Appendix A

Current Environmental Management Plans

GUJARAT NRE COKING COAL LIMITED
A.B.N. 28 111 244 896
NRE No 1 Colliery

NRE No.1 Colliery
Wonga East – Longwalls 4 & 5 EP/SMP

LW5 SUBSIDENCE MONITORING PLAN

GUJARAT NRE COKING COAL LIMITED
A.B.N. 28 111 244 896
NRE No 1 Colliery

Document Version	Revision				Revision Notes
	Date	Author	Checked	Release Date	
Rev 0	05/12/2012	D. Clarkson	K. Prajapati	7/12/2012	Final
Rev 1	07/02/2013	K. Prajapati	K. Prajapati	12/02/2013	Changes requested by DRE

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GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
AHD	Australian Height Datum
DoP&I	Department of Planning & Infrastructure
DSC	Dam Safety Committee
Mtpa	Million tonnes per annum
NRE	Gujarat NRE Coking Coal Limited
RMS	Roads and Maritime Services
ROM	Run of Mine
SCA	Sydney Catchment Authority
SMP	Subsidence Management Plan
AHD	Australian Height Datum

Terms	
Project Approval	Pt3A Major Project approval MP10_0046 as modified

1 INTRODUCTION

1.1 Project Background

Gujarat NRE Coking Coal Ltd (NRE) operates 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.

On 13 October 2011, the Project Approval (MP 10_0046) for the No.1 Colliery Preliminary Works Project was granted by the Minister for Planning under Section 75(J) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This approval allows NRE to continue its operations at the mine including the extraction of coal up to 1 million tonnes per annum and upgrade of and improvements to surface facilities, in addition to first workings and transport of coal to the Port Kembla Coal Terminal for shipment as required.

NRE intends to expand its mining operations at No.1 Colliery and has submitted an application for a Underground Expansion Project (MP 09_0013) which is currently under assessment by the Department of Planning and Infrastructure (DoP&I). In order to ensure the ongoing viability of the mine while awaiting the necessary approvals, NRE lodged a concurrent Subsidence Management Plan (SMP) application for the extraction of Longwalls 4 and 5 to the Department of Trade and Investment, Division of Resources and Energy (referred to herein as DRE). The SMP approval for Longwall 4 was granted on 26 March 2012 by DRE, however, approval for Longwall 5 was not granted.

NRE lodged a section 75W (s75W) Modification Application to Project Approval (MP 10 0046), located within the approved Preliminary Works 'Application Area', to modify the Preliminary Works Approval (MP 10_0046) to include:

- Amending the reference to the use of maingates (MGs) 4 and 5 from exploratory driveages to operational gateroads;
- The extraction of coal using longwall mining techniques from Longwall (LW) 4 in accordance with the approved SMP;
- The extraction of coal using longwall mining techniques from Longwall (LW) 5; and
- Development of maingates (MGs) 6, 7 and 8.

The proposed longwalls are wholly contained within the Sydney Catcment Authority (SCA) controlled Metropolitan Catchment Area, which is used to provide drinking water to Sydney and Wollongong. The longwalls lie outside the Dam Safety Committee (DSC) Notification Area for Cataract reservoir, with the reservoir high water mark located approximately 600 m northwest of Longwall 5.

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

1.2 Purpose and Scope

This monitoring plan details the monitoring to be undertaken of subsidence effects, subsidence impacts and environmental consequences from the extraction of Longwalls 4 & 5 in the Wonga East

domain. It also details the actions required to ensure that the appropriate responses to the monitoring results are implemented.

The purpose of this Plan is to:

- Provide data to assist with the management of the risks associated with subsidence, conventional or un-conventional;
- Validate the subsidence predications;
- Analyse the relationship between predicted and resulting subsidence effects and environmental consequences; and
- Inform the Contingency Plan and adaptive management process.

The plan is applicable to all surface areas which may be affected by mine subsidence due to the extraction of Longwalls 4 & 5, defined as the Study Area in the Longwalls 4 & 5; Maingates 6. 7 & 8 Pt3A modification application and also within the 'Additional Subsidence Management Area' defined on **Plan 2e – Additional Subsidence Management Area** (attached as **Appendix B**).

A summary of the monitoring of environmental consequences is included in this Plan, however further details are provided in the specific Management Plan relevant to that feature.

The Subsidence Monitoring Programme in this document also refers to following management plans:

(1) "NRE No.1 Colliery Wonga East – Longwall 4 & 5 EP/SMP LW 5 Electricity Transmission Lines Management Plan", Revision No.0, signed by the representatives of the Leaseholder and Endeavour Energy on 10 December 2012;

(2) "NRE No.1 Colliery Wonga East – Longwall 4 & 5 EP/SMP LW 5 Electricity Transmission Lines Management Plan", Revision No.1, signed by the representatives of the Leaseholder and Transgrid on 7 January 2013;

(3) "NRE No.1 Colliery Wonga East – Longwall 4 & 5 EP/SMP LW 5 Built Features Management Plan (RMS)", Revision No.3, signed by the representatives of the Leaseholder and RMS (Road and Maritime Services) on 6 December 2012 and 21 December 2012, respectively, and

(4) " NRE No.1 Colliery Wonga East – Longwall 4 & 5 EP/SMP LW 5 Public Safety Management Plan", Revision No.0, dated 3 December 2012.

Surface Features Plan

RUSSEL VALE NSW

Legend

- Longwall 5
- Longwall 4 Goaf
- Broad Headed Snake Habitat
- Electricity Transmission Line (LPI)
- Fire Trails and Vehicle Tracks (LPI)
- Major Roads (LPI)
- Watercourses (LPI)
- Project Application Area
- Upland Swamps (Biosis Research 2012)
- Major Waterbodies (LPI)
- Cadastre (LPI, 2011)

Archaeological Sites (AHIMS)

- Axe Grinding Groove
- Axe Grinding Groove - AHIMS Location - Unrelocated
- Axe Grinding Groove - Monitoring Point
- Open Camp Site
- Shelter with Art

N W E S

FIGURE 1

1:12,500 Scale at A3

Metres

0 200 400 600 800

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2012-12-06
Coordinate System: GDA 1994 MGA Zone 56
Project: 112069-02
Map: G2004_SurfaceFeaturesPlan.mxd 01

Aerial Imagery supplied by NearMap and associated third party suppliers (July 2012).

1.3 Consultation and Distribution

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

- Department of Planning (DoP&I);
- Division of Mineral Resources (DRE);
- Sydney Catchment Authority (SCA); and
- Roads and Maritime Services (RMS)

In accordance with ***Condition 10/Schedule 5*** of the Project Approval, NRE will make this Plan publicly available on the NRE website and will be responsible for its maintenance. A hard copy will also be kept at the Mine Site.

Any revisions undertaken will be the responsibility of NRE and any notifications sent accordingly. NRE will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on NRE's computer system, website, and hard copy at the Mine Site.

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-conformances

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

Figure 2 shows this Plan's position within the NRE Environmental Management Structure.

Environmental Management Structure

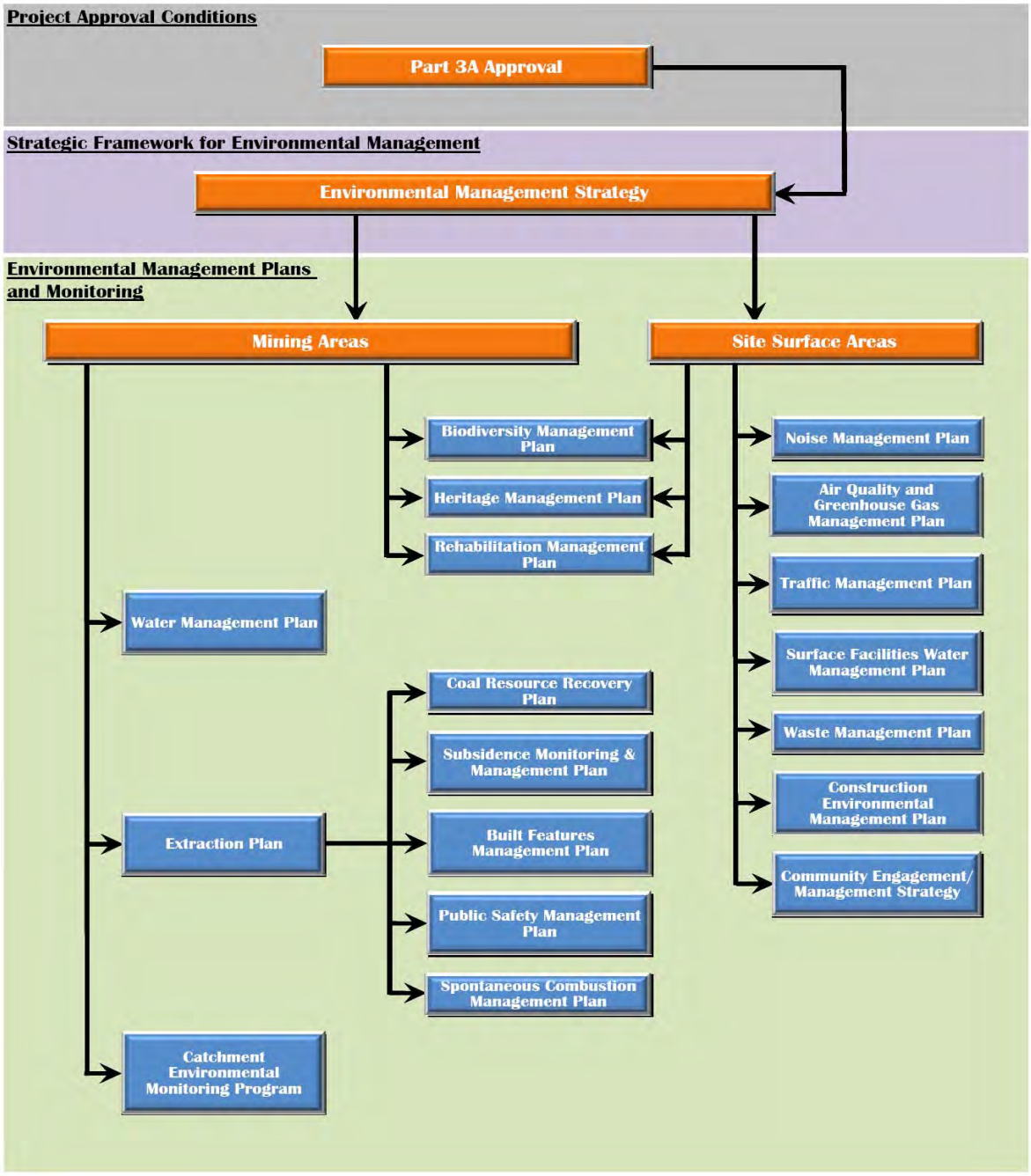

Figure 2 - Environmental Management Structure

2 STATUTORY REQUIREMENTS

2.1 Approval

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

Extraction Plan

7. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Director-General. This plan must:
…
(h) include the following to the satisfaction of DRE:
…

- *a Subsidence Monitoring Program to:*
  - *provide data to assist with the management of the risks associated with subsidence;*
  - *validate the subsidence predictions;*
  - *analyse the relationships between predicted and resulting subsidence effects and redicted and resulting subsidence impacts and environmental consequences; and*
  - *inform the contingency plan and adaptive management process;*

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
Condition 2/Schedule 5	
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
(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:	

Project Approval Condition	Plan Section
• impacts and environmental performance of the project; • effectiveness of any management measures (see c above);	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;	Sections 8
(g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and	Section 7
(h) a protocol for periodic review of the plan.	Section 8

2.2 Licences and Leases

In addition to the requirements of the Project Approval, all activities at or in association with the Gujarat NRE No.1 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	27/12/1990 – 30/12/2023
Mining Purposes Lease	271	09/05/1991 – 09/05/2033
Mining Lease	1575	22/3/2012 – 22/3/2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31/10/2001 23/01/2002 28/06/2001
Approval to mine P&O Panels (first workings)	10.123.081	7/01/2005
DC for Thin Seam Mining P/L	D1096/01	19/09/2001
EPA Licence	12040	Current
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10/08/1992
DC for Storm Water Control Dam and Water Treatment	D91/551	17/06/1992
Dangerous Goods Licence	NDG021269	14/11/2012 - 01/11/2013
SPCC Approval for Stage 3	90/4711 (280021C/20)	04/09/1992
DC for Russell Vale Waste Emplacement	D89/839	11/04/1990
DC for Demolition of Washery	D2004/32	14/12/2004

Licence/Approval	Document No.	Issue Date/Expiry Date
Mining operations Plan (MOP)		01/01/2008 – 31/12/2017
Water Extraction Licence	To be determined	Submitted to NoW in January 2009

2.3 Relevant Legislation and Guidelines

NRE will conduct the Project consistent with the Project Approval conditions and any other legislation that is applicable to the approval under the *EP&A Act.*

- *Mining Act, 1992*
- *Contaminated Land Management Act, 1997*
- *Dangerous Goods Act, 1975*
- *Noxious Weeds Act, 1993*
- *Road and Rail Transport (Dangerous Goods) Act, 1997*
- *Roads Act, 1993*
- *Protection of the Environment Operations Act, 1997*
- *Threatened Species Conservation Act, 1995*
- *Sydney Water Catchment Management Act, 1998*
- *Coal Mine Health and Safety Act, 2002*
- *Crown Lands Act, 1989*
- *Dams Safety Act, 1978*
- *Energy and Utilities Administration Act, 1987*
- *Fisheries Management Act, 1994*
- *Water Act, 1912*
- *Water Management Act, 2000.*

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

3 IMPACT ASSESSMENT

3.1 Baseline Data

Details of the existing surface features within the Study Area are provided in the Longwalls 4 and 5 SMP (NRE, 2011),the Subsidence Impact Assessment (SGPL, 2011) and the Environmental Assessment associated with the LW 4 & 5; Maingates 6, 7 & 8..

Generally, the surface land overlying the proposed extraction area lies wholly within crown land, declared as a Special Area which is controlled by the SCA. The surface topography comprises of undulating land and dense bushland. All streams and drainage are directed towards Cataract Dam, via Cataract Creek, Cataract River and their tributaries. Surface elevations range from 31 m to 390 m AHD.

Known surface and man-made features in the Study Area which may experience subsidence effects or impacts (or outside the Study Area but which may experience far-field subsidence effects) are:

- Declared Special Metropolitan Catchment lands controlled and managed by SCA;
- Rivers and Creeks (Cataract Creek and Cataract River);
- Upland swamps;
- Threatened and protected species;
- Natural vegetation;
- Cliffs and steep slopes;
- Areas of indigenous archaeological interest;
- Mt Ousley Road;
- Other Roads (dirt roads and fire trails);
- Bridge (Picton Road);
- Electricity transmission lines;
- Exploration boreholes; and
- Survey control marks.

The Study Area is not in an MSB Subsidence Area. Further, as all of the land is within the Special Area there are no known Public Amenities; Farm Lands/Facilities; Industrial/Commercial/Business Establishments; or Residential establishments within the Study Area.

3.2 Potential Impacts

The Subsidence Impact Assessment (SGPL, 2011) provided the predicted subsidence effects and subsidence impacts from the proposed mining on these features for the original SMP application for Longwall 4. Updated predictions based on subsidence survey data from the extraction of Longwall 4 and updated impact assessments was included in the LW 4 & 5 and Maingates 6, 7 & 8 Pt3A modification application's Environmental Assessment (EA). Further supplementary information to the EA was included in the NRE Response to Submissions Report dated 5 October 2012, Addendum to the NRE Response to Submissions Report dated 6 November 2012, and the revised SCT Response to Submissions Report dated 14 November 2012.

Former workings in the Bulli Seam and Balgownie Seam overlay the proposed workings in the Wongawilli East area. The Bulli workings date from early to mid 20th century, and the Balgownie workings, which were longwalls, were extracted between 1970 to 1982.

Because of the need to progressively validate model assumptions that underpin the prediction of subsidence with multiple seam extraction and the resultant subsidence impacts, engineering and administrative controls are proposed to manage the mining. These controls will continue to be developed progressively as monitoring data are collected and prediction models refined (SGPL, 2011).

The SMP provided as Appendix XI to the Longwalls 4 & 5 SMP Written Report provided details of the proposed monitoring, mitigation and management measures to be employed by the Colliery to manage subsidence impacts. The various subsidence management plans, including this one, have been updated for Longwall 5.

3.2.1 Risk Assessments

NRE has undertaken several Risk Assessments to determine key potential impacts from the extraction of Longwalls 4 & 5. The results of these assessments as relevant to the extraction of Longwalls 4 & 5 are presented below. The results of these Risk Assessments and supporting investigations by specialist consultants have informed the level of monitoring proposed in this Monitoring Plan.

Olsen Environmental Consulting. November 2009. NRE No.1 Colliery Wongawilli East and West Mining Areas. Failure Mode and Effects Analysis Report.

This Assessment was undertaken using the Failure Mode and Risk and Effect Analysis (FMEA) which is a recognized methodology described in the NSW Department of Primary Industries document MDG 1010, "*Risk Management Handbook for the Mining Industry*".

Although this Olsen (2009) RA included an assessment for both the Wonga East and Wonga West areas some of the findings are applicable to Longwalls 4 & 5 in Wonga East. A summary of the results of this RA, being the identified effects with a risk above low is provided in **Table 3.1**.

Knjconsultants. NRE No. 1 Colliery – Pillar Run in the Bulli Seam associated with Wongawilli Seam LW4 & LW5 Extraction. 6 March 2012.

A risk assessment was conducted at NRE No. 1 Colliery on Friday 2 March 2012 to identify, analyse, evaluate and treat the risk of subsidence that may extend beyond the predicted footprint as a result of extraction of the Wongawilli Seam Longwalls 4 and 5. The primary source of the risk was nominated as an event known as "Pillar Run" that has the potential to occur in old Bulli Seam workings that overly the proposed LW4 and LW5 zone, once operations in that area commence.

The potential consequence of a Pillar Run event is impact to a range of surface features, both natural and man-made, as identified in **Table 3.2** below. The risk assessment was conducted using the Bow Tie methodology. The risk assessment team comprised of representatives from NRE No. 1 Colliery, Seedsman Geotechnics and Pells Consulting.

The anticipated extent of any pillar run, should it occur, was determined in the Risk Assessment to be limited by Barriers in the Bulli Seam Workings (as shown in **Figure 4** – **Appendix B**).

Table 3.1 - LW's 4 & 5 Risk Assessment

Effect	Risk	Recommended Action (OEC, 2009)	Application to Longwalls 4 & 5	Longwalls 4 & 5 Risk
Adverse Impact on the habitat of the aquatic threatened species (Macquarie Perch) above Wongawilli East – Area 2 resulting in an interruption to/loss of spawning cycles.	Medium	Cardno Ecology Lab (CEL) to undertake necessary field work to determine whether Macquarie Perch is present in the Creek.	A number of Macquarie Perch were captured during electrofishing surveys in Cataract Creek, ~1.2 km downstream of Longwalls 4 & 5 (CEL, 2010). The extraction of coal from Longwalls 4 & 5 does not pose a significant risk to Cataract Creek or the Cataract River, and is unlikely to result in changes to stream flow, pond drainage and/or water quality (ERM 2011b). A Biodiversity Management Plan has been prepared to ensure the appropriate management of this item.	**Low**
Loss of maternity and roost sites for cave-roosting population of the threatened Eastern Bent-wing Bat.	Medium	Design monitoring activity to enable better prediction of the effects of mine subsidence on potential roost sites.	Although present in Wonga East, no habitat for Eastern Bent-wing Bat was identifies above Longwalls 4 & 5.	**Low**
Potential adverse subsidence effects on specific highly significant upland swamp and associated creek (Frog Swamp and Frog Creek) resulting in the loss of breeding habitat for the Giant Burrowing Frog (*Heleioperous australiacus*).	High	ERM to undertake field studies to ascertain extent and condition of species habitat.	The longwalls layout has been revised by NRE to minimise the impacts to significant swamps above Longwalls 4 & 5. Additional studies have been undertaken (ERM, 2012) and Biosis 2012 to reflect the revised impact on the swamps and these are now deemed to be negligible. A Water Management Plan has been prepared to ensure the appropriate management of this item.	**Low**
Disturbance to tributary standing pools	Medium	Implement appropriate monitoring	Not Applicable to Longwalls 4 & 5.	**N/A**

in tributaries to Wallondoola Creek above Wongawilli West Area 3. Adverse impacts are not likely.		program to confirm subsidence predictions. Mine plan has already been modified to minimise effects on major structures.		
Disturbance to tributary standing pools in 1st to 3rd order tributaries of Lizard Creek above Wongawilli West.	Medium	Ensure appropriate monitoring program is in place prior to mining in these areas.	Not Applicable to Longwalls 4 & 5.	**N/A**
Failure of Bald Hill Claystone due to mine subsidence leading to potential draining of Hawkesbury Sandstone aquifer through the Claystone and through underlying lithologies to workings.	Medium	Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.	The layout of longwalls 4 & 5 has been specifically designed with narrow panels and large chain pillars and revised in length to minimise the impacts to the Hawkesbury Sandstone aquifer.	**Low**
Mine subsidence leading to potential draining of lower to middle Bulgo Sandstone aquifer and underlying aquifers through goaf to workings.	Medium	Undertake appropriate monitoring to ascertain whether this type of failure has occurred. Will enhance future modelling predictions.	The layout of longwalls 4 & 5 has been specifically designed with narrow panels and large chain pillars and revised in length to minimise the impacts to the lower to middle Bulgo Sandstone aquifer.	**Low**
Rock shelters without art – Wongawilli East – Area 2. Potential impacts Collapse of rock shelter, cracking, changed conditions relating to water exposure.	Medium	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang. Rating all sites for scientific significance and potential damage. Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.	Additional assessment Biosis (2012) found only a rock grinding groove in the Longwalls 4 & 5 Study Area. Potential risk of the complete destruction of this item was deemed to be low. A Heritage Management Plan has been prepared to ensure the appropriate management of this item.	Low
Mine subsidence resulting in collapse of rock shelter along major creeks and their tributaries (Lizard Creek and Wollondoola Creek) in Wongawilli West – Areas 3 and 4.	Medium	Detailed monitoring prior to mining in conjunction with improved subsidence monitoring base. Should failure be predicted, suitable response can be developed at the time eg physical support of overhang.	Not Applicable to Longwalls 4 & 5.	**N/A**

Table 3.2 - Pillar Run Risk Assessment (knj, 2012)

Description	Residual Risk Rating			
	OHS	Assets	Env	Rep
Damage to Mt Ousley Road Pavement	5E	1E	N/A	2E
Damage to Mt Ousely Road culvert at Cataract Creek	5E	1E	N/A	2E
Damage to Picton Road	Hazard does not exist with respect to this surface feature			
Damage to Mount Ousley Road Interchange & Bridge	Hazard does not exist with respect to this surface feature			
Damage to 330kV transmission line	5E	5E	N/A	5E
Damage to 132kV transmission line	5E	5E	N/A	5E
Damage to 4 x 33kV transmission lines	5E	5E	N/A	5E
Various Dirt Fire Roads/ Trail	Nil identified effects			
Stored waters of Cataract Dam	Hazard does not exist with respect to this surface feature			
Various microwave/ Radio transmitters	Hazard does not exist with respect to this surface feature			
Cataract Creek	5E	5E	4E	3E
Cataract River	Hazard does not exist with respect to this surface feature			
Swamps associated with Cataract & Bellambi Creeks and Cataract River	5E	5E	3E	3E
Illawarra Escarpment	Hazard does not exist with respect to this surface feature			
Archaeological Sites	Nil hazard identified			
Threatened species habitat	5E	5E	4E	3E

4 PERFORMANCE MEASURES AND CRITERIA

Performance Criteria for the purposes of this Monitoring Plan are set out in ***Conditions 1 & 4, Schedule 3*** of the Project Approval and are replicated in Table 4.1.

NRE will also monitor if the recorded subsidence effects have the predicted environmental consequences. A summary of this monitoring is provided in **Appendix A**.

Table 4.1 provides the Performance Criteria for the project.

Table 4.1 - Subsidence Impact Performance Criteria

Water Resources	
Wallandoola Creek and Cataract Creek	Negligible environmental consequences including: • *negligible* diversion of flows or changes in the natural drainage behaviour of pools; • negligible gas releases and iron staining; and • negligible increase in water cloudiness
Cataract Reservoir	Negligible leakage from the reservoir and negligible reduction in the water quality of the reservoir
Swamps	
Upland Swamps adjacent to Wallandoola and Lizard Creeks (including valley fill swamp WCvfs1),Cataract Creek Upland Swamp 4 (CCUS4) and Cataract River Upland Swamp 1 (CRUS1)	Negligible environmental consequences including: • negligible change in the size of the swamps; • negligible change in the functioning of the swamps; • negligible change to the composition or distribution of species within the swamps; and • negligible drainage of water from swamps, or redistribution of water within the swamps.
Cataract Creek Upland Swamp 3 (CCUS3)	No greater subsidence impact or environmental consequences than predicted in EA – Mod 1
Biodiversity	
Threatened species, threatened populations, or threatened ecological communities	Negligible environmental consequences
Heritage Features	
Aboriginal heritage site 52-2-1223 and 52-2-0322	Negligible impact or environmental consequence
Built Features	
Key public infrastructure: Mt Ousley Road, Telstra fibre optic cable F HOME 2005 48 and 330 and 132kV power transmission lines	Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repairable
Access road to Vent Shaft No.4, fire trails, other public infrastructure, other built features	Always safe. Serviceability should be maintained wherever practicable. Loss of serviceability must be fully compensated. Damage must be fully repairable, and must be fully

	repaired or else replaced or fully compensated.
Public Safety	
Public Safety	No additional risk

Specific performance criteria relating to environmental consequences are detailed in the appropriate Management Plan for that surface feature. In addition to this Monitoring Plan, the following Management Plans have been prepared in support of the SMP Longwalls 4 & 5:

- Water Management Plan
- Biodiversity Management Plan
- Heritage Management Plan
- Built Features Management Plan (RMS)
- Electricity Transmission Lines Management Plan (Transgrid & Endeavour Energy)
- Public Safety Management Plan

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

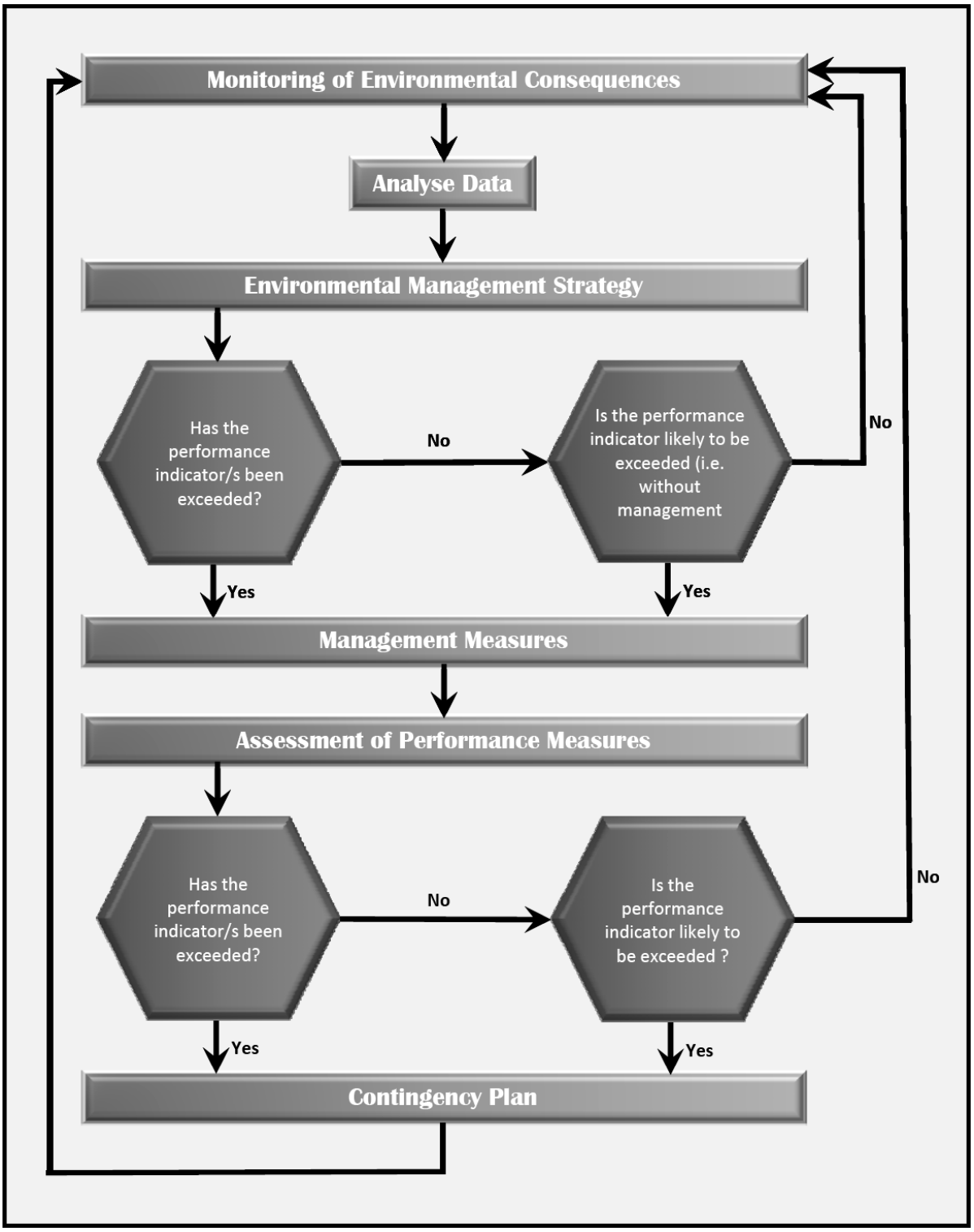

Figure 3 - Environmental Management Process

5 MONITORING AND REPORTING

5.1 Monitoring

Table 5.1 outlines the nature and frequency of survey monitoring and the actions proposed to manage impacts due to mining within the additional subsidence monitoring area as illustrated on **Plan 2e** in **Appendix B**. A complete Monitoring Plan, in the form of a TARP, is attached as **Appendix A**. A Plan showing the monitoring locations is provided in **Appendix B**. An outline of the monitoring methods and accuracy is provided in **Appendix C**.

Table 5.1 - Subsidence Effects Monitoring and Management

Management Period	Monitoring Proposed	Trigger	Response
LW's 4 ,5 and 6 – Cross lines and Centrelines, SX,MX & NX lines			
Baseline studies prior to mining	• 3D survey; **once prior to mining** *3D Level Accuracy: +/- 5 mm* *3D Position Accuracy +/- 50 mm*	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; and o Principal Subsidence Engineer – DRE
During mining	• 2D survey **of LW5 Centreline (marks 510-550) is being measured every 20m of retreat for the first 140m** *2D Level Accuracy: +/- 5 mm* • 3D survey at **midpoint of LW5 and LW 4 & LW6 Centrelines, SX,MX & NX** *3D Level Accuracy: +/- 5 mm* *3D Position Accuracy: +/- 50mm* • Real-time monitoring of Tilt *Tilt Accuracy: +/- 0.25 mm/m*	• No observable surface deformations • 3D survey data within predictions • Tilts are <6mm/m	• Within 48hrs following collection of data, document and report to: o NRE; and o Principal Subsidence Engineer – DRE
	• 3Dsurvey *3D Level Accuracy: +/- 5 mm* *3D Position Accur acy :+/- 50mm* • Real-time monitoring of Tilt *Tilt Accuracy: +/- 0.25 mm/m*	• Observable surface deformations; and/or • Surface cracking (<10mm); and/or • Tilts (6–8mm/m) as recorded on the tiltmeter/s	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: o NRE; o RMS/Technical Committee; o Electrical infrastructure owner/s; o Principal Subsidence Engineer - DRE; • Undertake additional survey and check against pre-mining

Management Period	Monitoring Proposed	Trigger	Response
			monitoring data and review against predictions; • Continue consultation with electrical owner/s (**Transgrid & Endeavour Energy**) and develop specific action plans to be implemented should they be required (see trigger below); • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s.
	• 3D survey *3D Level Accuracy: +/- 5 mm* *3D Posiiton Accuracy +/- 50 mm* *3D Relative Accuracy: +/- 30 mm* • Real-time monitoring of Tilt *Tilt Accuracy: +/- 0.25 mm/m*	• Observable surface deformations; and/or • Surface cracking (>10mm); and/or • Tilts (> 8mm/m) as recorded on the tiltmeter/s	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: o NRE; o RMS/Technical Committee; o Electrical infrastructure owner/s; o Principal Subsidence Engineer – DRE • Undertake additional survey and check against pre-mining monitoring data and review against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s. • Review Mining Options
Post mining	• 3D survey **at the Completion of mining** *3D Level Accuracy: +/- 5 mm* *3D Position Accuracy +/- 50 mm*	• Check **against subsidence predictions** to enable ongoing modelling of predictions	• Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
Creek Closure Points – CC1, CC2, CC3 & CC4			
Baseline Studies	• 3D relative survey of all closure lines 80m either side of the creek **once prior to mining** *3D Position Accuracy: +/- 30mm*	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; and o Principal Subsidence Engineer – DRE
During Mining	• 3D relative survey of all closure	• <50 mm closure	• Within 48hrs following collection of data, document and report to:

Management Period	Monitoring Proposed	Trigger	Response
	lines 80m either side of the creek **fortnightly after 140m of LW retreat** *3D Relative Accuracy :+/- 30mm*	observed	o NRE; and o Principal Subsidence Engineer – DRE
		• >50 mm closure observed	• Increase surveys to weekly • NRE commence planning to remove LW at next Maingate Cut-Through if closure continues to increase • Document and Report to: o NRE; and o Principal Subsidence Engineer – DRE within 48hrs following collection of data.
	• 3D relative survey of all closure lines 80m either side of the creek **weekly** *3D Relative Accuracy :+/- 30mm*	• >100 mm closure observed	• Increase surveys to three times a week • Remove longwall at next Maingate Cut-Through • Document and Report to: o NRE; and o Principal Subsidence Engineer – DRE within 48hrs following collection of data.
	• 3D relative survey of all closure lines 80m either side of the creek **three times weekly** *3D Relative Accuracy :+/- 30mm*	• >150 mm closure observed	• Stop and remove longwall immediately based on underground safety constraints • Document and Report to: o NRE; and o Principal Subsidence Engineer – DRE within 48hrs following collection of data
Post Mining	• 3D relative survey of all closure lines 80m either side of the creek **at the completion of mining** *3D Relative Accuracy :+/- 30mm*	• Check against subsidence predictions to enable ongoing modelling of predictions	• Undertake subsidence survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block
Regional 3D Points			
Baseline Studies	• 3D survey *3D Position Accuracy: +/- 25 mm* *3D Level Accuracy: +/- 35 mm*	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; and o Principal Subsidence Engineer – DRE
During Mining	• 3D Survey undertaken at **Mid-**	• No observable surface	• Within 48hrs following collection of data, document and report to:

Management Period	Monitoring Proposed	Trigger	Response
	Point of LW *3D Position Accuracy: +/- 25 mm* *3D Level Accuracy: +/- 35 mm*	deformations • 3D survey data within predictions	o NRE; and o Principal Subsidence Engineer – DRE
Post Mining	• 3D point survey; **at the Completion of mining** *3D Position Accuracy: +/- 25 mm* *3D Level Accuracy: +/- 35 mm*	• Check against subsidence predictions to enable ongoing modelling of predictions	• Undertake survey and review against predictions; • Document actual movement against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
Pavement – Mt Ousley Road			
Baseline studies prior to mining	• 2D survey of P-Line **once prior to mining** *2D Level Accuracy: +/- 5 mm* *2D Strain Accuracy: +/- 0.25 mm/m* • 3D survey of every fifth survey mark on P-Line **once prior to mining** *3D Position Accuracy: +/- 25 mm* *3D Level Accuracy: +/- 35 mm* • 2D relative survey of NB 1-24 & SB 1-24 prisms **once prior to mining** *2D Level Accuracy: +/- 5 mm* *2D Strain Accuracy: +/- 0.25 mm/m*	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
During mining	• 2D survey of P-Line (pegs P1 - P93) **fortnightly** *2D Level Accuracy: +/- 5 mm* *2D Strain Accuracy: +/- 0.25 mm/m* • *3D survey of* every fifth survey mark on P-Line **after 1st third, halfway, and 2nd third of the LW extraction** *3D Position Accuracy: +/- 25 mm* *3D Level Accuracy: +/- 35 mm*	• No observable surface deformations • 2D survey data within predictions	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• 2D relative survey of NB 1-24 &	• No observable surface	• Within 48hrs following collection of data, document and report to:

Management Period	Monitoring Proposed	Trigger	Response
	SB 1-24 prisms **after 1st third, halfway, and 2nd third of the LW extraction** *2D Level Accuracy: +/- 5 mm* *2D Strain Accuracy: +/- 0.25 mm/m*	deformations • 2D survey data within predictions	o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• 1D crack monitoring pin measurements at mark P40 along P-Line **after 1st third, halfway, and 2nd third of the LW extraction** *Pin Measurement Accuracy: +/- 1mm*	• Change to existing crack width ≤ 10mm	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Crackmeters in pavement slot measured **hourly from installation of slot until end of mining.** *Crackmeter Accuracy: 0.1mm*	• Crackmeter closure <30mm	• Document and Weekly Report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• 1D crack monitoring pins either side of pavement slot to be measured if electronic crackmeter system fails and **measured as required** *Pin Measurement Accuracy: +/- 1mm*	• Electronic system operating	o Install pins
	• Visual site inspection to identify emerging impacts on RMS infrastructure **Monthly during mining**	• No observable surface deformations from previous report	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Visual inspection of pavement by RMS **within 12 hours of trigger activation**	• Observable surface deformations; and/or • Step height >30 mm or ≤ 50 mm; and/or • Crackmeter closure of ≥ 30 mm; and/or • Pavement compressive strains (Cataract Creek) > 0.5 mm/m over a 40m	• NRE to notify the Technical Commitee within 24 hours of trigger activation • Technical Committee to meet within 72 hours and review monitoring data, including; o Culvert inspection o Determine peak convergence o Assess monitoring data for trends o Forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action

Management Period	Monitoring Proposed	Trigger	Response
		bay length; and/or • Pavement compressive strains (Bend) ≥ 0.5 mm/m over a 40m bay length	• NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Crack monitoring pins either side of pavement slot to be measured if electronic crackmeter system fails and **measured as required** • *Pin Measurement Accuracy: +/- 1mm*	• Failure of electronic crackmeter system in pavement slot	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the failure of electronic crackmeter: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE • Measure pins within 48 hours of notification of electronic crackmeter system failure if system cannot be repaired within this time
	• Visual inspection of pavement by RMS **within 2 hours of trigger activation**	• Step height > 50 mm • Pavement compressive strains (Cataract Creek) > 0.5 mm/m over a 40m bay length • Pavement compressive strains (Bend) ≥ 1 mm/m over a 40m bay length	• RMS to notify Traffic Commander via TMC within 2 hours to enforce immediate speed restriction – enforced by Traffic Commander and NSW Police • NRE to notify Technical Committee within 2 hours • Technical Committee to meet within 24 hours to consider and advise on immediate corrective action/s which may be required • NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; and o Principal Subsidence Engineer – DRE
Post mining	• 2D survey of P-Line (pegs P1 - P93) **at the completion of mining** • 3D survey of P-Line **at the completion of mining** • 2D relative survey of NB 1-24 & SB 1-24 prisms **at the completion of mining**	• Check against subsidence predictions and baseline survey	• Undertake 3D survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
Culverts			
Baseline studies prior to mining	•1D direct measurement of Cataract Creek culverts by convergence pole **once prior to**	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE;

Management Period	Monitoring Proposed	Trigger	Response
	mining *Measurement Accuracy: +/- 1 mm* ●Visual Inspection/Photographs of Cataract Creek culverts **once prior to mining**		o RMS/Technical Committee o Principal Subsidence Engineer – DRE
During mining	• 1D direct measurement of Cataract Creek culverts by convergence pole undertaken **after 1st third, halfway, and 2nd third of the LW extraction** *Measurement Accuracy: +/- 1 mm*	• No observable surface deformations • No change in culvert condition • ground closure < 50mm • convergence < 50 mm	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Visual Inspections/Photographs of Cataract Creek culverts undertaken **after 1st third, halfway, and 2nd third of the LW extraction**	• No observable surface deformations from previous report • No change in culvert condition	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Visual Inspections of culverts and overlying pavement by RMS **within 24hrs of trigger**	• Visible distortion of culverts • Movement in pavement associated with culvert distortion • Ground movement or formation of voids due to culvert distortion • Ground closure ≥ 50 mm • Convergence ≥ 50 mm	• Technical Committee to meet within 1 week and review monitoring data, including; o Culvert inspection o Determine peak convergence o Assess monitoring data for trends o Forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action • NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Visual inspections of culverts and overlying pavement by RMS **within 2 hours of trigger**	• Ground movement in pavement due to culvert damage or mining • Severe distortion or buckling of steel culverts • Imminent collapse of culvert structure	• RMS to notify Traffic Commander via TMC within 2 hours to enforce immediate speed restriction – enforced by Traffic Commander and NSW Police • NRE to notify Technical Committee within 2 hours • Technical Committee to meet within 24 hours to consider and advise on immediate corrective action/s which may be required

Management Period	Monitoring Proposed	Trigger	Response
			• NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; and o Principal Subsidence Engineer – DRE
Post mining	• 1D direct measurement of Cataract Creek culverts by convergence pole undertaken **at the end of mining** • *Measurement Accuracy: +/- 1 mm*	• Check against subsidence predictions and baseline survey	• Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
	• Visual Inspections/Photographs of Cataract Creek Culverts undertaken **at the end of mining**	• Check against CCTV, subsidence predictions baseline report	• Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
Picton Rd Bridge			
Baseline studies prior to mining	• 3D relative survey of 16 prisms on bridge structure **once prior to mining** *3D Position accuracy: +/- 1 mm* *3D Level Accuracy: +/- 2 mm*	• Documentation of pre-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Condition Survey of bridge structure **once prior to mining**	• Documentation of pre-mining conditions	• Within 48hrs following completion of the report, forward it to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
During Mining	• 3D relative survey of 16 prisms on bridge structure **monthly** *3D Position accuracy: +/- 1 mm* *3D Level Accuracy: +/- 2 mm*	• Relative movement between any two prisms ≤ 5 mm	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE
	• Bridge inspection by RMS/Bridge specialist **within 24 hours of trigger**	• Differential movement that could result in unacceptable distortion of any bridge element	• RMS/Bridge specialist to notify NRE with 24 hours of inspection • NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE

Management Period	Monitoring Proposed	Trigger	Response
			• Technical Committee to meet within 72 hours and review monitoring data, including; o Culvert inspection o Determine peak convergence o Assess monitoring data for trends o Forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action
	• Bridge inspection by RMS/Bridge specialist **within 2 hours of trigger**	• Structural defects noticeable • Advice from consultant that bridge has become unsafe or is in an unserviceable condition	• RMS to notify Traffic Commander via TMC within 2 hours to enforce immediate speed restriction – enforced by Traffic Commander and NSW Police • NRE to notify Technical Committee within 2 hours • Technical Committee to meet within 24 hours to consider and advise on immediate corrective action/s which may be required • NRE to notify the following critical stakeholders within 24hrs o NRE/RMS specialists; o Principal Subsidence Engineer – DRE
Post Mining	• 3D relative survey of 16 prisms on bridge structure **at the end of mining**	• Documentation of post-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
	• Condition Survey of bridge structure **at the end of mining**	• Documentation of post-mining conditions	• Within 48hrs following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer – DRE • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.
Powerlines – 330kV and 132kV			
Baseline studies prior to mining	• 3D survey of towers; **once prior to mining** o 330kV – TL11/54 to	• Documentation of pre-mining conditions	• Document and Report to: o NRE; and o Principal Subsidence Engineer – DRE within 48hrs following

Management Period	Monitoring Proposed	Trigger	Response
	TL11/58 o 132kV – Tower No. 63 – Tower No.69 • Earth Peaks Monitoring • Observational monitoring of 33kV line		collection of data.
During mining	• 3D survey of towers undertaken at **Mid-Point of LW** o 330kV – TL11/54 to TL11/58 o 132kV - Tower No. 63 – Tower No.69 • Earth Peaks Monitoring	• No observable surface deformations • <5 mm separation between tower legs • 3D survey data within predictions	• Document and Report to: o NRE; o Principal Subsidence Engineer – DRE; o Transgrid; and o Endeavour Energy, within 48hrs following collection of data.
	• 3D survey of towers: o 330kV – TL11/54 to TL11/58; o 132kV - Tower No. 63 – Tower No.69 • Observational monitoring of 33kV line.	• Observable surface deformations; and/or • Separation between tower legs (5-10 mm);	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger/s: o NRE; o Electrical infrastructure owner/s; o Principal Subsidence Engineer - DRE; • Continue consultation with electrical owner/s (**Transgrid & Endeavour Energy**) and develop specific action plans to be implemented should they be required (see trigger below); • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s.
	• 3D survey of towers: o 330kV – TL11/54 to TL11/58; o 132kV - Tower No. 63 – Tower No.69 • Observational monitoring of 33kV line.	• Observable surface deformations; and/or • Separation between tower legs (>10mm); and/or • Tilts (> 4mm/m) as recorded on the tiltmeter/s	• Notify the following Key Stakeholders, as appropriate, immediately following awareness of the trigger/s being met: o NRE; o Electrical infrastructure owner/s; o Principal Subsidence Engineer – DRE • Undertake additional 3D survey and check against pre-mining monitoring data and review against predictions; • Undertake visual inspections accordingly;

Management Period	Monitoring Proposed	Trigger	Response
			• Liaise with asset owner (**Transgrid & Endeavour Energy**) regarding any action/s required. • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s. • Review Mining Options
Post mining	• 3D survey of towers, **at the completion of mining**: o 330kV – TL11/54 to TL11/58; o 132kV - Tower No. 63 – Tower No.69 • Earth Peaks Monitoring • Observational monitoring of 33kV line.	• Check against subsidence predictions and baseline survey	• Undertake 3D survey and review against predictions; • Document actual subsidence against predictions; • Report monitoring data to Principal Subsidence Engineer - DRE within 48hrs following collection of data • Report to Principal Subsidence Engineer – DRE, within four (4) months after completion of each longwall block.

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5.1.1 Longwalls 4 and 5 Survey Monitoring

The monitoring in **Table 5.1** directly related to the mining of Longwalls 4 and 5 will be predominantly used to validate subsidence predictions and will include 3D survey monitoring of centrelines, crosslines and creek closure points, as well as regional 3D surveys at specific points. The monitoring locations are accurately illustrated on the Plans within **Appendix B.**

The frequency of this monitoring as outlined in **Table 5.1** will occur prior to mining, midway and post mining unless trigger values are met.

Any survey marks affected by subsidence will be fully restored at the completion of subsidence, or otherwise as required by the Land and Property Management Authority.

5.1.2 Additional Pavement Monitoring

A monitoring plan has been included in **Table 5.1** to encompass the monitoring that will be implemented to manage possible risks within the Additional Subsidence Management Area as illustrated in **Plan 2e- Additional Subsidence Management Area (Appendix B)**. This monitoring will be in addition to the monitoring described within the Built Features Management Plan (RMS) and will include 3D pavement monitoring to detect possible mining induced subsidence impacts east of Mt Ousley Road.

The frequency of this monitoring as outlined in **Table 5.1.**

5.1.3 Tilt Meters

The installation and monitoring of tilt meters as outlined in **Table 5.1** will be utilised to assist in detecting possible mining induced subsidence movement within the Additional Subsidence Management Area as illustrated in **Plan 2e- Additional Subsidence Management Area**.

The tilt meters, strategically located on the western side of Mt Ousley Rd as illustrated in the Plan within **Appendix B**, will continuously measure the tilts and if required manually downloaded daily.

The manual tilt meters are in place to act as a contingency for failure of electronic tilt meters once installed.

5.1.4 Transmission Line Monitoring

A monitoring plan has been developed for the **330kV, 132kV** and **33kV** transmission lines located within the **Plan 2e- Additional Subsidence Management Area**. NRE 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 details of the specific survey monitoring is shown on plans in **Appendix B.** The planned transmission line monitoring is detailed in Table 5.1 and the **Electrical Transmission Lines Management Plan.**

5.2 Reporting

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

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 LW's 4 & 5.

Specific mitigation measures for built features have been negotiated with the relevant asset owners (e.g. the RMS) and are detailed in the BFMP_RMS.

6.2 Trigger Action Response Plan

The Trigger Action Response Plan (TARP), as presented in **Appendix A** has been designed specific 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, NRE will implement the following Contingency Plan:

- The observation will be reported to NRE's Environment and Community Manager within 24 hours.
- The observation will be recorded.
- NRE will report any exceedance of the performance measure to the Director General of DOP&I and other relevant stakeholder as soon as practicable after NRE becomes aware of the exceedance.
- NRE 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 and Community 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.
- NRE will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- NRE will submit the proposed course of action to the DoP&I for approval.
- NRE will implement the approved course of action to the satisfaction of the DoP&I.
- NRE 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 NRE have failed to satisfactorily remediate the impact NRE will provide a suitable offset to compensate for the impact, to the satisfaction of the Director-General of DoP&I 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 NRE procedures in as detailed the Environmental Management Strategy.

In accordance with ***Condition 6/Schedule 5*** NRE 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 DoP&I within 7 days of the incident occurring.

7.2 Complaints Handling

Complaints will be managed through established NRE procedures in as detailed 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 NRE website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Environmental Management Reports (AEMRs).

7.3 Non-Conformance Protocol

NRE will manage and report non-compliances relevant against 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 NRE No.1 Colliery, and will be promoted through direct consultation and direction of the Mine's Operations Manager.

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

A Compliance Register ***Compliance Register (EMS RV APP 003 & EMS WW APP 003)*** will be established to monitor compliance against development consent criteria, mining leases etc. Non-compliances identified through the Compliance Register are to be reported, with corrective actions implemented.

A review of NRE'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 NRE'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 EMS are outlined in ***NREG EMS PRO005 Environmental Roles and Responsibilities*****.**

8.2 Resources Required

In accordance with the ***NRE 001 NRE 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 and Community Manager to ensure that these requirements are communicated to NRE Management.

8.3 Training

All training and inductions conducted are to be undertaken as per the ***NRE 012 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.

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.
- 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 ***NRE 010 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 ***NRE 010 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 Review

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 will be undertaken and annually thereafter.

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.
- 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 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:

- 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)

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**.

9 REFERENCES

Biosis (2012). NRE No.1 Colliery Major Expansion Upland Swamp Assessment. 4 October 2012.

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Appendix A - Monitoring Program and TARPs

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Subsidence Effects - Survey Monitoring	• 2D survey of LW5 centerline marks 510 to 550 • 3D survey monitoring at mid-point of LW5 and LW4 & LW6 centerlines, SX, MX & NX crosslines and regional 3D points R1 to R12 • 3D relative survey of creek closure sites CC1 to CC4 • Tiltmeters TM1, TM1A, TM2, TM3, TM4, TM5, & TM6 located between the 3D survey lines and Mt Ousley Rd	• Revise Subsidence Predictions (Total subsidence; Incremental subsidence; Variation in horizontal strain.) • 2D survey LW5 centerline (marks510-550) is being measured every 20m of retreat for the first 150m of longwall retreat • 3D survey of LW4, LW5 & LW6 centerlines, SX, MX & NX crosslines and regional 3D points R1 to R12 once prior to mining to document: o Total subsidence; o Incremental subsidence; and o Variation in horizontal strain • Real time monitoring of Tilt. • 3D relative survey of closure marks CC1 to CC4 fortnightly from 150m longwall retreat • 3D survey of LW4, LW5 & LW6 centerlines, SX, MX & NX crosslines and regional 3D points R1 to R12 at midpoint of LW5 • 3D survey LW4, LW5 & LW6 centerlines, SX, MX & NX crosslines and regional 3D points R1 to R12 at midpoint of LW5 on completion of each longwall • Comparison of survey measurement s with predictions. • Report to E&C Manager in Survey Reports *<u>2D Level Accuracy</u>: +/- 5 mm;* *<u>3D Level Accuracy</u>: +/- 5 mm* *<u>3D Position Accuracy</u>: +/- 50 mm* *<u>3D Relative Accuracy</u>: +/- 30mm* *<u>Tiltmeter Accuracy</u> +/- 0.25 mm/m*	• Baseline studies prior to mining (3D Survey) • During Mining • Once Post Mining	• No observable surface deformations • 3D data are within predictions • Tilts are <6mm/m • <50mm closure	• Within 48 hours following collection of data, document and report to: o NRE; and o Principal Subsidence Engineer - DRE	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Surveyor
				• Observable surface deformations; and/or • Surface cracking (<10mm); and/or • Tilts (6-8 mm/m); and/or • Creek closure (50-150mm)	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: o NRE; o RMS/Technical Committee; o Electrical Infrastructure owners; and o Principal Subsidence Engineer - DRE; • Undertake additional 3D survey and check other relevant monitoring data and review against predictions; • **If closure is the activated trigger at > 50mm** then plan to remove longwall at next maingate cut-through if closure continues to increase; • **If closure is the activated trigger at > 100mm** then remove longwall at next maingate cut-through; • **If closure is the activated trigger i**ncrease 3D relative closure surveys to weekly • Continue consultation with electrical infrastructure owners (Transgrid & Endeavor Energy) and develop specific action plans to be implemented should they be required by red triggers being activated below; • Within 48hrs following collection of data document and report to Principal Subsidence Engineer – DRE; and • Report monitoring data and any necessary actions to Key Stakeholders within 7 days of becoming aware of the impact/s.	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Surveyor
				• Observable surface deformations; and/or • Surface cracking (>10mm); and/or • Tilts (> 8mm/m); and/or • Creek closure > 150mm	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: o NRE;; o RMS/Technical Committee; o Electrical infrastructure owners; and o Principal Subsidence Engineer - DRE; • Undertake additional 3D survey and check other relevant monitoring data and review against predictions; • **If closure is the activated trigger** then stop longwall immediately based on underground safety considerations • **If closure is the activiated trigger** Increase 3D relative closure surveys to 3 times weekly**;** • Within 48hrs following collection of data document and report to Principal Subsidence Engineer – DRE • Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impact/s. • Review Mining Options	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Surveyor

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Transmission Lines	• 3D survey of Transmission Towers **330kV** TWR-T54 to TWR-T58 and **132kV** TWR-E63 to TWR-E69 • Observational monitoring of **33kV** line • All lines are located between Mt Ousley Rd and the escarpment	*Prior to Mining* • Visual inspection of 33kV line once prior to mining • 3D survey of towers and 2D relative survey of tower components once prior to mining to document: o Total subsidence; o Incremental subsidence; o Variation in horizontal strain; and o Tilt; *During Mining* • Visual inspection of 33kV line at midpoint of longwall retreat; • 3D survey of towers and 2D relative survey of tower components at midpoint of longwall retreat to document: o Total subsidence; o Incremental subsidence; o Variation in horizontal strain; and o Tilt; *Post Mining* • Visual inspection of 33kV line at the end of mining; • 3D survey of towers and 2D relative survey of tower components at the end of mining to document: o Total subsidence; o Incremental subsidence; o Variation in horizontal strain; and o Tilt; *2D survey accuracy +/- 5 mm* *3D Level Accuracy: +/- 5 mm* *3D Position Accuracy: +/- 50 mm*	• Baseline 3D survey and inspection prior to mining • 3D survey and inspection during mining if triggered; • 3D survey and inspection post mining	• No observable surface deformations • <5 mm separation between tower legs • 3D survey data within predictions.	• Within 48 hours following collection of data, document and report to: o NRE; o Principal Subsidence Engineer – DRE; o Transgrid; and o Endeavor Energy	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Surveyor
				• Observable surface deformations; and/or; • 5-10mm separation between tower legs	• Notify the following Key Stakeholders, as appropriate, within 24hrs of becoming aware of the trigger: o NRE; o Transgrid; o Endeavor Energy; and o Principal Subsidence Engineer - DRE; • Continue consultation with electrical infrastructure owners Transgrid and Endeavor Energy and develop contingency action plans (CMA) which can be implemented should they be required if red triggers below are activated; and • Within 48 hours following collection of data, document and report to Principal Subsidence Engineer – DRE;	
				• Observable surfact deformations; and/or • >10 mm separation between tower legs; and/or • >4 mm/m tilts as recorded by tiltmeters	• Notify the following Key Stakeholders, as appropriate, immediately of becoming aware of the impact/s: o NRE; o Transgrid; o Endeavor Energy; and o Principal Subsidence Engineer – DRE; • Undertake additional 3D survey and check other relevant monitoring data and review against predictions; • Undertake visual inspections; • Liaise with asset owners (Transgrid & Endeavour Energy) regarding any actions required; • Within 48 hours following collection of data, document and report to Principal Subsidence Engineer – DRE; • Report monitoring data and any necessary actions to Key stakeholders within 7 days of becoming aware of the impacts; and • Review mining operations	
Public Infrastructures	• Mt Ousley Road Pavement in the vicinity of Cataract Creek • Culverts, Cutting and Embankments along the same • Picton Road overpass bridge.	*Prior to Mining* • Deflectometer survey of road pavement by RMS once before mining • Laser profilometer survey of road pavement by RMS once prior to mining • 2D survey of P-Line (marks P1-P93) along slow lane shoulder of North Bound carriageway once prior to mining • 3D survey of every 5th survey mark on P-Line prior to mining	• Baseline studies prior to mining • During Mining • Post Mining	• Less than the Amber Trigger	• Within 48 hours following collection of data, document and report to: o NRE; o RMS/Technical Committee; and o Principal Subsidence Engineer - DRE	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Contract Surveyor • RMS • Technical Committee
				Pavements -		
				• Ground movement due to mining visible • Potential or actual step height > 30 mm & ≤ 50mm • Crackmeter closure ≥ 30mm	• Within 24 hours a technical specialist to notify Technical Committee; • Within 12 hours RMS inspect pavement • Within 72 hours the Technical Committee to meet to review monitoring data, including:	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		• 2D relative survey of NB 1-24 & SB 1-24 prisms once prior to mining • 1D direct measurement of Cataract Creek culverts by convergence pole once prior to mining • Visual inspections/photographs of Cataract Creek culverts once prior to mining • CCTV of Cataract Creek culverts by RMS prior to mining • 3D relative survey of 16 prisms on Picton Rd Bridge structure once prior to mining • Condition survey of Picton Rd Bridge once prior to mining *During Mining* • 2D survey of P-Line (marks P1-P93) along slow lane shoulder of North Bound carriageway fortnightly • 3D survey of every 5th survey mark on P-Line after 1st third, halfway and 2nd third of longwall extraction • 2D relative survey of NB 1-24 & SB 1-24 prisms after 1st third, halfway and 2nd third of longwall extraction • 1D Crack monitoring pin measurements on road shoulder at mark P40 along P-Line after 1st third, halfway and 2nd third of longwall extraction • Road inspections - drive through inspection by RMS – includes Picton Road interchange for pavement and road cuttings weekly during mining • Visual site inspection to identify emerging impacts on RMS infrastructure Monthly during mining • Visual inspections/photos of road cutting by RMS after amber trigger in pavement surveys exceeded • Crackmeters in pavement slot measured hourly from installation of slot until end of mining • 1D crack monitoring of 2 sets of 4 pins either side (one set on North Bound shoulder and one		• Pavement compressive strains (Cataract) ≥ 0.5mm/m over a 20m bay length • Pavement compressive strains (Bend) ≥ 0.5mm/m over a 20m bay length	o Pavement inspection report o Determine peak strain o Assess monitoring data for trends o Forecast if and/or when the RED trigger level might be exceeded; and o Decide on and direct proactive action • Within 24 hours NRE to notify: o relevant stakeholders; and/or o regulators; and/or o specialists	
				• Pavement step height > 50 mm; • Pavement compressive strains (Cataract Creek) ≥ 1.0mm/m over a 40m bay length; • Pavement compressive strains (Bend) ≥ 1.0mm/m over a 40m bay length	• Within 2 hours a technical specialist to notify Technical Committee; • Within 2 hours RMS to inspect pavement; • Within 2 hours RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police; • Within 24 hours the Technical Committee to meet to consider and advise immediate corrective action/s which may be required; and • Within 24 hours NRE to notify: o relevant stakeholders; and/or o regulators; and/or o specialists	
				Culverts		
				• Visible distortion of culverts; • Movement in pavement associated with culvert distortion • Ground movement or formation of voids due to culvert distortion • Ground closure ≥ 50mm • Convergence ≥ 50mm	• Within 24 hours a technical specialist to notify Technical Committee; • Within 24 hours RMS inspect culverts and pavement above; • Within 1 week the Technical Committee to meet to review monitoring data, including: o Culvert inspection report; o Determine peak convergence; o Assess monitoring data for trends; o Forecast if and/or when the RED trigger level might be exceeded; and o Decide on and direct proactive action • Within 24 hours NRE to notify: o relevant stakeholders; and/or o regulators; and/or o specialists	
				• Ground movement in pavement due culvert damage or mining • Severe distortion or buckling of steel culverts • Imminent collapse of culvert structure ***Note:*** *1) Red trigger actions are to ensure the safety of the travelling public* *2) It is assumed that the culvert structure will be unsafe to enter at this trigger level, therefore survey of prisms will be used rather than convergence poles*	• Within 2 hours a technical specialist to notify Technical Committee; • Within 2 hours RMS to inspect culverts and pavement above; • Within 2 hours RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police; • Within 24 hours the Technical Committee to meet to consider and advise immediate corrective action/s which may be required; and • Within 24 hours NRE to notify: o relevant stakeholders; and/or	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		set on South Bound Shoulder) of pavement slot to be measured as required by the Technical Committee if electronic crackmeters fail • 1D direct measurement of Cataract Creek culverts by convergence pole after 1st third, halfway and 2nd third of longwall extraction • Visual inspections/photographs of Cataract Creek culverts after 1st third, halfway and 2nd third of longwall extraction. • 3D relative survey of 16 prisms on Picton Rd Bridge structure monthly • Visual/photographic inspection of Picton Rd Bridge structure at midpoint of longwall extraction by RMS • Rain gauge monitoring daily during mining ***Post Mining*** • 2D survey of P-Line (marks P1-P93) along slow lane shoulder of North Bound carriageway once at the end of mining • 3D survey of P Line (marks P1-P93) once at the end of mining • 2D relative survey of NB 1-24 & SB 1-24 prisms once at the end of mining • Laser profilometer survey of road pavement by RMS once at the end of mining • Deflectometer survey of road pavement by RMS once at the end of mining • Visual/photos of road cuttings by RMS once at end of mining • 1D direct measurement of Cataract Creek culverts by convergence pole once at the end of mining • Visual inspections/photographs of Cataract Creek culverts once at the end of mining • CCTV of Cataract Creek culverts– reinspect by RMS at the end of mining • Visual/photographic inspection of Picton Rd Bridge structure by RMS once at the end of mining • 3D relative survey of 16 prisms on Picton Rd Bridge structure			o regulators; and/or o specialists	
				Cuttings/Embankments		
				• Observed changes in cuttings • Strains exceed 0.5mm/m in pavement at Cataract Creek	• Within 24 hours RMS geoscientist to assess impact; and • Technical Committee to meet and determine corrective action/s	
				Bridges		
				• Differential movement that could result in unacceptable distortion of any bridge element	• Within 24 hours RMS/bridge specialist to inspect bridge; • Within 1 week the Technical Committee to meet to review monitoring data, including: o Bridge inspection report; o Assess nature of differential movements; o Assess monitoring data for trends; o Forecast if and/or when the RED trigger level might be exceeded; and o Decide on and direct proactive action; • Within 24 hours NRE to notify: o relevant stakeholders; and/or o regulators; and/or o specialists	
				• Structural defects noticeable • Advice from consultant that bridge has become unsafe or is in an unserviceable condition.	• Within 2 hours a technical specialist to notify Technical Committee; • Within 2 hours RMS/bridge specialst to inspect bridge; • Within 2 hours RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police; • Within 24 hours the Technical Committee to meet to consider and advise immediate corrective action/s which may be required; and • Within 24 hours NRE to notify: o relevant stakeholders; and/or o regulators; and/or o specialists	
				Monitoring Devices		
				• Loss of power, communications or data from automated monitoring systems; • Unable to access automated monitoring data	• Within 72 hours when Pavement Trigger is Green o Identify cause and rectify o Inform Technical Committee of occurrence • Within 24 hours when Pavement Trigger is Amber o Identify cause and rectify o Inform Technical Committee of occurrence	
				• Major cracking or traffic impedance (i.e. >10mm)	• Notification to SCA immediately, then to DRE and MSB • Make area safe as soon as practicable including warning signs • Proposal for rectification within 1 week upon approval from SCA • Completion of works following approval from SCA • Additional daily monitoring.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		once at the end of mining • Condition survey of Picton Rd Bridge once at the end of mining				
Cultural Heritage	• 52-3-0320 Bulli Mine Shaft Site 25.	***Prior to Mining*** • Baseline archival recording prior to mining ***During Mining*** • 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 ***Post Mining*** • Final assessment recording at the end of mining	• Prior to mining • During mining • After the completion of all subsidence movements at the site.	• No Change in Site Condition Observed	• No further mitigation or management required. • Report in regular reporting.	• NRE No.1 Colliery (E & C Manager) • Biosis
				• If a change is observed but no threat to heritage values is identified then the monitoring program should continue.	• Site inspection with registered Aboriginal parties to document and photograph any observed changes / impacts. • Inform Registered Aboriginal Parties and OEH in writing.	
				• If a change is observed that may threaten heritage values then an appropriate mitigation strategy should be developed in consultation with a heritage specialist, registered Aboriginal parties, and the landowner to avoid or minimize impacts to heritage values.	• Within 1 week undertake site inspection with Registered Aboriginal Parties to document and photograph any observed changes / impacts; • Within 1 week of icompletion of investigation inform; o Director .Environmental Sustainability and Land Use; o Principal Subsidence Engineer DRE o Registered Aboriginal Parties; and o OEH • As required by OEH or If remediation or mitigation actions are required and may affect the archaeological values at an individual site, undertake ongoing consultation with OEH; • Use appropriate specialists to undertake physical remediation activities; and • Provide monthly updates of investigation progress if required by SCA/OEH;	
Swamp Groundwater & Surface Water	Swamps Discharge • CCUS2 • CCUS3 • CCUS4 • CCUS5 • CCUS6 • CRUS1 • BCUS4 Shallow piezometers • PCc2 • PCc3 • PCc4 • PCc5A • PCc5B • PCc6 • SP1 • SP2 • PCr1 • PBc4	***Prior to Mining*** • Bi-Monthly swamp visual monitoring of CCUS2, 3, 4, 5, & 6, CRUS1 and BCUS4 • Swamp pool water level/flow at or downstream of CCUS2, 3 4 5 & 6, CRUS1 and BCUS4 (if present) including: o Automatic 6 hourly level recording with Bi-monthly download; and o Bi-monthly manual measurement of pool depth at reference point • Swamp surface water outflow quality at or downstream of CCUS2, 3 4 5 & 6, CRUS1 and BCUS4 (if a discrete water outflow is present) including: o Bi-monthly manual field analysis of pH, EC, temp, DO and ORP o Bi-monthly laboratory analysis of TDS, Na, K,	• Baseline studies prior to mining • During Mining • Post Mining	• No observable change	• Continue monitoring • No notification required	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • Biosis • GeoTerra
				• Fracturing of bedrock in ephemeral drainage lines that are directly undermined • >3mth lowering of pool water levels or swamp seepage discharge reduction greater than baseline variability • Short term increase in groundwater salinity or reduction in pH outside of baseline variability observed in similar swamps, with the effect not persisting after a >2 year ARI rainfall event; • Short term water level reduction greater than baseline variability observed in similar swamps and effect not persisting after a >2 year ARI rainfall event.	• Continue monitoring program • Discuss in end of panel report, AEMR or Annual Review as required.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity. • Swamp groundwater quality at PCc2, 3, 4, 5A, 5B & 6, SP1 & 2, PCr1 and PBc4 including: o Bi-monthly field water quality (EC, pH); and o 4 monthly laboratory analysis of TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Swamp groundwater levels at PCc2, 3, 4, 5A, 5B & 6, SP1 & 2, PCr1 and PBc4 including o Automatic 12 hourly level recording with Bi-monthly download o Bi-monthly manual measure of water level using dip meter ***<u>During Mining</u>*** • Monthly swamp visual monitoring of CCUS2, 3, 4, 5, & 6, CRUS1 and BCUS4 • Swamp pool water level at CCUS2, 3 4 5 & 6, CRUS1 and BCUS4 (if present) o Automatic 2 hourly level recording with weekly download during active undermining of the swamp then monthly until completion of longwall o Weekly manual measurement of pool depth at reference point during active undermining of the swamp then monthly until completion of longwall • Swamp surface water outflow quality at or downstream of CCUS2, 3, 4, 5 & 6, CRUS1 and BCUS4 (if a discrete water outflow is present) including: o Manual field analysis of pH, EC, temp, DO and		• Fracturing of bedrock in ephemeral drainage lines that are not directly undermined; • Redirection of surface flows with <3m reduction of pool levels or swamp discharge • Increase in salinity or reduction in pH outside of baseline variability observed in similar swamps, with the effect persisting after a >2 year ARI rainfall event; • Piezometer becomes, or stays, dry where it has not done so previously	***<u>Swamp Discharge Drainage Lines</u>*** • Immediately inform: o DRE Director Environmental Sustainability and Land Use; o Principal Subsidence Engineer – DRE o SCA; o DP&I; and o OEH; • Within 1 week of trigger exceedance being noted instigate investigation including: o Engaging a specialist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge; o Investigation of possible mitigation measures in consultation with SCA / NOW o Prepare and implement a site mitigation/action plan in consultation with SCA / NOW if necessary o Report on mitigation as soon as practicable. • Report in End of Panel Report, AEMR & Annual Review as required ***<u>Swamp Groundwater Quality</u>*** • Immediately inform: o DRE Director Environmental Sustainability and Land Use; o Principal Subsidence Engineer – DRE o SCA; o DP&I; and o OEH o technical specialists • Immediately undertake photographic recording; • Within 2 weeks review monitoring program and continue to review as appropriate; • Within 1 month visit site with stakeholders • Within 1 week of site visit provide investigation results to: o SCA o DP & I o OEH; and o DRE • Within 1 month of stakeholder site visit prepare and implement a site mitigation/action plan and seek approvals from key agencies as required • Undertake post works monitoring as required • Report in End of Panel Report, AEMR & Annual Review as reuquired ***<u>Swamp Groundwater Levels</u>*** • Immediately inform: o DRE Director Environmental Sustainability and Land Use; o Principal Subsidence Engineer – DRE • Within 1 week of trigger exceedance being noted instigate investigation including:	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		ORP weekly during active undermining of the swamp then monthly until completion of longwall o Monthly laboratory analysis of TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity. • Swamp groundwater quality at PCc2, 3, 4, 5A, 5B, & 6, SP1 & 2, PCr1 and PBc4 o Weekly field water quality (EC, pH)during active undermining of the swamp then monthly until completion of longwall; and o Monthly laboratory analysis of TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Swamp groundwater levels at PCc2, 3, 4, 5A, 5B, & 6, SP1 & 2, PCr1 and PBc4 o Automatic 6 hourly level recording with weekly download during active undermining of the swamp then monthly until completion of longwall o Weekly manual measure of water level using dip meter during active undermining of the swamp then monthly until completion of longwall ***Post Mining*** • Bi-Monthly swamp visual monitoring of CCUS2, 3, 4, 5, & 6, CRUS1 and BCUS4 • Swamp discharge pool water level at CCUS2, 3 4 5 & 6, CRUS1 and BCUS4 for 1 year after swamp is undermined and the longwall has passed over 200m from swamp edge			o Engaging a hydrogeologist to investigate and report on the cause of trigger exceedances where the cause may not be directly related to lack of rainfall recharge; o Investigation of possible mitigation measures in consultation with SCA / NOW o Prepare and implement a site mitigation/action plan in consultation with SCA / NOW if necessary • Within 1 week of investigation provide investigation results to: o SCA o DP & I o OEH; and o DRE • Report in End of Panel Report, AEMR & Annual Review as required.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		o Automatic 6 hourly level recording with bi-monthly download o Bi-monthly manual measurement of pool depth at reference point • Swamp surface water outflow quality at or downstream of CCUS2, 3 4 5 & 6, CRUS1 and BCUS4 (if a discrete water outflow is present) including: o Bi-monthly manual field analysis of pH, EC, temp, DO and ORP o Bi-monthly laboratory analysis of TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity. • Swamp groundwater quality at PCc2, 3, 4, 5A, 5B, & 6, SP1 & 2, PCr1 and PBc4 including: o Bi-monthly field water quality (EC, pH) after swamp has been undermined; and o 4 monthly laboratory analysis of TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) for 1 year after the end of mining • Swamp groundwater levels at PCc2, 3, 4, 5A, 5B, & 6, SP1 & 2, PCr1 and PBc4 for 1 year after the swamp has been undermined including o Automatic 12 hourly level recording with Bi-monthly download o Bi-monthly manual measure of water level using dip meter				
Threatened species, populations and communities	• Upland Swamps (CRUS1, CRUS2, CRUS3, CCUS1,CCUS2 CCUS3, CCUS4) • Threatened frog breeding habitat in Cataract River tributary below	***Prior to Mining*** • Upland Swamp ecological 2 year baseline monitoring as follows o Monitoring of thirty 0.5mX0.5m quadrats along three 15m transects in CRUS1, CRUS3, CCUS1, CCUS3, and CCUS4	• Prior to mining (2 years baseline). • During mining. • Post mining (minimum 2 years)	***Upland Swamps*** • Negligible drainage of water from, or redistribution of water within a swamp, as illustrated by no observable mining induced changes in groundwater levels. • Negligible change to the composition of distribution of species, as illustrated by no	• Continue monitoring. • Report in End of Panel Report, AEMR & Annual Review as required.	• NRE No.1 Colliery (E & C Manager) • Biosis

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
	• CRUS1, Cataract River tributary below CRUS2, Cataract Creek tributary below CRUS4, and Cataract Creek • Threatened frog non-breeding habitat in CCUS1, CCUS2, CCUS3, CCUS4, CRUS1, CRUS2, and CRUS3	o Photopoint monitoring baseline established in swamps CRUS1, CRUS2, CRUS3, CCUS1, CCUS2, CCUS3, and CCUS4 • Threatened Frog Species 2 year baseline monitoring as follows: o Monitoring in spring, summer, autumn and winter (depending on species) of four transects spanning the length of breeding habitat in Cataract River tributary below CRUS1, Cataract River tributary below CRUS2, Cataract Creek tributary below CRUS4, and Cataract Creek o Monitoring of non-breeding habitat in spring, summer, autumn and winter (depending on species) of three 25m x 25m quadrats in each of CCUS1, CCUS2, CCUS3, CCUS4, CRUS1, CRUS2, and CRUS3 ***During Mining*** • Upland Swamp ecological monitoring as follows o 2 times yearly (autumn & spring) monitoring of thirty 0.5mX0.5m quadrats along three 15m transects in CRUS1, CRUS3, CCUS1, CCUS3, and CCUS4 o 2 times yearly (autumn & spring) photo point monitoring in swamps CRUS1, CRUS2, CRUS3, CCUS1, CCUS2, CCUS3, and CCUS4 • Threatened Frog Species monitoring as follows: o Monitoring in spring, summer, autumn and winter (depending on species) of four transects spanning the length of breeding habitat in Cataract River tributary		statistically significant difference between control and impacts sites or between before and after mining at impact sites • No change to vegetation recorded during observational monitoring ***Threatened Frog Species*** • Negligible changes in flow or natural drainage behaviour of pools, as illustrated by no observable mining induced change • Negligible environmental consequences for threatened frog species, as illustrated by no changes in parameters monitored and no impact habitat for threatened species		
				Upland Swamps • Negligible drainage of water from, or redistribution of water within a swamp, as illustrated a short term water level reduction greater than variability observed in similar swamps and effect not persisting after a > 2 year ARI rainfall event. • Negligible change to the composition of distribution of species, as illustrated by a short term (1 year duration for 1 year after mining commences) statistically significant difference between control and impacts sites or between before and after mining at impact sites • Minimal dieback recorded during observational monitoring. Dieback restricted to single area ***Threatened Frog Species*** • Negligible changes in flow or natural drainage behaviour of pools, as illustrated by pool level/flow decline <20% during mining compared to baseline for > 2 months • Negligible impacts to changes in general condition of streams, as illustrated by no observable change in stream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions • Negligible environmental consequences for threatened frog species, as illustrated by a short term (one year duration first year	• Continue monitoring • Within one week of potential impact being detected inform SCA, OEH & DRE • Within 1 month of impact detection review monitoring program, including frequency and location, and determine if additional monitoring is required • Report in annual and End of Panel reports to inform relevant agencies of results of monitoring; • Report in End of Panel Report, AEMR & Annual Review as required.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		below CRUS1, Cataract River tributary below CRUS2, Cataract Creek tributary below CRUS4, and Cataract Creek o Monitoring of non-breeding habitat in spring, summer, autumn and winter (depending on species)of three 25m x 25m quadrats in each of CCUS1, CCUS2, CCUS3, CCUS4, CRUS1, CRUS2, and CRUS3 ***Post Mining*** • Upland Swamp ecological monitoring for 2 years following end of mining as follows o 2 times yearly (autumn & spring) monitoring of thirty 0.5mX0.5m quadrats along three 15m transects in CRUS1, CRUS3, CCUS1, CCUS3, and CCUS4 o 2 times yearly (autumn & spring) photo point monitoring in swamps CRUS1, CRUS2, CRUS3, CCUS1, CCUS2, CCUS3, and CCUS4 • Threatened Frog Species monitoring for 2 years post mining as follows: o Monitoring in spring, summer, autumn and winter (depending on species) of four transects spanning the length of breeding habitat in Cataract River tributary below CRUS1, Cataract River tributary below CRUS2, Cataract Creek tributary below CRUS4, and Cataract Creek o Monitoring of non-breeding habitat in spring, summer, autumn and winter (depending on species) of three 25m x 25m quadrats in each of CCUS1, CCUS2, CCUS3, CCUS4, CRUS1, CRUS2, and CRUS3		after mining commences) significant statistical difference between control and impact sites or between before and after mining at the control sites		
				Upland Swamps • Piezometers become or stay dry where it has not done so before; • 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; • Significant dieback recorded during observational monitoring. Dieback not restricted to single area. ***Threatened Frog Species*** • Re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for >2 months, considering rainfall / runoff variability; • Observable increases stream bed or bank erosion, turbidity, iron staining algal growth vegetation compored to pre-mining conditions • Change to the composition or distribution of species, as illustrated by significant statistical difference between control and impact sites or between before and after mining at the control sites or a significant reduction in population numbers • Significant impacts to breeding habitat for threateded species at risk from subsidence effects (Giant Burrowing Frog, Littlejohn's Tree Frog, Stuttering Frog) spanning the annual lifecycle of these species	• Within 1 week of impact being detected engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts • Within 1 week inform SCA, OEH & DRE of investigation outcomes ; • Within 1 week of completion of investigation report results to OEH, SCA & DRE • Within 1 week, if necessary, commence preparation and implementation of a site mitigation/action plan and monitoring plan consultation with SCA/ OEH & DRE if necessary • Report in End of Panel, AEMR and Annual Review as required.	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Aquatic Ecology	• Impact monitoring of water quality and aquatic macroinvertebrates at Sites 5 & 6 in Cataract Creek • Control monitoring of water quality and macroinvertebrates at Sites 9 , 10, 11, 12, 13, &14 in Allen Creek and Lodden Creek • Monitoring of Macquarie Perch in Cataract Creek at Sites Mac-1 & Mac-2	***Prior to Mining*** • Aquatic macroinvertebrate 2 year baseline monitoring as follows: o AUSRIVAS monitoring in spring and autumn of Sites 5, 6, 9, 10, 11, 12, 13 & 14 o Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as relevant data from the Water Management Plan o Photo point monitoring of creeks in autumn and spring at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as data from Water Monitoring Program • Macquarie Perch 2 year baseline monitoring as follows: o Quantitative monitoring in summer of Sites Mac-1 & Mac-2 ***During Mining*** • Aquatic macroinvertebrate monitoring as follows: o AUSRIVAS monitoring in spring and autumn of Sites 5, 6, 9, 10, 11, 12, 13 & 14 o Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as relevant data from the Water Management Plan o Photo point monitoring of creeks in autumn and spring at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as data from Water Monitoring Program • Macquarie Perch monitoring as follows: o Quantitative monitoring in summer of Sites Mac-1 & Mac-2 ***Post Mining***	• Prior to mining (2 years baseline). • During mining. • Post mining (minimum 2 years)	• Negligible changes in flow or natural drainage behavior of pools, as illustrated by no observable mining induced change • Negligible environmental consequences for creeks, as illustrated by no significant changes in water quality or data collected during macroinvertebrate sampling • Negligible environmental consequences for threatened fish species, as illustrated by no changes to habitat for, or numbers of, Macquarie Perch	• Continue monitoring. • Report in End of Panel Report, AEMR or Annual Review as required	• NRE No.1 Colliery (E & C Manager) • Cardno Ecology Lab/Biosis
				• Negligible changes in flow or natural drainage behavior of pools, as illustrated by pool level / flow decline < 20% during mining compared to baseline for >2 months • Negligible impacts to changes in general condition of streams, as illustrated by no observable change to instream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions • Negligible environmental consequences for creeks, as illustrated by a 1 year reduction in aquatic habitat, as shown by: o Water quality data exceeding upper or lower limits of baseline monitoring o Change in OES50Taxa Score; or o Change in AUSRIVAS Band	• Continue monitoring • Within one week of potential impact being detected inform SCA, OEH & DRE • Within 1 month of impact detection review monitoring program, including frequency and location, and determine if additional monitoring is required • Report in annual and End of Panel reports to inform relevant agencies of results of monitoring; • Report in End of Panel Report, AEMR & Annual Review as required.	
				Macroinverebrates • Re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for >2 months, considering rainfall / runoff variability; • Observable increases stream bed or bank erosion, turbidity, iron staining algal growth vegetation compared to pre-mining conditions • Reduction in aquatic habitat at	• Within 1 week of impact being detected engage ecologist to investigate and report on the cause of trigger exceedances and advise of potential impacts • Within 1 week inform SCA, OEH & DRE of investigation outcomes ; • Within 1 week of completion of investigation report results to OEH, SCA & DRE • Within 1 week, if necessary, commence preparation and implementation of a site mitigation/action plan and monitoring plan consultation with SCA/ OEH & DRE • Within 1 month of impact detection review monitoring program, including frequency and location, and modify if necessary. This may include addition of flora monitoring	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		• Aquatic macroinvertebrate monitoring for two years post mining as follows: o AUSRIVAS monitoring in spring and autumn of Sites 5, 6, 9, 10, 11, 12, 13 & 14 o Water quality monitoring of temperature, conductivity, pH, oxidation, dissolved oxygen, and turbidity in spring and autumn at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as relevant data from the Water Management Plan o Photo point monitoring of creeks in autumn and spring at Sites 5, 6, 9, 10, 11, 12, 13 & 14 as well as data from Water Monitoring Program • Macquarie Perch monitoring as follows: o Quantitative monitoring in summer of Sites Mac-1 & Mac-2		impact sites only for an extended timeframe of > 2 years as shown by: o Water quality data exceeding upper o lower limits of baseline monitoring; o Change in OE50Taxa Score o Change in AUSRIVAS Band • Significant impacts to spawning habitiat for Macquarie Perch	along creeks where stream flow has reduced. • If mitigation / remediation measures are unsuccessful determine whether offsets will be required, and develop an offset strategy • Report in End of Panel, AEMR and Annual Review as required.	
Public Safety	• Cliffs and Steep Slopes • Rocky outcrops • Fire Trails • 4WD tracks	***Prior to Mining*** • Baseline observation once prior to mining, of: o Cliffs and steep slopes; o Rocky outcrops and cuttings o Fire roads; o 4WD tracks ***During Mining*** • 2 weekly observation of: o Cliffs and steep slopes; o Rocky outcrops o Fire roads; o 4WD tracks ***Post Mining*** • Monthly observation for 6 months after mining of: o Cliffs and steep slopes; o Rocky outcrops o Fire roads; o 4WD tracks	• Baseline studies prior to mining • During mining • Monthly following mining for 6 months	• No visible impact	• Continue monitoring • Report in End of Panel Report, AEMR or Annual Review as required	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team
				• Minor cracking (<10mm)	• Immediately undertake photographic recording • Within 24 hours notify the SCA, using photographic record • Continue monitoring • Undertake remediation measures if appropriate.	
				• Major cracking, noticeable instability or traffic impedance (>10mm)	• Immediately undertake photographic recording • Make area safe as soon as possible • Within 24 hours notify the SCA within 24 hrs, using photographic record • Notification to SCA immediately • Within 1 week prepare a proposal for rectification • Completion of works following approval from SCA • Review monitoring plan and modify is required • Undertake remediation measures as approved	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
Surface Water	• Sites CD1, CC1 – CC9, CT1	***Prior To Mining*** • Stream surface water quality at CD1, CC1 – CC9 & CT1 including o Monthly manual field water quality analysis for EC, pH, DO, ORP, temp o Monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity. • Monthly photo point recording at CD1, CC1 – CC9, & CT1 for observable iron hydroxide staining • Stream flow/water level monitoring at CC3, 4, 6, 7, 8, 9 & CT1(water level only) including: o Automatic 6 hourly level recording with 2 monthly download o Automatic 2 hourly level recording with monthly download when longwall is <500m from the monitoring point ***During Mining*** • Stream surface water quality at CD1, CC1-CC9 & CT1 including o Weekly manual water quality field analysis EC, pH, DO, ORP, temp when mining is within 100m of any 3rd order stream or higher then monthly until longwall completion o Monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity while mining within 100m of 3rd order stream or higher • Weekly photo point recording at CD1, CC1-CC9 & CT1 for observable iron hydroxide staining while mining within 100m of a 3rd order stream or	• Baseline studies prior to mining • During Mining • Post Mining	• No observable mining induced changes	• Continue monitoring program • Discuss in End of Panel Report , AEMR and Annual Review as required.	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • GeoTerra
				Surface Water Quality • Short term effect (<2 months) within baseline variability or temporary reduction over minimum 2 month period, i.e. EC > 200uS/cm pH < 4.5 Fe (Tot) > 10mg/L Mn (tot) > 0.8mg/L Al (tot) > 0.2mg/L Zn (filt) > 0.12mg/L SO4 (filt) > 20mg/L • Increase in stream Fe hydroxide precipitation compared to baseline ***Stream Flow/Water Level*** • Stream flow/water level within baseline variability or temporary reduction over < 2month period for pool levels and stream flow, considering rainfall/runoff variability; • Fracturing of bedrock in directly undermined channels • Pool level/flow decline <20% during mining compared to baseline for >2 months ***Stream Bed or Bank*** No observable change to stream bed or bank erosion, turbidity, iron staining, algal growth, and vegetation compared to baseline conditions	***Surface Water Quality*** • Continue monitoring program • Review monitoring frequency • Discuss in end of panel report or AEMR as required. ***Stream Flow/Water Level*** • For variation in stream flow/water level < 2 months then continue monitoring program, discuss in End of Panel Report, AEMR or Annual Review as required. • For variation in stream flow/water level > 2 months then continue monitoring program, review monitoring frequency, discuss in End of Panel Report, AEMR or Annual Review as required. ***Stream Bed or Bank*** • Continue monitoring program, discuss in End of Panel Report, AEMR, or Annual Review as required	
				Surface Water Quality • Significant reduction compared to baseline and predicted impacts over >2mths,i.e. o EC > 250uS/cm o pH < 4.0 o Fe (Tot) > 15mg/L o Mn (tot) > 1.0mg/L o Al (tot) > 0.4mg/L o Zn (filt) > 0.2mg/L o SO4 (filt) > 25mg/L • > 2 STD deviation reduction in water quality at downstream monitoring site compared to baseline & significant Fe OOH precipitate compared to baseline visual observations	• Immediately inform: o DRE Director of Environmental Sustainability and Land Use; and o Principal Subsidence Engineer – DRE o Notify technical specialists • Immediately record photographically; • Within 2 weeks collect laboratory samples within 2 weeks and analyse for standard analytes • Within 1 month review sampling program and continue revewi as required • Within 1 month of trigger exceedance being noted instigate investigation including: o Engaging a technical specialist to investigate and report on the cause of trigger o Undertake site inspection with SCA, DP&I, OEH & DRE dependant on availability. o Prepare and implement a site mitigation/action plan in consultation with SCA, DP&I, OEH & DRE including	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		higher then monthly until longwall completion • Opportunistic visual inspection for signs or erosion, iron staining or gas release during active mining • Stream flow/water level monitoring at CC3,4, 6, 7, 8, 9 & CT1(water level only) including: o Automatic hourly water level recording with weekly download while mining within 100m of a 3rd order stream or higher then monthly until completion of longwall ***Post Mining*** • Stream surface water quality monitoring at CD1, CC1 – CC9, CT1 including o Bi-monthly manual field water quality analysis of EC, pH, DO, ORP, temp for 1 year after end of mining; o Bi-monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Li, Ba, (filtered) DOC, Total Alkalinity for 1 year after end of mining • Bi-monthly photo point recording at CD1, CC1-9 & CT1 for observable iron hydroxide staining for 1 year after mining. • Stream flow/water level monitoring at CD1, CC3,4,6,7,8,9 & CT1 including: o Automatic 6 hourly water level recording with Bi-monthly for 1 year after the end of mining		***Stream Flow/Water Level*** • Fracturing of bedrock in stream reach not directly undermined • re-direction of surface water flows and pool level / flow decline >20% during mining compared to baseline for > 2mths, considering rainfall / runoff variability ***Stream Bed or Bank*** Observable increase in stream bed or bank erosion, turbidity, iron staining, algal growth, and vegetation compared to baseline conditions	approvals from key agencies if required o as required o Report on mitigation as soon as practicable. • Undertake additional post remediation works and monitoring as required • Report in End of Panel Report, AEMR & Annual Review as requried	
Groundwater	**Groundwater quality** Open Standpipe Piezometers NRE- A, C, D & GW1A **Groundwater Levels** Hawkesbury Sandstone Open Standpipe and VWP	***Prior to Mining*** • Groundwater quality at NRE A, NRE C, NRE D, GW1A including: o Bi-monthly manual field water quality analysis of EC & pH o Annual laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total	• Baseline studies prior to mining • During Mining • Post Mining	• No observable change	• Continue monitoring • Report in End of Panel Report, AEMR & Annual Review as required	• NRE No.1 Colliery (E & C Manager) • NRE Environmental Monitoring Team • GeoTerra
				• Short term increase in salinity or reduction in pH outside of baseline variability, with the effect not persisting after a significant rainfall recharge event	• Immediately inform: o DRE Director Environmental Sustainability and Land Use; o Principal Subsidence Engineer DRE	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
	piezometers NRE- A, B, C, D & GW1A **Groundwater Pressures** Hawkesbury Sandstone VWP piezometers NRE- A, B, D & GW1	N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Groundwater level monitoring including: o Automatic 12 hourly level recording with Bi-monthly download and manual dip meter measurement • Groundwater pressure monitoring including: o Automatic 12 hourly readings with Bi-monthly download ***During Mining*** • Groundwater quality at NRE A, NRE C, NRE D, GW1A including o Bi-monthly manual water quality field analysis of EC & pH o Six-monthly laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Groundwater level monitoring including: o Automatic 12 hourly level recording with monthly download and manual dip meter measurement while bore is being actively undermined • Groundwater pressure monitoring including: o Automatic 12 hourly readings with monthly download while bore is being actively undermined ***Post Mining*** • Groundwater quality at NRE A, NRE C, NRE D, GW1A including o Bi-monthly manual water quality field analysis EC, pH until the completion of mining in Wonga East Area 2 and then as required based on Water Management Plan		• Up to 10m water level reduction < 2 months • Up to 10m water pressure reduction for < 2 months	• Discuss the requirement or need and the potential cost/ benefit of a mitigation/action plan with stakeholders • Continue monitoring program • Report in End of Panel Report, AEMR & Annual Review as required	
				• Increase in salinity or reduction in pH outside of baseline variability, with the effect persisting after a significant rainfall recharge event • >10m water level reduction for > 2 months • >10m water pressure reduction for > 2 months	• Immediately inform: o DRE Director Environmental Sustainability and Land Use; o Principal Subsidence Engineer DRE • Discuss the requirement or need and the potential cost/ benefit of a mitigation/action plan with stakeholders	

Aspect	Sites	Parameters	Timing	Trigger	Action	Responsibility
		modifications o Annual laboratory water quality analysis for TDS, Na, K, Ca, Mg, F, Cl, SO4, HCO3, NO3, Total N, Total P, Cu, Pb, Zn, Ni, Fe, Mn, As, Se, Cd, (filtered) • Groundwater level monitoring for a minimum of 1 year post mining including: o Automatic 12 hourly level recording with Bi-monthly download and manual dip meter measurement • Groundwater pressure monitoring for a minimum of 1 year post mining including: o Automatic 12 hourly level recording with Bi-monthly download				

Appendix B - Plans

MGA

Cataract Creek

Road

Cross Lines - Centre Lines
400,500,600 NX & SX lines at 20m centres 3D
MX line @ 15m centres 3D
525 - 550 measured 2D for first 150m of LW5
500,600 SX & NX measured 3D relative
80m either side of Cataract Ceek after LW5
has advanced 150m

E 6197 000

LW 6 LW 5 LW 4

600 Line 500 Line 400 Line

CULVERT SITE 24
MARKS 12 IN EACH
CULVERT

R - Denotes Regional 3D Stations
(see plan 22167REG for details)

Slot Pins

Ousley

Mount

Pavement Crack Pins

Mount Ousley Road
P Line @ 20m centres 2d very 5th point 3D
NB & SB Fixed Prisms @ 20m centres relative - 2D
Cataract Creek Culvert 24 marks - 4 @ 3 locations in each Pipe - 1D
Pavement Crack 2 pins on NB shoulder and 2 in NB slow travel lane - 1D
Slot Pins both ND & SB shoulder - 1D (back up for electronic measurements)

Transmission Towers
Marks on structure measured to
determine component movements
Subsidence and distance between towers
(See 22167TX for Target details)

TWR-T59 TWR-E63 R9 TWR-T58 TWR-E64
TWR-E65 TWR-T57 R10 TWR-E66
TWR-T56 TWR-E67
TWR-T55 R11 TWR-E68
TWR-T54 TWR-E69

TM1 TM1A TM2 TM3 TM4 TM5 TM6

P10 P20 P30 P40 P50 P60 P70 P80 P93

NB24 SB01 SB24 NB01

E 6196 000

PICTON ROAD BRIDGE
(See 22167BDGE for Target Details)

To P1

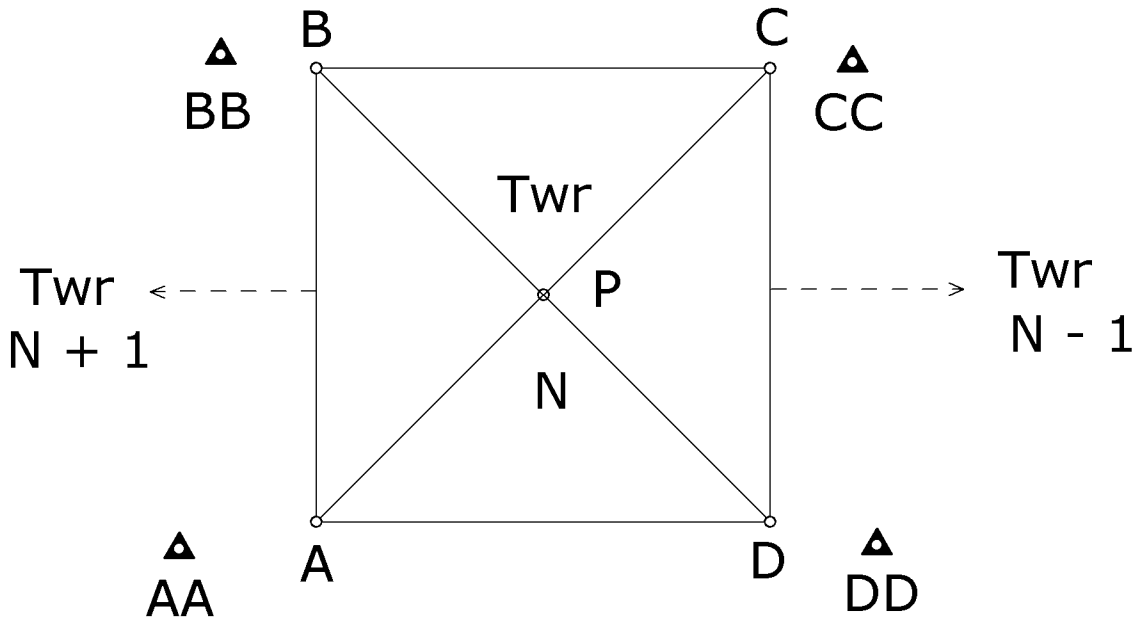
⊠ - DENOTES TILT METER

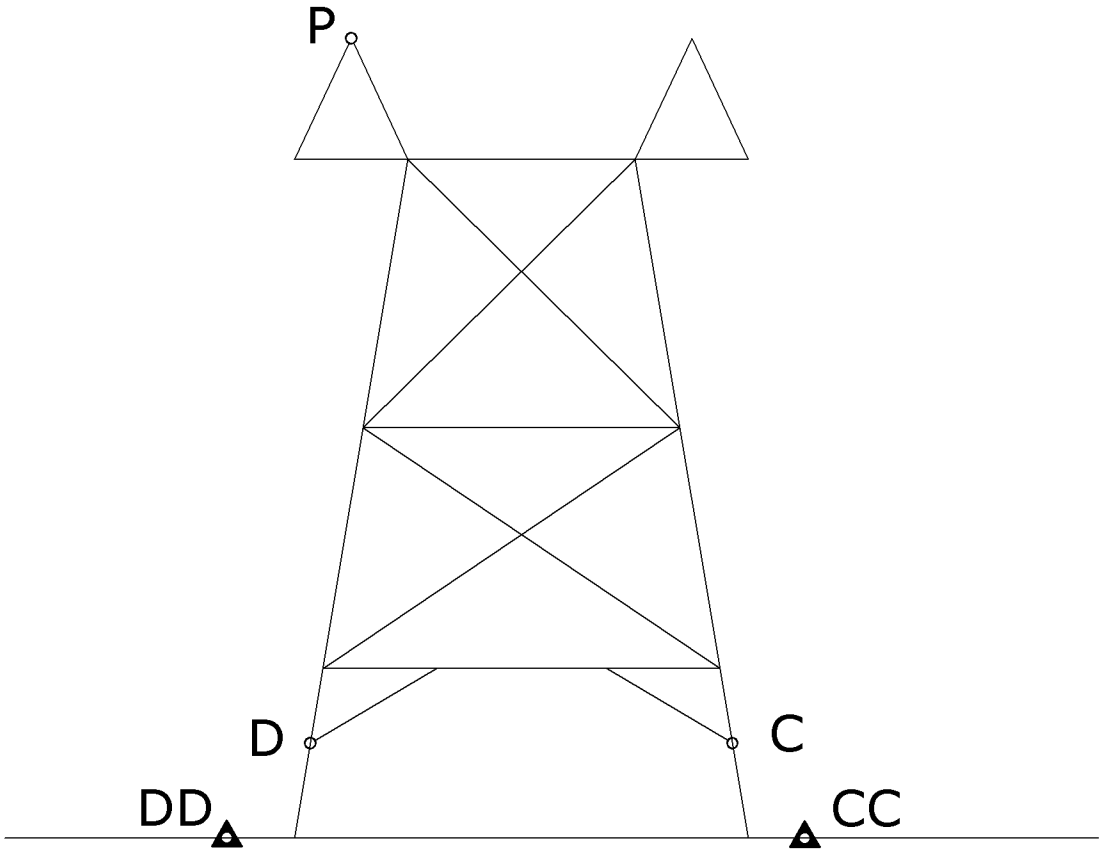
SCALE - 1:8000
AZIMUTH - MGA
CONTOUR INTERVAL -
DATUM -
DATE - 15 JANUARY 2013
REF - 22167-LW5-130115

GUJARAT NRE No1 COLLIERY
LONGWALL 5
PLAN SHOWING SUBSIDENCE MONITORING LOCATIONS

SOUTHERN CROSS CONSULTING SURVEYORS
20 Clifford Street
PO Box 142
GOULBURN NSW 2580
T: 02 4822 1366
F: 02 4822 1365
Email : admin@sccsurveyors.com.au

DIAGRAM SHOWING
NOMINAL MONITORING POINTS FOR TRANSMISSION TOWERS

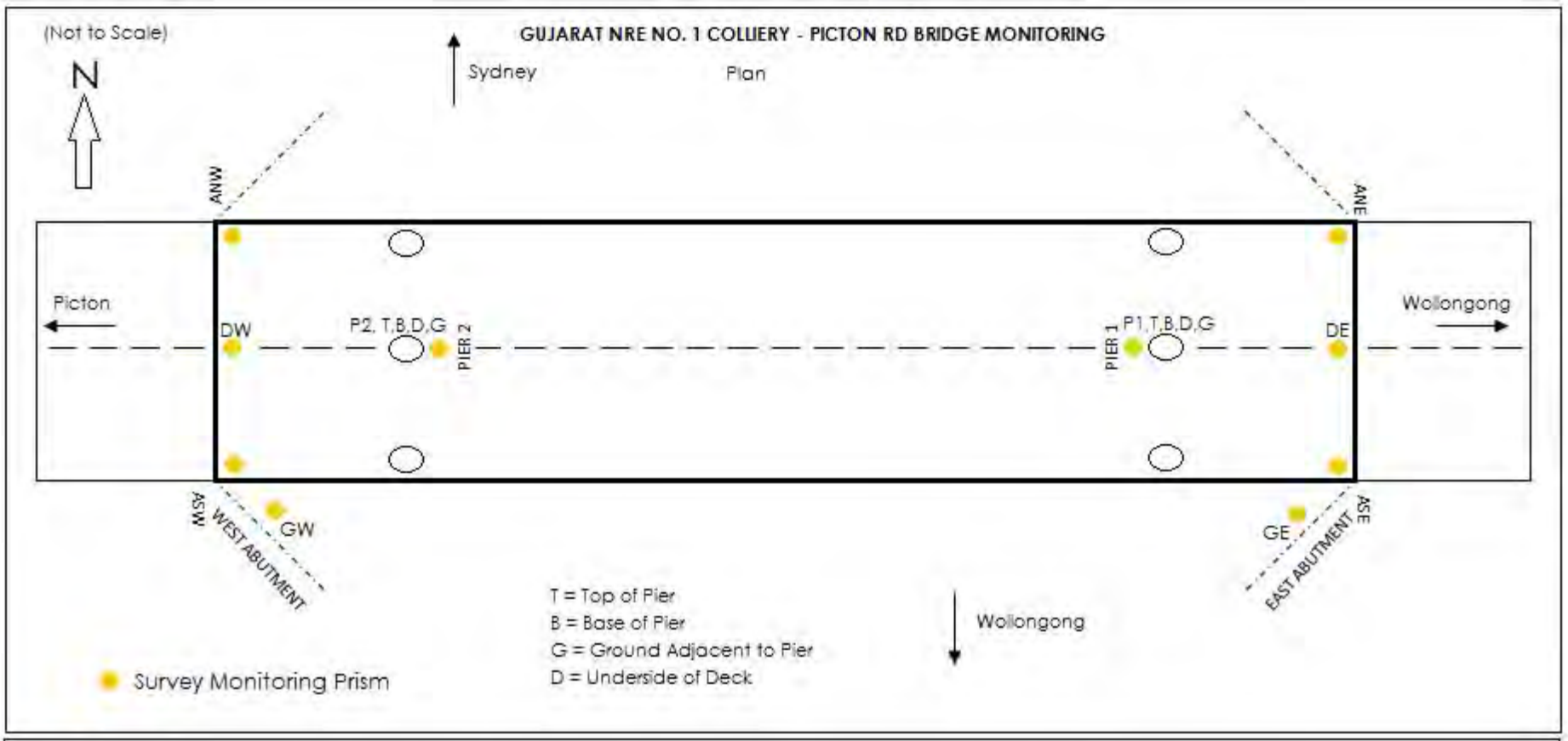


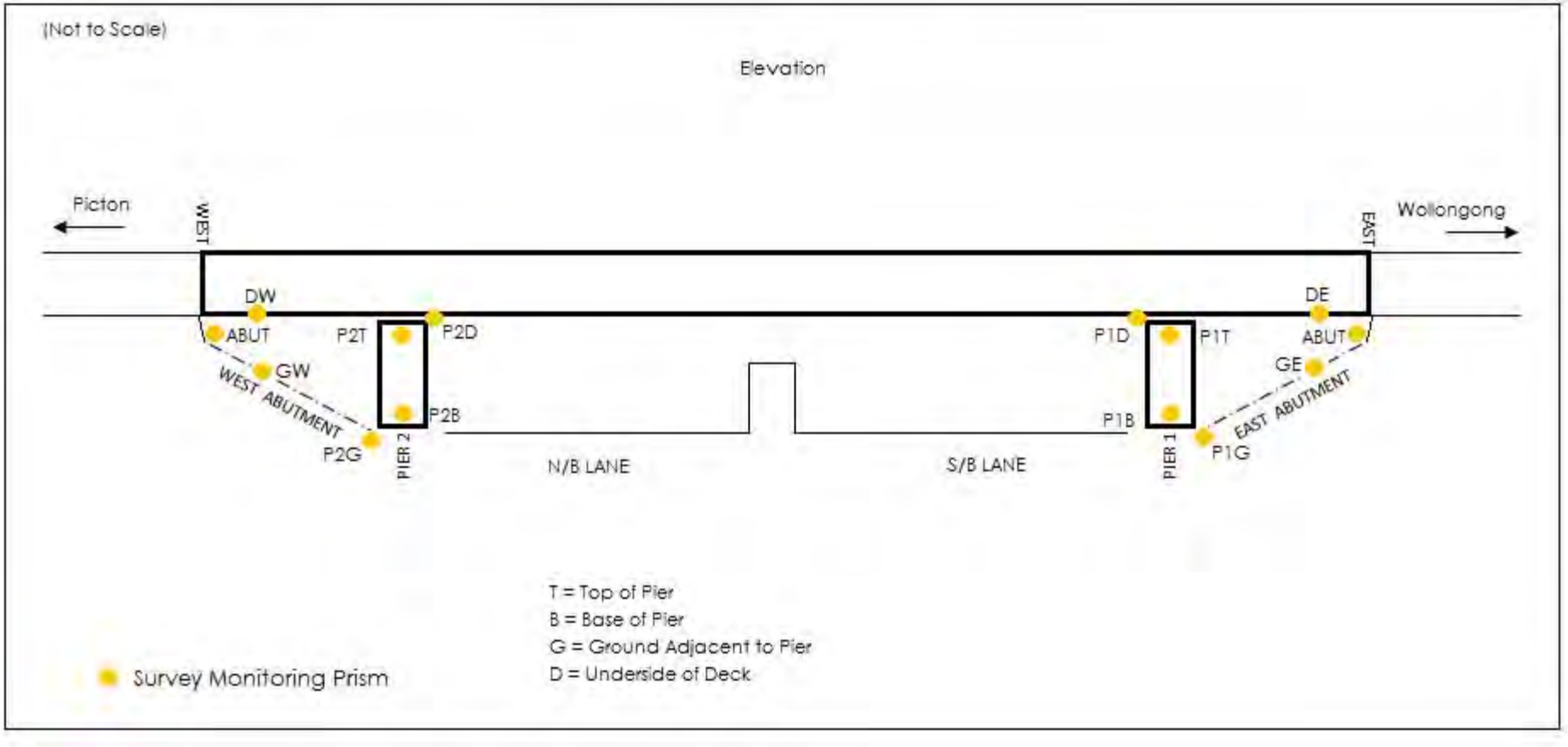


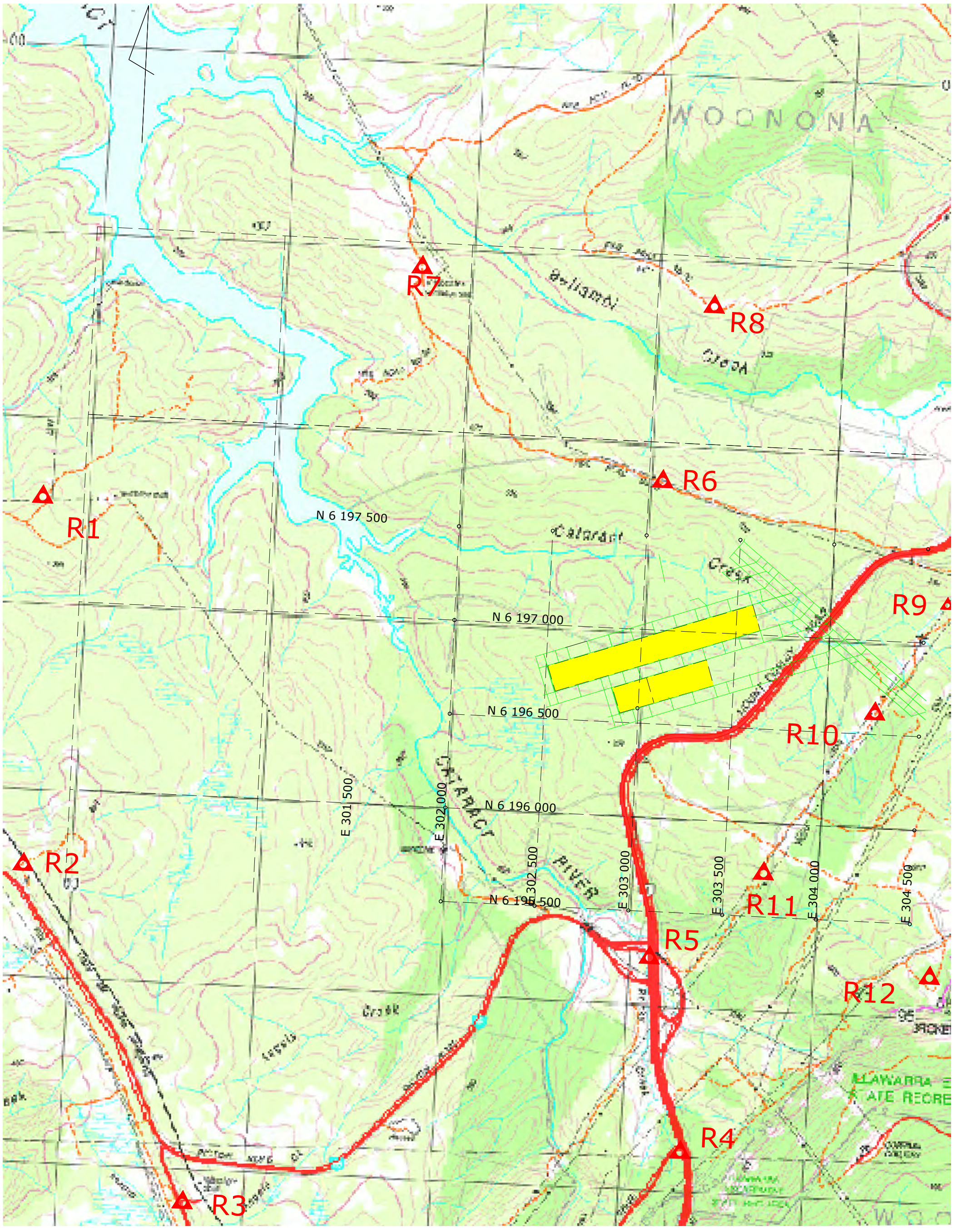
ELEVATION

A,B,C,D - REFLECTORLESS - MEASUREMENTS TO POINTS ON EACH LEG
E- EARTH WIRE TILT - REFLECTORLESS MEASUREMENT TO POINT AT TOP OF TOWER
AA - DD GROUND STATIONS ADJACENT TO EACH TOWER 2D MEASURMENT TO DIFFERENTIAL SUBSIDENCE AND GROUND STRAINS

SCALE - 1:100
REF - 22167TX


(Not to Scale)
GUJARAT NRE NO. 1 COLLIERY - PICTON RD BRIDGE MONITORING
N
Sydney
Plan
ANW
ANE
Picton
Wollongong
DW
P2, T,B,D,G
PIER 2
PIER 1
P1,T,B,D,G
DE
ASW
WEST ABUTMENT
GW
GE
EAST ABUTMENT
ASE
T = Top of Pier
B = Base of Pier
G = Ground Adjacent to Pier
D = Underside of Deck
Wollongong
Survey Monitoring Prism


(Not to Scale)
Elevation
Picton
WEST
Wollongong
EAST
DW
DE
ABUT
P2T
P2D
P1D
P1T
ABUT
GW
WEST ABUTMENT
GE
EAST ABUTMENT
P2B
P1B
P2G
PIER 2
N/B LANE
S/B LANE
PIER 1
P1G
T = Top of Pier
B = Base of Pier
G = Ground Adjacent to Pier
D = Underside of Deck
Survey Monitoring Prism



SCALE - 1:18286
AZIMUTH - MGA
CONTOUR INTERVAL -10m
DATUM - AHD
DATE -12 JUNE 1012
REF - 22167REG

GUJARAT NRE No 1 COLLIERY
PLAN SHOWING
LONGWALL's 4 & 5 AND
REGIONAL SUBSIDENCE MONITORING STATIONS

SOUTHERN CROSS CONSULTING SURVEYORS
20 Clifford Street
PO Box 142
GOULBURN NSW 2580
T: 02 4822 1366
F: 02 4822 1365
Email : admin@sccsurveyors.com.au

N6 198 000
N6 197 500
N6 197 000
N6 196 500
N6 196 000
N6 195 500
E 301 500
E 302 000
E 302 500
E 303 000
E 303 500
E 304 000
E 304 500
E 305 000
E 305 500

F.S.L. 10 289.92m AHD

CATARACT RESERVOIR

Notification Zone

Mount Ousley Road

Substation

33kV
330kV
132kV

Longwall 8
Longwall 7
Longwall 5
Longwall 4

Cataract

Maingate 8
Maingate 7
Maingate 6
Maingate 5
Maingate 4
Tailgate 4

Crhs

20m Barrier
20.12 M BARRIER (Bulli Seam Only)

TOP OF ESCARPMENT
ESCARPMENT

Mine Lease Boundary

South Bellambi Colliery
(Balgownie Seam)
C.C.L. 745

GUJARAT NRE COKING COAL LTD.
NRE No.1 COLLIERY

EXTRACTION PLAN
Plan 2e Additional Subsidence Management Area
Wongawilli Seam LW4, LW5, MG6, MG7
and MG8 Application

Signed: _____ Date _____ Signed: _____ Date _____
P Wakeford
Manager of Mining Engineering
G.Hamilton
Mine Surveyor

Plan No. : WE10227	Revision : 0
Date: 07/12/12	Scale_A0;1:4000
	Drawn:G.Hamilton

LEGEND
- Existing First Workings
- Proposed First Workings
- Mine Lease Boundary CCL745
- Application Area
- Corrimal Bulli Seam Workings
- Bulli Seam Workings
- Balgownie Seam Workings
- Dyke
- Fault
- Additional Subsidence Management Area
- Archeology Sites

Upland Swamps - Key
- Upland Swamps - Banksia Thicket
- Upland Swamps - Sedgeland-Heath Complex
- Upland Swamps - Tea Tree Thicket

Appendix C - Monitoring Methods and Accuracy

GUJARAT NRE NO.1 COLLIERY SUBSIDNECE MONITORING PROGRAM LONGWALL 5

Asset Description	Asset Type	Monitoring Description	Frequency / Survey Type	Survey Methodology
Mount Ousley Road (*RMS Assets*)	Pavement	Survey marks placed at 20m nominal centres		Static GNSS observations at 3D control points linked by Total Station Traverse.
		P1 – P93 spikes in edge of pavement. Adjacent to shoulder of outside of slow lane.	• 2D survey of P Line marks Frequency: Prior to start of LW5 -fortnightly during mining –end of LW5 • 3D survey of every 5th mark of P Line Frequency : Prior to start of LW5 then 1st Third-mid length-2nd third • 3D survey of P Line at the end of LW5	Level & Strain measurements using Trimble S8 Total Station (1" angular accuracy, EDM 1mm +1ppm) – or similar instrument. *Accuracy Expectation* 3D Position +/- 25mm 3D Levels +/- 5mm 3D Strains +/- 0.25mm/m
		NB1 – NB24 fixed prisms behind guardrail adjacent to Southbound travel lane. SB1 – SB24 fixed prisms behind guardrail adjacent to Southbound travel lane.	• Relative 2D survey of NB & SB prisms Frequency: Prior to start LW5 then 1st Third - mid length - 2nd third - end of LW5	*Accuracy Expectation* 3D Position +/- 25mm 3D Levels +/- 5mm 3D Strains +/- 0.25mm/m
		Crack monitoring Pins 4 marks placed 2 either side of crack adjacent to P40 on shoulder and in slow lane NB.	Check measure crack opening / closure measured during P line surveys	Direct Measurement - steel tape +/- 1mm
		Slot Pins 2 sets of 2 pins placed on NB & SB shoulder either side of slot	Backup system to measure slot operation should electronic measurement system fail. Frequency as required.	Direct Measurement - steel tape +/- 1mm
	Culvert	Culverts - Cataract Creek 3 sets of 4 punch marks placed diagonally at 1/4, 1/2 and 3/4 distances along culvert walls. Additionally monitoring prisms have been established adjacent to these points should access to culverts be prohibited	Measured during P Line surveys to determine any change in culvert shape.	Direct Measurement - convergence pole +/- 1mm
	Bridge	Relative 3D survey to 16 monitoring prisms on the structure and ground at points determined by RMS and Cardno structural engineers.	Frequency: Prior to start LW5 then monthly during mining and again at end of LW5	Relative survey to determine differential movements between selected structural components and ground. Determined using Trimble S8 Total Station (1" angular accuracy, EDM 1mm +1ppm) – or similar instrument. *Accuracy Expectation:* Position +/1mm Height +/2mm

Subsidence Survey Lines (*Sydney Catchment Authority*)	Cross Lines, Centre Lines and Cataract Creek	Marks placed at 20m nominal centres as shown on plan 22167-LW5 to monitor subsidence resulting from LW5 extraction	• 3D Prior to start LW5 - mid length - end of LW5. • LW5 centreline (marks 510 - 550) 2D survey is being measured every 20m of retreat for the first 140m. • Cataract Creek relative 3D survey of all lines approx. 80m either side of creek, fortnightly after 140m of retreat.	Static GNSS at Control points to fix ground measurements using Trimble S8 Total Station (1" angular accuracy, EDM 1mm +1ppm) – or similar instrument. *Accuracy Expectation* 3D Absolute Position +/- 50mm 3D Relative +/- 30mm Levels +/- 5mm
Electricity Transmission Lines (*Transgrid & Endeavour Energy Assets*)	Transmission Lines east of Mount Ousley Road - 13 Towers -	Relative survey to measure base of structure for leg tilts, leg separation or closure at each tower	Frequency: Prior to start of LW5 - mid length - end of LW5	Relative survey- Tower Legs +/- 3mm Horz. - +/- 5mm Vert. Reflectorless measurement to structural components.
		Measurement to top of each structure to calculate earth wire tilt.		Earth Wire Tilts +/- 20mm
		3D measurement to ground point established adjacent to the base of each tower to determine MGA/AHD absolute position. Enabling determination of subsidence and inter-tower distances for strain calculation.		RTK GNSS observations at ground points adjacent to each Tower. Determined by Trimble GNSS receivers and CORSnet base station at Wollongong. *Accuracy Expectation* Position +/- 30mm Height +/-50mm
		Ground stations noted AA – DD, established adjacent to each tower leg. Relative 2D survey to determine ground strain and differential vertical movements.	Measured as required to confirm any anomaly if observed structural measurement.	Measured with Total Station to targets set over each mark. Relative Levels & Distances +/- 5mm
Regional "Far Field" 3D Monitoring (*Various Asset Owners*)	Various Locations as per Appendix B	3D survey of 12 Stations surrounding LW5 up to 3.5km from panel	Frequency: Prior to start of LW5- Mid LW5 -end of LW5	Static GNSS observations referenced to CORSnet base station at Wollongong. *Accuracy Expectation* Position +/- 25mm Height +/- 35mm

GUJARAT NRE COKING COAL LIMITED
A.B.N. 28 111 244 896
NRE No 1 Colliery

NRE No.1 Colliery
Wonga East – Longwall 4 & 5 EP/SMP

LW 5 BUILT FEATURES MANAGEMENT PLAN (RMS)

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

GUJARAT NRE COKING COAL LIMITED
A.B.N. 28 111 244 896
NRE No 1 Colliery

Document Version	Revision				Revision Notes
	Date	Author	Checked	Release Date	
1	26/10/2012	H. Buys			Developed in consultation with Technical Committee
2	26/10/2012	C. Harvey			Developed from consultation with Technical Committee
3	21/11/2012	K.Prajapati	D.Clarkson	29/11/2012	Incorporated approval requirements

Authorised by: For and on behalf of RMS Name & Date Position	For and on behalf of NRE Name & Date Position

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GLOSSARY OF TERMS AND ABBREVIATIONS

Abbreviations	
BFMP	Built Features Management Plans
DoP&I	Department of Planning & Infrastructure
DSC	Dam Safety Committee
DRE	Division of Resources and Energy
DTIRIS	NSW Department of Trade and Investment, Regional Infrastructure and Services
MSB	Mine Subsidence Board
Mtpa	Million tonnes per annum
NRE	Gujarat NRE Coking Coal Limited
OEH	Office of Environment and Heritage
RMS	Roads and Maritime Services (the former Roads and Traffic Authority (RTA))
ROM	Run of Mine
SMP	Subsidence Management Plan
SGPL	Seedsman Geotechnics Pty Ltd
TC	Technical Committee

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. Bottom of Form
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 NRE No.1 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 stain (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

Gujarat NRE Coking Coal Ltd (NRE) operates 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.

On 13 October 2011, the Project Approval (MP 10_0046) for the No.1 Colliery Preliminary Works Project was granted by the Minister for Planning under Section 75(J) of the *Environmental Planning and Assessment Act 1979* (EP&A Act). This approval allows NRE to continue its operations at the mine including the extraction of coal up to 1 million tonnes per annum and upgrade of and improvements to surface facilities, in addition to first workings and transport of coal to the Port Kembla Coal Terminal for shipment as required.

NRE intends to expand its mining operations at No.1 Colliery and has submitted an application for a Underground Expansion Project (MP 09_0013) which is currently under assessment by the Department of Planning and Infrastructure (DoP&I). In order to ensure the ongoing viability of the mine while awaiting the necessary approvals, NRE lodged a concurrent Subsidence Management Plan (SMP) application for the extraction of Longwalls 4 and 5 to the Department of Trade and Investment, Division of Resources and Energy (referred to herein as DRE). The SMP approval for Longwall 4 was granted on 26 March 2012 by DRE, however, approval for Longwall 5 was not granted.

NRE lodged a section 75W (s75W) Modification Application to Project Approval (MP 10 0046), located within the approved Preliminary Works 'Application Area', to modify the Preliminary Works Approval (MP 10_0046) to include:

- Amending the reference to the use of maingates (MGs) 4 and 5 from exploratory driveages to operational gateroads;
- The extraction of coal using longwall mining techniques from Longwall (LW) 4 in accordance with the approved SMP;
- The extraction of coal using longwall mining techniques from Longwall (LW) 5; and
- Development of maingates (MGs) 6, 7 and 8.

The proposed longwalls are wholly contained within the Sydney Catcment Authority (SCA) controlled Metropolitan Catchment Area, which is used to provide drinking water to Sydney and Wollongong. The longwalls lie outside the Dam Safety Committee (DSC) Notification Area for Cataract reservoir, with the reservoir high water mark located approximately 600 m northwest of Longwall 5.

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 the light of changes to LW5 geometry and in consideration of LW4 subsidence monitoring observations, it is proposed to amend the LW4 BFMP. This BFMP covers changes to the LW 4 BFMP (RMS) for the extraction of LW5.

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.

1.2 Purpose and Scope

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

- The geometry of the next longwall, LW5 has changed.
- Some RMS infrastructure will no longer lie within the RMS zone of interest (5 x seam depth) during extraction of LW5.
- During extraction of LW4 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 the BFMP.

Accordingly, this Built Features Management Plan (RMS) for extraction of LW5 has been produced to:

- Provide an overview of mining, monitoring and impacts associated with LW4;
- 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 secondary extraction of LW5; and
- Incorporate amendments into the Monitoring Plan, TARP and Management Flow Sheet.

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

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 (DoP&I);
- Division of Resources and Energy (DRE); and

- Department of Roads and Maritime Services (RMS).

NRE will make this BFMP publicly available on the NRE website and will be responsible for its maintenance. A hard copy will also be kept at the NRE No.1 Colliery, Bellambi Lane, Russell Vale.

Any revisions undertaken will be the responsibility of NRE and any notifications will be sent accordingly. NRE will not be responsible for maintaining uncontrolled copies beyond ensuring the most recent version is maintained on NRE's computer system, website, and hard copy at the NRE No.1 Colliery, Bellambi Lane, Russell Vale.

1.4 Report Structure

The remainder of this BFMP 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-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 NRE Environmental Management Structure.

Environmental Management Structure

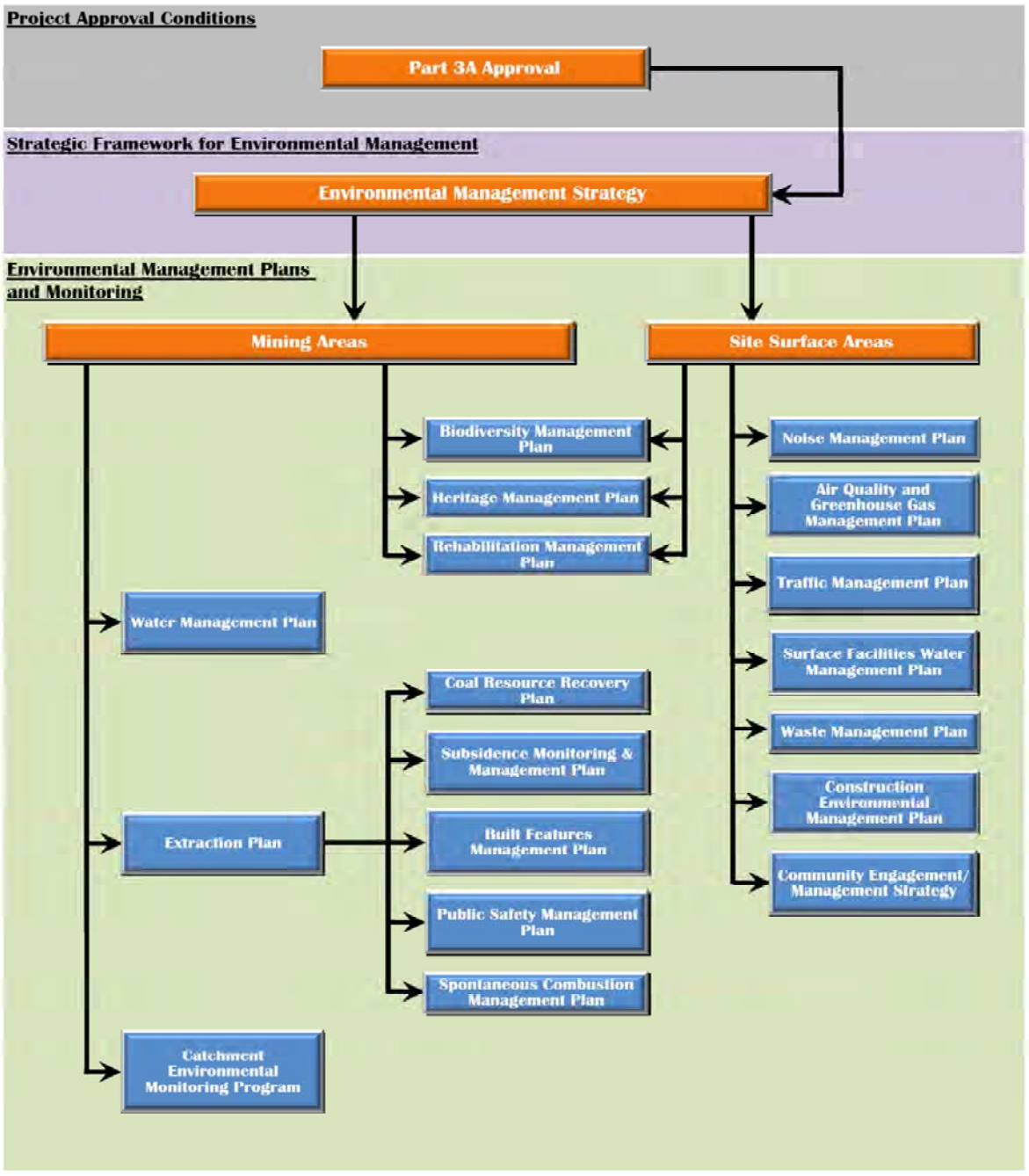
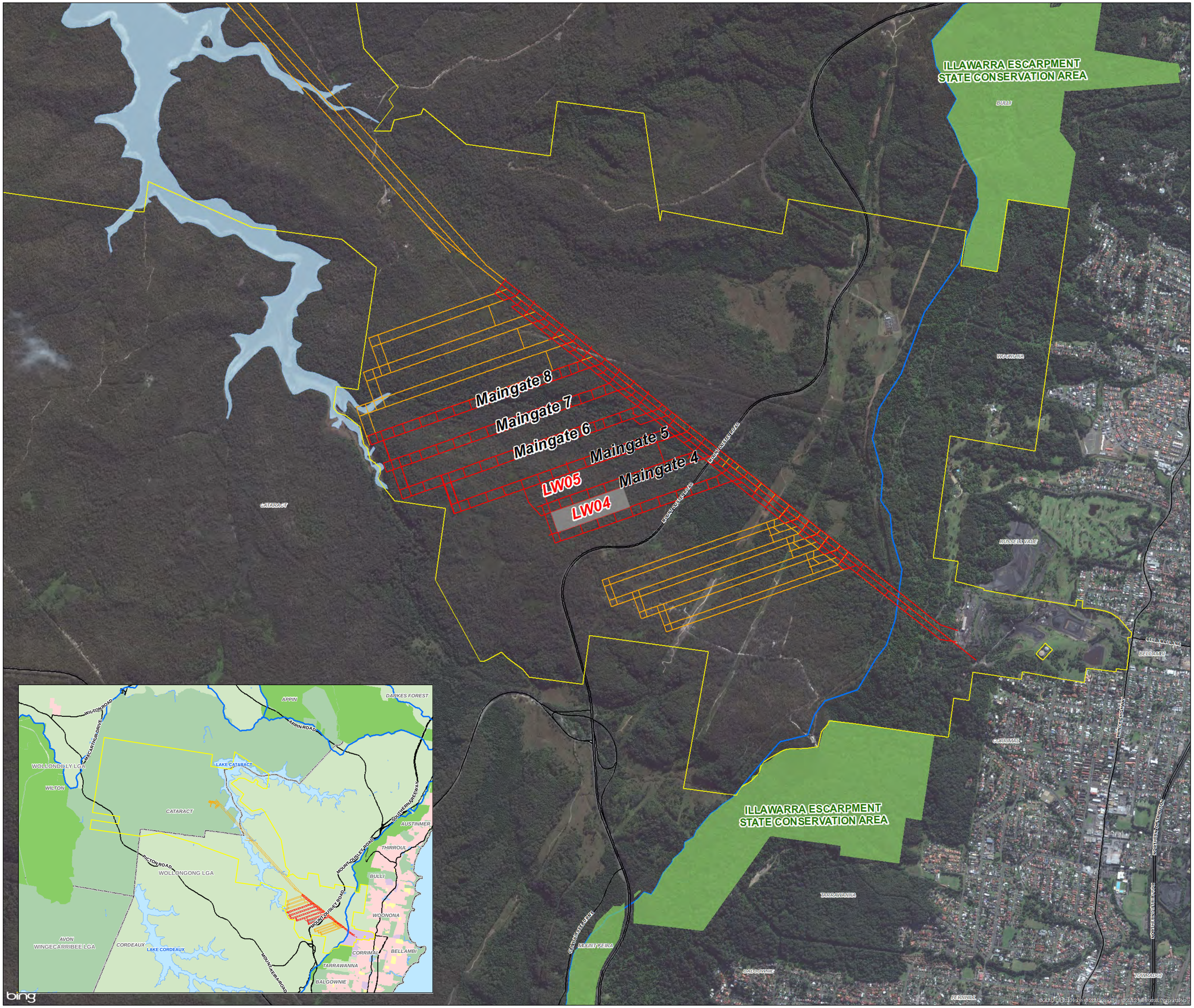


Figure 1 - Environmental Management Structure



Location Plan

RUSSELL VALE NSW

Legend

- Project Application Area
- Longwalls
- Mine Layout (February 2012)
- Major Roads (LPI)
- Longwall 4 Goaf
- LGA Boundary (LPI)
- Major Waterbodies (LPI)
- NPWS Reserve (LPI)
- Special Water Catchment Areas (SCA)

Land Use (ABS, 2011)

- Agricultural
- Commercial
- Education
- Hospital/Medical
- Industrial
- Parkland
- Residential

N
W E
S

FIGURE 2

1:12,000 Scale at A1

0 125 250 500 750 1,000 1,250 Metres

Cardno

Map Produced by Cardno NSW/ACT Pty Ltd (WOL)
Date: 2012-11-29
Coordinate System: GDA 1994 MGA Zone 56
Project: 112069-01
Map: G1001_LocationPlan.mxd 03

Aerial Imagery supplied by Bing Map and associated third party suppliers.

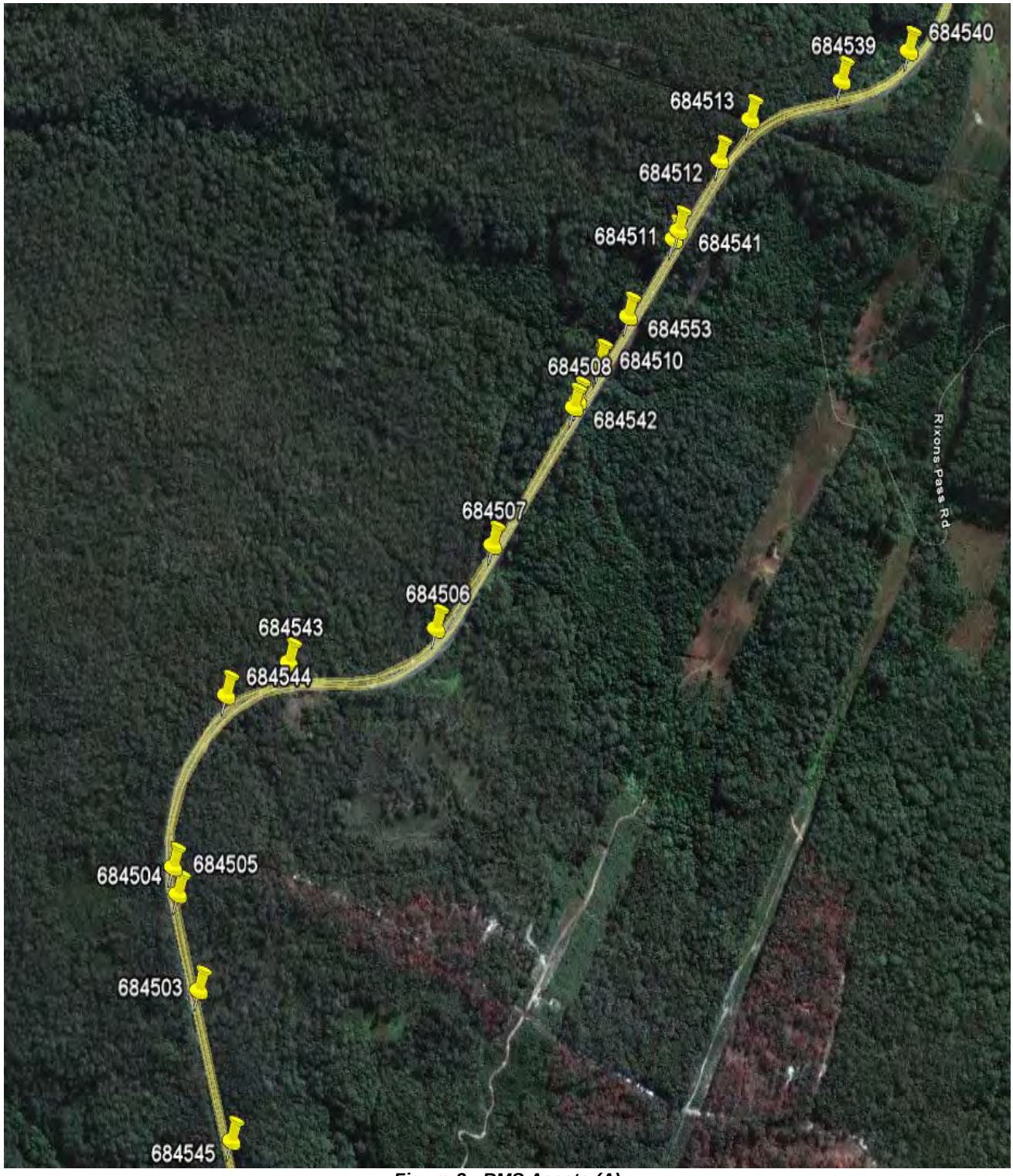


Figure 3 - RMS Assets (A)

Figure 4 - RMS Assets (B)

Figure 5 - RMS Assets (C)

2 STATUTORY REQUIREMENTS

2.1 Approval

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

Extraction Plan

7. The Proponent shall prepare and implement an Extraction Plan for all second workings on site to the satisfaction of the Director-General. This plan must:
…
(h) include the following to the satisfaction of DRE:
…

- *a Built Features Management Plan to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which:*
  - *addresses in appropriate detail all items of public infrastructure and all classes of other built features; and*
  - *has been prepared following appropriate consultation with the owner/s of potentially affected feature/s;*

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
Condition 2/Schedule 5	
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
(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:	

Project Approval Condition	Plan Section
• impacts and environmental performance of the project; • effectiveness of any management measures (see c above);	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;	Sections 8
(g) a protocol for managing and reporting any: • incidents; • complaints; • non-compliances with statutory requirements; and • exceedances of the impact assessment criteria and/or performance criteria; and	Section 7
(h) a protocol for periodic review of the plan.	Section 8

2.2 Licences and Leases

In addition to the requirements of the Project Approval and the S75W Modification Approval, all activities at or in association with the NRE No.1 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	27/12/1990 – 30/12/2023
Mining Purposes Lease	271	09/05/1991 – 09/05/2033
Mining Lease	1575	22/3/2012 – 22/3/2029
Pillar Extraction Approval T&W Mains	C90/0146(G) C91/0146(H) C01/009	31/10/2001 23/01/2002 28/06/2001
Approval to mine P&O Panels (first workings)	10.123.081	7/01/2005
DC for Thin Seam Mining P/L	D1096/01	19/09/2001
EPA Licence	12040	Current
EPA Approval for Storm Water Control Dam	90/6041 (280.021C/21)	10/08/1992
DC for Storm Water Control Dam and Water Treatment	D91/551	17/06/1992
Dangerous Goods Licence	NDG021269	14/11/2012 - 01/11/2013
SPCC Approval for Stage 3	90/4711 (280021C/20)	04/09/1992
DC for Russell Vale Waste	D89/839	11/04/1990

Licence/Approval	Document No.	Issue Date/Expiry Date
Emplacement		
DC for Demolition of Washery	D2004/32	14/12/2004
Mining operations Plan (MOP)		01/01/2008 – 31/12/2017
Preliminary Works Major Project	MP10_0046	13/10/2011 – 13/10/2014
Complying Development Certificate – Bath House	1091/11	07/11/2011
SMP Approval – Longwall 4	11/3941	26/03/2012 – 31/03/2015
Water Extraction Licence	To be determined	Submitted to NoW in January 2009
EPBC Act approval	EPBC 2011/5891	12/01/2012

2.3 Relevant Legislation and Guidelines

NRE will conduct the Project 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:

- *Mining Act 1992*
- *Contaminated Land Management Act 1997*
- *Dangerous Goods Act 1975*
- *Mining Act 1992*
- *Noxious Weeds Act 1993*
- *Road and Rail Transport (Dangerous Goods) Act 1997*
- *Roads Act 1993*
- *Protection of the Environment Operations Act 1997*
- *Threatened Species Conservation Act 1995*
- *Sydney Water Catchment Management Act 1998*
- *Coal Mine Health and Safety Act 2002*
- *Crown Lands Act 1989*
- *Dams Safety Act 1978*
- *Energy and Utilities Administration Act 1987*
- *Fisheries Management Act 1994*
- *Water Act 1912*
- *Water Management Act 2000*
- *Work Health and Safety Act 2011*
- *Environment Protection and Biodiversity Conservation Act 1999*

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

3 IMPACT ASSESSMENT

3.1 Baseline Data

The nature of the proposed extraction in conjunction with previous mining operations undertaken by the past owners, means that some sections of the Application Area, specifically in the Balgowine seam have been considered in earlier applications and approvals under the (now repealed) *Coal Mines Regulations Act 1982*. Consideration of all previously extracted seam sections (i.e. Bulli and Balgownie) within the Application Area, have been included in the assessments in predicting the potential impacts to surface features from the proposed mining of Longwalls 4 & 5. There has also been considerable review of the previously extracted areas of the Bulli and Balgownie seam with specific reference to mine record tracings to gain a comprehensive understanding of these areas. Added to this is the extensive subsidence monitoring of the surface lands for the Balgownie seam longwall extraction, which resulted in subsidence exceeding the Balgownie seam height of 1.2 m (i.e. up to 1.4 m).

3.1.1 Extraction Layout

Longwalls 4 & 5 and the surrounding Application Area are shown on **Figure 2.** The LW4 actual and LW5 estimated production schedules are provided in **Table 3.1.**

Table 3.1 - Extraction Schedule

Area	Start Date	Finish Date
LW4	19/4/2012	26/9/2012
LW5	December, 2012	April , 2013

LW4 is generally the closest panel to key RMS infrastructure, so extraction of this longwall has the greatest potential for subsidence impacts that could be experienced by the identified and assessed RMS assets. These impacts generally become less severe for LW5 and should be further attenuated in subsequent longwall extraction. The exception to this is potential for valley closure effects which could be greatest during LW5 extraction. This impact is dealt with later in this BFMP.

3.1.2 Geology

The geology of the Application Area is described in the BFMP. The dominant structural features which may have some impact on RMS infrastructure is summarised in **Table 3.2** below and presented **in Figure 6**.

Table 3.2 - Key Geological Features

Fault Name	Description
Corrimal Fault	• Normal Fault extending from seam outcrop at escarpment for approximately 3200 m to the northwest, bearing approximately 310°. • Downthrow to the northeast (throw varies from approximately 30 m to zero).

	• Hade angle of approximately 40° (to horizontal).
Dyke	• Intrusion, bearing approximately 300°. • Singularly up to 3.5 m thick with variable hardness. • Minor faulting (throw) & irregular cindering of coal associated with this structure.

3.1.3 Overview of LW 4 Subsidence Monitoring

The actual and predicted subsidence parameters provided by SGPL specific to Mt Ousley Road are presented in **Table 3.3** including the range of maximum predicted total subsidence, tilt and strain on the road resulting from the proposed extraction of LW 5 and previous mining operations including LW4.

Table 3.3 - Maximum Predicted Total Subsidence Parameters along Mt Ousley Road after the Proposed Extraction

Location	**Maximum Vertical Movement (mm)**		**Maximum Tilt (mm/m) Over 20m bay length**		**Maximum Strain (mm/m) Over 20m bay length**	
Mt Ousley Road	**Actual**	**Predicted**	**Actual**	**Predicted**	**Actual**	**Predicted**
LW4	30	<20	<0.1	<0.1	0.87	<0.1
LW5 (additional)		Zero		Zero		Zero
LW4, LW5 Cumulative		29		<0.1		<0.1

The maximum vertical downward movement recorded in monitoring records for LW4 is 30mm along the P line. It is considered that part of this movement could be “Survey Noise” and could be due to environmental effects (shrink/swell as a result of ground moisture changes) and not fully attributable to subsidence as a result of mining. Up to 20 mm of systematic subsidence movements had been predicted at the edge of the road pavement.

The maximum strain measured over a 20m bay length along the P line is a tensile 0.87mm/m (at point P39). However, it is followed immediately by compressive strain of 0.61mm/m (P40). These large changes in strain magnitude and direction over short bay lengths are consistent with survey noise. Over a 40m bay length these strains reduce to a maximum tensile strain of 0.57mm/m (P39) and a compressive strain of 0.44mm/m (P51). Assessment of these movements and strains has been reported to the TC by SGPL.

During LW4 extraction, tensile cracking was identified in the visual surveys of the Mount Ousley Road pavement at the bend south of LW4. Crack widths are in the range 2mm to 10mm as recorded on 4 September 2012. The cracking has a similar orientation to the regional faulting in the area.

The maximum recorded differential movement between any two monitoring points at the Picton Road Bridge is 10.5mm. These maximum movements are generally related to movement of the deck pegs or transient movements recorded at a ground peg (GW) during a single survey epoch, Epoch 2. Assessment of these movements has been reported to the TC by AECOM and Cardno.

3.2 Overview of LW 4 Mining Impacts to Individual Features

3.2.1 Pavements

It is likely that the cause of tensile cracking described in the overview of monitoring is the result opening of geological features such as faults or joints associated with the faulting described above. The cracks are narrow and diagonal across the pavement and therefore do not present a hazard to road users, in particular motorcyclists. The cracking to date is therefore considered to have no impact on the amenity or safety of Mount Ousley Road. The infrastructure damage is considered minor and will be repaired by crack sealing.

The maximum vertical downward movement of 30mm recorded to date is considered to be mainly related to survey precision and soil shrink/swell with little if any mining related movement. The visual surveys of the Mount Ousley Road pavement identified no surface impacts where these movements had occurred and it is considered that these movements have had no impact on the infrastructure, amenity or safety of Mount Ousley Road.

3.2.2 Picton Road Bridge

It is considered very unlikely that the recorded movements at the bridge are associated with mining. The movements in the deck are considered to be due to environmental movements (expansion and contraction due to temperature variations). The surveys to date have not indicated any changes to safety or serviceability of the bridge

3.2.3 Culverts

No impacts on culverts have been identified.

Determination of the spontaneous combustion propensity of coal from NRE No.1 Colliery.

"It was found by testing that coal from the Wongawilli, Balgownie, Bulli seam, Wongawilli Roof coal and the NRE No.1 multi seam composite is ranked as having a low propensity to spontaneously combust."

Simtars Report No. **OG420191F1**

SCALE
0 125 250

N

NOTES :
Projected contours shown on the floor of the Wongawilli Seam are interpolated from the floor of the Bulli & Balgownie seams from survey data.
All contour heights are A.H.D. related to sea level.
The thickness of the Wongawilli Seam at SB9 is 14.45m. The thickness of the 'working section' of the Wongawilli Seam varies from 2.8 to 3.2m.

Borehole SB16
E 303 112.95
N 6197 630.32
Collar (Balgownie Seam) RL 44.29
Depth to Wonga Seam 23.29m

Borehole SB9
E 303 992.67
N 6196 992.60
Collar (Bulli Seam) RL 89.302
Depth to Wonga Seam 35.20m

NRE No.1 Colliery
C.C.L. 745

Corrimal Colliery
C.C.L. 768

DSC Notification Area

Colliery Holding Boundary

Longwall 8
Longwall 7
Longwall 6
Longwall 5 (843.3m)
Longwall 4 (522.7m)

Maingate 8 · Maingate 7 · Maingate 6 · Maingate 5 · Maingate 4
Tailgate 4

310m · 285m · 270m · 265m · 275m · 300m · 320m · 260m · 275m · 300m · 325m · 350m · 365m

-20 · -10 · 0 - Sea Level · 10 · 20 · 30 · 40 · 50 · 60 · 70 · 75

N 6 197 500
N 6 197 000
N 6 196 500
N 6 196 000
E 301 500
E 302 000
E 302 500
E 303 000
E 303 500
E 304 000
E 304 500

LEGEND
- Existing First Workings
- 2nd Workings Extraction Void
- Proposed First Workings (88.3m)
- Mine Lease Boundary CCL745
- Depth of cover to Wonga Seam (365m)
- Wongawilli Seam Dykes
- Wongawilli Seam Faults
- Wongawilli Seam Floor Contours (50)
- Borehole

Borehole SB13
E 303 079.5
N 6196 524.1
Collar (Balg. Seam) RL 48.4
Depth to Wonga Seam 22.9m

Borehole SWM1
E 303414.67
N 6196086.00
Collar RL 381.75m
Depth to Wonga Seam 344.9m

Borehole SWM3
E 303681.69
N 6196048.13
Collar RL 376.23
Depth to Wonga Seam 326.18m

Borehole SB17
E 304 496.80
N 6196 494.23
Collar (Balg.Seam) RL 103.15
Depth to Wonga Seam 22.52m

CORRIMAL FAULT PROJECTED ALIGNMENT (BULLI SEAM) 15-240

20m Barrier · 20m Barrier

GUJARAT NRE COKING COAL LTD.
NRE No.1 COLLIERY

EXTRACTION PLAN
Plan 3 Geological Features
Wongawilli Seam LW4, LW5, MG6, MG7 and MG8 Application

Signed:	Date	Signed:	Date
P Wakeford Manager of Mining Engineering		G.Hamilton Mine Surveyor	

Plan No. : WE10209		Revision : 0
Date: 06/12/12	Scale_A1;1:4000	Drawn:G.Hamilton

3.3 Review of Management Measures

The following ground deformation mechanisms which may impact on RMS infrastructure as a result of mining Longwalls 4 & 5 have previously been considered in the BFMP-RMS:

- Systematic subsidence;
- Far field movements;
- Valley closure; and
- Pillar run.

The impacts of these mechanisms as a result of LW4 extraction, the implications for LW5 extraction and hence modifications to the BFMP to account for these changes are discussed in the sections that follow.

It is considered that there are no additional mining related mechanisms that could realistically impact on RMS infrastructure during extraction of LW5.

The RMS assets relevant to the extraction of LW5 are illustrated in **Figure 3, Figure 4** and **Figure 5**. For LW5 some of these assets are no longer within the RMS zone of interest and the treatment and continued inclusion of these assets in the BFMP is discussed under the relevant deformation mechanism. A summary of the relative distances between various RMS assets and LW5 is provided in **Table 3.4**.

Table 3.4 - Details of Key RMS Assets along Mt Ousley Road

Asset	RMS Reference	Approximate Distance to Longwall 5 (m)
Pavement	Refer to BFMP for details	220
Culvert 1 - North	Culvert No. 684 509	260
Culvert 2 - South	Culvert No. 684 510	260
Bridge at Picton Road Interchange	Bridge No. 7926	1500
Cutting	Slope No. 13482 &10840	450

3.3.1 Systematic Subsidence

The following observations are relevant to review of management measures for systematic subsidence:

- The LW4 and LW5 layout presented in the BFMP was developed so that RMS infrastructure was predicted to be outside the zone impacted by systematic subsidence due to extraction of these longwalls.
- 2D survey monitoring of the Mount Ousley Road shoulders indicated maximum vertical downward displacement of 29mm.
- Assessment of the monitoring data by SGPL indicates that in addition to subsidence caused by LW 4 there appears to be a relationship between vertical ground movements (both up and down) and rainfall. This could be associated with swelling and shrinking of the soil as a result of moisture changes in the ground. It is therefore considered that most of the ground movement as recorded could be a combination of "Survey Noise", subsidence induced by the extraction of LW4 and environmental effects (shrink/swell as a result of ground moisture changes).
- Visual inspection of the Mount Ousley Road pavement did identify some tension cracks that are attributable to movement along geological features possibly induced by mine subsidence.
- Ground survey along the P line has not been able to predict the onset of cracking due to the low level of strain, largely within survey tolerance.
- The extracted LW4 lies between Mount Ousley Road and the proposed LW5 for most of its length in conjunction with a 60m chain pillar and hence extraction of LW5 should have less impact on Mount Ousley Road.

In view of the above no significant additional management measures are considered necessary during extraction of LW5 and the following changes have been made to the management measures:

- Rainfall data which is recorded at the NRE Shaft 4 site will be reviewed together with the 2D survey data to try to establish a closer relationship between ground movement and rainfall.
- The 2D survey along the edge of Mount Ousley road will be modified to include a number 3D survey points.
- The survey lines down the Centre of LW 4 & 5 and the 3 cross lines (NX, MX and SX) will incorporate 3D survey points where practical due to terrain considerations.
- 2D and 3D relative closure measurements across Cataract Creek.

The last three measures above have been adopted to enhance knowledge of mine subsidence behaviour, not as a requirement for management of RMS infrastructure.

3.3.2 Far field movements

Picton Road Bridge

Detailed assessments of the potential movements at the Picton Road interchange Bridge have been provided in the BFMP (SGPL 2011). In summary, farfield movements were not anticipated at the bridge. However due to the consequence class associated with damage to the bridge, survey monitoring of the bridge was included in the BFMP.

The following observations are relevant to review of management measures for far field movements at the Picton Road Bridge:

- The Bulli and Balgownie seams have previously been extracted between the bridge and the currently proposed longwalls. Hence residual regional horizontal stresses will be insufficient to drive significant movement towards the goaf.
- A thorough assessment of potential movement at the time of BFMP development concluded that predicted movements are actually negligible.
- At the time of the original BFMP development it was considered that differential horizontal far field movements were likely to be less than 1 mm.
- Due to the shortening of the originally proposed lengths of Longwalls 4 & 5 (see **Figure 2**), the bridge is now located outside the RMS zone of interest.
- Amber triggers were activated prior to and during the course of LW4 extraction. Visual inspections of the bridge following these triggers identified that movements had occurred at the bearings. The surveys and inspections were reviewed by the TC and the recorded movements are considered to be associated with environmental effects and survey tolerance. Assessment of these movements has been reported to the TC by AECOM and Cardno.

In view of the above, it is considered that there will be no impacts on the bridge associated with far-field movements due to LW5 extraction. However, due to its importance the following changes have been made to the management measures for the bridge:

- 3D monitoring of the Bridge will continue for the extraction of LW5.

Mount Ousley Road Pavement

The following observations are relevant to review of management measures for far field movements affecting the Mount Ousley Road pavement:

- During LW4 extraction, tensile cracking occurred in the Mount Ousley Road pavement as described in the overview of monitoring. The cracking has a similar orientation to the regional faulting in the area and due to this orientation and the timing of the crack development, it is considered to be associated with ground movements due to extraction of LW4.
- The tiltmeters were ineffective as a monitoring tool and were unable to identify potential or actual changes in tilt.
- LW5 is located approximately 200m further from the road than LW4, and in addition LW4 is located between LW5 and the road. Both these factors would attenuate possible further cracking in the pavement due to extraction of LW5.
- The cracking to date is considered to be too slight to be a safety hazard.
- The cracking indicates concentration of horizontal tensile strains at the cracks. Direct measurement of movement at the cracks will provide substantially improved monitoring of the behaviour of these features compared with the current 2D survey.

In view of the above, the following change has been made to the management measures for the Mount Ousley Road pavement:

- Further monitoring of horizontal movements is best served by direct measurement of movement at the cracks. The monitoring plan has been amended to include crack width measurements between sets of pavement pins on both the north bound and south bound carriageways.
- Tiltmeters will no longer be included in this BFMP.

The following management action has been determined to remediate mining impacts:

- In view of the limited crack width, and anticipated attenuation or cessation in crack development during extraction of LW5, crack sealing is considered the appropriate response to repairing the cracks in the Mount Ousley Road pavement and this work will be undertaken by RMS.

Culverts

Similar observations to those noted for the bridge relating to far field movements apply to the culverts in the vicinity of the Picton Road Bridge. As a consequence the following changes have been made to the management measures for these culverts:

- The culverts in the vicinity of the Picton Road Bridge will only be surveyed after completion of LW5.

There will be no changes to the BFMP in relation to the culverts at Cataract Creek.

Cuttings

The following observations are relevant to review of management measures for far field movements of the cuttings along Mount Ousley Road:

- No discernible mining related movements have been identified in pavement monitoring for cuttings 10841 and 13482, located north of Cataract Creek
- No changes in cutting 13485 have been identified at the bend as a result of mining that would result in a change to condition of the cutting.

In view of the above, the following change has been made to the management measures for the cuttings:

- Using the ARL assessment of 8 December 2011as a baseline, reinspect at the completion of LW5.

3.3.3 Valley Closure

Valley closure was only anticipated during extraction of LW5, and no valley closure movements were detected by survey monitoring during extraction of LW4. Accordingly there has been no change in management measures for valley closure. However, to facilitate survey the following change has been made to monitoring for valley closure:

- Measurement of culvert deformation will be by survey measurement only. Convergence tape measurement will no longer be used.

The following management actions have been proactively undertaken to manage impacts due to valley closure:

- The pavement slot scheduled for construction prior to extraction of LW5 was installed in August 2012.
- Culvert invert strengthening as required in the BFMP was completed in March 2012.

3.3.4 Pillar Run

There has been no evidence of pillar run during extraction of LW4 and hence no change in management for this phenomenon. It is not considered further as a movement mechanism that could impact on RMS infrastructure.

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	Always safe and serviceable. Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.

4.1 Performance Indicators

In the Note to Schedule 3, Condition 4, 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	• Measurable ground strains; • Pavement cracking; • Deterioration in ride quality; and • Defects in minor structures such as kerbs and gutters, pits, etc.
Bridge Distortion	Limits have been established and will be used for monitoring the performance of the bridge: • Relative movement between any two monitored points on the structure or in the adjacent ground; and • Cracks in concrete elements. 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 **Section 5**.
Cuttings	• Measurable ground strains • Rock falls; • Cracking or visual deterioration at the rock face; and Visible displacement at joints.

Road Feature	Performance Indicators
Culverts	• Visible displacement at joints; • Displacements in the steel culverts at Cataract Creek • Cracks in concrete culverts; and • Ponding.

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 7**.

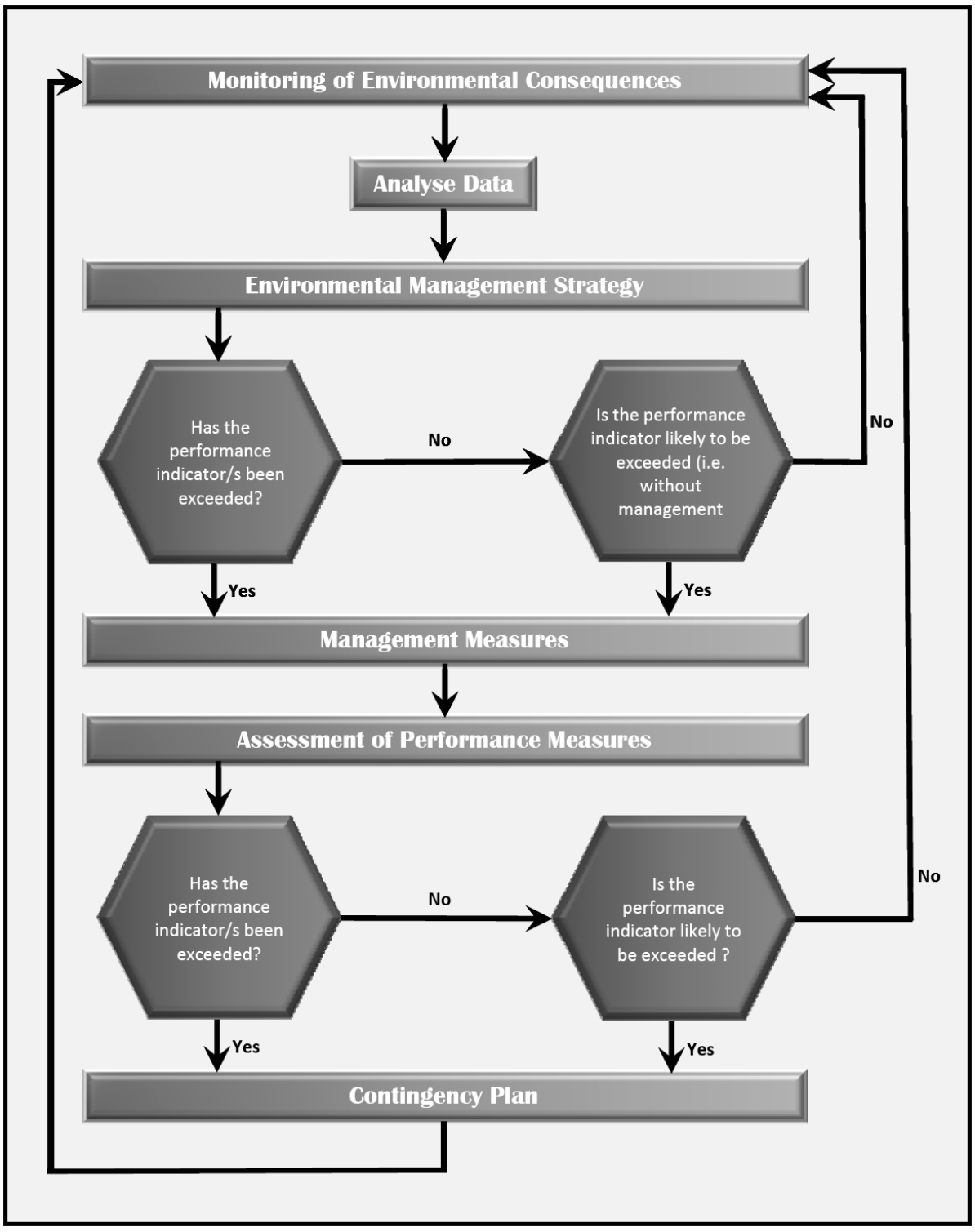


Figure 7 – Environmental Management Process

5 MONITORING AND REPORTING

5.1 Baseline Surveys

Baseline surveys have been carried out for all items listed in the Monitoring Plan. Where monitoring has been undertaken during or after extraction of LW4, this monitoring constitutes the pre-mining survey for LW5. The Monitoring Plan has been updated to reflect this process.

5.2 Monitoring

A number of monitoring and inspection programs will be undertaken during mining, of LW 5 which 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 will be reviewed by the TC when performance indicators are likely to 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 monthly 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 now be signed by NRE's Consultant Subsidence Engineer to confirm he has reviewed 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.

Reporting will be made available in accordance with the requirements *of* ***Condition 7/Schedule 3*** of the Project Approval.

Table 5.1 - Monitoring Plan for LW5

Asset	Failure	Monitoring	Accuracy	Frequency	Responsibility	Purpose
Pavements						
	• Compression shear failure leading to step or hump	• 2D survey with 3D measurements every 5th station for "P" Line along slow lane shoulder of North Bound carriageway • Relative 2D Survey Lines, on each slow lane shoulder (North Bound and South Bound) carriageway adjacent to Cataract Creek. • Approx 25 survey monitoring prisms on each line.	2D Level +/- 5mm 2D position +/-2.5mm 2D Strain +/- 0.25mm/m	• LW5: o prior to start o 1st third o mid length o 2nd third end of mining	NRE/TC NRE to carry out survey, provide results to TC specialists. Specialists report to TC within one week.	• Surveys to provide relative subsidence and strain data. **Note:** there will be no direct correlation between N/B and S/B lines
	• Propagation of tensile cracks	• Measurements of up to three sets of four pavement pins installed in the road shoulder to give direction of cracks. • Location of sets to be determined by development of cracks	+/- 1mm	• LW5: o Set up on development of cracks o 1st third o mid length o 2nd third o End of mining o Visible change in crack width	NRE/TC NRE to carry out survey, provide results to TC specialists. Specialists report to TC within one week.	• Surveys to provide strain and crack width data
		• Crackmeters in slot in pavement	+/-1mm	• Hourly from installation of slot to end of mining (See note 3) • Reported weekly	• Pells Consulting/NRE NRE to download data from crackmeters, or process data sent to web portal. Pells Consulting to produce weekly summary reports of that data (See note 3). Technical specialists to review report	• Monitor slot closure due to environmental (temperature) and valley closure effects
		• Survey Pins across slot • Two sets of pins • One set located on North Bound shoulder and another set on South Bound Shoulder	+/- 1mm	• On installation of slot At discretion of the Technical Committee	NRE/TC • NRE to carry out survey, provide results to TC specialists. Specialists report to TC within one week	• Provide slot closure information if crackmeter measurements need to be verified
		• Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange	In accordance with record sheet	• Weekly	• RMS	• Subjective assessment of rideability and pavement condition. Report on change for detailed investigation
		• Visual site inspection to identify emerging impacts on RMS infrastructure	In accordance with record sheet	• Monthly	NRE (Inspector to satisfy job description for visual pavement inspection as advised by C Dove of CNS)	• Inspection to identify and track emerging impacts potentially before they are detected by survey measurement.
		• Laser profilometer	Not applicable	Before and after LW5	RMS	• Assess pre and post mining pavement condition
		• Deflectometer	Not applicable	Before and after LW5	RMS	• Assess pre and post mining pavement condition
	Assist in evaluation of data	• Rain Gauge	Not applicable	Daily – compiled monthly	NRE	• Assist in evaluation of data
Culverts						
	• Horizontal compression leading to ovalling and buckling of culvert	• Horizontal and vertical diameter measurements at three locations in culvert (third points and centre)	+/- 1mm	**Cataract Creek Culverts** • LW5: o prior to start o 1st third o mid length o 2nd third o end of mining **Picton Road Culverts**	NRE/TC NRE to carry out survey, provide results to TC specialists. Specialists report to TC within one week	• Specific measurements to determine change of culvert shape
		Visual inspection/photos	• Monitor any change from previous report	• LW5: o prior to start o 1st third o mid length o 2nd third o end of mining • End of mining	NRE/RMS joint inspection	• Assessment of culvert condition and any changes from previous inspection
		CCTV	• Prior to mining -Identify visible cracks and defects • Monitor any change	• Use original RMS CCTV inspections as a baseline. Reinspect at the completion of LW5.	RMS	• Assess pre and post mining culvert condition

			from previous report				
Bridges							
	• Differential horizontal movements leading to destructive distortion of the bridge elements	• Relative 3D survey of the bridge structure and ground. • Fixed prisms (approx. 16): o 1 at each side of each abutment, o 1 at top and 1 at base of central column of each pier, o 1 on underside of central box girder adjacent each pier and abutment, o 1 at ground beside each pier and abutment	1mm	• LW5: o Prior to start o Monthly during mining up to middle of LW5: o End of Mining		NRE/TC NRE to carry out survey, provide results to TC specialists. Specialists report to TC within one week.	• Survey to measure relative 3D movements at target locations so that differential movements between any two points can be calculated.
		Visual survey/photos	• Identify visible cracks and defects prior to mining • Monitor any change from previous report	• LW5: o Mid length o On completion		RMS	• Assessment of bridge condition condition (cracks and other defects) and any changes from previous inspection
		Condition survey	• Prior to mining: o Identify visible cracks and defects o Survey position of bearings • Monitor any change from previous report	• Before mining and • After completion of each longwall		NRE/RMS	• Assess pre and post mining bridge condition (cracks and other defects)
Cuttings							
	Differential horizontal movements leading to instability	• Visual inspection/photos	• Monitor change from previous report	• Use ARL assessment of 8 December 2011as a baseline. Reinspect at the completion of LW5 Monthly after amber trigger in pavement surveys exceeded		RMS	Assessment of cutting condition and any changes from previous inspection
		• Road inspections – drive through inspection by RMS Network Inspector – includes Picton Road interchange	• In accordance with record sheet	• Weekly		RMS	Subjective assessment of cutting condition. Report on change for detailed investigation
Cross Lines and Centre Lines As required by SMP							
During mining of LW5		• 3D Survey on completion of Longwall 5 • block of: o Total subsidence; o Incremental subsidence; o Variation in horizontal strain. • Survey measurement comparison with predictions • Reported in Survey Reports	Refer to SMP	• Monthly during Mining		NRE	Surveys to provide subsidence and strain data
Post mining of LW5		• 3D Survey once prior to mining: o Total subsidence; o Incremental subsidence; o Variation in horizontal strain. • Report as appropriate	Refer to SMP	• Once post mining		NRE	Surveys to provide subsidence and strain data

1. **Monitoring detailed in the table above relates to monitoring after completion of baseline and LW4 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 NRE surveyor. The data will then be recorded hourly by the data logger at the site and downloaded weekly by the NRE surveyor with weekly 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.**

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	• Milling of localised humps • Heavy patch repair • Slotting • Crack sealing
Bridge	• Crack repairs; • Modifications to bearings; • Installation of temporary support; • Structural modification.
Culverts	• Point repairs; • Structural lining • Void grouting around the culverts • Internal support or strutting
Cuttings	• Rock bolting; • Scaling; • Shotcreting; • Installation of rockfall mesh; • Installation of barriers;

Road Feature	Potential Mitigation Measures
	• Trim back.
Embankments	• Trim slope • Rock Toe support • Sheet pile or other piling solution

6.2 Technical Committee

A condition of NRE'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).

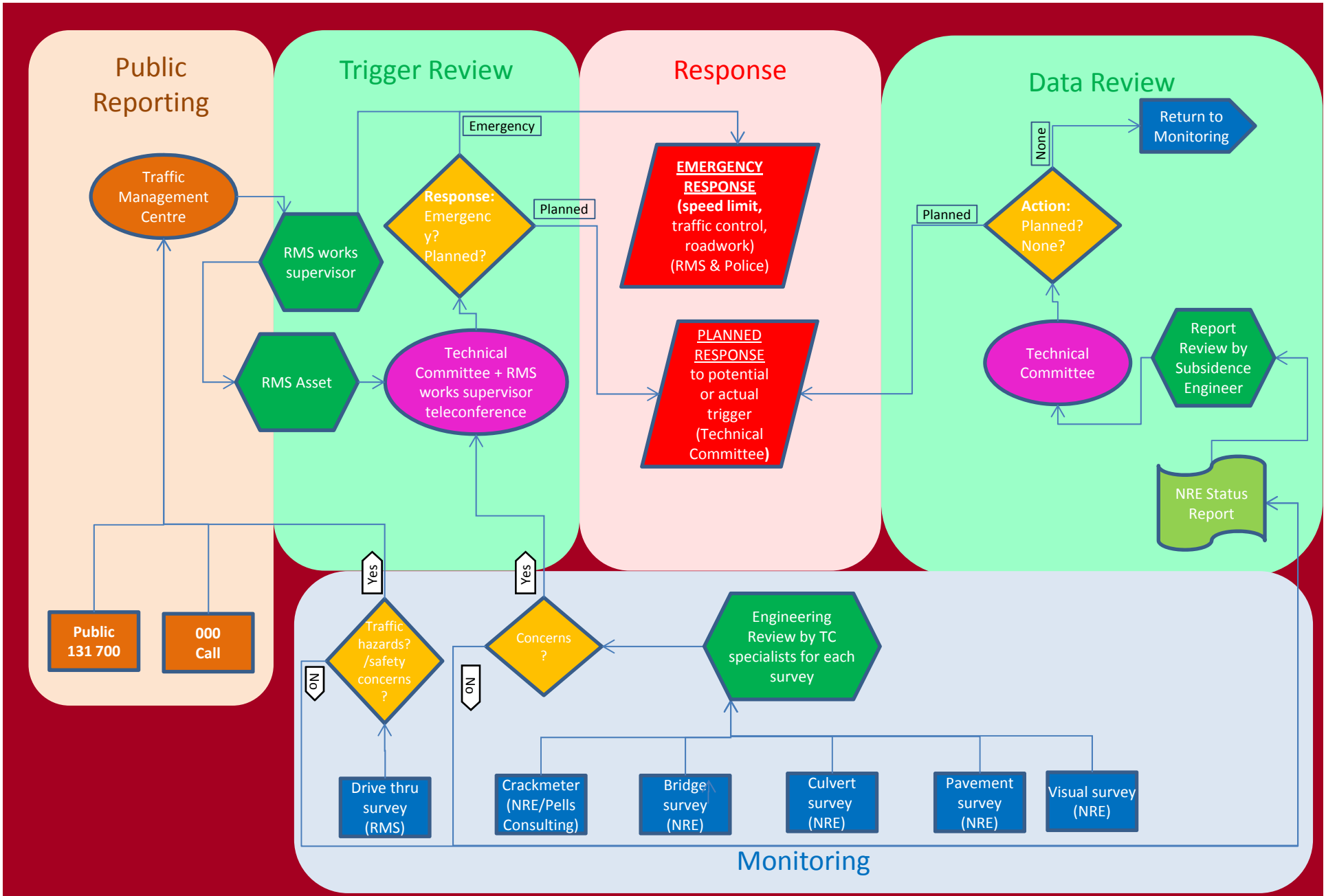
In accordance with this condition (***Condition 7h/Schedule 3***) suitably qualified and experienced specialist/s have managed and/or provided input into, the preparation of this BFMP-RMS, namely representatives from SGPL, AECOM, Pells Consulting and NRE.

This BFMP-RMS has been prepared with the assistance of a Technical Committee (TC) comprising representatives of the RMS and NRE 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 (Asset Manager)	Paul Vecovski
RMS (Senior Geotechnical Engineer)	Stanley Yuen
RMS (Supervising Pavement Engineer)	Andreas Nataatmadja
RMS (Bridge Engineer)	Dony Castro
NRE (Head of Corporate Relations)	Chris Harvey
NRE (Environment Manager)	Kamlesh Prajapati
SGPL (Principal)*	Ross Seedsman
AECOM (Technical Director) *	Henk Buys
Pells Consulting (Director)*	Philip Pells
Cardno (Senior Principal)*	Richard Woods

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



NRE Built Features Management Plan – RMS

Figure 8 - 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 specific 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.

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, NRE will implement the following Contingency Plan:

- The observation will be reported to NRE's Environment and Community Manager within 24 hours.
- The observation will be recorded.
- NRE will report any exceedance of the performance measure to the Director General of DOP&I and other relevant stakeholder as soon as practicable after NRE becomes aware of the exceedance.
- NRE 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 and Community 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.
- NRE will identify an appropriate action plan to manage the identified impact(s), in consultation with other specialists and/or key stakeholders.
- NRE will submit the proposed course of action to the DoP&I for approval.
- NRE will implement the approved course of action to the satisfaction of the DoP&I.
- NRE 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 NRE have failed to satisfactorily remediate the impact NRE will provide a suitable offset to compensate for the impact, to the satisfaction of the Director-General of DoP&I in accordance with ***Condition 3/ Schedule 3*** of the Project Approval.

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

NRE 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.

The following are 'last resort' measures that may be considered by NRE and the TC when events beyond the capacity of the management measures occur:

- Close Mount Ousley Road and divert traffic.
- Stop mining.

Note: *these would only occur following consent from both parties and with due consideration given to all other aspects likely to be influenced by this decision.*

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

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 NRE procedures in as detailed the Environmental Management Strategy.

In accordance with ***Condition 6/Schedule 5*** NRE 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 DoP&I within 7 days of the incident occurring.

7.2 Complaints Handling

Complaints will be managed through established NRE procedures in as detailed 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 NRE website. A summary of complaints will be available to regulatory authorities on request and provided in the Annual Environmental Management Reports (AEMRs).

7.3 Non-Conformance Protocol

NRE will manage and report non-compliances relevant against 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 NRE No.1 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 and Community Manager, to identify any remediation/rectification work required, and areas of actual or potential non-compliance.

A Compliance Register ***Compliance Register (EMS RV APP 003 & EMS WW APP 003)*** will be established to monitor compliance against development consent criteria, mining leases etc. Non-compliances identified through the Compliance Register are to be reported, with corrective actions implemented,

A review of NRE'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 NRE'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 EMS are outlined in ***NREG EMS PRO005 Environmental Roles and Responsibilities*****.**

8.2 Resources Required

In accordance with the ***NRE 001 NRE 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 and Community Manager to ensure that these requirements are communicated to NRE Management.

8.3 Training

All training and inductions conducted are to be undertaken as per the ***NRE 012 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.

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 ***NRE 010 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 ***NRE 010 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 will be undertaken and annually thereafter.

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.
- 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 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:

- 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)

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**.

9 REFERENCES

Cardno NSW, (2012). Investigation of Effects of Longwall Mining on the Picton Road Bridge over Mt Ousley Road. (Ref: Report No. 607247-R-1).

Roads and Traffic Authority, (2011). NSW Subsidence Impacts on Mount Ousley Road Risk Assessment. (Ref: REP/221093/S001, 7 November 2011).

Seedsman Geotechnics Pty Ltd (2011) Gujarat NRE No1 Colliery: Management of Subsidence Risks associated with Wongawilli Seam Extraction. Report to Gujarat NRE Minerals. As included in NRE, (2011). Subsidence Management Plan for NRE No. 1 Colliery Russell Vale Longwall Panels 4 & 5 in 'Wonga East'.

Seedsman Geotechnics Pty Ltd (2012). Management of Subsidence Risks associated with Wongawilli Seam Extraction with particular focus on Wongawilli East – Area 2. Report to Gujarat NRE Colliery. As included in Olsen Environmental Consulting, (2012). Review of Environmental Factors. NRE No. 1 Colliery Longwalls 4 & 5.

Seedsman Geotechnics Pty Ltd (September 2012). Subsidence Associated with WWLW4. Letter Report to Gujarat NRE Coking Coal Ltd.

AECOM Australia Pty Ltd (November 2012). NRE - Longwall 4 Extraction: Assessment of Bridge Surveys.

Cardno NSW/ACT (November 2012). NRE Longwall 4 Extraction: Assessment of Picton Road Bridge Surveys at End of Longwall.

Appendix A – Trigger Action Response Plan (TARP)

Appendix A

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. NRE 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. NRE 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. Tiltmeters, 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**
NRE	Control Room	4223 3827	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
NRE	Site Inspector	4223 6826/ 4223 6822	Y	Y	N
NRE	Crackmeter monitoring and reporting	4223 6826/ 4223 6822	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)

NRE Control Room – (02) 4223 3827

Organisation	Position	Name		Alternate		Notification required for		
		Name	Contact details	Name	Contact details	Amber	Red	Grey
RMS	Technical Commitee Chair	Dick Lee Shoy	0431 487 204	Paul Vecovski	0437 130 821	Y	Y	N
RMS	Asset Manager	Paul Vecovski	0437 130 821	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	Senior Pavement Engineer	Andreas Nataatmadja	0429 505 700	Paul Vecovski	0437 130 821	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
NRE	Head of Corporate Realtions	Chris Harvey	0425 398 380	Kamlesh Prajapati	0400 352 436	Y	Y	N
NRE	Environment Manager	Kamlesh Prajapati	0400 352 436	Chris Harvey	0425 398 380	Y	Y	N
SGPL	Geotechnical Principal	Ross Seedsman	0417 279 556	-	-	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	***Minor*** • No visible ground movement due to mining • Potential or actual step height < 30mm • Crackmeter closure < 30mm • Pavement strains (Cataract) < 0.5mm/m • Pavement strains (Bend) < 0.5mm/m	• Manage in accordance with monitoring plan	Not applicable
		AMBER	***Moderate*** • Ground movement due to mining visible • Potential or actual step height > 30 mm & ≤ 50mm • Crackmeter closure ≥ 30mm • Pavement compressive strains (Cataract Creek) >0.5mm/m over a 20m bay length • Pavement compressive strains (Bend) ≥ 0.5mm/m over a 20m bay length	• Technical specialist to notify TC • RMS to inspect pavement • TC to meet – review monitoring data, including: o Pavement inspection o Determine peak strain o Assess monitoring data for trends o forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 24 hours • Within 12 hours • Within 72 hours • Within 24 hours
		RED	***Severe*** • Step height > 50 mm • Pavement compressive strains (Cataract Creek) ≥ 1.0mm/m over a 40m bay length • Pavement compressive strains (Bend) ≥ 1.0mm/m over a 40m bay length	• Technical specialist to notify TC • RMS to inspect pavement • RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police • TC to meet – consider and advise on immediate corrective action/s which may be required • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 2 hours • Within 2 hours • Within 2 hours • Within 24 hours • Within 24 hours
Culverts – Cataract Creek					
Low Risk	Horizontal compression, leading to ovalling and buckling of culvert	GREEN	***Minor*** • No visible ground movement • No change in culvert condition • Steel culverts only: – Ground closure < 50mm – Convergence < 50mm	• Manage in accordance with monitoring plan	

		AMBER	***Moderate*** • Visible distortion of culverts • Movement in pavement associated with culvert distortion • Ground movement or formation of voids due to culvert distortion • Ground closure ≥ 50mm • Convergence ≥ 50mm	• Technical specialist to notify TC • RMS to inspect culverts and pavement above • TC to meet – review monitoring data, including: o Culvert inspection o Determine peak convergence o Assess monitoring data for trends o forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 24 hours • Within 24 hours • Within 1 week • Within 24 hours
		RED	***Severe*** • Ground movement in pavement due culvert damage or mining • Severe distortion or buckling of steel culverts • Imminent collapse of culvert structure ***Note:*** *1) Red trigger actions are to ensure the 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*	• Technical specialist to notify TC • RMS to inspect pavement and culvert • RMS to notify Traffic commander via TMC to enforce immediate speed restriction – enforced by traffic commander and NSW police • TC to meet – consider and advise on immediate corrective action/s which may be required • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 2 hours • Within 2 hours • Within 2 hours • Within 24 hours • Within 24 hours
Cuttings/Embankments					
High Risk (cuttings) Medium Risk (embankments)	Ground strains leading to instability of rock cuttings	GREEN	***Minor*** • No visible change in cuttings	• Manage in accordance with monitoring plan	
		AMBER	***Moderate*** • Observed changes in cuttings • Strains exceed 0.5mm/m in pavement at Cataract Creek	• RMS geoscientist to assess impact • TC to meet and determine corrective action/s	• Within 24 hrs • Within 48 hrs
Bridges					
High Risk	Differential horizontal movements leading to destructive distortion of the bridge elements	GREEN	***Minor*** • Normal operation • Relative movement between any two monitoring points ≤ 5mm	• Manage in accordance with monitoring plan	
		AMBER	***Moderate*** • Differential movement that could result in	• Technical specialist to notify TC	• Within 24 hours

			unacceptable distortion of any bridge element	• RMS/Bridge specialist to inspect bridge • TC to meet – review monitoring data, including: o Inspect bridge o Assess nature of differential movements o Assess monitoring data for trends o forecast if and/or when the RED trigger level might be exceeded o Decide on and direct proactive action • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 24 hours • Within 72 hours • Within 24 hours
		RED	***Severe*** • Structural defects noticeable • Advice from consultant that bridge has become unsafe or is in an unserviceable condition.	• Technical specialist to notify TC • RMS/bridge specialist to inspect bridge • RMS to notify Traffic commander via TMC to enforce bridge and road closure – enforced by traffic commander and NSW police • TC to meet – consider and advise on immediate corrective action/s which may be required • NRE to notify relevant stakeholders and/or regulators and/or specialists	• Within 2 hours • Within 2 hours • Within 2 hours • Within 24 hours • Within 24 hours
Monitoring devices					
Low risk		GREEN	***Minor*** • All devices operating	• Monitor in accordance with management plan	
		GREY	• Loss of power, communications or data from automated monitoring systems • Unable to access automated monitoring data	• When Pavement Trigger is Green: o Identify cause and rectify o Inform TC of occurrence • When Pavement Trigger Amber: o Identify cause and rectify o Inform TC of occurrence	• Within 72 hours • Within 24 hours