Built Features Management Plan LW107 to LW110

This page has been intentionally left blank

Contents

Tables

Appendices

This page has been intentionally left blank

1 INTRODUCTION

This Built Features Management Plan (BFMP) has been prepared as part of the Extraction Plan for Longwalls LW107 to LW110 in the Hoskissons Seam at the Narrabri Mine. This plan sets out the management objectives and performance measures proposed to manage potential subsidence impacts to the built features that are located within the Extraction Plan area.

Subsidence predictions by Ditton Geotechnical Services (DGS) have been used as a basis for developing the performance measures, management actions and monitoring contained within this BFMP (DGS, 2017). DGS' analysis and results are contained, in full, as an appendix to the Extraction Plan.

This BFMP has been prepared in accordance with Project Approval (PA) 08_0144 for Narrabri Mine, the supporting Environmental Assessment (EA) and relevant legislation and guidelines.

1.1 Scope

This BFMP applies to built features that are considered likely to be adversely affected by subsidence associated with secondary extraction of LW107 – LW110. The purpose of this document is to ensure that impacts to these features are managed in accordance with the PA 08_0144, as modified, in particular the subsidence impact performance measures stipulated by Schedule 2, Condition 2 which require that:

- Any infrastructure affected by subsidence will be always maintained as safe; and
- 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.

The proposed mine plan and affected built features is shown on Plan 2 and also described further below.

1.1.1 Description of Underground Mining

Longwall panels at the Narrabri Mine are oriented in a north-south layout and radiate out from the mains headings which are oriented East-West (refer to Plan 1). Longwall panels vary in length, but are approximately 403 metres wide, with depth of cover ranging from approximately 220m to 340m. The longwall will recover the lower 4.3m of the Hoskissons Seam, which ranges from around 5m to 9.8m thick. 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 (also a sub-set to the Extraction Plan).

Table 1 below outlines the proposed mine schedule and completed longwall panels to date.

Table 1: Proposed Mining Schedule (Secondary Extraction)

Longwall Panel	Start Date	Duration	Completion Date
107	April 2017	11 Months	February 2018
108	March 2018	13 Months	March 2019
109	April 2019	16 Months	July 2020
110	August 2020	15 Months	October 2021

1.1.2 Affected Built Features

LW107 – LW110 lies within the boundaries of Mining Lease 1609. The land has 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 of up to 15°, which drains the Extraction Plan area to the north east. A range of built features are located within the potential mine subsidence area. These can generally be described as the following built form elements:

- Private roads and access tracks, including unsealed gravel access tracks;
- Water storage dams (earth embankments) and associated soil conservation banks;
- Property and livestock fences;
- Residential dwellings and machinery sheds (owned by NCOPL); and
- Mine infrastructure, consisting of:
    - Surface to in seam gas drainage wells and associated surface plant;
    - Groundwater monitoring bores; and
    - PED cable.

Predictions of subsidence impacts and potential consequences to the above built features are described in Section 2.

The Narrabri Mine is not located within a declared Mine Subsidence District under the *Mine Subsidence Compensation Act 1961*.

1.1.3 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, was revised for LW106 and has subsequently been updated for to LW107 to LW110, refer to EP Appendix K.

The updated risk assessment for LW107 to LW110 extraction has not identified any high risk items. As a result, risks associated with subsidence above LW107 to LW110 for the Narrabri Mine have been assessed as low to moderate.

1.2 Statutory Requirements

This document has been prepared in accordance with PA 08_0144, relevant legislation and guidelines, including the Department of Planning and Environment (DP&E) '*Guidelines for the Preparation of Extraction Plans*', and in consultation with relevant government agencies.

1.2.1 Project Approval

The Project Approval requires that NCOPL prepare a Built Features Management Plan to the satisfaction of the Division of Resources and Energy (DRE). Specifically, Schedule 3, Condition 4(g) of PA 08_0144, states inter alia:

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:

(g) 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.*

PA 08_0144 also requires the preparation of subsidence impact performance measures, as per Schedule 3, Condition 2, which states:

Performance Measures – Built Features

2. The proponent shall ensure that the project does not cause any exceedances of the performance measures in Table 2, to the satisfaction of the Secretary of DRE.

Table 2: Subsidence Impact Performance Measures

Built Features	
All 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*

Notes to the above condition require NCOPL to define more detailed performance indicators for each of the above performance measures. These indicators are defined

within Section 3.2 of this BFMP. Public safety risks are (in part) addressed by some of the management measures proposed in this BFMP and are discussed and addressed specifically in the Public Safety Management Plan.

It is also noted that performance measure requirements do not prevent preventative or mitigatory actions being undertaken in order to achieve these objectives. Any compensation payable includes that which may be applicable under the *Mine Subsidence Compensation Act 1961* and/or the *Mining Act 1912*.

Schedule 3, Condition 3 of PA 08_0144 includes provisions for dispute resolution between the Narrabri Mine and the owner of any built features affected by mining. In the event of a dispute, the matter may be settled by the Secretary of the DRE, with any such settlement being final under the Project Approval.

Annual Review

In accordance with Schedule 6, Condition 6, Narrabri Mine must prepare an Annual Review of the performance of the mine. The Annual Review is required to be prepared to review the performance of the mine against its Environmental Management Strategy, the relevant Mining Operations Plans, the conditions of this consent, and other licences and approvals relating to the mine. Further details on this requirement are provided in the Extraction Plan and Environmental Management Strategy.

Subsidence Reports

Narrabri Mine has committed (Statement of Commitments 5.20 and 5.21) to reporting of subsidence impacts in regards to built features within an Individual Property Subsidence Management Plan "*or similar as required under any Extraction Plan requirements*". This BFMP has been prepared to satisfy the requirements of an Individual Property Subsidence Management Plan (IPSMP) and as such includes the following information (as nominated in Commitment 5.21): issues:

- Timing and scale of predicted impacts (refer to Section 1.1 and Section 2.2);
- Monitoring of the effected property during mining (refer to Section 3.3);
- Timing for any remaining disconnection of services (refer to Section 3.3); and
- Post-mining inspection and reporting (refer to Section 3.3 and Section 4.3).

As the above commitments and requirements of an IPSMP has been addressed by this document, IPSMPs will not be prepared for LW107 – LW110.

1.2.2 Mining Act 1992

Narrabri Mine's Mining Lease (ML) 1609 has been amended to include a reference to Extraction Plans, removing the requirements for a Subsidence Management Plan. ML 1609 includes a number of requirements of relevance to the management of subsidence on built features. Conditions of ML 1609 of relevance to this BFMP include:

Safety

16 *Operations must be carried out in a manner that ensures the safety of persons or stock in the vicinity of the operations. All drill holes, shafts and excavations must be appropriately protected, to the satisfaction of the Director-General, to ensure that access to them by persons and stock is restricted. Abandoned shafts and excavations opened up or used by the leaseholder must be filled in or otherwise rendered safe to a standard acceptable to the Director-General.*

Fences, Gates

20 *(a) Activities on the lease must not interfere with or damage fences without the prior written approval of the owner thereof or the Minister and subject to any conditions the Minister may stipulate.*

(b) Gates within the lease area must be closed or left open in accordance with the requirements of the landholder.

Roads and Tracks

21 *(a) Operations must not affect any road unless in accordance with an accepted Mining Operations Plan or with the prior written approval of the Director-General and subject to any conditions he may stipulate.*

(b) The lease holder must pay to the designated authority in control of the road (generally the local council or the Roads and Traffic Authority) the cost incurred in fixing any damage to roads caused by operations carried out under the lease, less any amount payable from the Mine Subsidence Compensation Fund.

22 *Access tracks must be kept to a minimum and be positioned so that they do not cause any unnecessary damage to the land. Temporary access tracks must be ripped, topsoiled and revegetated as soon as possible after they are no longer required for mining operations. The design and construction of access tracks must be in accordance with specifications fixed by the Department of Climate Change and Environment.*

Trigonometrical Stations and Survey Marks

28 *A person must not remove, damage, destroy, displace, obliterate or deface any marks in connection with any trigonometrical station, permanent mark or survey mark unless authorised to do so by the Surveyor-General.*

1.2.3 Commonwealth Approvals

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 BFMP 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 the Commonwealth Department of the Environment (DoE).

The EPBC Referral documentation, on which the approval was granted, included various comments regarding management of the environment, including that "surface cracks repair works may be required, in particular along access tracks and roads and along watercourses where cracks do not infill naturally with sediment".

1.2.4 Work Health and Safety Legislation

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

- *Work Health and Safety Act 2011*;
- *Work Health and Safety Regulation 2011*;
- *Work Health and Safety (Mines and Petroleum Sites) Act 2013*; and
- *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*.

Components of the Extraction Plan will be submitted to DRE as part of the High Risk Notification, required by the *Work Health and Safety (Mines and Petroleum Sites) Regulation 2014*, for LW107 to LW110.

2 SUBSIDENCE AND ENVIRONMENTAL CONSEQUENCES

2.1 Revised Subsidence Predictions

For LW107 to LW110 the subsidence predictions have been modelled and predictions updated, which includes using the measured levels for LW101 to LW105 (DGS, 2017). Maximum predicted and observed subsidence values (worst-case scenarios) for extraction of these panels, as presented in Table 2, have been adopted for the purposes of this management plan.

Table 2: Maximum Subsidence Predictions

Longwall Panel	Final Maximum Subsidence (S_{max})	Maximum Tilt	Maximum Strain - Tensile	Maximum Strain - Compressive
Units	m	mm/m	mm/m	mm/m
LW107	2.75	44	13	16
LW108	2.75	38	10	13
LW109	2.75	33	9	11
LW110	2.75	30	8	10

Source: DGS, 2017.

Based on a review of the observed surface cracking for LW101 to LW105, 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 LW106. The revised cracking width range of 30 mm to 260 mm for LW107 to LW110 is therefore likely to be conservative and crack widths are expected to decrease with cover depth increases over LW107 to LW110 (DGS, 2017).

DGS (2017), 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 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, 2017).

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, 2017).

Significant damage to buildings is considered likely to occur where tilts exceed 7mm/m or compressive strains are greater than 4mm/m (Holla & Barclay, 2000 in DGS, 2017). The severity of damage depends on the type, geometry and materials of each structure.

Predicted subsidence contours and the location of built features relative to the mine plan are shown in Plan 2.

2.2 Potential Environmental Consequences: Built Features

A brief description of built features likely to be affected by potential subsidence impacts and environmental consequences is provided below. Management actions have been developed for each of the identified built features asset groups and are detailed within individual tables in Appendix A.

2.2.1 Roads and Access Tracks

Private unsealed access roads and tracks, owned by NCOPL, occur across all four longwall panels. Portions of the former Narrabri Shire Council road, known as Greylands Road, that traverse ML 1609 have been purchased by NCOPL, which is now maintained to allow access for mine-related traffic.

The unsealed gravel access roads and tracks above the proposed longwall panels are likely to be damaged by cracking and 'shoving' at tensile and compressive strain zones. Cracking and compression humps are likely to reduce the safe trafficability of all unsealed access roads, and impact the effectiveness of any longitudinal drainage (i.e. swales) or transverse pipe culverts that may be present.

Potential risks to traffic may result from either the cracking or compression humps, or through inadequate drainage resulting in aquaplaning during wet weather or accelerated erosion / pothole damage during wet weather.

2.2.2 Water Storage Dams

Numerous small farm water storage dams exist above LW107 – LW110. The expected phases of tensile and compressive strain development may result in breaching of the dam walls or water losses through the floor of the dam storage area via surface cracks. Loss or increase of storage areas may also occur due to the predicted tilting. Maximum tensile crack widths across dam walls or storage areas are estimated to range between 30 mm and 130 mm. Surface 'steps' or humps due to compressive shear failures are estimated to range between 30 mm and 130 mm.

Were any dams to fail, damage is likely to be limited to access tracks and fences due to their location, size and general lack of other infrastructure in the Extraction Plan area.

2.2.3 Soil Conservation Banks

A number of contour banks exist across the area covered by the Extraction Plan, particularly in cleared areas which have been historically used for cropping. These banks act to manage water flow across the site, minimise erosion and reduce sediment transport.

Generally speaking, contour banks are constructed to have very low longitudinal gradients (i.e. less than 0.5%) or even zero grade. The banks are generally constructed from local soil material (i.e. either a back-push or front-push bank).

Subsidence of sections of contour banks are likely to prevent the banks performing their intended purpose by altering the longitudinal grade, either steepening the grade, or causing a section to pond (i.e. unable to drain). Cracking and ground deformations may also cause damage to the bank, resulting in possible erosion or bank failure.

2.2.4 Property and Livestock Fences

The fence lines above LW101 – LW110 will be subject to the maximum predicted subsidence tilt of between 17 – 44 mm/m.

Damage to fences is likely to include the following:

- Straining and possibly tensile failure of fencing wire strands in tensile strain zones;
- Sagging of fencing wire strands and possibly loss of fence serviceability in compressive strain zones;
- Loss of gate function in either tensile or compressive strain zones; and
- Tilting of fence, gate and strainer posts, leading to the outcomes mentioned above.

The above impacts would potentially lead to the escape of livestock onto public roads, and would hinder movement across the property (i.e. if gates won't readily open).

2.2.5 Residential Dwellings and Machinery Sheds

The existing buildings within the limits of LW107 – LW110 include two existing rural dwellings and associated infrastructure and two small machinery sheds, all of which are owned by Narrabri Mine. All other existing buildings are located outside a 26.5° angle of draw to the longwall panels and are unlikely to be impacted by subsidence effects.

Based on Holla & Barclay (2000), significant damage to the existing buildings and associated infrastructure is likely where tilts > 7 mm/m and tensile or compressive strains > 2 mm/m. The severity of the damage will also be dependent on the type and geometry of each structure.

The affected dwellings are located within LW107 (refer to Plan 2). The affected NCOPL-owned dwellings and associated structures are expected to be significantly damaged as a result of subsidence. Associated potential consequences include: building(s) no longer fit

for purpose, personal safety risk (as a result of structural failure / damage), and release or stored effluent from the septic tank. These structures will be vacated and secured prior to undermining as described in Section 3.3.

2.2.6 Utility infrastructure

No public utility infrastructure exists within the Extraction Plan area above LW107 – LW110.

2.2.7 Mine Infrastructure

NCOPL has installed a series of surface to in-seam (SIS) gas drainage bores and associated surface infrastructure to allow for pre-drainage coal seam gases ahead of mining. These bores are installed and operate in advance of the mining operations to assist in reducing gas concentrations within the underground workings. These bores will be decommissioned prior to undermining by the longwall, with surface infrastructure being removed and the bores being sealed/grouted. Therefore, no adverse consequences are predicted to the SIS gas drainage infrastructure as a result of subsidence.

Gas drainage pipelines are also located over the longwall panels, the location of which varies as mining progresses. These pipelines lie across the surface, are constructed using flexible polypipe, with flexible seals/joints. As they are located on the surface (not buried) they will not be subjected to strains and shear forces and therefore damage as a result of subsidence ground movements are not anticipated.

A small number of groundwater monitoring bores are located over the longwall goaf. These will be damaged as a result of subsidence and will be reinstalled where required for ongoing groundwater monitoring purposes (refer to Water Management Plan).

A PED cable is located within LW107 and LW108. Where located over longwall panels, this cable is likely to experience subsidence impacts but has been designed and installed with enough ‘slack’ for subsidence related impacts as was the case for the PED cable in LW105, which has been extracted with no issues reported.

2.2.8 Survey Marks

One State Survey mark (SS40225) will be undermined during the extraction of LW108. In accordance with the requirements of the NSW *Surveying and Spatial Information Act 2002*, the NSW *Surveying and Spatial Information Regulation 2014* and ML 1609, the following will be undertaken:

- Approval will be sought from the NSW Surveyor General prior to removing, damaging, destroying, obliterating or defacing the survey mark. Applications for authorisation must be made to the Surveyor General at least 14 days before the date on which the survey mark will be impacted; and

- Following subsidence the functionality of the survey mark will be restored to the satisfaction of the NSW Surveyor General.

3 SUBSIDENCE MANAGEMENT

3.1 Objectives

The objective of the BFMP is to provide for the adequate management of built features within the Extraction Area that will be potentially affected by subsidence.

This objective will be achieved through:

- Monitoring of subsidence and environmental consequences to:
    - Confirm predicted impacts/consequences are within predicted ranges;
    - Identify impacts or exceedances that require additional management or response; and
    - Inform future subsidence prediction and consequence management.
- Management of potentially affected features to:
    - Mitigate potential consequences prior to subsidence occurring;
    - Minimise the risk of service disruption to residents and road users;
    - Prevent personal injury; and
    - Remediation of impacts following active subsidence.
- Effectively communicating with potentially affected stakeholders;
- Implementing appropriate contingency response measures in the event of adverse consequences or impacts outside predicted range; and
- Implementing a process of reporting and review of subsidence management measures to allow for continual improvement.

3.2 Performance Measures and Indicators

General performance measures for built features are defined under the Project Approval. These measures require that NCOPL must ensure that:

- Built features are always safe;
- Serviceability be maintained wherever practicable, and that loss of serviceability be fully compensated; and
- Damage is fully repairable, must be fully repaired, or else replaced or fully compensated.

Additional, specific performance indicators for individual built features have been developed and are listed in Table 3.

Table 3: Built Features Performance Measures

Feature	Performance Measure / Indicator
Roads and access tracks	
Roads (all)	Access to and within ML 1609 is maintained
Culverts	Any culverts fully functional after active subsidence
Water storage dams and soil conservation banks	
Farm dams	Capacity and function of existing dams is restored post-subsidence and no unplanned discharge of water downstream due to subsidence damage
Soil conservation works	Capacity and function of existing contour banks is restored post-subsidence
Property and livestock fences	
Fences	Functionality of fencing remediated after active subsidence
Livestock	No unplanned stock movements as a result of subsidence damage
Residential dwellings and machinery sheds	
Farm buildings and sheds	Buildings repaired and returned to use if practicable, cost-effective and safe, otherwise demolished Safety risk to staff as a result of subsidence-related structural damage managed to prevent injury Harmful substances managed to prevent impacts
Mine Infrastructure	
SIS gas drainage infrastructure	Decommissioned and made safe prior to being affected by subsidence
Surface gas pipelines	No impact anticipated
PED cable	Design/install PED cable to avoid subsidence impacts
Survey Marks	
Survey Marks	At the completion of subsidence, or otherwise as required by the Surveyor General, the Leaseholder shall ensure that the functionalities of any survey marks affected by subsidence are fully restored to the satisfaction of the Surveyor General

3.3 Subsidence Monitoring and Management

The built features managed under the scope of this BFMP have been grouped into the following asset groupings:

- Roads and access tracks;
- Dams and soils conservation banks (including windmills);
- Property and livestock fences;
- Residential dwellings and machinery sheds; and
- Mine infrastructure.

Detailed subsidence monitoring and management actions have been developed for each of the identified built features asset groups and are detailed within individual tables in **Appendix A**.

Each management table includes specific actions for the mitigation of subsidence impacts, categorised into:

1. Monitoring;
2. Management; and
3. Notification and Consultation.

3.4 Incident and Contingency Response

A general procedure for contingency responses for an exceedance of any performance measures under the Extraction Plan is described in Section 4.3 of the Extraction Plan.

Potential risks and controls associated with subsidence of affected built features were identified as part of a risk assessment updated on the 30th September 2016, refer to Section 1.1.3. **Appendix B** includes a Trigger Action Response Plan tables for all of the asset groups and foreseeable potential incidents identified under this BFMP.

In particular, more detailed contingency response procedures for undertaking road repairs are outlined in **Appendix C**.

4 IMPLEMENTATION AND OPERATION

4.1 Resources and Responsibilities

To ensure adequate implementation of this management plan, the following Narrabri Mine responsibilities have been assigned to relevant Narrabri Mine personnel (see Table 4). It is also noted that additional responsibilities are referred to within Appendix A.

Table 4: Roles and Responsibilities

Roles	Responsibilities
General Manager	Ensure this Built Features Management Plan is implemented and adhered to.
	Ensure that adequate resources are available to NCOPL personnel to facilitate the completion of their responsibilities under this management plan.
Technical Services Superintendent	Ensure that all monitoring and reporting is carried out within the timeframes specified, checked, processed and filed appropriately.
	Liaise with stakeholders regarding subsidence impact management.
	Authorise changes to this BFMP.
Environment Superintendent	Ensure that the ongoing community consultation processes detailed in this Built Features Management Plan are carried out.
	Prepare, maintain and distribute a stakeholder contact register.
	Keep documentation and undertake reporting for the Annual Review (AR) regarding subsidence management activities on the site.
	Ensure that audits and reviews are carried out as detailed in this Plan.
Mine Surveyor	Undertake survey monitoring as identified in this plan, and in accordance with any relevant survey procedures contained in the Subsidence Monitoring Program.
Civil Services Coordinator	Undertake road inspections, direct the Earthworks Contractor to undertake remediation as required and document and report to the Environmental Superintendent.

4.2 Communications/Consultation

Details of contacts relevant to this BFMP are provided in Table 5:

Table 5: Stakeholder Contact Details

Organisation	Representative	Phone	Postal Address
Division of Resources and Energy (DRE)	Director, Mine Safety Operations	02 4931 6644	PO Box 344 Hunter Regional Mail Centre, NSW 2310
Narrabri Mine	Technical Services Superintendent Environmental Superintendent	02 6794 4755	Locked Bag 1002, Narrabri NSW 2390
Narrabri Shire Council	Planning & Development Manager	02 6799 6866	Narrabri Shire Council PO Box 261 NARRABRI NSW 2390
State Forests NSW	Forests NSW - Baradine	02 6843 1607	Cnr Lachlan & Darling Streets PO Box 63 Baradine NSW 2396

4.3 Reporting

The primary reporting mechanism will be through the Narrabri Mine AR. Statutory reporting requirements are described in Section 1.2.

4.4 Review

Schedule 6, Condition 3 of PA 08_0144 requires reviews of the Extraction Plan, and if necessary revisions, to be undertaken within three months of the following:

- Completion of an independent environmental audit required by Schedule 6, Condition 7;
- Submission of an Incident Report required by Schedule 6, Condition 4;
- Submission of an Annual Review Report required by Schedule 6, Condition 6; and
- Any modification to the conditions of this approval.

5 REFERENCES

Alt S, Jenkins A, Lines-Kelly R (2009) Saving Soil – A landholder's guide to preventing and repairing soil erosion, NSW Department of Primary Industries. Available at: http://www.dpi.nsw.gov.au/agriculture/resources/soils/erosion/saving-soil/

Department of Environment & Climate Change (2008) Managing Urban Stormwater: Soils and Construction, Volume 2c - Unsealed Roads. Available at: http://www.environment.nsw.gov.au/resources/stormwater/0802soilsconststorm2c.pdf

Ditton Geotechnical Services (DGS) (2017) Mine Subsidence Assessment for the Proposed LW107 to LW110 Extraction Plan at the Narrabri Mine

Ditton Geotechnical Services (DGS) (2015) Mine Subsidence Assessment on the Proposed 75W Modification to the Stage 2 Mining Layout at the Narrabri Mine, Narrabri.

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

Landcom (2004) Managing Urban Stormwater - Soils and Construction: Volume 1

Appendix A
Built Features Management

Roads Access Tracks

Table 6: Management of Roads and Access Tracks

Built Features Management Plan – Roads & Access Tracks				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1	**Monitoring**			
1.01	Visual monitoring of access roads and any affected internal access tracks to note any subsidence impacts that require remediation or implementation of additional traffic controls.	On an as needs basis (access tracks/roads are used daily by mine personnel).	Environment Superintendent / Civil Services Coordinator	Document internally – see checklist in Appendix C.
2	**Management**			
2.01	Where practicable, gates to NCOPL properties will be kept locked to prevent unauthorised access, or alternatively, signage placed noting access restrictions (i.e. authorised persons only) and potential hazards.	To be maintained throughout mining.	All staff	Document internally.
2.02	Temporary signage will be erected on access roads during active subsidence (at both approaches to the subsiding section), advising of potential subsidence risks. The signage may be relocated following the completion of active subsidence and subsequent remediation works.	Prior to longwall progressing below access roads.	Environment Superintendent	Document internally.
2.03	Grade road(s) during active subsidence to temporarily remediate subsidence impacts to the road surface and to maintain traffic ability (refer to Appendix C).	Daily (if required) during active subsidence.	Environment Superintendent	Document internally.
2.04	Construction of new, or remediation of existing tracks, will aim to maintain or improve the current standard of tracks, with consideration to the minimisation of erosion and the recommendations made in *Managing Urban Stormwater: Soils and Construction, Volume 2c Unsealed Roads* (Department of Environment and Climate Change, 2008) where appropriate.	As required. Remediation to occur within 1 month of undermining.	Environment Superintendent	Document internally.
3	**Notification/Consultation**			
3.02	Provide written notification (e.g. TBT) to mine personnel of the potential for subsidence impacts to access tracks/roads, advising of potential hazards, and including relevant contact details for further information the reporting of potential issues.	Annually.	Environment Superintendent	Document internally

Water Storage Dams and Soil Conservation Contour Banks

Table 7: Management of Water Storage Dams and Soil Conservation Contour Banks

Built Features Management Plan – Water Storage Dams and Soil Conservation Contour Banks				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1.0	**Monitoring**			
1.01	Obtain xyz coordinates along contour banks and water storage dams, e.g. LiDAR data.	Pre-mining (baseline) and post-mining.	Mine Surveyor	Document internally.
1.02	Photographic records of all dams and contour banks within the Extraction Plan area.	Pre-mining (baseline) and post-mining.	Environment Superintendent	Document internally.
1.03	Visual inspections of dams noting their condition and any changes in accordance with the Subsidence Monitoring Program.	Daily during undermining of structure.	Environment Superintendent	Document internally.
2.0	**Management**			
2.01	Maintain safe access to the water storage dams and contour banks to allow for personnel to undertake inspection, maintenance and remediation works (if required).	Ongoing.	Environment Superintendent	Document internally.
2.02	Assess each dam prior to undermining to determine need to drain (fully or partially) each dam prior to subsidence to reduce risk of dam wall failure or mine inflows, or if any modifications are required to dam wall and spillway. If lowered/drained –water level will be maintained for duration of undermining until assessment and repairs are completed (i.e. excess water pumped out following rainfall).	Complete assessments prior to undermining, with modifications to be completed prior to subsidence impacts occurring.	Environment Superintendent	Document internally.
2.03	Assess each dam to determine any required remediation works (which may include): - Repairs or reconstruction of earth dam wall(s) to ensure stability - Repair or reinstatement of level spillways for dam overflows - Repair of cracking in / around dam to prevent future erosion Repairs will aim to restore as close as practicable the pre-mining storage capacity of each dam, unless otherwise identified under a site management plan regarding the final land-use/rehabilitation strategy.	Post-subsidence, within 12 months of undermining.	Environment Superintendent	AR
2.04	Reconstruct contour banks affected by subsidence to a similar grade, capacity,	Post-subsidence, within 12 months	Environment	AR

Built Features Management Plan – Water Storage Dams and Soil Conservation Contour Banks				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
	spacing and location as the pre-mining condition (baseline) *or* in accordance with recommendations provided in the guideline *Saving Soil: A landholder's guide to preventing and repairing erosion* (Alt *et al*, 2009) or similar.	of undermining.	Superintendent	
3.0	**Notification, Consultation & Reporting**			
3.01	None proposed for LW107 – LW110.			

Property and Livestock Fences

Table 8: Management of Property and Livestock Fences

Built Features Management Plan – Property and Livestock Fences				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1.0	**Monitoring**			
1.01	Survey (aerial) to identify all existing fence lines and location / type of gates or access points (i.e. cattle grids).	Pre-subsidence (baseline).	Mine Surveyor	Document internally.
1.02	Visual inspections of fences and gates/cattle grids within active subsidence area noting their condition and functionality.	On an as needs basis.	Environment Superintendent	Document internally.
2.0	**Management**			
2.01	Exclude stock from areas of active subsidence by relocation or temporary fencing as required.	In advance of longwall extraction.	Environment Superintendent	Document internally.
2.02	NCOPL or nominated contractor to rectify any impacts to property or livestock fences/gates.	Post-subsidence, prior to re-stocking.	Environment Superintendent	Document internally.
3.0	**Notification, Consultation & Reporting**			
3.01	None proposed for LW107 – LW110.			

Dwellings and Machinery Sheds

Table 9: Management of Buildings / Structures

Built Features Management Plan – Residential Dwelling and Machinery Sheds				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1	**Monitoring**			
1.01	Undertake assessment of potentially affected building(s) to identify the presence of asbestos or other hazardous building materials/substances unable to remain in situ.	Prior to undermining.	Environment Officer	Document internally.
2	**Management**			
2.01	All habitable buildings will be vacated prior to subsidence impacts occurring. These buildings and surrounding area will then be secured to prevent unauthorised access or use, and minimise risk of personal injury.	Prior to undermining.	Technical Services Superintendent	Document internally.
2.02	Entry to all farm machinery and storage sheds will be restricted prior to and throughout active subsidence.	Prior to undermining.	Technical Services Superintendent	Document internally.
2.03	Services to subsidence-affected buildings to be disconnected.	Prior to undermining.	Technical Services Superintendent	Document internally.
2.04	Septic tank(s) will be pumped out and effluent disposed of to an appropriately licensed treatment facility prior to subsidence to prevent unplanned release of effluent due tank damage.	Prior to undermining.	Environmental Superintendent	Document internally.
2.05	Where buildings/structures are to be retained they will be inspected by a person(s) suitably qualified to assess their structural stability. Structures will only be returned to use once it is confirmed that the structures are sound and fit for purpose.	Following completion of active subsidence. Prior to intended re-use.	Technical Services Superintendent	Document internally.
2.06	Buildings affected by subsidence will remain secured to prevent unauthorised access until such time as they are structurally assessed, demolished or repaired.	Following completion of active subsidence. If demolished this will occur within 2 years.	Technical Services Superintendent	Document internally.
3	**Notification/Consultation**			
3.01	None proposed for LW107 – LW110.			

Mine Infrastructure

Table 10: Management of Mine Infrastructure

Built Features Management Plan – Mine Infrastructure				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1.0	**Monitoring**			
1.01	Inspect decommissioned SIS gas drainage sites to confirm all structures have been safely decommissioned and site is stable and safe.	Prior to undermining and following completion of subsidence.	Technical Services Superintendent	Document internally.
1.02	Survey collars of all affected piezometers and groundwater monitoring bores to confirm accurate levels for monitoring of groundwater	Prior to and following completion of subsidence.	Environmental Superintendent	Document internally and inform groundwater monitoring personnel of any RL changes.
2.0	**Management**			
2.01	Decommission SIS gas drainage sites prior to impact by subsidence	Prior to undermining.	Technical Services Superintendent	Document internally.
2.02	Continue to monitor subsidence affected groundwater piezometers following subsidence (note: life-of-mine network installed outside of Extraction Plan area to monitor impacts)	Ongoing.	Environmental Superintendent	Document internally.
2.03	Design/install PED cable with enough ‘slack’ for subsidence related impacts	Prior to undermining.	Technical Services Superintendent	Document internally.
3.0	**Notification, Consultation & Reporting**			
3.01	None proposed for LW107 – LW110.			

Survey Marks

Table 11: Management of Survey Marks

Built Features Management Plan – Mine Infrastructure				
Item	**Action**	**Trigger/Timing**	**Responsibility**	**Reporting**
1.0	**Monitoring**			
1.01	Approval to be sought from the Surveyor General prior to removing, damaging, destroying, obliterating or defacing any survey marks.	Application must be made at least 14 days prior to impacts.	Registered Surveyor	Notify Surveyor General.
2.0	**Management**			
2.01	Once undermined, restore the survey mark and submit the updated details to the Surveyor General	After subsidence is practically complete (i.e. difference between 6-monthly surveys is within measureable limits)	Registered Surveyor	Notify Surveyor General.
3.0	**Notification, Consultation & Reporting**			
3.01	Surveyor General to be notified as outlined above.	Prior to and post mining, as outlined above.	Registered Surveyor	Notify Surveyor General.

Appendix B
Trigger Action Response Plan (TARP)

Table 12: Trigger Action Response Plan

Monitoring	Trigger	Action
Roads and Access Tracks		
To note any subsidence impacts that require remediation or implementation of additional traffic controls **Sites** Visual monitoring of affected roads and tracks. **Parameters** Note any damage to roads that may cause traffic hazard (i.e. cracks, compression humps, ponded water on road surface) **Analysis:** Visual identification, refer to road management response tables in Appendix C. **Frequency** As required whilst active subsidence is affecting the road(s) and until any required remediation works are completed.	**Level 1** If inspections note that road is no longer trafficable or safe.	• Implement appropriate traffic control (may include hazard signs or temporary road closure). • Notify mine personnel. • Review potential detour options and provide alternative access (if available). • Initiate road repairs/reconstruction to restore affected section to a trafficable standard (refer to Appendix C).
	Level 2 If vehicle accident occurs	• As for Level 1. • Apply appropriate emergency / first aid treatment if required. • Record and report incident in accordance with Narrabri Mine Health and Safety protocols. • Identify cause of accident. If subsidence impact related, review the effectiveness of the management/monitoring actions under this BFMP and revise accordingly if required.
Water Storage Dams and Soil Conservation Banks		
Condition		

Monitoring	Trigger	Action
To document pre and post subsidence condition and allow identification of required remedial works **Sites:** All dams **Parameters** Obtain xyz coordinates along of water storage dam embankments/spillways and along contour banks. Photographic records. **Analysis:** Pre and post mining comparison **Frequency** Pre and Post subsidence	**Level 1** Post-subsidence survey identifies that spillway and dam wall not likely to operate as intended (i.e. spillway no longer lowest point on wall) or Post-subsidence survey identifies that contour bank not likely to operate as intended (i.e. damaged due to cracking, areas no longer able to drain, or lengths with increased slope).	• Notify Environmental Superintendent. • Reduce stored water level (if not already reduced), assess and undertake repairs to wall or spillway as required (see Appendix A) • Reconstruct or repair as per Appendix A.
Dam Failure		
To observe possible subsidence effects to dam wall and identify potential risk of impending dam failure **Sites** All dams **Parameters:** Visual inspections noting their condition, water level, cracking or recent erosion of earth embankment. **Analysis:** Visual identification of changes **Frequency**: Daily during undermining of structure	**Level 1** Minor superficial surface cracking observed – no apparent water leaking through wall.	• Notify Environmental Superintendent. • Continue to monitor.
	Level 2 Sudden drop in water level noted that is not attributable to other recent activities or use or deep cracking observed and water seepage through wall is visible (i.e. damp areas or signs of increased grass growth within embankment or immediately downstream) or severe cracking and visible signs of water discharging through earth embankment.	• As for Level 1 • Notify Technical Services Superintendent. • Restrict access to the area • Reduce stored water level by pumping water out (release downstream) and maintain lowered water level until post-subsidence assessment and repairs can be carried out.
Property and Livestock Fences		

Monitoring	Trigger	Action
To note the condition and functionality of affected fences to ensure effective exclusion of stock from active subsidence area. **Sites:** All panels (LW107-LW110) **Parameters:** Visual inspections of fences and gates/cattle grids within active subsidence area **Analysis:** Visual observation **Frequency:** On an as needs basis	**Level 1** Damage observed to fences that can be attributed to subsidence movements.	• Notify Environmental Superintendent. • Undertake repairs as per Appendix A.
Residential Dwellings and Machinery Sheds		
Harmful Substances		
To identify presence of potentially harmful substances that may be released as a consequence of subsidence **Sites:** All subsidence-affected buildings and structures **Parameters:** Hazardous materials (i.e. asbestos) identification survey **Analysis:** - **Frequency:** Prior to subsidence	**Level 1** Survey reveals presence of asbestos or other hazardous material within the buildings or surrounds and that is considered a potential risk to the environment in the event of subsidence damage.	• Notify Environmental Superintendent. • Remove or 'make safe' (demarcate) any potentially hazardous building materials that would potentially pose a health or environmental threat as a result of subsidence impacts (i.e. damage to asbestos) prior to subsidence impacts.
Post Subsidence Condition		
To assess post subsidence condition of structure and determine if repair is practicable, cost-effective and safe **Sites:** All subsidence-affected buildings and structures **Parameters:** Post-subsidence structural assessment	**Level 1** Structure collapses or is considered to be uneconomic to repair.	• Notify Technical Services Superintendent. • Maintain safety fencing / exclusion of property to prevent access. • Demolish structure(s) and recycle/dispose of materials to a licensed waste facility.

Monitoring	Trigger	Action
Analysis: - **Frequency:** Post subsidence		
Mine Infrastructure		
SIS gas drainage wells		
To confirm site has been decommissioned and is stable and safe	**Level 1** Not fully decommissioned or considered unsafe to people or livestock.	• Notify Technical Services Superintendent. • Undertake additional works as required to remove remaining structures and rehabilitate. • Repair post-subsidence cracking or identified impacts as required.
PED Cable		
Maintain communications	**Level 1** No longer operational.	• Notify Technical Services Superintendent. • Inspect to locate site of damage and replace or repair as required.
Survey Marks		
Pre and Post-mining notifications for impacts.	**Level 1** Notify of impacts to survey marks 14 days prior to impacts.	• Registered Surveyor to update details following mining.

Appendix C
Road Inspections and Response

Roads Inspections

As nominated in Table 6, inspection of roads and access tracks will be undertaken as required. Inspections will be the responsibility of the Civil Services Coordinator and will be recorded using the checklist attached. Any required actions (as outlined below) implemented accordingly and reported to the Environmental Superintendent.

Impacts to Roads – Response

The following table has been developed to assist in implementing appropriate levels or response for a range of potential subsidence impacts to the unsealed access roads within the Mining Lease.

Table 13: Road Impact Table

Impact	Full Road Width	Half Road Width	Road Edge
Cracking > 100mm wide	HIGH	HIGH	MODERATE
Cracking 20 – 100mm wide	MODERATE	MODERATE	LOW
Cracking < 20mm wide	MODERATE	LOW	LOW
Water ponding	HIGH	MODERATE	LOW
Compression humps	HIGH	MODERATE	LOW
Other	MODERATE	LOW	LOW

Where impacts are noted to roads, the following guidelines will be implemented, noting that individual circumstances may require deviation from the following action. The order of priority for any contingency response under this plan will be:

1) Ensure the safety of mine personnel;
2) Minimise the duration of inconvenience or disruption; and
3) Repair in accordance with the level of impact (high, medium, or low) as identified in the table below.

Table 14: Road Response Table

Level of Impact	Response
HIGH	Barricade affected area and notify landowner, affected occupants/road users. Provide alternative access around hazard until remediation works are complete. Proceed with remediation works within 24 hours and document all actions.
MODERATE	Erect warning signs on both sides of hazard. Notify landowner, occupants/road users. Proceed with remediation works as soon as practicable and document all actions.
LOW	Proceed with remediation works in accordance with normal maintenance procedures under this plan and document all actions.

Method of Remediation and Available Resources

NCOPL maintains an Earthworks Contractor on-site to maintain and repair all internal mine access roads. Where repairs are required under this BFMP, the Civil Services Coordinator will direct the Contractor to undertake the works. The following resources will be available on-site to undertake repairs:

- Machinery: Earthworks Contractor will maintain a standard fleet on site, including a grader, roller, excavator, front-end loader and haul trucks; and
- Materials: Earthworks Contractor will maintain a small stockpile of road gravel or similar onsite for incidental repairs.

Inspection Checklist Template

Subsidence Inspection Checklist – Roads			
Date:		Longwall No.	
Time:		Face Position (chainage):	
Inspected by:		Area inspected	
Road(s) Inspected			

Inspection Items	Present?	Comments	Impact Level (see table)
Warning signage	*Y / N*	*In place / visible / undamaged?*	
Surface Cracking	*Y / N*	*Present? Widths? Extent? Location?*	*High / Medium /Low*
Compression humps	*Y / N*	*Present? Widths? Extent? Location?*	*High / Medium /Low*
Damage to roadside drainage or ponding over pavement	*Y / N*	*Present? Widths? Extent? Location?*	*High / Medium /Low*
Safety issues / Other impacts?	*Y / N*	*Details?*	*Risk?*

Remediation Required	Earthworks Contractor Notified?	Reported to Technical Services Manager?
Summary details and timeframes for repair – see response table	*(Time/Date)*	*(Date)*

Signed:	