was provided to NIAC for comment on the 20 January 2015.



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### **Wodi Wodi Elders Corporation**

A copy of the Draft HMP was provided to WWEC for comment on the 20 January 2015

### **Kullilia Welfare and Housing Aboriginal Corporation**

A copy of the Draft HMP was provided to the KWHAC for comment on the 20 January 2015.

### **Ongoing RAP Consultation Procedures**

Ongoing consultation with RAPs will be required:

- In the preparation of any subsequent revisions of the HMP;
- If unanticipated Aboriginal objects are encountered;
- If Aboriginal ancestral remains are encountered; and,
- To participate in the monitoring of sites 52-2-0320, 52-3-0323, 52-2-0325.

When consultation is required, RAPs will be provided with verbal and written notification of the following:

- The purpose and expectation of consultation;
- Details of stakeholder responsibilities, including details of expected timings; and
- Details of any Work Health and Safety requirements to participate in fieldwork or any other consultation activities.

Detailed records of consultation with RAPs will be kept in a consultation log and include:

- Date and time of consultation;
- Details of RAP responses and copies of any correspondence with RAPs; and
- Details of RAP involvement in the development of any management strategies or actions.

A copy of the consultation log will be held at the Russell Vale Colliery site office. The relevant sections of this log should be published in any monitoring report, management strategy report or any other document reporting on Aboriginal heritage and has involved Aboriginal community consultation.

## **1.4 Report Structure**

The remainder of this Management Plan is structured as follows:



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**Section 2:** Outlines the statutory requirements applicable to the Plan.

**Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.

**Section 4:** Details the performance measures and indicators that will be used to assess the impacts of mining.

**Section 5:** Describes the monitoring program.

**Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.

**Section 7:** Describes the protocols for the handling of incidents, complaints and non-compliances.

**Section 8:** Details how the Plan will be implemented, managed, reviewed and updated and managed.

**Figure 1** shows this Plan's position within the WCL's Environmental Management Structure.

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## Environmental Management Structure

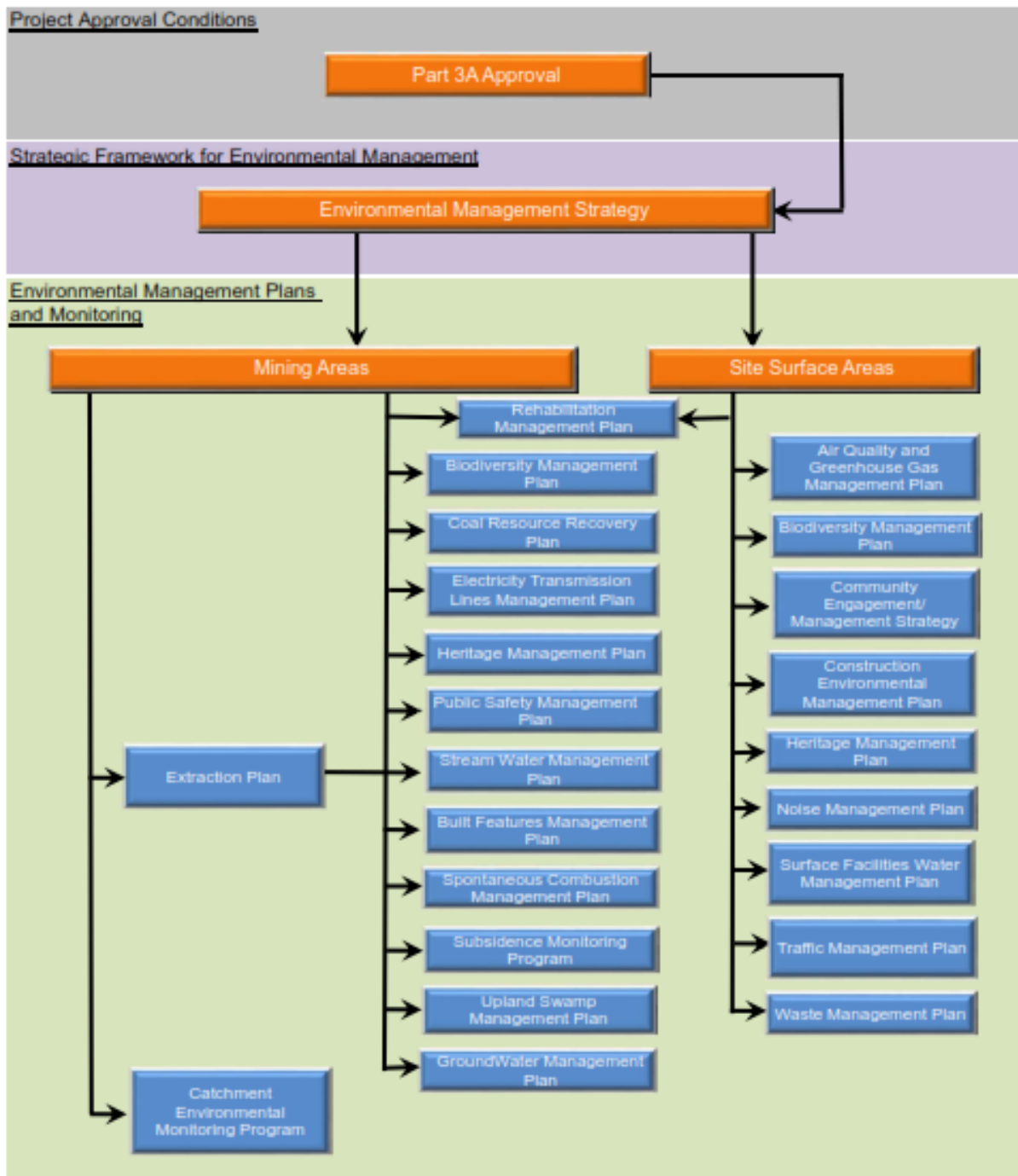


Figure 1- Environmental Management Structure



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## 2 STATUTORY REQUIREMENTS

### 2.1 Approval

**Condition 7/Schedule 3** of the Project Approval requires the preparation of a HMP as a component of an Extraction Plan for second workings. Approval condition 7(h1) states:

#### *Extraction Plan*

*7. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Secretary. This plan must:*

*(h1) include appropriate references to:*

- water resources, biodiversity values and heritage values managed under the Water Management, Biodiversity and Heritage Management Plans required under Condition 29, 35 and 38 of Schedule 3 and;*
- programs, procedures, management measures and the like required under those plans;*

**Condition 38/ Schedule 3** of Project Approval outlines the requirements that are applicable to the preparation and performance of this HMP. **Table 2.1** indicates where each component of the condition is addressed within this Plan.

**Table 2.1 - Heritage Management Plan Requirements**

Project Approval Condition	Plan Section
<p><b>Condition 38/Schedule 3</b></p> <p>The Proponent shall prepare and implement a Heritage Management Plan for the project to the satisfaction of the Secretary. This Plan must:</p> <p>(a) be prepared in consultation with OEH, WCC, any relevant local historical organisations and any relevant Aboriginal stakeholders;</p> <p>(b) be submitted for approval to the Secretary within 6 months of this approval;</p> <p>(c) include consideration of the Aboriginal and non-Aboriginal cultural context and significance of the site;</p> <p>(d) detail the responsibilities of all stakeholders; and</p> <p>(e) include programs/procedures and management measures for:</p> <ul style="list-style-type: none"> <li>dealing with previously unidentified Aboriginal objects (excluding human remains), including any need to halt works in the vicinity, assessment of significance, determination of appropriate mitigation measures (by a</li> </ul>	<p>Section 1.3</p> <p>Section 2.1</p> <p>Section 3</p> <p>Sections 7.1 and 7.2 of the Extraction Plan</p> <p>Section 6.3</p>



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Project Approval Condition	Plan Section
<p>qualified archaeologist in consultation with Aboriginal stakeholders), re-commencement of works, notifying OEH, and registering the new site(s) in the OEH AHIMS register;</p> <ul style="list-style-type: none"> <li>dealing with any human remains which may be discovered, including halting of works in the vicinity; notifying NSW Police, OEH, the Department and Aboriginal stakeholders; and not recommencing any works in the vicinity unless authorised;</li> <li>heritage induction for construction personnel (including procedures for keeping records of inductions);</li> <li>ongoing Aboriginal consultation and involvement (including procedures for keeping records of this);</li> <li>the monitoring of site 52-2-0320 and 52-2-1223 by a qualified archaeologist and the Aboriginal community;</li> <li>appropriate identification, management, conservation and protection of non-Aboriginal heritage items identified on the site, particularly within the NRE No. 1 Colliery surface facilities site; and</li> <li>dealing with previously unidentified non-Aboriginal heritage items which may be discovered during the project.</li> </ul>	<p>Section 6.3</p> <p>Section 7.3 of the Extraction Plan</p> <p>Section 1.3</p> <p>Section 5</p> <p>Sections 5 and 6,</p> <p>Section 6.3</p>

In addition, **Condition 1/Schedule 3** of the Project Approval sets out the Subsidence Impact Performance Measures for Heritage Features (see **Table 4.1**).

**Conditions 2/Schedule 5** of the Project Approval outline the requirements that are applicable to the preparation and performance of all Management Plans.

**Table 2.2** indicates where each component of the condition is addressed within this Plan.

**Table 2.2 -Heritage Management Plan Requirements**

Project Approval Condition	Plan Section
<p><b>Condition 1/Schedule 3</b></p> <p>The proponent shall ensure that the project does not cause any exceedance of the performance measures in Table 1, to the satisfaction of the Secretary.</p>	Section 4
<p><b>Condition 2/Schedule 5</b></p> <p>2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:</p> <p>(a) detailed baseline data;</p> <p>(b) a description of:</p>	<p>Sections 3.1 and 5.1.1</p> <p>Section 2</p>



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Project Approval Condition	Plan Section
<ul style="list-style-type: none"> <li>the relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>any relevant limits or performance measures/criteria;</li> <li>the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;</li> </ul>	<p>Section 4</p> <p>Sections 5 and 6</p>
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 5
(d) a program to monitor and report on the:	Section 5
<ul style="list-style-type: none"> <li>impacts and environmental performance of the project;</li> <li>effectiveness of any management measures (see c above);</li> </ul>	Section 5
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.3
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Section 7.5.1 of the Extraction Plan
(g) a protocol for managing and reporting any:	Section 6 of the Extraction Plan
<ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and</li> <li>exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	
(h) a protocol for periodic review of the plan.	Section <b>Error! Reference source not found.</b> 7.5 of the Extraction Plan

## 2.2 Licences and Leases

In addition to the requirements of the Project Approval, all activities at or in association with the Russell Vale Colliery will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

*Table 2.3 - Licences, Permits and Leases*

Licence/Approval	Document No.	Issue Date/	Expiry Date
Consolidated Coal Lease Renewal	745	27 Dec 1990	30 Dec 2023
Mining Purposes Lease	271	09 May 1991	09 May 2033





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Licence/Approval	Document No.	Issue Date/	Expiry Date
Mining Lease	1575	22 Mar 2012	22 Mar 2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31 Oct 2001 23 Jan 2002 28 Jun 2001	-
Approval to mine P&O Panels (first workings)	10.123.081	7 Jan 2005	-
DC for Thin Seam Mining P/L	D1096/01	19 Sep 2001	-
Environmental Protection Licence	12040	Current	-
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10 Aug 1992	-
DC for Storm Water Control Dam and Water Treatment	D91/551	17 Jun 1992	-
Dangerous Goods Licence	NDG021269	Application Pending	Application Pending
Licence to Store Explosives	XSTR100114	21 Oct 2012	3 Oct 2017
SPCC Approval for Stage 3	90/4711 (280021C/20)	04 Sep 1992	-
DC for Russell Vale Waste Emplacement	D89/839	11 Apr 1990	-
DC for Demolition of Washery	D2004/32	14 Dec 2004	-
Mining operations Plan (MOP)		1 Jan 2008	31 Dec 2017
Bore Licence	10BL602992	29 Jan 2013	28 Jan 2018



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## 2.3 Relevant Legislation and Guidelines

WCL will conduct the Project consistent with the Project Approval conditions and any other legislation that is applicable. The following Acts, planning instruments and guidelines that will inform the conduct of the Project include:

- *Coal Mine Health and Safety Act 2002*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 1989*
- *Dams Safety Act 1978*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Energy and Utilities Administration Act 1987*
- *Environmental Planning and Assessment Act 1979*
- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
- *Fisheries Management Act 1994*
- *Heritage Act 1977*
- *Mining Act 1992*
- *National Parks and Wildlife Act 1974*
- *Noxious Weeds Act 1993*
- *Protection of the Environment Operations Act 1997*
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- *Roads Transport Act 2013*
- *Road Transport (Vehicle and Driver Management) Act 2005*
- *Sydney Water Catchment Management Act 1998*
- *Threatened Species Conservation Act 1995*
- *Water Act 1912*
- *Water Management Act 2000.*

Relevant licences or approvals required under these Acts will be obtained as required.



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## 3 IMPACT ASSESSMENT

### 3.1 Site Description

The initial environmental assessments for the overall NRE No.1 Colliery Project Application (ERM 2013) were completed in 2013, and included an Aboriginal Heritage Assessment (AHA) (ERM 2012a) and a Historic Heritage Assessment (HHA) (ERM 2012b) undertaken by Environmental Resources Management Australia (ERM).

Since this time, Biosis has undertaken an extensive relocation program and relocated an additional ten sites and identified five new sites; however four sites (all grinding grooves) remain unaccounted for (Biosis 2013). Four sites assessed by ERM (2012) are no longer located within the study area, as they confirmed location is now outside of the study area.

A total of seven sites are located within the study area for this HMP (400m buffer from the edge of secondary extraction). Six of these sites are located within the 20mm subsidence impact limit (SIL) with the remaining site located within the 400m buffer zone.

A summary of the seven Aboriginal sites located within study area for this HMP is provided in *Table 3.1*. The location of these sites is shown in *Figure 2*.

*Table 3.1- Subsidence Impact Performance Measures for Aboriginal heritage features*

Site Name	AHIMS No.	Context	Site Type
<b>Bulli Mine Shaft Site 20</b>	<b>52-3-0311</b>	<b>Enclosed Shelter</b>	<b>Shelter with Deposit</b>
<b>Bulli Mine Shaft Site 25</b>	<b>52-3-0320</b>	<b>Open Site</b>	<b>Axe grinding grooves</b>
Bulli Mine Shaft Site 31	52-3-0322	Open Site	Axe grinding grooves
<b>Bulli Mine Shaft Site 26</b>	<b>52-3-0323</b>	<b>Enclosed Shelter</b>	<b>Shelter with Deposit</b>
<b>Bulli Mine Shaft Site 27</b>	<b>52-3-0325</b>	<b>Enclosed Shelter</b>	<b>Shelter with Art and Deposit</b>
<b>Wonga East 4</b>	<b>n/a</b>	<b>Enclosed Shelter</b>	<b>Shelter with Deposit</b>
<b>Wonga East 5</b>	<b>n/a</b>	<b>Enclosed Shelter</b>	<b>Shelter with Stone Arrangement</b>

\* Sites in bold are located within the subsidence impact limit (SIL).

No historical sites were identified in the study area by the HHA (ERM 2012b).

Details for Aboriginal heritage sites within the study area for this HMP are provided below.

#### 3.1.1 Bulli Mine Shaft Site 20 (52-3-0311)

Site 52-3-0311 is a shelter site with deposit. The deposit consists of yellowish-brown sand with quartz, silcrete and chert flakes. The deposit has been disturbed to some extent through wombat



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burrowing. The site is a typical example of a common site type in the region and is of moderate scientific significance due to its preservation and lack of disturbance.

### 3.1.2 Bulli Mine Shaft Site 25 (52-3-0320)

This axe grinding groove site was originally recorded in 1985 by the Illawarra Prehistory Group. The site was recorded as a single grinding groove located within a sandstone outcrop measuring 22 x 2.5m. The site is recorded as being in reasonable condition. The site is an example of a common site type in the region with poorly preserved features and is of low scientific significance.

At the time of recording, the site was in a reasonable condition but was unable to be re-located during surveys for the 2011 AHA (ERM 2012a) or subsequently by Biosis (2013, In Prep.).

### 3.1.3 Bulli Mine Shaft Site 31 (52-3-0322)

Site 52-3-0322 is a grinding groove site. The site was recorded as two grinding grooves located within a sandstone outcrop measuring approximately 11 x 20m. The site is recorded as being in reasonable condition. The site is an example of a common site type in the region with poorly preserved features and is of low scientific significance.

### 3.1.4 Bulli Mine Shaft Site 36 (52-2-0323)

Site 52-3-0323 is a shelter with deposit. Three surface artefacts consisting of silcrete, chert and quartz flakes have been recorded in the drip line at this site. A deposit of yellowish grey sand is present with a depth of 20 cm and is intact and in fair condition. The site is a typical example of a common site type in the region, and is of moderate scientific significance due to its preservation and lack of disturbance.

### 3.1.5 Bulli Mine Shaft Site 27 (52-2-0325)

Site 52-3-0325 is a shelter with Art and deposit. Five surface artefacts consisting of silcrete, fossilised wood and quartz flakes and a quartz core have been recorded. A deposit of yellowish clayey sand is present but has been subject to wombat burrowing. A single art panel consisting of sprayed red ochre is present on the rear wall. The art is in poor condition and indiscernible. The site is a typical example of a common site type in the region, and is of moderate scientific significance due to the range of features present.

### 3.1.6 Wonga East 4

Wonga East 4 is a shelter with archaeological deposit. Four surface artefacts consisting of quartz and silcrete flakes have been recorded in the drip line at this site. A deposit of yellowish grey sand is present and is intact and in fair condition. The site is a typical example of a common site type in the region, and is of moderate scientific significance due to its preservation and lack of disturbance.



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### 3.1.7 Wonga East 5

Wonga East 5 is a shelter with stone arrangement. The shelter is low with two piles of stones in the entrance. The lichen growing on the stones indicates that they were placed some time ago. The shelter does not contain a deposit, art or artefacts. Although this may have been a historical feature, consultation with Aboriginal stakeholders indicates that the site may have cultural significance. Given the condition of the site, uncertainty as to its context, and limited range of site features, the site is of low scientific significance.

## 3.2 Subsidence Impacts

The potential for impacts to Aboriginal heritage sites was assessed by Biosis (2013). This report outlines potential impact mechanisms, provides a review of Aboriginal site monitoring results from the Southern Coalfield and provides a risk assessment for all sites located within the UEP application area.

The subsidence impact assessment for Aboriginal sites in the Study Area is presented below in **Table 3.2**. This assessment was made using the parameters in Sefton's (2000) Principal Components Analysis and in conjunction with the subsidence predictions provided by SCT (SCT 2013), detailed in **Table 3.3**. The assessment of risk was made using the criteria outlined in Section 3.6.4 of Biosis (2013).

*Table 3.2 - Summary of the predicted risk of impact to Aboriginal sites*

Site Name	Site Number	Site Type	Scientific Significance	Cultural Significance	Risk of Impact
Bulli Mine Shaft Site 20	52-3-0311	Shelter with Deposit	Moderate	High	Negligible
Bulli Mine Shaft Site 25	52-3-0320	Axe grinding grooves	Low	High	Very low
Bulli Mine Shaft Site 31	52-3-0322	Axe grinding grooves	Low	High	Negligible
Bulli Mine Shaft Site 26	52-3-0323	Shelter with Deposit	Moderate	High	Very low
Bulli Mine Shaft Site 27	52-3-0325	Shelter with Art and Deposit	Moderate	High	Very low
Wonga East 4	n/a	Shelter with Deposit	Moderate	High	Negligible
Wonga East 5	n/a	Shelter with Stone Arrangement	Low	High	Negligible

\*Sites in bold are located within the SIL.



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Table 3.3 - Subsidence Effect Risk Assessment

Site Number	L (m)	W (m)	H (m)	Volume (m³)	Aspect	Faces aspect	Art	Location	Wet / Dry	Location End LW	Location in LW	DIR	SUBS	Tensile Strain	Comp Strain	Tilt	Previously Undermined	Previously Subsided
52-3-0311	7.5	6.9	1.2	62.10	SW	CW	N	UVS	W	N	O	SE-NW	<0.1	<0.5	<1.0	<2.0	Yes	Yes
52-3-0320	22	2.5	N/A	N/A	N/A	SP	N	RT	W	N	CP	SE-NW	1.8	14.1	28	47	Yes	Yes
52-3-0322	11	20	N/A	N/A	S	SP	N	UVS	W	N	O	SE-NW	<0.1	<0.5	<1.0	<2.0	Yes	Yes
52-3-0323	6	3.5	3	63.00	SW	BF	N	LVS	W	N	O	SE-NW	<0.1	<0.5	<1.0	<2.0	No	No
52-3-0325	3	2.5	1.2	9.00	NW	CW	Y	LVS	W	Y	M	SE-NW	1.4	8.6	17	29	Yes	Yes
Wonga East 4	10	4	10	24.00	S	CW	N	UVS	D	N	O	E-W	<0.1	<0.5	<1.0	<2.0	Yes	No
Wonga East 5	7.5	6.9	1.2	62.10	SW	CW	N	UVS	W	N	O	SE-NW	<0.1	<0.5	<1.0	<2.0	Yes	Yes

Abbreviations:

L	sandstone platform length
W	sandstone platform width
Area	in m²
Location	RT = ridge top UVS = upper valley slope LVS = lower valley slope VB = valley bottom (lowest cliff line)
Wet / dry	D = surfaces mainly not affected by water seepage W = surface mainly affected by water seepage
Location END	Y = located within 100m of the end of a longwall, whether inside or outside the longwall
LW	N = not located within 100m of the end of a longwall, whether inside or outside the longwall
Location IN LW	O = located outside the longwall and chain pillar CP = located over the longwall and chain pillar E = located closer to the edge of the longwall than the middle (centre) M = located closer to the centre of the longwall than the end
DIR LW	Direction of the nearest longwall
SUBS	Maximum predicted subsidence (mm)
Tensile Strain	Maximum predicted tensile strain (mm/m)
Comp. Strain	Maximum compressive strain (mm/m)
Tilt	Maximum tilt (mm/m)

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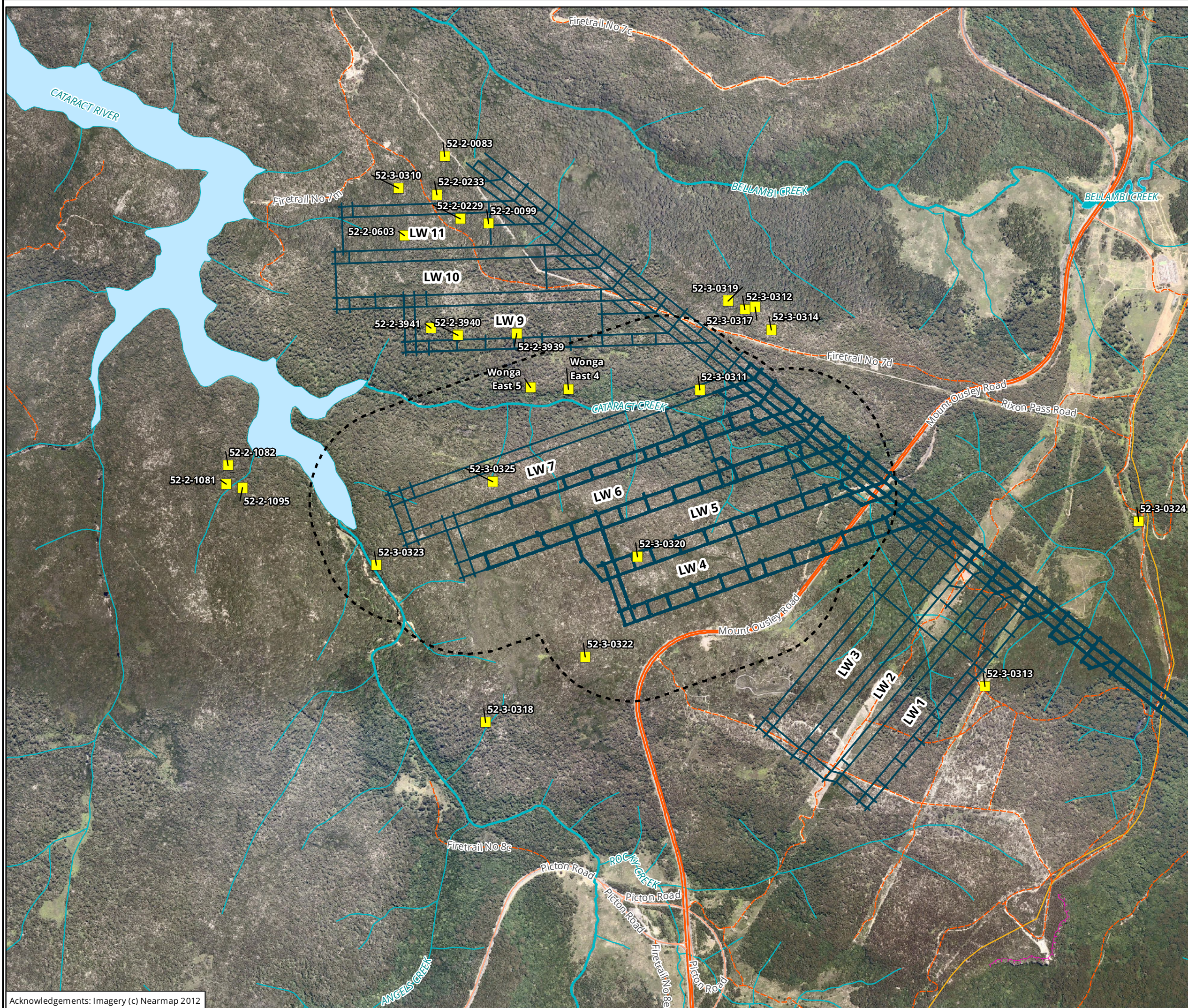
Four sites are considered to be at negligible risk of impact. Three sites are considered to be at a very low risk of impact: site 52-3-0320 (Bulli Mine Shaft Site 25, an axe grinding groove site) site 52-3-0323 (Bulli Mine Shaft Site 26, a rock shelter with Archaeological Deposit) and site 52-3-0325 (Bulli Mine Shaft Site 27, a rock shelter with Art and Archaeological Deposit). These sites are discussed further below and a rationale for the risk of impact provided.

Site 52-3-0320 is mapped as occurring on the upper valley slope; however this site could not be relocated. Based on the mapped location, the site has been previously undermined as part of the Bulli and Balgownie seam extraction works and does appear to have been subject to previous subsidence. Based on subsidence predictions for the UEP (as modified by the PPR) and the mapped location, the site has maximum predicted systematic tensile strains of 14.1mm/m, an overall subsidence movement of 1.8m and is located within the chain pillar associated with LW5. Whilst the site is predicted to be subject to movement, as an open site it will not be subject to rock falls caused by horizontal compression along cliffs (predicted at 450mm/m per 20m section). The sites recorded location places it over the chain pillar between LWs 4 and 5, within a detached boulder. This location, if correct, reduces the potential for impacts. As this site has not been located, it is difficult to accurately determine precise impacts based upon the landform context and subsidence modelling. The current impact assessment is based upon the assumption that the site is located in its recorded location but has been obscured by vegetation cover which has significantly increased since the original recording (post-bush fire).

Site 52-3-0323 is located on a lower valley slope along an extended 600m long, 2-6m high cliff formation which has a predicted horizontal compression of less than 20mm/m. The site has not been previously undermined or to have been subject to previous subsidence. Based on subsidence predictions for the UEP, the site has very low maximum predicted systematic tensile strains of less than 500mm/m, an overall subsidence movement of less than 100 mm and is located 230m southwest of Longwall 7. The site has a volume greater than 50 m<sup>3</sup> and water seepage is present. Despite the minimal impacts predicted, the shelter's size elevates its impact assessment.

Site 52-3-0325 is located on a lower valley slope; the shelter has been formed through block fall and is detached from the main cliff line, which is located 60m upslope. The site has been previously undermined as part of the Bulli seam extraction works and has been subject to previous subsidence. Based on subsidence predictions for the PPR, the site is located within LW7 block with a predicted maximum subsidence of 1.4m, compressive strains of 8.6mm/m and tensile strains of 17.0mm/m. The site is detached from the cliff line and is unlikely to be subject to rock falls or perceptible cracking. The site has a small volume which is less than 50 m<sup>3</sup> and water seepage is present. Despite the site's small volume, its impact assessment is elevated by the presence of art and water seepage within the shelter.





# Legend

■ Aboriginal heritage sites

## Survey Area

  Study Area

Longwall Layout

**Figure 2: Aboriginal heritage sites**

0 150 300 450 600 750  
Metres

Scale: 1:15,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 56



Ballarat, Brisbane, Canberra, Melbourne,  
Sydney, Wangaratta & Wollongong

Matter:  
Date: 15 September 2014,  
Checked by: , Drawn by: ngarvey  
Locations: P:\18600s\18644\Mapping\18644\_F2\_Aboriginal Sites





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## 4 PERFORMANCE MEASURES AND CRITERIA

Performance Measures are prescribed by **Condition 1/ Schedule 3** of MP 10\_0046. Performance Measures relevant to the HMP are outlined in Table 4.1 below.

*Table 4.1 - Subsidence Impact Performance Criteria*

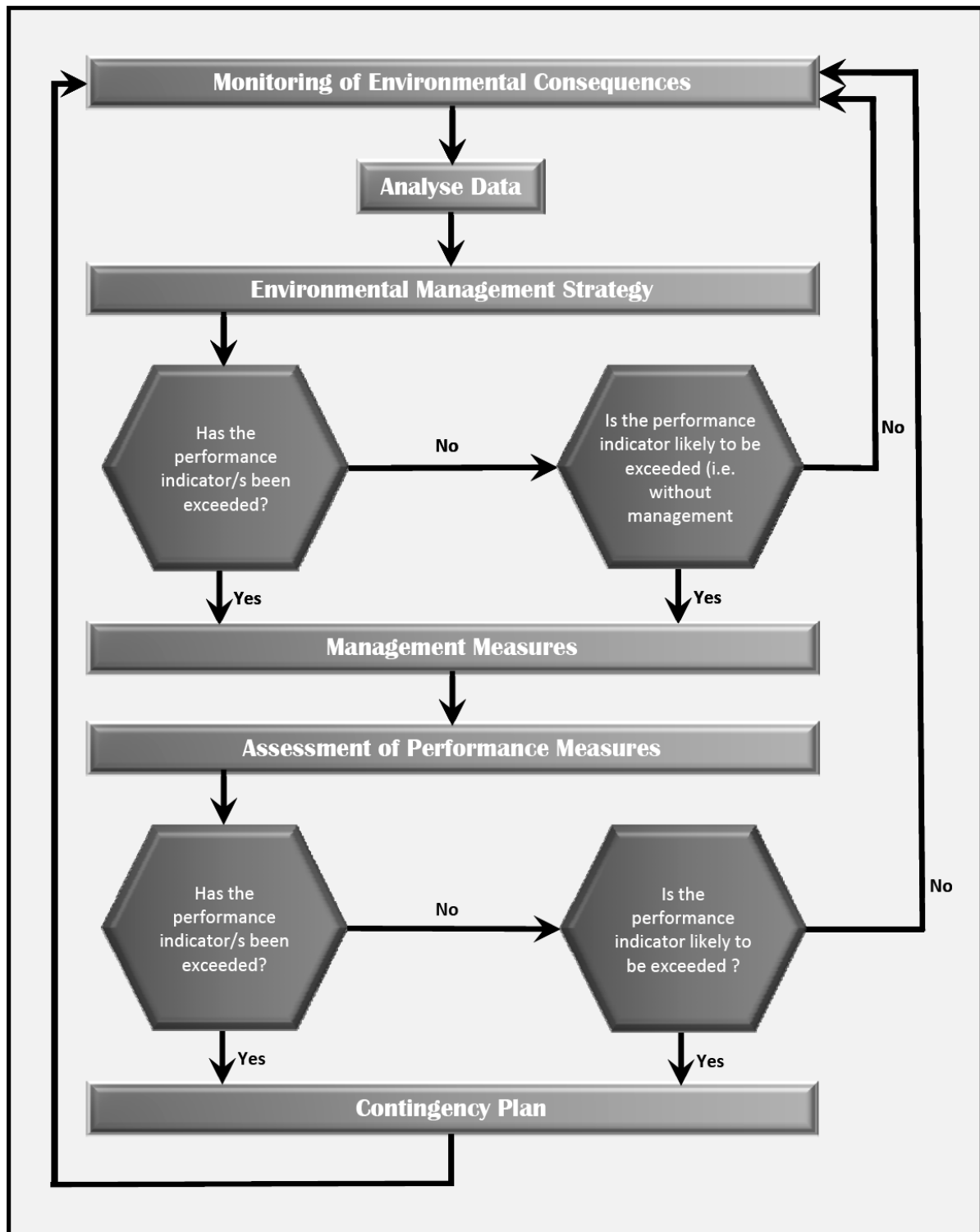
Feature	Performance Measure
Aboriginal heritage sites 52-2-1233 and 52-3-0320	Negligible* impact or environmental consequence

\*Negligible is defined as: Small and unimportant, such as to be not worth considering.

Management of site 52-2-1233 is outlined in the NRE No. 1 Colliery HMP. This site is located to the west of Cataract Reservoir and is distant from the study area. Accordingly, management of site 52-2-1233 is not considered further in this HMP.

In general, management of all sites would aim to achieve negligible impacts or environmental consequences. This is defined within the TARP.

Environmental management will be undertaken in accordance with the process described in **Figure 3** below.



*Figure 3 - Management Process*

## 5 MONITORING AND REPORTING

### 5.1 Monitoring

The proposed assessment methodology, strategies and timing of all activities in relation to Aboriginal sites in the study area are described below.

The following general schedule in **Table 5.1** is proposed for the monitoring of the Aboriginal sites within the study area.

*Table 5.1 - Subsidence Effects Monitoring and Management*

Activity	Timing
Baseline archival recording	Prior to longwall mining beginning in the study area.
Impact assessment recording	Three to six months after each predicted subsidence movement at the site (that is when a longwall makes its closest traverse to the site), and/or if the longwall is to finish mining within 6 months.
Final assessment recording	At the completion of all subsidence movements at the site. The results of the assessment to be reported in End of Panel Reports and/or Annual Reviews.

#### 5.1.1 Baseline Recording on Aboriginal Archaeological Sites

All currently known Aboriginal archaeological sites within the study area have been subject to recording at the level appropriate for registration on the AHIMS register.

However, additional recording of site characteristics is required for the purpose of the detailed baseline recording for the monitoring program. A monitoring regime established by Sefton (2000) and amended and continued by Biosis, has proven effective in observing and detecting changes to Aboriginal sites due to subsidence. The following activities will be undertaken as a part of baseline recording for the seven Aboriginal sites in the study area:

- Comprehensive photographic coverage of axe grinding groove sites and rockshelter sites using high resolution digital photography, showing heritage sites in their wider context and in relation to each other;
- Sites will be digitally photographed at scales appropriate to their size and complexity; and,
- Site plans recording structural and surface features including but not limited to axe grinding grooves, graffiti, joints, bedding planes, exfoliation scars, cracks, mineral and micro-organism growth, areas of running water and water seepage locations.



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Upon completion of the baseline recording, and prior to the commencement of mining in the study area, a report and archival material will be submitted to OEH. The report will include a detailed description of each of the sites recorded. The archival material will consist of all digital photographs, and written records for each site transferred to archival quality CD-ROM in accordance with the National Parks and Wildlife Service (NPWS) Standards and Guidelines (NSW NPWS 1997).

Baseline monitoring of all sites within the study area will be undertaken.

### 5.1.2 Subsidence Monitoring

The results of the archival recording procedures will be used for ongoing comparisons to determine any actual impact from mining.

Monitoring will be undertaken during mining (three to six months after each predicted subsidence movement at the site) and post-mining (at the completion of all subsidence movements at the site) as per the schedule outlined in **Table 5.1**.

Any impacts will be assessed by comparing the results of the impact recording stages with the baseline data. Movement at and within the site will be monitored by comparing observations of the monitoring points and general observations of the surrounding landscape for evidence of subsidence impact.

Subsidence monitoring will be undertaken at sites 52-3-0320, 52-3-0323 and 52-3-0325. Other sites are considered to be at negligible risk of impact and therefore do not need to be monitored.

### 5.1.3 Inability to Re-locate

Axe-grinding grooves and engraving sites on sandstone platforms within creek lines and swamps within the catchment areas can be problematic in relocating. Cultural features, such as axe grinding grooves, can be obscured by vegetation growth and organic litter build-up over time and may only be revealed in specific conditions (e.g. after a bushfire event).

Site 52-3-0320 (Bulli Mine Shaft Site 25) was unable to be re-located and thus baseline recording is unable to be undertaken. As this site could not be relocated, comprehensive photographic coverage of sandstone platforms within 50 m of the site were undertaken and monitored as per the steps outlined in **Section 5.1.1** and **Section 5.1.2** above. If subsidence effects are subsequently identified during the monitoring program at this location, then minor removal of vegetation potentially obscuring the site will be undertaken to attempt re-locate cultural features and identify any potential impacts to cultural features.



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#### 5.1.4 Impact and Risk Management Schedule

In the event that there are subsidence impacts to any sites observed during monitoring, or impact to the immediate context surrounding sites, management strategies specific to the impact will be developed and implemented in consultation with relevant regulatory agencies and RAPs.

The management strategies will be implemented in accordance with current conservation practice and the conservation principles contained within the Australia International Council on Monuments and Sites (ICOMOS) Burra Charter, and industry best practice. RAPs would be consulted regarding appropriate management methodologies and any advice would be taken into consideration in the development of the management strategies. All contingent management strategies will be developed in consultation with RAPs, WCC and OEH.

In all cases, monitoring will only be conducted when a site and condition specific risk assessment determines that it is safe to do so.

The triggers and suggested management actions are detailed in the Trigger Action Response Plan (TARP) (**Appendix A**).

## 5.2 Reporting

Progress against the requirements of this Plan will be reported regularly to the DP&E and other relevant agencies as required by the Project Approval.

In accordance with the requirements of **Condition 7/Schedule 5** of the Project Approval, the environmental performance of the colliery will be reported on the WCL website.

Reports will be produced and submitted to DP&E, OEH and RAPs at the following project milestones:

- Completion of baseline recording;
- Six monthly reports; and,
- Annual reviews.

The monitoring reports will include observations on any changes observed within the monitored shelters, and an interpretation of the mechanisms effecting those changes. Ongoing review of the factors influencing the preservation of shelters and the rock art within them will be included in each report where relevant observations and findings are made.



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## 6 MITIGATION AND MANAGEMENT STRATEGIES

The following management options and mitigation measures for cultural heritage sites that may be impacted due to mining subsidence have been made to inform the Extraction Plan. The heritage performance measures and indicators are presented in the TARP (**Appendix A**).

### 6.1 General

Within the study area, there are three recorded Aboriginal sites that may be subject to subsidence effects. As discussed in **Section 3.2**, predicting subsidence impacts to Aboriginal sites is subject to some variability.

Notwithstanding, only minor changes in monitored Aboriginal site conditions as a result of subsidence have occurred to date and none of the impacts have directly affected art, engravings or grinding grooves. It is expected that any impacts to Aboriginal archaeological sites from subsidence effects in the study area will be very low to negligible. Management responses for Aboriginal heritage in the study area need to be carefully considered so as to be commensurate with the level of risk of impact.

### 6.2 Trigger Action Response Plan

The TARP, as presented in **Appendix A**, has been designed specifically for this HMP to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant performance measures. The TARP also outlines the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- Trigger levels from monitoring to assess performance; and
- Triggers that flag implementation of contingency measures.



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## 6.3 Contingency Plan

### 6.3.1 Exceeding Performance Measures

In the event that the observed parameters or impacts exceed or are considered likely to exceed the Performance Measures detailed in **Section 4** of this HMP, WCL will implement the following Contingency Plan:

- The observation will be reported to the Environment Manager within 24 hours.
- The observation will be recorded.
- WCL will report any exceedance of the Performance Measure to the DP&E and other relevant stakeholders as soon as practicable after WCL becomes aware of the exceedance.
- WCL will assess the exceedances referred to in the TARP (outlined in **Section 6.2** of this document) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s.
- The Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary.
- WCL will develop an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders (RAPs).
- WCL will submit the proposed course of action to DP&E for approval.
- WCL will implement the approved course of action to the satisfaction of DP&E.
- WCL will continue to monitor performance with the new action plan in place and, if successful will formalise these actions as part of the Management Plan.

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

### 6.3.2 Discovery of Unanticipated Aboriginal Cultural Material

The following contingency plan describes the actions that must be taken in instances where Aboriginal cultural material is discovered or unearthed:

- 1) Discovery: Should unanticipated Aboriginal cultural material be identified during any works, works must cease in the vicinity of the find.
- 2) Notification: OEH must be notified of the find.



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- 3) Management: In consultation with OEH, registered Aboriginal parties and a qualified archaeologist, a subsidence impact assessment should be undertaken and management strategy developed to manage the identified Aboriginal cultural material. A subsidence monitoring program may be required for Aboriginal sites, using a methodology consistent with that outlined in **Section 5**.
- 4) Recording: The find will be recorded in accordance with the requirements of the *National Parks and Wildlife Act 1974* and OEH guidelines.

### 6.3.3 Discovery of Human Remains

A contingency plan relating to the unanticipated discovery of human remains is provided in the *NRE No. 1 Colliery Heritage Management Plan* (NREN EMSMP 008). Due to the significant depths at which mining will take place, there is no risk of encountering human remains during the extraction of Longwalls 6 & 7. There are no construction activities associated with the approved mining.





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## 7 REFERENCES

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ERM, (2012a). NRE No.1 Colliery Aboriginal Heritage Assessment. An unpublished report for Gujarat NRE Coking Coal Ltd.

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ERM (2013). NRE No.1 Colliery Project Application (09\_0013) Environmental Assessment. An unpublished report for Gujarat NRE Coking Coal Ltd.

MSEC, (2007). Introduction to Longwall Mining and Subsidence. MSEC, Chatswood.

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Sefton, C. (2003). Monitoring of Sandstone Overhangs and Engraving Sites on Longwalls 4-7 Metropolitan Colliery. An unpublished report for Illawarra Coal BHP Minerals



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## 8 CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	15/12/2014

### Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	28/10/2014	L O'Brien (Biosis) A.Wu (Hansen Bailey) K.Prajapati (WCL)	Draft
2	15/12/2014	N Garvey (Biosis) D Munro (Hansen Bailey) D Clarkson (WCL)	Final Draft
3	06/02/2015	N Garvey (Biosis) A Wu (Hansen Bailey) D Clarkson (WCL)	Final



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## Appendix A - Trigger Action Response Plan (TARP)

Site	Wollongong Coal	DOC ID	RVC EC TAR 005
Type	TARP	Date Published	06/02/2015
Doc Title	HERITAGE MONITORING TARP		

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Aboriginal Heritage	Aboriginal heritage sites:  • 52-3-0320 - Bulli Mine Shaft Site 25 • 52-3-0323 - Bulli Mine Shaft Site 26 • 52-3-0325 - Bulli Mine Shaft Site 27	Baseline recording and comparative photographic monitoring regime	Baseline archival recording prior to longwall mining beginning in the SMP area.  Impact assessment recording, three to six months after each predicted subsidence movement at the site (that is when a longwall makes its closest traverse to the site), and/or (if the longwall is to finish mining within 6 months).  Final assessment recording at the completion of all subsidence movements at the site.	To determine if subsidence effects resulting from longwall mining result in impacts to Aboriginal heritage sites and the heritage values of those sites.	<b>Within prediction (Level 1):</b>  <b>No change in site condition observed.</b>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Report negligible impact in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>
					<b>Within prediction (Level 2):</b>  <b>Change in site condition is observed, but the heritage values of the site are not impacted.</b>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Inform DP&amp;E, OEH and Registered Aboriginal Parties (RAPs) of potential impact.</li> <li>Undertake site inspection with RAPs to document and photograph any observed changes / impacts.</li> <li>Report potential impacts in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>DP&amp;E, OEH and RAPs informed within one week.</li> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>
					<b>Exceeding prediction:</b>  <b>Change in site condition is observed, and the heritage values of the site are impacted.</b>	<ul style="list-style-type: none"> <li>Continue monitoring.</li> <li>Inform DP&amp;E, OEH and Registered Aboriginal Parties (RAPs) of potential impact.</li> <li>Undertake site inspection with RAPs to document and photograph any observed changes / impacts.</li> <li>Discussion of potential remediation / mitigation. Consultation with OEH will be required if remediation or mitigation measures affect the archaeological values at individual sites.</li> <li>Use appropriate specialists to undertake physical remediation activities.</li> <li>Report potential impacts in six monthly reports.</li> </ul>	Russell Vale Colliery (Environmental Manager)	<ul style="list-style-type: none"> <li>DP&amp;E, OEH and RAPs informed within one week.</li> <li>Commence preparation of mitigation/action and monitoring plan within one week (if required).</li> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>



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Doc Title	HERITAGE MANAGEMENT PLAN		

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## Appendix B - Aboriginal Consultation and OEH correspondence



Site	Wollongong Coal	DOC ID	RVC EC PLN 005
Type	Plan	Date Published	06/02/2015
Doc Title	HERITAGE MANAGEMENT PLAN		

Organisation	Contact and date	Contact Description	Response	Response Description
Office of Environment and Heritage Planning & Aboriginal Heritage Conservation and Regulation	Email – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Via DP&E – 15 December 2014	Provision of Draft HMP (LW6&7) for Review		
Illawarra Local Aboriginal Land Council	Letter – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Letter – 20 January 2015	Provision of Draft HMP (LW6&7) for Review		
Peter Falk Consultancy	Letter – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Letter – 20 January 2015	Provision of Draft HMP (LW6&7) for Review		
Northern Illawarra Aboriginal Collective	Letter – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Letter – 20 January 2015	Provision of Draft HMP (LW6&7) for Review		
Wodi Wodi Elders Corporation	Letter – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Letter – 20 January 2015	Provision of Draft HMP (LW6&7) for Review		
Kullilia Welfare and Housing Aboriginal Corporation	Letter – 04 December 2012	Provision of Draft HMP (LW4&5) for Review		
	Letter – 20 January 2015	Provision of Draft HMP (LW6&7) for Review		



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 010
Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

## APPENDIX H

### BUILT FEATURES MANAGEMENT PLAN (RMS)



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 002
Type	Plan	Date Published	04/09/2014
Doc Title	BUILT FEATURES MANAGEMENT PLAN (RMS)		

## Russell Vale Colliery Wonga East – Longwalls 6 & 7

### BUILT FEATURES MANAGEMENT PLAN (RMS)



Source: <http://www.ozroads.com.au/NSW/Freeways/MtOusley/01.JPG>

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## GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
BFMP	Built Features Management Plans
DP&E	Department of Planning & Environment
DSC	Dam Safety Committee
DRE	Division of Resources and Energy
DTIRIS	NSW Department of Trade and Investment, Regional Infrastructure and Services
LW	Longwall
MSB	Mine Subsidence Board
Mtpa	Million tonnes per annum
PAC	Planning Assessment Commission
PPR	Preferred Project Report
PSE	Principal Subsidence Engineer
RMS	Roads and Maritime Services (the former Roads and Traffic Authority (RTA))
ROM	Run of Mine
SMP	Subsidence Management Plan
SMPA	Subsidence Management Plan Area
TC	Technical Committee
UEP	Underground Expansion Project
WCL	Wollongong Coal Limited

Term	Definition
Coal clearance system	A system used to transfer coal from the working faces to the surface.
Coking coal	Coking coal is coal that can be used in the production of coke which in turn is used in the blast furnace in the production of pig iron.
Continuous miner	A remote-controlled, tracked, electrically powered coal cutting and loading machine used to form mine roadways and extract coal pillars.
Driveage	A horizontal or inclined heading or roadway in the process of construction. The road way will be used to access a new mining area within the lease.
First workings	Involves the development headings or roadways which will provide access to the coal resource. They are developed using continuous miners with integrated roof and rib bolting rigs. First workings leave the coal pillars intact and the overlying strata fully supported
Gate roads	Access roadways connecting the longwall working face with the main roadways.
Goaf	The space left following extraction of the coal seam where the roof material is allowed to collapse.

Main roadways	Roadways that are used as the means of primary access/egress, to supply materials, provide ventilation and enable coal to be conveyed to the surface.
Metropolitan Special Area	An area categorised as Restricted Access under Schedule 1 of the Sydney Water Catchment Management Act 1998. It is managed by the Sydney Catchment Authority.
Mining Lease	Title granted under the Mining Act 1992 that provides rights to mine a coal resource.
Non-systematic subsidence	Non-systematic subsidence movements include far-field horizontal movements, irregular subsidence movements and valley related movements.
Portal	Entry point on the Escarpment into the coal seam.
Project Approval	Pt3A Major Project approval MP10_0046 as modified
Run-of-mine	ROM - Raw coal as mined that has not undergone any screening, crushing or washing.
Shaft	A vertical or inclined excavation used for the purpose of opening or servicing a mine.
Strain	The change in the horizontal distance between two points divided by the original horizontal distance between the points.
Russell Vale site	Location of main surface infrastructure, including stock pile area, offices etc
Stage 1	Preliminary Works Project – production continuing at current rates of 1mtpa
South Bulli Colliery	Previous name for the Russell Vale Colliery
Subsidence	Generally refers to the vertical movement of a point as a result of the longwall extraction, but subsidence of the ground actually includes both vertical and horizontal movement.
Systematic Subsidence	The normal ground movements resulting from the extraction of longwalls including subsidence (as above), tilt, curvature and strain (both compressive and tensile).
Tilt	The difference in subsidence between two points divided by the horizontal distance between the points.
Upsidence	Relative upward movement, or uplift, created by the horizontal compression and buckling behaviour of the rock strata in the vicinity of a valley floor
Valley closure	A phenomenon whereby one or both sides of a valley move horizontally towards the valley centreline, due to changed stress conditions beneath the valley and its confining land masses



## 1 INTRODUCTION

### 1.1 Project Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

The Russell Vale Colliery currently operates under a project approval granted by the Planning Assessment Commission (PAC) under delegation on 13 October 2011 (MP 10\_00046). The project approval was modified (MOD1) by the PAC in 2012 to allow:

- extraction of coal using longwall mining techniques in the Wongawilli Seam for longwalls 4 and 5 (LW4 and LW5); and
- development of the main gate roads for longwall 6 (LW6) and establishment of the Wonga mains.

A second modification to the project approval (PA 10\_0046 MOD2) was made in 2014 to authorise:

- secondary extraction of the first 400 m of longwall 6; and
- extension of the duration of mining until 31 December 2015.

WCL has lodged a separate application (09\_0013) for its Underground Expansion Project (UEP) to facilitate further mining operations at Russell Vale Colliery. In October 2013, WCL lodged a Preferred Project Report (PPR) which proposed significant amendments to the UEP (as originally proposed). The amended UEP would facilitate the continued operation of the colliery for five years and would allow extraction of 4.7 million tonnes of Run of Mine (ROM) coal. The mine plan for the amended UEP consists of 8 longwall panels (including longwalls 6 & 7). The environmental impact assessment for the Underground Expansion Project has been protracted based on the complex environment of the Russell Vale Colliery in proximity to the Cataract Reservoir and sensitive upland swamps, and the high level of community and stakeholder interest in the project. It is unlikely that determination of the application will be made until late 2014.

This Built Features Management Plan (BFMP) has been prepared in support of an Extraction Plan, as required by **Condition 7/Schedule 3** of Project Approval (MP 10 0046).

In consideration of LW4 and LW5 subsidence monitoring observations, it is proposed to amend the LW5 BFMP. This BFMP covers changes to the LW5 BFMP (RMS) for the extraction of LW6 and LW7.

This BFMP provides a summary of a review of management measures by the Technical Committee (TC) in relation to RMS assets which included:

- Review of scope and frequency of monitoring (Summarised in this BFMP);

- Site inspections (Carried out as part of management measures);
- Review by relevant specialists (See referenced reports);
- Initiate traffic management procedures (Not required);
- Review of the potential factors contributing to the exceedance of the performance trigger including review of subsidence measurements and predictions (contributing factors discussed in this BFMP); and
- Review effectiveness of management measures (summarised in this BFMP).

The endorsement and signatory on the front of this document by a representative from RMS, indicates concurrence with the content and adequacy of this BFMP with respect to the management of mining impacts on RMS assets.

## 1.2 Purpose and Scope

Following extraction of LW4 and LW5, the TC (as constituted in this BFMP) has identified a need to review the BFMP for the following reasons:

- The next longwalls, LW6 and LW7 are further away from RMS infrastructure.
- Some RMS infrastructure will no longer lie within the RMS zone of interest (5 x seam depth) during extraction of LW6 and LW7.
- During extraction of LW4 and LW5 the TC reviewed monitoring data to assess ground movements and their impacts on RMS infrastructure. Review of this monitoring data has allowed the TC to identify redundancy and potential improvements to monitoring systems and make appropriate amendments to this BFMP. In particular, the review highlighted specific areas of RMS infrastructure that need to be the main monitoring focus – valley closure around Cataract Creek and cracking across Mount Ousley Road within the identified extension zone near Peg 46 on the P-line.

Accordingly, this BFMP (RMS) for extraction of LW6 and LW7 has been produced to:

- Provide an overview of mining, monitoring and impacts associated with LW4 and LW5;
- Based on the monitoring data, mine plan and location of RMS infrastructure, consider amendments to the management measures for RMS assets;
- Report on pre-emptive actions taken prior to mining of LW6 and LW7; and
- Incorporate amendments into the Monitoring Plan, TARP and Management Flow Sheet.

The locations of the previously mined LW4 and LW5 and the proposed LW6 and LW7 panels are shown in **Figure 2**.

This BFMP (RMS) also provides the basis for protection and management of items of RMS infrastructure identified to be potentially at risk due to mining of LW6 and LW7, and to take proactive action to resolve any manifestation of unexpected events. In accordance with a



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key aspect of RMS protocols for managing mine subsidence, all infrastructures within an area of up to five times seam depth from the longwalls has been considered. The RMS assets within this area of interest are listed below and are shown in **Figures 3, 4 and 5**.

- Bridge at Picton Road interchange (at limit of area of interest for LW6, beyond area of interest for LW7);
- Pavements within the area of interest;
- Culverts:
  - Cataract Creek – Culvert No"s 684509 & 684510;
  - Picton Road – Culvert No"s 671052, 671051, 671050, 671049, 671048, 671047, 671046, 684550, 684551, 684549, 684501, 684502, 684548, 684547, 684552, 684546, 684545, 684503, 685504, 684505, 684544, 684543, 684506, 684507, 684542, 684508, 684509, 684510, 684553, 684511, 684541, 684512, 684513, 684539, 684540;
  - Picton Road – Culvert No"s 671075, 671074, 671073, 671071 & 671070.
- Slopes:
  - Embankment No"s 10840, 13483, 13484;
  - Cutting No"s 10841, 13482, 13485;
- Minor structures such as barriers, fixed sign posts, roadside furniture, etc will be managed in accordance with the RMS"s normal asset management procedures and are not included in this document.

### 1.3 Consultation and Distribution

This plan has been prepared in consultation with RMS Technical Committee.

Copies of this BFMP will be distributed to:

- Department of Planning and Environment (DP&E);
- Division of Resources and Energy (DRE); and
- Roads and Maritime Services (RMS).

WCL will make this BFMP publicly available on the WCL website and will be responsible for its maintenance. A hard copy will also be kept at the Russell Vale Colliery, 7 Princes Highway, Corrimall, NSW 2518.

Any revisions undertaken will be the responsibility of WCL and any notifications will be sent accordingly. WCL will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on WCL"s computer system, website, and hard copy at the Russell Vale Colliery, 7 Princes Highway, Corrimall, NSW 2518.

### 1.4 Report Structure

The remainder of this BFMP is structured as follows:

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 002
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**Section 2:** Outlines the statutory requirements applicable to the Plan.

**Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.

**Section 4:** Details the performance measures and indicators that will be used to assess the Project.

**Section 5:** Describes the monitoring program.

**Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.

**Section 7:** Describes the protocols for the handling of incidents, complaints and compliances.

**Section 8:** Details how the Plan will be implemented, managed, reviewed and updated and managed.

**Figure 1** shows this Plan's position within the WCL Environmental Management Structure.

## **Environmental Management Structure**

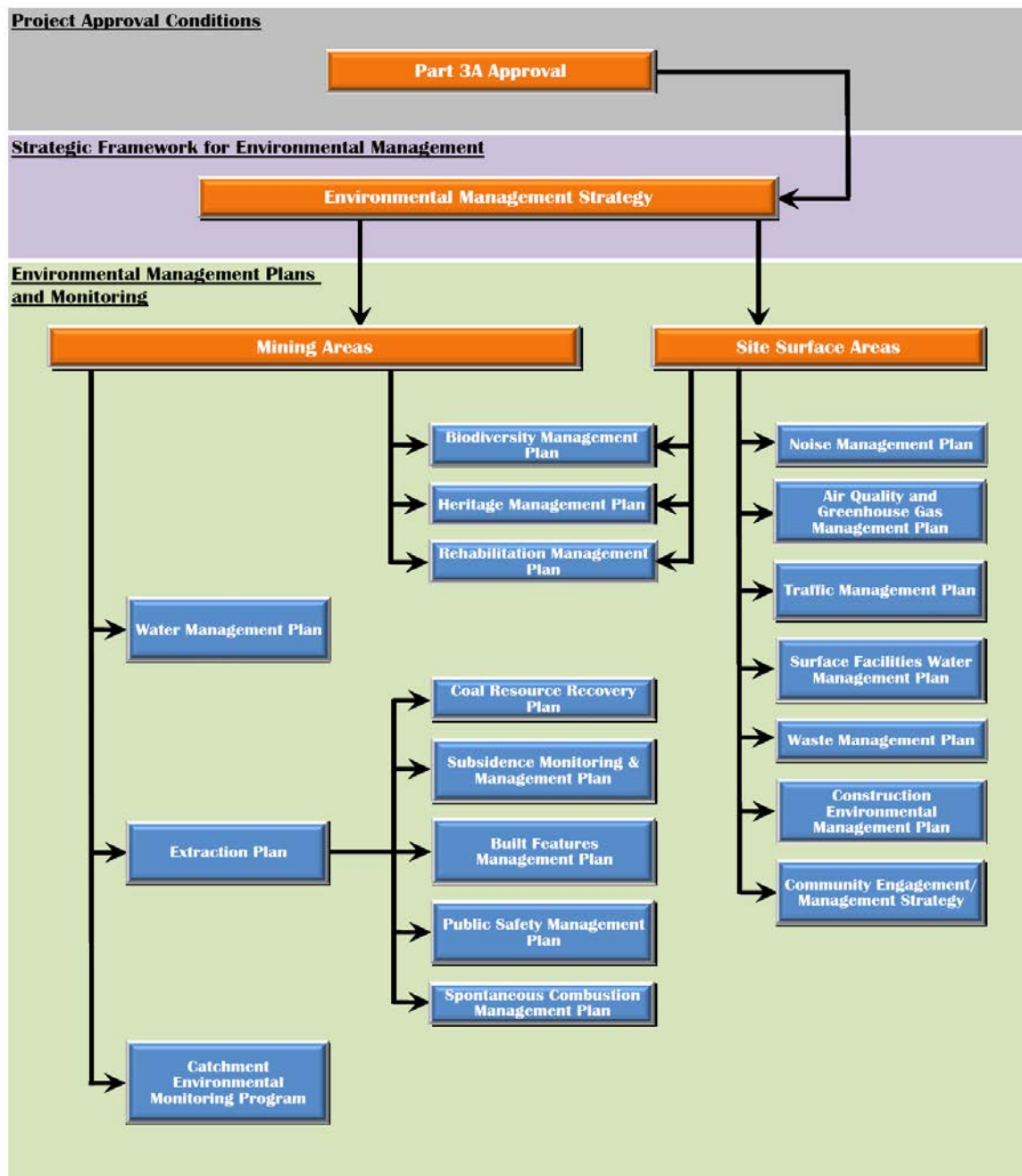
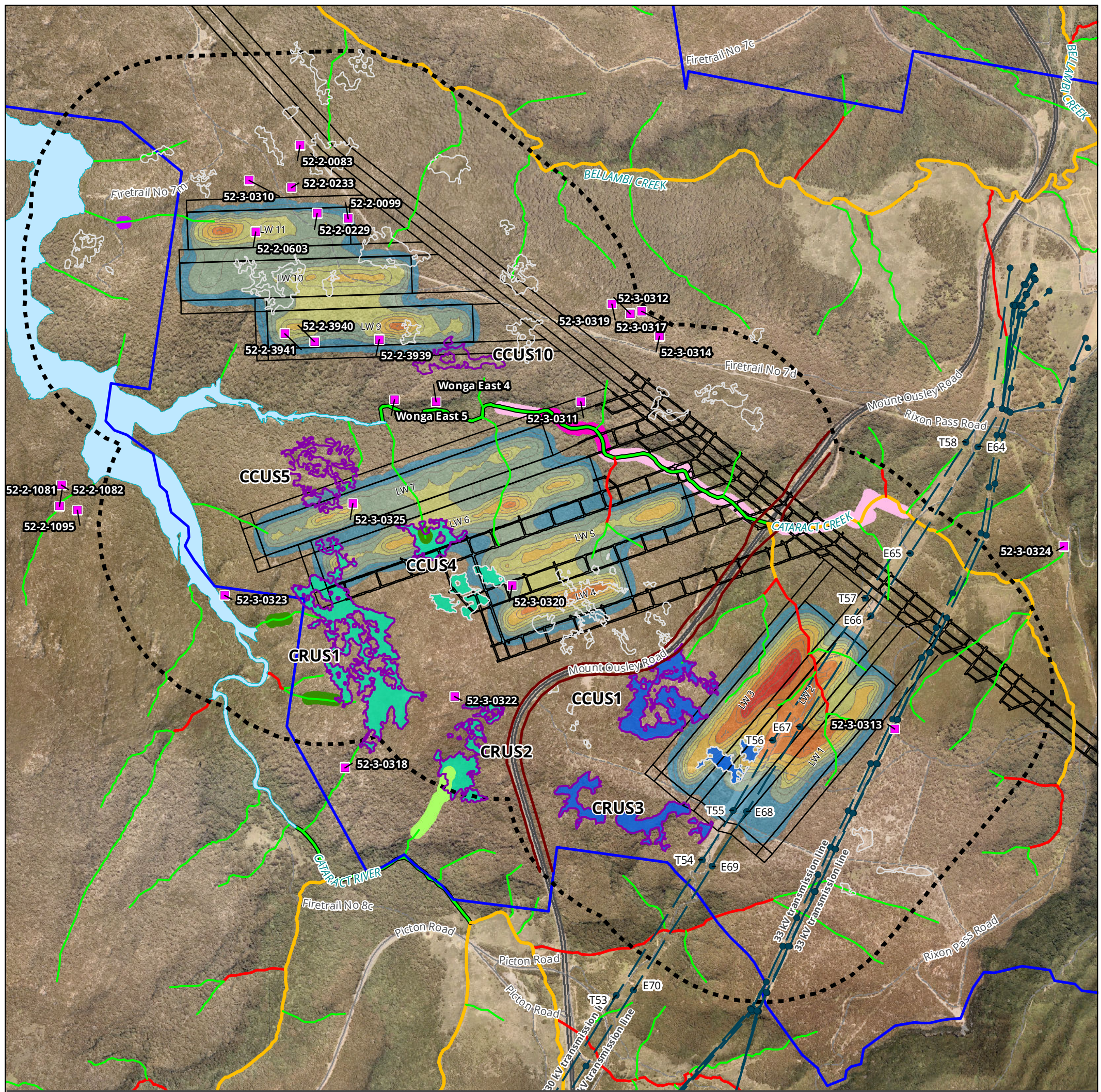


Figure 1 - Environmental Management Structure





**Legend**

- Wonga East Workings
- Study Area - Wonga East
- Project Application Area
- Power Poles
- Powerlines
- Mt Ousley Road Easement
- Streams with Strahler Order**
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- Lake Cataract

**Location of Cultural Heritage Sites**

- Cultural Heritage Site

**Swamp of Special Significance (Biosis 2012)**

- Yes
- No

**Threatened Frog Breeding Habitat**

- Littlejohn's Tree Frog - Low
- Stuttering Frog - High
- Stuttering Frog - Low
- Littlejohn's Tree Frog & Giant Burrowing Frog - High
- Littlejohn's Tree Frog & Giant Burrowing Frog - Low

**Threatened Frog Non-Breeding Habitat**

- Giant Burrowing Frog
- Littlejohn's Tree Frog & Giant Burrowing Frog

**Predicted Subsidence Contour (m) Wongawilli Seam (SCT Operations)**

- 0.2 to -0.4
- 0.6 to -0.8
- 1 to -1.2
- 1.4 to -1.6
- 1.8 to -2
- 2.2 to -2.4

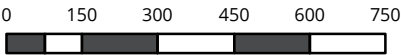


Map created by Biosis Pty Ltd

Figure 2 - Features of Special Significance - Wonga East

Acknowledgements: Imagery (c) Nearmap 2012  
Topo (c) NSW Land and Planning Information (2012)

Matter:  
Date: 22 August 2014,  
Checked by: , Drawn by: ANP, Last edited by: apritchard  
Location: P:\16600s\16646\Mapping\Figure for PPR Plan\  
16646 FXX\_Plan for PPR.V6



Metres  
Scale 1:15,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 56





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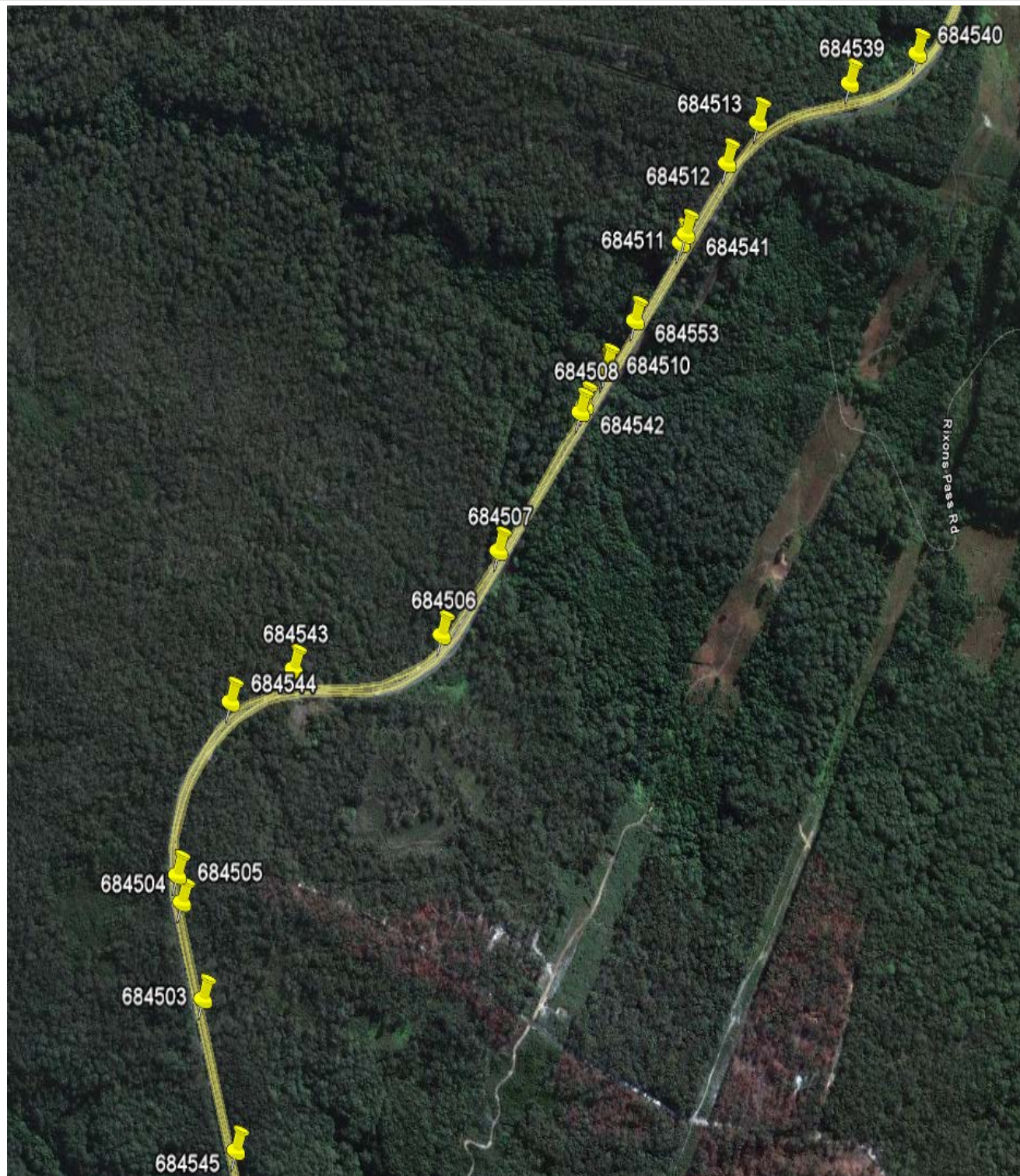


Figure 3 - RMS Assets (A)



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 002
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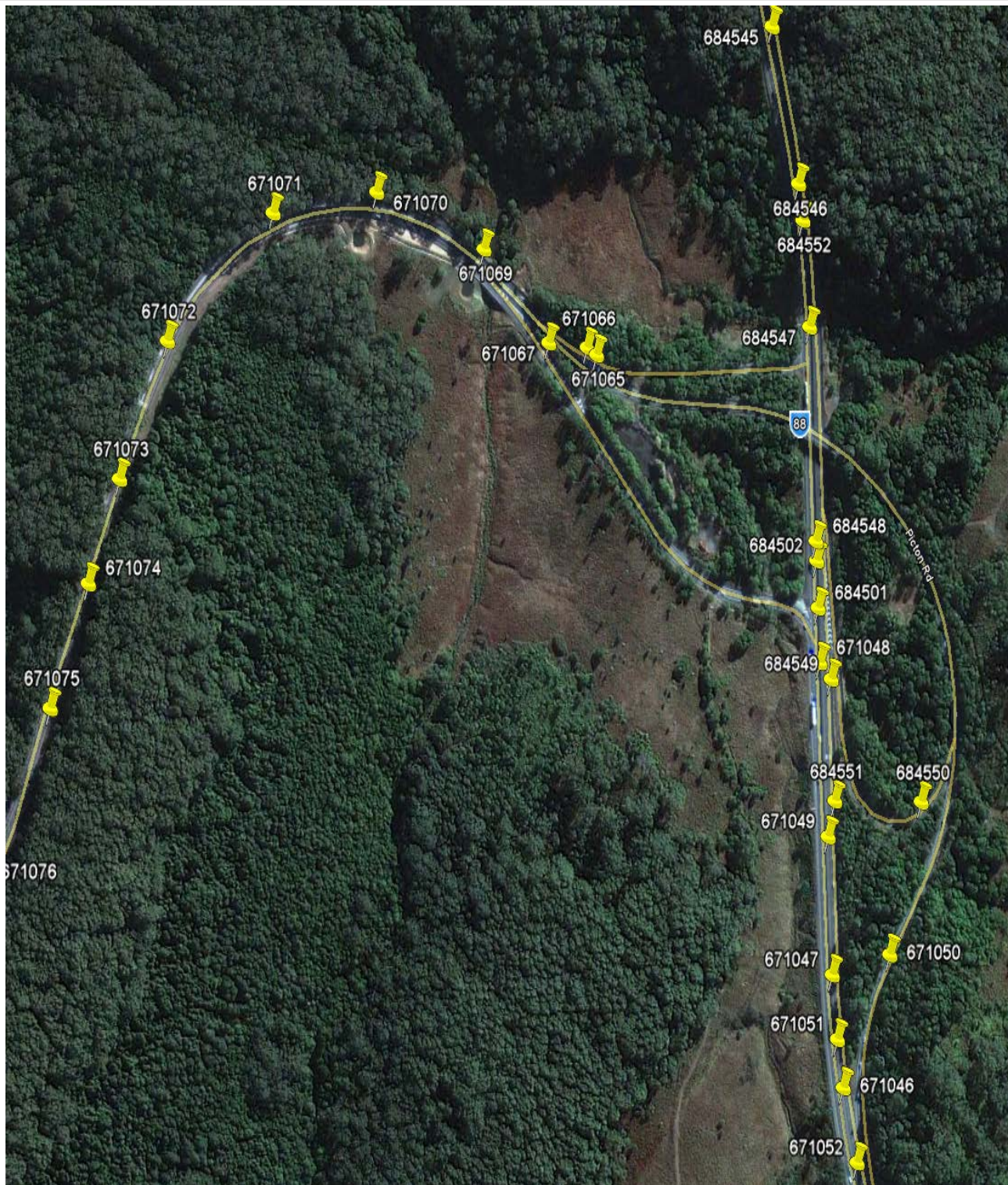


Figure 4 - RMS Assets (B)



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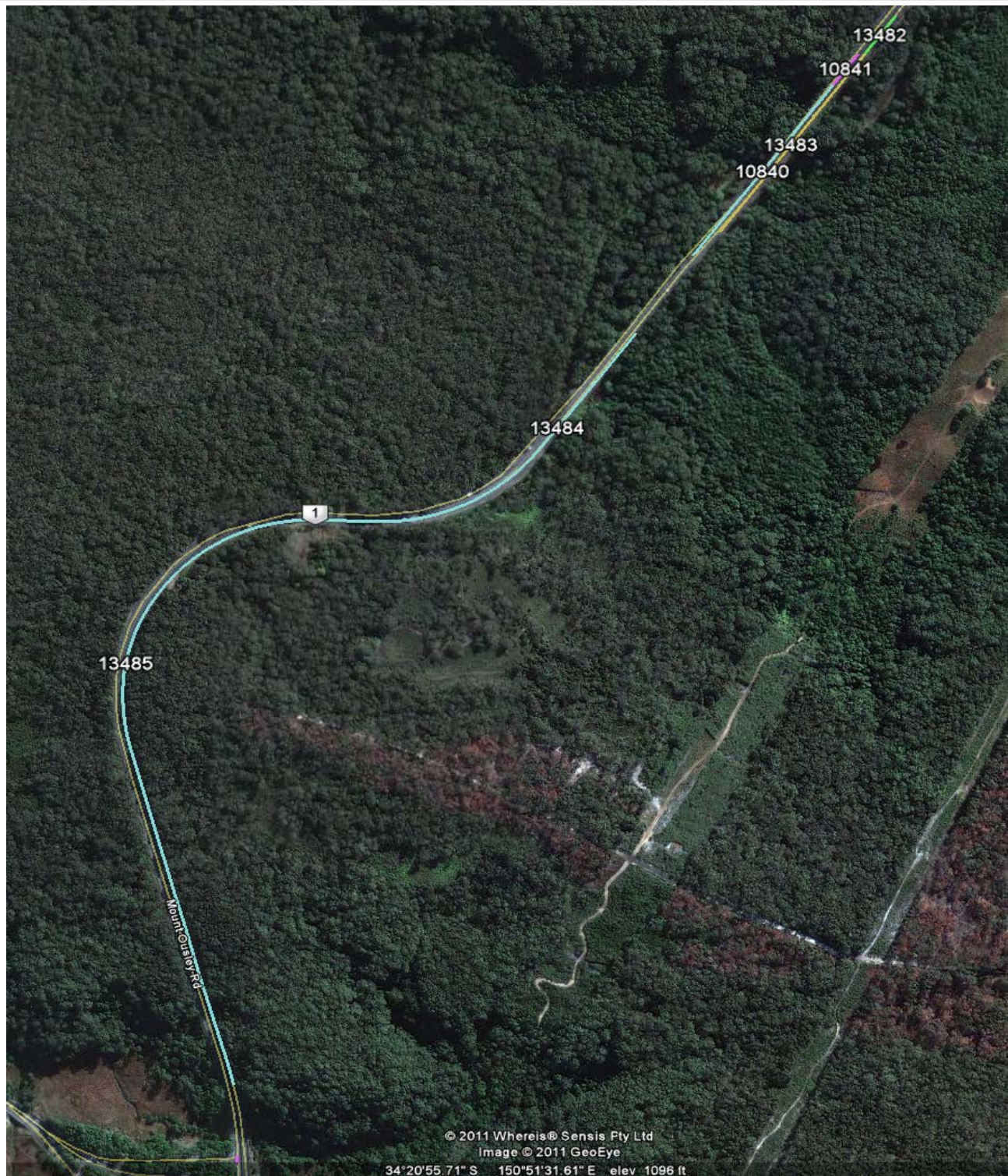
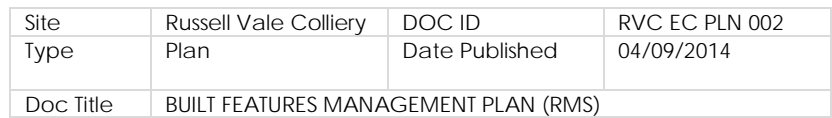


Figure 5 - RMS Assets (C)





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Project Approval Condition	Plan Section
performance measures/criteria;	
(d) a program to monitor and report on the: <ul style="list-style-type: none"> <li>impacts and environmental performance of the project;</li> <li>effectiveness of any management measures (see c above);</li> </ul>	Section 5.2 and 5.3
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.4
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Sections 8.5
(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and</li> <li>exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	Section 7
(h) a protocol for periodic review of the plan.	Section 8.5

## 2.2 Licences and Leases

In addition to the requirements of the Project Approval, all activities at or in association with the Russell vale Colliery will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

*Table 2.2 - Licences, Permits and Leases*

Licence/Approval	Document No.	Issue Date/	Expiry Date
Consolidated Coal Lease Renewal	745	27 Dec 1990	30 Dec 2023
Mining Purposes Lease	271	09 May 1991	09 May 2033
Mining Lease	1575	22 Mar 2012	22 Mar 2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31 Oct 2001 23 Jan 2002 28 Jun 2001	-
Approval to mine P&O Panels (first workings)	10.123.081	7 Jan 2005	-
DC for Thin Seam Mining P/L	D1096/01	19 Sep 2001	-
Environmental Protection Licence	12040	Current	-
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10 Aug 1992	-
DC for Storm Water Control Dam and Water Treatment	D91/551	17 Jun 1992	-

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Licence/Approval	Document No.	Issue Date/	Expiry Date
Dangerous Goods Licence	NDG021269	17 Sep 2013	01 Nov 2014
Licence to Store Explosives	XSTR100114	21 Oct 2012	3 Oct 2017
SPCC Approval for Stage 3	90/4711 (280021C/20)	04 Sep 1992	-
DC for Russell Vale Waste Emplacement	D89/839	11 Apr 1990	-
DC for Demolition of Washery	D2004/32	14 Dec 2004	-
Mining operations Plan (MOP)		1 Jan 2008	31 Dec 2017
Bore Licence Certificate	10BL602992	29 Jan 2013	28 Jan 2018

## 2.3 Relevant Legislation and Guidelines

WCL will conduct approved mining operations consistent with the Project Approval conditions and any other legislation that is applicable. The following Acts may be applicable to the conduct of the Project:

- *Coal Mine Health and Safety Act 2002*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 1989*
- *Dams Safety Act 1978*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Energy and Utilities Administration Act 1987*
- *Environmental Planning and Assessment Act 1979*
- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
- *Fisheries Management Act 1994*
- *Heritage Act 1977*
- *Mining Act 1992*
- *Noxious Weeds Act 1993*
- *Protection of the Environment Operations Act 1997*
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- *Roads Transport Act 2013*
- *Road Transport (Vehicle and Driver Management) Act 2005*
- *Sydney Water Catchment Management Act 1998*
- *Threatened Species Conservation Act 1995*
- *Water Act 1912*
- *Water Management Act 2000.*

Relevant licences or approvals required under these Acts will be obtained as required.

### 3 IMPACT ASSESSMENT

This section is based on the subsidence assessment conducted for the Preferred Project Report and particularly the detail presented in SCT Report WCRV4263 and the associated environmental assessment reports. However, only those sections relevant to LW6 and LW7 are considered. Impacts on the Illawarra Escarpment and the power transmission towers east of Mount Ousley Road are not considered in detail because the proposed mining of LW6 and LW7 will be remote from these features and these features are not relevant to RMS infrastructure. However, due to the Additional Subsidence Management Area, impacts on Mount Ousley Rd will be used to trigger inspections and/or surveys of the electricity transmission lines.

#### 3.1 Site Description

**Figure 2** shows a plan of the proposed LW6 and LW7 and the Subsidence Management Plan Area (SMPA) which includes the 'Additional Subsidence Management Area' defined on Plan 2e – Additional Subsidence Management Area (attached as **Appendix B**). The previously extracted panels LW4 and LW5 are also shown.

Generally, the surface land overlying the proposed extraction area is bushland that lies within crown land, declared as a Metropolitan Special Area controlled by the SCA in the headwaters of Cataract Reservoir adjacent to Cataract Creek. All streams and drainage are directed towards Cataract Dam, via Cataract Creek, Cataract River and their tributaries.

Known surface (natural and built) features in the SMPA that may experience subsidence effects or impacts are:

- Declared Special Metropolitan Catchment lands controlled and managed by SCA;
- Parts of Cataract Creek and Cataract River;
- Natural vegetation;
- Upland swamps;
- Threatened and protected species;
- Cliffs and steep slopes;
- Areas of indigenous archaeological interest;
- Mount Ousley Road; and
- Other Roads (dirt roads and fire trails).

Surface features that are not expected to be directly impacted include:

- A bridge and culverts associated with the Picton Road Interchange;
- High voltage electricity transmission lines east of Mount Ousley Road;

- Mine infrastructure (exploration boreholes, electricity lines, and ventilation shafts); and
- Survey control marks.

There are no known public amenities, agricultural lands, industrial/commercial establishments, or residential properties within the SMPA. The SMPA is not in an MSB Mine Subsidence District.

### 3.2 Subsidence Impacts

Predicted subsidence and an assessment of subsidence impacts are presented in detail in the PPR. The summary of the subsidence assessment for those features located within the SMPA is presented below as a subset of the PPR assessment. A copy of the full report for the PPR is available on WCL's and DPE websites.

The subsidence parameters predicted for the proposed LW6 and LW7 are summarised in **Table 3.1** including the subsidence estimated and measured that has occurred previously due to mining in the Bulli Seam prior to 1950 and the Balgownie Seam between 1970 and 1982. The subsidence predicted and measured for LW4 and LW5 is included as an indication of the conservative approach used for the prediction of subsidence parameters.

**Table 3.1 - Predicted Subsidence**

General Observations Above Individual Panels	Previous Bulli and Balgownie Seam Subsidence (m)	Predicted Additional Subsidence for PPR Wongawilli Seam (m) and Measured (in bold)	Predicted Tilt for PPR Wongawilli Seam (mm/m) and Measured (in bold)	Predicted Tensile Strain for PPR Wongawilli Seam (mm/m) and Measured (in bold)	Predicted Compressive Strain for PPR Wongawilli Seam (mm/m) and Measured (in bold)	Predicted Maximum Closure on Cataract Creek (mm) (Southern Tributary in Brackets - LW1-3)
Longwall 4	1.9	2.1 (1.8)	35 (30)	10.5 (7.5)	21 (14)	N/A
Longwall 5	0.9	1.9 (1.8)	36 (16)	10.8 (6)	22 (12)	300 (49)
Longwall 6	1.5	2.1	38	11	23	290
Longwall 7	1.2	1.5	28	8	17	290

Mount Ousley Road is protected from direct mine subsidence by a horizontal distance from the nearest goaf edge of greater than half overburden depth. Low levels of vertical subsidence of less than about 100mm in total are expected in the vicinity of Mount Ousley Road with up to approximately 40mm of this maximum having already occurred during mining of LW4 and LW5. LW6 and LW7 are not expected to cause additional subsidence along the road alignment. These low level vertical movements are expected to be imperceptible for all practical purposes. Tensile cracking adjacent to the topographic high ground south of Cataract Creek and closure of up to a maximum of about 50mm is expected at the crossing of Cataract Creek. Some 11mm of closure was measured during mining of LW5 with most of the rest likely to be associated with mining LW2 and LW3 (the

effects of which are not considered in this management plan). There is considered to be no potential for significant horizontal movements to impact the Picton Road Interchange and no movements attributable to mining have been measured in the subsidence monitoring conducted to date.

The 2002 ACARP Method for predicting valley closure indicates horizontal movement in a downslope direction caused by mining below the slope on the southern side of Cataract Creek is likely to generate closure at the creek crossing as summarised in **Table 3.2**.

**Table 3.2 - Predicted Horizontal Closure Across Cataract Creek at Mount Ousley Road**

Longwall	Maximum Incremental Closure Predicted and Measured (mm)	Maximum Cumulative Closure Predicted (mm)
4	6	6
5	11 (10)	17

The upper limit of 19mm of compression in the bottom of the valley estimated at the completion of LW6 and LW7 is expected to be accompanied by a similar level of cumulative tensile cracking toward the top of the slope. Some of the tensile cracking that began during LW4 appears to be continuing during mining of LW5 particularly at Peg 46 on P Line. The ongoing cracking observed near Peg 46 may also include sub-base deterioration associated with repetitive vehicle loading and fines migration into the crack below the pavement that formed during LW4.

The Picton Road Interchange is located on the opposite side of Cataract River and the opposite side of a tributary that joins Cataract River at the interchange. LW6 and LW7 are located predominantly below the north facing slope that leads down to Cataract Creek. As these longwall panels start below the ridge and mine away to the north, horizontal movements in a downslope direction are considered unlikely to extend across Cataract River to interact with the Picton Road Interchange. The bridge on the Picton Road Interchange is further protected by being on the far side of the west flowing tributary to Cataract River.

On this basis, there is considered to be no potential for significant horizontal movements to impact the Picton Road Interchange. A monitoring strategy is considered appropriate to confirm that subsidence movements are of low level and of no significance for the structures around the interchange. A reduction in the frequency of monitoring compared to the monitoring conducted for LW4 and LW5 is considered appropriate.

The road cutting on the northern side of Cataract Creek has been formed in Hawkesbury Sandstone strata to create cuttings up to about 10m high. These cuttings are located beyond 500m from the nearest longwall panel on the opposite side of Cataract Creek. There is considered to be no potential for mining induced cliff falls to occur along this section of exposed rock. No impacts to cuttings or embankments were identified from mining of LW4 and LW5.

### 3.3 Geology

The geology of the Application Area is described in the LW 4 and LW5 BFMP (NRE No.1 Colliery Wonga East – Longwalls 4 & 5 SMP (NREN EMS MP003) Built Features Management Plan (RMS)) and PPR. The dominant structural features which may have some impact on RMS infrastructure is summarised in **Table 3.3** below and presented in **Figure 6**.

*Table 3.3 - Key Geological Features*

Fault Name	Description
Corrimal Fault	<ul style="list-style-type: none"> <li>Normal Fault extending from seam outcrop at escarpment for approximately 3200 m to the northwest, bearing approximately 310°.</li> <li>Downthrow to the northeast (throw varies from approximately 30 m to zero).</li> <li>Hade angle of approximately 40° (to horizontal).</li> </ul>
Dyke D8	<ul style="list-style-type: none"> <li>Intrusion, bearing approximately 300°.</li> <li>Singularly up to 3.5 m thick with variable hardness.</li> <li>Minor faulting (throw) &amp; irregular cindering of coal associated with this structure.</li> </ul>

### 3.4 Overview of LW4 and LW5 Mining Impacts to Individual Features

#### 3.4.1 Pavements

There have been minor subsidence related impacts observed on pavement including several tension cracks and a compression hump. The tension crack at P48 and the compression hump at the slot created in the Mount Ousley Road where it crosses Cataract Creek are the main changes to have occurred during mining of Longwalls 4 and 5. The asphalt in the pavement slot has been milled to restore rideability.

#### 3.4.2 Picton Road Bridge

Cardno (2014) reported on the surveys conducted on the Picton Road interchange at intervals during mining of LW5. The measurements reported indicate maximum changes of 5mm but these changes are considered by Cardno as likely to have been survey tolerance because no other related changes were observed. No significant changes to the structure beyond those that can be ascribed to normal thermal variation or age of the structure are noted.

#### 3.4.3 Culverts

No impacts on culverts have been identified.



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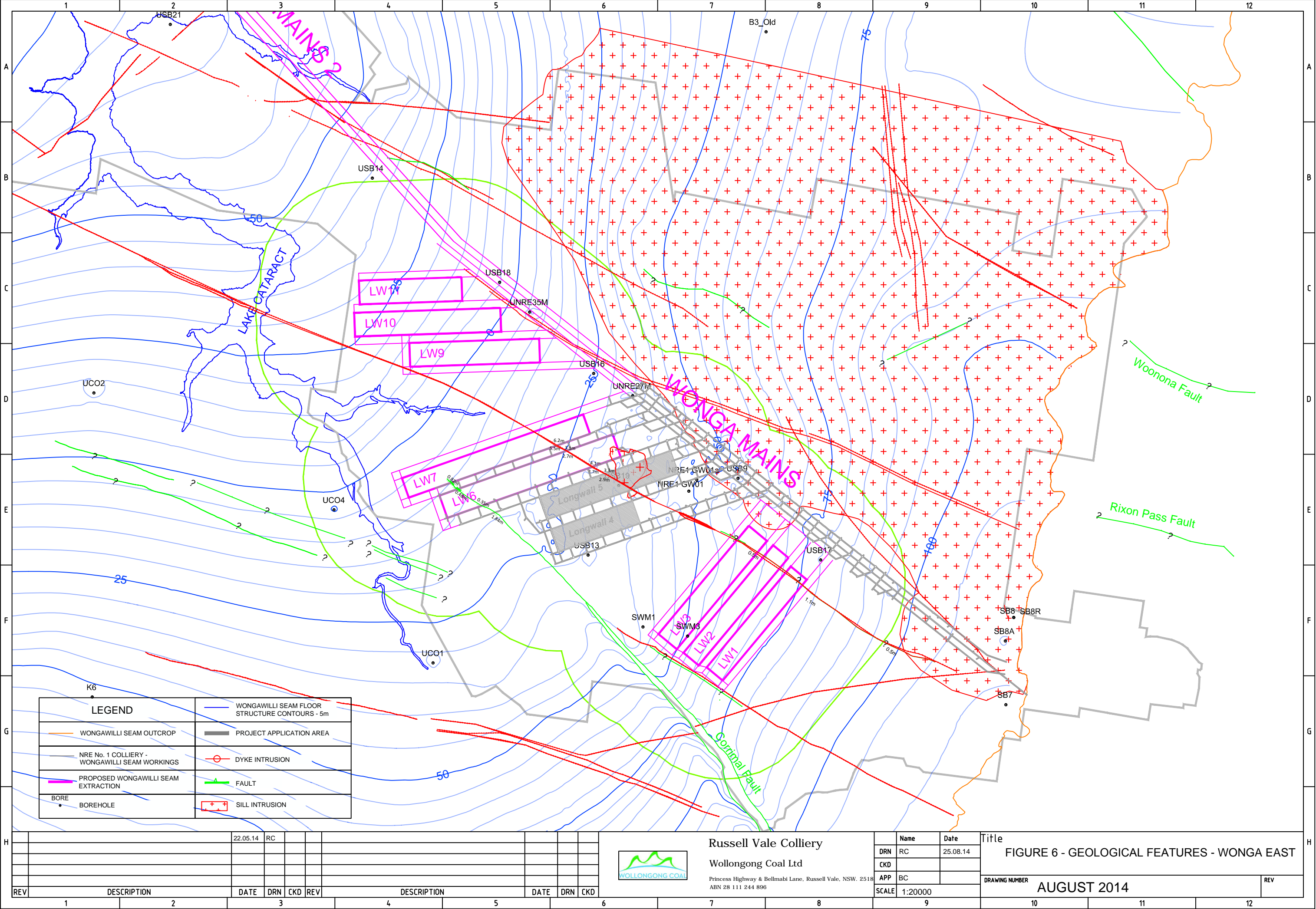
#### 3.4.4 Cuttings and embankments

No impacts on cuttings or embankments have been identified.

### 3.5 Risk Assessment

A Risk Assessment (RA) workshop facilitated by Arup Risk Consulting was convened on 10 July 2014 with representatives from the TC to assess the potential for impacts on RMS infrastructure associated with mining related ground movements.

The RA is described in detail in a separate report by Arup Risk Consulting (**Mount Ousley Road: Wollongong Coal – Impacts of LW6&7 Mining on RMS Assets**) – refer **Appendix C**).



### 3.6 Review of Management Measures

Management of subsidence impacts on Mount Ousley Road, Picton Road Bridge and Culverts is covered in this BFMP and is substantially guided by the TC. This strategy has proved effective to date and is considered to provide a strong basis to manage future monitoring protocols and assess potential impacts. Given the increasing remoteness of proposed mining from Mount Ousley Road and the low levels of ground movement so far observed from LW4 and LW5, a reduction in the frequency of monitoring for this BFMP is planned with the following refinements and improvements of key monitoring. However, this reduction is based on the recognition that the TC can adjust and refine the monitoring at any time depending on circumstances above and beyond this BFMP.

- The frequency of monitoring on Mount Ousley Road and the Picton Road Interchange is planned to be reduced to the beginning and end of each longwall in recognition that proposed mining will be increasingly remote from the road and the interchange.
- Monitoring of tiltmeters alongside Mount Ousley Road will be discontinued.
- P Line will be replicated on the southbound side of the road following the completion of LW5, but before the commencement of any subsequent longwall panels. The new marks will be recessed below the surface of the road so they are not vulnerable to being scraped off during road maintenance activities. The pegs will be surveyed in three dimensions at the beginning and end of each longwall panel or at other times as required by TC. The existing P Line pegs are not planned to be removed, but would only be surveyed on an as required basis.
- Monitoring of road condition to continue at the intervals indicated in the monitoring plans or at more frequent intervals as required by the TC.
- Closure of the slot at the crossing point on Cataract Creek will continue to be monitored as per previous panels. .
- Closure measurements in the culvert will be upgraded to include closure measurements between the sides of the culvert and between the roof and floor. The diagonal measurements will continue to be made, but it has been recognised that these measurements alone are unlikely to be sensitive to closure across the culvert.
- Two points suitable to affix prisms will be established at convenient locations alongside the road formation some 50-100m either side of Cataract Creek. These prisms would be located so that they can be surveyed without needing to close the road. By setting up a third mark close to one of the prisms and in line with the two prisms, high resolution point to point surveys can be made by backsighting to one prism and forward sighting to the other to accurately measure changes in distance between the prisms. Resolutions of typically better than a few millimetres across 100-200m are possible using this approach. These marks will be surveyed at the intervals indicated in the monitoring plan or at other times as may be necessary to confirm the closures measured at the slot or Cataract Creek culvert.
- Observations of cracking on the road surface have identified the presence of a zone of stretching movement along the northern side of the ridge between Cataract Creek

and Cataract River. A second set of prisms will be established across this zone to measure the magnitude of stretching movements that may develop during mining of LW6 and LW7. The marks should ideally be 50-100m apart, but the zone of stretching is apparent as clearly identifiable cracks and shorter line lengths may be suitable if longer sight lines are not available.

- Marks on the bridges and culverts around the Picton Road Interchange are planned to be surveyed at the end of LW6 and LW7.
- As an analogue to the level of movements that may be expected from mining LW1, LW2, and LW3 in a direction away from the interchange, it is planned to measure movements on the centrelines of LW6 and LW7 as these panels mine away from Cataract River in an uphill direction. These observations will inform the management options for the Picton Road Interchange should LW1, LW2, and LW3 be mined in the future.
- Inspections of cutting/embankments will be carried out end of LW6 and LW7.
- The location and extent of all monitoring lines and survey targets mentioned above are shown in **Figure 7**.

Site	Russell Vale Colliery	DOC ID	RVC EC PLN 002
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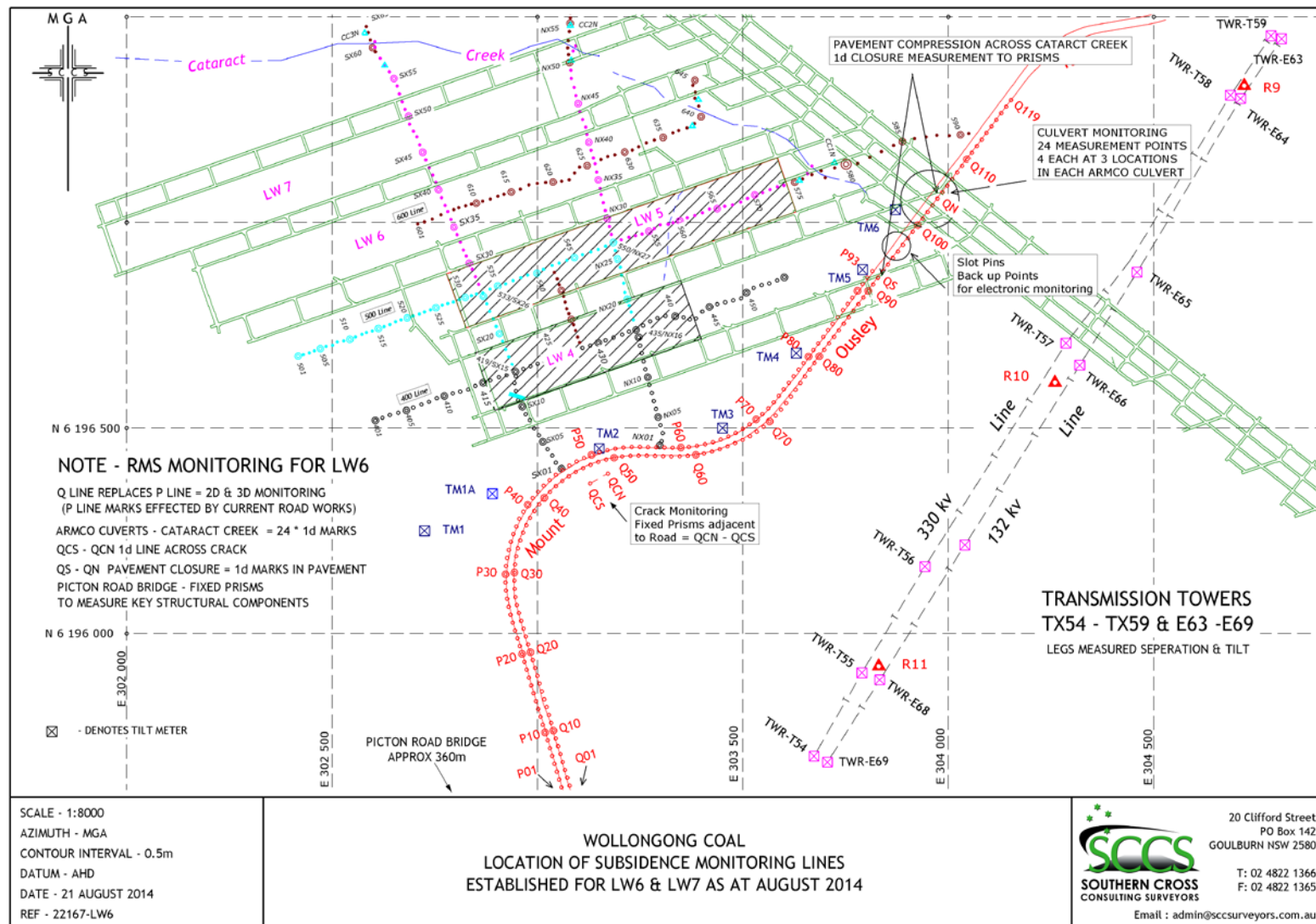


Figure 7 - The Location and Extent of All Monitoring Lines and Survey Targets



## 4 PERFORMANCE MEASURES AND CRITERIA

Performance Measures for the management of built features are outlined in **Table 2** of **Condition 4/ Schedule 3**. These Performance Measures relevant to the BFMP are outlined in **Table 4.1** below.

**Table 4.1 - Subsidence Impact Performance Measures for Built features**

Built features	
Key public infrastructure: Mount Ousley Road	<p>Always safe and serviceable.</p> <p>Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.</p>

### 4.1 Performance Indicators

In the Note to **Condition 4/ Schedule 3**, point 1) states:

*"The Proponent will be required to define more detailed performance indicators (including impact assessment criteria) for each of these performance measures in [a] Built Features Management Plan or Public Safety Management Plan...."*

As such a summary list of the performance indicators proposed to ensure that the above performance measure is achieved is provided in **Table 4.2**.

**Table 4.2 - Performance Indicators**

Road Feature	Performance Indicators
Pavement Cracking and Deformation	<ul style="list-style-type: none"> <li>Ground strains – limits have been established and will be used for monitoring the performance of the pavement in compression;</li> <li>Pavement cracking;</li> <li>Deterioration in ride quality; and</li> <li>Defects in minor structures such as kerbs and gutters, pits, etc.</li> </ul>
Bridge Distortion	<p>Limits have been established and will be used for monitoring the performance of the bridge:</p> <ul style="list-style-type: none"> <li>Relative movement between any two monitored points on the structure or in the adjacent ground; and</li> <li>Cracks in concrete elements.</li> </ul> <p>The established limits were adopted to provide a reasonable indicator of ground movements, including differential movements, and distortion of the bridge as a result of extraction of the longwalls. Should these limits be exceeded, structural analysis along with more detailed monitoring would be used to assess the ongoing performance of the bridges. The proposed monitoring locations and frequency are outlined in <b>Section 5</b>.</p>

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Doc Title	BUILT FEATURES MANAGEMENT PLAN (RMS)		

Road Feature	Performance Indicators
Cuttings	<ul style="list-style-type: none"> <li>• Measurable ground strains</li> <li>• Rock falls;</li> <li>• Cracking or visual deterioration at the rock face; and</li> <li>Visible displacement at joints.</li> </ul>
Culverts	<ul style="list-style-type: none"> <li>• Visible displacement at joints;</li> <li>• Displacements in the steel culverts at Cataract Creek</li> <li>• Cracks in concrete culverts; and</li> <li>• Ponding.</li> </ul>

**Section 5** of this BFMP-RMS describes the monitoring that will be conducted to assess the Project against the above performance indicators.

**Section 6** describes the management measures that will be implemented in the event that one or more of the performance indicators are exceeded. **Section 6** also provides a Contingency Plan in the event the performance measure/s is exceeded or is considered likely to be exceeded.

Environmental management will be undertaken in accordance with the process described in **Figure 8**.



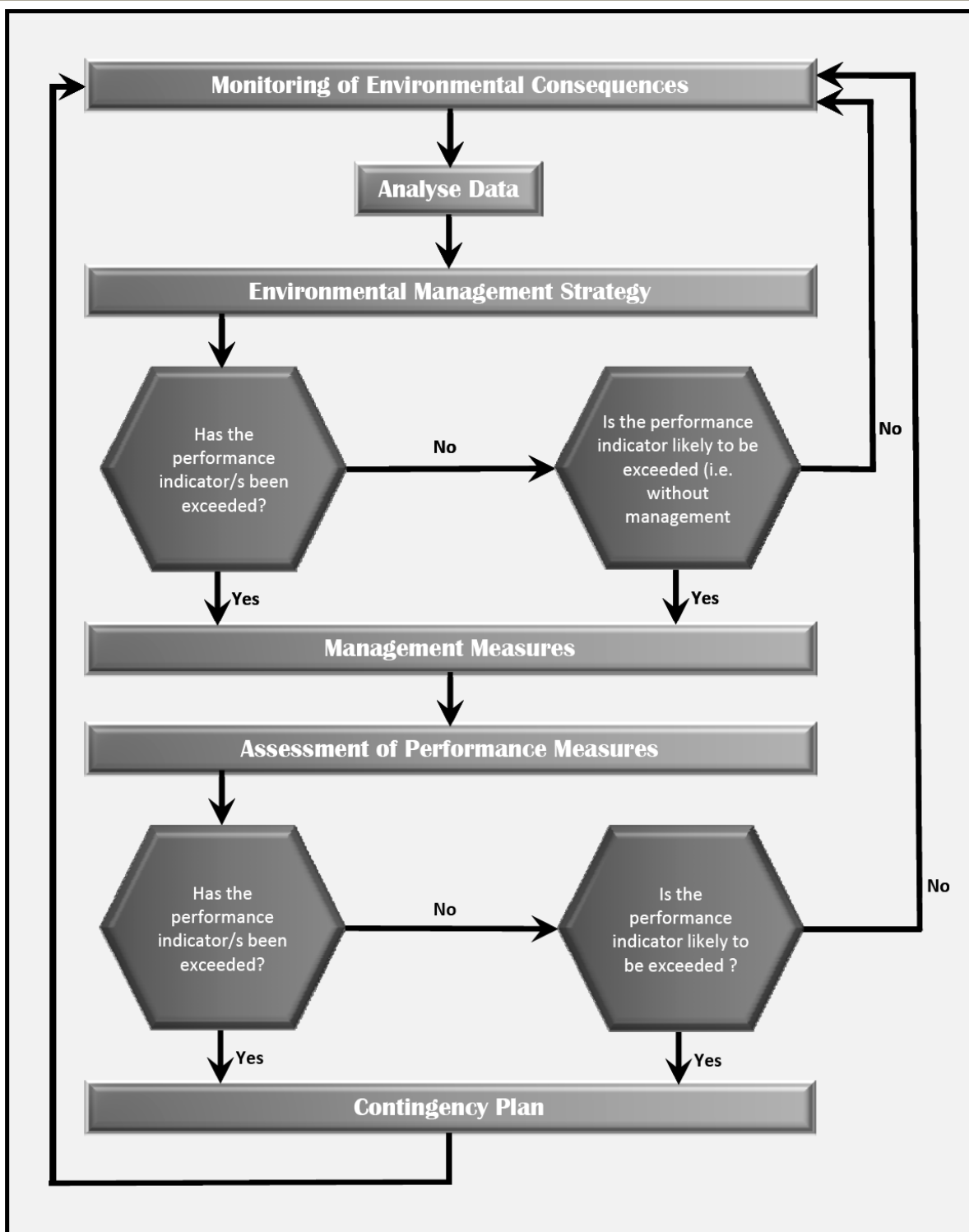


Figure 8 - Environmental Management Process

## 5 MONITORING AND REPORTING

### 5.1 Baseline Surveys

Baseline surveys have been and/or will be carried out for all items listed in the Monitoring Plan. Where monitoring has been undertaken during or after extraction of a LW block, this monitoring constitutes the pre-mining survey for the next LW block. The Monitoring Plan has been updated to reflect this process.

### 5.2 Monitoring

The monitoring and inspection programs planned to be undertaken during mining of LW6 and LW7 are described in this section. The results of monitoring and inspections will be reported to the TC as nominated in the Monitoring Plan (refer **Table 5.1**).

All performance indicators and monitoring frequency are planned to be reviewed by the TC should performance indicators be exceeded.

The monitoring outlined in the following sections will be implemented to monitor the impacts of the Project on key RMS assets. **Table 5.1** summarises the BFMP-RMS monitoring components

### 5.3 Reporting

The management process has been reviewed to improve responses to triggers, reporting accuracy and data review.

The TC receives regular status reports summarising mining progress and monitoring reports, as well as impacts and management measures actioned during the reporting period if they occur.

This reporting process has been modified to improve quality assurance. The report will be reviewed and signed off by WCL's Consultant Subsidence Engineer to confirm his endorsement of the report. This amendment has been incorporated into a revised management flow chart.

The TARP has been modified to incorporate early input by the TC specialists following each survey epoch and hence prior to activating triggers. Pre-set values for triggers have been removed as these are considered too simplistic. These changes, particularly in relation to the Picton Road Bridge and Mount Ousley Road pavement, will enhance management of potential mining impacts through early engineering review of all monitoring data rather than only after triggers have been activated.

The Management Flow Chart and the Monitoring Plan have been updated to reflect changes to the TARP.



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Reporting will be made available in accordance with the requirements of **Condition 7/Schedule 5** of the Project Approval.

**Table 5.1 - Monitoring Plan**

Asset	Failure	Monitoring	Accuracy	Frequency	Responsibility	Purpose
<b>Pavements</b>						
	<ul style="list-style-type: none"> <li>Compression shear failure leading to step or hump</li> </ul>	<ul style="list-style-type: none"> <li>3D measurements every replicated "P" Line along slow lane shoulder of South Bound carriageway</li> <li>Relative 2D Survey Lines, on each slow lane shoulder (North Bound and South Bound) carriageway adjacent to Cataract Creek</li> <li>Approx 25 survey marks on each line</li> </ul>	2D Level +/- 5mm 2D position +/-2.5mm 2D Strain +/- 0.25mm/m	<ul style="list-style-type: none"> <li><u>LW6 &amp; LW7:</u> <ul style="list-style-type: none"> <li>prior to start</li> <li>end of mining</li> <li>At TC discretion if creek, culvert, slot or point to point survey closures exceed triggers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide relative subsidence and strain data.</li> <li><b>Note:</b> there will be no direct correlation between N/B and S/B lines</li> </ul>
		<ul style="list-style-type: none"> <li>Relative 2D Survey Line in shoulder on topside corner (N/B side) (P-Line)</li> </ul>	+/- 2.5mm	<ul style="list-style-type: none"> <li>prior to start</li> <li>end each panel</li> <li>At TC discretion if point to point survey closures exceed triggers</li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide relative subsidence and strain data.</li> </ul>
		<ul style="list-style-type: none"> <li>Crackmeters in slot in pavement</li> </ul>	+/-1mm	<ul style="list-style-type: none"> <li>Hourly from installation of slot to end of mining (See note 3)</li> <li>Reported Fortnightly</li> </ul>	<ul style="list-style-type: none"> <li>Pells Consulting/WCL</li> <li>WCL to download data from crackmeters, or process data sent to web portal. Pells Consulting to produce fortnightly summary reports of that data (See note 3). Technical specialists to review report</li> </ul>	<ul style="list-style-type: none"> <li>Monitor slot closure due to environmental (temperature) and valley closure effects</li> </ul>
		<ul style="list-style-type: none"> <li>Survey Pins across slot</li> <li>Two sets of pins</li> <li>One set located on North Bound shoulder and another set on South Bound Shoulder</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li>On installation of slot</li> <li>At discretion of the TC</li> </ul>	WCL/TC <ul style="list-style-type: none"> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week</li> </ul>	<ul style="list-style-type: none"> <li>Provide slot closure information if crackmeter measurements need to be verified</li> </ul>
		<ul style="list-style-type: none"> <li>Survey pins at topside corner cracks</li> <li>One set of pins located across crack</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li><u>LW6 &amp; LW7:</u> <ul style="list-style-type: none"> <li>prior to start</li> <li>end of mining</li> <li>At monthly visual inspections</li> <li>At TC discretion if point to point survey closures exceed triggers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/CNS</li> </ul>	<ul style="list-style-type: none"> <li>Provide information on tension crack development</li> </ul>
		<ul style="list-style-type: none"> <li>Point to point high resolution surveys across Cataract Creek and over the extension zone associated with P46</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li>Prior to start</li> <li>At quarter, mid and three quarter-panel and completion of each longwall panel.</li> <li>At discretion of the TC</li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week</li> </ul>	<ul style="list-style-type: none"> <li>Provide slot closure information more broadly than crackmeter measurements</li> </ul>
		<ul style="list-style-type: none"> <li>Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange</li> </ul>	In accordance with record sheet	<ul style="list-style-type: none"> <li>Weekly</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Subjective assessment of rideability and pavement condition. Report on change for detailed investigation</li> </ul>
		<ul style="list-style-type: none"> <li>Visual site inspection to identify emerging impacts on RMS infrastructure</li> </ul>	In accordance with record sheet	<ul style="list-style-type: none"> <li>Monthly</li> </ul>	<ul style="list-style-type: none"> <li>WCL (Inspector to satisfy job description for visual pavement inspection as advised by C Dove of CNS)</li> </ul>	<ul style="list-style-type: none"> <li>Inspection to identify and track emerging impacts potentially before they are detected by survey</li> </ul>

		<ul style="list-style-type: none"> <li>Laser profilometer</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Before and after LW6 &amp; LW7</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>measurement.</li> <li>Assess pre and post mining pavement condition</li> </ul>
		<ul style="list-style-type: none"> <li>Deflectometer</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Before and after LW6 &amp; LW7</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assess pre and post mining pavement condition</li> </ul>
<b>Culverts</b>						
	<ul style="list-style-type: none"> <li>Horizontal compression leading to ovaling and buckling of culvert</li> </ul>	<ul style="list-style-type: none"> <li>Horizontal and vertical diameter measurements at three locations in culvert (third points and centre)</li> </ul>	+/- 1mm	<b>Cataract Creek Culverts</b> <ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>prior to start</li> <li>¼ length</li> <li>mid length</li> <li>¾ length</li> <li>end of mining</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week</li> </ul>	<ul style="list-style-type: none"> <li>Specific measurements to determine change of culvert shape</li> </ul>
		Visual inspection/photos	<ul style="list-style-type: none"> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>prior to start</li> <li>mid length</li> <li>end of mining</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/RMS joint inspection</li> </ul>	<ul style="list-style-type: none"> <li>Assessment of culvert condition and any changes from previous inspection</li> </ul>
		CCTV	<ul style="list-style-type: none"> <li>Prior to mining - Identify visible cracks and defects</li> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>Use original RMS CCTV inspections as a baseline. Reinspect at the completion of LW6 &amp; LW7.</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assess pre and post mining culvert condition</li> </ul>
<b>Bridges</b>						
	<ul style="list-style-type: none"> <li>Differential horizontal movements leading to destructive distortion of the bridge elements</li> </ul>	<ul style="list-style-type: none"> <li>Relative 3D survey of the bridge structure and ground</li> <li>Fixed prisms (approx. 16): <ul style="list-style-type: none"> <li>1 at each side of each abutment,</li> <li>1 at top and 1 at base of central column of each pier</li> <li>1 on underside of central box girder adjacent each pier and abutment</li> <li>1 at ground beside each pier and abutment</li> </ul> </li> </ul>	1mm	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>Prior to start</li> <li>End of Mining</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.</li> </ul>	<ul style="list-style-type: none"> <li>Survey to measure relative 3D movements at target locations so that differential movements between any two points can be calculated.</li> </ul>
		Visual survey/photos	<ul style="list-style-type: none"> <li>Identify visible cracks and defects prior to mining</li> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>Mid length</li> <li>On completion</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assessment of bridge condition condition (cracks and other defects) and any changes from previous inspection</li> </ul>
		Condition survey	<ul style="list-style-type: none"> <li>Prior to mining: <ul style="list-style-type: none"> <li>Identify visible cracks and defects</li> <li>Survey position of bearings</li> </ul> </li> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>Before mining and</li> <li>After completion of each longwall</li> </ul>	<ul style="list-style-type: none"> <li>WCL/RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assess pre and post mining bridge condition (cracks and other defects)</li> </ul>

Cuttings						
	Differential horizontal movements leading to instability	<ul style="list-style-type: none"> <li>Visual inspection/photos</li> </ul>	<ul style="list-style-type: none"> <li>Monitor change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>Use ARL assessment of 8 December 2011 as a baseline. Reinspect at the completion of LW6 &amp; LW7 Monthly after amber trigger in pavement surveys exceeded</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assessment of cutting condition and any changes from previous inspection</li> </ul>
		<ul style="list-style-type: none"> <li>Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange</li> </ul>	<ul style="list-style-type: none"> <li>In accordance with record sheet</li> </ul>	<ul style="list-style-type: none"> <li>Weekly</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Subjective assessment of cutting condition.</li> <li>Report on change for detailed investigation</li> </ul>
Cross Lines and Centre Lines As required by SMP						
During mining of LW6 & LW7		<ul style="list-style-type: none"> <li>3D Survey <ul style="list-style-type: none"> <li>Total subsidence</li> <li>Incremental subsidence</li> <li>Variation in horizontal strain</li> </ul> </li> <li>Survey measurement comparison with predictions</li> <li>Report as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	<ul style="list-style-type: none"> <li>WCL</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide subsidence and strain data</li> </ul>
Post mining of LW6 & LW7		<ul style="list-style-type: none"> <li>3D Survey <ul style="list-style-type: none"> <li>Total subsidence</li> <li>Incremental subsidence</li> <li>Variation in horizontal strain</li> </ul> </li> <li>Survey measurement comparison with predictions</li> <li>Report as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	<ul style="list-style-type: none"> <li>WCL</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide subsidence and strain data</li> </ul>

- Monitoring detailed in the table above relates to monitoring after completion of baseline and LW5 surveys
- Where movement monitoring in the table above is scheduled at the end of mining, monitoring will continue until, in the opinion of the Technical Committee, all mining related movement has ceased, at which point the TARP for that particular Longwall will cease to operate.
- It is intended to transmit crackmeter data from the site to a web portal for processing. However, mobile phone reception in the vicinity of Cataract Creek is very poor and this may impact on the transmission of data to the web portal. If it is not practical to transmit the data consistently, it will be downloaded by the WCL. The data will then be recorded hourly by the data logger at the site and downloaded fortnightly by the WCL with fortnightly reporting by Pells Consulting.
- Cross lines and centre line data will assist in informing the TC, but is not a fundamental requirement for management of impacts to RMS assets.



## 6 MITIGATION AND MANAGEMENT STRATEGIES

### 6.1 General

A number of general management measures in relation to RMS assets are applicable and a broad outline of the measures for the various infrastructure elements is provided in the sections below. These include:

- Review of scope and frequency of monitoring;
- Site inspections;
- Review by relevant specialists;
- Initiate traffic management procedures;
- Review of the potential factors contributing to the exceedance of the performance trigger including review of subsidence measurements and predictions; and
- Review effectiveness of management measures.

In addition, management measures in relation to each specific RMS asset have been consolidated in the schedule provided in **Appendix A** in the form of a triggered action response plan, or TARP. Added to this management measure is a process flow diagram (**Figure 8**) that illustrates the roles and responsibilities should a trigger level be reached.

**Table 6.1** provides more specific management measures for each road feature.

*Table 6.1 - Indicative Mitigation Measures*

Road Feature	Potential Mitigation Measures
Pavement	<ul style="list-style-type: none"> <li>• Milling of localised humps</li> <li>• Heavy patch repair</li> <li>• Slotting</li> <li>• Crack sealing</li> </ul>
Bridge	<ul style="list-style-type: none"> <li>• Crack repairs;</li> <li>• Modifications to bearings;</li> <li>• Installation of temporary support;</li> <li>• Structural modification.</li> </ul>
Culverts	<ul style="list-style-type: none"> <li>• Point repairs;</li> <li>• Structural lining</li> <li>• Void grouting around the culverts</li> <li>• Internal support or strutting</li> </ul>
Cuttings	<ul style="list-style-type: none"> <li>• Rock bolting;</li> <li>• Scaling;</li> </ul>

Road Feature	Potential Mitigation Measures
	<ul style="list-style-type: none"> <li>Shotcreting;</li> <li>Installation of rockfall mesh;</li> <li>Installation of barriers;</li> <li>Trim back.</li> </ul>
Embankments	<ul style="list-style-type: none"> <li>Trim slope</li> <li>Rock Toe support</li> <li>Sheet pile or other piling solution</li> </ul>

## 6.2 Technical Committee

A condition of WCL's approval is to prepare and implement a BFMP in conjunction with the owner of the relevant built feature/s to manage potential consequences as a result of mining (i.e. potential impacts to infrastructure, Safety and Functionality).

In accordance with this condition (**Condition 7h/Schedule 3**) suitably qualified and experienced specialist/s have managed and/or provided input into, the preparation of this BFMP-RMS, namely representatives from SCT, AECOM, Pells Consulting, RMS and WCL.

This BFMP-RMS has been prepared with the assistance of a Technical Committee (TC) comprising representatives of the RMS and WCL together with technical specialists as listed in **Table 6.2**. In addition, representatives from the MSB and DRE attended one or more of the TC Meetings as observers.

**Table 6.2 - Technical Committee Members**

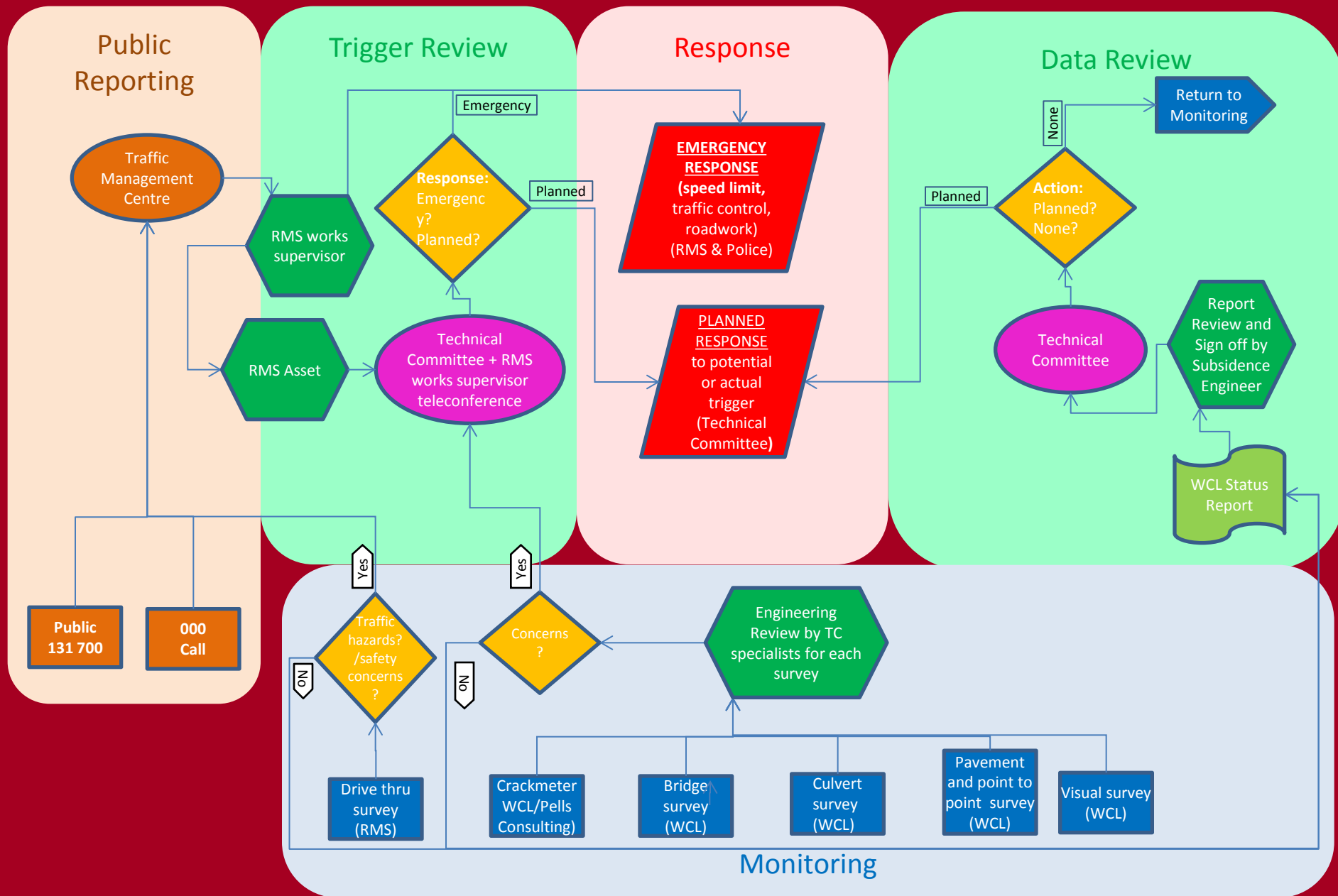
Organisation	Member
RMS (Technical Committee Chair)	Dick Lee Shoy
RMS (Pavement Maintenance Planner)	Cyril Gunaratne
RMS (Senior Geotechnical Engineer)	Stanley Yuen
RMS (Pavement Manager)	Zahid Hoque
RMS (A/Maintenance Planner Bridges)	Dony Castro
WCL (Group Environmental Manager)	Dave Clarkson
WCL (Environment Monitoring Manager)	Kristen Lee
SCT (Principal Geotechnical Engineer/Director)*	Dr K.W. (Ken) Mills
AECOM (Technical Director) *	Henk Buys
Pells Consulting (Director)*	Steven Pells
Cardno (Senior Principal)*	Richard Woods



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*\*Technical specialist organisations with representation on the TC who will provide specialist technical advice as required.*



## WCL Built Features Management Plan – RMS

Figure 9 - Infrastructure Management Process Chart for Mount Ousley Road

### 6.3 Trigger Action Response Plan

The Trigger Action Response Plan (TARP), as presented in **Appendix A** has been designed specifically for this BFMP to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- trigger levels from monitoring to assess performance; and
- triggers that flag implementation of contingency measures.

The BFMP – RMS TARP has been developed in consultation with the TC.

### 6.4 Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in **Section 4** of Plan, WCL will implement the following Contingency Plan:

- The observation will be reported to WCL's Environment Manager within 24 hours.
- The observation will be recorded.
- WCL will report any exceedance of the performance measure to the Secretary of DP&E, Principal Subsidence Engineer at DRE, RMS and other relevant stakeholder as soon as practicable after WCL becomes aware of the exceedance.
- WCL will assess the exceedances referred to in the TARP (outlined in **Section 6.3** of this document) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s.
- The Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary.
- WCL will identify contingency measures to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- WCL will submit the proposed contingency measures to the DP&E, PSE and RMS for approval.
- WCL will implement the approved contingency measures to the satisfaction of the DP&E, PSE and RMS.

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- WCL will continue to monitor performance with the contingency measures in place and, if successful will formalise these measures as part of a revised Management Plan.

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

WCL shall consult with the TC with regards to the implementation of any contingency measures required for RMS infrastructure.

WCL will investigate the potential contributing factors and evaluate using the following:

- A re-survey of relevant subsidence monitoring lines;
- Compare and analyse measured versus predicted subsidence parameters;
- Review measured subsidence parameters against the observed impact; and
- Review the subsidence monitoring program and update the program if required.

If either, it is not reasonable or feasible to remediate the impact or remediation measures implemented by WCL have failed to satisfactorily remediate the impact WCL will provide a suitable offset to compensate for the impact, to the satisfaction of the Director-General of DPE in accordance with **Condition 3/ Schedule 3** of the Project Approval.



## 7 INCIDENTS, COMPLAINTS AND NON-CONFORMANCES

### 7.1 Incidents and Ongoing management Reporting

The Project Approval defines an 'incident' to be *"a set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in this Approval."*

Incidents will be managed through established WCL procedures as detailed in the Environmental Management Strategy.

In accordance with **Condition 6/Schedule 5** WCL will notify the Director-General and any other relevant agencies of any incident:

- At the earliest opportunity if the incident has caused, or has the potential to cause significant risk of material harm to the environment.
- As soon as practicable in all other cases.

A detailed report of the incident shall be provided to DPE within 7 days of the incident occurring.

WCL will notify RMS of any incident in accordance with the requirements of the Conditions of Approval. WCL will notify RMS of the following where they may have implications for RMS assets:

- Any significant unpredicted and/or higher-than-predicted subsidence and/or abnormalities in the development of subsidence;
- Any observed subsidence impacts adverse to the serviceability and/or safety of infrastructure and other built structures that may be affected by longwall mining; and
- Any significant subsidence-induced cracking and/or ground deformations observed in any surface areas within the Application Area.

### 7.2 Complaints Handling

Complaints will be managed through established WCL procedures as detailed in the Environmental Management Strategy.

As required by **Condition 10/Schedule 5** of the Project Approval a copy of a complaints register (updated on a monthly basis) will be kept on the WCL website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Review/Annual Environmental Management Reports (AEMRs).

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### 7.3 Non-Conformance Protocol

WCL will manage and report non-compliances with relevant statutory requirements in accordance with an established protocol developed as a component of the Environmental Management Strategy.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with WCL Russell Vale Colliery, and will be promoted through direct consultation and direction of the mines' Operations Manager.

Regular inspections and/or internal audits will be undertaken as required by suitably qualified personnel under the direction of the Environment Manager, to identify any remediation/rectification work required, and areas of actual or potential non-compliance.

A Compliance Register will be established to monitor compliance against project approval conditions, mining leases etc. Non-compliances identified through the Compliance Register are to be reported, with corrective actions implemented,

A review of WCL's compliance with all conditions of the Project Approval, mining leases and all other approvals and licences will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on WCL's website.

## 8 PLAN ADMINISTRATION

### 8.1 Roles and Responsibilities

Environment and community management is regarded as part of the responsibilities of all Colliery personnel. The roles and function of the main personnel responsible for the implementation of environmental and community management including the plans, procedures and action plans contained in this EMP are outlined in **WCL's Management Operating System**.

### 8.2 Resources Required

In accordance with the **WCL SYS POL 003 Environmental Policy**, Management shall ensure that the appropriate resources are made available to achieve the implementation of this Plan.

It is the role of the Environment Manager to ensure that these requirements are communicated to WCL Management.

### 8.3 Training

All training and inductions conducted are to be undertaken as per the **WCL Training procedures**.

#### 8.3.1 Staff Training

Staff training will be undertaken as detailed in the EMS. This consists of three levels of training applicable to different types of staff:

- Level 1 – High level training on environmental requirement – Management
- Level 2 – Operational level training – Project Managers, Supervisors, Surface Personnel
- Level 3 – Basic environmental awareness – Underground staff

#### 8.3.2 Inductions

All contractors and associated subcontractors will be required to participate in site induction prior to the commencement of work. As a minimum, the induction is to include:

- An overview of the Cardinal Rules, Environment Policy and EMS requirements.
- Environmental incident and community compliant reporting requirements.
- Environmental emergency contact details.

In the event that there are specific environmental management requirements relating to a contractor's work activities, details of these requirements are to be issued to the contractor in writing as a part of the induction.

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Records, which detail the attendees, content of the induction/training as well as any additional information provided, will be maintained.

## 8.4 Record Keeping and Control

Environmental records are to be managed in accordance with the **WCL SYS PRO 001 Document Control Procedure**.

All records of the EMS will be stored so that they are readily retrievable and suitably protected from deterioration or loss. Archiving will be managed in accordance with the **WCL SYS PRO 001 Document Control Procedure**.

A master copy of each EMS document including all appendices and supporting information is to be held in the office of the E&C Department.

## 8.5 Plan Revision

### 8.5.1 Annual Review

In accordance with **Condition 3/Schedule 5** of the Project Approval, an Annual Review of the environmental performance of the Project is prepared.

The Annual Review will:

- Describe the works carried out in the past year, and the works proposed to be carried out over the next year.
- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous year/s; and
  - relevant predictions in the EA(s).
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance.
- Identify any trends in the monitoring data over the life of the Project.
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies.
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

### 8.5.2 Auditing

In accordance with **Condition 8/ Schedule 5** of the Project Approval an Independent Environmental Audit will be undertaken by a suitably qualified auditor and include experts in

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any field specified by the Director-General within 12 months of the approval and every three years after that.

This audit must:

- Be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Director-General.
- Include consultation with the relevant agencies.
- Assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals).
- Review the adequacy of strategies, plans or programs required under the abovementioned approvals.
- Recommend measures or actions to improve the environmental performance of the project, and/or any strategy, plan or program required under these approvals.

### 8.5.3 Plan Revision

In accordance with **Condition 4/ Schedule 5** of Project Approval, this Plan will be reviewed within three months of:

- The submission of an annual review;
- The submission of an incident report;
- The submission of an audit; and
- Any modification to the conditions of approval (unless the conditions require otherwise or as otherwise agreed with DP&E).

The revision status of this plan is indicated on the title page of each copy. Revisions to any documents listed within this Plan will not necessarily constitute a revision of this document. The distribution of controlled copies is described in **Section 1.3**.

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## 9 REFERENCES

Arup Risk Consulting, Mount Ousley Road: Wollongong Coal – “Impacts of LW6&7 Mining on RMS Assets, Risk Assessment Report”.

Cardno NSW/ACT (February 2014), Picton Rd Bridge over Mt Ousley Rd End of Longwall Panel Condition Inspection.

SCT Report WCRV4193 2014, “Longwall 5 End of Panel Subsidence Report”.

SCT Report WCRV4263 2014, “Update of Subsidence Assessment for Wollongong Coal Preferred Project Report Russell Vale No 1 Colliery”.

NRE No.1 Colliery Wonga East – LW4 & LW5 SMP (NREN EMS MP003), “Built Features Management Plan (RMS)”,




## 10 CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	27/08/2014

### Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	20/06/2014	K. Prajapati	First Draft
2	11/08/2014	K. Prajapati, RMS TC	Modified with comments from RMS TC and Inclusion of Risk Assessment Report
2.1	27/08/2014	K. Prajapati, RMS TC	Modified with comments from RMS TC
2.2	4/09/2014	K. Prajapati, RMS TC	Modified with comments from RMS TC

<p>Authorised by:</p>  <p><b>PETER MEERS.</b></p> <p>Name &amp; Date                      19 SEP 2014</p> <p>Company/Position</p> <p><b>RMS ASSET MGR, SOUTHERN REGION</b></p>	<p>Authorised by:</p>  <p><b>Kamlesh Prajapati</b></p> <p>Name &amp; Date                      23/09/14</p> <p>Company/Position</p> <p><b>Group Environmental Coordinator.</b></p>
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## Appendix A - Trigger Action Response Plan (TARP)

## Trigger Action Response Plan (TARP)

### Trigger Response Procedure

#### Drive through Surveys:

RMS informs Traffic Management Centre (TMC). TMC responds in accordance with RMS incident response protocols. RMS Works Supervisor inspects site and acts in accordance with these protocols and if the incident is confirmed, informs the Asset Manager who will request a TC meeting to determine appropriate action.

#### Notes:

1. WCL will set up teleconferencing facilities with phone in numbers and call cards.
2. Ensure the Flow Chart is referenced to ensure notification occurs appropriately.
3. First response to any trigger is a site inspection.
4. Green – normal operation of RMS infrastructure – infrastructure managed in accordance with normal asset management procedures.
5. Amber and red triggers relate to behaviour of RMS infrastructure that could lead to risks to infrastructure, safety or network availability. Technical specialists may determine other triggers from monitoring information and alert TC members and Works Supervisor–see also response flow chart.
6. Grey triggers relate to the performance of the monitoring system. The behaviour of the RMS's infrastructure is not directly at risk as a result of a grey trigger, but the ability to assess its current and likely future behaviour is. WCL Control Room is not informed of grey triggers. Grey are triggers reported in the relevant monitoring report.
7. Due to interactions between monitoring elements and ultimate need to protect the assets, this TARP is based on infrastructure elements to be protected.
8. 'After mining', 'end of mining' and similar terms mean after completion of the longwalls covered by this BFMP.

9. Cross lines and longitudinal lines are not trigger devices, but are monitoring devices to assist the Technical Committee in reaching decisions in conjunction with other monitoring devices.
10. Survey is the main monitoring/control system. It is carried out approximately monthly. Amber trigger response times are geared to this frequency. Red triggers need urgent response in all cases.
11. Slot closure is the total slot closure due to mining impacts and is net of any premining movement, temperature, creep and other effects.
12. TC meeting can be a teleconference call – all TC members to be supplied with business card providing call in details.
13. Duty cards to be supplied to all organisations undertaking monitoring in terms of the monitoring plan.

Contacts (Wider Project)					
Organisation	Description	Contact Details	Notification Required For		
			Amber	Red	Grey
WCL	Control Room	4223 6827	Y	Y	N
RMS	Traffic Management Centre (TMC)	131 700	N	Y	N
RMS	Works Supervisor	132701	Y	Y	N
SCCS	Surveyors	4822 2405	Y Survey only	Y Survey only	N
WCL	Site Inspector	0458 059 564/ 0439 709 513	Y	Y	N
WCL	Crackmeter monitoring and reporting	0458 059 564/ 0439 709 513	Y Crackmeters only	Y Crackmeters only	Y Crackmeters only
Pells Consulting	Crackmeter monitoring and reporting	0408 418 296/ 0409 155 946	Y Crackmeters only	Y Crackmeters only	Y Crackmeters only

## Contact List (Technical Committee)

WCL Control Room – (02) 4223 6827

Organisation	Position	Name		Alternate		Notification required for		
		Name	Contact details	Name	Contact details	Amber	Red	Grey
RMS	Technical Committee Chair	Dick Lee Shoy	0431 487 204	Cyril Gunaratne	0429 667 012	Y	Y	N
RMS	Pavement Maintenance Planner	Cyril Gunaratne	0429 667 012	Peter Meers	0411 110 575	Y	Y	N
RMS	Senior Geotechnical Engineer	Stanley Yuen	0400 699 232	Bo Xiao	0409 605 916	Y	Y	N
RMS	Pavement Manager	Zahid Hoque	0400473090	Cyril Gunaratne	0429 667 012	Y (Pavement only)	Y (Pavement only)	N
RMS	Bridge Engineer	Dony Castro	0403 098 092	Scott Fayers	0419 262 796	Y (Bridge Only)	Y (Bridge Only)	N
WCL	Group Environment Manager	Dave Clarkson	0458 059 564	Kristen Lee	0439 709 513	Y	Y	N
WCL	Environment Monitoring Manager	Kristen Lee	0439 709 513	Dave Clarkson	0458 059 564	Y	Y	N
SCT	Principal Geotechnical Engineer	Dr K.W. (Ken) Mills	0417 674 436	-	-	Y	Y	N
AECOM	Technical Director –	Henk Buys	0448 997 500	Stanley Yuen	0400 699 232	Y	Y	N
Pells Consulting	Director	Philip Pells	0408 418 296	Steven Pells	0409 155 946	Y	Y	N
Cardno	Senior Principal	Richard Woods	0414 246 238	Colin Edmonds	0423 020 238	Y (Bridge Only)	Y (Bridge Only)	N

Asset Assessed risk level (from workshop)	TRIGGER			ACTION	RESPONSE
	Failure	Level	Condition		
Pavements					
Low Risk(compression)	Compression shear failure leading to step or hump	GREEN	<u>Minor</u> <ul style="list-style-type: none"><li>No visible ground movement due to mining</li><li>Potential or actual step height &lt; 30mm</li><li>Crackmeter closure &lt; 30mm</li></ul>	<ul style="list-style-type: none"><li>Manage in accordance with monitoring plan</li></ul>	Not applicable
		AMBER	<u>Moderate</u> <ul style="list-style-type: none"><li>Ground movement due to mining visible</li><li>Potential or actual step height &gt; 30 mm &amp; ≤ 50mm</li><li>Crackmeter closure ≥ 30mm</li><li>Misclosure between point to point survey and crackmeter in excess of 25mm</li><li>Extension of 25mm in point to point survey at bend</li></ul>	<ul style="list-style-type: none"><li>Technical specialist to notify TC</li><li>RMS to inspect pavement</li><li>Carry out survey of NB and SB lines (If the trigger is misclosure at Cataract Creek)</li><li>Carry out Survey of P-Line from P30 to P60 (If trigger is extension at bend)</li><li>TC to meet – review monitoring data, including:<ul style="list-style-type: none"><li>Pavement inspection</li><li>Determine peak strain</li><li>Assess monitoring data for trends</li><li>forecast if and/or when the RED trigger level might be exceeded</li><li>Decide on and direct proactive action</li></ul></li><li>WCL to notify relevant stakeholders and/or regulators and/or specialists</li></ul>	<ul style="list-style-type: none"><li>Within 24 hours</li><li>Within 12 hours</li><li>Within 48 hours</li><li>Within 48 hours</li><li>Within 72 hours</li><li>Within 24 hours</li></ul>
		RED	<u>Severe</u> <ul style="list-style-type: none"><li>Step height &gt; 50 mm</li><li>Pavement compressive strains (Cataract Creek) ≥ 1.0mm/m over a 40m bay length</li><li>Pavement compressive strains (Bend)</li></ul>	<ul style="list-style-type: none"><li>Technical specialist to notify TC</li><li>RMS to inspect pavement</li><li>RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic</li></ul>	<ul style="list-style-type: none"><li>Within 2 hours</li><li>Within 2 hours</li><li>Within 2 hours</li></ul>



			≥ 1.0mm/m over a 40m bay length	<ul style="list-style-type: none"> <li>commander and NSW police</li> <li>TC to meet – consider and advise on immediate corrective action/s which may be required</li> <li>WCL to notify relevant stakeholders and/or regulators and/or specialists</li> </ul>	<ul style="list-style-type: none"> <li>Within 24 hours</li> <li>Within 24 hours</li> </ul>
<b>Culverts – Cataract Creek</b>					
Low Risk	Horizontal compression, leading to ovaling and buckling of culvert	GREEN	<u>Minor</u> <ul style="list-style-type: none"> <li>No visible ground movement</li> <li>No change in culvert condition</li> <li>Steel culverts only: <ul style="list-style-type: none"> <li>Ground closure &lt; 50mm</li> <li>Convergence &lt; 50mm</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Manage in accordance with monitoring plan</li> </ul>	Not applicable
		AMBER	<u>Moderate</u> <ul style="list-style-type: none"> <li>Visible distortion of culverts</li> <li>Movement in pavement associated with culvert distortion</li> <li>Ground movement or formation of voids due to culvert distortion</li> <li>Ground closure ≥ 50mm</li> <li>Convergence ≥ 50mm</li> </ul>	<ul style="list-style-type: none"> <li>Technical specialist to notify TC</li> <li>RMS to inspect culverts and pavement above</li> <li>TC to meet – review monitoring data, including: <ul style="list-style-type: none"> <li>Culvert inspection</li> <li>Determine peak convergence</li> <li>Assess monitoring data for trends</li> <li>forecast if and/or when the RED trigger level might be exceeded</li> <li>Decide on and direct proactive action</li> </ul> </li> <li>WCL to notify relevant stakeholders and/or regulators and/or specialists</li> </ul>	<ul style="list-style-type: none"> <li>Within 24 hours</li> <li>Within 24 hours</li> <li>Within 1 week</li> <li>Within 24 hours</li> </ul>
		RED	<u>Severe</u> <ul style="list-style-type: none"> <li>Ground movement in pavement due to culvert damage or mining</li> <li>Severe distortion or buckling of steel culverts</li> <li>Imminent collapse of culvert structure</li> </ul> <p><u>Note:</u></p> <p>1) Red trigger actions are to ensure the</p>	<ul style="list-style-type: none"> <li>Technical specialist to notify TC</li> <li>RMS to inspect pavement and culvert</li> <li>RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police</li> <li>TC to meet – consider and advise</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 hours</li> <li>Within 2 hours</li> <li>Within 2 hours</li> <li>Within 24 hours</li> </ul>

			<p>safety of the travelling public, 2) It is assumed that the culvert structure will be unsafe to enter at this trigger level, therefore, it is unlikely that a survey can be carried out</p>	<p>on immediate corrective action/s which may be required</p> <ul style="list-style-type: none"> <li>WCL to notify relevant stakeholders and/or regulators and/or specialists</li> </ul>	<ul style="list-style-type: none"> <li>Within 24 hours</li> </ul>
<b>Cuttings/Embankments</b>					
High Risk (cuttings) Medium Risk (embankments)	Ground strains leading to instability of rock cuttings	GREEN	<p><u>Minor</u></p> <ul style="list-style-type: none"> <li>No visible change in cuttings</li> </ul>	<ul style="list-style-type: none"> <li>Manage in accordance with monitoring plan</li> </ul>	Not applicable
		AMBER	<p><u>Moderate</u></p> <ul style="list-style-type: none"> <li>Observed changes in cuttings</li> <li>Strains exceed 0.5mm/m in pavement at Cataract Creek</li> </ul>	<ul style="list-style-type: none"> <li>RMS geoscientist to assess impact</li> <li>TC to meet and determine corrective action/s</li> </ul>	<ul style="list-style-type: none"> <li>Within 24 hrs</li> <li>Within 48 hrs</li> </ul>
<b>Bridges</b>					
High Risk	Differential horizontal movements leading to destructive distortion of the bridge elements	GREEN	<p><u>Minor</u></p> <ul style="list-style-type: none"> <li>Normal operation</li> <li>Relative movement between any two monitoring points <math>\leq 5\text{mm}</math></li> </ul>	<ul style="list-style-type: none"> <li>Manage in accordance with monitoring plan</li> </ul>	Not applicable
		AMBER	<p><u>Moderate</u></p> <ul style="list-style-type: none"> <li>Differential movement that could result in unacceptable distortion of any bridge element</li> </ul>	<ul style="list-style-type: none"> <li>Technical specialist to notify TC</li> <li>RMS/Bridge specialist to inspect bridge</li> <li>TC to meet – review monitoring data, including: <ul style="list-style-type: none"> <li>Inspect bridge</li> <li>Assess nature of differential movements</li> <li>Assess monitoring data for trends</li> <li>forecast if and/or when the RED trigger level might be exceeded</li> <li>Decide on and direct proactive action</li> </ul> </li> <li>WCL to notify relevant stakeholders</li> </ul>	<ul style="list-style-type: none"> <li>Within 24 hours</li> <li>Within 24 hours</li> <li>Within 72 hours</li> <li>Within 24 hours</li> </ul>

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				and/or regulators and/or specialists	
		RED	<b><u>Severe</u></b> <ul style="list-style-type: none"> <li>Structural defects noticeable</li> <li>Advice from consultant that bridge has become unsafe <u>or</u> is in an unserviceable condition.</li> </ul>	<ul style="list-style-type: none"> <li>Technical specialist to notify TC</li> <li>RMS/bridge specialist to inspect bridge</li> <li>RMS to notify Traffic commander via TMC to enforce bridge and road closure – enforced by traffic commander and NSW police</li> <li>TC to meet – consider and advise on immediate corrective action/s which may be required</li> <li>WCL to notify relevant stakeholders and/or regulators and/or specialists</li> </ul>	<ul style="list-style-type: none"> <li>Within 2 hours</li> <li>Within 2 hours</li> <li>Within 2 hours</li> <li>Within 24 hours</li> <li>Within 24 hours</li> </ul>
<b>Monitoring devices</b>					
Low risk		GREEN	<b><u>Minor</u></b> <ul style="list-style-type: none"> <li>All devices operating</li> </ul>	<ul style="list-style-type: none"> <li>Monitor in accordance with management plan</li> </ul>	Not applicable
		GREY	<ul style="list-style-type: none"> <li>Loss of power, communications or data from automated monitoring systems</li> <li>Unable to access automated monitoring data</li> </ul>	<ul style="list-style-type: none"> <li>When Pavement Trigger is <b>Green</b>:               <ul style="list-style-type: none"> <li>Identify cause and rectify</li> <li>Inform TC of occurrence</li> </ul> </li> <li>When Pavement Trigger <b>Amber</b>:               <ul style="list-style-type: none"> <li>Identify cause and rectify</li> <li>Inform TC of occurrence</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Within 72 hours</li> <li>Within 24 hours</li> </ul>

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## Appendix B - Plan 2e – Additional Subsidence Management Area







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## Appendix C - Risk Assessment Report



Roads and Maritime Services

**Mount Ousley Road: Wollongong  
Coal – Impacts of LW6&7 Mining  
on RMS Assets**

**Risk Assessment Report**

REP/237373-00/001

Issue | 4 August 2014

This report takes into account the particular instructions and requirements of our client.

It is not intended for and should not be relied upon by any third party and no responsibility is undertaken to any third party.

Job number 237373-00

Arup  
Arup Pty Ltd ABN 18 000 966 165


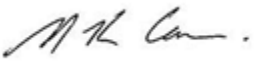
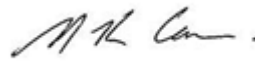


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# Document Verification

# ARUP

<b>Job title</b>		Mount Ousley Road: Wollongong Coal – Impacts of LW6&7 Mining on RMS Assets		<b>Job number</b>		237373-00	
<b>Document title</b>		Risk Assessment Report		<b>File reference</b>			
<b>Document ref</b>		REP/237373-00/001					
<b>Revision</b>	<b>Date</b>	<b>Filename</b>	20140703 RMS LW6&7 Report.docx				
Draft 1	18 Jul 2014	<b>Description</b>	First draft				
			Prepared by	Checked by	Approved by		
		Name	Jenny Li	Nigel Cann	Nigel Cann		
		Signature					
Draft 2	24 Jul 2014	<b>Filename</b>	20140724 RMS LW6&7 Report Draft 2.docx				
		<b>Description</b>	Second draft				
			Prepared by	Checked by	Approved by		
		Name	Jenny Li	Nigel Cann	Nigel Cann		
		Signature					
Draft 3	1 Aug 2014	<b>Filename</b>	20140801 RMS LW6&7 Report Draft 3.docx				
		<b>Description</b>	Third draft				
			Prepared by	Checked by	Approved by		
		Name	Jenny Li	Nigel Cann	Nigel Cann		
		Signature					
Issue	4 Aug 2014	<b>Filename</b>	20140804 RMS LW6&7 Report Issue.docx				
		<b>Description</b>	Report for Issue				
			Prepared by	Checked by	Approved by		
		Name	Jenny Li	Nigel Cann	Nigel Cann		
		Signature					
Issue Document Verification with Document							<input checked="" type="checkbox"/>

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<b>6 Results</b>	<b>9</b>
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## Appendices

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SCT Presentation – Update of Subsidence Movements

### Appendix B

Monitoring Plan for LW6&7

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RMS Risk Matrices

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LW6&7 Risk Register

## Executive Summary

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This report outlines the findings of a risk assessment conducted on the subsidence impacts from the mining of longwalls LW6&7 in the Wongawilli Seam on the assets of Roads and Maritime Services NSW (RMS). The proposed activity is being undertaken by Wollongong Coal Limited (WCL) in the Southern Coalfield of NSW.

This risk assessment was conducted in accordance with AS/NZS ISO31000:2009 – Risk Management, and also the various standards of RMS, specifically those relating to the assessment of risks posed by subsidence mining.

A previous risk assessment was completed in 2011 on the impacts due to the extraction of longwalls 4 and 5 (LW4&5). WCL has recently completed the extraction of LW4&5. A history of the impacts of subsidence has been gained, along with knowledge about the performance of mitigation control measures applied, and the reliability of the monitoring systems utilised.

A risk workshop was facilitated by Arup and attended by relevant stakeholders including RMS, WCL and various consultants to the project. The risks were rated according to their perceived frequency and consequences, using RMS look up sheets for such assessments. 23 risk events were identified during the workshop; none would pose an unacceptable risk to RMS. Additional mitigations were discussed for one risk event.

It is predicted that the mining of LW6&7 will not result in significant subsidence at Mount Ousley Road, since the mining is moving away from the road. However, the movement of the block of ground containing LW4-7 is causing tension across the ridge south of the longwalls and compression at the Cataract Creek crossing to the north. The movement of this block has resulted in surface cracks from previous mining of the Balgownie and Bulli Seams at the ridge to open with complementary valley closure of approximately 40mm at the creek. This ground movement has resulted in pavement cracking in the tension zone at the ridge and closure of the slot in the compression zone at Cataract Creek.

A suite of control measures and monitoring systems were identified and employed in controlling the risks posed by LW4&5. These were considered at the workshop and found to be operating effectively and reliably. The measures were also agreed to be generally appropriate in controlling the risk posed by LW6&7, subject to customisation of the differences in longwall characteristics.

A new risk event was identified from the mining of LW4&5. At the Tension Zone at the ridge (P46), cracking of the pavement including differential settlement has occurred due to tensile movements. Remedial work will be carried in this area to reinstate rideability and safety standards, and the treated area will be included in the Monitoring Plan for proactive action should the pavement impacts reappear during the mining of LW6&7.

The events and activities identified in the workshop will be addressed and managed in the Built Features Management Plan for LW6&7.

# 1 Introduction

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Arup has been engaged by the Roads and Maritime Services NSW (RMS) to undertake a qualitative risk assessment of the risks to RMS infrastructure associated with the extraction of longwalls 6 and 7 (LW6&7) in the Wongawilli Seam by Wollongong Coal Limited (WCL, formerly Gujarat NRE Minerals Limited).

A previous risk assessment was completed in 2011 on the impacts due to the extraction of longwalls 4 and 5 (LW4&5). WCL has recently completed the extraction of LW4&5. A history of the impacts of subsidence has been gained, along with knowledge about the performance of mitigation control measures applied, and the reliability of the monitoring systems utilised.

As with the previous assessment, the concern of RMS is the possible impacts from the mining of LW6&7 on its surface assets with a specific emphasis on how the mining might result in loss of functionality of the assets with regard to the users (motorists and public), possible life safety issues, damage to infrastructure and cost of reinstatement, should the mining impact on any of the assets.

The process adopted by Arup follows closely the principles set out in AS/NZS ISO31000:2009 – Risk Management, and also the various standards of RMS, specifically those relating to the assessment of risks posed by subsidence mining.

Arup undertook an inspection of the assets followed by a facilitated workshop with relevant stakeholders to firstly identify the assets at risk and then ascertain the risks posed to those assets from the mining of LW6&7. This same workshop also considered various mitigation and control measures and determined the effectiveness of these in reducing risk levels.

## 2 Description of Mining Activities

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WCL operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) in the Southern Coalfield of NSW. WCL is proposing to extract coal from LW6&7 as part of its ongoing underground coal mining operations within the Wongawilli seams in New South Wales.

The overall layout of the entire longwall mining area (LW1-11) is shown in Figure 1 below.

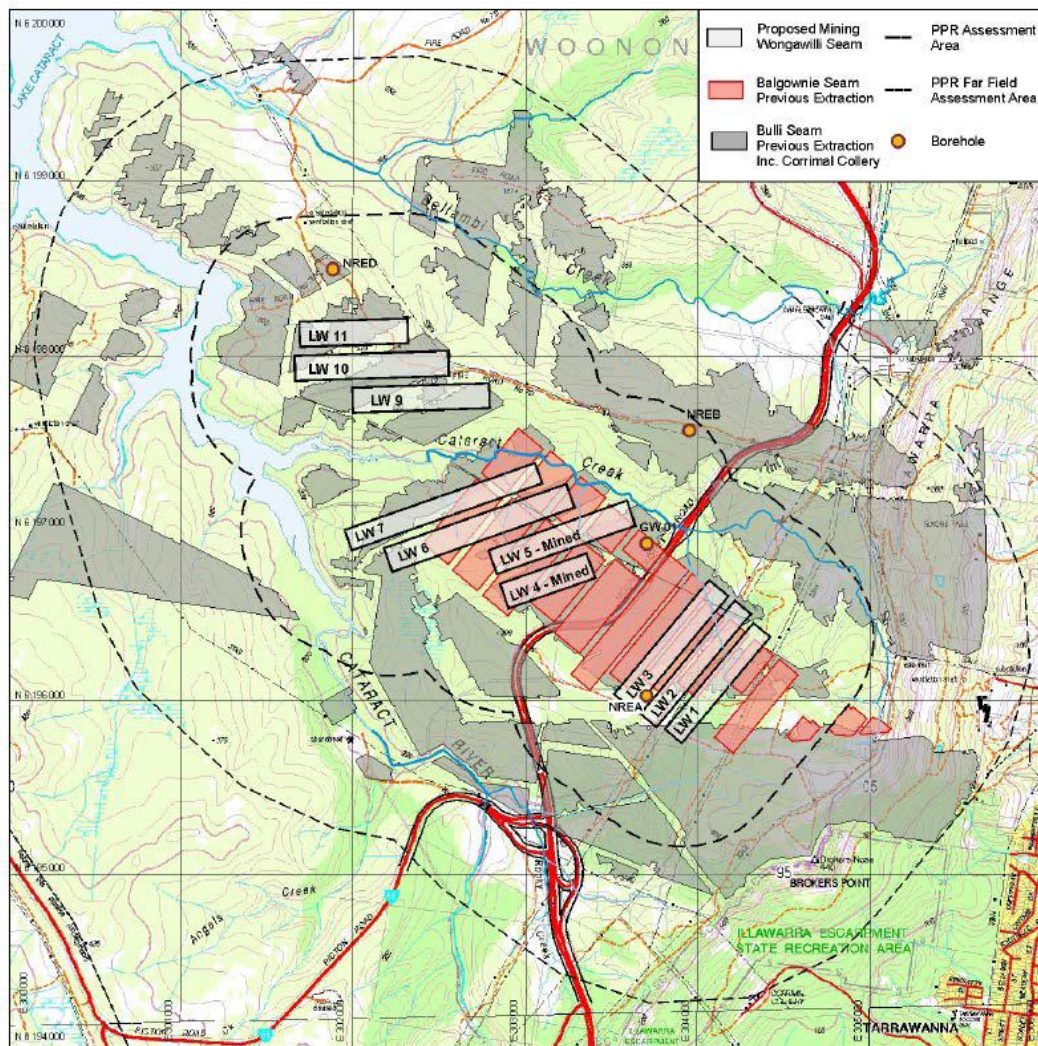


Figure 1: Overall Layout of LW1-11

WCL has recently completed the extraction of LW4&5. LW6&7 are the next longwalls to be mined. Future mining is proposed for LW9-11 and may be followed by LW1-3. This risk assessment considers only the impacts of extracting LW6&7.

The geological setting of the mining area is shown in Figure 2 below. The Wongawilli Seam lies approximately 400m below ground level.



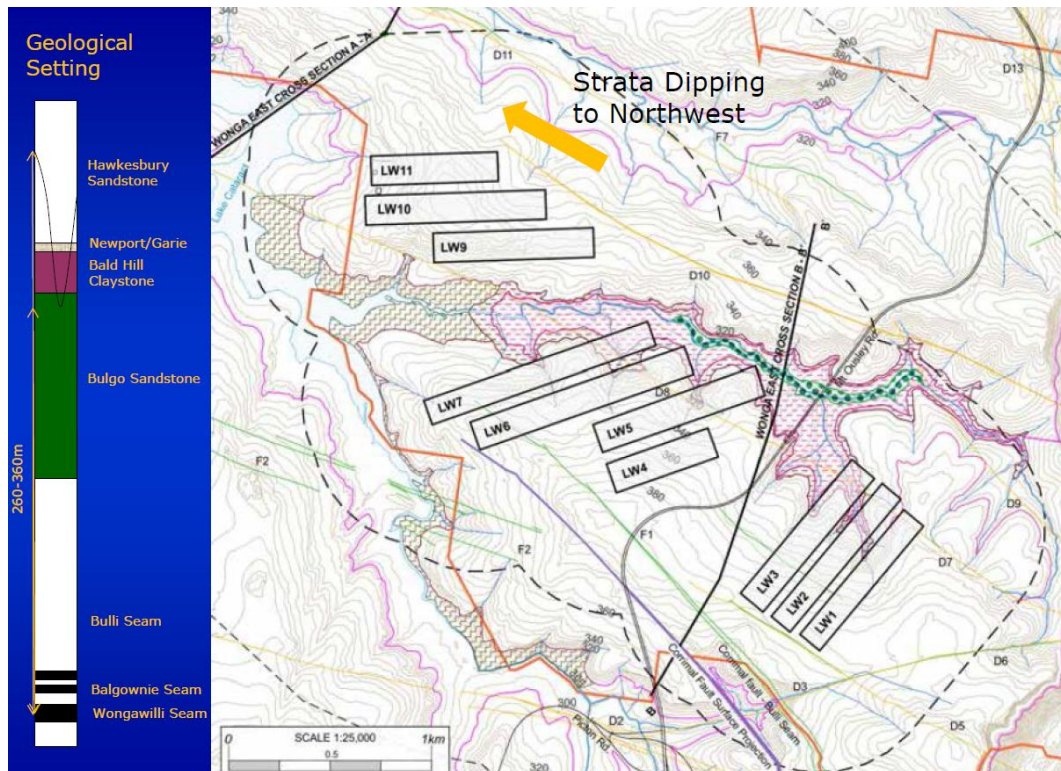


Figure 2: Geological Profile of the Area

The Bulli and Balgownie Seams, which are above the Wongawilli Seam, were previously mined several decades ago.

RMS assets that are present in this area are:

- Mount Ousley Road;
- Cataract Creek Crossing; and
- Picton Road Bridge.

### 3 Assessment of Impacts

LW4&5 lie between LW6&7 and Mount Ousley Road.

Strata Control Technologies (SCT) conducted an assessment of the subsidence and geological impacts from the previous mining activities and predictions for the mining of LW6&7 (refer to Appendix A).

Monitoring programs for the following items have been in place since the commencement of LW4&5:

- Pavements (P-Line survey, NB and SB survey, drive through and visual inspections);
- Pavement slot (crackmeter, pavement pins);
- Culverts (diagonal closure measurements);
- Bridge (survey, visual inspections); and
- Cuttings (visual inspections).

### 3.1 Subsidence

The P Line (see Figure 3 below) runs along the northbound shoulder of Mount Ousley Road, an asset of interest to RMS. The maximum subsidence along the P Line (and hence the road) from the mining of LW4&5 is approximately 40mm.

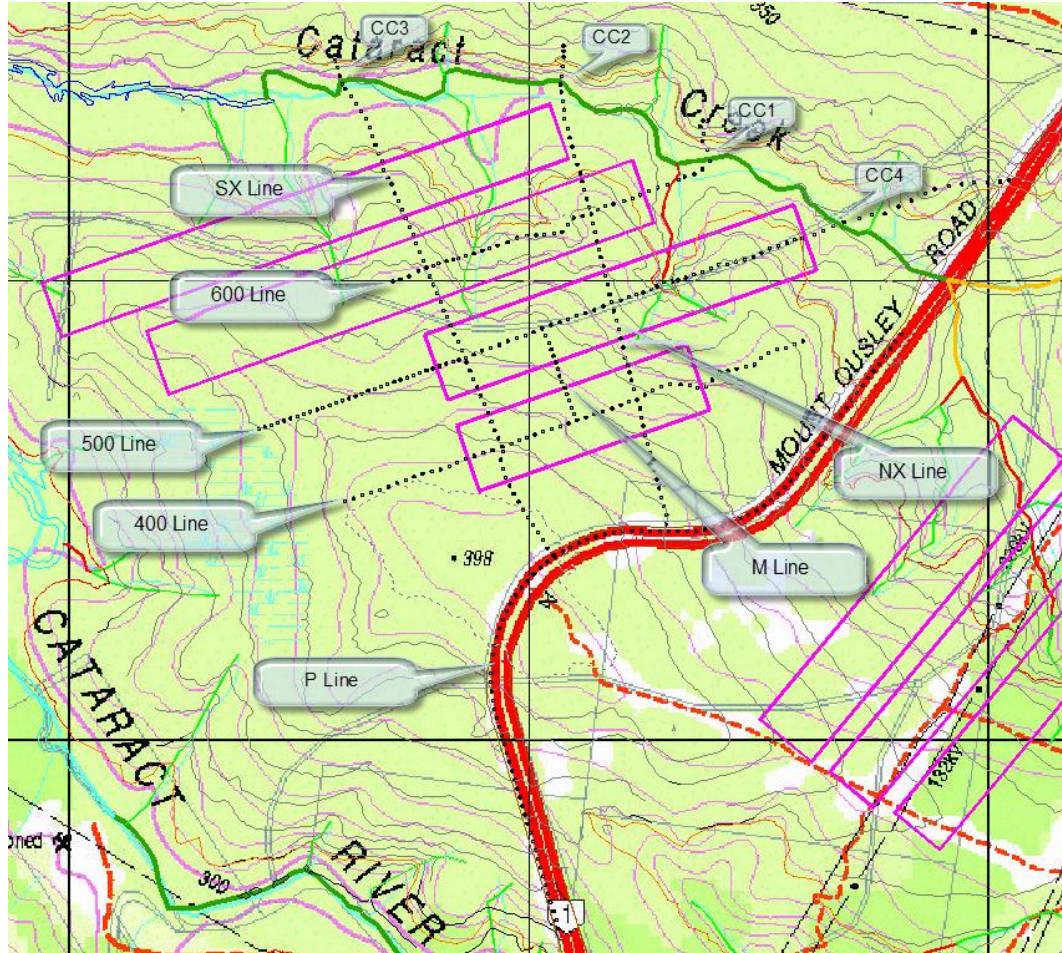


Figure 3: Subsidence Monitoring Lines

The total maximum subsidence over the longwalls from the mining of LW4&5 is 1.8m or less across all the lines in the area.

The subsidence at the road occurred mainly after LW4 was mined (see Figure 4). When LW5 was mined, there was little additional subsidence along the P Line.

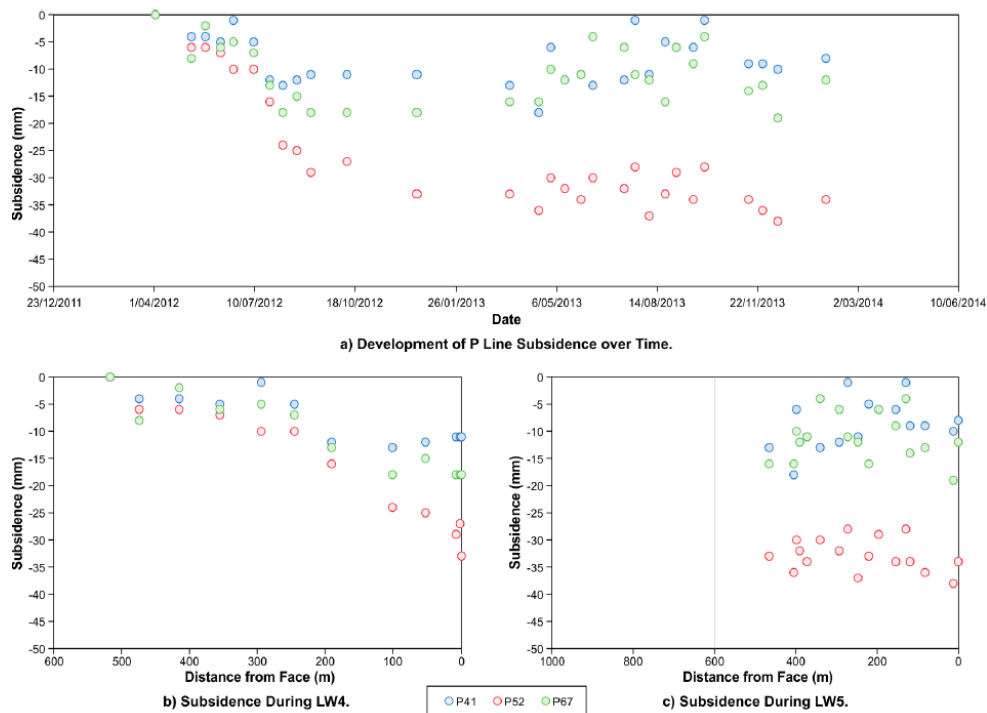


Figure 4: Subsidence at Mount Ousley Road over Time

It is predicted that the mining of LW6&7 will result in little to no measurable subsidence at Mount Ousley Road, since the mining is moving away from the road.

## 3.2 Horizontal Movement

Figure 5 below shows block movement of the ground over the mined area towards the Cataract Creek.



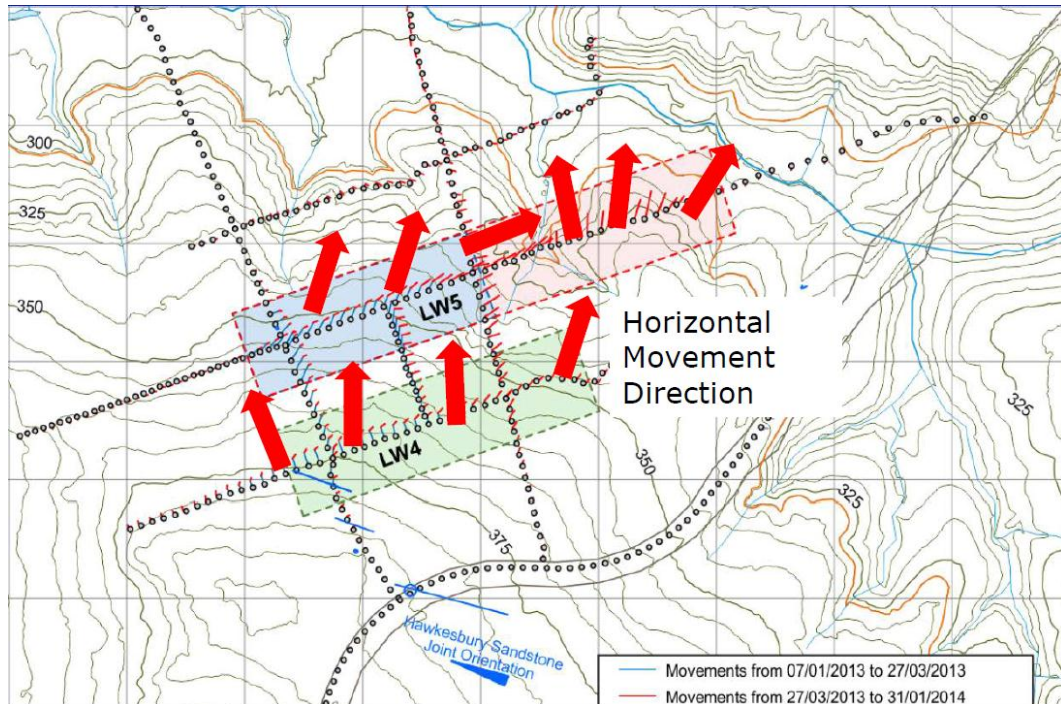


Figure 5: Horizontal Movements from the Mining of LW4&5

The block movement of ground containing LW4-7 is causing tension across the ridge and compression in the valley. The tensile movement has resulted in cracks in the pavement at the ridge (see Figure 6 below).



Figure 6: Cracks in the Pavement

The compression has resulted in closures of approximately 40mm at the creek. A slot was installed on the Mount Ousley Road embankment above Cataract Creek (after LW4 and before LW5) as part of the Management Plan for LW4&5. The slot experienced approximately 11mm of closure during the mining of LW5 and resulted in a bump in the slot surface that required milling to reinstate rideability. However no significant compression has been experienced in the pavement in the vicinity of Cataract Creek due to the existence of the slot. The slot can accommodate compressive forces generated by up to 40m of pavement length on

either side of the slot. The workshop group confirmed that the slot was performing as expected and that it was in the correct position.

## 4 Management Strategy

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A suite of control measures and monitoring systems were identified and employed in controlling the risks posed by LW4&5. These were considered at the workshop and found to be operating effectively and reliably. The measures were also generally agreed to be appropriate in controlling the risk posed by LW6&7, subject to customisation to accommodate differences in longwall characteristics.

The management strategy for LW6&7 is as follows:

- Reduce the frequency of monitoring;
- Replicate the P Line to the Southbound Lane;
- Continue road condition monitoring;
- Continue slot closure monitoring;
- Upgrade culvert closure monitoring;
- Discontinue tiltmeters;
- Commence high resolution point to point closure surveying;
- Continue visual survey at Picton Road Bridge; and
- Use LW6&7 monitoring to inform the management options for Picton Road Interchange for LW1-3.

A summary of these measures is provided in Appendix A.

Monitoring of culvert closure at Cataract Creek is currently being performed on the diagonals of the culvert. This does not provide an accurate measure of the closure of the culvert. The vertical and horizontal cross-sections of the culvert will be monitored in the future.

The Monitoring Plan for LW6&7 is provided in Appendix B.

## 5 Risk Workshop

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On 10 July, 2014, a risk workshop was convened at the RMS Offices in Wollongong. The purpose of this workshop was to assess the risks posed to the assets of the RMS from the proposed LW6&7 mining operations. A list of the participants at the workshop is included in Appendix C. The agenda is attached in Appendix D.

This workshop was qualitative and used the RMS look up sheets for assessing both frequency and consequence. These sheets have been adopted as the standard by the RMS when assessing the risk posed to their assets from subsidence mining. The look up sheets for assessing frequency, consequence, and the risk matrix are included in Appendix E.

The assets considered in the risk assessment included:

- Carriageway (excluding Cataract Creek and Tension Zone);
- Culverts (excluding Cataract Creek);
- Kerbs;
- Cuttings;
- Embankments;
- Furniture;
- Drains;
- Variable Message Sign (VMS);
- Bridge;
- Cataract Creek Pavement (approximately 100m in length);
- Cataract Creek Culvert; and
- Pavement at Tension Zone.

The workshop used the risk register from the last study of LW4&5 as the basis of discussion and reviewed each of the risks. For new items, a check-list of Assets and Fault/Failure modes was used to trigger thoughts and discussion. This information was recorded in the risk register, attached in Appendix F.

Assets that may be impacted upon by the mining of LW1-3 were flagged to be reviewed prior to the mining of those longwalls.

## 6 Results

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A total of 23 risk events were identified during the workshop, of which 10 were not considered to present a credible risk (the level of possible impacts was not measurable) due to the proposed mining of LW 6&7. Additional mitigations were discussed for one risk event.

A new risk event was added to the risk register. At the Tension Zone at the ridge (P46), cracking of pavement including differential settlement has occurred due to tensile movement from the mining of LW4&5. Trenches are to be dug in the shoulder to investigate the cracking in the underlying rock and to confirm the cracks were present in the rock before the road was constructed. Current horizontal movements predict that the block of ground containing LW4-7 is moving towards Cataract Creek. The consequences are expected to be minor with less than 5mm of increase in crack width – from 10mm to 15mm. Additional mitigations were discussed for this risk event.

The risk profile, before and after the application of additional mitigation and control measures, is shown in Table 1 below.



Table 1: Risk Profile Before and After Implementation of Additional Mitigations

Risk Level	BASE RISK LEVELS				RESIDUAL RISK LEVELS			
	Infra.	Funct.	Safety	Total	Infra.	Funct.	Safety	Total
<b>E</b>	0	0	0	0	0	0	0	0
<b>H</b>	2	2	1	5	1	1	1	3
<b>M</b>	2	2	1	5	3	2	0	5
<b>L</b>	6	4	0	10	6	4	0	10

The final risk profile has no extreme risks. Two risk events (one has high risks in two categories) have high residual risks due to their high consequences even though the likelihood has been reduced to rare or hypothetical.

It was recognised that the impacts to RMS assets from the mining of LW6&7 will be less significant than those of LW4&5, as the mining is moving away from RMS assets. As little impact resulted from LW4&5, then even less is expected for LW6&7.

The group did however note to review certain risk events in regards to the mining of LW1-3 prior to commencement of mining as these longwalls are closer to RMS assets but on the opposite side of Mount Ousley Road to LW4-7.

## 7 Mitigation and Control Measures

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For the majority of the risk events, continuation of monitoring measures is sufficient. Updates to the management strategy for LW6-7 are discussed in section 4 above. No significant impacts to RMS assets resulted from the mining of LW4&5. Since LW6&7 are further away, no significant impacts are expected.

One mitigation action was discussed for cracking and differential settlement of the pavement at the Tension Zone at the ridge (P46) due to tensile movement. Remedial work will be carried out in this area to reinstate rideability and safety standards, and the treated area will be included in the Monitoring Plan (subject to weekly drive through and monthly site inspection) for proactive action should the pavement impacts reappear during the mining of LW6&7. This mitigation action will decrease the Infrastructure Risk to medium (from high) and eliminate the Safety Risk (from medium).

## 8 Conclusions

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A risk assessment workshop has been completed for RMS assets from the proposed mining of longwalls LW6&7 by Wollongong Coal Limited. None of the 23 risk events that were identified would pose an unacceptable risk to RMS.

A new risk event was identified from the mining of LW4&5. At the Tension Zone at the ridge (P46), cracking of the pavement including differential settlement has occurred due to tensile movements. Mitigation actions include remedial work to reinstate rideability and safety standards, and point to point monitoring included in the Monitoring Plan for LW6&7.

The events and activities identified in the workshop will be addressed and managed in the Built Features Management Plan for LW6&7. The existing monitoring of the assets is to continue, adapted for LW6&7 and further adaptive to change as the mining progresses.

## **Appendix A**

### **SCT Presentation – Update of Subsidence Movements**

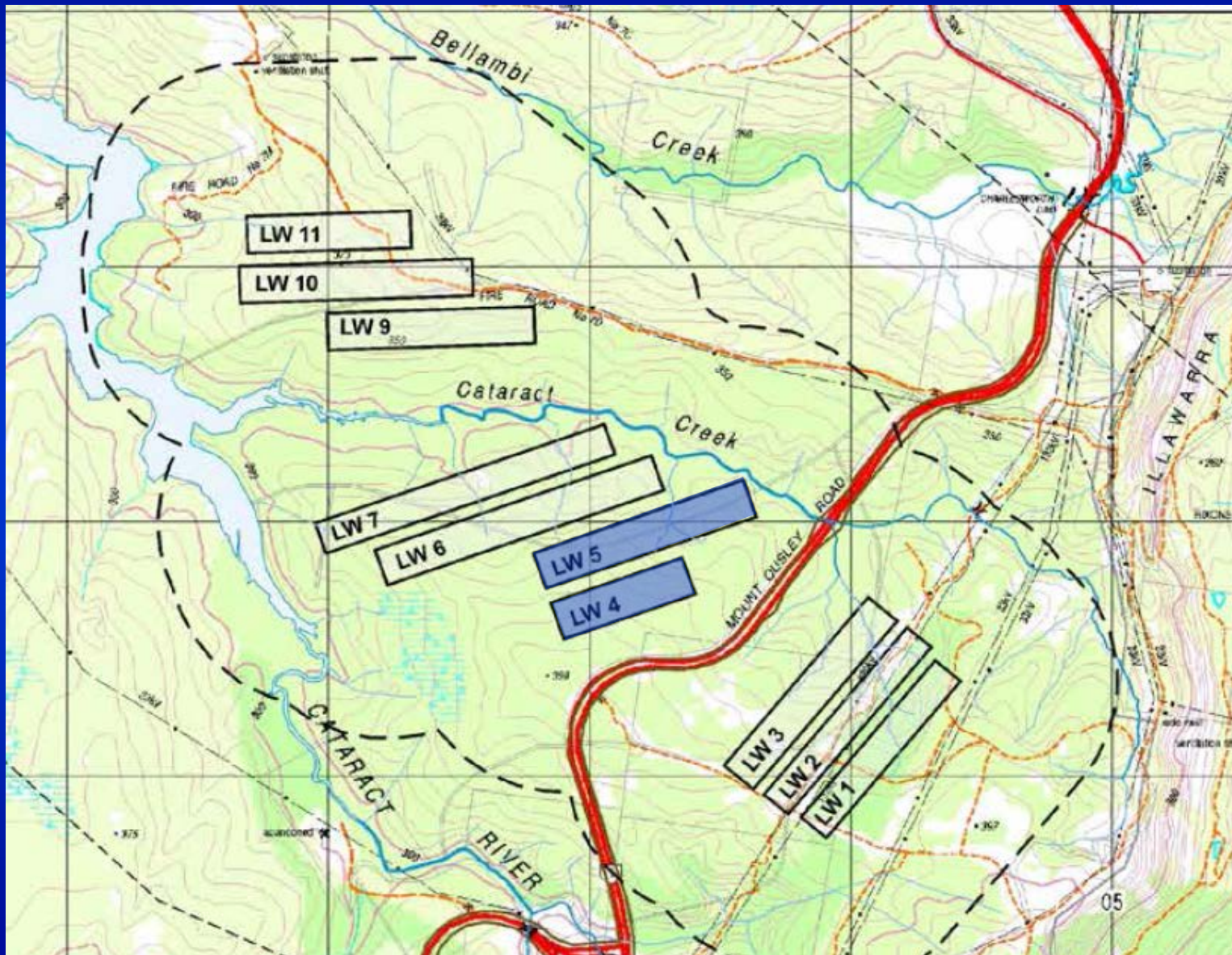
# **Update of Subsidence Movements at Russell Vale Colliery in Vicinity of Mount Ousley Road and Proposed Ongoing Management Strategy**

**Ken Mills,  
Dave Clarkson, Kamlesh Prajapati**

# Overview

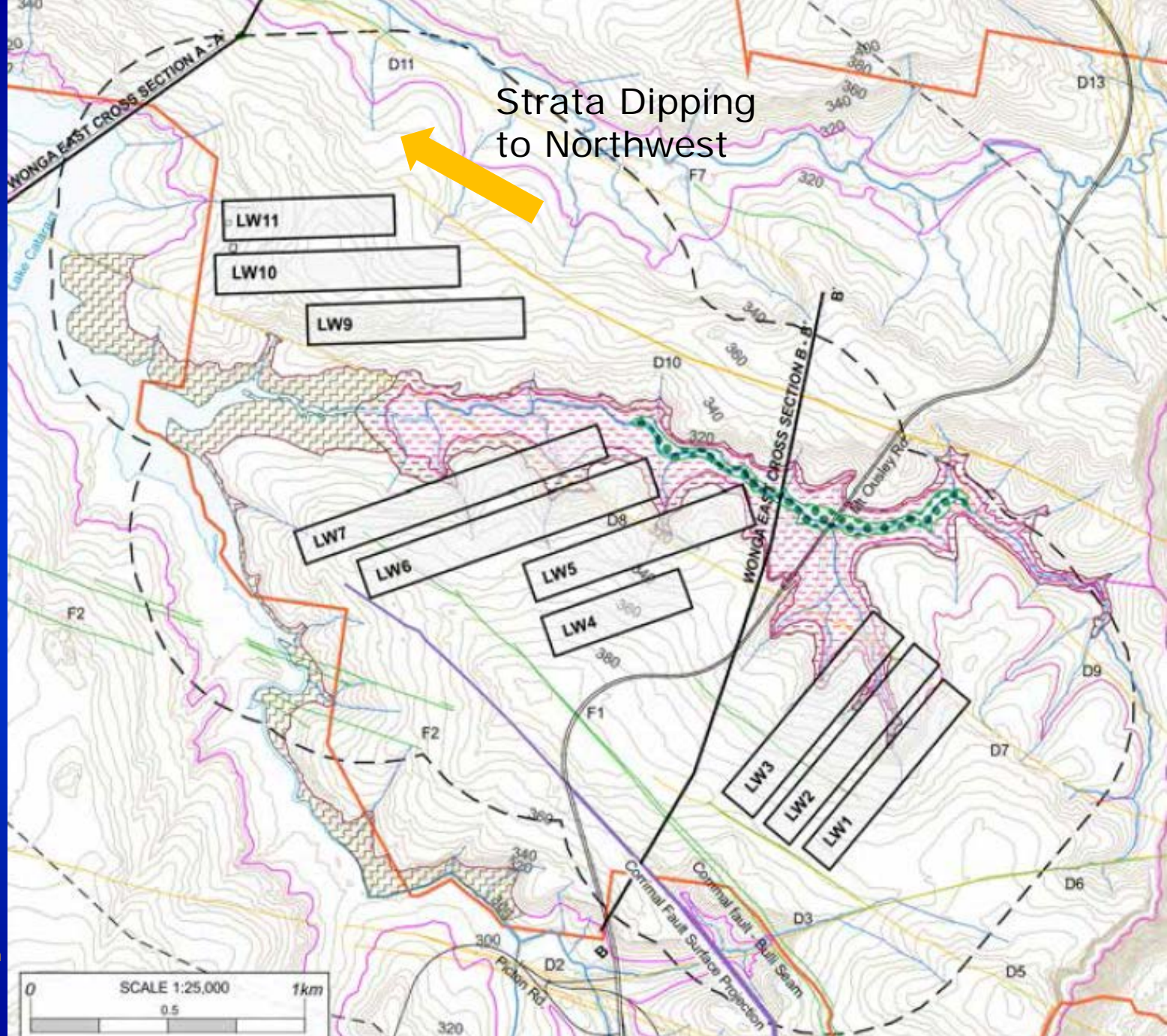
- **Site Overview**
- **Subsidence Monitoring to End of Longwall 5**
- **Results of Mount Ousley Road Monitoring**
- **Proposed Changes to Monitoring for Longwall 6 onwards**

# Site Overview

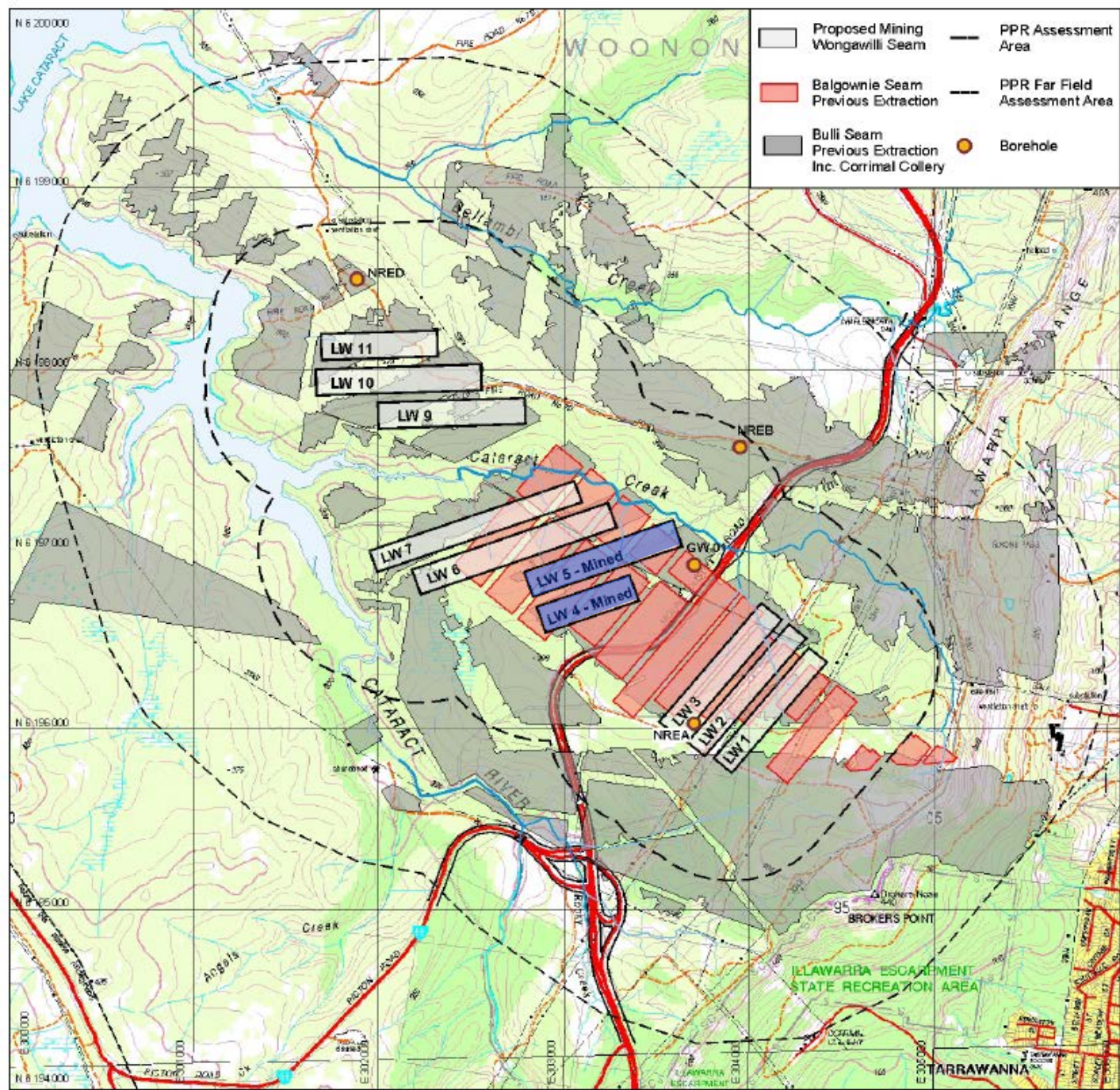




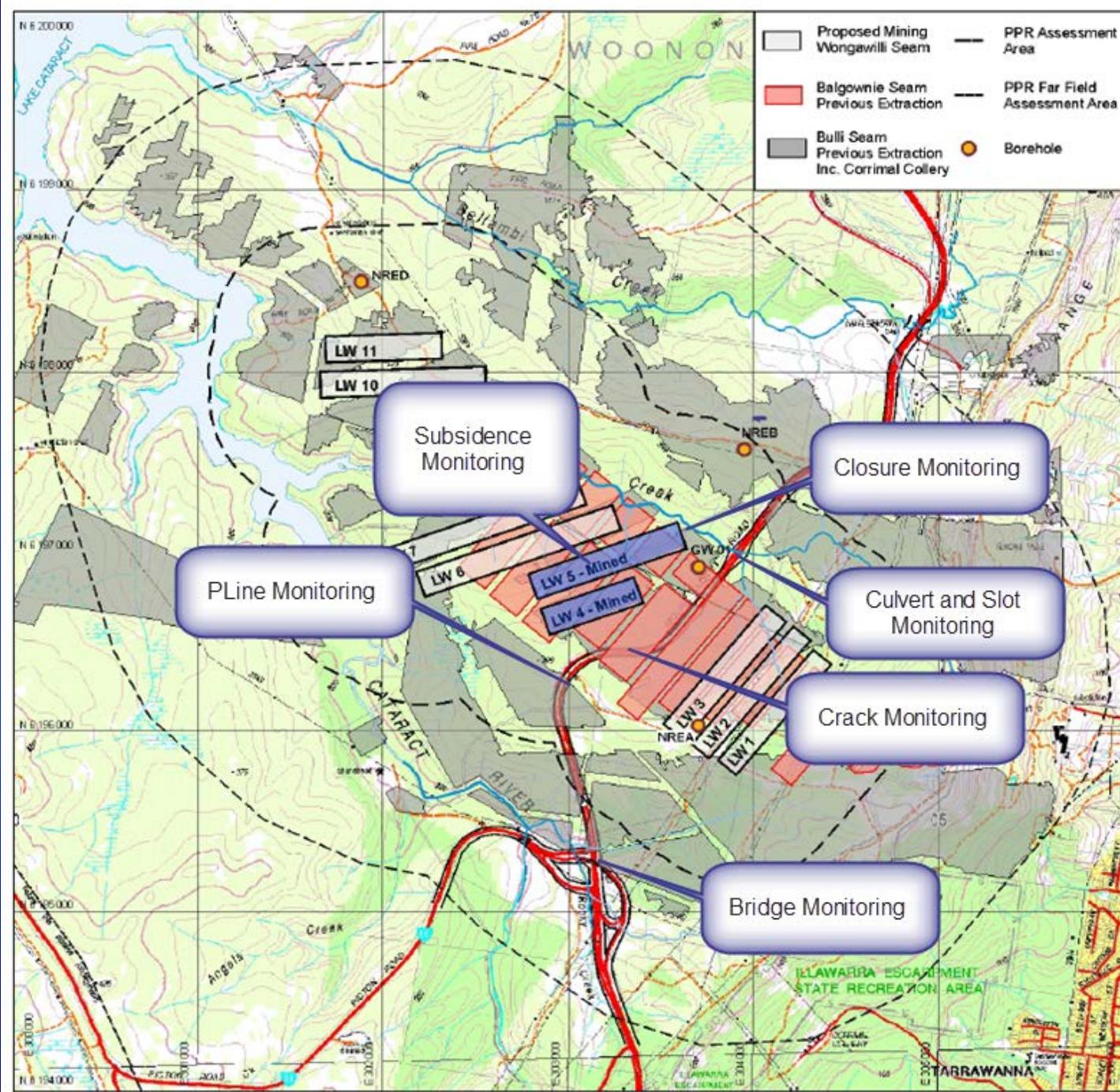
## Geological Setting





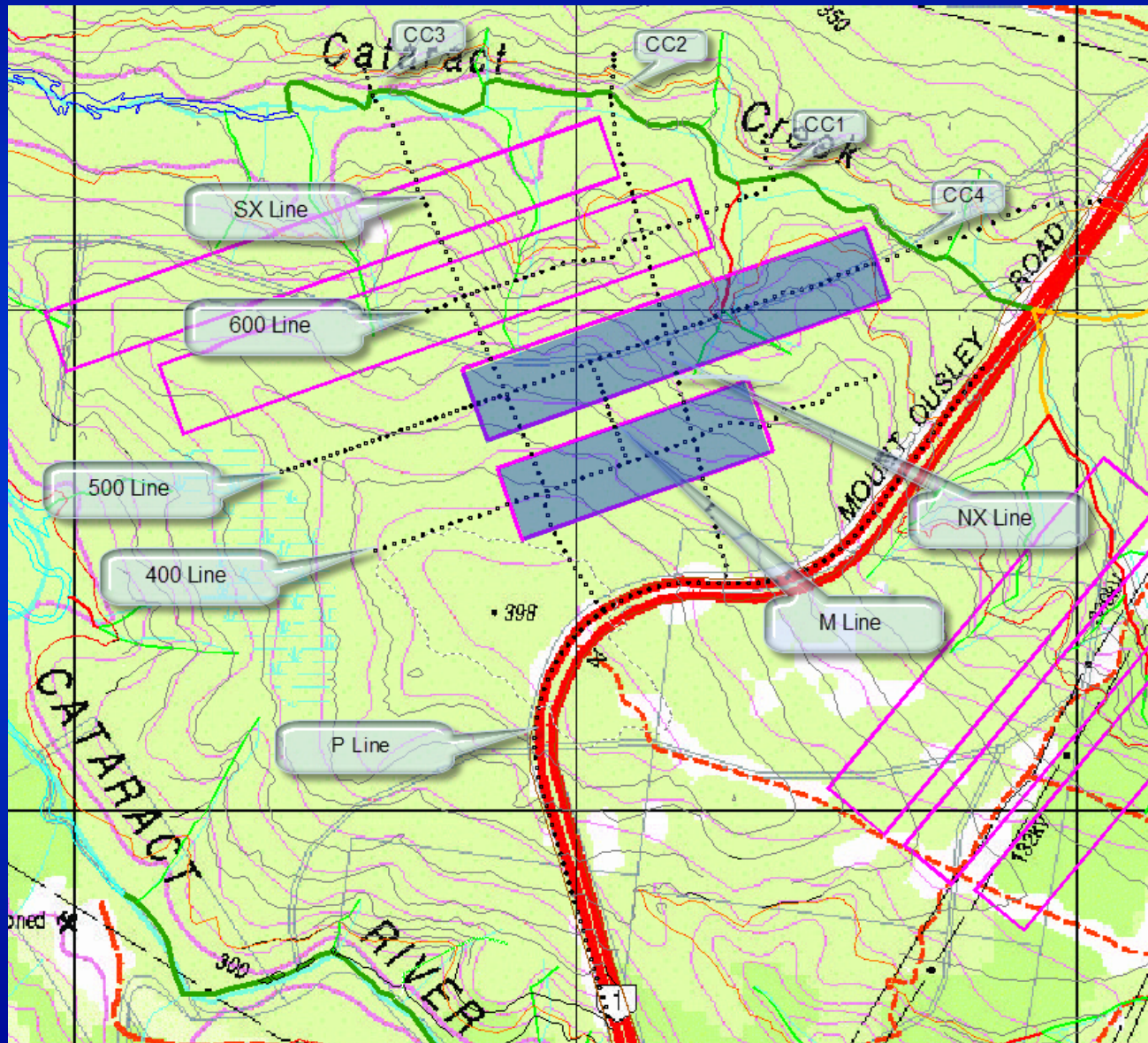








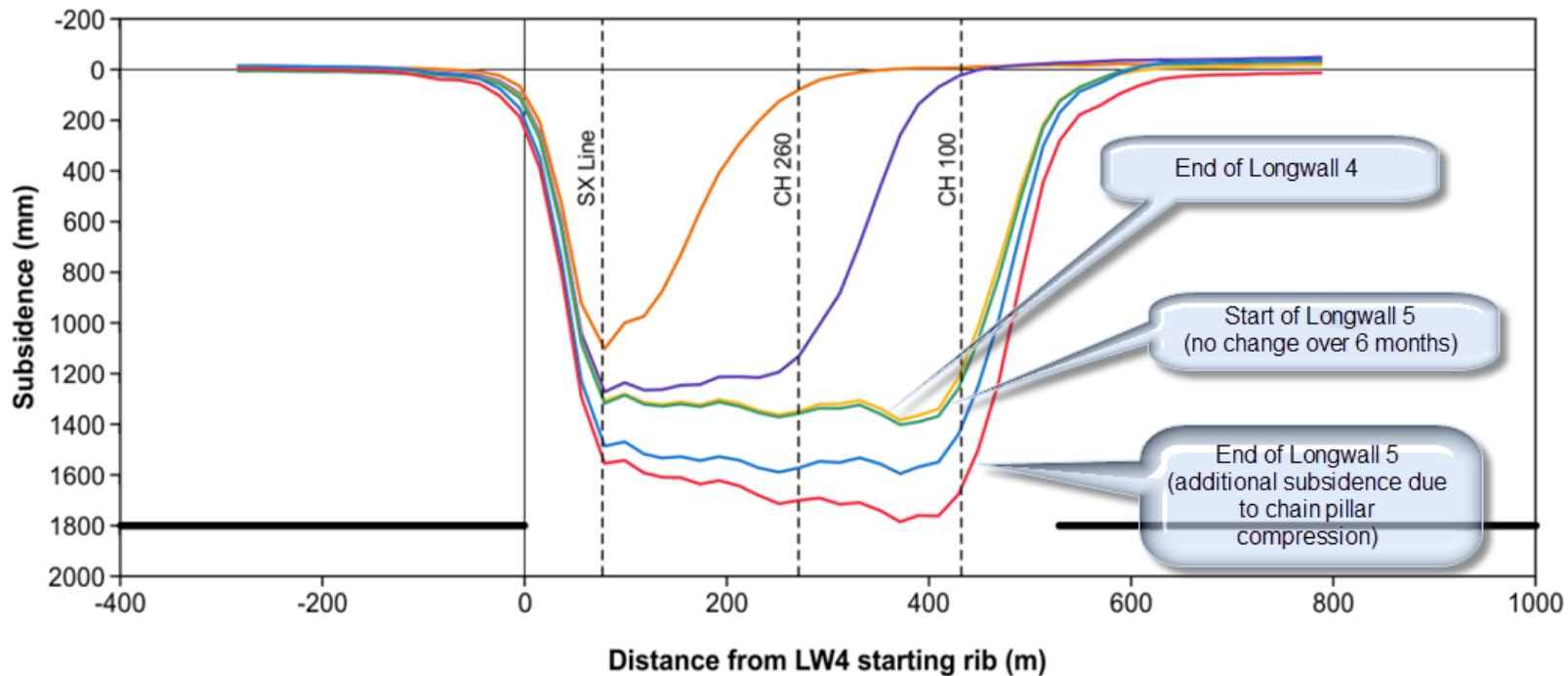
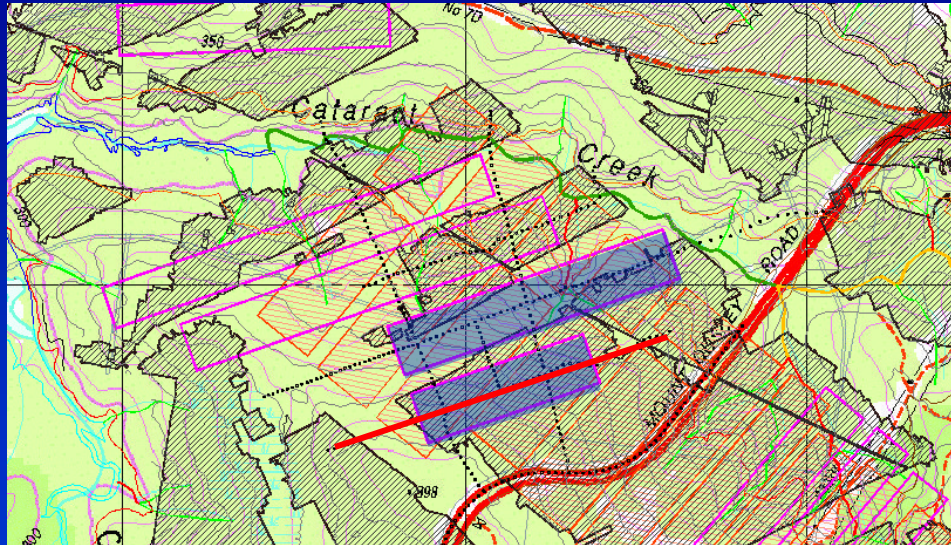
# Subsidence Monitoring



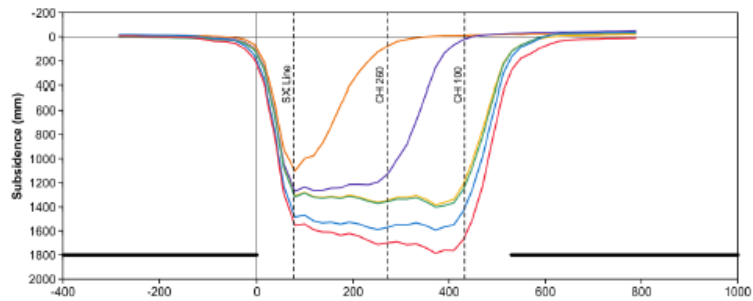
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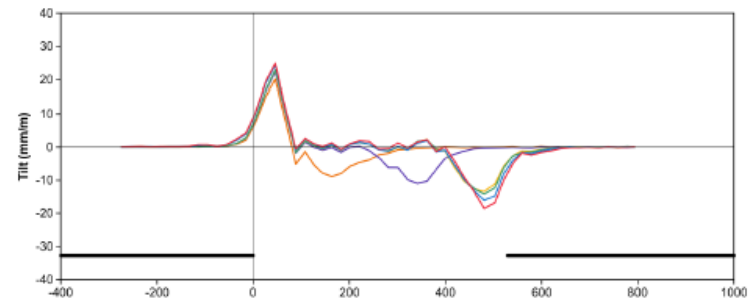
Subsidence limited substantially to within panel boundaries



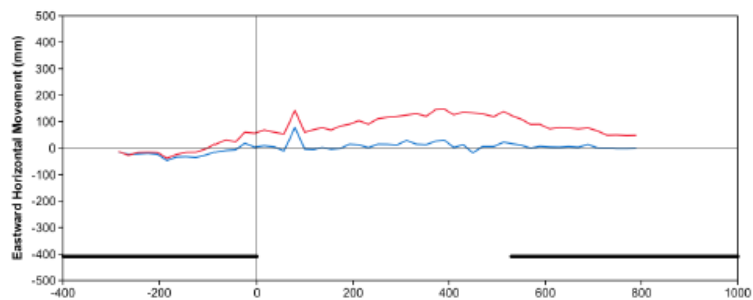




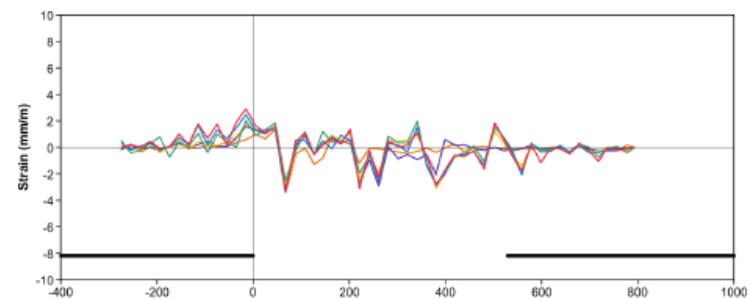
Distance from LW4 starting rib (m)  
Line 400 - Subsidence



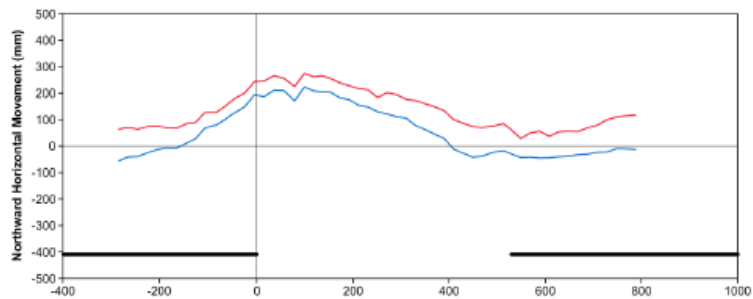
Distance from LW4 starting rib (m)  
Line 400 - Tilt



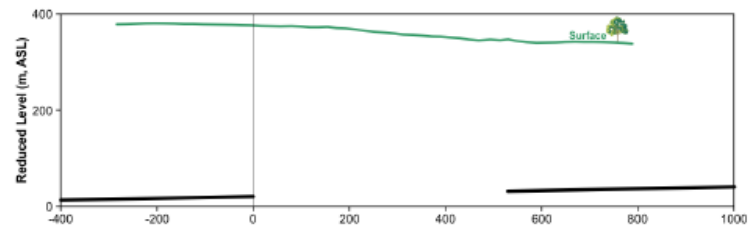
Distance from LW4 starting rib (m)  
Line 400 - Long Panel Horizontal Movement



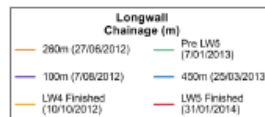
Distance from LW4 starting rib (m)  
Line 400 - Strain



Distance from LW4 starting rib (m)  
Line 400 - Cross Panel Horizontal Movement



Distance from LW4 starting rib (m)  
Line 400 - Surface Topography

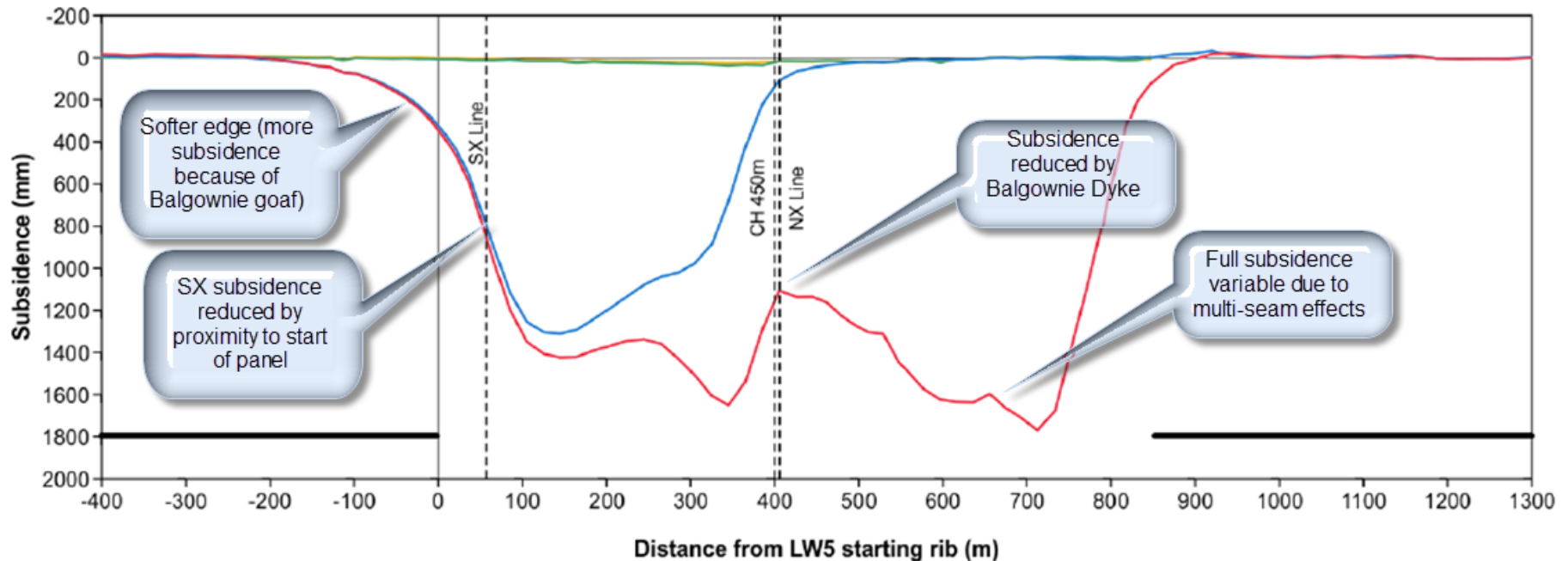
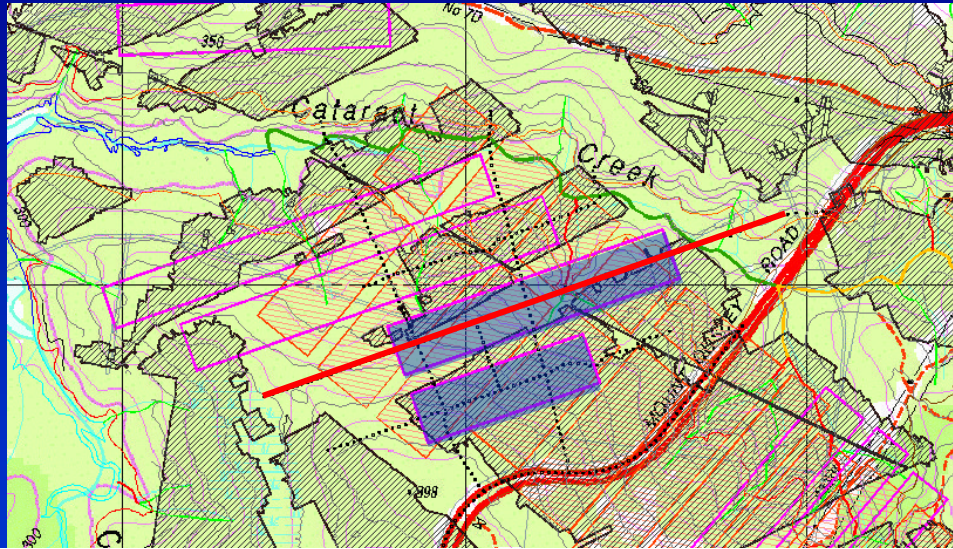


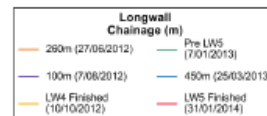
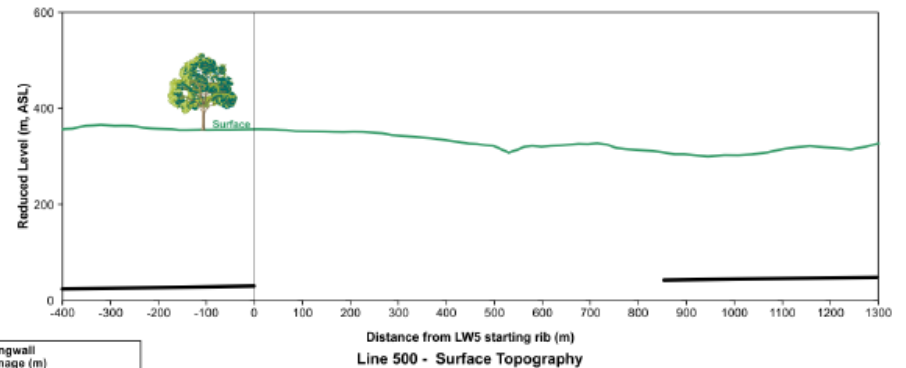
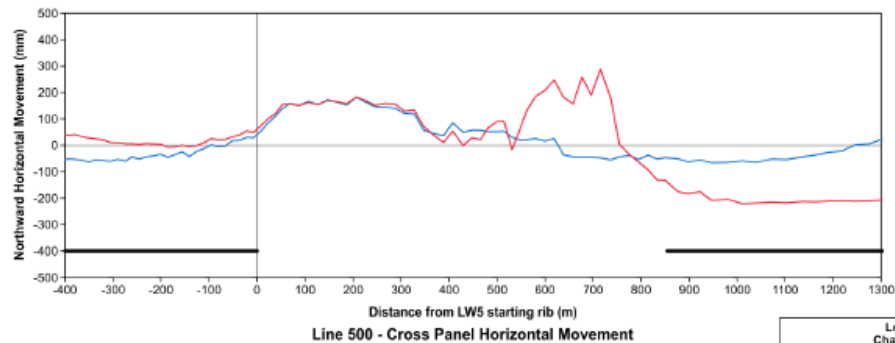
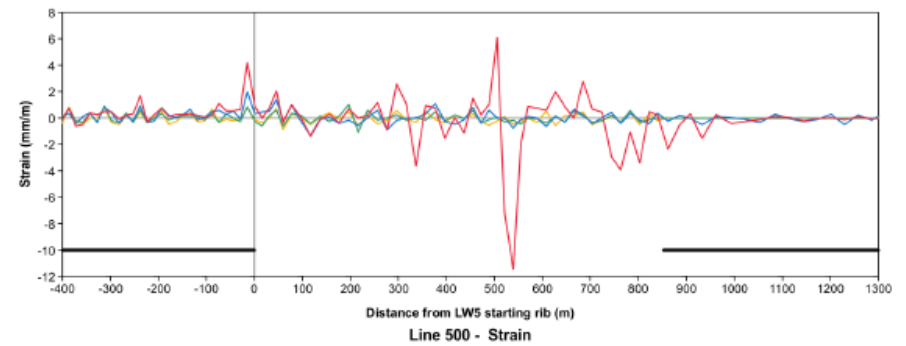
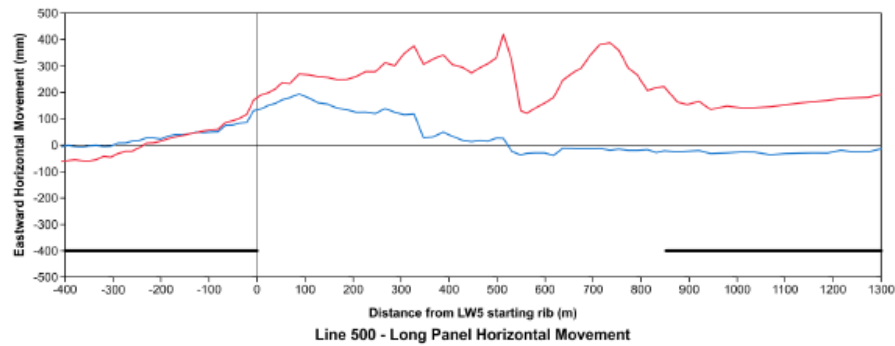
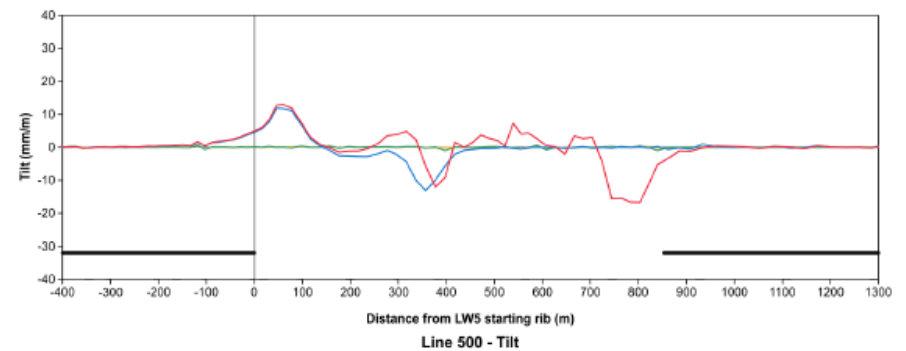
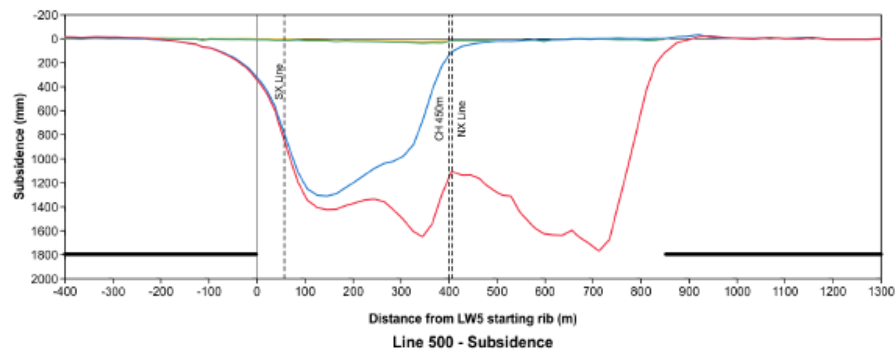


# 500 Line

$S_{max} = 1.8m$

**Subsidence limited substantially to within panel boundaries**

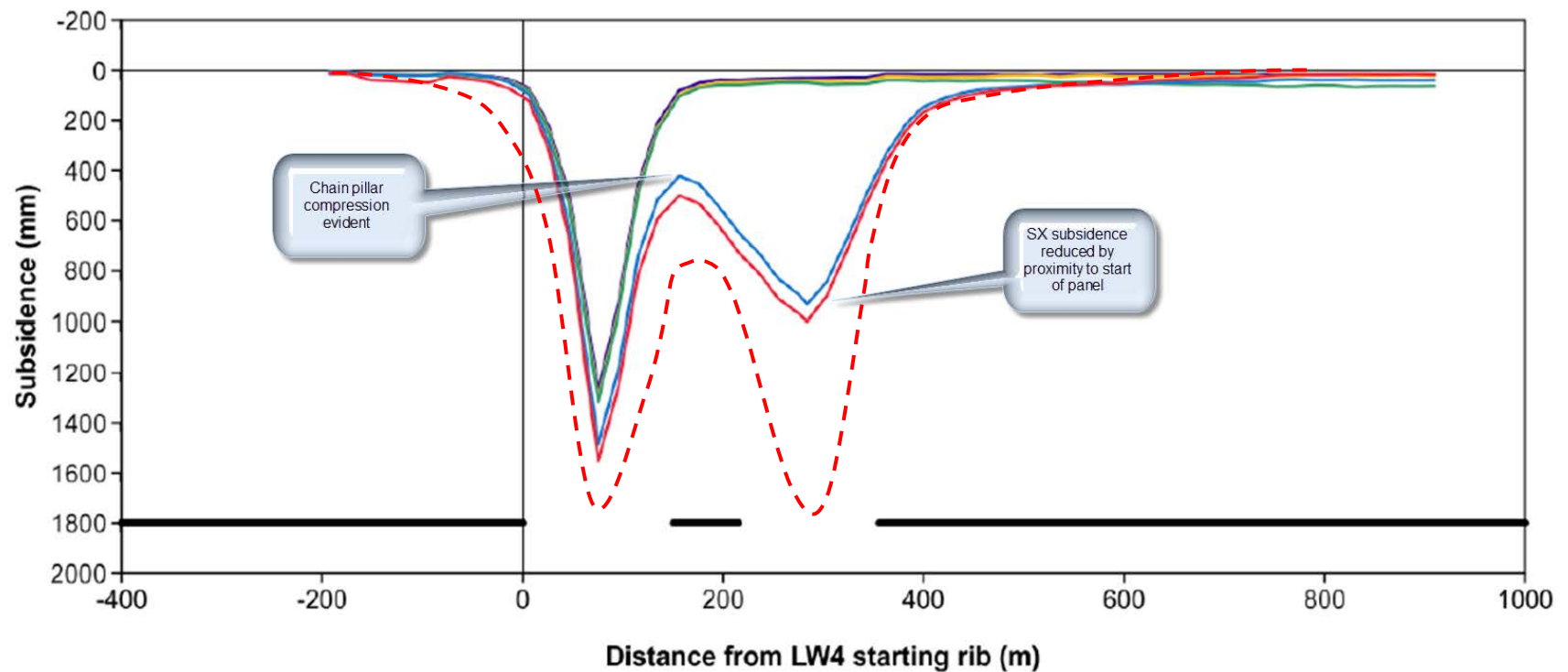
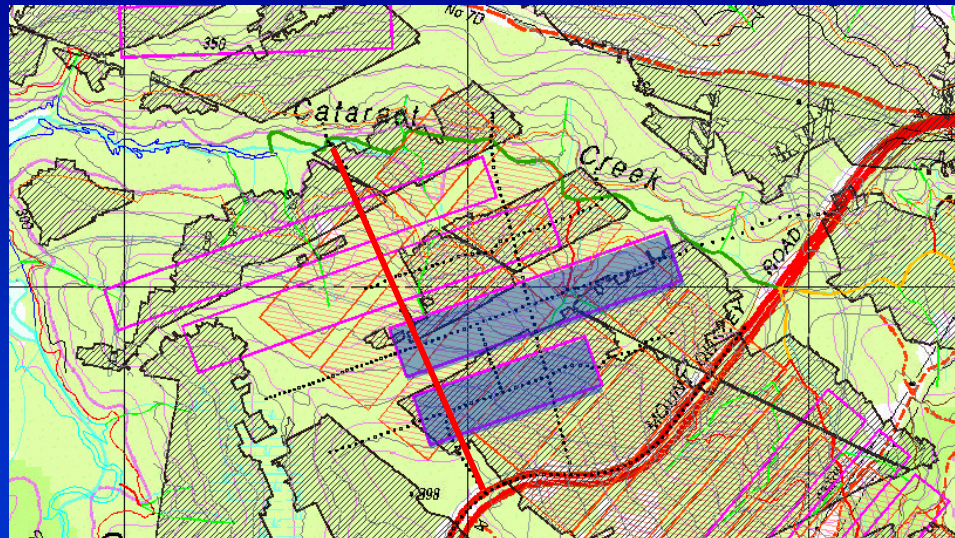


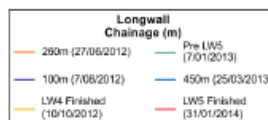
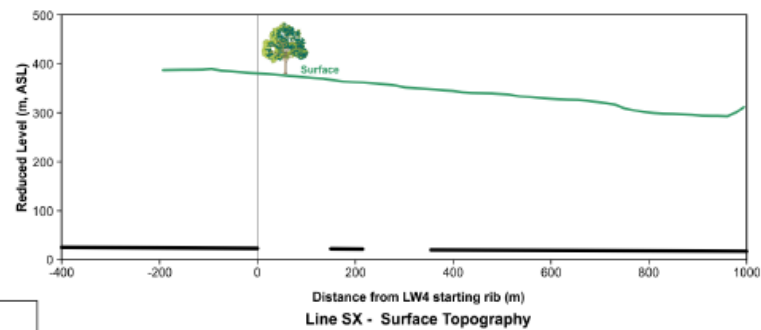
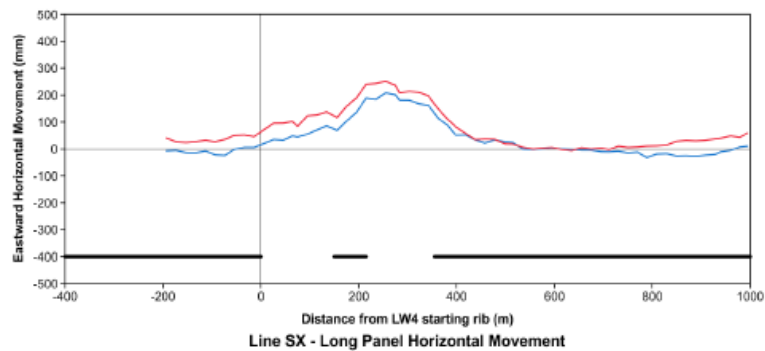
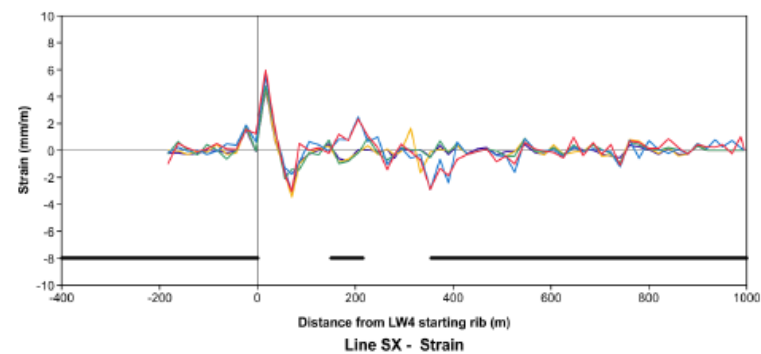
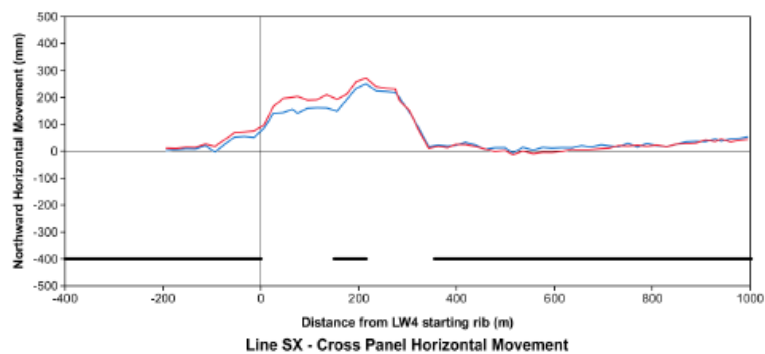
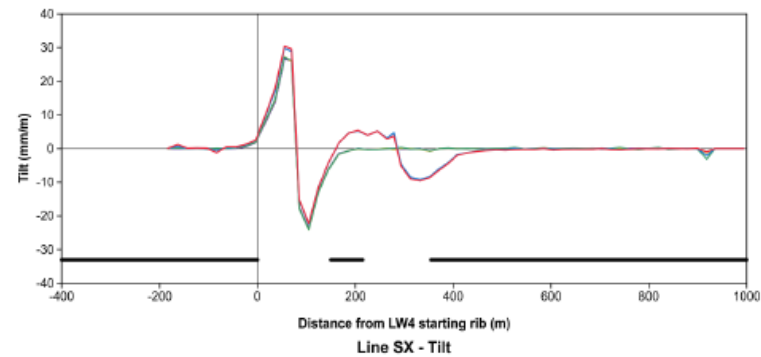
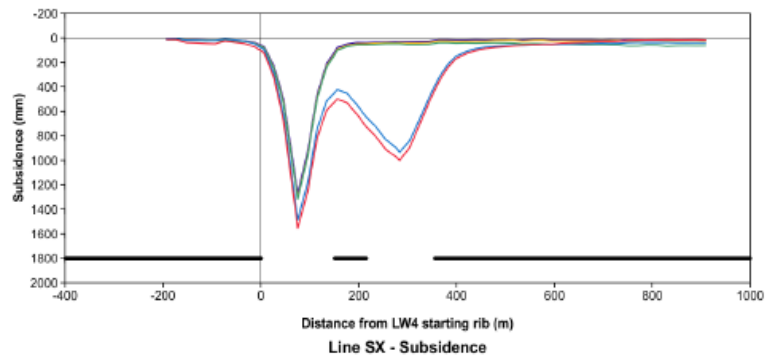


# SX Line

Smax = 1.6m (1.8m)

Sag subsidence  
and chain pillar  
compression evident

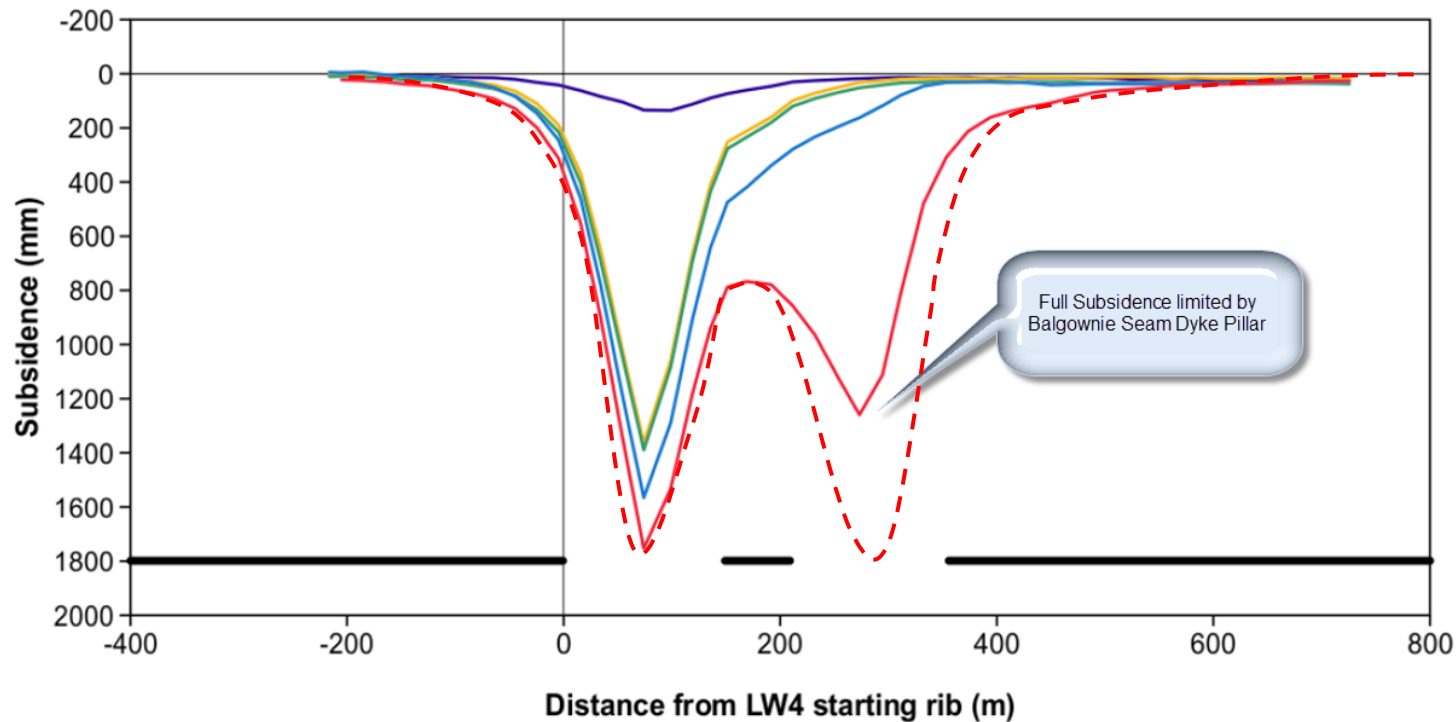
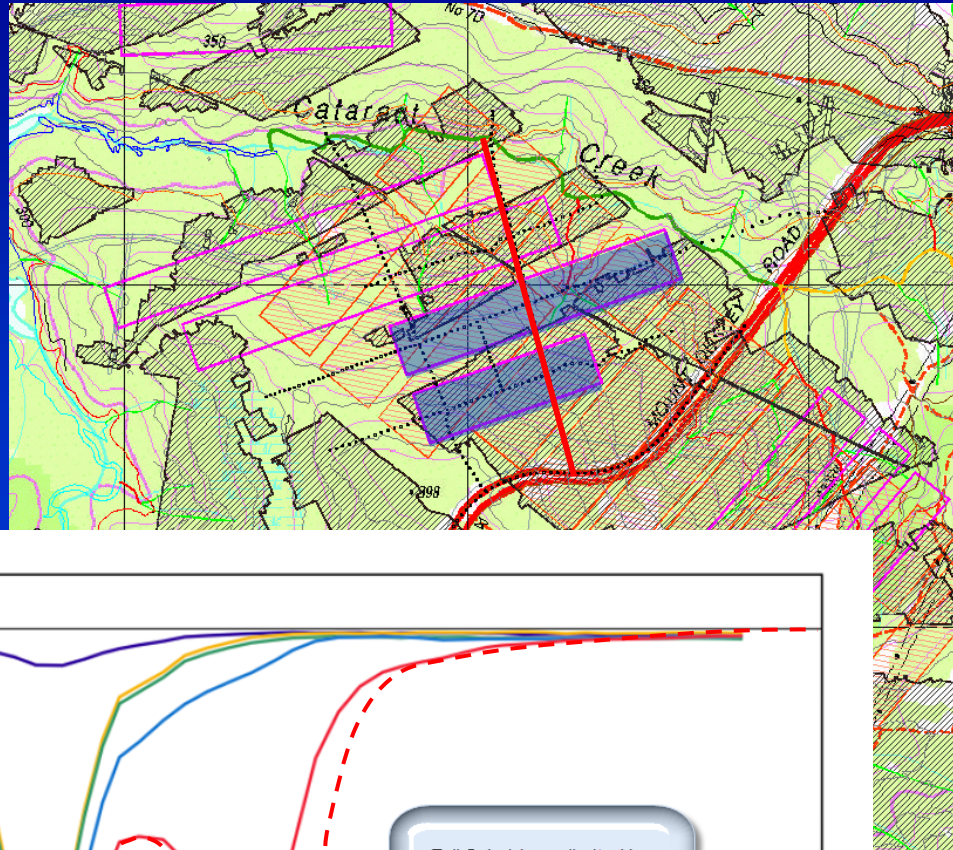


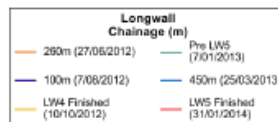
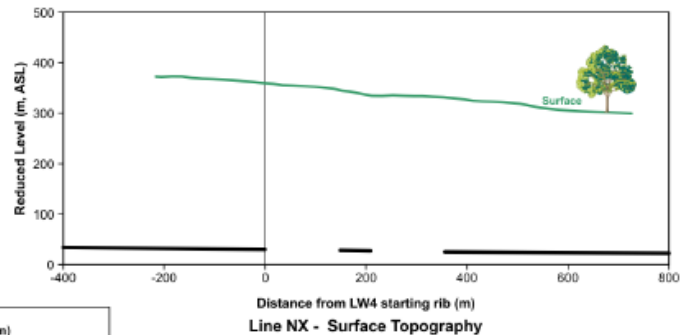
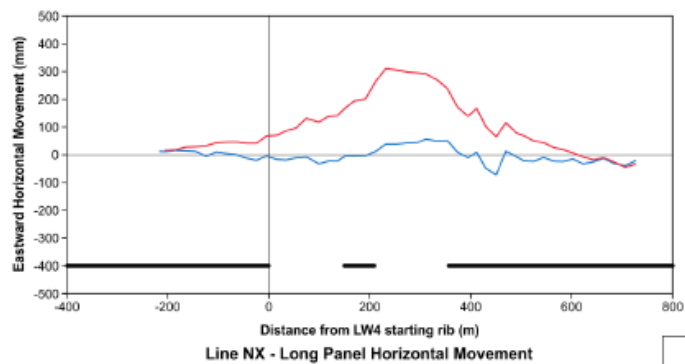
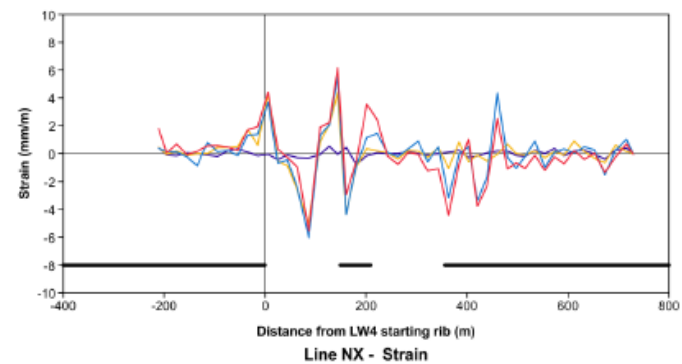
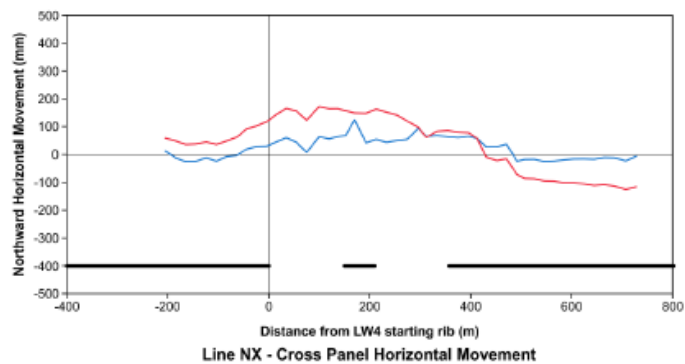
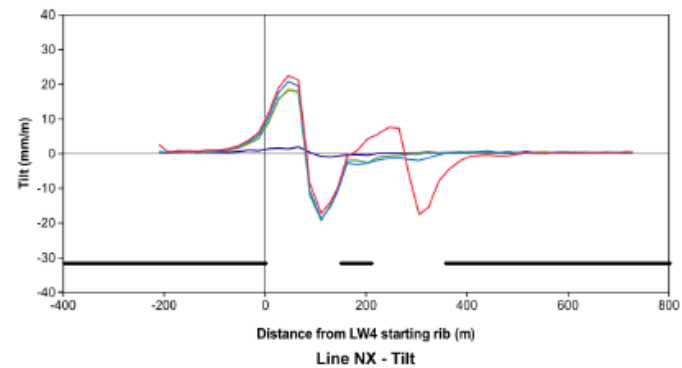
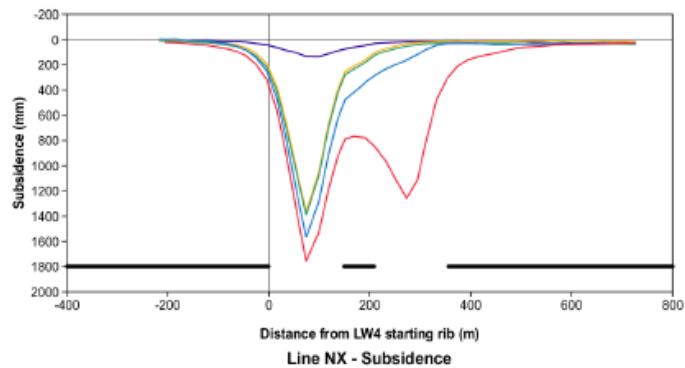




# NX Line

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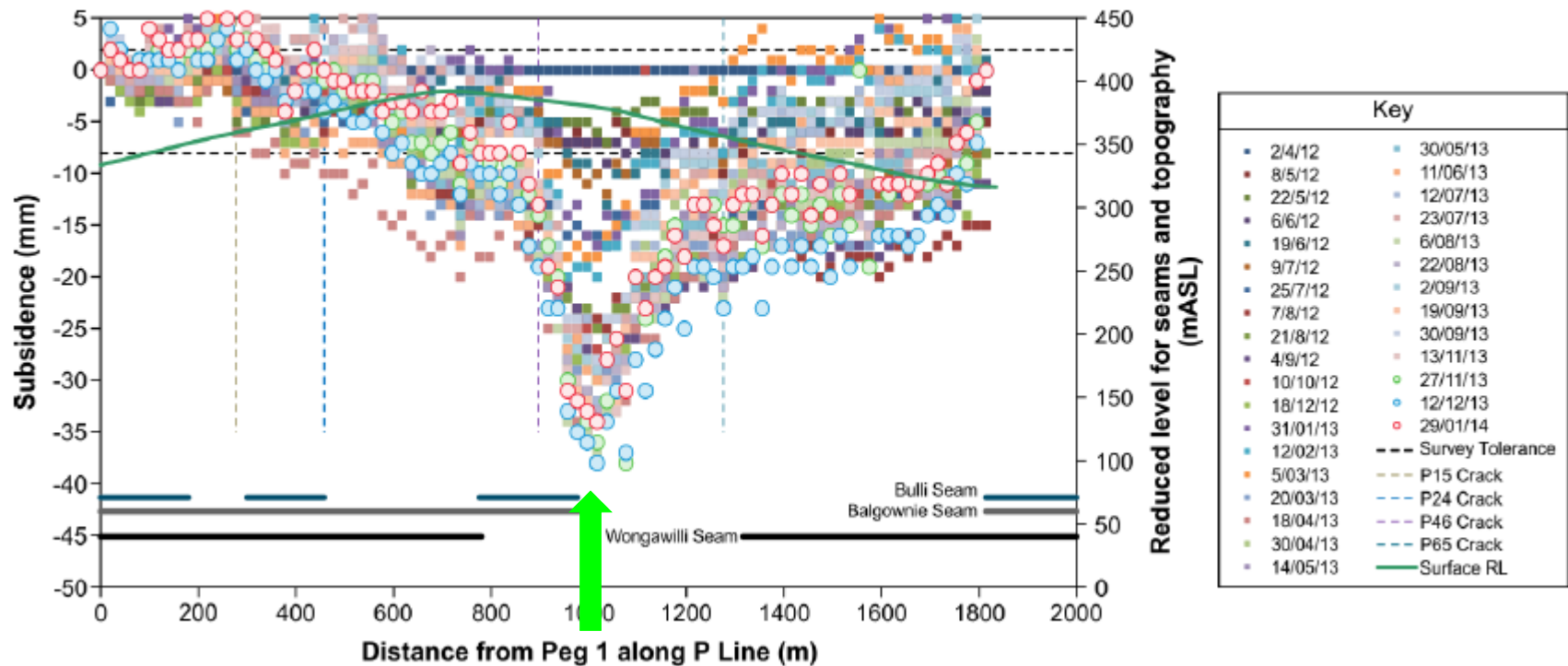
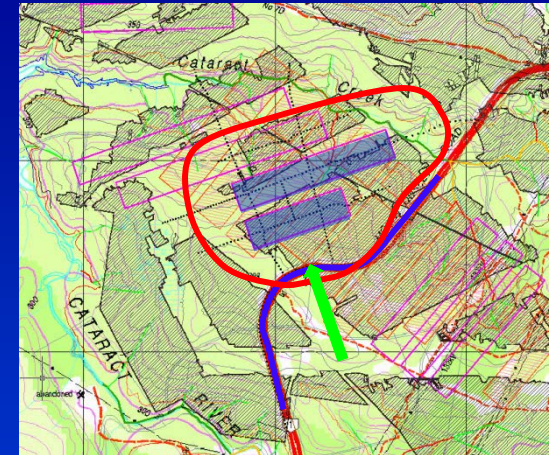
# P Line

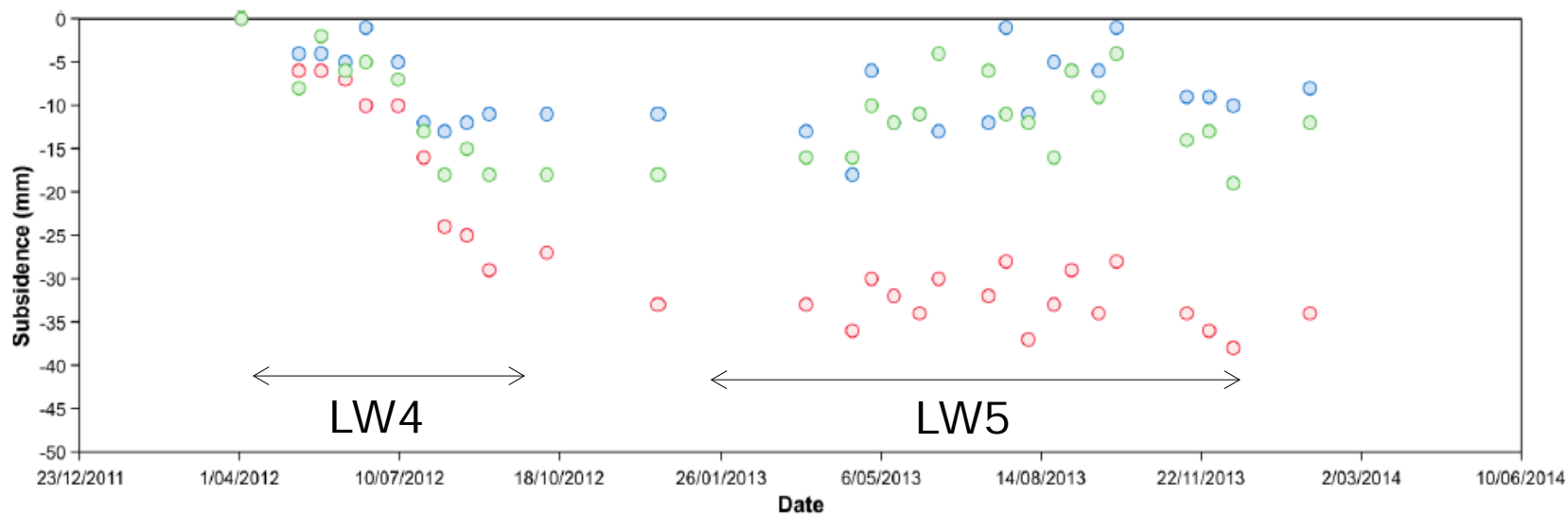
$S_{max} = 40\text{mm}$

Centred on Longwall 4

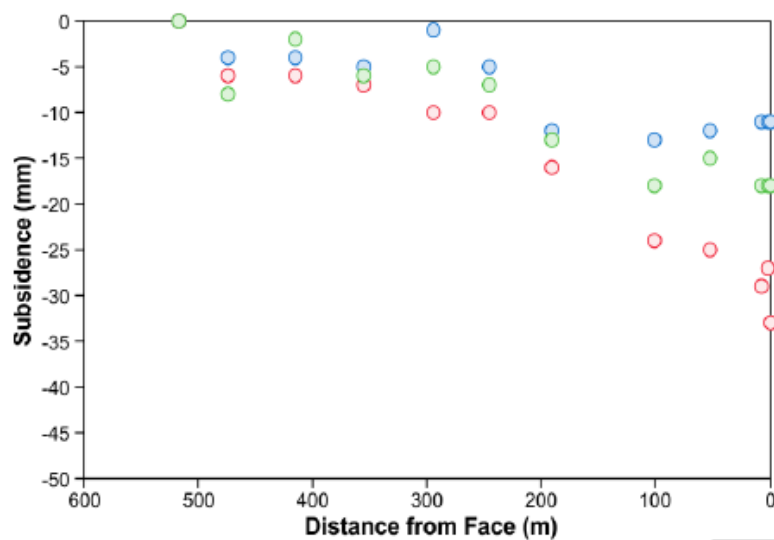
Normal Angle of Draw Effect

Half Depth 40mm

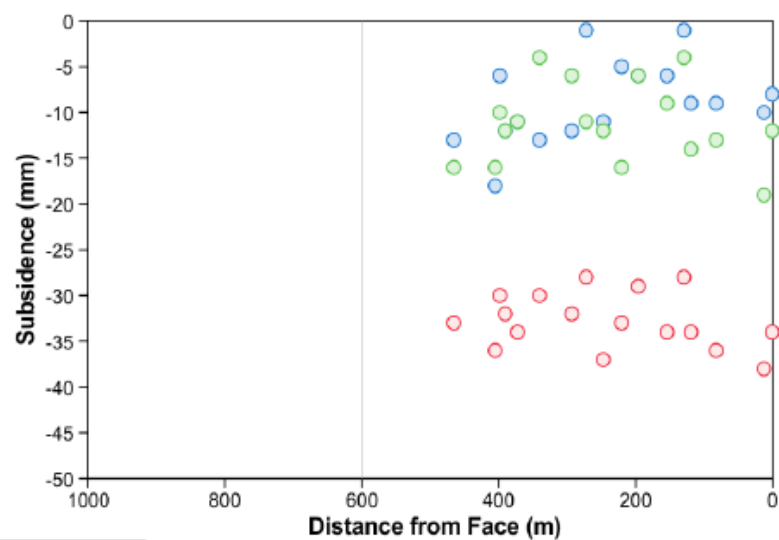




a) Development of P Line Subsidence over Time.



b) Subsidence During LW4.



c) Subsidence During LW5.



# Summary of Subsidence Parameters

## Maximum Subsidence Parameters at End of Longwall 5 on Individual Lines

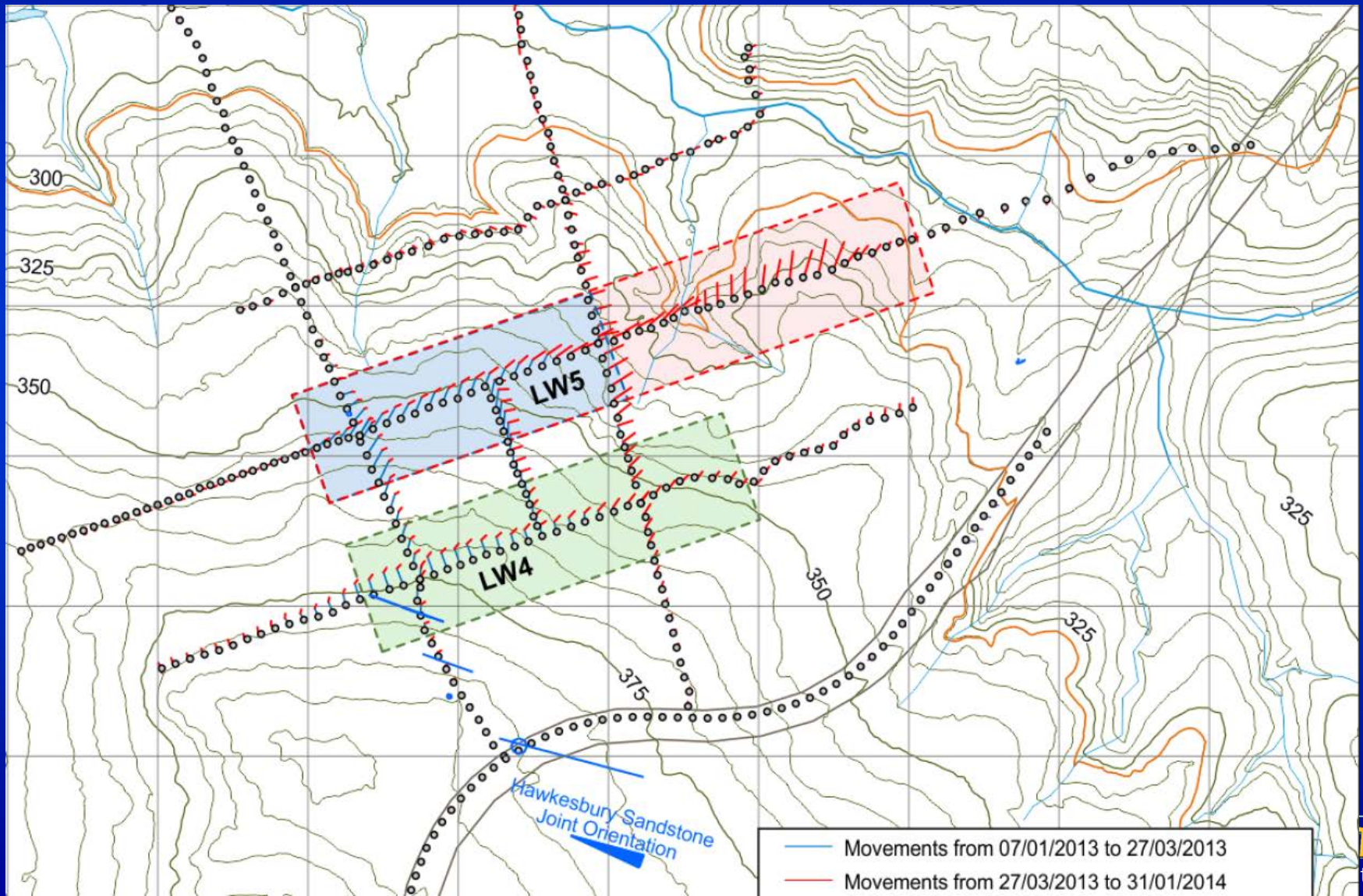
Line	Total Max. Subsidence (m)	Max. Tilt (mm/m)	Max. Tensile Strain (mm/m)	Max. Compressive Strain (mm/m)
Line 400	1.8	25	3	4
Line 500	1.8	15	6	12
SX Line	1.3 (1.0 over LW5)	30	6	4
MX Line	0.64	19	(2)*	(3)*
NX Line	1.8 (1.3 over LW5)	22	6	6
P Line	0.04	<1	<1	<1

Strains and tilt values are rounded up to nearest mm/m

- Strains on MX Line incomplete because line installed after Longwall 4 was mined.

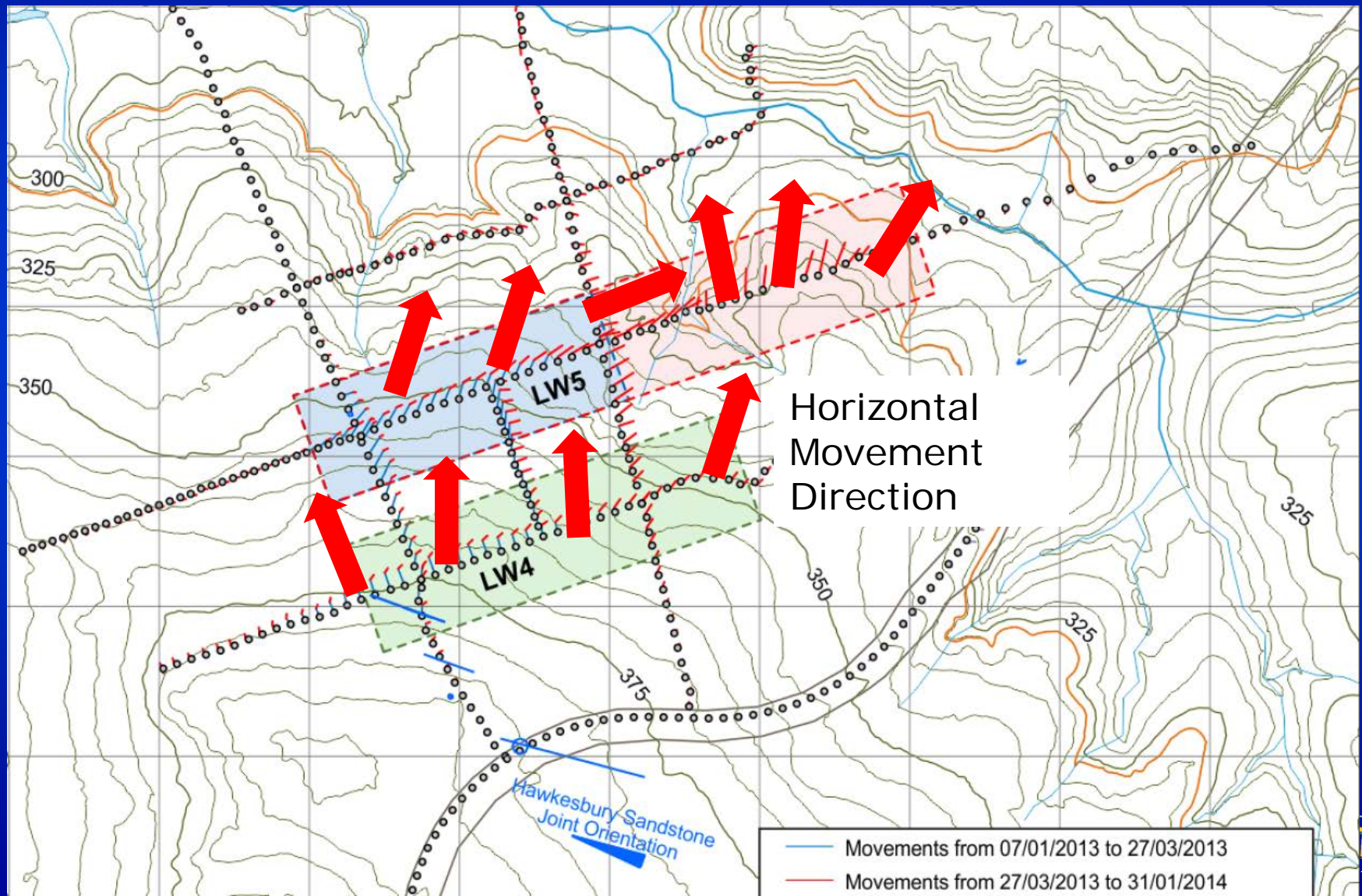


# Horizontal Movements



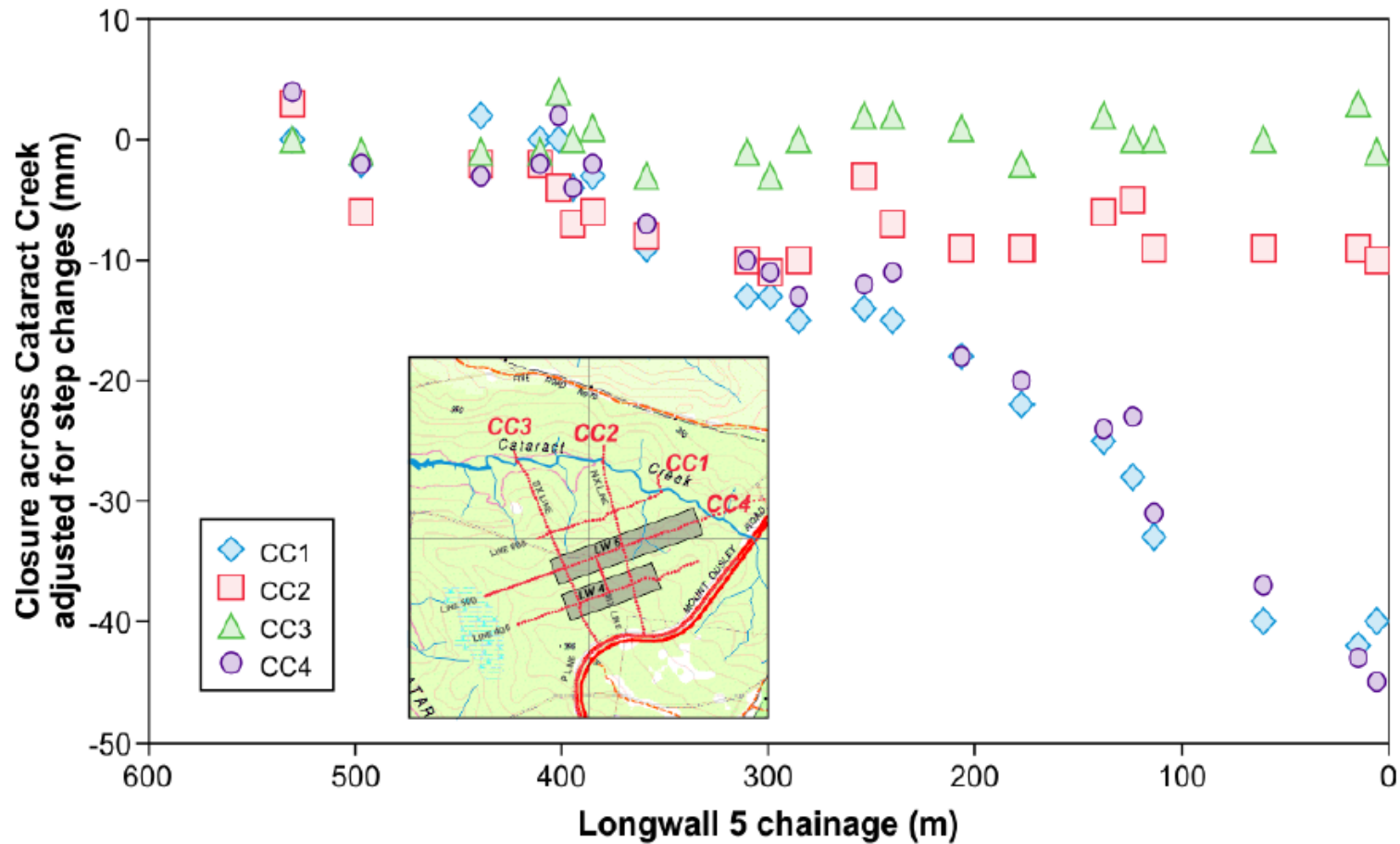


# Horizontal Movements

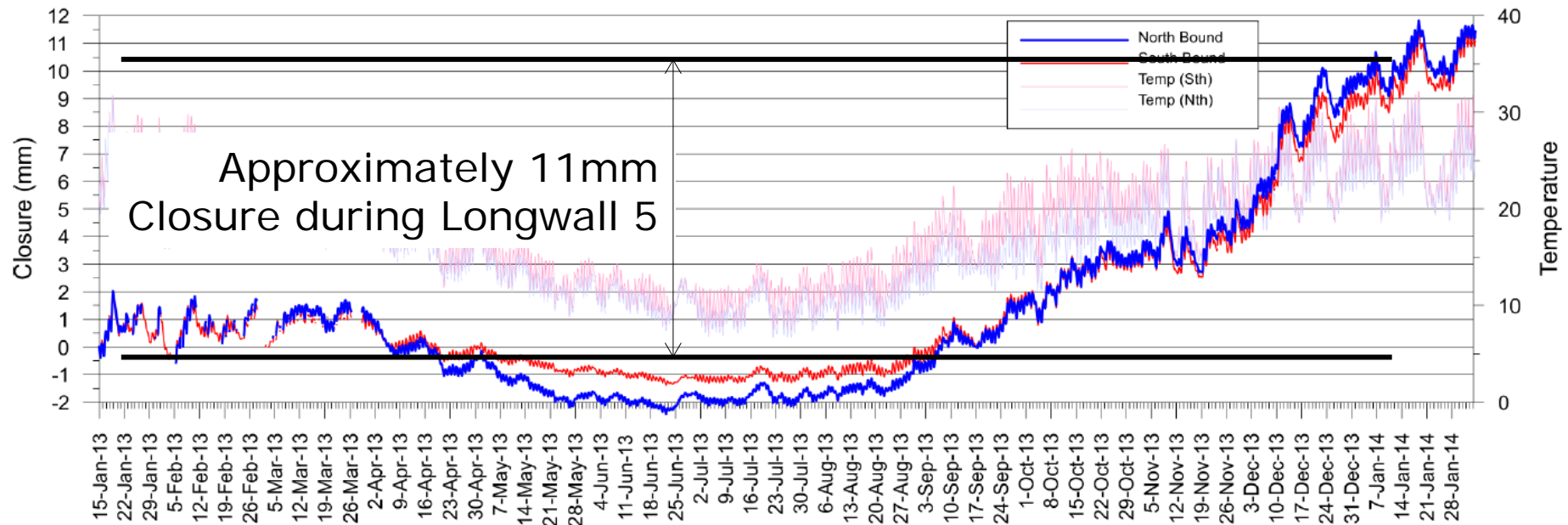




# Closure Measurements



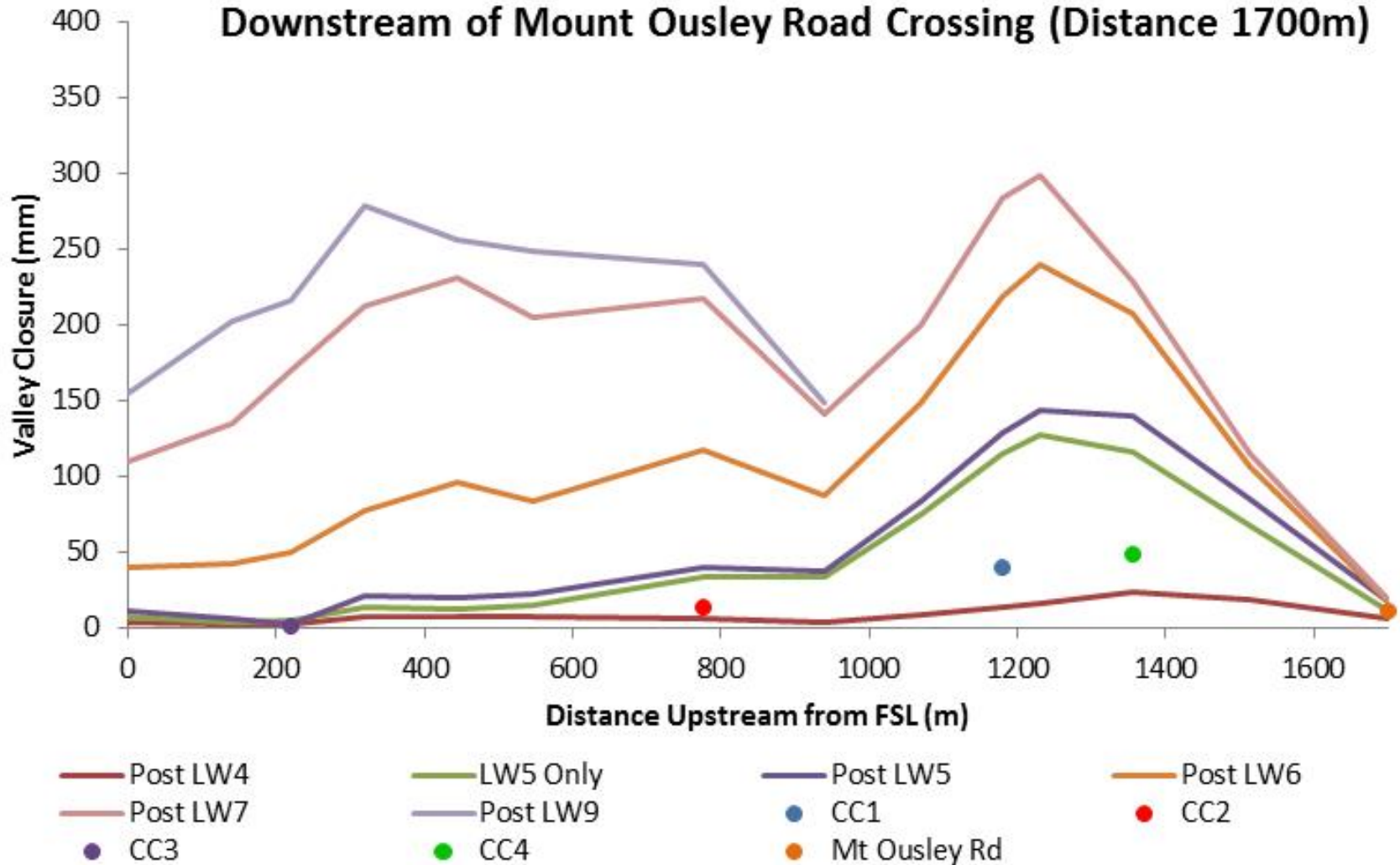
# Slot Closure Measurements

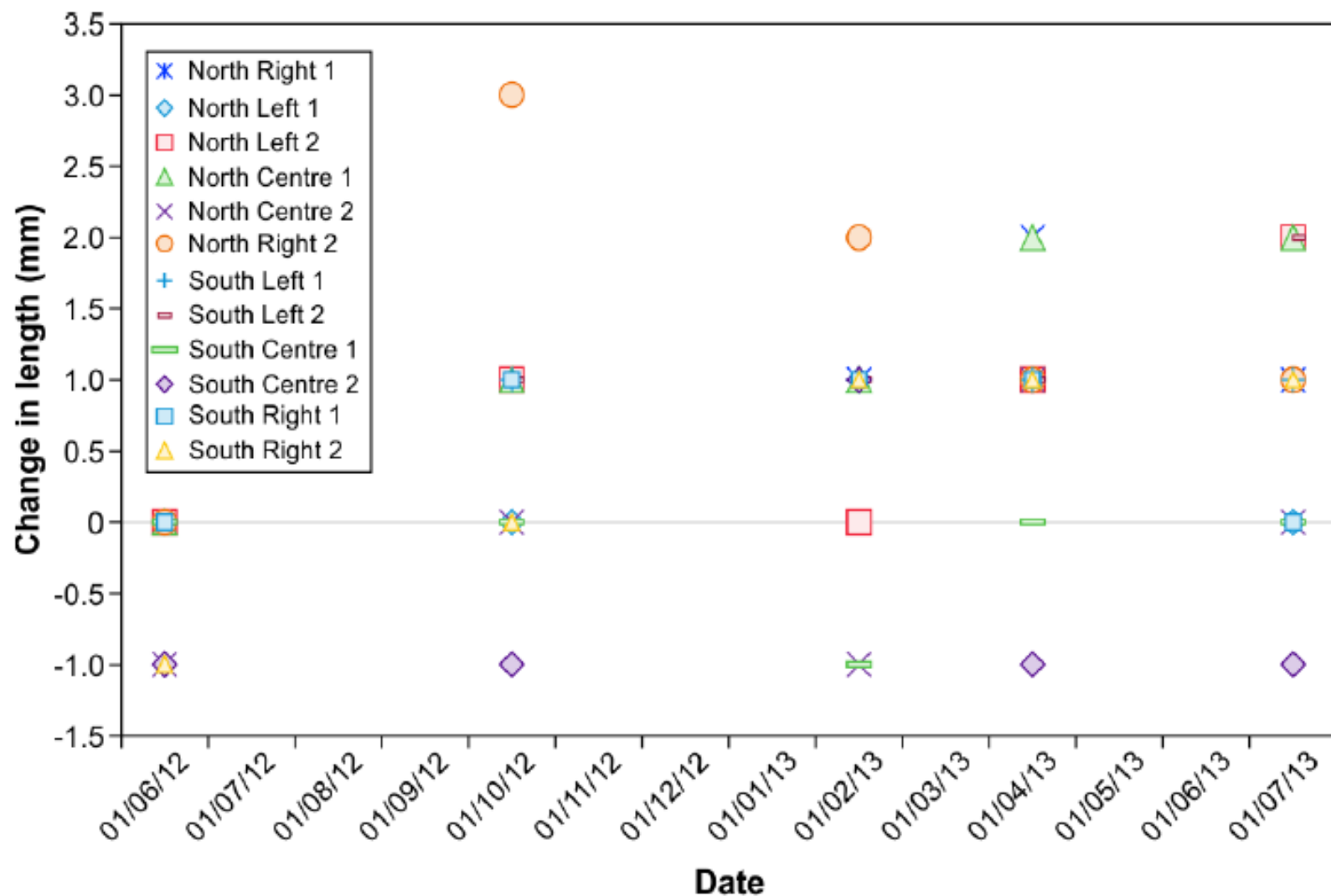


(after Pells Consulting 2014)

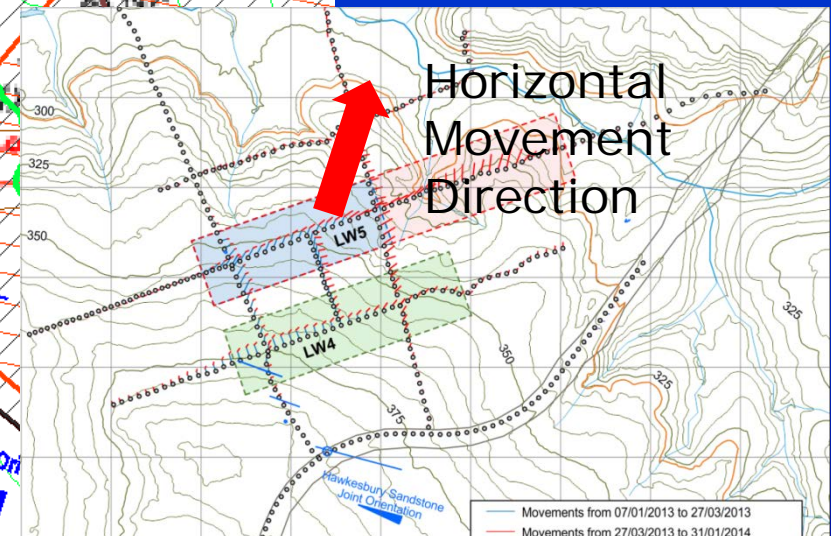
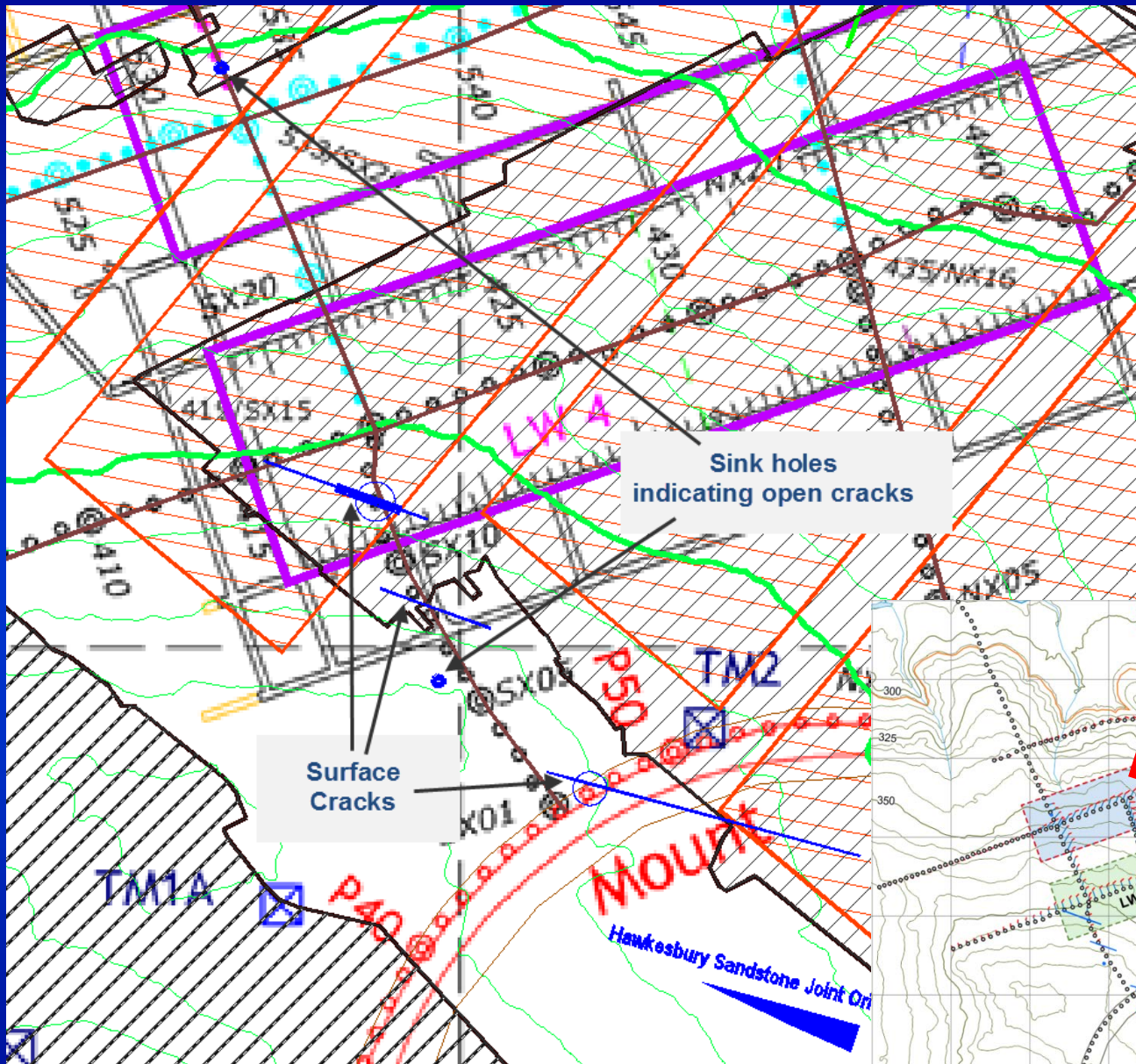
# Cataract Creek Closure Estimates

Downstream of Mount Ousley Road Crossing (Distance 1700m)

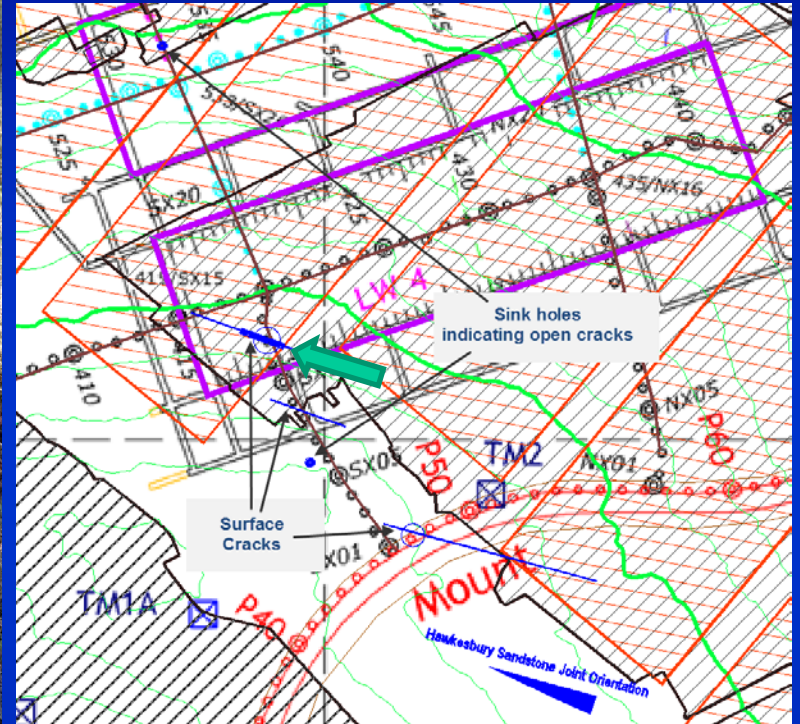




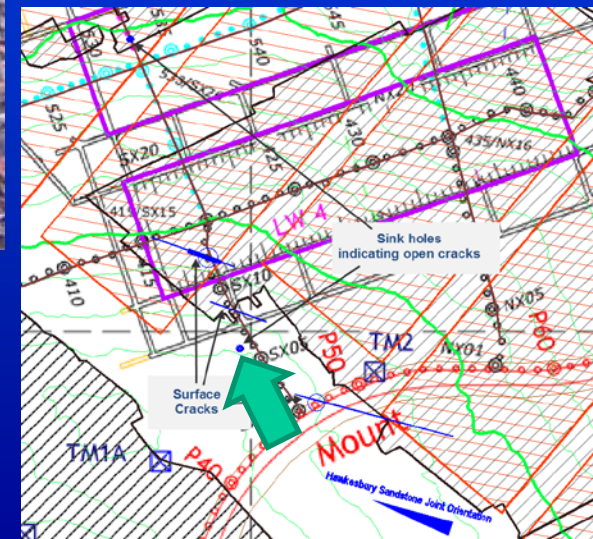
**Change in Diagonal Dimensions within Mount Ousley Road Culverts since 10 May 2012.**



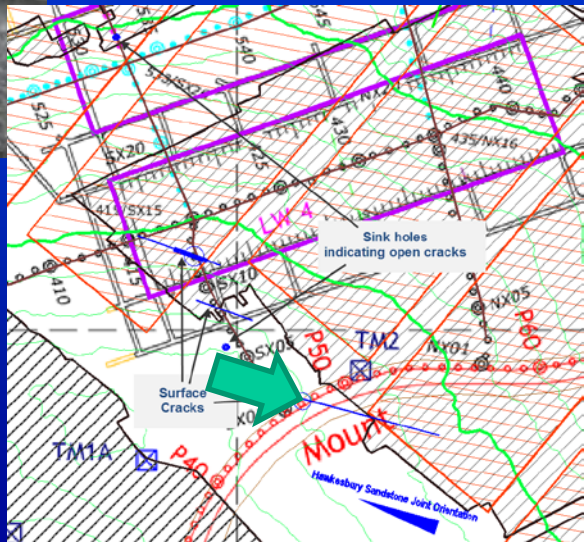




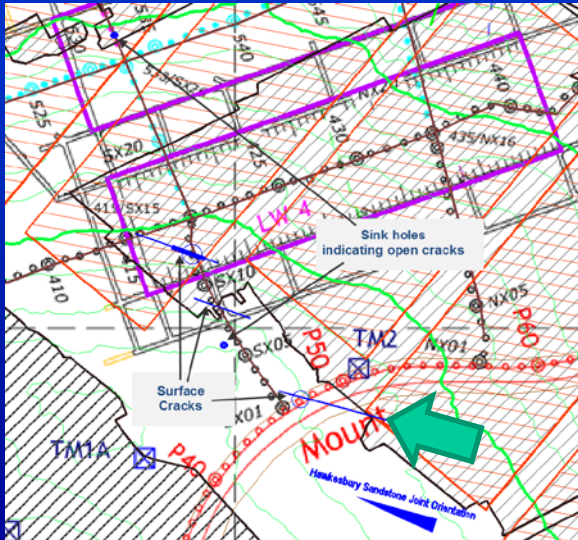




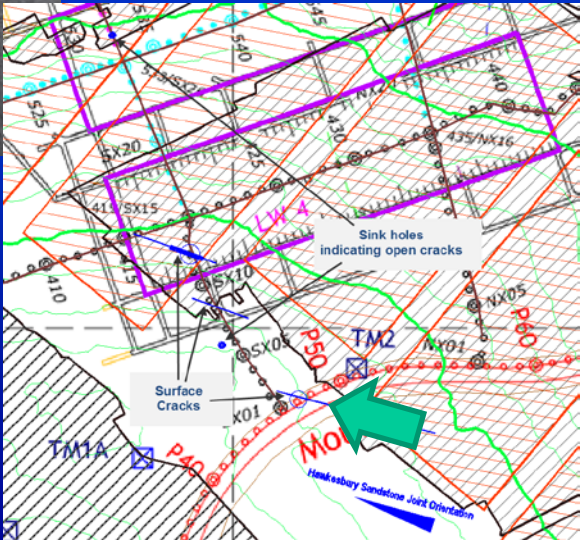














# Picton Road Interchange

No subsidence induced change  
noted (Cardno 2014)

# Management Strategy

Management of subsidence impacts on Mount Ousley Road guided by the Mount Ousley Road Technical Committee.

Given:

- the increasing remoteness of proposed mining from Mount Ousley Road,
- the low levels of ground movement so far observed from Longwalls 4 and 5,
- and the effectiveness of the Mount Ousley Road Technical Committee as a basis to manage monitoring protocols and assess potential impacts,

a reduction in the frequency of monitoring is planned with refinement and improvement of key monitoring recognising that the technical committee can adjust and refine the monitoring at any time.

All subsidence monitoring data is to be made available to the PSE and the Mount Ousley Road Technical Committee within 48 hours of the information becoming available.

## **Frequency of Monitoring**

A reduction in the frequency of monitoring on Mount Ousley Road and the Picton Road Interchange to beginning and end of panel is planned in recognition that proposed mining will be increasingly remote from the road and interchange.

## **Replication of P Line**

P Line will be replicated on the southbound side of the road following the completion of Longwall 5 and before the commencement of any subsequent longwall panels. The new marks will be recessed below the surface of the road so they are not vulnerable to being scraped off. The pegs will be surveyed in three dimensions at the beginning and end of each longwall panel or at other times as required by the Mount Ousley Road Technical Committee. The existing P Line pegs are not planned to be removed, but would only be surveyed on an as required basis.

## **Road Condition Monitoring**

Monitoring of road condition to continue at end of panel or at more frequent intervals as required by the Mount Ousley Road Technical Committee.

## **Slot Closure Monitoring**

Closure of the slot at the crossing point on Cataract Creek will continue to be monitored as per previous panels, but some additional monitoring is proposed.

## **Culvert Closure Monitoring**

Closure measurements in the culvert will be upgraded to include closure measurements between the sides of the culvert and between the roof and floor. The diagonal measurements will continue to be made, but it has been recognised that these measurements alone are not sufficient to determine closure across the culvert.

## **Tiltmeters**

Monitoring of tiltmeters alongside Mount Ousley Road will be discontinued.

## High Resolution Closure Surveying

Two points suitable to affix prisms will be established at convenient locations off to the side of the road some 50-100m either side of Cataract Creek. By setting up a third mark close to one of the prisms and in line with the two prisms, high resolution point to point surveys can be made by backsighting to one prism and forward sighting to the other to confirm changes in distance between the prisms. Resolutions of typically better than a few millimetres across 100-200m are possible using this approach. These marks will be surveyed at the completion of each longwall panel or at other times as may be necessary to confirm the closures measured at the slot.

Observations of cracking on the road surface have identified the presence of a zone of stretching movement along the northern side of the ridge between Cataract Creek and Cataract River. A second set of prism points will be established across this zone to measure the magnitude of stretching movements that may develop during mining of Longwall 6 and 7. The marks should ideally be 50-100m apart, but the zone of stretching is apparent as clearly identifiable cracks and shorter line lengths may be suitable if longer sight lines are not available.



## **Picton Road Interchange**

Marks on the bridges and culverts around the Picton Road Interchange are planned to be surveyed at the end of Longwalls 6 and 7. In the future, it is possible that Longwall 1, 2, and 3 will be mined and these are somewhat closer to the interchange than other panels.

## **Longwall 6 and 7 Monitoring**

As an analogue to the level of movements that may be expected from mining Longwalls 1, 2, and 3 in a direction away from the interchange, it is planned to measure movements on the centrelines of Longwalls 6 and 7 as these panels mine away from Cataract River in an uphill direction. These observations will inform the management options for the Picton Road Interchange should Longwalls 1, 2, and 3 be mined in the future.

# Management Strategy Summary

Frequency of Monitoring Reduced

Replication of P Line to Southbound Lane

Road Condition Monitoring Continue

Slot Closure Monitoring Continue

Upgraded Culvert Closure Monitoring

Discontinue Tiltmeters

High Resolution Closure Surveying

Picton Road Interchange Continue

Longwall 6 and 7 Monitoring to Inform Picton Road Interchange



## Appendix B

### Monitoring Plan for LW6&7

**Table 5.1 - Monitoring Plan for LW6 & LW7**

Asset	Failure	Monitoring	Accuracy	Frequency	Responsibility	Purpose
<b>Pavements</b>						
	<ul style="list-style-type: none"> <li>Compression shear failure leading to step or hump</li> </ul>	<ul style="list-style-type: none"> <li>3D measurements every replicated "P" Line along slow lane shoulder of South Bound carriageway</li> <li>Relative 2D Survey Lines, on each slow lane shoulder (North Bound and South Bound) carriageway adjacent to Cataract Creek.</li> <li>Approx 25 survey marks on each line.</li> </ul>	2D Level +/- 5mm 2D position +/-2.5mm 2D Strain +/- 0.25mm/m	<ul style="list-style-type: none"> <li><u>LW6 &amp; LW7:</u> <ul style="list-style-type: none"> <li>prior to start</li> <li>end of mining</li> <li>At TC discretion if creek, culvert, slot or point to point survey closures exceed triggers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide relative subsidence and strain data. <b>Note:</b> there will be no direct correlation between N/B and S/B lines</li> </ul>
		<ul style="list-style-type: none"> <li>Relative 2D Survey Line in shoulder on topside corner (N/B side) (P-Line)</li> </ul>	+/- 2.5mm	<ul style="list-style-type: none"> <li>prior to start</li> <li>end each panel</li> <li>At TC discretion if point to point survey closures exceed triggers</li> </ul>	<ul style="list-style-type: none"> <li>WCL/TC</li> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.</li> </ul>	<ul style="list-style-type: none"> <li>Surveys to provide relative subsidence and strain data.</li> </ul>
		<ul style="list-style-type: none"> <li>Crackmeters in slot in pavement</li> </ul>	+/-1mm	<ul style="list-style-type: none"> <li>Hourly from installation of slot to end of mining (See note 3)</li> <li>Reported Fortnightly</li> </ul>	<ul style="list-style-type: none"> <li>Pells Consulting/WCL WCL to download data from crackmeters, or process data sent to web portal. Pells Consulting to produce fortnightly summary reports of that data (See note 3). Technical specialists to review report</li> </ul>	<ul style="list-style-type: none"> <li>Monitor slot closure due to environmental (temperature) and valley closure effects</li> </ul>
		<ul style="list-style-type: none"> <li>Survey Pins across slot</li> <li>Two sets of pins</li> <li>One set located on North Bound shoulder and another set on South Bound Shoulder</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li>On installation of slot</li> <li>At discretion of the TC</li> </ul>	WCL/TC <ul style="list-style-type: none"> <li>WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week</li> </ul>	<ul style="list-style-type: none"> <li>Provide slot closure information if crackmeter measurements need to be verified</li> </ul>
		<ul style="list-style-type: none"> <li>Survey pins at topside corner cracks</li> <li>One set of pins located across crack</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li><u>LW6 &amp; LW7:</u> <ul style="list-style-type: none"> <li>prior to start</li> <li>end of mining</li> <li>At monthly visual inspections</li> <li>At TC discretion if point to point survey closures exceed triggers</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>WCL/CNS</li> </ul>	<ul style="list-style-type: none"> <li>Provide information on tension crack development</li> </ul>
		<ul style="list-style-type: none"> <li>Point to point high resolution surveys across Cataract Creek and over the extension zone associated with P46.</li> </ul>	+/- 1mm	<ul style="list-style-type: none"> <li>Prior to start</li> <li>At quarter, mid and three quarter-panel and completion of each longwall panel.</li> <li>At discretion of the TC</li> </ul>	WCL/TC WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week	<ul style="list-style-type: none"> <li>Provide slot closure information more broadly than crackmeter measurements</li> </ul>
		<ul style="list-style-type: none"> <li>Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange</li> </ul>	In accordance with record sheet	<ul style="list-style-type: none"> <li>Weekly</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Subjective assessment of rideability and pavement condition. Report on change for detailed investigation</li> </ul>
		<ul style="list-style-type: none"> <li>Visual site inspection to identify emerging impacts on RMS infrastructure</li> </ul>	In accordance with record sheet	<ul style="list-style-type: none"> <li>Monthly</li> </ul>	<ul style="list-style-type: none"> <li>WCL (Inspector to satisfy job description for visual pavement inspection as advised by C Dove of CNS)</li> </ul>	<ul style="list-style-type: none"> <li>Inspection to identify and track emerging impacts potentially before they are detected by survey measurement.</li> </ul>
		<ul style="list-style-type: none"> <li>Laser profilometer</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Before and after LW6 &amp; LW7</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assess pre and post mining pavement condition</li> </ul>
		<ul style="list-style-type: none"> <li>Deflectometer</li> </ul>	Not applicable	<ul style="list-style-type: none"> <li>Before and after LW6 &amp; LW7</li> </ul>	<ul style="list-style-type: none"> <li>RMS</li> </ul>	<ul style="list-style-type: none"> <li>Assess pre and post mining pavement condition</li> </ul>
<b>Culverts</b>						
	<ul style="list-style-type: none"> <li>Horizontal compression leading to ovaling and buckling of culvert</li> </ul>	<ul style="list-style-type: none"> <li>Horizontal and vertical diameter measurements at three locations in culvert (third points and centre)</li> </ul>	+/- 1mm	<u>Cataract Creek Culverts</u> <ul style="list-style-type: none"> <li>LW6 &amp; LW7:               <ul style="list-style-type: none"> <li>prior to start</li> <li>¼ length</li> <li>mid length</li> <li>¾ length</li> </ul> </li> </ul>	WCL/TC WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week	<ul style="list-style-type: none"> <li>Specific measurements to determine change of culvert shape</li> </ul>



				<ul style="list-style-type: none"> <li>end of mining</li> </ul>		
		Visual inspection/photos	<ul style="list-style-type: none"> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>prior to start</li> <li>mid length</li> <li>end of mining</li> </ul> </li> </ul>	WCL/RMS joint inspection	<ul style="list-style-type: none"> <li>Assessment of culvert condition and any changes from previous inspection</li> </ul>
		CCTV	<ul style="list-style-type: none"> <li>Prior to mining - Identify visible cracks and defects</li> <li>Monitor any change from previous report</li> </ul>	Use original RMS CCTV inspections as a baseline. Reinspect at the completion of LW6 & LW7.	RMS	<ul style="list-style-type: none"> <li>Assess pre and post mining culvert condition</li> </ul>
<b>Bridges</b>						
	<ul style="list-style-type: none"> <li>Differential horizontal movements leading to destructive distortion of the bridge elements</li> </ul>	<ul style="list-style-type: none"> <li>Relative 3D survey of the bridge structure and ground.</li> <li>Fixed prisms (approx. 16): <ul style="list-style-type: none"> <li>1 at each side of each abutment,</li> <li>1 at top and 1 at base of central column of each pier,</li> <li>1 on underside of central box girder adjacent each pier and abutment,</li> <li>1 at ground beside each pier and abutment</li> </ul> </li> </ul>	1mm	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>Prior to start</li> <li>End of Mining</li> </ul> </li> </ul>	WCL/TC WCL to carry out survey, provide results to TC specialists. Specialists report to TC within one week.	<ul style="list-style-type: none"> <li>Survey to measure relative 3D movements at target locations so that differential movements between any two points can be calculated.</li> </ul>
		Visual survey/photos	<ul style="list-style-type: none"> <li>Identify visible cracks and defects prior to mining</li> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>LW6 &amp; LW7: <ul style="list-style-type: none"> <li>Mid length</li> <li>On completion</li> </ul> </li> </ul>	RMS	<ul style="list-style-type: none"> <li>Assessment of bridge condition condition (cracks and other defects) and any changes from previous inspection</li> </ul>
		Condition survey	<ul style="list-style-type: none"> <li>Prior to mining: <ul style="list-style-type: none"> <li>Identify visible cracks and defects</li> <li>Survey position of bearings</li> </ul> </li> <li>Monitor any change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>Before mining and</li> <li>After completion of each longwall</li> </ul>	WCL/RMS	<ul style="list-style-type: none"> <li>Assess pre and post mining bridge condition (cracks and other defects)</li> </ul>
<b>Cuttings</b>						
	Differential horizontal movements leading to instability	<ul style="list-style-type: none"> <li>Visual inspection/photos</li> </ul>	<ul style="list-style-type: none"> <li>Monitor change from previous report</li> </ul>	<ul style="list-style-type: none"> <li>Use ARL assessment of 8 December 2011 as a baseline. Reinspect at the completion of LW6 &amp; LW7 Monthly after amber trigger in pavement surveys exceeded</li> </ul>	RMS	Assessment of cutting condition and any changes from previous inspection
		<ul style="list-style-type: none"> <li>Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange</li> </ul>	<ul style="list-style-type: none"> <li>In accordance with record sheet</li> </ul>	<ul style="list-style-type: none"> <li>Weekly</li> </ul>	RMS	Subjective assessment of cutting condition. Report on change for detailed investigation
<b>Cross Lines and Centre Lines As required by SMP</b>						
<b>During mining of LW6 &amp; LW7</b>		<ul style="list-style-type: none"> <li>3D Survey <ul style="list-style-type: none"> <li>Total subsidence;</li> <li>Incremental subsidence;</li> <li>Variation in horizontal strain.</li> </ul> </li> <li>Survey measurement comparison with predictions</li> <li>Report as appropriate</li> </ul>	Refer to SMP	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	WCL	Surveys to provide subsidence and strain data
<b>Post mining of LW6 &amp; LW7</b>		<ul style="list-style-type: none"> <li>3D Survey <ul style="list-style-type: none"> <li>Total subsidence;</li> </ul> </li> </ul>	Refer to SMP	<ul style="list-style-type: none"> <li>Refer to SMP</li> </ul>	WCL	Surveys to provide subsidence and strain data



Site	Wollongong Coal	DOC ID	Click here to enter text.
Type	Plan	Date Published	
Doc Title	Enter Doc Title		

		<ul style="list-style-type: none"><li>○ Incremental subsidence;</li><li>○ Variation in horizontal strain.</li><li>• Survey measurement comparison with predictions</li><li>• Report as appropriate</li></ul>				
--	--	--	--	--	--	--

1. Monitoring detailed in the table above relates to monitoring after completion of baseline and LW5 surveys
2. Where movement monitoring in the table above is scheduled at the end of mining, monitoring will continue until, in the opinion of the Technical Committee, all mining related movement has ceased, at which point the TARP for that particular Longwall will cease to operate.
3. It is intended to transmit crackmeter data from the site to a web portal for processing. However, mobile phone reception in the vicinity of Cataract Creek is very poor and this may impact on the transmission of data to the web portal. If it is not practical to transmit the data consistently, it will be downloaded by the WCL. The data will then be recorded hourly by the data logger at the site and downloaded fortnightly by the WCL with fortnightly reporting by Pells Consulting.
4. Cross lines and centre line data will assist in informing the TC, but is not a fundamental requirement for management of impacts to RMS assets.

## Appendix C

### Workshop Attendance

## ROADS & MARITIME SERVICES

### RISK ASSESSMENT

### MOUNT OUSLEY ROAD: WOLLONGONG COAL - IMPACTS OF LW6&7 ON RMS ASSETS

ATTENDANCE SHEET – 10 July, 2014



**Transport**  
Roads & Maritime  
Services

Name	Position	Organisation
Nigel Cann	Associate Principal	Arup
Zahid Hoque	Manager Pavement (Pavement Performance)	RMS
Dick Lee Shoy	Chair, Technical Committee	RMS
Chris Harvey	Head of Corporate Relations	WCL
Cyril Gunaratne	Pavement Maintenance Planner	RMS
Ken Mills	Senior Geotechnical Engineer	SCT (for WC)
Dave Clarkson	Group Environment Manager	WCL
Kamlesh Prajapati	Group Environment Coordinator	WCL
Henk Buys	Technical Director – Ground Engineering	AECOM
Stanley Yuen	Senior Geotechnical Engineer	RMS
Dony Castro	A/ Bridge Maintenance Planner	RMS

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## Appendix D

### Workshop Agenda



# Wollongong Coal – LW6&7

# AGENDA for Workshop

- Introductions
- Mining Plan
- Subsidence Expectations
- RMS Asset Impacts
  - Previous
  - Expectations
- Management Plan
- Risk Workshop
  - General (Carriageway, Culverts, embankments, furniture, kerbs, bridges)
  - Cataract Creek (Pavement, Culverts)

# Mining Area

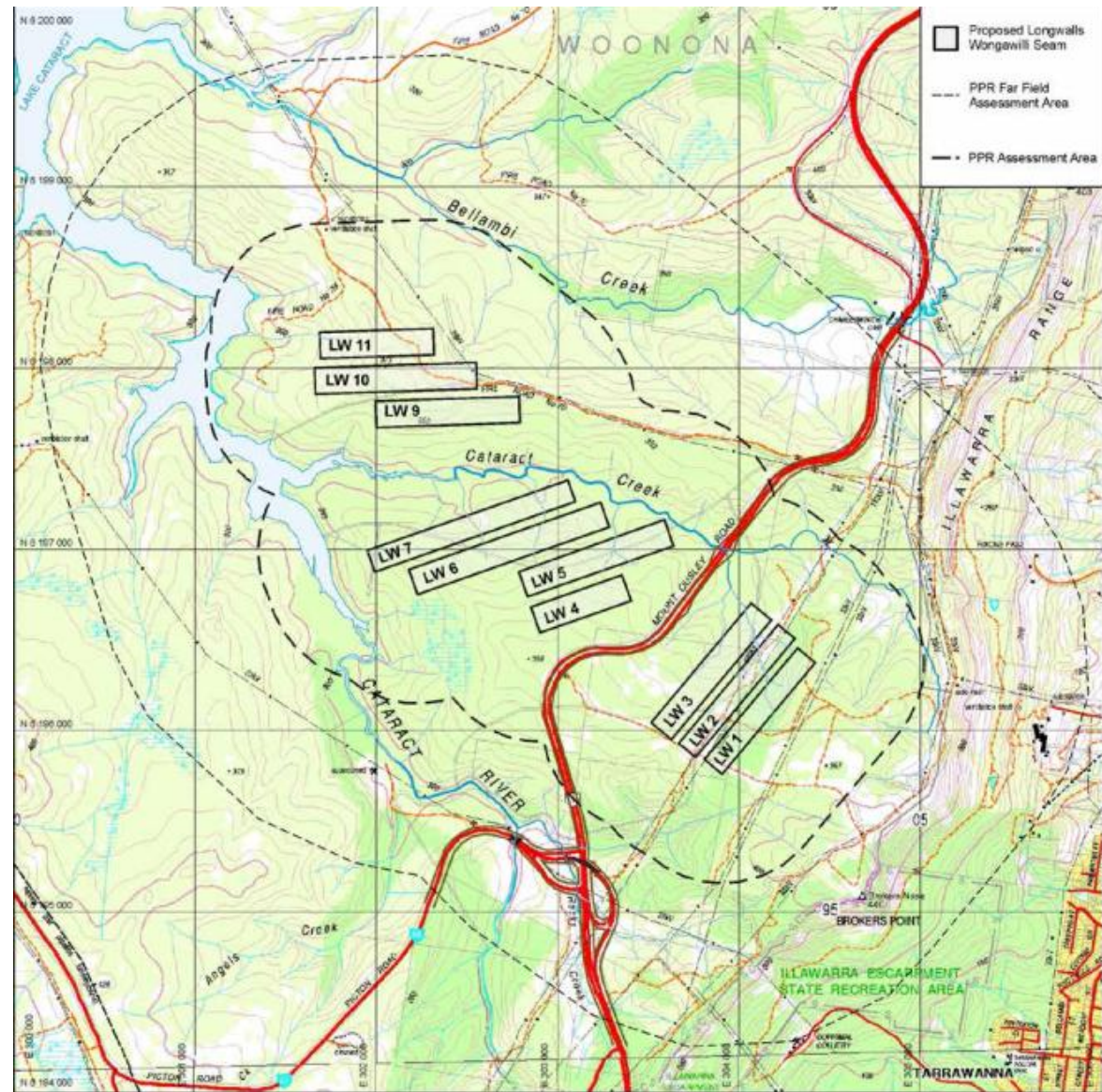


Figure 1: Plan showing location of PPR Assessment Area and proposed longwall panels superimposed onto a 1:25,000 topographic series map with creek alignments update based on LiDAR imaging of the ground surface.

## Appendix E

### RMS Risk Matrices

# ROADS & MARITIME SERVICES

## RISK ASSESSMENT - SUBSIDENCE IMPACTS ON RMS ASSETS

### FREQUENCY



Level	Descriptor	Alt. Description	Description	Chance %	Frequency
O	<b>Absolutely Certain</b>	Definite	This event will occur / known to occur now - Will occur several (many) times each year and many times (constantly) during this project	99.99	Several times each year
A	<b>Almost Certain</b>	Frequent	This event is expected to occur in most circumstances - Expected to occur more than once during the duration of this project	95	1 / year
B	<b>Likely</b>	Probable	This event will probably occur in most circumstances - Expected to occur once during the duration of the project	10	at least 1 / 10 years
C	<b>Possible</b>	Occasional	This event might (should) occur at some time - Not likely to occur in life of project, but it is possible.	1	at least 1 / 100 years
D	<b>Unlikely</b>	Remote	This event could occur at some time - Unlikely (very) to occur in life of project	0.1	at least 1 / 1,000 years
E	<b>Rare</b>	Very Unlikely	This event may occur in exceptional circumstances - Examples of this have occurred historically, but it is not anticipated for this project	0.01	at least 1 / 10,000 years
F	<b>Hypothetical</b>	Barely credible	Theoretically possible but never occurred to date (anywhere in the world) - Often applied to natural events	1.00E-03	every Million years



# ROADS & MARITIME SERVICES

## RISK ASSESSMENT - SUBSIDENCE IMPACTS ON RMS ASSETS

### CONSEQUENCES

Level	Descriptor	Infrastructure			Amenity			Safety / Societal Cost
		Pavement etc	Bridges	Cost	Access	Speed	Political	
1	Insignificant	Minor damage	Minor repairable damage	< \$50 k	Some loss in condition	No traffic effect	No political impact	No injuries or health effects
2	Minor	Noticeable damage	Damage that will deteriorate if not repaired quickly	< \$100 k	One lane closed for < half day; One planned lane closure < 1 day	Speed reduction for < 1 month - 80 kph	Minimal political impact (brief press coverage)	First aid treatment or minor damage to vehicles
3	Moderate	Significant damage	Significant damage	< \$1 M	One lane closed for < 1 day	Speed reduction for > 1 month - 80 kph or < 1 day - 40 kph	Political impact (press coverage)	Medical treatment required
4	Major	Extensive damage	Major damage - restricted speed	< \$10 M	One lane closed for > 1 day	Speed reduction for < 1 month - 40 kph	Significant political impact (extensive negative press coverage)	Extensive injuries or one or two permanent disabilities
5	Catastrophic	Loss of use of carriageway	Extensive damage. One carriageway closed until repaired	< \$50 M	One carriageway closed for > 1 day or both carriageways for < 2 day	Speed reduction for > 1 month - 40 kph	Major political impact (Commission of Enquiry)	Single fatality or severe permanent disabilities to several people
6	Unthinkable		Total failure of bridge or closed until repaired	> \$50 M	Both carriageways closed for > 2 day	Speed restrictions for > 12 months - 40 kph		Multiple fatalities

# ROADS & MARITIME SERVICES

## RISK ASSESSMENT - SUBSIDENCE IMPACTS ON RMS ASSETS

### RISK MATRIX



Transport  
Roads & Maritime  
Services

LIKELIHOOD		CONSEQUENCES					
		1 (Insignificant)	2 (Minor)	3 (Moderate)	4 (Major)	5 (Catastrophic)	6 (Unthinkable)
Multiple	O	H	E	E	E	E	E
Almost Certain	A	H	H	E	E	E	E
Likely	B	M	H	H	E	E	E
Possible	C	L	M	H	E	E	E
Unlikely	D	L	L	M	H	E	E
Rare	E	L	L	M	H	H	E
Hypothetical	F	L	L	L	M	H	H

Low	Low risk; managed by routine procedures.
Moderate	Moderate risk; requires above normal attention.
High	High risk; ALARP must be applied.
Extreme	Extreme risk; not acceptable and must be reduced.

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## Appendix F

### LW6&7 Risk Register

ROADS & MARITIME SERVICES														Transport Roads & Maritime Services														ARUP																				
RISK ASSESSMENT - SUBSIDENCE IMPACTS ON RMS ASSETS																																																
RISK REGISTER - 10 July 2014																																																
ISSUE																																																
REV D																																																
LW4&5																																																
LW6&7																																																
ID	ASSET	FAILURE TYPE	EVENT	Infra			Function			Safety			COMMENT	ADDITIONAL MITIGATION	Infra			Function			Safety			COMMENT	ADDITIONAL MITIGATION	Infra			Function			Safety			COMMENT													
				F	C	R	F	C	R	F	C	R			F	C	R	F	C	R	F	C	R			F	C	R	F	C	R	F	C	R		F	C	R										
1	Carriage way excluding Cataract Creek	Compression buckling	Rapid pavement failure, leading to hump or step > 50mm										Rapid implies very fast - matter of minutes to few hours.  Not credible to get compression failure.																			No compression zone except Cataract Creek - No risk.																
2		Stepping (Shearing)	Rapid pavement failure, leading to hump or step > 50mm										Not credible to get compression failure.																			No compression zone except Cataract Creek - No risk.																
3		Cracking	Crack due to tensile movement - excluding Tension Zone at Ridge (P46)	C	2	M	C	2	M				Any cracking would be visible - probably <5 mm in width.  Not deemed to be a safety issue as crack propagation would be gradual and would be repaired before it caused accident	TARP to be developed to respond to cracks.  RMS will be paid for the cost of all repairs  Baseline condition survey before mining	C	1	L	C	2	M												C	1	L	Likely will get a small movement (<5mm). Minor impact. Not a safety issue.													
4		Various	Reduced life of pavement	D	4	H							Requirement to undertake pre-mining condition survey of road - confirm actions with MSB		D	2	L							Risk event virtually eliminated provided RMS are able to be reasonably compensated - residual risk is that smaller dollar amount that resides with the RMS.								No predicted risk outside Ridge and Cataract Creek areas.																
5	Culvert	Culvert cracking / movement	Culvert joints open, culvert damage (minor cracking)	C	3	M						Culverts vary in size from 300 mm to 750 mm in diameter.  Requirement to undertake pre-mining condition survey of culverts - confirm actions with MSB	Condition survey before and after mining (consider impacts from LW4&5).  RMS will be financially compensated for any repairs	C	1	L																D	1	L	Post condition survey for LW 4&5 needs to be completed by RMS. Take action if any issues highlighted. This will be the baseline condition report for LW6&7. RMS to be reimbursed for any repairs.													
6		Lose culvert grading (compression buckling)	Ponding (on carriageway)									Ponding not an issue based on cross falls.																																				
7	Kerb	Kerb/gutter cracking / buckling	Kerb cracking / buckling requiring repair	C	1	L						Credible loads are tension.		C	1	L																	E	1	L	Not predicted to be an issue but will be monitored via weekly drive through and monthly visual site inspections.												
8	Cuttings	Excessive ground movement	Slumping, cracks, water in, falling material	D	2	L	D	2	L	E	5	H	Currently ARL (Assessed Risk Level - RMS term) along this section of road is mainly 3 with one area of 2.  ARL 2 is a HIGH risk.  Will undertake a total inspection of the cuttings to re-assess the ARL's with a view to any changes that might occur due to mining.	Undertake reassessment prior to mining followed by adequate remedial actions to reduce risks to ALARP (As Low As Reasonably Practicable).  RMS to be compensated for any expenses caused by mining or responding to needs prior to mining commencing.	D	1	L	D	2	L	E	5	H	Note that the risk level with regard to public safety has not been reduced.  The chance of an event is not credibly less than RARE and should the event occur the consequences do not change.  Provided all reasonable actions are taken to stabilise and make safe the slopes prior to mining and regular inspections are undertaken during mining this risk event can be reasonably be considered to be managed in accordance with ALARP.	Currently ARL (Assessed Risk Level - RMS term) along this section of road is mainly 3 with one area of 2.  ARL 2 is a HIGH risk.  LW4&5 has created no impacts. None expected with LW6&7.  As all reasonable actions have been undertaken to stabilise and make safe the slopes prior to mining and regular inspections are undertaken during mining this risk event can be reasonably be considered to be managed in accordance with the ALARP principle.															E	1	L	E	2	L	E	5	H
9	Embankments	Excessive ground movement	Cracks, water, instability	F	4	M	F	4	M			North of Picton Rd Interchange - ARL 3.  Slope is at limit of stability.  Damage to edge of road. Failure is expected to be slow - allows intervention before significant impact.  Nearest longwall is approx 700 m away	Normal maintenance inspections supplemented by data from other surveys to trigger actions in regard to this embankment	F	4	M	F	4	M																	F	4	M	F	4	M	There is not expected to be a change due to LW6&7. Review in relation to LW1-3.						
10	Furniture	Excessive ground movement										Guard rails, median barriers & signs.																																				
11	Drains	Excessive ground movement										None of relevance in area of mining																																				
12	VMS	Excessive ground movement	Damage to buried cables									None present																																				







23	Pavement at the Tension Zone at Ridge (P46)	Cracking	Crack due to tensile movement - Tension Zone at Ridge (P46)														B	2	H					C	2	M	Trenches to be dug in shoulder to investigate cracking in underlying rock to confirm cracks existed before road construction. Possible some crack opening from LW4&5 leading to local settlement and creating a step.  Balgownie LWs north of road may also have contributed to initial movement. Likely to see block movement with LW6 towards Cataract Creek. Consequences expected to be minor (<5mm - increase from 10 to 15mm).	Existing crack and step will require treatment (correction layer) to maintain safety/rideability. Monitor crack width (RMS weekly drive through and C Dove monthly site inspection) and respond with temporary treatment as required.	B	1	M							With mitigation no safety consequence.
<b>NOTE:</b> All mitigation measures, regardless of the cell in which they are recorded, are deemed to apply to all risk events. Furthermore, control and mitigation measures listed in the report are also deemed to apply to all risk events in the risk register.																																						



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Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

# APPENDIX I

## ELECTRICITY TRANSMISSION LINES MANAGEMENT PLAN



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 001
Type	Plan	Date Published	06/02/2015
Doc Title	ELECTRICITY TRANSMISSION LINES MANAGEMENT PLAN		

Russell Vale Colliery  
Wonga East – Longwalls 6 & 7

ELECTRICITY TRANSMISSION LINES MANAGEMENT PLAN



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 001
Type	Plan	Date Published	06/02/2015
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## GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
DP&E	Department of Planning & Environment
DRE	Division of Resources and Energy
MP	Management Plan
Mtpa	Million tonnes per annum
NRE	Gujarat NRE Coking Coal Limited
RMS	Roads and Maritime Services
ROM	Run of Mine
LGAs	Local Government Areas
LW	Longwall
PAC	Planning Assessment Commission
PPR	Preferred Project Report
SMP	Subsidence Management Plan
TARP	Trigger Action Response Plan
UEP	Underground Expansion Project
WCL	Wollongong Coal Limited

Terms	
Project Approval	Pt3A Major Project approval MP10_0046 as modified



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## 1 INTRODUCTION

### 1.1 Project Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

The Russell Vale Colliery operates under project approval (10\_0046) granted by the Planning Assessment Commission (PAC) on 13 October 2011. The project approval was modified (MOD1) by the PAC in 2012 to allow:

- extraction of coal using longwall mining techniques in the Wongawilli Seam for longwalls 4 and 5 ; and
- development of the main gate roads for longwall 6.

A second modification to the project approval (PA 10\_0046 MOD2) was granted by the PAC on 19 November 2014 to authorise:

- secondary extraction of the first 365 m of Longwall 6; and
- extension of the duration of mining until 31 December 2015.

Prior to this, a third modification (MOD 3) to MP 10\_0046 was approved on 10 October 2014. MOD 3 authorised the continuation of mining operations until 31 December 2014. This modification has effectively been superseded by MOD 2, which allows mining operations to be undertaken until 31 December 2015.

WCL has lodged a separate application (09\_0013) for its Underground Expansion Project (UEP) to facilitate further mining operations at Russell Vale Colliery. In October 2013, WCL lodged a Preferred Project Report (PPR) which proposed significant amendments to the UEP (as originally proposed). The amended UEP would facilitate the continued operation of the colliery for five years and would allow extraction of 4.7 million tonnes of Run of Mine (ROM) coal. The mine plan for the amended UEP consists of 8 longwall panels (including longwalls 6 & 7). The environmental impact assessment for the Underground Expansion Project has been protracted based on the complex environment of the Russell Vale Colliery in proximity to the Cataract Reservoir and sensitive upland swamps, and the high level of community and stakeholder interest in the project. It is unlikely that determination of the application will be made until early 2015.

This Electricity Transmission Lines Management Plan has been prepared in support of an Extraction Plan, as required by **Condition 7/Schedule 3** of Project Approval (MP 10\_0046).



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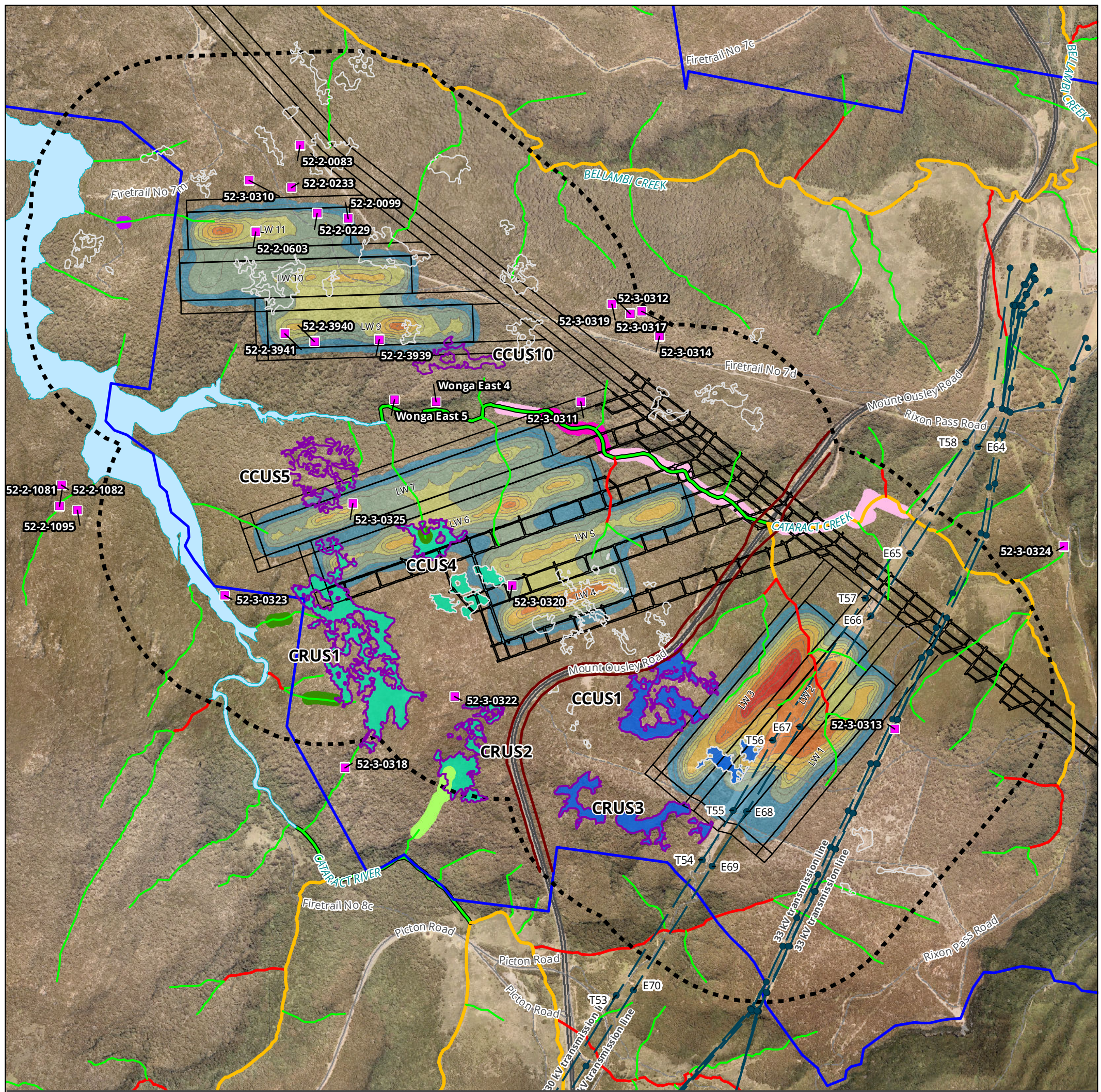
## 1.2 Purpose and Scope

The purpose of this management plan is to document the potential risks to electrical infrastructure, from the extraction of Longwalls 6 and 7 in the Wonga East Domain, and detail any management or mitigation measures to be put in place to mitigate these risks in consultation with the infrastructure owner. This infrastructure includes:

- 330kV Transmission Line and associated infrastructure, owned and maintained by **TransGrid**;
- 132kV Transmission Line and associated infrastructure owned and maintained by **Endeavour Energy**; and
- 33kV Transmission Line and associated infrastructure owned and maintained by **Endeavour Energy**.

The plan is applicable to all surface areas which may be affected by mine subsidence due to the extraction of Longwalls 6 and 7, defined as the Study Area in the UEP PPR & Longwall 6 (400m) application and also within the 'Additional Subsidence Management Area' defined on *Plan 2e – Additional Subsidence Management Area* (attached as **Appendix B**).





**Legend**

- Wonga East Workings
- Study Area - Wonga East
- Project Application Area
- Power Poles
- Powerlines
- Mt Ousley Road Easement
- Streams with Strahler Order**
- 1st Order Stream
- 2nd Order Stream
- 3rd Order Stream
- 4th Order Stream
- Lake Cataract

**Location of Cultural Heritage Sites**

- Cultural Heritage Site

**Swamp of Special Significance (Biosis 2012)**

- Yes
- No

**Threatened Frog Breeding Habitat**

- Littlejohn's Tree Frog - Low
- Stuttering Frog - High
- Stuttering Frog - Low
- Littlejohn's Tree Frog & Giant Burrowing Frog - High
- Littlejohn's Tree Frog & Giant Burrowing Frog - Low

**Threatened Frog Non-Breeding Habitat**

- Giant Burrowing Frog
- Littlejohn's Tree Frog & Giant Burrowing Frog

**Predicted Subsidence Contour (m) Wongawilli Seam (SCT Operations)**

- 0.2 to -0.4
- 0.6 to -0.8
- 1 to -1.2
- 1.4 to -1.6
- 1.8 to -2
- 2.2 to -2.4

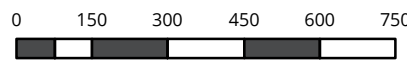


Map created by Biosis Pty Ltd

**Figure 1 - Features of Special Significance - Wonga East**

Acknowledgements: Imagery (c) Nearmap 2012  
Topo (c) NSW Land and Planning Information (2012)

Matter:  
Date: 22 August 2014,  
Checked by: , Drawn by: ANP, Last edited by: apritchard  
Location: P:\16600s\16646\Mapping\Figure for PPR Plan\  
16646 FXX\_Plan for PPR.V6



Metres  
Scale 1:15,000 @ A3  
Coordinate System: GDA 1994 MGA Zone 56





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### 1.3 Consultation and Distribution

This Plan has been prepared in consultation with, and copies will be distributed to:

- Department of Planning and Environment (DP&E);
- Division of Mineral Resources (DRE);
- TransGrid; and
- Endeavour Energy.

In accordance with **Condition 10/Schedule 5** of the Project Approval, WCL will make this Plan publicly available on the WCL website and will be responsible for its maintenance. A hard copy will also be kept at the Russell Vale Colliery, 7 Princes Highway, Corrimal, NSW 2518.

Any revisions undertaken will be the responsibility of WCL and any notifications will be sent accordingly. WCL will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on WCL's computer system, website, and hard copy at the Russell Vale Colliery, 7 Princes Highway, Corrimal, NSW 2518.

### 1.4 Report Structure

The remainder of this Management Plan is structured as follows:

**Section 2:** Outlines the statutory requirements applicable to the Plan.

**Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.

**Section 4:** Details the performance measures and indicators that will be used to assess the Project.

**Section 5:** Describes the monitoring program.

**Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.

**Section 7:** Describes the protocols for the handling of incidents, complaints and non-compliances.

**Section 8:** Details how the Plan will be implemented, managed, reviewed and updated and managed.

**Figure 2** shows this Plan's position within WCL's Environmental Management Structure.



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## Environmental Management Structure

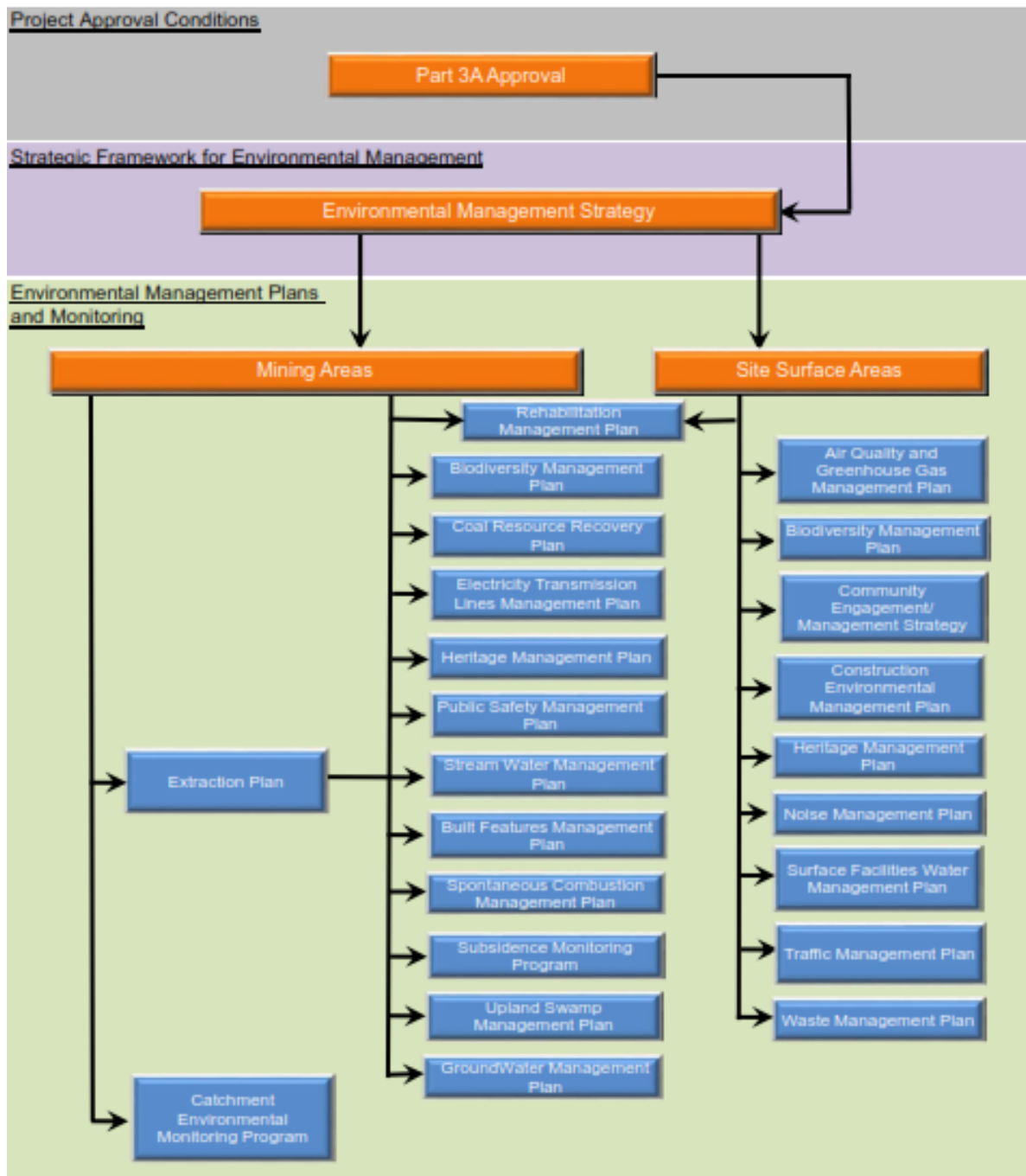
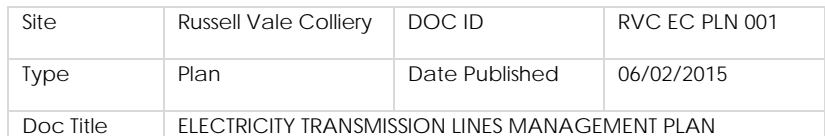


Figure 2 - Environmental Management Structure



## 2.1 Approval

### Extraction Plan

...  
(h) include the following to the satisfaction of DRE:  
...

- In addition, **Condition 2/Schedule 5** of the Project Approval outlines the requirements that are applicable to the preparation and performance of this Management Plan. **Table 2.1** indicates where each component of the condition is addressed within this Plan.

*Table 2.1 - Management Plan Requirements*

Project Approval Condition	Plan Section
<p><b><i>Condition 2/Schedule 5</i></b></p> <p>The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:</p> <p>(a) detailed baseline data;</p> <p>(b) a description of:</p> <ul style="list-style-type: none"> <li>the relevant statutory requirements (including any relevant approval, licence or lease conditions);</li> <li>any relevant limits or performance measures/criteria;</li> <li>the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;</li> </ul>	<p>Section 3</p> <p>Section 2</p> <p>Section 4</p> <p>Section 4</p>

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Project Approval Condition	Plan Section
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 6.2 and 6.3
(d) a program to monitor and report on the: <ul style="list-style-type: none"> <li>impacts and environmental performance of the project;</li> <li>effectiveness of any management measures (see c above);</li> </ul>	Section 5.1 and 5.2
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to levels below relevant impact assessment criteria as quickly as possible;	Section 6.3
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	Sections 7.5
(g) a protocol for managing and reporting any: <ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and</li> <li>exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	Section 6
(h) a protocol for periodic review of the plan.	Section 7.5

## 2.2 Licences and Leases

In addition to the requirements of the Project Approval, all activities at or in association with the Russell Vale Colliery will be undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

*Table 2.2 - Licences, Permits and Leases*

Licence/Approval	Document No.	Issue Date/	Expiry Date
Consolidated Coal Lease Renewal	745	27 Dec 1990	30 Dec 2023
Mining Purposes Lease	271	09 May 1991	09 May 2033
Mining Lease	1575	22 Mar 2012	22 Mar 2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31 Oct 2001 23 Jan 2002 28 Jun 2001	-
Approval to mine P&O Panels (first workings)	10.123.081	7 Jan 2005	-
DC for Thin Seam Mining P/L	D1096/01	19 Sep 2001	-
Environmental Protection Licence	12040	Current	-
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10 Aug 1992	-



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Licence/Approval	Document No.	Issue Date/	Expiry Date
DC for Storm Water Control Dam and Water Treatment	D91/551	17 Jun 1992	-
Dangerous Goods Licence	NDG021269	17 Sep 2013	01 Nov 2014
Licence to Store Explosives	XSTR100114	21 Oct 2012	3 Oct 2017
SPCC Approval for Stage 3	90/4711 (280021C/20)	04 Sep 1992	-
DC for Russell Vale Waste Emplacement	D89/839	11 Apr 1990	-
DC for Demolition of Washery	D2004/32	14 Dec 2004	-
Mining operations Plan (MOP)		1 Jan 2008	31 Dec 2017
Bore Licence	10BL602992	29 Jan 2013	28 Jan 2018

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## 2.3 Relevant Legislation and Guidelines

WCL will conduct approved mining operations consistent with the Project Approval conditions and any other legislation that is applicable. The following Acts may be applicable:

- *Coal Mine Health and Safety Act 2002*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 1989*
- *Dams Safety Act 1978*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Energy and Utilities Administration Act 1987*
- *Environmental Planning and Assessment Act 1979*
- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
- *Fisheries Management Act 1994*
- *Heritage Act 1977*
- *Mining Act 1992*
- *Noxious Weeds Act 1993*
- *Protection of the Environment Operations Act 1997*
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- *Roads Transport Act 2013*
- *Road Transport (Vehicle and Driver Management) Act 2005*
- *Sydney Water Catchment Management Act 1998*
- *Threatened Species Conservation Act 1995*
- *Water Act 1912*
- *Water Management Act 2000*

Relevant licences or approvals required under these Acts will be obtained as required.



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### 3 IMPACT ASSESSMENT

This section is based on the subsidence assessment conducted for the Preferred Project Report and particularly the detail presented in SCT Report WCRV4263 and the associated environmental assessment reports. However, only those sections relevant to Longwalls 6 and 7 are considered.

Impacts on the Illawarra Escarpment and the power transmission towers east of Mount Ousley Road are not considered in detail because the proposed mining of Longwalls 6 and 7 will be remote from these features. However, due to the Additional Subsidence Management Area, impacts on Mount Ousley Rd will be used to trigger inspections and/or surveys of the electricity transmission lines.

#### 3.1 Site Description

*Figure 1* shows a plan of the proposed Longwalls 6 and 7 and the Subsidence Management Plan Area (SMPA) to which includes the 'Additional Subsidence Management Area' defined on Plan 2e – Additional Subsidence Management Area (attached as Appendix B). The previously extracted panels Longwalls 4 and 5 are also shown.

Generally, the surface land overlying the proposed extraction area is bushland that lies within crown land, declared as a Metropolitan Special Area controlled by the SCA in the headwaters of Cataract Reservoir adjacent to Cataract Creek. All streams and drainage are directed towards Cataract Dam, via Cataract Creek, Cataract River and their tributaries.

Known surface features (natural and built) in the SMPA that may experience subsidence effects or impacts are:

- Declared Special Metropolitan Catchment lands controlled and managed by SCA;
- Parts of Cataract Creek and Cataract River;
- Natural vegetation;
- Upland swamps;
- Threatened and protected species;
- Cliffs and steep slopes;
- Areas of indigenous archaeological interest;
- Mount Ousley Road; and
- Other Roads (dirt roads and fire trails).

Surface features that are not expected to be directly impacted include:

- A bridge and culverts associated with the Picton Road Interchange;
- High voltage electricity transmission lines east of Mount Ousley Road;
- Mine infrastructure (exploration boreholes, electricity lines, and ventilation shafts); and
- Survey control marks.



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There are no known public amenities, agricultural lands, industrial/commercial establishments, or residential properties within the SMPA. The SMPA is not in an MSB Mine Subsidence District.

### 3.2 Subsidence Impacts

Predicted subsidence and an assessment of subsidence impacts are presented in detail in the PPR. A copy of the full report for the PPR is available on WCL's and DP&E's websites.

Impacts on the Illawarra Escarpment and the power transmission towers east of Mount Ousley Road are not considered in detail because the proposed mining of Longwalls 6 and 7 will be remote from these features. However, due to the Additional Subsidence Management Area, impacts on Mount Ousley Rd will be used to trigger inspections and/or surveys of the electricity transmission lines.

### 3.3 Overview of LW4 and LW5 Mining Impacts

No impacts have been identified on power transmission towers.

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## 4 PERFORMANCE MEASURES AND CRITERIA

Performance criteria for the management of the 330kV and 132kV electrical transmission lines within the Study Area or the 'additional subsidence management area' are set out in Table 2 of **Condition 4/Schedule 3** of the Project Approval and are reproduced in Table 4.1 below.

WCL will also monitor if the recorded subsidence effects trigger the predicted and/or proposed levels. A summary of this monitoring is provided in **Appendix A**.

**Table 4.1** provides the general expectations and Performance Criteria for the project.

**Table 4.1 - Subsidence Impact Performance Criteria**

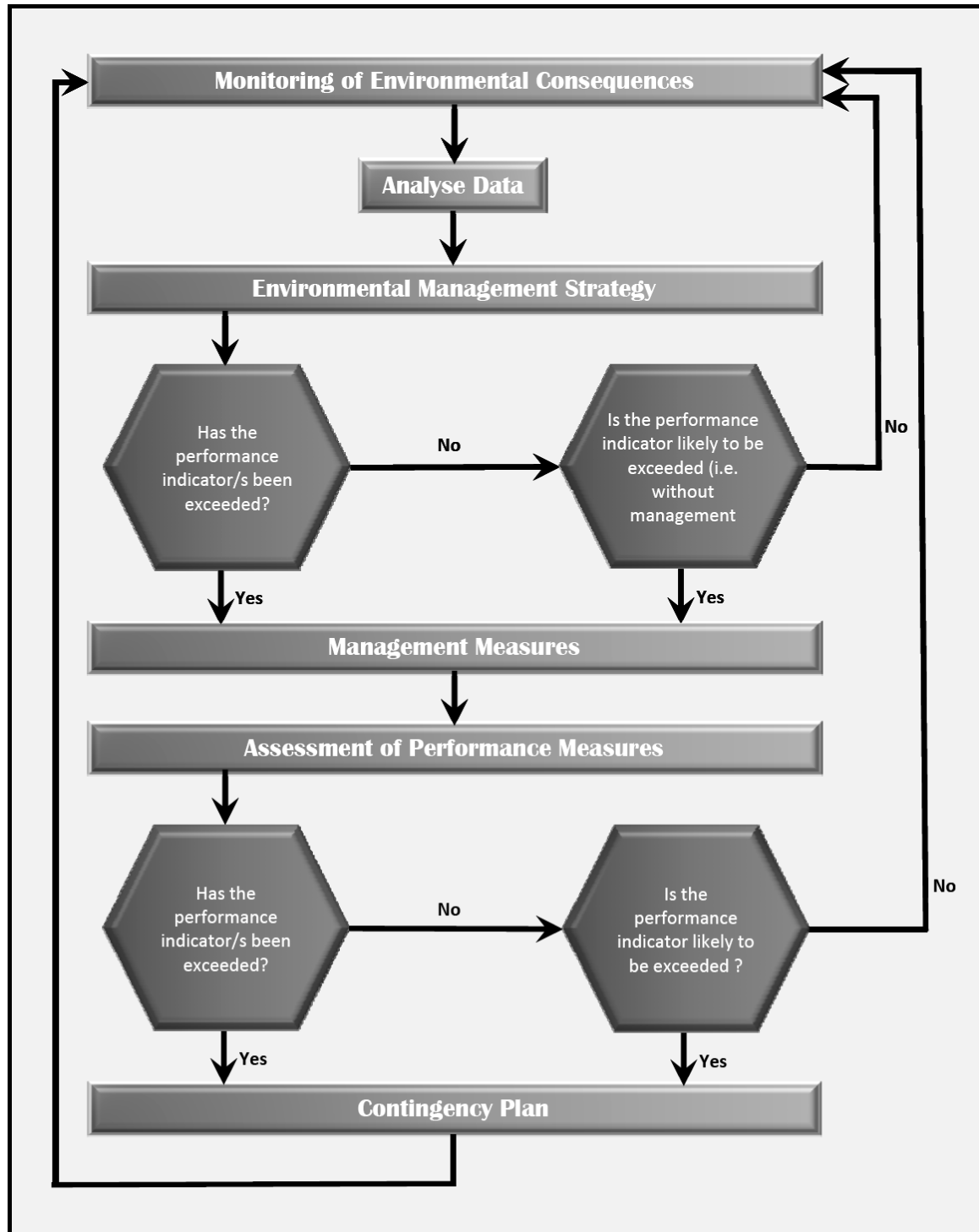
Feature	Performance Indicators
330kV, 132kV Transmission Lines	<ul style="list-style-type: none"> <li>Always safe and serviceable.</li> <li>Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired</li> </ul>

Other specific performance criteria relating to surface infrastructure and/or environmental consequences are detailed in the appropriate Management Plan for that feature. In addition to this Management Plan, the following Management Plans have been prepared:

- Water Management Plan;
- Biodiversity Management Plan;
- Heritage Management Plan;
- Built Features Management Plan (RMS); and
- Public Safety Management Plan.

Environmental management will be undertaken in accordance with the process described in **Figure 3**.

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*Figure 3 - Environmental Management Process*

## 5 MONITORING AND REPORTING

### 5.1 Monitoring

**Table 5.1** outlines the nature and frequency of monitoring and the actions proposed to manage impacts due to mining within the additional subsidence monitoring area as illustrated in **Appendix B**. A Monitoring Plan, in the form of a TARP, is attached as **Appendix A**. The monitoring locations are also shown in **Figure 1**.

*Table 5.1 - Subsidence Effects Monitoring and Management*

Management Period	Monitoring Proposed	Trigger	Response
<b>Powerlines - 330kV, 132kV and 33KV</b>			
Baseline studies prior to mining	<ul style="list-style-type: none"> <li>Survey of towers <b>prior to mining</b>: <ul style="list-style-type: none"> <li>330kV – TL11/54 to TL11/59</li> <li>132kV – Tower No. 63 to Tower No.69</li> </ul> </li> <li>Earth Peaks Monitoring</li> <li>Observational monitoring of 33kV line</li> </ul>	<ul style="list-style-type: none"> <li>N/A</li> </ul>	<ul style="list-style-type: none"> <li>Document and Report to: <ul style="list-style-type: none"> <li>WCL; and</li> <li>Principal Subsidence Engineer – DRE within 48hrs following collection of data.</li> </ul> </li> </ul>
During mining	<ul style="list-style-type: none"> <li>Survey of towers undertaken when mining reaches <b>Mid-Point of LW</b>: <ul style="list-style-type: none"> <li><u>330kV</u> – TL11/54 to TL11/59</li> <li><u>132kV</u> – Tower No. 63 to Tower No.69</li> </ul> </li> <li>Earth Peaks Monitoring</li> <li>Observational monitoring of 33kV line</li> </ul>	<ul style="list-style-type: none"> <li>No observable surface deformations;</li> <li>&lt;5 mm separation between tower legs;</li> <li>&lt;5 mm leg vertical differential;</li> <li>&lt;50 mm vertical subsidence;</li> <li>&lt;50 mm distance between towers; and</li> <li>&lt;50 mm tilt.</li> </ul>	<ul style="list-style-type: none"> <li>Document and Report to: <ul style="list-style-type: none"> <li>WCL;</li> <li>Principal Subsidence Engineer – DRE;</li> <li>TransGrid; and</li> <li>Endeavour Energy within 48hrs following collection of data.</li> </ul> </li> </ul>



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Management Period	Monitoring Proposed	Trigger	Response
	<ul style="list-style-type: none"> <li>Survey of towers when mining reaches the Mid-point of LW: <ul style="list-style-type: none"> <li>330kV – TL11/54 to TL11/59</li> <li>132kV – Tower No. 63 to Tower No.69</li> </ul> </li> <li>Earth Peaks Monitoring</li> <li>Observational monitoring of 33kV line</li> </ul>	<ul style="list-style-type: none"> <li>Observable surface deformations; and/or</li> <li>Separation between tower legs (5-10 mm);</li> <li>Leg vertical differential (5-10 mm);</li> <li>Vertical subsidence (50-100 mm);</li> <li>Distance between towers (50-100 mm); and</li> <li>Tilt (50-100 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: <ul style="list-style-type: none"> <li>WCL;</li> <li>Electrical infrastructure owner/s; and</li> <li>Principal Subsidence Engineer – DRE.</li> </ul> </li> <li>Continue consultation with electrical owner/s (<b>TransGrid &amp; Endeavour Energy</b>) and develop specific action plans to be implemented should they be required (see trigger below).</li> <li>Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data.</li> <li>Report any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s.</li> </ul>
	<ul style="list-style-type: none"> <li>Survey of towers when mining reaches the Mid-Point of LW: <ul style="list-style-type: none"> <li>330kV – TL11/54 to TL11/59</li> <li>132kV – Tower No. 63 to Tower No.69</li> </ul> </li> <li>Earth Peaks Monitoring</li> <li>Observational monitoring of 33kV line</li> </ul>	<ul style="list-style-type: none"> <li>Observable surface deformations; and/or</li> <li>Separation between tower legs (&gt;10mm);</li> <li>Leg vertical differential (&gt;10 mm);</li> <li>Vertical subsidence (&gt;100 mm);</li> <li>Distance between towers (&gt;100 mm); and</li> <li>Tilt (&gt;100 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Notify the following Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: <ul style="list-style-type: none"> <li>WCL;</li> <li>Electrical infrastructure owner/s; and</li> <li>Principal Subsidence Engineer – DRE.</li> </ul> </li> <li>Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions.</li> <li>Undertake visual inspections accordingly.</li> <li>Liaise with asset owner (<b>TransGrid &amp; Endeavour Energy</b>) regarding any action/s required.</li> <li>Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data.</li> <li>Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s.</li> <li>Review Mining Options.</li> </ul>

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Management Period	Monitoring Proposed	Trigger	Response
Post mining	<ul style="list-style-type: none"> <li>Survey of towers, <b>at the completion of mining</b>: <ul style="list-style-type: none"> <li><u>330kV</u> – TL11/54 to TL11/59</li> <li><u>132kV</u> – Tower No. 63 to Tower No.69</li> </ul> </li> <li>Earth Peaks Monitoring</li> <li>Observational monitoring of 33kV line</li> </ul>	<ul style="list-style-type: none"> <li>Check against subsidence predictions and baseline survey</li> </ul>	<ul style="list-style-type: none"> <li>Undertake 3D survey and review against predictions.</li> <li>Document actual subsidence against predictions.</li> <li>Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data.</li> <li>Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.</li> </ul>

**Note:** Where impacts are identified, monitoring and mitigation will continue until determined unwarranted. Also, the Subsidence Management Status Report will be implemented to include the above subsidence monitoring data.



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## 5.2 Transmission Line Monitoring

A monitoring plan has been included in *Table 5.1* for the **330kV, 132kV** and **33kV** transmission lines located within the *Plan 2e- Additional Subsidence Management Area*. WCL is not predicting any impacts to this infrastructure by conventional subsidence. The planned monitoring however is being implemented, in the event that unconventional or non-systematic subsidence effects occur.

The towers supporting the transmission lines will be subject to observational inspections and a pre-mining, mid-panel and end of mining 3D surveys, as well as earth peaks monitoring to inform the infrastructure owner, should any impacts occur.

## 5.3 Reporting

In accordance with the requirements of *Condition 7/Schedule 5* of the Project Approval, the environmental performance of the colliery will be reported on the WCL website.

## 5.4 Emergency Contact Details

Organisation	Contact Details
TransGrid (Mains Technical Support Engineer)	John Petrolo (02 9620 0737 / 0438 250 778)
Endeavour Energy (Transmission Mains Development Manager)	Steven Williams (02 9853 7042 / 0481 008 503)
WCL (Group Environmental Coordinator)	Kamlesh Prajapati (02 4223 6826 / 0430 111 672)
WCL (Environment Monitoring Manager)	Kristen Lee (0439 709 513)
WCL Control Room	Control Room Operator (02 4223 6827)

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## 6 MITIGATION AND MANAGEMENT STRATEGIES

### 6.1 General

Mitigation and management strategies to reduce subsidence effects, subsidence impacts and environmental consequences are detailed in the relevant and respective Management Plans.

These methods will be specific to the impact observed and developed in consultation with the appropriate stakeholders when and if impacts occur that have been definitively assessed as being directly related to the proposed mining of Longwalls 6 and 7.

Specific mitigation measures for built features will be discussed and endorsed with the relevant asset owners (i.e. TransGrid and Endeavour Energy).

### 6.2 Trigger Action Response Plan

The Trigger Action Response Plan (TARP), as presented in **Appendix A** has been designed specifically for this MP to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures.

The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- Trigger levels from monitoring to assess performance; and
- Triggers that flag implementation of contingency measures.

### 6.3 Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in **Section 4** of this Plan, WCL will implement the following Contingency Plan:

- The observation will be reported to WCL's Environment Manager within 24 hours;
- The observation will be recorded;

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- WCL will report any exceedance of the performance measure to the Secretary of DP&E, Principal Subsidence Engineer at DRE and relevant infrastructure owner as soon as practicable after WCL becomes aware of the exceedance;
- WCL will assess the exceedances referred to in the TARP (outlined in **Section 6.2** of this document) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s;
- The infrastructure owner/s have indicated that the following measures may generally apply:
  - Up to 24 hours of power supply may be available in the event power might be disrupted ; and
  - The installation of roller sheaves may be available within 24 hours of notification;
- The Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or relevant agencies if necessary;
- WCL will develop an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders;
- WCL will submit the proposed course of action to the DP&E for approval;
- WCL will implement the approved course of action to the satisfaction of the DP&E; and
- WCL will continue to monitor performance with the new action plan in place and, if successful, will formalise these actions as part of a revised Management Plan.

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences.

If either, it is not reasonable or feasible to remediate the impact or remediation measures implemented by WCL have failed to satisfactorily remediate the impact, WCL will provide a suitable offset to compensate for the impact, to the satisfaction of the Secretary of DP&E in accordance with **Condition 3/Schedule 3** of the Project Approval.



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## 7 INCIDENTS, COMPLAINTS AND NON-CONFORMANCES

### 7.1 Incidents

The Project Approval defines an 'incident' to be "*a set of circumstances that causes or threatens to cause material harm to the environment, and/or breaches or exceeds the limits or performance measures/criteria in this Approval.*"

Incidents will be managed through established WCL procedures as detailed in the Environmental Management Strategy.

In accordance with **Condition 6/Schedule 5** WCL will notify the Secretary and any other relevant agencies of any incident:

- At the earliest opportunity if the incident has caused, or has the potential to cause significant risk of material harm to the environment; and
- As soon as practicable in all other cases.

A detailed report of the incident shall be provided to DP&E within 7 days of the incident occurring.

### 7.2 Complaints Handling

Complaints will be managed through established WCL procedures as detailed in the Environmental Management Strategy.

As required by **Condition 10/Schedule 5** of the Project Approval, a copy of a complaints register (updated on a monthly basis) will be kept on the WCL website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Review/Annual Environmental Management Reports (AEMRs).

### 7.3 Non-Conformance Protocol

WCL will manage and report non-compliances with relevant statutory requirements in accordance with an established protocol developed as a component of the Environmental Management Strategy.

Compliance with all approvals, plans and procedures will be the responsibility of all personnel (staff and contractors) employed on or in association with WCL Russell Vale Colliery, and will be promoted through direct consultation and direction of the Mine's Operations Manager.



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Regular inspections and/or internal audits will be undertaken as required by suitably qualified personnel under the direction of the Environment Manager, to identify any remediation/rectification work required, and areas of actual or potential non-compliance.

A Compliance Register will be established to monitor compliance against project approval conditions, mining leases etc. Non-compliances identified through the Compliance Register are to be reported, with corrective actions implemented.

A review of WCL's compliance with all conditions of the Project Approval, mining leases and all other approvals and licences will be undertaken prior to (and included within) each Annual Review. The Annual Review will be made publicly available on WCL's website.



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## 8 PLAN ADMINISTRATION

### 8.1 Roles and Responsibilities

Environment and community management is regarded as part of the responsibilities of all Colliery personnel. The roles and function of the main personnel responsible for the implementation of environmental and community management including the plans, procedures and action plans contained in this EMP are outlined in *WCL's Management Operating System*.

### 8.2 Resources Required

In accordance with the *WCL SYS POL 003 Environmental Policy*, Management shall ensure that the appropriate resources are made available to achieve the implementation of this Plan.

It is the role of the Environment Manager to ensure that these requirements are communicated to WCL Management.

### 8.3 Training

All training and inductions conducted are to be undertaken as per the *WCL Training procedures*.

#### 8.3.1 Staff Training

Staff training will be undertaken as detailed in the EMS. This consists of three levels of training applicable to different types of staff:

Level 1 – High level training on environmental requirement – Management

Level 2 – Operational level training – Project Managers, Supervisors, Surface Personnel

Level 3 – Basic environmental awareness – Underground staff

#### 8.3.2 Inductions

All contractors and associated subcontractors will be required to participate in site induction prior to the commencement of work. As a minimum, the induction is to include:

- An overview of the Cardinal Rules, Environment Policy and EMS requirements;
- Environmental incident and community compliant reporting requirements; and
- Environmental emergency contact details.



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In the event that there are specific environmental management requirements relating to a contractor's work activities, details of these requirements are to be issued to the contractor in writing as a part of the induction.

Records, which detail the attendees, content of the induction/training as well as any additional information provided, will be maintained.

In addition to the induction program, training will be provided as deemed necessary to contractors to provide them with the knowledge, skills and awareness to minimise environmental impact. At a minimum this should include:

- Contractors whose activities are not directly supervised by Colliery personnel; and
- Contractors whose activities are ongoing and have the potential to result in an environmental incident (e.g. stockpile contractors).

## 8.4 Record Keeping and Control

Environmental records are to be managed in accordance with the ***WCL SYS PRO 001 Document and Data Control procedure***.

All records of the EMS will be stored so that they are readily retrievable and suitably protected from deterioration or loss. Archiving will be managed in accordance with the ***WCL SYS PRO 001 Document and Data Control procedure***.

A master copy of each EMS document including all appendices and supporting information is to be held in the office of the E&C Department.

## 8.5 Plan Revision

### 8.5.1 Annual Review

In accordance with ***Condition 3/Schedule 5*** of the Project Approval, an Annual Review of the environmental performance of the Project is prepared.

The Annual Review will:

- Describe the works carried out in the past year, and the works proposed to be carried out over the next year.

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- Include a comprehensive review of the monitoring results and complaints records of the Project over the past year, including a comparison of these results against the:
  - relevant statutory requirements, limits or performance measures/criteria;
  - monitoring results of previous year/s; and
  - relevant predictions in the EA(s).
- Identify any non-compliance over the last year, and describe what actions were (or are being) taken to ensure compliance.
- Identify any trends in the monitoring data over the life of the Project.
- Identify any discrepancies between the predicted and actual impacts of the Project, and analyse the potential cause of any significant discrepancies.
- Describe what measures will be implemented over the next year to improve the environmental performance of the Project.

### 8.5.2 Auditing

In accordance with **Condition 8/ Schedule 5** of the Project Approval, an Independent Environmental Audit will be undertaken by a suitably qualified auditor and include experts in any field specified by the Secretary within 12 months of the approval and every three years after that.

This audit must:

- Be conducted by a suitably qualified, experienced and independent team of experts whose appointment has been endorsed by the Secretary.
- Include consultation with the relevant agencies.
- Assess the environmental performance of the project and assess whether it is complying with the requirements in this approval and any relevant EPL or Mining Lease (including any assessment, plan or program required under these approvals).
- Review the adequacy of strategies, plans or programs required under the abovementioned approvals.
- Recommend measures or actions to improve the environmental performance of the project, and/or any strategy, plan or program required under these approvals.





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### 8.5.3 Plan Revision

In accordance with **Condition 4/ Schedule 5** of Project Approval, this Plan will be reviewed within three months of:

- The submission of an annual review.
- The submission of an incident report.
- The submission of an audit.
- Any modification to the conditions of approval (unless the conditions require otherwise or as otherwise agreed with DP&E).

The revision status of this plan is indicated in the **Section 10** of each copy. Revisions to any documents listed within this Plan will not necessarily constitute a revision of this document. The distribution of controlled copies is described in **Section 1.3**.



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## 9 REFERENCES

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SCT Report WCRV4193 2014 "Longwall 5 End of Panel Subsidence Report".

SCT Report WCRV4263 2014 "Update of Subsidence Assessment for Wollongong Coal Preferred Project Report Russell Vale No 1 Colliery".



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## 10 CONTROL AND REVISION HISTORY

PROPERTY	VALUE
Approved by	David Clarkson, Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	06/02/2015

### Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	04/08/14	K. Prajapati (WCL), A. Wu (Hansen Bailey), John Petrolo & Graham Luff (TransGrid), Steven Williams (Endeavour Energy), K. Mills (SCT)	Final Plan
1.1	08/09/14	K.Prajapati (WCL), John Petrolo & Graham Luff (TransGrid)	Modified with comments from TransGrid
2	06/02/15	K.Prajapati (WCL), John Petrolo & Graham Luff (TransGrid), K. Mills (SCT)	Modified with comments from TransGrid

Authorised by:          Name & Date Company/Position	Authorised by:          Name & Date Company/Position
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## Appendix A - Trigger Action Response Plan (TARP)

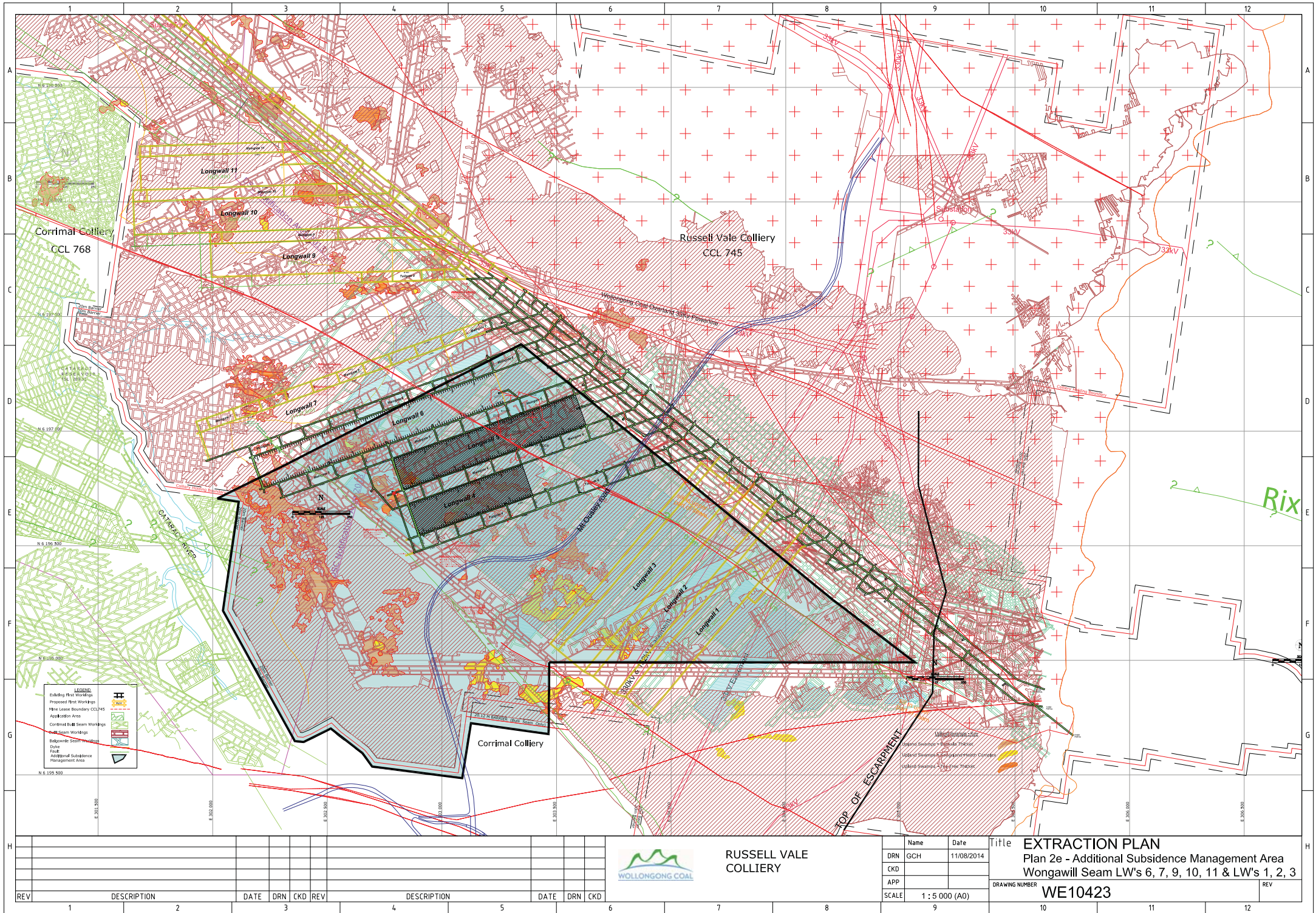
Aspect	Sites	Parameters	Trigger	Action	Responsibility
Transmission Lines	<ul style="list-style-type: none"> <li>Transmission Line/s towers: <ul style="list-style-type: none"> <li>- <b>330 kV</b> - TL11/54 to TL11/59</li> <li>- <b>132 kV</b> - Tower No. 63 to Tower No.69</li> <li>- <b>33 kV</b></li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Observable surface deformations</li> <li>Separation between tower legs</li> <li>Leg vertical differential</li> <li>Vertical subsidence</li> <li>Distance between towers</li> <li>Tilt</li> <li>Observational Monitoring of 33 kV</li> </ul>	<ul style="list-style-type: none"> <li>No observable surface deformations</li> <li>&lt; 5 mm separation between tower legs</li> <li>&lt;5 mm leg vertical differential;</li> <li>&lt;50 mm vertical subsidence;</li> <li>&lt;50 mm change in distance between towers; and</li> <li>&lt;50 mm tilt.</li> </ul>	<ul style="list-style-type: none"> <li>Within 1 week following collection &amp; processing of data, document and report to: <ul style="list-style-type: none"> <li>o Principal Subsidence Engineer – DRE;</li> <li>o Transgrid and Endeavour Energy</li> </ul> </li> </ul>	<ul style="list-style-type: none"> <li>Russell Vale Colliery (Environmental Manager)</li> <li>Russell Vale Colliery Environmental Monitoring Team</li> <li>Survey Manager</li> </ul>
			<ul style="list-style-type: none"> <li>Observable surface deformations; and/or</li> <li>Separation between tower legs (5- 10mm);</li> <li>Leg vertical differential (5-10 mm);</li> <li>Vertical subsidence (50-100 mm);</li> <li>Change in distance between towers (50-100 mm); and</li> <li>Tilt (50-100 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: <ul style="list-style-type: none"> <li>o Electrical infrastructure owner/s (Endeavour Energy and TransGrid) ;and</li> <li>o Principal Subsidence Engineer – DRE.</li> </ul> </li> <li>Continue consultation with electrical owner/s (TransGrid &amp; Endeavour Energy) and develop specific action plans to be implemented should they be required (see trigger below).</li> </ul>	
			<ul style="list-style-type: none"> <li>Observable surface deformations; and/or</li> <li>Separation between tower legs (&gt;10mm);</li> <li>Leg vertical differential (&gt;10 mm);</li> <li>Vertical subsidence (&gt;100 mm);</li> <li>Change in distance between towers (&gt;100 mm); and</li> <li>Tilt (&gt;100 mm).</li> </ul>	<ul style="list-style-type: none"> <li>Notify the following Key Stakeholders, as appropriate, immediately following awareness of trigger being met: <ul style="list-style-type: none"> <li>o Electrical infrastructure owner/s; and (TransGrid &amp; Endeavour Energy)</li> <li>o Principal Subsidence Engineer – DRE.</li> </ul> </li> <li>Liaise with asset owner (<b>Transgrid &amp; Endeavour Energy</b>) regarding any action/s required.</li> <li>Review mining options.</li> </ul>	





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## Appendix B - Plan 2e – Additional Subsidence Management Area





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Doc Title	EXTRACTION PLAN		

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## APPENDIX J

### PUBLIC SAFETY MANAGEMENT PLAN



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Type	Plan	Date Published	06/02/2015
Doc Title	PUBLIC SAFETY MANAGEMENT PLAN		

Russell Vale Colliery  
Russell Vale East – Longwalls 6 & 7

PUBLIC SAFETY MANAGEMENT PLAN



## GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	Description
DP&E	Department of Planning & Environment
DRE	Division of Resources and Energy
kV	Kilovolt
LGA	Local Government Area
LW	Longwall
MSB	Mine Subsidence Board
PAC	Planning Assessment Commission
PPR	Preferred Project Report
RMS	Roads and Maritime Services (formerly the Roads and Traffic Authority)
ROM	Run of Mine
SMA	Subsidence Management Area
TARP	Trigger Action Response Plan
UEP	Underground Expansion Project
WCL	Wollongong Coal Limited

Terms	
Project Approval	Pt3A Major Project approval MP10_0046 as modified



## 1. INTRODUCTION

### 1.1 Project Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly the NRE No.1 Colliery) located in the Southern Coalfield of New South Wales (NSW). The mine is located at Russell Vale, approximately 8 km north of Wollongong and 70 km south of Sydney, within the local government areas (LGAs) of Wollongong and Wollondilly in the Illawarra region of NSW.

The Russell Vale Colliery operates a Project Approval (MP 10\_0046), granted by the Planning Assessment Commission (PAC) on 13 October 2011. The Project Approval was modified (MOD 1) by the PAC in 2012 to allow:

- extraction of coal using longwall mining techniques in the Wongawilli Seam for longwalls 4 and 5 ; and
- development of the main gate roads for longwall 6.

A second modification to the project approval (MP 10\_0046 MOD2) was granted by the PAC on 19 November 2014 to authorise:

- extraction of coal using longwall mining techniques in the first 365 m of longwall 6 (LW6); and
- extension of the duration of mining until 31 December 2015.

Prior to this, a third modification (MOD 3) to MP 10\_0046 was approved on 10 October 2014. MOD 3 authorised the continuation of mining operations until 31 December 2014. This modification has effectively been superseded by MOD 2, which allows mining operations to be undertaken until 31 December 2015.

WCL has lodged a separate application (MP 09\_0013) for its Underground Expansion Project (UEP) to facilitate further mining operations at Russell Vale Colliery. In October 2013, WCL lodged a Preferred Project Report (PPR) which proposed significant amendments to the UEP (as originally proposed). The amended UEP would facilitate the continued operation of the colliery for five years and would allow extraction of 4.7 million tonnes of Run of Mine (ROM) coal. The mine plan for the amended UEP consists of 8 longwall panels (including longwalls 6 & 7). The environmental assessment for the UEP has been protracted due to the complex environment of the Russell Vale Colliery, its proximity to the Cataract Reservoir and sensitive upland swamps, and the high level of community and stakeholder interest. It is unlikely that determination of the application will be made before early 2015.

This Public Safety Management Plan (this Plan) has been prepared in support of an Extraction Plan, as required by **Condition 7/Schedule 3** of the Project Approval (MP 10\_0046).

## 1.2 Purpose and Scope

The purpose of this Plan is to document the potential risks to public safety associated with the extraction of Longwalls 6 & 7 (LW6 & LW7) in the Russell Vale East Domain, and detail any measures to manage these risks.

This plan addresses the potential risks to public safety posed by the following hazards:

- Potential impacts of subsidence on built features;
- Potential instability of clifflines and steep slopes resulting from subsidence; and
- Deformation or fracturing of land due to subsidence.

This plan is applicable to all surface areas that may be subject to subsidence resulting from the extraction of LW6 & LW7. This area is referred to as the Subsidence Management Area (SMA) and includes the area within the predicted 20 mm subsidence extent and the 'Additional Subsidence Management Area'. The 'Additional Subsidence Management Area' is the area where there is a risk of 'pillar run' occurring. The SMA and surface features that relate to public safety are shown on *Figure 1*.

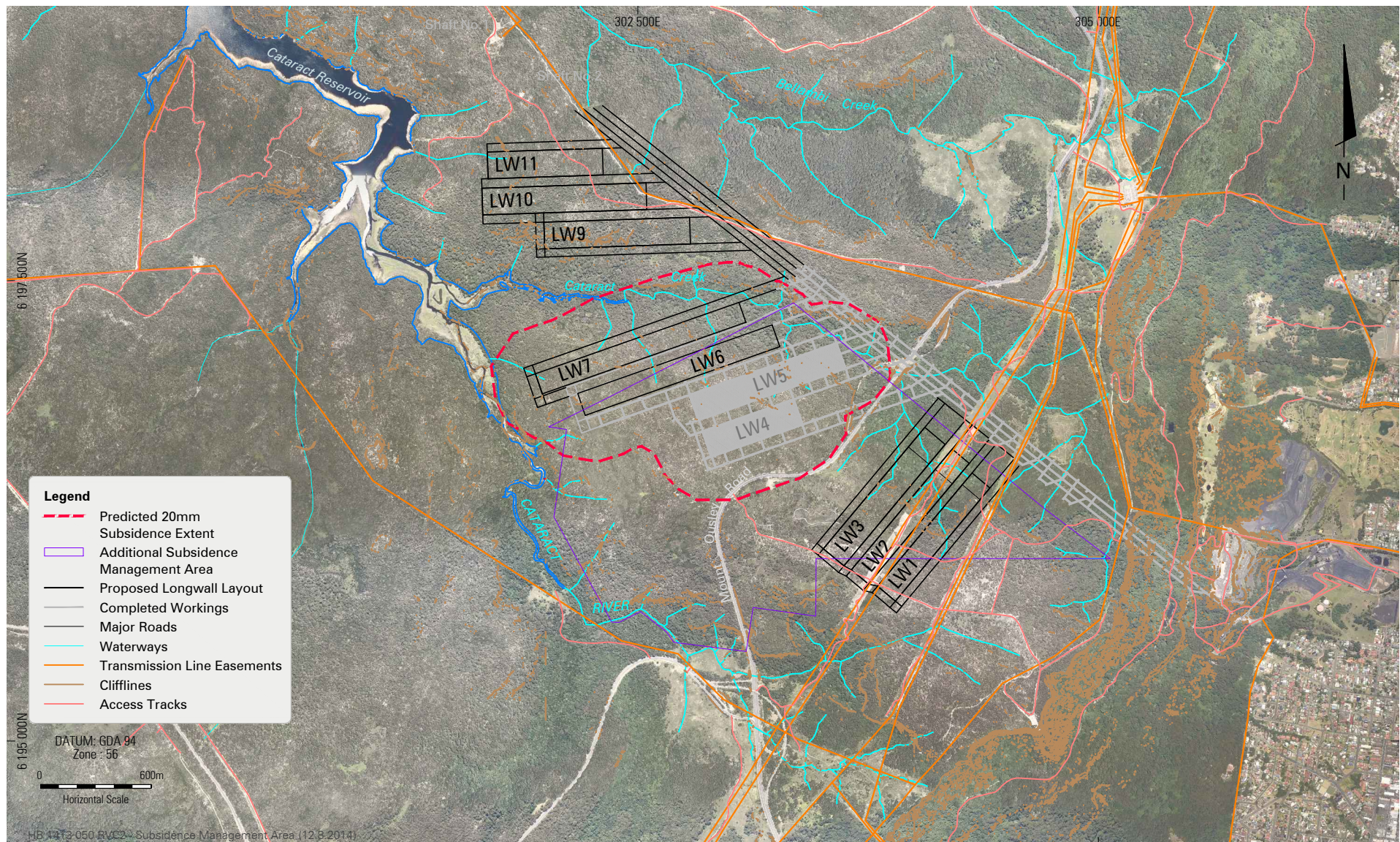
## 1.3 Consultation and Distribution

This Plan has been prepared in consultation with and copies will be distributed to the Division of Resources and Energy (DRE).

WCL will make this Plan accessible on the WCL website and will be responsible for its maintenance. A hard copy will also be kept at the Russell Vale Colliery, 7 Princes Highway, Corrimal NSW 2518.

Any revisions undertaken will be the responsibility of WCL and any notifications sent accordingly. WCL will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on WCL's computer system, website, and hard copy at the Russell Vale Colliery, 7 Princes Highway, Corrimal NSW 2518.





RUSSELL VALE COLLIERY

Subsidence Management Area

FIGURE 1



**Hansen Bailey**  
ENVIRONMENTAL CONSULTANTS



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 009
Type	Plan	Date Published	06/02/2015
Doc Title	PUBLIC SAFETY MANAGEMENT PLAN		

## 1.4 Report Structure

The remainder of this Plan is structured as follows:

**Section 2:** Outlines the statutory requirements applicable to the Plan.

**Section 3:** Outlines the baseline data and impact assessments undertaken which support this Plan.

**Section 4:** Details the performance measures and indicators that will be used to assess the Project.

**Section 5:** Describes the monitoring program.

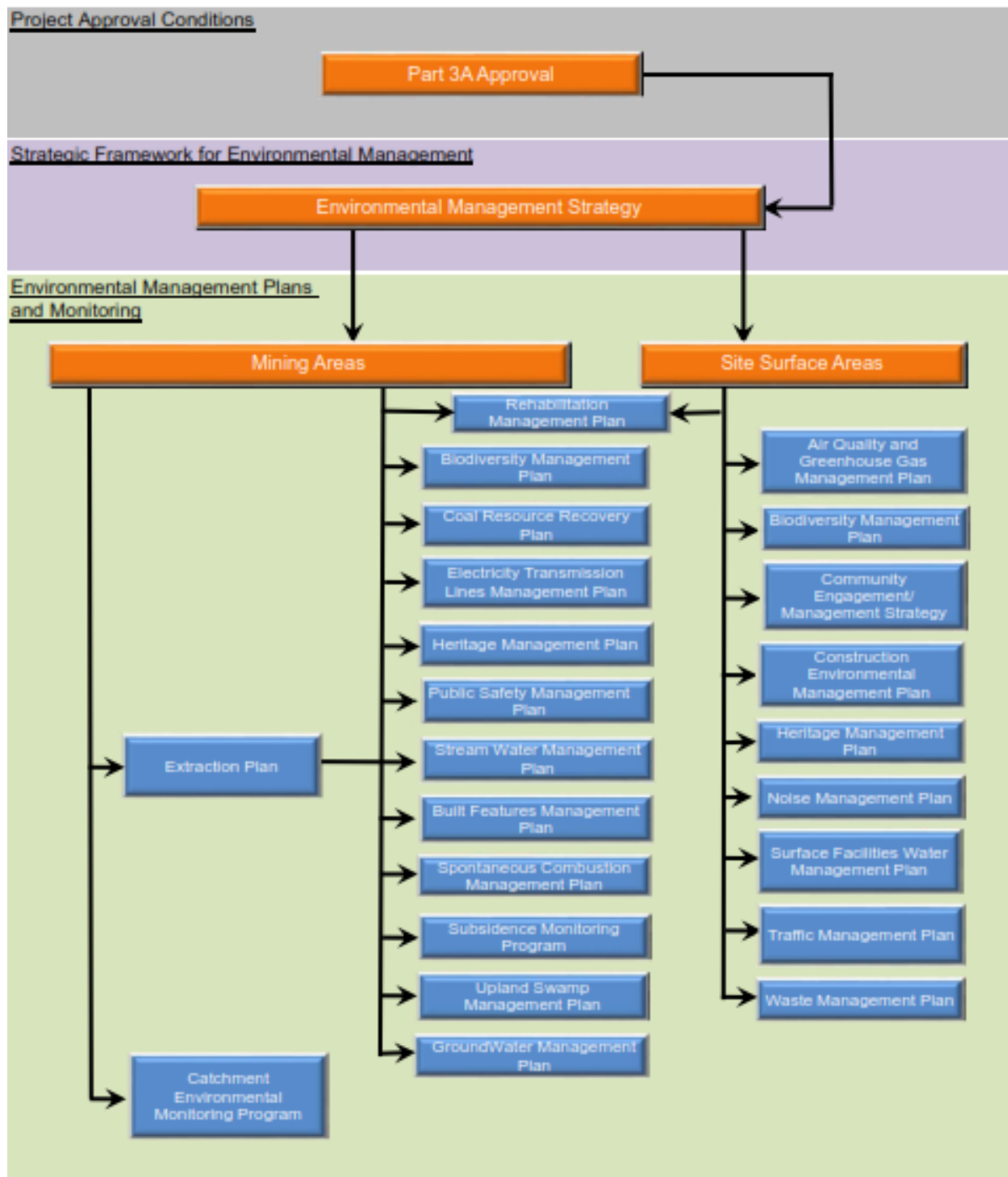
**Section 6:** Describes the management, remediation and mitigation measures that will be implemented to reduce potential impacts as well as the Contingency Plan to manage any unpredicted impacts and their consequences.

**Section 7:** Describes the protocols for the handling of incidents, complaints and non-compliances.

**Section 8:** Details how the Plan will be implemented, managed, reviewed and updated.

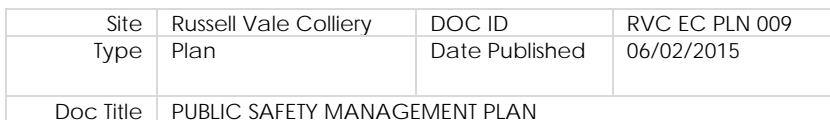
*Figure 2* shows this Plan's position within WCL's Environmental Management Structure.

## Environmental Management Structure



**Figure 2 - Environmental Management Structure**





## 2.1 Approval

### Extraction Plan

...

- *a Public Safety Management Plan to ensure public safety in the mining area;*

*Table 2.1 - Management Plan Requirements*

Project Approval Condition	Plan Section
<b><i>Condition 2/Schedule 5</i></b>	
The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:	
(a) detailed baseline data;	Section 3.1
(b) a description of:	
• the relevant statutory requirements (including any relevant approval, licence or lease conditions);	Section 2
• any relevant limits or performance measures/criteria;	Section 4
• the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures;	Section 4
(c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria;	Section 6
(d) a program to monitor and report on the:	
• impacts and environmental performance of the project;	Section 5.1
• effectiveness of any management measures (see c above);	Section 6.3
(e) a contingency plan to manage any unpredicted impacts and their consequences and to ensure that ongoing impacts reduce to	Sections 6.3

Project Approval Condition	Plan Section
levels below relevant impact assessment criteria as quickly as possible;	Section 7.5.1 of the Extraction Plan
(f) a program to investigate and implement ways to improve the environmental performance of the project over time;	
(g) a protocol for managing and reporting any:	
<ul style="list-style-type: none"> <li>incidents;</li> <li>complaints;</li> <li>non-compliances with statutory requirements; and</li> <li>exceedances of the impact assessment criteria and/or performance criteria; and</li> </ul>	
(h) a protocol for periodic review of the plan.	
	Section 6 of the Extraction Plan
	Section 7.5 of the Extraction Plan

## 2.2 Licences and Leases

In addition to the requirements of the Project Approval, all activities at or in association with the Russell Vale Colliery are undertaken in accordance with the following licences, permits and leases which have been issued or are pending.

*Table 2.2 - Licences, Permits and Leases*

Licence/Approval	Document No.	Issue Date/	Expiry Date
Consolidated Coal Lease Renewal	745	27 Dec 1990	30 Dec 2023
Mining Purposes Lease	271	09 May 1991	09 May 2033
Mining Lease	1575	22 Mar 2012	22 Mar 2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31 Oct 2001 23 Jan 2002 28 Jun 2001	-
Approval to mine P&O Panels (first workings)	10.123.081	7 Jan 2005	-
DC for Thin Seam Mining P/L	D1096/01	19 Sep 2001	-
Environmental Projection Licence	12040	Current	-
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10 Aug 1992	-
DC for Storm Water Control Dam and Water Treatment	D91/551	17 Jun 1992	-
Dangerous Goods Licence	NDG021269	Application Pending	Application Pending
Licence to Store Explosives	XSTR100114	21 Oct 2012	3 Oct 2017
SPCC Approval for Stage 3	90/4711 (280021C/20)	04 Sep 1992	-
DC for Russell Vale Waste Emplacement	D89/839	11 Apr 1990	-
DC for Demolition of Washery	D2004/32	14 Dec 2004	-
Mining operations Plan (MOP)		1 Jan 2008	31 Dec 2017
Bore Licence	10BL602992	29 Jan 2013	28 Jan 2018

## 2.3 Relevant Legislation and Guidelines

WCL will operate in accordance with the Project Approval conditions and any other legislation that is applicable. The following Acts may be applicable to operations of Russell Vale Colliery:

- *Coal Mine Health and Safety Act 2002*
- *Contaminated Land Management Act 1997*
- *Crown Lands Act 1989*
- *Dams Safety Act 1978*
- *Dangerous Goods (Road and Rail Transport) Act 2008*
- *Energy and Utilities Administration Act 1987*
- *Environmental Planning and Assessment Act 1979*
- *Environment Protection and Biodiversity Conservation Act 1999 (Commonwealth)*
- *Fisheries Management Act 1994*
- *Heritage Act 1977*
- *Mining Act 1992*
- *Noxious Weeds Act 1993*
- *Protection of the Environment Operations Act 1997*
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- *Roads Transport Act 2013*
- *Road Transport (Vehicle and Driver Management) Act 2005*
- *Sydney Water Catchment Management Act 1998*
- *Threatened Species Conservation Act 1995*
- *Water Act 1912*
- *Water Management Act 2000*

Relevant licences or approvals required under these Acts will be obtained as required.

### 3. IMPACT ASSESSMENT

This section is based on the subsidence assessment (SCT Operations, 2014) conducted for the Preferred Project Report (PPR) and the associated environmental assessment reports. However, only those aspects relevant to LW6 & LW7 are considered.

#### 3.1 Site Description

**Figure 1** shows the proposed LW6 and LW7 and the SMA. The previously extracted panels (LW4 and LW5) are also shown.

The SMA is located entirely within the Metropolitan Special Area managed by the Sydney Catchment Authority (SCA). The Metropolitan Special Area is a restricted area and cannot be accessed by the public, except with the consent of SCA. This area is accessed by WCL personnel and contractors for monitoring activities. The Metropolitan Special Area is also accessed by SCA personnel. Mount Ousley Road is a public road that passes through the Metropolitan Special Area.

Known surface features (natural and built) in the SMA that have the potential to affect public safety include:

- Cliff lines and steep slopes; and
- Other Roads (dirt roads and fire trails).

Surface features that are not expected to be directly impacted include:

- Mount Ousley Road;
- Picton Road Interchange;
- High voltage electricity transmission lines east of Mount Ousley Road; and
- Mine infrastructure (exploration boreholes, electricity lines, and ventilation shafts).

Locations of these surface features are shown in **Figure 1**.

There are no known public amenities, agricultural lands, industrial/commercial establishments, or residential properties within the SMA. The SMA is not in an MSB Mine Subsidence District.

### 3.2 Subsidence Impacts

Predicted subsidence effects and an assessment of subsidence impacts are presented in detail in the PPR. A copy of the PPR is available on WCL's and DP&E's websites.

The environmental consequences of subsidence that may pose a risk to public safety include:

- Damage to road infrastructure;
- Impacts on electricity transmission lines;
- Instability of cliff lines;
- Dislodgement of rocks onto fire trails and access tracks; and
- Cracking of fire trails and access tracks.

Mount Ousley Road is located outside of the predicted 20 mm subsidence extent and is therefore not expected to experience significant impacts. Notwithstanding, monitoring will be undertaken along Mount Ousley Road since the road passes through the Additional Subsidence Management Area. Picton Road Interchange is located outside of the SMA entirely. Predicted impacts on road infrastructure are detailed in the *LW6 & LW7 Built Features Management Plan (RMS)*.

The 330 kV and 132 kV electricity transmissions lines are located east of Mount Ousley Road. There are 33 kV transmission lines located to the east, north and south of LW6 & LW7. All transmission lines are located beyond the predicted 20 mm subsidence extent. However, these transmission lines intersect the Additional Subsidence Management Area. Impacts on Mount Ousley Road will be used to trigger inspections and/or surveys of the electricity transmission lines. Impacts on electricity transmission lines are discussed in the *LW6 & LW7 Electricity Transmission Lines Management Plan*.

The Illawarra Escarpment is also located east of Mount Ousley Road and a significant distance beyond the predicted 20 mm subsidence extent. There are no predicted impacts on the Illawarra Escarpment that would generate a risk to public safety. There are some cliff lines located within the predicted 20 mm subsidence extent. The mining of LW6 & LW7 may result in instability of some cliff lines.

There are fire trails and unsealed access tracks located within the predicted subsidence 20 mm extent. Subsidence may result in cracking of these unsealed tracks. These cracks may pose a risk to the WCL and SCA personnel that use these fire trails and access tracks.



#### 4. PERFORMANCE MEASURES AND CRITERIA

Performance measures for the management of public safety are set out in Table 2 of *Condition 4/Schedule 3* of the Project Approval and are reproduced in *Table 4.1*.

**Table 4.1 – Subsidence Performance Measures**

Feature	Performance Measure
Public Safety	No additional risk

Environmental management will be undertaken in accordance with the process described in *Figure 3*.

To ensure that mining does not result in any additional risks to public safety, WCL had adopted the following performance objectives:

- No impacts affecting the traffickability of fire trails and access tracks;
- Proper management of risks associated with cliffclines or rock formations; and
- No impacts on public roads that would affect the safety of motorists.

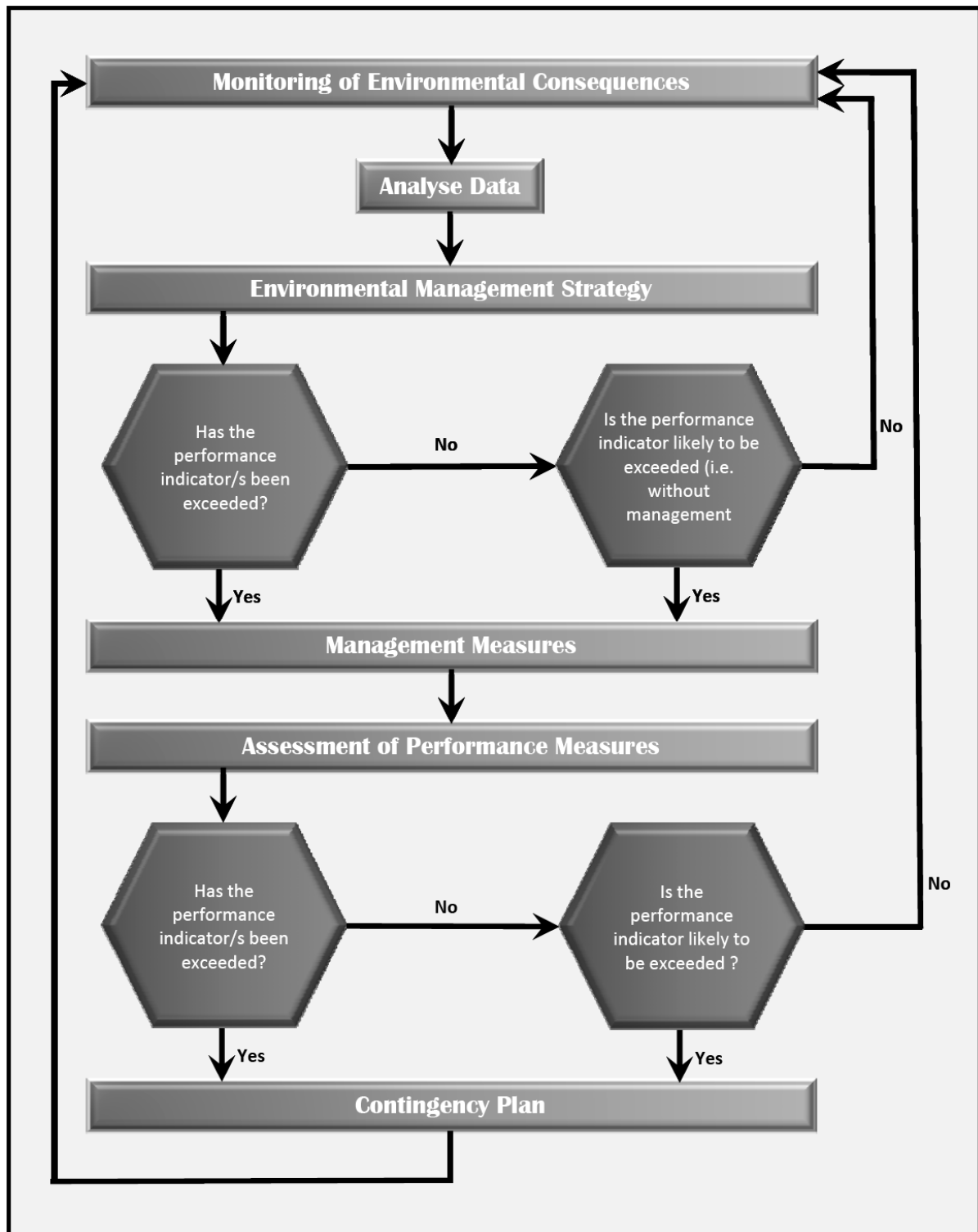


Figure 3 - Management Process

## 5. MONITORING AND REPORTING

### 5.1 Monitoring

The monitoring activities that will be undertaken to identify and manage risks to public safety are outlined in this section.

#### 5.1.1 RMS Infrastructure

Monitoring of Mount Ousley Road and other road infrastructure will be undertaken as described in the *LW6 & LW7 Built Features Management Plan (RMS)*. This includes monitoring of the road pavement and other associated infrastructure, including culverts, cuttings and embankments.

#### 5.1.2 Electrical Transmission Lines

Monitoring of Electrical Transmission Lines will be undertaken as described in detail within the *LW6 & LW7 Electrical Transmission Lines Management Plan*. This includes the monitoring of the 330kV, 132kV and 33kV transmission lines that are owned by Transgrid and Endeavour Energy.

#### 5.1.3 Unsealed Access Roads and Fire Trails

The unsealed access roads and trails within the predicted 20 mm subsidence extent may experience cracking as a result of mining. The monitoring regime for these unsealed roads is outlined in the Public Safety TARP (attached as **Appendix A**). Visual inspections of unsealed roads will be undertaken fortnightly during longwall extraction and monthly for a period of 6 months after mining. If cracks larger than 10 mm are identified, WCL will notify DP&E and SCA and prepare a remediation plan within 1 week.

### 5.2 Reporting

In accordance with the requirements of Condition 7/Schedule 5 of the Project Approval, the environmental performance of the colliery will be reported on the WCL website. Results of monitoring activities will be reported to WCL's Environment & Community Department on a regular basis during active mining to ensure that any remedial actions can be undertaken as soon as possible after any impact that has the potential to affect public safety. The results of regular monitoring will be provided to infrastructure and asset owners in accordance with the individual agreements between the asset owners and WCL. In some cases this may include regular reporting to steering and/or technical committees in addition to WCL's regular reporting.

Progress against the requirements of this Plan will be reported regularly to DP&E and other agencies as required by the Project Approval. An Annual Review will also be prepared and provided to DP&E.

## 6. MITIGATION AND MANAGEMENT STRATEGIES

### 6.1 General

#### 6.1.1 Access

The portion of the SMA to the west of Mount Ousley Road is within the Metropolitan Special Area. The general public is not permitted to enter the Metropolitan Special Area (unless authorised by the SCA). Signage installed at the entries to the SCA area clearly stipulate that public access is restricted. The current maximum penalty for unauthorised access is up to \$44,000.

The portion of the SMA to the east of Mount Ousley Road consists predominantly of WCL owned land, with small areas of private land. Access to this land is restricted. Due to the restricted access to the land within the SMA, subsidence is not predicted to pose a significant risk to the general public. Nevertheless, WCL will implement a number of management measures to prevent, mitigate and promptly remediate hazards within the Subsidence Management Area.

WCL personnel and contractors will access these restricted areas to conduct monitoring activities. These areas may also be accessed by SCA staff and other persons with permission from the SCA (e.g. asset owners such as TransGrid and Endeavour Energy). Therefore, such persons may be exposed to subsidence related risks.

All WCL staff and contractors will be required to hold current WCL and SCA inductions, and will be trained in personal safety requirements before accessing these lands. WCL personnel and contractors will be required to wear the appropriate Personal Protective Equipment (PPE) when working within the restricted area. The necessary PPE includes hard hat, protective boots, gloves, safety glasses, long-sleeved shirt and trousers.

WCL will abide by the SCA Standards Conditions and/or Entry and Access Agreements at all times whilst working in the Metropolitan Special Area. Such conditions include:

- Abiding by speed restrictions (40 km/h);
- Driving only on designated access tracks;
- Locking all gates after entering and leaving the area (to prevent public access);
- Abiding by access restrictions (e.g. wet weather, total fire ban etc.);
- Provision of appropriate documentation to the SCA prior to the commencement of works (including obtaining all relevant approvals and inductions); and
- Provision of emergency contact numbers.

WCL will advise the SCA, DP&E and other relevant parties as soon as practicable after the identification of a subsidence impact that may pose a risk to public safety.

If dangerous surface cracks are identified along access roads, remediation will be undertaken in consultation with the SCA and would be undertaken in accordance with the SCA track maintenance guidelines (including the Track Stabilisation and Control Manual). Surface cracks will generally be remediated by in-filling.

### 6.1.2 Built Features

Public roads and electricity transmission lines are not expected to be significantly impacted by mining of LW6 & LW7. If WCL or the asset owner considers that the integrity of the asset and/or public safety has been compromised as a result of subsidence, remediation works and/or contingency measures will be implemented in accordance with the relevant management plan or as otherwise agreed with the asset owner. Risks to public safety as a result of impacts on road infrastructure will be managed in accordance with the *LW6 & LW7 Built Features Management Plan (RMS)*. Risks to public safety arising from impacts on transmission lines will be managed in accordance with the *LW6 & LW7 Electricity Transmission Lines Management Plan*.

Management measures in relation to public safety may include:

- Traffic control;
- Temporary speed restrictions;
- Warning signs/lights;
- Restriction of public access;
- Erection of barriers;
- Implementation of security services; and
- Use of emergency services for public control.

### 6.1.3 Cliff Lines

The cliff lines that may be impacted by subsidence are located within the Metropolitan Special Area and are therefore not accessible to the public. To ensure the safety of personnel that have authority to access the area, the following safety measures will be implemented:

- Signs shall be prominently displayed at any rock formation that has been identified as potentially being susceptible to failure. Signposts will warn specifically of the danger. Signposts that are to be installed on private or public property will be installed in agreement with the relevant authority;
- The location of all signs, fences, and other remedial or warning provisions established will be marked on a Plan. This Plan will be maintained as a record of any remedial measures instituted during mining; and
- Any potentially unstable rock structures will be assessed and secured (if safe and practicable to do so). Methods used to secure unstable rock structures will be determined on a case by case basis, and may include rock bolting or grouting of rock fractures. If required, measures to stabilise rock formations will be developed in consultation with the relevant regulatory agencies.



## 6.2 Trigger Action Response Plan

The Trigger Action Response Plan (TARP) presented in **Appendix A** has been designed specifically for this Plan to illustrate how the various predicted subsidence impacts, monitoring components, performance measures, and responsibilities are structured to achieve compliance with the relevant statutory requirements, and the framework for management and contingency actions.

The TARP system provides a simple, transparent and useable reference of the monitoring of environmental performance and the implementation of management and/or contingency measures. The TARP is designed with consideration of baseline conditions and predicted subsidence impacts and comprises the following:

- Trigger levels from monitoring to assess performance; and
- Triggers that flag implementation of contingency measures.

## 6.3 Contingency Plan

In the event that the observed parameters or impacts exceed or are considered likely to exceed the performance measures detailed in **Section 4** of this Plan, WCL will implement the following Contingency Plan:

- The observation will be reported to WCL's Environment Manager within 24 hours;
- The observation will be recorded;
- WCL will report any exceedance of the performance measure to the DRE, DP&E and other relevant stakeholder as soon as practicable after WCL becomes aware of the exceedance;
- WCL will assess the exceedances referred to in the TARP (see Section 6.2 and Appendix A) and where appropriate, implement safety measures in accordance with the appropriate Management Plan/s;
- The Environment Manager will investigate any potential contributing factors and identify an appropriate action plan to manage the identified impact(s), in consultation with specialists and/or infrastructure owners and/or relevant agencies, if necessary;
- WCL will develop an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders;
- WCL will submit the proposed course of action to the DP&E for approval;
- WCL will implement the approved course of action to satisfaction of DP&E; and
- WCL will continue to monitor performance with the new action plan in place and, if successful, will formalise these actions as part of a revised Management Plan.

Contingency measures will be developed in consideration of the specific circumstances of the issue and the assessment of consequences. If either, it is not reasonable or feasible to remediate the impact or remediation measures implemented by WCL have failed to satisfactorily remediate the impact, WCL will provide a suitable offset to compensate for the impact, to the satisfaction of the Secretary of DP&E in accordance with **Condition 3/Schedule 3** of the Project Approval.

## 7. REFERENCES

- Gujarat NRE Coking Coal Limited (2013), *Underground Expansion Project Preferred Project Report*.
- SCT Operations (2014), *Update of Subsidence Assessment for Wollongong Coal Preferred Project Report Russell Vale No. 1 Colliery*.

## 8. CONTROL AND REVISION HISTORY

Property	Value
Approved by	Group Environment Manager
Document Owner	Group Environment Coordinator
Effective Date	06/02/2015

### Revisions

Version	Date reviewed	Review team (consultation)	Nature of the amendment
1	01/12/14	K. Prajapati (WCL), A. Wu (Hansen Bailey)	Draft Plan
2	10/12/14	D. Clarkson (WCL)	Final Draft
3	06/02/15	A. Wu (Hansen Bailey), D. Clarkson (WCL)	Final



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 009
Type	Plan	Date Published	06/02/2015
Doc Title	PUBLIC SAFETY MANAGEMENT PLAN		

## Appendix A – Trigger Action Response Plan

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Public Safety	Rockmass identified as being at risk of instability	Visual observations of instability or cracking	<ul style="list-style-type: none"> <li>Once prior to mining</li> <li>Fortnightly during extraction</li> <li>Every month following mining for 6 months</li> </ul>	To identify changes related to mining and enact management strategies to minimise impacts to public safety.	<u>No Change Observed</u>  No observable cracking or instability	<ul style="list-style-type: none"> <li>No further mitigation or management required</li> <li>No notification required</li> <li>Continue monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval.</li> </ul>
					<u>Change in Site Condition Observed Within Performance Criteria:</u>  Minor cracking (<10mm)  No observable instability  <b>If a change is observed but no threat to is identified then the monitoring program should continue.</b>	<ul style="list-style-type: none"> <li>Photographic Record</li> <li>Continuing monitoring</li> <li>Undertake remediation measures where appropriate in consultation with DRE, DP&amp;E and SCA (e.g. grouting of rock cracks)</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval</li> </ul>
					<u>Change in Site Condition Observed That Exceeds Performance Criteria:</u>  Major cracking (>10mm) and noticeable instability	<ul style="list-style-type: none"> <li>Photographic Record</li> <li>Continuing monitoring</li> <li>Undertake remediation measures as appropriate in consultation with DRE, DP&amp;E &amp; SCA (e.g. rock bolting or grouting of rock cracks)</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Notify SCA and DP&amp;E within 24 hours of becoming aware of the Impact</li> <li>Provide detailed report on the incident to DP&amp;E within 7 days</li> <li>Six monthly reporting in accordance with Extraction Plan approval</li> </ul>

ASPECT	MONITORING				TRIGGER			
	SITES	PARAMETERS	FREQUENCY	PURPOSE	LEVEL	ACTION / REPORTING	RESPONSIBILITY	TIMING
Public Safety	Fire Trails / Access Tracks	Visual observation and opportunistic inspection of road surface	<ul style="list-style-type: none"> <li>Once prior to mining</li> <li>Fortnightly during extraction</li> <li>Every month following mining for 6 months</li> </ul>	To identify changes related to mining and enact management strategies to minimise impacts to public safety.	<u>No Change Observed</u> No cracking visible	<ul style="list-style-type: none"> <li>No further mitigation or management required</li> <li>No notification required</li> <li>Continue monitoring.</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval</li> </ul>
					<u>Change in Site Condition Observed Within Performance Criteria:</u> Minor cracking (<10mm)  <b>If a change is observed but no threat is identified then the monitoring program should continue.</b>	<ul style="list-style-type: none"> <li>Photographic Record</li> <li>Notification to SCA and DP&amp;E within 24 hrs</li> <li>Continuing monitoring</li> <li>Undertake remediation measures as appropriate</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Six monthly reporting in accordance with Extraction Plan approval</li> </ul>
					<u>Change in Site Condition Observed That Exceeds Performance Criteria:</u> Major cracking (>10mm) and noticeable instability or traffic (foot/vehicular) impedance	<ul style="list-style-type: none"> <li>Notification to SCA and DP&amp;E immediately</li> <li>Make area safe as soon as practicable</li> <li>Proposal for rectification within 1 week</li> <li>Completion of remediation works following approval from SCA</li> <li>Revise monitoring program and management plan</li> </ul>	<ul style="list-style-type: none"> <li>Environment Manager</li> <li>Environmental Monitoring Team</li> </ul>	<ul style="list-style-type: none"> <li>Provide detailed report on the incident to DP&amp;E within 7 days</li> <li>Commence preparation of mitigation/action plan within 1 week (if required)</li> <li>Monthly updates of investigation progress, if required by SCA</li> <li>Six monthly reporting in accordance with Extraction Plan approval</li> </ul>





Site	Russell Vale Colliery	DOC ID	RVC EC PLN 010
Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

## APPENDIX K

### GRAPHICAL PLANS

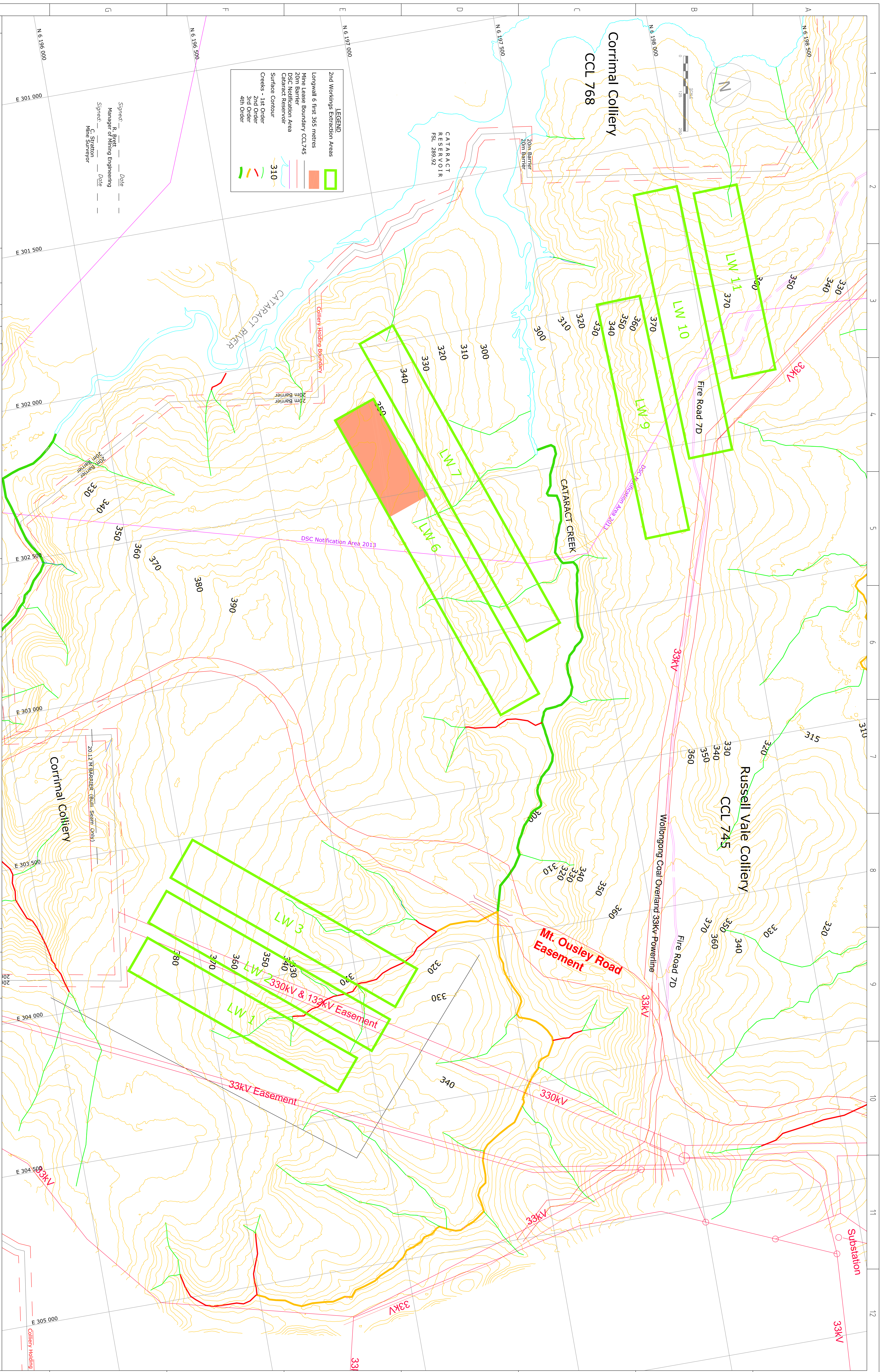










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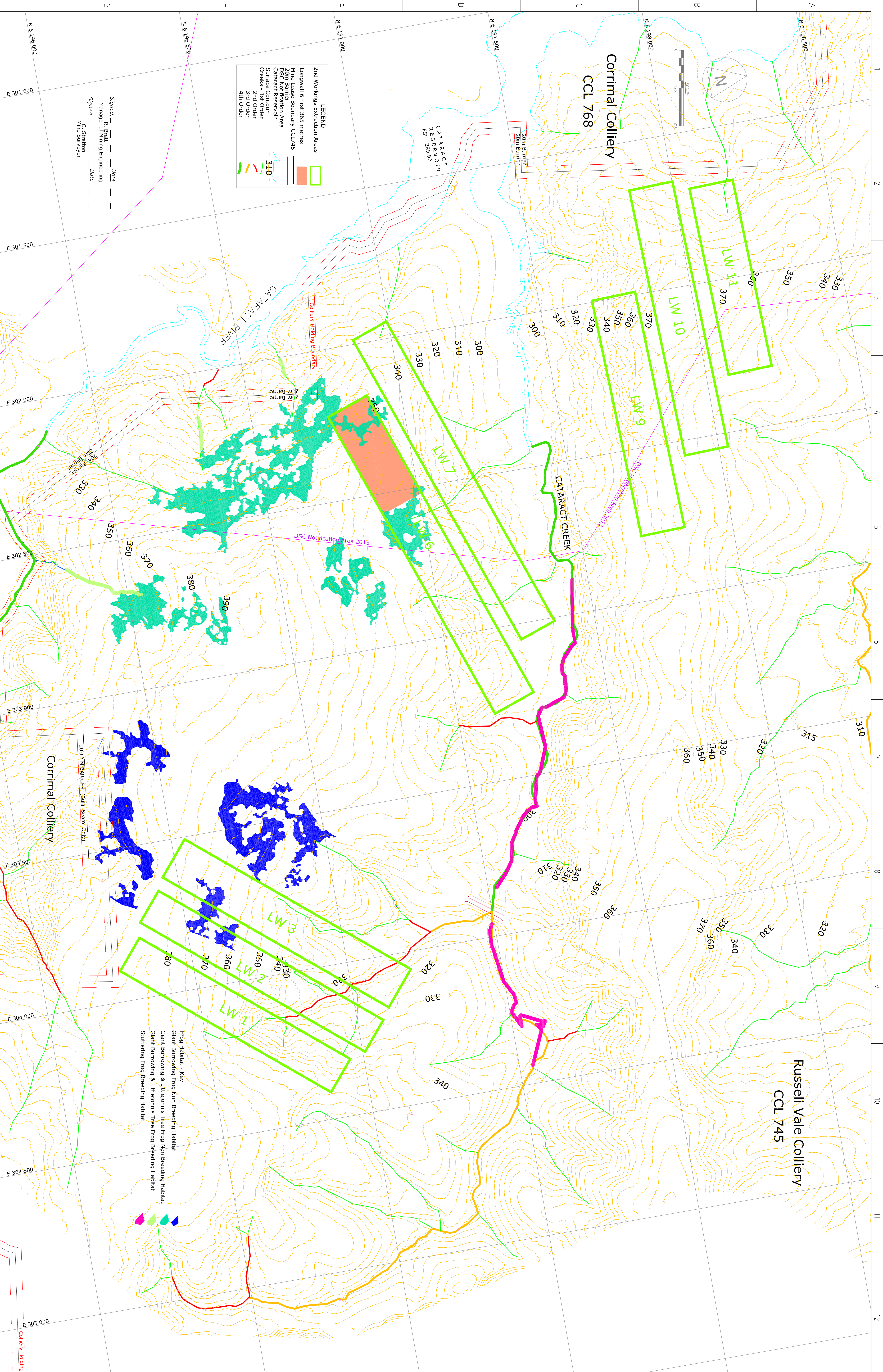












- LEGEND**
- 2nd Workings Extraction Areas
  - Longwall 6 first 365 metres
  - Mine Lease Boundary CCL745
  - 20m Barrier
  - DSC Notification Area
  - Catract Reservoir
  - Surface Contour
  - Creeks - 2nd Order
  - 3rd Order
  - 4th Order

Signed: R. Smith Date: ---  
Manager of Mining Engineering  
Signed: C. Smith Date: ---  
Mine Surveyor

<div><p><b>RUSSELL VALE</b> <b>COLLIERY</b></p></div>										Name		Date		Title	
DRN		GCH		25/11/2014		EXTRACTION PLAN									
CKD						SMP Plan 2d - Natural & Man-made Surface Features									
APP						Wongawill Seam LW's 6, 7, 9, 10, 11 & LW's 1, 2, 3									
SCALE		1 : 4 000 (A0)				DRAWING NUMBER									
						WE10425									
						REV									

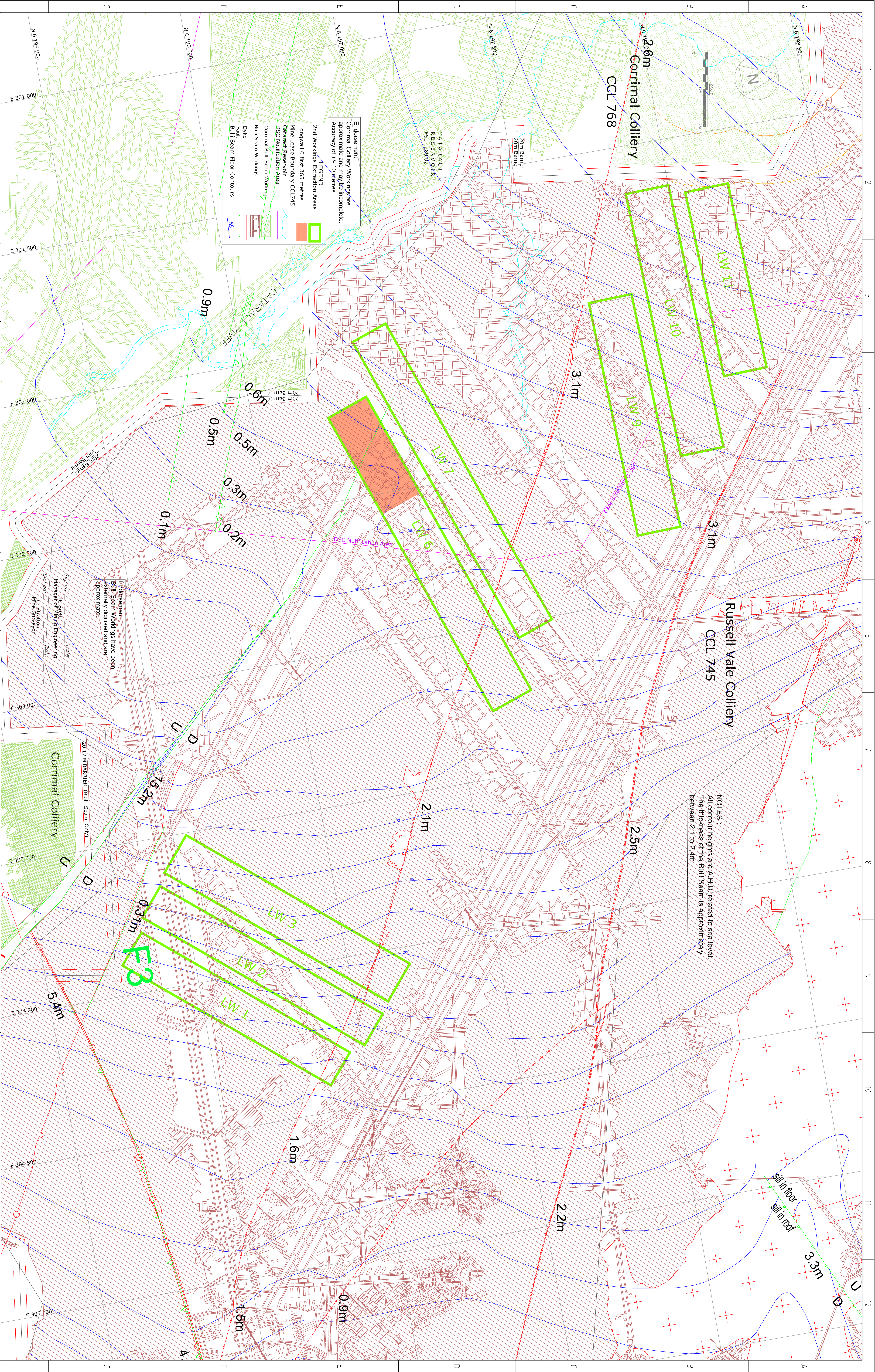






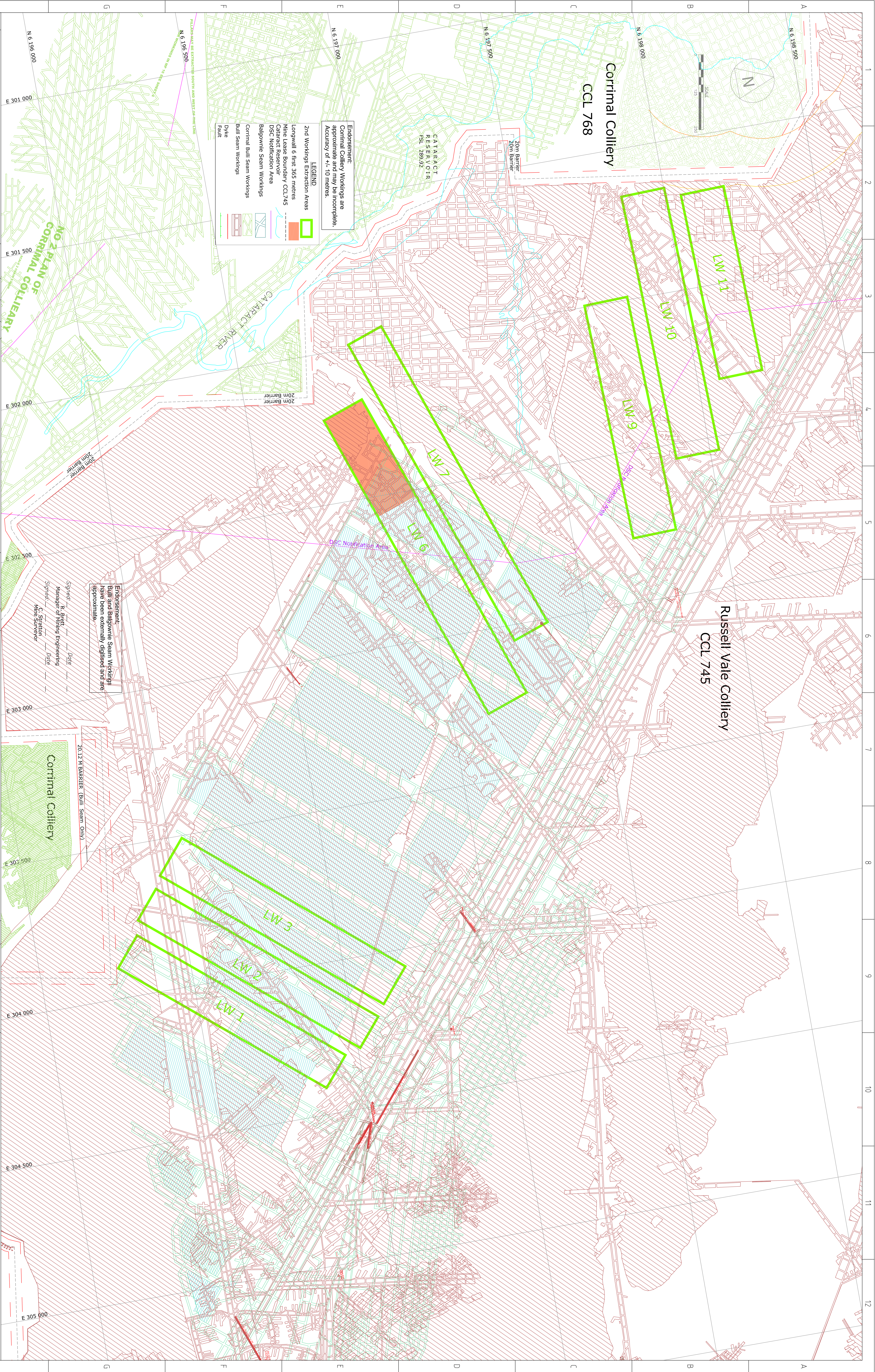






REV			DATE			DESCRIPTION			NAME			DATE			TITLE		
1			1			DESCRIPTION			DRN			25/11/2014			EXTRACTION PLAN		
2			2			DESCRIPTION			GCH						SMP Plan 4b - Composite Workings - Bull Seam		
3			3			DESCRIPTION			CKD						Wongawilli Seam Lws 6, 7, 9, 10, 11 & Lws 1, 2, 3.		
4			4			DESCRIPTION			APP						DRAWING NUMBER		
5			5			DESCRIPTION			SCALE			1 : 4 000 (A0)			WE10429		
6			6			DESCRIPTION			REV								



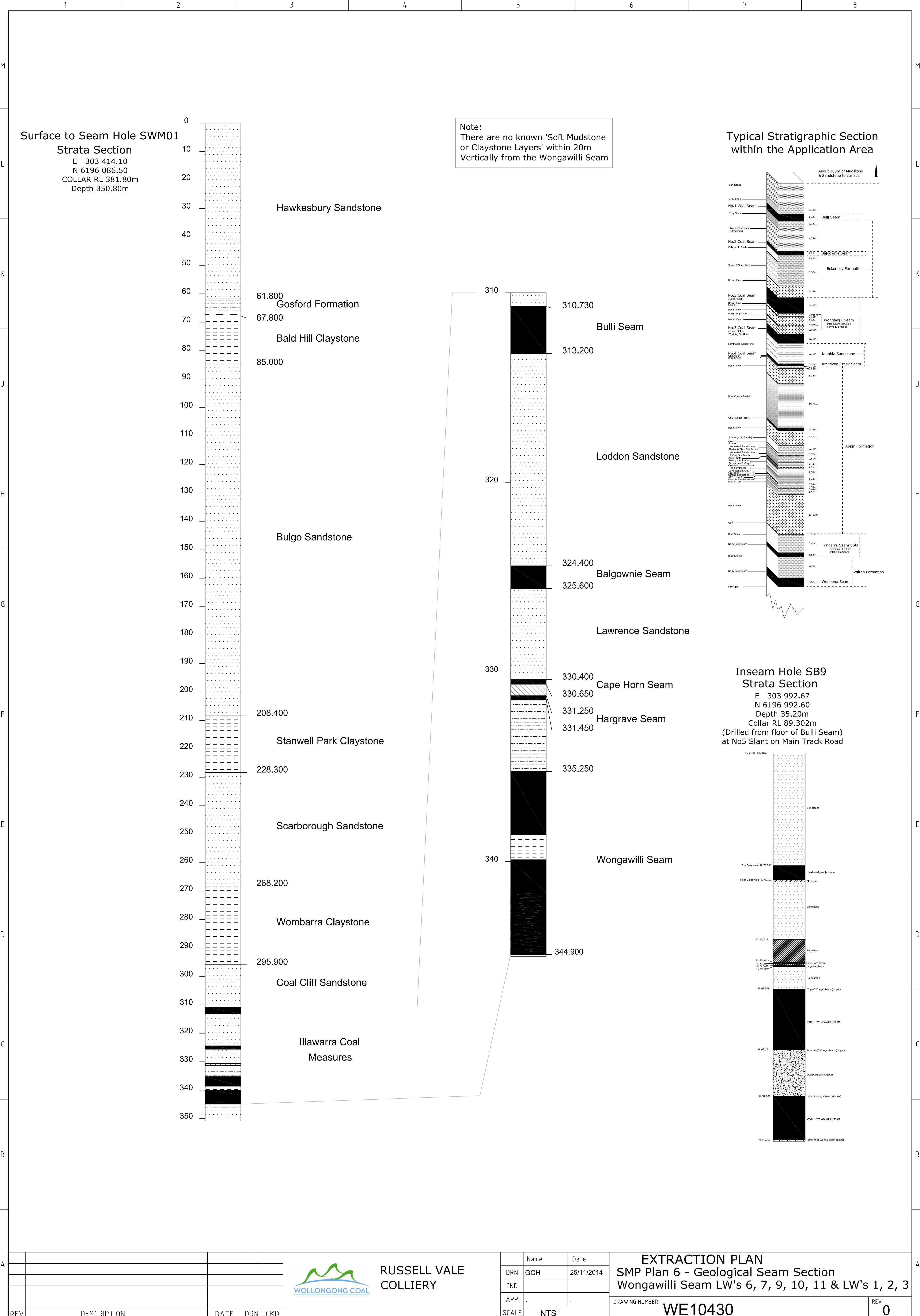


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RUSSELL VALE  
COLLIERY

Name	Date
DRN GCH	25/11/2014
CKD	
APP	.
SCALE	NTS

EXTRACTION PLAN	
SMP Plan 6 - Geological Seam Section	
Wongawilli Seam LW's 6, 7, 9, 10, 11 & LW's 1, 2, 3	
DRAWING NUMBER	REV
WE10430	0

REV	DESCRIPTION	DATE	DRN	CKD



Site	Russell Vale Colliery	DOC ID	RVC EC PLN 010
Type	Plan	Date Published	06/02/2015
Doc Title	EXTRACTION PLAN		

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# APPENDIX L

## COAL RESOURCE RECOVERY PLAN



Site	Russell Vale Colliery	DOC ID	<a href="#">Click here to enter text.</a>
Type	Plan	Date Published	15/12/2014
Doc Title	COAL RESOURCE RECOVERY PLAN		

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## COAL RESOURCE RECOVERY PLAN

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## 1. INTRODUCTION

### 1.1 Background

Wollongong Coal Limited (WCL) operates the Russell Vale Colliery (formerly known as NRE No 1 Colliery) located approximately 8 km north of Wollongong and 70 km south of Sydney. The Russell Vale Site is located on the eastern slopes of the Illawarra Escarpment. The Russell Vale Site consists of the main surface infrastructure for the colliery, including coal stockpiles, drift portals, conveyors, truck loading facilities, administration buildings and water management infrastructure.

Underground mining operations at the colliery have targeted the Bulli, Balgownie and Wongawilli coal seams. Mining operations are currently taking place in the Wongawilli seam. The underground mining domain is located beneath the Woronora Plateau, west of the Illawarra Escarpment. The portion of the underground mining domain, east of Cataract Reservoir is known as the Russell Vale East Domain (formerly known as the Wonga East Domain). The WCL mine plan for the Russell Vale East Domain consists of eight longwall panels in the Wongawilli seam, beneath previous workings in the Bulli and Balgownie seams.

WCL undertakes mining operations under Project Approval MP 10\_0046. To date, WCL has completed mining of Longwall (LW) 4 and LW5 in the Wongawilli seam within the Russell Vale East Domain. WCL has approval to mine the first 365 m of LW6 (LW6 (365 m)) and anticipates that approval to mine the remainder of LW 6 and LW 7 will be granted in 2015. This Coal Resource Recovery Plan (CRRP) has been prepared in support of an Extraction Plan for mining of LW6 (365 m). This CRRP addresses aspects of coal recovery for LW6 and LW7.

### 1.2 Statutory Requirements

The Coal Resource Recovery Plan (CRRP) has been prepared in support an Extraction Plan, as required by **Condition 7 under Schedule 3** of MP 10\_0046. This condition states;

7. The Proponent shall prepare and implement an Extraction Plan for all secondary workings on site to the satisfaction of the Secretary. This plan must;

(h) include the following to the satisfaction of DRE:

- A Coal Resource Recovery Plan that demonstrates effective recovery of the available resource.



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## 2. SCOPE

This CRRP has been developed to describe the proposed resource recovery for secondary extraction of LW6 & LW7, including LW6 (365 m). To demonstrate compliance with the statutory requirements outlined in **Section 1.2**, this CRRP provides a description of:

- Coal resource available;
- Proposed mining method, schedule and mine plan;
- Resource recovery and effects on future mining; and
- Justification for the proposed mine plan.

## 3. RESOURCE DESCRIPTION

### 3.1 Geological and Geotechnical Setting

The Russell Vale East Domain area lies in the southern extent of the Permo-Triassic Sydney Basin and contains the Illawarra Coal Measures of late Permian age. Overlying the Illawarra Coal Measures are sandstones, shales and mudstones of the Narrabeen Group, which in turn are overlain by the Hawkesbury Sandstone. Overlying the Hawkesbury Sandstone is the Wianamatta Group which is the uppermost unit in the Southern Coalfield.

The target coal seams at Russell Vale Colliery are the Bulli, Balgownie and Wongawilli Seams. The Bulli Seam is the uppermost seam and has been extensively mined since the 1880s. The Bulli Seam within the Russell Vale East Domain has previously been mined using bord and pillar methods. Within the Russell Vale East Domain, the thickness of the Bulli Seam varies from 2.05 m to 2.35 m and the depth to the seam varies from 225 m to 350 m.

The Balgownie Seam is located below the Bulli Seam and above the Wongawilli Seam. The Balgownie Seam within the Russell Vale East Domain was mined from 1970 to 1982 using longwall mining techniques. Within the Russell Vale East Domain, the thickness of the Balgownie Seam varies from 0.9 m to 1.3 m and the depth to the seam varies from 233 m to 360 m.



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The Wongawilli Seam is the deepest of the target coal seams. Within the Russell Vale East Domain, the Wongawilli Seam varies in thickness from 9.1 m to 10.6 m which is also the typical thickness for LW6 & LW7. However, only the lower extent of this seam is economic to mine. The depth of cover to the roof of the Wongawilli Seam varies from approximately 257 m near the escarpment to over 382 m in the northwest of the Russell Vale East Domain area. For LW6 & LW7 the depth of cover ranges from 282 m to 332 m.

The five or six coal seams below the Wongawilli Seams vary in thickness. Of these seams, only the Tongarra Seam has been extensively mined in the southern part of the Coalfield. In the Russell Vale East Domain, the Tongarra Seam and the other underlying seams and are not economic to mine.

### 3.2 Coal Resource

The Coal Resource and Reserve statements for Russell Vale Colliery were last updated in 2010. There has been a minor change in the stated Resource and Reserve values. The Eastern Bulli seam has been fully extracted and production of 1.6 Mt has occurred in the Russell Vale East Domain. The table below gives a summary of the Resource and Reserve tonnages of Russell Vale Colliery. The JORC statements for Russell Vale Colliery are presented in **Appendix A**.

*Table 3.1  
Coal Resources and Reserves*

Seam	Resources (Mt)				Reserves (Mt)		
	Measured	Indicated	Inferred	Total	Proven	Probable	Total
Bulli	12	31.2	13.3	<b>56.5</b>	3.2	26.2	<b>29.4</b>
Balgownie	–	34.1	41.5	<b>75.6</b>	–	–	–
Wongawilli	13.5	62.2	107.1	<b>182.8</b>	11.7	50.9	<b>62.6</b>
<b>Total</b>	<b>25.5</b>	<b>127.5</b>	<b>161.9</b>	<b>314.9</b>	<b>14.9</b>	<b>77.1</b>	<b>92.0</b>

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The predicted properties of ROM coal to be extracted by LW6 & LW7 are presented in **Table 3.2**.

*Table 3.2  
Expected Coal Quality for LW6 & LW7*

<b>Russell Vale Mine Run of Mine Coal</b>		
<b>Properties</b>	<b>Basis</b>	<b>Specification</b>
<b>UNWASHED COAL</b>		<b>Average</b>
Total Moisture	% ar	7.5
VM	% ad	18.5
Ash	% ad	35.0
Sulphur	% ad	0.44
CSN		5.5
Phosphorus	% ad	0.013
MMR	%	1.25

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## 4. MINING SYSTEM AND RESOURCE RECOVERY

### 4.1 Mine Design, Geometry and Depth of Cover

LW6 and LW7 are located on a north-east / south-west orientation. The LW6 and LW7 layout has been specifically designed to reduce impacts to key surface features and infrastructure by utilising narrow panel widths and large chain pillars. The lower Wongawilli Seam lies in a moderate setting with depth of cover ranging from 282 m to 332 m with depth increasing towards the north-west due to seam dip. Development panels will be extracted down dip from north-east to south-west. In contrast longwall extraction will retreat against the seam grade.

WCL has obtained approval to extract LW6 (365 m). The remaining length of LW6 will be extracted following completion of LW6 (365 m), subject to WCL obtaining further approvals. LW7 will be mined immediately after LW6.

**Table 4.1** presents the panel lengths, panel widths and maingate pillar widths for LW6 & LW7.

*Table 4.1  
Longwall Panel Geometry*

Longwall	Overall Void Length Including Installation Heading (m)	Panel Width(m)	Maingate Pillar Width (m)
Longwall 6 (365m)	365	150	45
Longwall 6 (remaining length)	755	150	45
Longwall 7	1175	131	45

### 4.2 Stability of Underground Workings

Geotechnical experts have provided advice on strata control and the stability of underground workings in a range of specific reports which address:

- Gateroad drivage;
- Pillar, rib and roof stability;
- Installation road and secondary support requirements;
- Longwall takeoff support requirements;





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- The extracted working section of the Wongawilli Seam is the basal 3.0 m. Approximately 7.3 m of interbedded coal and carbonaceous material forms the immediate roof, which is weak and forms a relatively steep caving angle upon longwall extraction. This provides very favourable goaf-forming characteristics and mitigates the risk of windblast events.
- Strata characteristics are monitored and managed in accordance with WCL's Mine Strata Failure Management Plan;
- Several support codes exist for the longwall and are implemented as required by the conditions encountered. The different support codes are referred to by colours, any persons intending to work at the longwall mining face is required to familiarise themselves with operational Trigger Action Response Plans (TARPs); and
- TARPs exist for strata control in the longwall including the Longwall Face Operations TARP and the Face creep and alignment control TARP. These TARPs rely on visual indicators that might be observed on the longwall face line, to set clear trigger points at which remedial action must be taken to rectify the problem encountered.

### 4.3 Mining Method and Schedule

The gateroads for LW6 have been developed by continuous miners. Secondary extraction of LW6 and LW7 will be undertaken using retreat longwall mining methods. The coal will be continuously removed from the working face onto a series of conveyors that transfer coal to the surface. As the face is cut away, both the shearer and the hydraulic roof supports advance forward for the next shear, after which the unsupported strata behind the longwall collapse.

**Table 4.2** outlines the expected sequence of longwall extraction and approximate start and completion dates.



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*Table 4.2  
Expected sequence of Longwall Extraction*

Longwall	Estimated Start Date	Estimated Completion Date
Longwall 6 (365m) Development	Complete	Complete
Longwall 6 (365m) Extraction	January 2015	March 2015
Longwall 6 (Remaining Length) Development	Complete	Complete
Longwall 6 (Remaining Length) Extraction	April 2015	July 2015
Longwall 7 Development	April 2015	November 2015
Longwall 7 Extraction	November 2015x	February 2015

#### 4.4 Possible Effect on Other Seams

The proposed LW6 and LW7 panels underlie goaf areas in the Bulli Seam and Balgownie Seam. The Bulli Seam workings overlying LW6 and LW7 consist of first workings and pillar extraction. The Balgownie Seam workings overlying LW6 and LW7 consist of longwall goaves. There are no Balgownie Seam workings that overlie the western half of LW7.

The overlying mine workings have the effect of softening the overburden strata, resulting in a greater magnitude of subsidence (compared to the subsidence above a similar width panel in a single seam scenario). However, subsidence monitoring data for previous operations at Russell Vale Colliery indicate that multi-seam subsidence occurs predominantly within the panel footprint in much the same way as a single seam scenario. Within the Russell Vale East Domain, multi-seam subsidence has occurred predominantly within the boundaries of the mined panels and intermediate chain pillars.

The proposed mining area represents the logical and final extraction of coal beneath these previously mined areas. Therefore, extraction of the Wongawilli Seam will complete the extraction of minable resources in this eastern portion of the lease and will not have further impacts on surrounding seams.

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## 4.5 Resource Recovery

It has been estimated that extraction of coal in LW6 & LW7 will recover approximately 1.3 million tonnes of run of mine (ROM) coal. Secondary extraction of LW6 (365 m) is anticipated to recover 230,000 tonnes of ROM coal. **Table 4.3** indicates the projected level of resource recovery.

*Table 4.3  
Estimated Resource Recovery for the Secondary Extraction of Longwalls 6 & 7*

Area	Secondary Extraction (tonnes)
Longwall 6 (365 m)	~230,000
Longwall 6 (remaining length)	~454,000
Longwall 7	~625,000

\* Extraction of the full length of LW6 is predicted to produce 684,000 tonnes of ROM coal.

## 4.6 Justification

Detailed information on the mine plan is provided in the Preferred Project Report (Gujarat NRE Coking Coal Ltd, 2013). The proposed mine plan for the Wongawilli Seam in the Russell Vale East Domain has been designed to minimise impacts on identified significant features whilst maintaining an economically viable coal reserve (Gujarat NRE Coking Coal Ltd, 2013).



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## 5. REFERENCES

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- Department of Planning and Environment (2014) *Guidelines for the Preparation of Extraction Plans* (draft)
- Gujarat NRE Coking Coal Ltd (2013) *Gujarat NRE Coking Coal Underground Expansion Project – Preferred Project Report*



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## APPENDIX A – JORC STATEMENTS





**RESOURCE STATEMENT FOR GUJARAT NRE No.1 COLLIERY  
as at 30th April 2010**

An estimation of Coal Resources in Gujarat NRE No.1 Colliery has been carried out by the undersigned and is here reported as prescribed by the “**Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves**” (2004 edition, The JORC Code, Clauses 37 to 39) and also using the terminology and the guidelines put forth in the 2003 edition of “**Australian Guidelines for Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves**”. The following Table summarises the results of an objective assessment of the coal resources of the NRE No.1 Colliery.

SUMMARY OF COAL RESOURCES FOR NRE No. 1 COLLIERY as at end April 2010 (million tonnes)			
SEAM	MEASURED	INDICATED	INFERRED
BULLI	12.04	31.23	13.27
BALGOWNIE		34.1*	41.5*
WONGAWILLI	13.49	62.20	107.1
TOTAL	25.5	127.5	161.9

\* Balgownie seam resources were not reviewed in this estimation

A substantiating report containing details of the methodologies, data assessment and interpretations used to derive the Resource assessment should be referenced in conjunction with the associated statement.

Barry Clark  
Technical Services Consultant  
Wollongong Office



**RESERVE STATEMENT FOR GUJARAT NRE MINEALS LTD No.1 MINE  
as at end April 2010**

An estimation of Coal Reserves for Gujarat NRE Minerals Ltd No.1 Mine has been carried out by the undersigned and is here reported as prescribed by the “**Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves**” (2004 edition, The JORC Code, Clauses 37 to 39) and also using the terminology and the guidelines put forth in the 2003 edition of “**Australian Guidelines for Estimating and Reporting of Inventory Coal, Coal Resources and Coal Reserves**”. The following Table summarises the results of an objective assessment of the coal reserve of the Gujarat NRE Minerals Ltd No.1 Mine.

NRE No1 Mine RESERVE SUMMARY	Bulli Seam		Wongawilli Seam		TOTAL
	P, 300 & V Panels	Western Bulli	Wonga East	Wonga West	
Proven Reserve	1,452,000	1,738,000	4,749,000	6,982,000	<b>14,921,000</b>
Probable Reserve	0	26,221,000	1,834,000	49,009,000	<b>77,064,000</b>
<b>Total</b>	1,452,000	27,959,000	6,583,000	55,991,000	<b>91,985,000</b>
<b>Seam Total</b>	<b>29,411,000</b>		<b>62,574,000</b>		<b>91,985,000</b>
Potential Reserve from Inferred Resource	0	6,424,000	4,870,000	24,711,000	<b>36,005,000</b>
<b>Potential Total</b>	1,452,000	34,383,000	11,453,000	80,702,000	<b>127,990,000</b>
<b>Potential Seam Total</b>	<b>35,835,000</b>		<b>92,155,000</b>		<b>127,990,000</b>

A substantiating report containing details of the methodologies, data assessment and interpretations used to derive the Resource assessment (Appendix A) should be referenced in conjunction with the associated statement and Reserve Report.

Krzysztof Markowski, *B.Eng (Mining)*  
Senior Mining Engineer  
Gujarat NRE Minerals Limited



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# APPENDIX M

## SPONTANEOUS COMBUSTION MANAGEMENT PLAN

# SPONTANEOUS COMBUSTION - MHMP 009

## MAJOR HAZARD MANAGEMENT PLAN

### 1. INTRODUCTION

Spontaneous combustion has been the source of numerous underground fires and explosions in the history of coal mining. The fact that certain coal types may readily catch on fire by themselves is an ever present danger in underground coal mines.

The Russell Vale Colliery Spontaneous Combustion Major Hazard Management Plan (hereafter 'the MHMP 009' or 'the plan') has been developed to comply with clause 28(b)(vii) of the *Coal Mine Health and Safety Regulation 2006*. In the writing of this plan, it is recognised that all underground mines are subject to some risk of spontaneous combustion. The likelihood varies from mine to mine but nonetheless each mine needs to have in place a major hazard management plan and an appropriate level of awareness and response to the hazard.

### 2. OBJECTIVE

The objective is to define the standards, procedures and responsibilities required to maintain a system for effectively managing the spontaneous combustion hazard at Russell Vale Colliery and comply with the requirements of the Health and Safety Policy, MDG 1006 Spontaneous Combustion Management Guideline (2011), and the relevant legislation.

### 3. SCOPE

The Spontaneous Combustion Major Hazard Management Plans applies to the identification and control of spontaneous combustion within the underground environment and in surface stockpiles at Russell Vale Colliery. It applies to all underground and surface personnel who are identified herein as having a role in this process.

### 4. LIMITATIONS AND ASSUMPTIONS

The main assumption is that there is low risk of a spontaneous combustion incident at Russell Vale Colliery. This is based on the following:

- Extensive mining over a period in excess of 120 years within the Balgownie, Bulli and Wongawilli seams in the Southern District of NSW indicates that Illawarra coal measures do not have a history of spontaneous combustion under a wide variety of circumstances.
- Propensity testing conducted by the SIMTARS laboratory in 2012 (report no. OG420191P1) on coal samples from Russell Vale Colliery specifically (Balgownie, Bulli and Wongawilli seam samples, and a composite [mixed] sample) was found to have a low propensity to spontaneously combust.

Irrespective of the assumption above, a Spontaneous Combustion Major Hazard Management Plans is still required by all NSW coal operations, and accordingly, this plan was developed based on information in the relevant legislation and published literature, and other management plans and associated documents such as risk assessments. These include:

*Coal Mine Health and Safety Act 2002*

- *Coal Mine Health and Safety Regulation 2006*



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- NSW Work Health and Safety Act 2011
- NSW Work Health and Safety Regulation 2011
- MDG 1006 Spontaneous Combustion Management Guideline (2011)
- MDG 1006 Technical Reference for Spontaneous Combustion (2011)
- SIMTARS, 2004. Spontaneous Combustion in Australian Underground Coal Mines.
- Ham, B. 2005. A review of spontaneous combustion incidents. In Aziz, N (ed), Coal Operators Conference proceedings, University of Wollongong and the Australian Institute of Mining and Metallurgy, pp. 237-242.
- Russell Vale Colliery Emergency Management System
- Russell Vale Colliery Ventilation and Gas Monitoring Management Plan
- Russell Vale Colliery Mine Inspection Management Plan
- Russell Vale Colliery. A risk assessment on spontaneous combustion (27.2.13)

## 5. DEFINITIONS

**Coal Rank** is used to classify coal into groups, depending on when and how the coal was originally formed. Generally, as the rank decreases, the moisture and oxygen levels and volatile matter content of the coal increase, and the carbon content decreases. It is generally found that the lower the coal rank, the higher the propensity to spontaneously combust.

**Haze or fog** may be caused by hot humid air from the goaf condensing in a cooler ventilating airflow. This is a physical indicator of spontaneous combustion.

**Propensity Testing** - There are various laboratory techniques used to measure the propensity or likelihood of a coal sample to spontaneous combustion. These include single index testing, composite indices testing, regression analysis, and expert systems.

**Pyrites** - Iron in the form of iron pyrites may be present in a coal seam. When present as veins, the surface area exposed to oxygen is relatively small and contributes little to any heating. However, in a finely divided state, the iron pyrite is able to react with oxygen to produce heat. The heat produced from oxidation of the pyrite increases the temperature of the coal and the rate of oxidation, and the increase in volume can cause fracturing of the coal which increases the surface area and allows air to enter the coal mass.

**Smell** may indicate spontaneous combustion. It is sometimes referred to as 'goaf stink', 'fire stink' or 'stink damp'.

**Self Heating** is a synonym for spontaneous combustion.

**Source of Ignition** - A heating which has progressed to a point where sufficient energy is available to ignite a flammable gas mixture. It must be accepted that an ignition source is most probably present when a heating has produced signs capable of detection by the human senses.

**Spontaneous Combustion** - Oxidisation of coal is a normal process and this produces heat and certain gases. All coal oxidises. Spontaneous combustion is the process by which certain materials can ignite as a result of internal heat which arises spontaneously due to reactions liberating heat faster than it can be lost to the environment



**Spontaneous Combustion Risk** – the sets of risks to people and/or property which may arise from spontaneous combustion where the rate of oxidation is, or is likely to, increase and result in undesirable temperature increase.

**Sweating** is another of the physical indicators of spontaneous combustion. It is the condensation of moisture on the roof, ribs or metal straps and washers used in strata support. This is a result of high temperatures in a goaf area or other underground area driving out the moisture contained in the coal. This warm and humid air condenses on the cooler surfaces outside the goaf.

## 6. CONTROL PROCEDURES

### 6.1. Design Parameters

MDG 1006 Technical Reference for Spontaneous Combustion Management Guideline (2011) provides a detailed outline of considerations for mine design, prediction, prevention, detection, response and methods of control for the spontaneous combustion hazard. This is an important supporting document for the development of this plan, and should be consulted directly for more detailed explanation of the fundamentals and history of spontaneous combustion management.

### 6.2. External Resources

External resources such as off-site or mobile gas analysis services, mines rescue response, inertisation unit or external expertise are available through NSW Coal Services.

### 6.3. Spontaneous Combustion Treatment

Processes to be used to treat spontaneous combustion at Russell Vale Colliery (should it ever occur) may include inertisation, flooding, sealing etc. Any such actions will be accompanied by a risk assessment process and development of best practice procedures in consultation with relevant stakeholders. Clause 64 of the *Coal Mine Health and Safety Regulation 2006* is noted here, as it requires the operator of a coal mine to give notice to the Chief Inspector of the first indication of spontaneous combustion in the underground parts of the coal operation.

### 6.4. Goods/Services Acquisition Control

Processes are in place for any equipment to be used in the management of a spontaneous combustion event to be fit for purpose (see Plant Introduction Management Plan). Also, any contracted services required will be managed in accordance with Contractor Management Plan (WCL HS PLN 001).

### 6.5. Mine Standards and Procedures

Relevant mine standards and procedures currently in place include:

- Safe Work Procedure for Mine Monitoring System details and responses
- Safe Work Procedure for Longwall Goaf Seal Construction
- Safe Work Procedure for Procedure to alter gas monitoring points or alarm settings
- Safe Work Procedure for Mine Shut Down Procedures
- Safe Work Procedure for Mine Pre Shift Inspection
- Safe Work Procedure for Discovery of fire underground
- Deputies Statutory Report
- Undermanagers Report

Mine standards that assist in preventing (or certainly not facilitating) spontaneous combustion are listed below:

- Accessible roadways are maintained adjacent to goaf areas,
- Restrictions in roadways are eliminated where possible,
- Ventilation control devices are installed and maintained to a high standard,
- Pillars where stoppings and seals are to be placed to contain a goaf are designed and roadways are supported to a standard so that they are stable when subject to abutment loading.
- Ventilation quantities, pressures and arrangements (eg goaf 'bleeds') are minimised consistent with requirements related to gas and dust,
- Mine water is removed,
- Longwall goaf areas are sealed following completion of extraction,
- The Longwall tailgate goaf atmosphere is monitored as the longwall retreats,
- The potential for migration of air from the Wongawilli Seam goaf to the Bulli and Balgownie Seam goaf areas is monitored and
- Boreholes that may allow air into goaf areas are sealed.

Issues (below) are not considered to be necessary in the Russell Vale Colliery circumstance.

- Pressure balancing of seals,
- Provision for inertisation of extracted areas,
- Segregation of parts of the mine and
- Regular sampling from behind goaf seals

## 7. MONITORING

### 7.1. Inspections

Inspections for "evidence of self heating" are included on the Deputies Statutory Report. This forms part of the Mine Inspection Management Plan.

The signs that would indicate a possible self heating circumstance to a Mining Supervisor performing an inspection required under the Mine Inspection System, particularly if investigating an atmospheric monitoring anomaly or if abnormal methane or CO levels have been detected, are :

- Sweating (see definitions).
- Haze or Fog (see definitions) often described as a shimmering or blurring (heat haze)
- Smell (see definitions) - the smell itself is reminiscent of rotten egg gas (Hydrogen Sulphide) at higher temperatures and at lower temperatures is usually a petrol-like odour.
- Hot air from the goaf may be an indication that self heating is occurring.
- Smoke is obviously an indicator that a fire is imminent.

### 7.2. Gas sampling and Analysis

The Ventilation and Gas Monitoring Management Plan (MSMP-002) details the ventilation standards applicable within the mine and the type, location and standards of monitoring devices. These are supplemented by the hand held monitors issued to all mining supervisors.



### 7.3. Continuous Gas Monitoring

The mine operates both tube bundle and real-time gas monitoring systems as required by legislation and mining approvals. See also MSMP 002 SWP3 Mine Monitoring System details and responses.

Monitoring devices installed within the mine site include:

- Air pressure is measured at the Russell Vale Coal plant barometer and is recorded in the Russell Vale Control Room. This provides indication of the potential for goaf areas to be 'breathing' in or out and are to be read and recorded each shift on the Deputies Statutory Report.
- Differential pressure sensors located on the main fans to automatically indicate any sudden change in ventilation pressure produced by the main fan.
- Multi-gas real time monitors located at strategic points in the mine's ventilation system and in the vicinity of items of plant that represent either a heightened fire risk or require protection against the presence of flammable and noxious gases.
- Tube bundle monitoring to support the real time monitoring system.

The atmospheric monitoring arrangements in place at the mine analyse for CH<sub>4</sub>, CO, CO<sub>2</sub> and O<sub>2</sub> with instantaneous high and sustained high alarms. These will be supplemented as the mine develops and further locations require regular monitoring but the system provides for the early warning of potential gas-related and combustion issues that require closer investigation or an immediate response. The occurrence of an abnormal concentration of CO that, on investigation cannot be adequately explained and controlled may be an initial indicator of spontaneous combustion and must be reported to the MME. Further interpretation of gas evolution and ratios (as defined in MDG 1006 Technical Reference, Section 6.6) will come into effect if the MME determines this to be necessary. He will involve the requisite expertise in such considerations.

### 7.4. Trend Analysis

The mine has in place processes for the monitoring of conditions and detection of changes in the mining environment of spontaneous combustion indicators (e.g. MSMP 005 Mine Inspection Management Plan and MSMP 002 SWP3 Mine Monitoring System details and responses). This includes the collection and retention of relevant records (e.g. archiving of statutory reports; also storage of relevant records for each management plan, including MSMP-026, on O Drive).

### 7.5. Calibration

The calibration requirements for gas monitoring instrumentation that may be used for spontaneous combustion management are detailed in MSMP 022 Plant Inspection and Testing Scheme.

### 7.6. Response

The mine's Emergency Management System (MSMP 001) provides a plan for the mitigation of all types of emergency scenarios, including spontaneous combustion, and includes measures to protect personnel and the mine itself.

#### 7.6.1. Triggered Action Response Plans (TARP's)

A specific TARP has been developed to deal with spontaneous combustion events and is contained in Withdrawal Conditions TARP.

### 7.6.2. Incident Management Team

Control of a spontaneous combustion event at Russell Vale Colliery would involve use of the duty card system and formation an Incident Management Team (see Duty Cards and Incident Management Guideline).

### 7.6.3. Withdrawal of Persons

In place is a process for the withdrawal of persons from the mine in the event of a potentially life threatening situation (including from a spontaneous combustion event), see Withdrawal Conditions TARP.

### 7.6.4. Emergency sealing

Arrangements for the rapid and effective sealing of the mine form part of MSMP 001 Emergency Management System.

## 7.7. Document and Data Control

The document control system in place at the mine site is durable, communicable and able to be updated (see WCL SYS PRO 001 Document Control Procedure).

## 7.8. Record keeping

See also WCL SYS PRO 001 Document Control Procedure.

## 7.9. Corrective action

The corrective action procedure, or SHRECQ request (Safety Health Environmental Community and Quality System) as it is also known, provides a means for all personnel involved in the operation of the management plans to report non-conformities. If any employee believes he has discovered a nonconformance with the provisions of this plan or wishes to submit a suggestion aimed at improving the effectiveness of this plan in managing spontaneous combustion, he or she should formalise those concerns in writing and submit it to the Shift Undermanager who will in turn forward it to the Manager of Mining Engineering who shall address the issue.

## 8. INFORMATION

The mine planning and design process has considered spontaneous combustion, albeit as a low-risk hazard compared to other mine-specific hazards. Extraction is by way of development of gate roads and then longwall mining with the number of entries minimised and percentage extraction maximised consistent with safe and efficient mining of the resource.

Historically, it has not been considered to be necessary in South Coast mines, in the sealing of goaf areas, to introduce any special pressure balancing arrangements or to install high-rated seals. As well, controls in relation to gas, in particular goaf 'bleed' systems have been considered to be of greater priority than the potential for spontaneous combustion. Where appropriate, provision will be made in seals to allow sampling of the atmosphere within any sealed area.

In relation to surface stockpiles of coal at Russell Vale Colliery, if a spontaneous combustion or fire event was to occur on or within the stockpile, the response actions may include exposing the 'seat' of the heating and/or quenching with water or otherwise as determined by the MME coupled with an ongoing monitoring and inspection program to ensure the heating does not re-ignite. Should the nature of surface stockpiling or the site of surface stockpiles at Russell Vale



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Colliery change, the Russell Vale Colliery Site Supervisor will discuss the change with the MME and determine if an assessment of risk is necessary related to the potential for spontaneous combustion to occur due to the altered circumstances.

In the event of a spontaneous combustion incident occurring at Russell Vale Colliery, a recording form has been developed. This follows the guidance materials in MDG 1006 and allows for a standard set of variables to be documented which may assist in subsequent analyses and mine-site comparisons.

## 9. TRAINING

Persons with responsibilities under the MHMP 009 shall undergo training including:

- the relevant sections of the MHMP 009 and the importance of compliance
- roles and responsibilities of persons in relation to the operation of the MHMP 009
- spontaneous combustion indicators
- reporting and recording the observation of spontaneous combustion related indicators
- relevant standards and procedures associated with the MHMP 009
- conduct of internal and external audits
- persons new to the mine should be trained in relevant aspects of the MHMP 009

## 10. ROLES AND RESPONSIBILITIES

### Manager of Mining Engineering (MME)

- Understand the requirements of this Plan
- Be conversant with MDG 1006 Spontaneous Combustion Management Guideline
- Provide all necessary resources as required to comply with the requirements of this plan
- Ensure all plan requirements are in place and check periodically that they are being followed
- Instigate audits and reviews as required
- Ensure all training is carried out as per this plan and that appropriate records are maintained
- Authorise any changes to the plan and advise the Inspectorate

### Production Manager

- Understand the requirements of this plan
- Act as the MME's nominee in his absence for all aspects of the plan.
- Be aware of MDG1006 Spontaneous Combustion Management Guideline
- Ensure complaints or deviations with respect to this plan are addressed promptly
- Report Instances of abnormal gas make (particularly CO and CH<sub>4</sub>) to the MME whether detected by him or by other mining supervisors.
- Monitor trending through the tube bundle and real time monitoring system.
- Bring to the MME's attention any matter of which he or any mining supervisor becomes aware that may represent a hazard under this plan.

### Undermanagers

- Understand the requirements of this plan.
- Ensure, on each shift, that all aspects of the plan are followed.
- Bring to the MME's attention any non-conformance or areas of concern that relate to this plan



- Report Instances of abnormal gas make (particularly CO or CH<sub>4</sub>) to the Production Manager or MME whether detected by him or by other mining supervisors
- Monitor trending through the tube bundle and real time monitoring system
- Participate in review meetings if required
- Ensure all ventilation appliances are maintained to the appropriate standards.

### **Geologist**

- Ensure that all geological information is plotted on a plan.
- Pass coal quality information appropriate to the prediction of spontaneous combustion properties to the MME.
- Bring to the MME's attention any matter of which he becomes aware that may represent a hazard under this plan.

### **Russell Vale Colliery Site Supervisor**

- Conduct a weekly stockpile inspection and report the result of this to the MME.
- Investigate any report of the possible occurrence of self heating in any surface coal or refuse accumulation and report the results of the investigation to the MME.
- Bring to the MME's attention any matter of which he becomes aware that may represent a hazard under this plan.

### **Deputies**

- Ensure that any observation during any inspection conducted that may relate to the occurrence of spontaneous combustion is recorded on his shift report and that he advises the Shift Undermanager
- Notify the crew of any changes that may indicate the presence of a heating
- Ensure that all areas of this plan are complied with in his area of control
- Report Instances of abnormal gas make (particularly CO and CH<sub>4</sub>) on his shift report and advise the Shift Undermanager.

### **Ventilation Officer**

- Ensure that weekly gas monitoring trending information is reviewed for indications of spontaneous combustion
- Report instances of abnormal gas make (particularly CO and CH<sub>4</sub>) whether detected by the tube monitoring or real time monitoring system to the MME
- Bring to the MME's attention any matter of which he becomes aware that may represent a hazard under this plan.

### **Coal Handling and Processing Plant (CHPP) Workforce (including Contractors)**

- Endeavour (as far as is practical) to load out the oldest stockpiled coal in preference to newer stockpiled coal,
- Bring to the attention of the Russell Vale Colliery Site Supervisor the presence of any coal that has been stockpiled for longer than 3 months so that consideration can be given to sealing this coal to prevent the ingress of oxygen and
- Immediately report to the Russell Vale Colliery Site Supervisor or Geologist any physical signs that may indicate the presence of a heating in a stockpile or refuse emplacement area.

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## General Underground Workforce (including Contractors)

- Follow instructions as given by any statutory officials concerning spontaneous combustion.
- Bring to the attention of a mining supervisor any changes in the nature of the coal being mined or mining conditions.
- Advise a mining supervisor of any concerns or information that relate to this plan.

## 11. AUDIT AND REVIEW

The plan shall be audited and reviewed at 3 yearly intervals and the Manager of Mining Engineering shall be responsible for ensuring their inclusion in the internal/external audit and review schedules. The audit and review process shall include a review of risk assessments associated with this plan and review of legislative requirements and MDG 1006 Spontaneous Combustion Management Guideline.

Triggers that may also initiate a review of the plan include:

- A spontaneous combustion event at Russell Vale Colliery or within the NSW southern coalfields
- Directives from the Inspectorate
- Changes to legislation, departmental policies (e.g. MDG 1006) and standards
- Recommendations from accident/incident investigations and analyses
- Change of management structure



Records of all audits should be maintained.

## 12. DOCUMENT CONTROL

This MHMP will be maintained as per Wollongong Coal's Document Control Procedure (WCL SYS PRO 001). There is to be one controlled copy maintained in the MME's office and another controlled copy in the Control Room. These are the only controlled copies available and will be updated and revised as appropriate. All other copies of this document are not subject to updating or revision and should be treated as uncontrolled documents that may fall out of date.

The master copy will be located and maintained electronically within SHECQ.

The MME is responsible for ensuring that this System remains current. Revision issues can only be released when approved by the MME and copies of each revision will be supplied to the holders of controlled copies.

DOCUMENT AUTHORISATION:			
Document Owner	Rhys Brett Manager of Mining Engineering	Effective Date	1 <sup>st</sup> August 2014
Approved by	Rhys Brett Manager of Mining Engineering	Approved by	Matthew Way Operations Manager
Signature		Signature	



## Revisions

VERSION	DATE REVIEWED	REVIEW TEAM (CONSULTATION)	NATURE OF THE AMENDMENT
1	30/07/2014 31/07/2014	G Smart, Rhys Brett	NRE MSMP 026 converted to a WCL RVC Major Hazard Management Plan in accordance with the CMH&S Regs 2006 & MDG 1006 Spontaneous Combustion Management Guideline (2011).
2			