

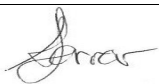


**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Extraction Plan LW101 to LW106

Edition	Rev.	Comments	Author	Authorised By	Date
A	7-Oct-2011	For NCOPL Review	Peter Horn Associate Director		
B	29-Nov-2011	For DP&E Submission	Peter Horn Associate Director		
C	18 May 2016	LW106 Update	Steve Farrar Environmental Superintendent		18/05/2016



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ABBREVIATIONS

ACHMP	Aboriginal and Cultural Heritage Management Plan
AEMR	Annual Environmental Management Report
AQMP	Air Quality Management Plan
BFMP	Built Features Management Plan
CHPP	Coal Handling and Preparation Plant
DGS	Ditton Geotechnical Services
DoE	Commonwealth Department of Environment (formerly the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC))
DP&E	Department of Planning and Environment
DPI	Department of Primary Industries
DPI Water	Department of Primary Industries – Water
DRE	Division of Resources & Energy (a division of DTIRIS)
EA	Environmental Assessment (RW Corkery & Co Pty Ltd, November 2009)
EMP	Environmental Management Plan
EMS	Environmental Management Strategy
EP&A Act	Environmental Planning and Assessment Act 1979 (NSW)
EPL	Environmental Protection Licence
ESAP	Energy Savings Action Plan
km	kilometres
LandMP	Land Management Plan
LMP	Landscape Management Plan
LW	Longwall (e.g. LW4)
m	metres
MCP	Mine Closure Plan
MG	maingate (i.e. MG1 = maingate 1)



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ML	Mining Lease
mm	millimetres
MOP	Mining Operations Plan
Mtpa	Million tonnes per annum
NCOPL	Narrabri Coal Operations Pty Ltd
NM	Narrabri Mine
NMP	Noise Management Plan
NSC	Narrabri Shire Council
OEH	Office of Environment and Heritage
PA	Project Approval
PED	Personnel Emergency Device (communications system)
RMP	Rehabilitation Management Plan
RMS	Roads and Maritime Services
RRP	Resource Recovery Plan
SMP	Subsidence Monitoring Program
TG	tailgate (i.e. TG1 = tailgate 1)
WCL	Whitehaven Coal Limited
WMP	Water Management Plan



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GLOSSARY

Angle of Draw	The angle between the vertical and the line joining the edge of the mining void with the limit of vertical subsidence, usually taken as 20mm.
Cover depth	The depth of coal seam from the ground surface (metres).
Environmental consequences	The environmental consequences of subsidence impacts including: damage to built features; loss of surface flows to the subsurface; loss of standing pools; adverse water quality impacts; development of iron bacterial mats; cliff falls; rock falls; damage to Aboriginal heritage sites; impacts to aquatic ecology; ponding.
Far-field subsidence	Mining-induced movements of the ground surface in areas where vertical subsidence is less than 20mm.
First workings	Development headings created by a continuous mining machine - designed to remain stable during development and longwall extraction. Provide ventilation and services, access for staff and materials, and allow for transportation of raw coal out of the mine (i.e. also referred to as mains headings, gate roads, maingate, tailgate).
Goaf	The mined-out area into which the immediate roof strata breaks.
Project Approval	Development consent (DA_08_0144) issued on 26th July 2010 under Section 75J of the Environmental Planning and Assessment Act 1979 by the Department of Planning & Infrastructure (and as modified).
Second Workings	Extraction of coal from longwall panels, mini-wall panels, or pillar extraction.
Subsidence	The totality of subsidence effects, subsidence impacts and environmental consequences of subsidence impacts.
Subsidence effects	Deformation of the ground mass due to mining, including all mining-induced ground movements, including both vertical and horizontal displacement, tilt, strain and curvature.
Subsidence impacts	Physical changes to the ground and its surface caused by subsidence effects, including tensile and shear cracking of the rock mass, localised buckling of strata caused by valley closure and upsidence and surface depressions or troughs.
Upsidence	Relative vertical upward movements of the ground surface associated with subsidence.
Vertical subsidence	Vertical downward movements of the ground surface caused by underground coal mining.



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1 INTRODUCTION

1.1 Background

The Narrabri Mine is located approximately 10km southeast of Narrabri and approximately 30km northwest of Gunnedah in New South Wales (NSW) (refer to Figure 1). The project includes an underground longwall coal mine, a Coal Handling and Preparation Plant and associated rail siding and surface infrastructure.

The Narrabri Mine is operated by Narrabri Coal Operations Pty Limited (NCOPL), a wholly-owned subsidiary of Whitehaven Coal Limited (WCL). The Narrabri Mine has been designed as an underground mine using retreating longwall methods, consisting of approximately 20 longwall panels, recovering up to 4.3 metres (m) of coal from the lower part of the Hoskissons Coal Seam. The total underground mine has an approximate footprint of 3,630 hectares (ha) and is covered by Mining Lease (ML) 1609.

The Narrabri Mine was granted project approval for Stage 1, by the NSW Minister for Planning in November 2007 under Part 3A of the NSW Environmental Planning and Assessment Act, 1979 (EP&A Act). This included the development of a continuous-miner underground operation, a crushing and sizing plant and loading of product coal into train wagons for transportation to the Port of Newcastle.

Construction works of the surface facilities commenced under the Stage 1 approval at the site in January 2008. Development of the underground mine commenced in 2010.

In late 2008, NCOPL applied under the EP&A Act to increase production at the Narrabri Mine through the introduction of longwall mining ("Stage 2"). This Project Application included the commencement of longwall mining operation ("secondary extraction"), and the installation of additional coal processing and handling infrastructure to increase the annual production rate from 2.5 million tonnes per annum (Mtpa) to 11 Mtpa, in accordance with PA 08_0144 Modification 5, approved during December 2015. Modification 5 also allowed for mining wider longwall panels beyond LW106.

Stage 2 was approved by the Minister in July 2010, and the consolidated Project Approval (PA) 08_0144, as modified, includes a series of consent conditions regarding the management of subsidence impacts and environmental consequences of longwall mining, including the preparation and approval of a suite of management plans prior to the commencement of longwall mining (also referred to hereafter as second workings or secondary extraction).

1.2 Scope

Prior to undertaking longwall operations proposed as part of Stage 2 works, the Narrabri Mine Project Approval, (Schedule 3, Condition 4), requires that inter alia:

"The proponent shall prepare and implement Extraction Plans for any second workings to be mined to the satisfaction of the Secretary."

Therefore, this Extraction Plan sets out the proposed monitoring, management, and reporting activities developed to address the predicted subsidence impacts from the secondary extraction of Longwalls (LW) 101 to 106 in the Hoskissons seam at the Narrabri



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Mine and has been prepared in accordance with Schedule 3, Condition 4 of the modified PA 08_0144. The original plan was developed by AECOM and related to the extraction of LW101 to LW105. This revision has been undertaken to incorporate LW106. Future longwall panels, i.e. from LW107 and beyond, will be subject to a new Extraction Plan to be approved prior to mining these panels.

1.3 Objective

The objective of this Extraction Plan is to provide for the adequate protection of important natural and built features from direct and indirect subsidence impacts associated with LW101 to 106.

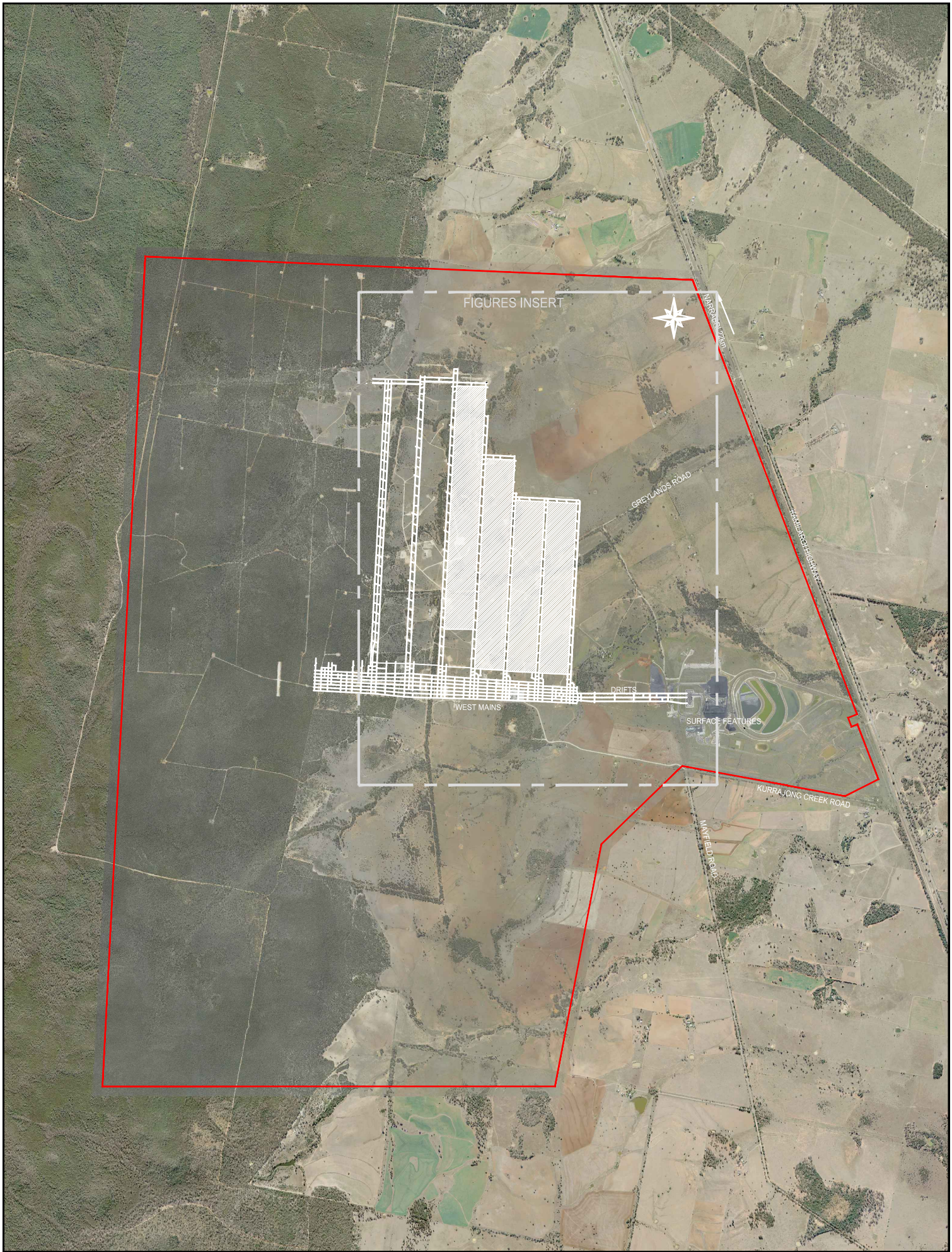
This objective will be achieved by:






- Implementing the proposed monitoring and management measures to reduce the identified subsidence risks; and
- Implementing a review and auditing process to provide possible feedback on the proposed monitoring and management measures and to allow for continual improvement.

1.4 Risk Assessment





A subsidence risk assessment has been undertaken to identify the risks associated with subsidence at the Narrabri Mine. The initial risk assessment was undertaken during February 2012 for LW101 to LW105. This risk assessment has since been reviewed and updated to include LW106, refer to Appendix K.

The initial risk assessment ranked two items as having a high risk level and both related to the 11kV power line that traverses the mining area above LW101 to LW105. This line has since been disconnected and as such, these risk ratings have been reduced to low. As a result, there are no high level risk ratings remaining and the risks associated with subsidence above LW101 to LW106 for the Narrabri Mine have been assessed as low to moderate.



LEGEND			By	Date:	Narrabri Mine Locality Plan		 WHITEHAVEN COAL		
	First Workings		Second Workings	Drafted:				A.Taylor	18/06/15
	Mine Lease Boundary							Edited:	
	Secondary Extraction							Approved:	
			Scale:	1:50,000		Plan No: APN.05.01	NARRABRI MINE		



LEGEND  First Workings  Mine Lease Boundary  Secondary Extraction	By	Date:	Mine Plan		 WHITEHAVEN COAL NARRABRI MINE	
	Drafted:	A.Taylor				25/06/15
	Edited:					
	Approved:			Plan No: APN.05.02		
	Scale:	1:20,000				



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1.5 Site Description

Longwall panels at the Narrabri Mine are oriented in a north-south layout and radiate out from the mains headings "West Mains" (refer to Figure 2). Longwall panels vary in length, but are approximately 306m wide, with depth of cover ranging from approximately 160m to 240m. The longwall will recover the lower 4.3m of the Hoskissons Seam, which ranges from around 4.6m to 10.5m total thickness. A detailed description of the mine plan, anticipated extraction schedule, along with local geology, overburden description and resource recovery is provided in the Coal Resource Recovery Plan (**Appendix A**).

The footprint of Longwalls (LW) 101 to 106 covers approximately 550 ha and predominantly comprises private landholdings owned by NCOPL. These landholdings have been historically used for livestock grazing and cereal crop farming. The surface terrain is generally undulating with slopes between 2° and 5°, with localised increases in the vicinity of the ephemeral tributaries to Pine Creek, which drains the Extraction Plan area to the north east.

In summary, existing natural and built surface features across the surface area of LW101 to 106 include:

- Ephemeral tributaries of Pine Creek, and remnant riparian vegetation corridors;
- Low quality sub-surface groundwater aquifers at depths ranging from 5m to 50m;
- Aboriginal heritage sites;
- Greylands Road and associated Crown Land road reserve;
- 11kV overhead electricity transmission line (owned by Essential Energy);
- Agricultural land holdings (grazing, limited cropping);
- Unsealed access roads and property fences;
- Earth embankment water storage dams;
- Soil conservation works (contour banks);
- One rural-residential building, machinery shed and orchard (owned by NCOPL); and
- PED Cable, surface to in-seam gas drainage bores, and other associated mining infrastructure.

Potentially affected surface features are shown in Figure 3. A full description of the pre-mining environment is contained in the Environmental Assessment (EA) for the Narrabri Coal Mine, Stage 2 Longwall Project (RW Corkery & Co. Pty Ltd, 2009).

1.6 Project Team

The project team responsible for the preparation of this Extraction Plan and supporting documents is listed in Table 1. In compliance with Schedule 3, Condition 4(a), the project team was endorsed by a delegate of the Secretary for DP&E on 23 April 2015.



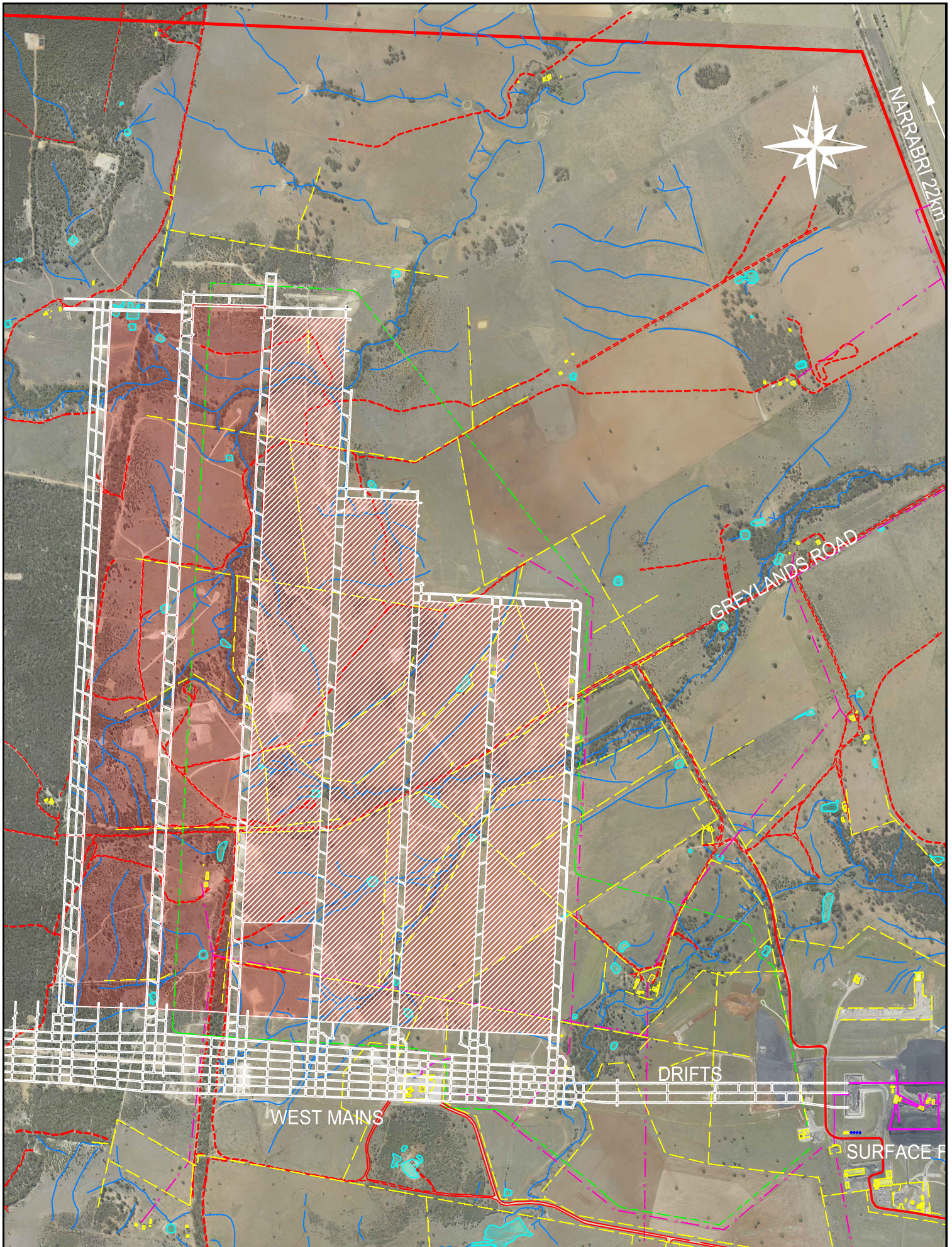
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Table 1 Project Team

Name	Company	Technical Area / Document
Steve Farrar Tony Dwyer	Whitehaven Coal Limited	Non-expert / administrative changes within the Extraction Plan, Coal Resource Recovery Plan, Subsidence Monitoring Program, Built Features Management Plan and Public Safety Management Plan
Amanda Kerr Luke Kirkwood	AECOM	Heritage Management Plan
Steve Ditton	DGS	Subsidence Predictions
Saul Martinez	URS Australia	Water Management Plan
Paul Frasier Nathalie van der Veer	Eco Logical Australia	Biodiversity and Land Management Plans and revisions to the Landscape Management Plan
Andrew Hutton	SLR Consulting	Revisions to the Mine Closure Plan



LEGEND

	First Workings		Over Land Water Path		Tank
	Mine Lease Boundary		Unsealed Road		
	Secondary Extraction		Mine Infrastructure		
	Buildings		Ped Cable		
	Dams		Overhead Powerline		
			Fence		

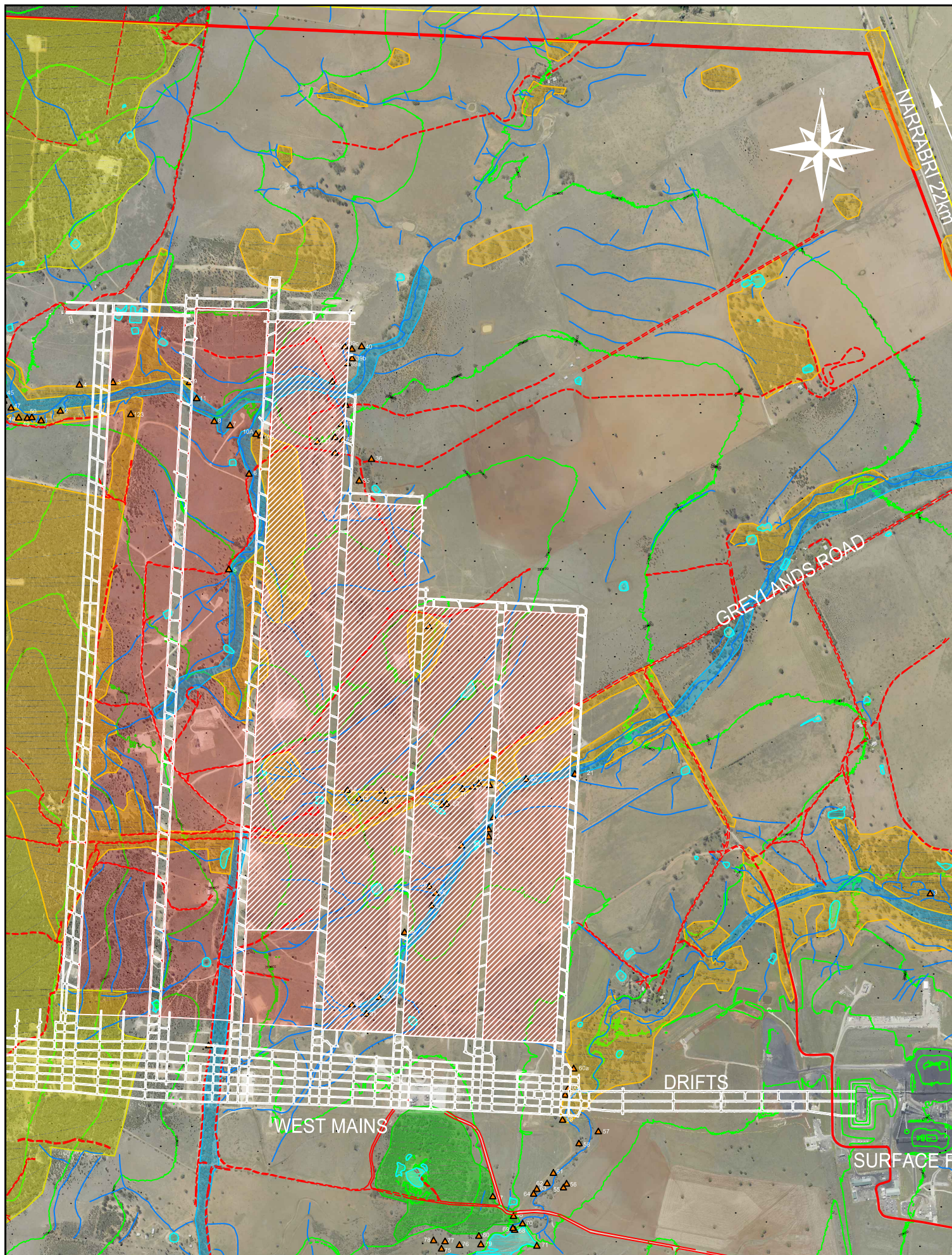
By	A.Taylor	Date:	24/06/15
Drafted:			
Edited:			
Approved:			
Scale:	1:20,000		

Built Surface Features

Plan No: APN.05.05



NARRABRI MINE



LEGEND

	First Workings		Brown Bloodwood - Pilliga Box woodland		Weeping Myall Endangered Ecological
	Mine Lease Boundary		Inland Grey Box Woodland		Cleared Pastoral and Agricultural Land
	Secondary Extraction		Riparian Forest		Unsealed Road
	Cultural Heritage Site		Calli's Forest		Major Contour
	Dams		River Red Gum		
	Over Land Water Path				

By	Date:
Drafted: A.Taylor	24/06/15
Edited:	
Approved:	
Scale:	1:20,000

Environmental Features

Plan No: APN.05.04



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1.7 Document Structure

This Extraction Plan forms part of Narrabri Mine's Environmental Management Strategy (EMS) and Mining Operations Plan (MOP). The EMS includes a suite of environmental management plans. The relationship of this Extraction Plan to the Narrabri Mine EMS and MOP is shown as Figure 5.

This Extraction Plan provides a brief overview of the proposed mine plan, associated subsidence and resulting environmental consequences. This Extraction Plan also briefly outlines the proposed monitoring and management measures, which are provided in greater details in the Appendices. In summary, this document includes the following information:

- Section 2 – Summarises the relevant statutory requirements for the preparation of this document and the management of subsidence impacts, providing cross-referencing to the appropriate section or appendices where each requirement is addressed;
- Section 3 – Summarises the results of recent subsidence modelling and outlines the predicted environmental consequences;
- Section 4 – Outlines the performance measures, management and monitoring activities that are proposed to mitigate predicted subsidence impacts and confirm that subsidence and its consequences are within predicted ranges. The section also sets out the proposed contingency response in the event that subsidence impacts exceed (or are considered likely to exceed) the adopted performance indicator; and
- Section 5 – Details the responsibilities of NCOPL personnel under this Extraction Plan and sets out the reporting, auditing and review requirements.

The Extraction Plan includes this main document and a number of sub-plans which form appendices to the Extraction Plan. These are included at the end of this document and described in Table 2.

Table 2 Extraction Plan Structure

Plan/ Report Name (author)	Location	Description
Coal Resource Recovery Plan (initial by AECOM, revised by WCL)	Appendix A	Provides an analysis of the expected coal recovery from the mining operations associated with LW101 – 106.
Subsidence Predictions (DGS)	Appendix B	Revised subsidence predictions for LW101 – 106.
Subsidence Monitoring Program (initial by AECOM, revised by WCL)	Appendix C	Provides a subsidence monitoring program to validate the predicted subsidence impacts, and analyse the relationship between subsidence effects and impacts.
Built Features Management Plan (initial by AECOM, revised by WCL)	Appendix D	Provides analysis and management of potential subsidence consequences on the built features of the mining area.



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Plan/ Report Name (author)	Location	Description
Public Safety Management Plan (initial by AECOM, revised by WCL)	Appendix E	Provides for the management of public safety to ensure the safety of the public in the mining area.
Landscape Management Plan (Eco Logical Australia and SLR Consulting)	Appendix F	Revision of the Landscape Management Plan (including the Rehabilitation Management Plan and Mine Closure Plan) in response to the revised subsidence predictions.
Water Management Plan (URS Australia)	Appendix G	Provides for the management of surface and groundwater issues within the mining area including watercourse consequences and water management features.
Biodiversity Management Plan (Eco Logical Australia)	Appendix H	Analysis of the potential impacts to, and the required management of, the aquatic and terrestrial flora and fauna.
Land Management Plan (Eco Logical Australia)	Appendix I	Provides analysis and management of impacts to the landscape (ground movement, stability, cracking etc) on the landscape.
Heritage Management Plan (AECOM)	Appendix J	Provides for the management of the potential environmental consequences of mining and subsidence on the heritage sites and values.

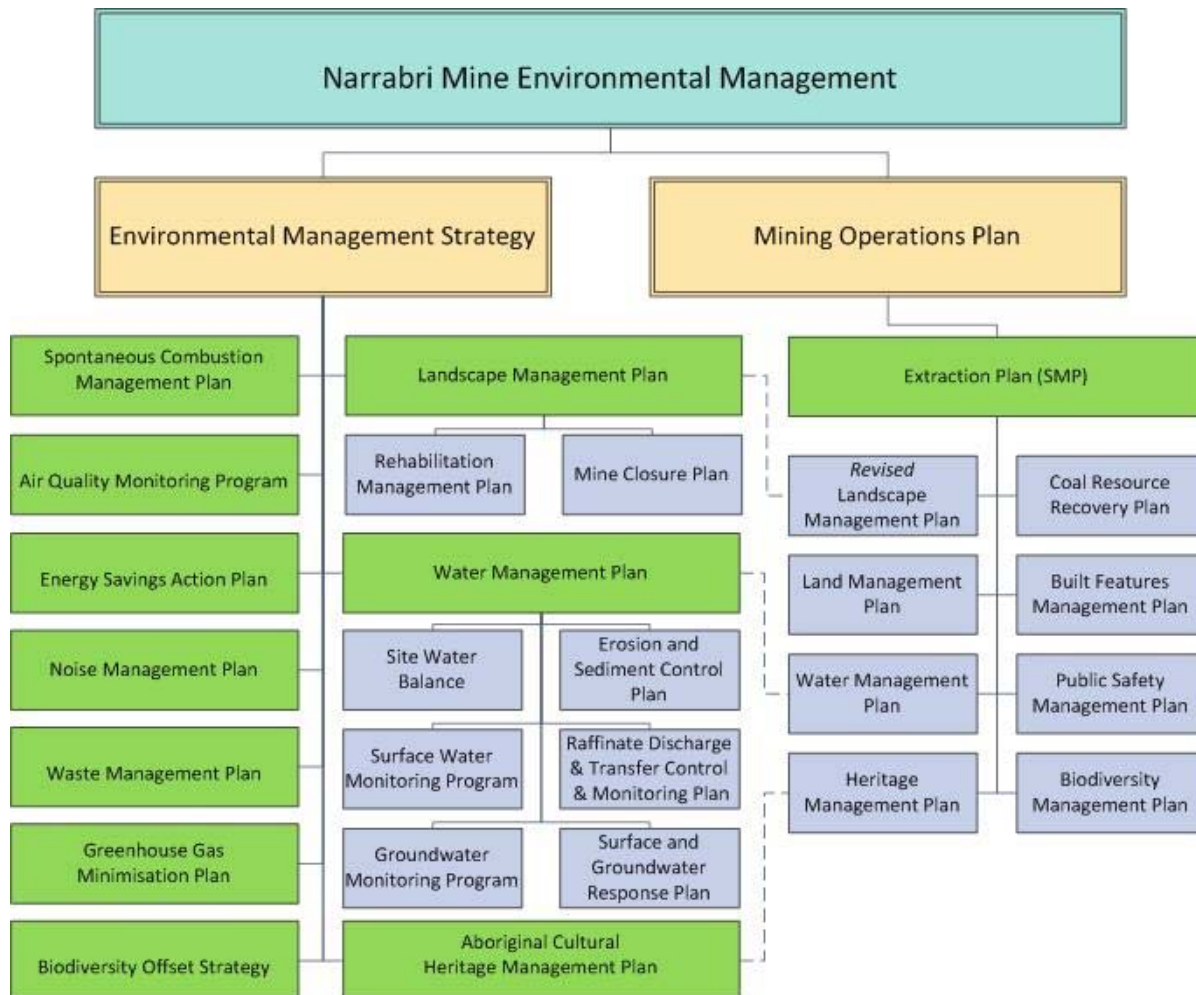


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Figure 5 Environmental Management Structure





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2 STATUTORY REQUIREMENTS

2.1.1 Project Approval

This document has been prepared in accordance with Schedule 3 of the Project Approval. In addition Condition 2 of Schedule 6 is relevant to the preparation of management plans under the approval.

The Project Approval requirements and relevant reference for this information within the Extraction Plan is provided in Table 3.

Table 3 Management Plan Requirements

Project Approval Condition	EP Reference
Condition 4 of Schedule 3 4. The Proponent shall prepare and implement Extraction Plans for any second workings to be mined to the satisfaction of the Secretary. Each Extraction Plan must:	Section 1.5
a) be prepared by a team of suitably qualified and experienced persons whose appointment has been endorsed by the Secretary;	
b) be approved by the Secretary before the Proponent carries out any of the second workings covered by the plan;	<i>No second workings will be commenced in LW106 until approval of this Extraction Plan is granted.</i>
c) include detailed plans of the proposed first and second workings and any associated surface development;	Appendix A – Coal Resource Recovery Plan
d) include detailed performance indicators for each of the performance measures in Tables 1 and 2;	Appendix G – Water Management Plan, Appendix G – Biodiversity Management Plan, Appendix D – Built Features Management Plan, and Appendix E – Public Safety Management Plan
e) provide revised predictions of the potential subsidence effects, subsidence impacts and environmental consequences of the proposed second workings, incorporating any relevant information obtained since this approval;	Appendix B – Subsidence Predictions
f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 1 and 2, and manage or remediate any impacts and/or environmental consequences;	Appendices C to J
g) include the following to the satisfaction of DRE: <ul style="list-style-type: none"> ▪ a Coal Resource Recovery Plan that demonstrates effective recovery of the available resource; 	Appendix A
<ul style="list-style-type: none"> ▪ a Subsidence Monitoring Program to: <ul style="list-style-type: none"> ○ provide data to assist with the management of the risks associated with subsidence; 	Appendix C



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Project Approval Condition	EP Reference
<ul style="list-style-type: none"> ○ validate the subsidence predictions; and ○ analyse the relationship between the subsidence effects and impacts under the plan and any ensuing environmental consequences; 	
<ul style="list-style-type: none"> ▪ a Built Features Management Plan to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which: <ul style="list-style-type: none"> ○ 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; 	Appendix D
<ul style="list-style-type: none"> ▪ a Public Safety Management Plan to ensure public safety in the mining area; and 	Appendix E
<ul style="list-style-type: none"> ▪ appropriate revisions to the Landscape Management Plan required under condition 3 of Schedule 5; and 	Appendix F
h) include a: <ul style="list-style-type: none"> ▪ Water Management Plan, which has been prepared in consultation with OEH and DPI Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on surface water resources, groundwater resources and flooding, and which includes: <ul style="list-style-type: none"> ○ surface and groundwater impact assessment criteria, including trigger levels for investigating any potentially adverse impacts on water resources or water quality; ○ a program to monitor and report groundwater inflows to underground workings; and ○ a program to manage and monitor impacts on groundwater bores on privately-owned land; 	Appendix G
<ul style="list-style-type: none"> ▪ Biodiversity Management Plan, which has been prepared in consultation with OEH and DRE, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on flora and fauna; 	Appendix H
<ul style="list-style-type: none"> ▪ Land Management Plan, which has been prepared in consultation with any affected public authorities, to manage the potential impacts and/or environmental consequences of the proposed second workings on land in general; 	Appendix I
<ul style="list-style-type: none"> ▪ Heritage Management Plan, which has been prepared in consultation with OEH and relevant stakeholders for Aboriginal heritage, to manage the potential environmental consequences of the proposed second workings on heritage sites or values; and 	Appendix J
i) include a program to collect sufficient baseline data for future Extraction Plans.	Appendix C (provides summary of all subsidence and relevant environmental monitoring)
Condition 5 of Schedule 3 5. The Proponent shall ensure that the management plans required under condition 4(h) above include: <ul style="list-style-type: none"> a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since this approval; 	Potential environmental consequences were considered in detail in the recently approved



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Project Approval Condition	EP Reference
<ul style="list-style-type: none"> b) a detailed description of the measures that would be implemented to remediate predicted impacts; and c) a contingency plan that expressly provides for adaptive management. 	<p>EA.</p> <p>Proposed measures and contingency plan are contained within each management plan, and the mines EMS.</p>
<p>Condition 2 of Schedule 6</p> <p>2. The Proponent shall ensure that the management plans required under this approval are prepared in accordance with any relevant guidelines, and include:</p> <ul style="list-style-type: none"> a) detailed baseline data; b) a description of: <ul style="list-style-type: none"> ▪ the relevant statutory requirements (including any relevant approval, licence or lease conditions); ▪ any relevant limits or performance measures/criteria; ▪ the specific performance indicators that are proposed to be used to judge the performance of, or guide the implementation of, the project or any management measures; c) a description of the measures that would be implemented to comply with the relevant statutory requirements, limits, or performance measures/criteria; d) a program to monitor and report on the: <ul style="list-style-type: none"> ▪ impacts and environmental performance of the project; ▪ effectiveness of any management measures (see c above); e) a contingency plan to manage any unpredicted impacts and their consequences; f) a program to investigate and implement ways to improve the environmental performance of the project over time; g) a protocol for managing and reporting any: <ul style="list-style-type: none"> ▪ incidents; ▪ complaints; ▪ non-compliances with statutory requirements; and ▪ exceedances of the impact assessment criteria and/or performance criteria; and h) a protocol for periodic review of the plan. 	<p>See Appendices C to J</p> <p>See also: Section 4.2</p> <p>See also: Section 4.1</p> <p>See also: Section 4.3</p> <p>See also: Section 5.2</p> <p>See also: Section 5.3</p>

2.1.2 Mining Lease

Narrabri Mine's Mining Lease (ML) 1609 was amended to include a reference to Extraction Plans. However, as this is an amendment to an Extraction Plan approved prior to December 2014, the submission and approval of a Subsidence Management Plan can be recognised as an Extraction Plan for the purposes of the ML 1609. As the existing Extraction Plan is in a transition period, preparation of this Extraction Plan will still be guided by the Division of Resources and Energy (DRE) document "Guidelines for Applications for Subsidence Management Plan Approvals" (Department of Mineral Resources, 2003).



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Where not addressed by the relevant planning approval documents, this Extraction Plan has also been prepared to enable NCOPL to comply with the Subsidence Management Plan approval process with DRE.

The Mining Lease includes a number of requirements of relevance to the management of subsidence. These are summarised in Table 4, along with a brief summary of where they are addressed in this Extraction Plan and associated sub-plans.

Table 4 Applicable Mining Lease Conditions

No.	Mining Lease Conditions (summary only)	Comment
2	Environmental Harm The proponent shall implement all practicable measures to prevent and/or minimise any harm to the environment that may result from the construction, operation or rehabilitation of the development.	All Extraction Plan documents
4	Environmental Management Reporting	Section 5.2
8	Extraction Plan Condition Preparation of an Extraction Plan	All Extraction Plan documents
16	Safety The lease holder shall ensure the safety of persons and stock in the vicinity of the operations.	Appendix E - Public Safety Management Plan has been prepared and aims to ensure that the safety of persons and stock is not compromised as a result of subsidence impacts.
18	Prevention of Soil Erosion and Pollution Operation must be carried out in manner that does not aggravate air pollution, water pollution, or soil contamination unless otherwise authorised by a relevant approval and in accordance with an accepted MOP.	Appendix G - Water Management Plan and Appendix I - Land Management Plan
19	Transmission Lines, Communications Lines and Pipelines Operations must not interfere with these or any other utility without the prior written approval of the Secretary	Appendix D - Built Features Management Plan
20	Fences and Gates Activities on the lease must not interfere or damage fences without the prior written approval of the owner or the Minister	Appendix D - Built Features Management Plan
21	Roads and Tracks Operations must not affect any road unless in accordance with an accepted MOP or the prior written approval of the Secretary. The lease holder is liable for any costs incurred by the appropriate road authority for fixing any damage to roads caused by operations	Appendix D - Built Features Management Plan
25	Resource Recovery Economic and efficient recovery of available resources by the lease holder	Appendix A - Coal Resource Recovery Plan
28	Trigonometrical Stations and Survey Marks	Appendix D - Built Features Management Plan



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2.1.3 EPBC Approval

The Narrabri Mine is subject to an approval issued under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The conditions of this approval include the development / implementation of an Extraction Plan (of which this Extraction Plan forms part) according to NSW Secretary's Assessment Report and approval conditions (26 July 2010). A copy of the Extraction Plan must be submitted to Department of Environment (DoE) (formerly the Department of Sustainability, Environment, Water, Population and Communities (DSEWPC)).

2.1.4 Work Health and Safety Legislation

This Extraction Plan has been developed to comply with the Work Health and Safety legislation including but not limited to:

- The Work Health and Safety Regulation 2011; and
- The Work Health and Safety (Mines) Regulation 2014.



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3 SUBSIDENCE ASSESSMENT

3.1 Review of Subsidence Predictions

3.1.1 Overview

Project Approval for Stage 2 was granted by the Department of Planning in 2010 for extraction of coal using longwall methods at the Narrabri Mine. The proposed mine plan is consistent with that presented and assessed as part of the Environmental Assessment (EA) for that development application, with minor amendments to the mining geometry, including:

- Increased longwall panel widths from 301m to 306.4m; and
- Increased chain pillar widths from between 30-40m.

As a result, revised subsidence modelling and predictions were prepared for the amended mine plan by Ditton Geotechnical Services (DGS, 2011). To include LW106 in the Extraction Plan, the subsidence predictions have been modelled and predictions updated, which includes using the measured levels for LW101 to LW104 (DGS, 2015). The DGS (2015) report is produced in full as **Appendix B**, with the conclusion reproduced below.

The subsidence prediction model used in the approved Extraction Plan for LW101 to LW105 estimated a maximum subsidence of 2.44 m or 0.58T. Although the predicted values for LW101 to LW104 have been within 15% of the measured results, the model has now been adjusted to match to reflect the actual 95%CLs for subsequent panels as follows:

- Single maximum panel S_{max}/T has been increased from 0.58 to 0.60 for LW101 and to 0.63 from LW102 to LW106;
- Final maximum panel S_{max}/T has been increased to 0.64 from LW102 to LW106.
- Supercritical width appears to occur at 1.2H instead of 1.4H, based on measured tilts and strains to-date.

It is considered that the development of subsidence impacts will be not be affected by the spanning potential of the Garrawilla Volcanics, Basalt Sill or Digby Conglomerate units. Subsidence predictions have therefore only considered 'Low' SRP for the worst-case scenario.

Revised subsidence profiles and contours have subsequently been derived for LW101 to LW106. The key outcomes of the results of the study are presented below for the six panels:

- (i) First and Final maximum panel subsidence is likely to range between 2.69 m and 2.75 m (64% of the mining height).
- (ii) Maximum chain pillar subsidence is estimated to range between 0.29 m and 0.54 m above pillar widths ranging from 30 m to 39.5 m. The vertical stress acting on the pillars are estimated to range from 14.7 to 22.5 MPa with pillar FoS values of 2.54 to 1.36 estimated for a 3.5 m pillar height under double abutment loading conditions.



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- (iii) Yielding of the chain pillars is not expected for the proposed mining layout (i.e. the predicted FoS values are > 1). However, strain-hardening of the pillars due to core confinement and goaf materials within the panels themselves will limit and result in eventual cessation of subsidence if overloading conditions were to occur.
- (iv) Maximum panel tilts are estimated to range from 25 to 47 mm/m for 'smooth' profile subsidence, with occasional tilts from 38 mm/m to 71 mm/m due to discontinuous strata behaviour (i.e. localised block rotations).
- (v) The maximum tensile and compressive strains are expected to range from 4 mm/m to 14 mm/m for 'smooth' profile subsidence, with occasional strains ranging from 11 mm/m to 33 mm/m due to discontinuous strata behaviour (i.e. cracking).

The potential maximum subsidence predictions based on no spanning of the Garrawilla Volcanics and the upper (95th percentile) confidence limits are contained in Table 5. Resulting subsidence contours are plotted in Figure 6.



LEGEND First Workings Mine Lease Boundary Secondary Extraction		0.0m Subsidence Contour -0.1m Subsidence Contour -0.3m Subsidence Contour -0.5m Subsidence Contour	-1.0m Subsidence Contour -1.5m Subsidence Contour -2.0m Subsidence Contour -2.0m Subsidence Contour	By: A.Taylor Edited: Approved: Scale: 1:20,000	Date: 22/06/15 Predicted Subsidence Contours Plan No: APN.05.03	WHITEHAVEN COAL NARRABRI MINE
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Table 5 Revised Maximum Subsidence Predictions (DGS, 2015)

Longwall Panel	Final Maximum Subsidence (S_{max})	Maximum Tilt	Maximum Strain - Tensile	Maximum Strain - Compressive
Units	m	mm/m	mm/m	mm/m
LW101	2.69 (2.44*)	47 (45)	26 (11)	33 (14)
LW102	2.69 (2.44*)	45 (41)	23 (9)	30 (12)
LW103	2.75 (2.44*)	41 (35)	20 (8)	26 (10)
LW104	2.75 (2.44*)	43 (32)	22 (6)	28 (8)
LW105	2.75 (2.44*)	38 (30)	18 (6)	23 (8)
LW106	2.75 (2.44*)	31 (30)	14 (5)	18 (8)

Previous EA subsidence predictions - values shown in brackets. * - EA predictions for 305.4 m wide panels with a mining height of 4.2 m.

A comparison of the original and revised subsidence estimates (refer to Table 5) show that overall, the extension to the mine plan will not change the level of impact assessed in the 2009 Environmental Assessment or current 2012 Extraction Plan. However, based on a review of measured subsidence data for LW101 to LW104 and minor model input assumption (i.e. the supercritical panel width reduction) and output definition changes (i.e. discontinuous strata behaviour effects are now included in the U95%CL values provided), the revised subsidence effect predictions represent a marginally higher subsidence than the previous layout predictions (<15%).

3.1.2 Surface Cracking

Based on a review of the observed surface cracking for LW101 to LW104, surface cracks have typically ranged from 50 mm to 100 mm wide, with some cracking up to 200 mm. The measured cracks have therefore been within the predicted crack width ranges of between 40 mm and 220 mm in the approved Extraction plan for LW101 to LW105. The revised cracking width range of 40 mm to 260 mm for LW101 to LW106 is therefore likely to be conservative. It is noted that the largest cracks are predicted over LW101 to LW104, with cracking over LW106 expected to range between 40 mm to 110 mm (DGS, 2015).

DGS (2015), Appendix B, outlines that based on reference to ACARP, 2003, the cracks will probably have developed by the time the longwall face has retreated past a given location for a distance equal to 1 to 2 times the cover depth. Cracks will usually develop within several days after a mine has retreated beneath a given location, with some of the cracks closing in the compression zone in the middle of the fully developed subsidence trough, together with new cracks developing in the tensile zones along and inside the panel sides several weeks later.

The cracks in the tensile strain zones will probably be tapered and extend to depths ranging from 5 to 15 m, and possibly deeper in near surface rock exposures. Cracks within compressive strain zones are generally low-angle shear cracks caused by failure and



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shoving of near surface strata. Some tensile type cracks can also be present due to buckling and uplift of near surface rock, if it exists (DGS, 2015).

The cracks usually develop in groups of two or three over a tensile zone of 20 m in width. Once the cracks develop, the strain is usually relieved in the adjacent ground, however, the topography and near surface geology also can influence the extent of cracking (DGS, 2015).

3.1.3 Sub-Surface Cracking

Conservative estimates by DGS (refer to **Appendix B**) indicate that continuous sub-surface cracking between the goaf and the surface is 'very unlikely' at the cover depths that will exist during extraction of LW101-106 (DGS, 2015). However discontinuous sub-surface fracturing could potentially interact with surface cracks at cover depths less than 255m.

3.1.4 Slope Instability

Based on the surface topography and geology above LW101-106, the risk of landslide occurring as a result of subsidence is considered 'barely credible' (DGS, 2015).

3.1.5 Valley Closure and Uplift

As the valleys across the mining lease are very broad between crests, and there is a lack of thick massive beds of conglomerate and/or sandstone units along the creeks / valleys, the development of 'upside' and closure along the creek beds above LW101 to LW106 is likely to be negligible.

3.1.6 Far-Field Subsidence

There is a potential for far-field displacements to occur outside the longwall extraction area but would not generate significant strains or movements outside a distance equal to one cover depth from the extraction area (DGS, 2015).

3.2 Potential Environmental Consequences

As the predicted maximum subsidence (as reviewed by DGS) is consistent with the EA and Project Approval, environmental consequences are expected to be consistent with those presented in the EA. Therefore, a detailed review of environmental consequences has not been conducted for this Extraction Plan.

A summary of potential environmental consequences, the proposed performance measure and applicable management plan under this document is provided in Section 4.2.



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4 SUBSIDENCE MONITORING AND MANAGEMENT

4.1 Subsidence Monitoring

Proposed survey monitoring across the Extraction Plan area is documented in the Subsidence Monitoring Program (**Appendix C**). The purpose of the Subsidence Monitoring Program is to quantify subsidence parameters, i.e. vertical movements, ground tilts and strains. The Subsidence Monitoring Program also summarises the monitoring of environmental and built features (as documented in other sub-plans).

4.2 Subsidence Management

The Project Approval defines several subsidence impact performance measures for the management of natural and built features. It also notes that other performance measures and performance indicators may require further definition under the relevant management plans.

These performance measures require that NCOPL ensure the following:

- Great Artesian Basin: Any loss of water flow into the Great Artesian Basin aquifers will be managed, licensed, or offset.
- Flora and Fauna: Clearing and disturbance of vegetation above the mining area is minimised.
- Built Features: any infrastructure affected by subsidence will be maintained as always safe. Where possible, serviceability will be maintained and any loss of serviceability will be compensated. Damage will be fully repaired, or else replaced or fully compensated.
- Public Safety: No additional public safety risk will be posed as a result of subsidence.

Surface and sub-surface features within the study area are listed in Table 6, along with a brief description of predicted environmental consequences and proposed performance measures. Management actions have been developed that aim to ensure these performance measures are met, and the proposed monitoring is intended to monitor subsidence impacts and confirm that they are within predicted limits. These management and monitoring actions are detailed within the relevant management plans (refer to Table 6).

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Table 6 Summary of Environmental Consequences and Performance Measures

Feature	Environmental Consequence (s)	Performance Measure / Indicator	Management Plan
Natural Features			
Pine Creek and tributaries	Change in hydrology and/or water quality.	Monitoring parameters are in accordance with relevant parameters within ANZECC guidelines.	Water Management Plan
Groundwater resources	Change in level and/or quality.	Monitoring parameters are in accordance with relevant parameters within ANZECC guidelines.	Water Management Plan
Land prone to flooding or inundation	Changes to flooding regime.	Watercourse survey. Maintain existing flow regimes.	Water Management Plan
Threatened or protected species	Impacts on woodland and riparian vegetation may reduce the habitat resources available to threatened or protected species.	Assess the health and cover of threatened populations or species.	Biodiversity Management Plan
Natural vegetation	Changes to vegetation communities' health, cover, species dominance and weed infestation in disturbance areas.	Assess the health and cover of threatened populations or species.	Biodiversity Management Plan
Public Utilities			
Roads (All Types)	Deformation of road surfaces	Maintain functionality of roads. Examine (visual and survey) for deformation.	Built Features Management Plan
Culverts	Function of culverts affected by changes to flow regimes or direct subsidence impacts (damage).	Culverts fully functional after active subsidence.	Built Features Management Plan
Electricity transmission lines	Infrastructure movement and service interruption.	Maintain electricity services.	Built Features Management Plan



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Telecommunications lines	Infrastructure movement and service interruption.	Maintain telecommunications services.	Built Features Management Plan
Farm Land and Facilities			
Agricultural utilisation or agricultural suitability of farm land	Change in agricultural suitability or capability from current level.	Maintain agricultural capability of farm land above LW 101-105 after active subsidence.	Land Management Plan
Farm buildings or sheds	Structural or cosmetic damage to buildings.	Vacate, pre and post dilapidation survey, repair or demolish.	Built Features Management Plan
Fences	Damage or breaks in fence lines.	Functionality of fencing after active subsidence.	Built Features Management Plan
Farm dams	Changes to catchments or loss of water through surface or dam wall cracking.	Maintain capacity of existing dams. Examine (visual and survey) for impacts to dam walls or water loss through cracking.	Built Features Management Plan
Soil conservation works	Changed flow regimes impacts effectiveness of contour banks.	Examine for deformation.	Built Features Management Plan
Wells or bores	Increased or decreased water availability (aquifer interference).	Monitor water levels in bores.	Water Management Plan
Access tracks	Deformation of access track surface.	Survey access tracks for deformation.	Built Features Management Plan
Industrial, commercial and business establishments			
Mine infrastructure	Structural or cosmetic damage to mine infrastructure.		Built Features Management Plan
Other significant features			
Areas of archaeological and/or heritage significance	Movement of artefacts from existing location or damage to artefacts.	Visual observation of known and marked artefact areas	Heritage Management Plan

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4.3 **Contingency Response and Adaptive Management**

In the event of subsidence impacts that exceed the performance measures limits identified in the relevant management plan, the following process will be implemented:

- Report the observation/event to the Technical Services Manager or Environment Officer as soon as practicable, ideally within 24 hours;
- Assess public safety and where applicable, implement safety measures in accordance with the Public Safety Management Plan or as otherwise necessary to prevent injury or harm to any person;
- Report any event to the relevant stakeholders (as identified in each sub-plan to this Extraction Plan) as soon as practicable after NCOPL becomes aware of the event; and
- Investigate, in consultation with affected stakeholders (where appropriate) to evaluate the contributing factors to the event. The investigation may include (where applicable):
 - Re-survey of the relevant subsidence monitoring lines;
 - Re-sampling or re-surveying of the applicable environmental monitoring locations (i.e. groundwater bores, surface water monitoring sites);
 - Review measured subsidence parameters against the observed impact, and latest subsidence predictions; and
 - Determine appropriate remedial response.
- Implement remedial response and/or adaptive management measures, dependent on the outcomes of the above investigation. Any such measures will be undertaken in consultation with the relevant stakeholder and/or to the satisfaction of the appropriate government agency and DP&E;
- Review the subsidence management and subsidence monitoring program, where appropriate, to reduce the risk of future incidents; and
- Revise future plans and implement change if required.



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5 PLAN IMPLEMENTATION

5.1 Responsibilities

The General Manager has overall responsibility for ensuring contractors, employees and service providers comply with all laws, regulations, licences, approvals and conditions of the project approval. Table 7 outlines the responsibilities of personnel at Narrabri Mine under this Extraction Plan. These responsibilities are in addition to those already outlined in the Narrabri Mine EMS. Additional responsibilities may also be detailed in each of the relevant sub-plans to this document.

Table 7 Roles and Responsibilities

Role	Responsibility
General Manager	<ul style="list-style-type: none"> - Provide adequate resources to undertake the activities required by this plan; and - Communication with statutory authorities and the community.
Mine Manager	<ul style="list-style-type: none"> - Ensure all contractors, sub-contractors and service-personnel are appropriately qualified, competent and/or licensed to undertake the required work and have a good environmental performance record; and - Ensure all operations are undertaken in accordance with the requirements of the extraction plan approval.
Technical Services Manager	<ul style="list-style-type: none"> - Ensure that people under their charge who have duties and responsibilities under this EMS undergo training and assessment in those duties; - Manage / implement the subsidence management actions under this Extraction Plan; - Provide support and guidance to the Environmental Officer as required; and - Authorise changes to this Extraction Plan.
Group Environment Manager	<ul style="list-style-type: none"> - In consultation with the General Manager, liaise with relevant government authorities; and - Provide support and guidance to the Environmental Officer as required.
Environment Officer	<ul style="list-style-type: none"> - Monitor environmental impacts as a result of subsidence activities; - Ensure all operations are undertaken in accordance with the requirements of this Extraction Plan; - Advise on matters identified in the development consent and compliance with those conditions, and other environmental matters; - Receive and respond to complaints in accordance with the EMS; - Co-ordination / management of environmental monitoring programs; - Environmental reporting; - Site rehabilitation; and - Post-induction education and contact with all site-based and contracted employees on environmental matters.
Mine Surveyor	<ul style="list-style-type: none"> - Co-ordinate the undertaking of survey monitoring as required under these plans; and - Report on any discrepancy between observed and expected data as a result of survey monitoring.



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Though retaining the responsibilities identified above, these personnel may, at their discretion, delegate specific tasks to suitably qualified and/or experienced operational personnel and/or consultants.

5.2 Reporting

5.2.1 Incident

Each of the sub-plans contained within this Extraction Plan identifies appropriate incident responses to potential incidents associated with the project.

In accordance with Condition 4, Schedule 6, of the Project Approval, upon becoming aware of an incident, NCOPL will:

- Notify the Secretary and any other relevant agency as soon as practicable; and
- Prepare and submit a detailed report to the Secretary, and any other relevant agencies within 7 days of the date of the incident.

5.2.2 Regular

Regular reporting on the environmental performance of the project is placed on the Project website via the Community Consultative Committee – Environmental Monitoring Reports, in accordance with Condition 5, Schedule 6 of the Project Approval.

5.2.3 Annual

In accordance with Condition 6, Schedule 6 of the Project Approval, an Annual Review will be prepared and submitted to the Secretary that reviews the environmental performance of the project. With respect to management of subsidence, this will include:

- a) Works carried out in the past year, and works planned to be carried out in the next year;
- b) Comprehensive review of monitoring results and complaints records over the past year, including a comparison of results to:
 - Relevant statutory requirements, limits and performance measures/criteria;
 - Baseline data and monitoring results of previous years; and
 - Relevant predictions in the EA and Extraction Plan.
- c) Identification of any non-compliance and what actions are being undertaken to ensure compliance;
- d) Discussion of any trends in monitoring data over the life of the project;
- e) Identification of any discrepancies between predicted and actual impacts of the project and analyse the potential cause of any significant discrepancies; and
- f) Describe any measures to be implemented over the next year to improve the environmental performance of the project.

5.3 Review

Review of this Extraction Plan is required under the terms of the Project Approval. In accordance with Condition 3 of Schedule 7, strategies, plans and programs included with this Extraction Plan will be reviewed within three months of the following:



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- Completion of an independent environmental audit under Condition 7, Schedule 6;
- Submission of an Incident Report under Condition 4, Schedule 6; and
- Submission of an Annual Review Report under Condition 6, Schedule 6.

This Extraction Plan will be revised, if necessary, in response to a review conducted in accordance with the above or within three months of any modification to the Project Approval that affects the scope of this plan.



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6 REFERENCES

Department of Mineral Resources (2003) Guidelines for Applications for Subsidence Management Plan Approvals.

Ditton Geotechnical Services (DGS) (2015) Mine Subsidence Assessment for the Proposed Addition of Longwall (LW) 106 to the Approved LW101 to LW105 Extraction Plan at the Narrabri Mine, Narrabri

Ditton Geotechnical Services (DGS) (July 2011) Mine Subsidence Effect Predictions and Impact Assessment for the Proposed Longwalls 1 to 5 at the Narrabri Coal Mine, Narrabri.

Ditton Geotechnical Services (DGS)(November 2009) Narrabri Coal Mine Stage 2 Longwall Project, Mine Subsidence Predictions and Impact Assessment Specialist Consultant Studies Compendium Volume 1, Part 1.

RW Corkery & Co. Pty Ltd (November 2009) Environmental Assessment for the Narrabri Coal Mine Stage 2 Longwall Project, Project Application No:MP08_0144.



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Appendix A

Coal Resource Recovery Plan



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Appendix B

Subsidence Predictions



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Appendix C

Subsidence Monitoring Program



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Appendix D

Built Features Management Plan



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Appendix E

Public Safety Management Plan



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Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix F

Landscape Management Plan



**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix G

Water Management Plan



**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix H

Biodiversity Management Plan



**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix I

Land Management Plan



**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix J

Heritage Management Plan



**NARRABRI MINE
ENVIRONMENTAL
MANAGEMENT SYSTEM**

Document Owner:	Technical Services Manager
Revision Period:	3 Years
Issue:	2
Last Revision Date:	18/05/2016
Date Printed:	19/05/2016

WHC_PLN_NAR_EXTRACTION PLAN LW101 to LW106

Appendix K

Subsidence Risk Assessment