CENTENNIAL

VOLUME 1

Extraction Plan Main Report

Longwall Panels 30 and 31

Mandalong Mine

June 2021

DOCUMENT CONTROL / TITLE BLOCK

EXTRACTION PLAN DETAILS	**Title:**	Extraction Plan Main Report: Longwall Panels 30 and 31
	Applicant:	Centennial Mandalong Pty Limited
	Operation:	Mandalong Mine
	Development Consent:	SSD-5144
	Mining Lease:	ML1722 and ML1744
	Revision No:	Rev 2
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	Date:	June 2021

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Volume 3 – Key Component Plans

EP-WMP	Water Management Plan
EP-LMP	Land Management Plan
EP-BMP	Biodiversity Management Plan
EP-HMP	Heritage Management Plan
EP-BFMP	Built Features Management Plan
	▪ Public Roads Management Plan
	▪ Communications Management Plan
	▪ Powerline Management Plan
EP- PSMP	Property Subsidence Management Plan (private properties)
EP-PMP	Public Safety Management Plan
EP-SMP	Subsidence Monitoring Program

Abbreviations

Abnormal Subsidence – means the development of subsidence that is:

(1) different from the predicted nature (e.g. tension or compression), magnitude, location, distribution, timing or duration of subsidence, or

(2) difficult to predict or unexpected in terms of the nature (e.g. tension or compression), magnitude, location, distribution, timing or duration of subsidence.

ACHMP – Aboriginal and Cultural Heritage Management Plan

Adaptive management – Adaptive management includes monitoring subsidence effects and impacts and, based on the results, modifying the mining plan as mining proceeds to ensure that the effects, impacts and/or associated environmental consequences remain within predicted and/or designated ranges and in compliance with the conditions of consent (definition from Development Consent Conditions, DPIE).

Angle of draw – typically taken as 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.

Baseline subsidence data – subsidence monitoring data collected prior to the commencement of subsidence. This data is required for the calculation of various subsidence parameters or the assessment of effects of subsidence on relevant surface and subsurface features.

BC Act – Biodiversity Conservation Act 2016

BFMP – Built Features Management Plan

BMP – Biodiversity Management Plan

Built features – Includes any building or work erected or constructed on land, including dwellings, outbuildings and infrastructure such as formed road, street path, walk, or driveway and any pipeline, water, sewer telephone, gas or other service main. (definition from Development Consent Conditions, DPIE).

CCC – Community Consultative Committee

Competent person – a person who has acquired through training, qualification or experience the knowledge and skills to carry out the task (other than in respect of work for which a particular competency is prescribed, for example clause 5(1) definition of 'competent person' paragraphs (a)-(f) of the WHS Regulation, or in clause 3(1) of the WHSMP Regulation).

Components of subsidence – in conventional subsidence engineering theories, these components include mining-induced vertical displacement (or vertical subsidence), horizontal displacement, tilt, horizontal strain and curvature, which are used for various engineering or risk management purposes. In recent years, additional components of subsidence have been identified including mining-induced valley closure, upsidence and shear strain.

Control measure – in relation to a risk to health and safety, means a measure to eliminate or minimise risks.

Cover depth – the depth of coal seam from the ground surface (metre).

Curvature – the radius of curvature of the ground surface or subsurface strata induced by underground coal mining. The curvature of deformed ground can be either concave or convex.

Discontinuity – a general term for natural or mining-induced planes of weakness or breaks in a rockmass.

DOC – Depth of Cover

DPIE – Department of Planning, Industry and Environment, NSW

EEC – Endangered Ecological Community

EIS – Environmental Impact Statement

EMS – Environmental Management System

EP – Extraction Plan

EPA – Environment Protection Authority, NSW DPIE

EPBC – Environmental Protection and Biodiversity Conservation Act 1999

EP&A Act – Environmental Planning and Assessment Act 1979

EPL – Environment Protection License

Far-field subsidence – subsidence that occurs outside the conventional limit of subsidence. The limit is defined based on 35 degrees of angle of draw for the Southern Coalfield or 26.5 degrees of angle of draw for the other Coalfields in NSW.

Far-field horizontal displacement – mining-induced horizontal displacement that occurs outside the conventional limit of subsidence. The conventional limit of subsidence is defined based on 35 degrees of angle of draw for the Southern Coalfield or 26.5 degrees of angle of draw for the other Coalfields in NSW.

First workings – the formation of two sets of roadways (i.e. headings and cut-through) in a coal seam. The two sets of roadways are at an angle to each other (e.g. 90 degrees) forming pillars or blocks of coal that may be extracted at a later stage. First workings are primarily used for the development of coal resources prior to the extraction of the above-mentioned pillars or blocks of coal. First workings can also be the only type of mine workings in some mines or parts of mines.

FOS – Factor of Safety

GDE – Groundwater Dependent Ecosystems

Geological structures – all natural planes of weakness in the rockmass that pre-date any mining activity. Geological structures include faults, folds, igneous intrusions, joints, bedding planes or any other type of geological discontinuities or disturbances within the rockmass.

HHMP – Historical Heritage Management Plan

Horizontal displacement – mining-induced change in the horizontal position of any part of the ground surface or subsurface strata.

Horizontal strain – mining-induced change in the horizontal distance between two points relative to their original horizontal distance. The strain can be shortening (i.e. compressive) or lengthening (i.e. tensile).

HRA – High Risk Activity

Improvement – improvement includes the following (a) any building or work erected or constructed on land, (b) infrastructure, whether above or below the surface of the land. (as defined in Part 1 (4) of the Coal Mine Subsidence Compensation Act 2017).

IPC – Independent Planning Commission

LMP – Land Management Plan

Long-term subsidence – on-going development of subsidence after the completion of underground coal mining.

Massive strata – a rockmass that has a paucity of well-developed bedding planes. In the underground coal mining sector, the term 'massive' is often used to refer to the strata that are strong and have a capacity to span across the mine workings.

ML – Mining Lease

MOP – Mining Operations Plan

Mtpa – Million tonnes per annum

Negligible – Small and unimportant, such as to be not worth considering (definition from Development Consent Conditions, DPIE).

PHMP – Principle Hazard Management Plan

Pillar – an area of coal left to support the overlying rock.

PSMP –Property Subsidence Management Plan

PMP – Public Safety Management Plan

RCE – Rehabilitation Cost Estimate

Reasonably practicable – means that which is, or was at a particular time, reasonably able to be done in relation to ensuring health and safety, taking into account and weighing up all relevant matters (refer to section 18 of the WHS Act).

Rehabilitation – The restoration of land disturbed by the development to a good condition, to ensure it is safe, stable and non-polluting (definition from Development Consent Conditions, DPIE).

Remediation – Activities associated with partially or fully repairing or rehabilitating the impacts of the development or controlling the environmental consequences of this impact (definition from Development Consent Conditions, DPIE).

RMP – Rehabilitation Management Plan

ROM – Run of Mine

RR – Resources Regulator, Department for Regional NSW

SA NSW – Subsidence Advisory NSW (formerly the Mine Subsidence Board)

Secondary working – underground coal mining (e.g. longwall mining or pillar extraction) to remove the pillars or blocks of coal delineated by the first workings. Shear strain – a component of deformation that is defined by an angular change between two lines within an object.

SEE – Statement of Environmental Effects

SMP – Subsidence Monitoring Program

SMS – Safety Management System

Stakeholders – relevant persons conducting any business or undertaking that is, or is likely to be, affected by subsidence.

Strain – refers to changes in configuration of an object, which is measured by "normal strain" and "shear strain".

Subsidence – The totality of subsidence effects, subsidence impacts and consequences of subsidence impacts (definition from Development Consent Conditions, DPIE).

Subsidence effects – Deformation of the ground mass due to mining, including all mining induced ground movements, such as vertical and horizontal displacement, tilt, strain and curvature (definition from Development Consent Conditions, DPIE).

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 depression or troughs (definition from Development Consent Conditions, DPIE).

Surface or subsurface features – The surface and subsurface features refer to features which could give rise to risks, if the features are affected by subsidence. The surface and subsurface features include:

(1) **public utilities** (e.g. highways, railways, tunnels, bridges, air strips, electrical transmission infrastructure or pressurised gas pipelines),

(2) **public amenities** (e.g. shopping centres, hospitals, churches, sport facilities, child care centres or schools),

(3) **built features** other than public utilities and amenities (e.g. dwellings, factories, workshops, privately owned gas storages or surface mining voids or facilities), and

(4) **natural features** (e.g. cliffs, steep slopes, natural caves or dams or surface of land), where subsidence may result in hazardous conditions due to instability of rock or soil masses, rock falls, landslide, fractures, sinkholes, inundation, gas release or pollution of drinking water..

TARP – Trigger Action Response Plan

Tilt – mining-induced slope of a line between two points at the ground surface or within the subsurface strata.

Upsidence – mining-induced relative upward vertical displacement of the ground surface or subsurface strata, generally observable at the bottom of valleys.

Valley closure – mining-induced relative horizontal movement of the two sides of a valley towards each other.

Vertical displacement (or vertical subsidence) – mining-induced change in the vertical position of any part of the ground surface or subsurface strata.

Vertical subsidence – refer to vertical displacement.

WHS Act – means the Work Health and Safety Act 2011.

WHS Regulation – means Work Health and Safety Regulation 2017.

WHS laws – means the WHS Act, WHS Regulation, WHSMP Act and WHSMP Regulation.

WHSMP Act – means Work Health and Safety (Mines and Petroleum Sites) Act 2013.

WHSMP Regulation – means Work Health and Safety (Mines and Petroleum Sites) Regulation 2014

WMP – Water Management Plan

1 INTRODUCTION

1.1 Background

Mandalong Mine is an existing underground longwall coal mine located on the western side of Lake Macquarie near Morisset, approximately 35 km southwest of Newcastle as illustrated on **Figure 1.1**. Centennial Mandalong Pty Ltd is the operator of the mine and is a wholly owned subsidiary of Centennial Coal Company Pty Limited.

Development Consent for Mandalong Mine (SSD-5144) was approved on 12 October 2015 and permits extraction of 6.5 million tonnes of run-of-mine (ROM) coal per calendar year until 31 December 2040.

An Extraction Plan is required to be developed and approved prior to undertaking secondary extraction. This Extraction Plan, prepared for Longwalls 30-31 (LW30-31), describes the applicable regulatory framework, mine planning, management and monitoring measures to be implemented to protect all surface/subsurface natural and built features in addition to administering public safety measures associated with secondary extraction, as defined in **Section 1.2**.

1.2 Scope and Extraction Plan Application Area

This Extraction Plan has been developed in accordance with Condition 6, Schedule 4 of Development Consent SSD-5144 (as modified) and the relevant conditions of Mining Leases ML1722 and ML1744 issued under the *Mining Act 1992* to extract LW30 and LW31 within the West Wallarah Seam. The Extraction Plan has been prepared generally in accordance with the Department of Planning & Environment's Draft Guidelines for the Preparation of Extraction Plans V5 (2015) and Managing Risk of Subsidence, Guide: WHS (Mines and Petroleum Sites) Legislation (NSW Department of Industry - Resources Regulator, 2017).

The Extraction Plan Area (EP Area) comprises a surface area of approximately 230 hectares. Across the EP Area, the ground surface elevation ranges from 40 m to 240 m. Due to the elevated topography, alluvium is limited in this area. The depth of cover above the West Wallarah Seam in this area ranges from approximately 285 m to 500 m.

The existing surface environment of the EP Area includes creeks, native bushland, steep slopes and archaeological heritage items.

There are nine private properties, one property owned by Central Coast Council, one owned by Centennial Coal and one Crown Land lot. A small area of Olney State Forest is located at the southern extent of the EP Area. Local roads, power lines, telecommunication networks and other associated infrastructure are also included in the area of potential subsidence influence.

The overall EP Area is comprised of two key components as defined below and illustrated on **Figure 1.2**.

Table 1.1: Extraction Plan Area

Extraction Plan Area Components	Defining Comments
Principal Subsidence Management Area *(Secondary Extraction Area)*	▪ Predicted limit of **vertical subsidence** (20mm); **and** ▪ 26.5 degree AOD (half depth of cover) ▪ Permissible per Centennial *Operations Permit* process
Extended Monitoring and Management Area	▪ Considers potential for **horizontal movements, valley closure** and **far-field** subsidence effects on highly-sensitive features located **beyond** the Principal Subsidence Management Area ▪ Preservation of Survey Infrastructure (State Survey Control) as required by Surveyor-General's Directions No. 11.

1.3 Relevant Features and Component Plans

A summary of the natural and built features within the EP Area and the component Management Plans that the respective features are managed through is provided in **Table 1.2**. The locations, descriptions, predictions and impact assessments for each of the natural and built features are provided in **Section 3**.

Table 1.2: Natural and Built Features within the Extraction Plan Area

Features	Present in Principal SMA? (Y/N)	Present in Extended Monitoring & Management Area?	Section	Comments
Natural Feature				
Steep Slopes and rock outcrops	Y		4.4; 4.8	Land management and Public Safety Management Plans
Morans, Buttonderry and Mannering Creeks	Y		4.3	Water Management Plan
Public Utilities				
TransGrid 330kV	N			
Ausgrid Powerlines 11kV	Y		4.7.3	Powerline Management Plan
Telstra Communications (aerial copper cables)	Y		4.7.1	Communications Management Plan
Crown Roads - Kiar Ridge Rd and Toepfers Rd.	Y		4.7.2	Public Roads Management Plan
Public Amenities				
Nil	N			
Farm Land and Facilities				
Private properties	Y		4.7.4	Property Subsidence Management Plans
Industrial, Commercial and Business Establishments				
Nil	N			
Areas of Archaeological and/or Heritage Significance				
Aboriginal heritage items	Y		4.6	Heritage Management Plan
Items of Architectural Significance				
Nil	N			
Permanent Survey Control Marks				
PM, SSM, Yambo trig stn.	Y	Y	4.7	Built Features Management Plan
Residential Establishments				
Private dwellings (4)	Y		4.7.4	PSMPs
Other				
Nil	N			

1.4 Document Structure

This Extraction Plan is comprised of three volumes. An overview of the Extraction Plan and supporting management plans and studies is provided below.

VOLUME 1 Extraction Plan Main Report (this document)

Section 1 Provides an overall context and introduction to the Extraction Plan

Section 2 Includes details on the development of the Extraction Plan, including details of the legal requirements which apply and have been addressed, review of relevant risk assessments and consultation with relevant agencies and other stakeholders within the EP Area.

Section 3 Includes an overview of the mine planning and design, overall subsidence predictions related to that mine design, potential impacts from the predicted subsidence, demonstration of the subsidence predictions meeting the performance objectives and subsidence management strategies and measures.

Section 4 Provides the key component plans of the Extraction Plan including appropriate consideration to risk assessment and risk management, subsidence management measures and the plans prepared to address impacts to relevant environmental and/or built features, public safety requirements and compensation and offsets. The individual management plans are contained in Volume 2 of the Extraction Plan.

Section 5 Outlines the Subsidence Monitoring Program being the program for monitoring the subsidence effects associated with the proposed extraction in addition to summarising and consolidating the various key component plans presented in **Section 4**.

Section 6 Addresses how the Extraction Plan is implemented, including trigger action response plans and the adaptive management approach, reporting, regular review and key responsibilities.

Section 7 Comprises the graphical plans required as part of the Extraction Plan. The plans have also been prepared in accordance with relevant requirements to support a High-Risk Activity Notification. The graphical plans are contained in Volume 3 of the Extraction Plan.

Section 8 Contains all other material necessary to support the Extraction Plan as appendices and/or attachments including a full list of reference documents, subsidence compliance and obligations register, subsidence and environmental risk assessment, subsidence predictions and impact assessment report, Extraction Plan trigger action response plans.

VOLUME 2 Graphical Plans (submitted separately in A0 format)

Volume 2 contains graphical plans prepared in accordance with the *(Draft) Guidelines for the Preparation of Extraction Plans V5* (DPE, 2015).

Plan 1	Existing and Future Workings	MG14064
Plan 2.1	Surface Features Natural	MG14065
Plan 2.2	Surface Features Built	MG14066
Plan 3	Geological and Seam Data	MG14067
Plan 4	Existing Workings in Other Seams	Not applicable
Plan 5	Mining Titles and Land Ownership	MG14068
Plan 6	Geological Sections	MG14069
Plan 7	Subsidence Monitoring	MG14070

VOLUME 3 Component Management Plans

Volume 3 contains the key component management and monitoring plans of the Extraction Plan.

EP-WMP	Water Management Plan
EP-LMP	Land Management Plan
EP-BMP	Biodiversity Management Plan
EP-ACHMP	Aboriginal Cultural Heritage Management Plan
EP-HMP	Heritage Management Plan
EP-BFMP	Built Features Management Plan
	▪ Public Roads Management Plan
	▪ Communications Management Plan
	▪ Powerline Management Plan
EP- PSMP	Property Subsidence Management Plan (private properties)
EP-PMP	Public Safety Management Plan
EP-SMP	Subsidence Monitoring Program

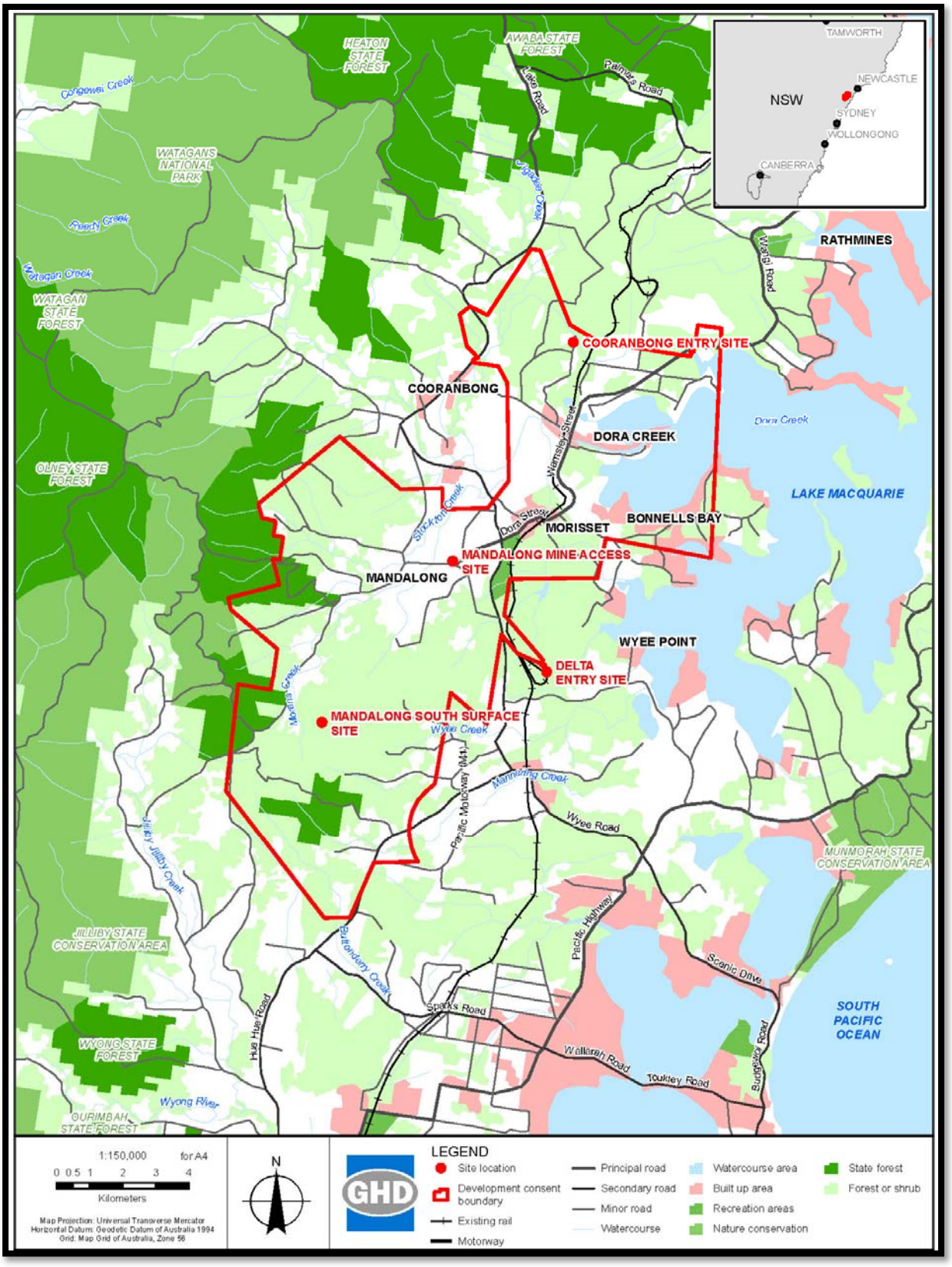

Figure 1.1: Locality Plan

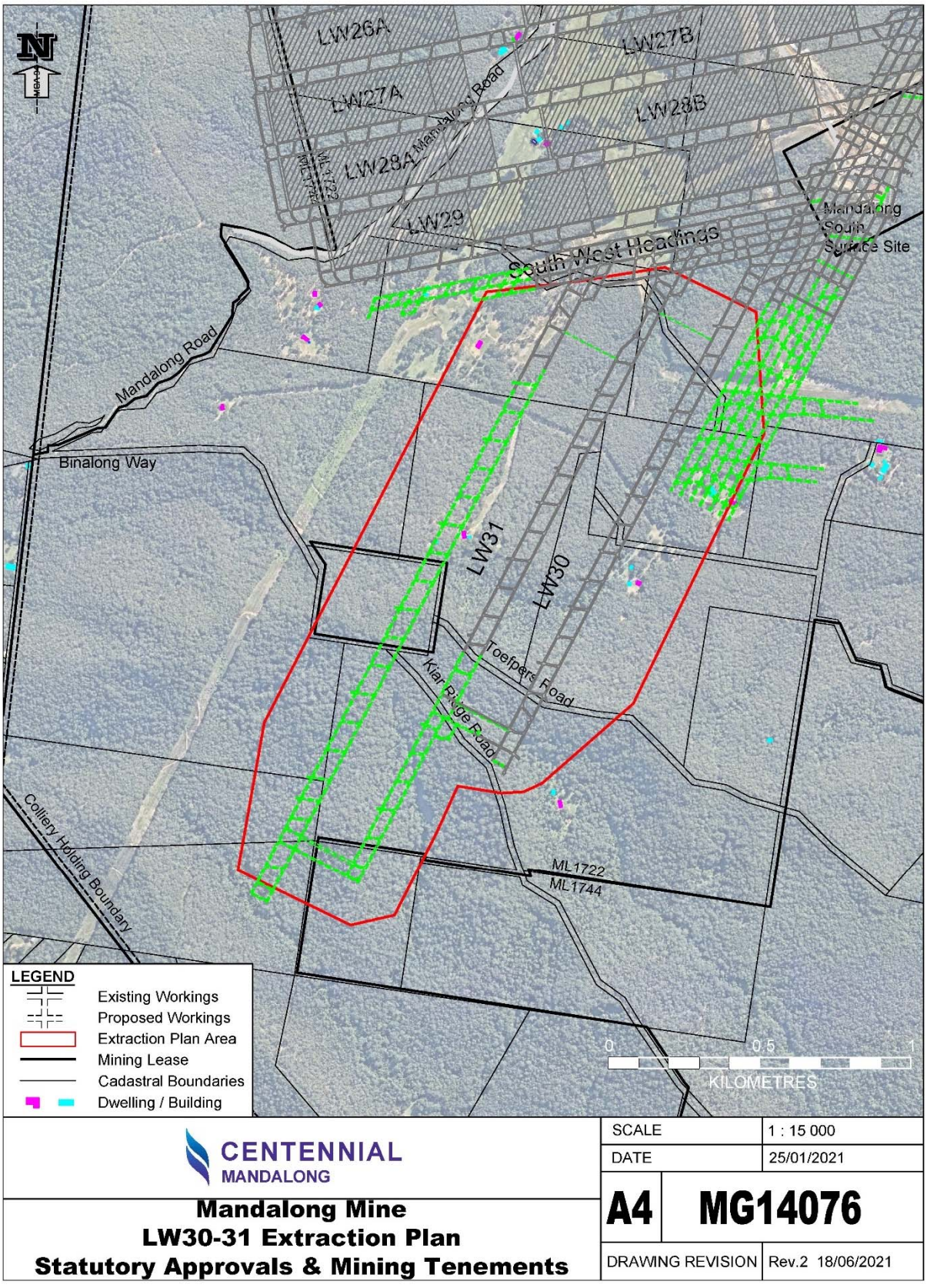

Figure 1.2: Extraction Plan Area

2 DEVELOPMENT OF THE EXTRACTION PLAN

As an established operation, Mandalong Mine has an extensive ongoing consultation process across government, organisational and community stakeholders. The consultation process undertaken specifically for this Extraction Plan regarding LW30–31 builds on that undertaken to support the Mod 9 Modification Report and is in addition to that undertaken by Mandalong Mine as part of its existing operations.

2.1 Stakeholder Consultation

2.1.1 Identification of Key Stakeholders

During development of this Extraction Plan and its key component plans, substantial consultation has been undertaken with key stakeholders. Stakeholder analysis undertaken during preparation of this Extraction Plan included:

- Risk-based consideration of key environmental and built features within the proposed EP Area;
- Stakeholders prescribed for consultation for this Extraction Plan under the Development Consent and other relevant instruments;
- Stakeholders identified as part of SSD-5144 Mod 9;
- Existing and known stakeholders to Mandalong Mine, including the Community Consultative Committee, and
- Landowners relevant to the EP Area.

Key Stakeholders identified for consultation are outlined in Table 2.1 below:

Table 2.1: Key Stakeholders

Group	Stakeholder
NSW Government Agency	▪ Department of Planning, Industry and Environment ▪ DPIE Water ▪ Crown Lands ▪ Environment Protection Authority ▪ Heritage NSW ▪ NSW Resources Regulator ▪ Mining Exploration and Geoscience ▪ Subsidence Advisory NSW ▪ The Environment, Energy and Science Group
Local Government Authority	▪ Central Coast Council ▪ Lake Macquarie City Council
Organisation	▪ Ausgrid ▪ Forestry Corporation of NSW ▪ Telstra
Community	▪ Mandalong Mine Community Consultative Committee ▪ Mandalong Community Association ▪ Private landowners

Group	Stakeholder
	▪ Registered Aboriginal Parties

2.1.2 Consultation Required by Development Consent

Condition 6 of Schedule 4 under development consent SSD-5144 requires the preparation of this Extraction Plan in consultation with key relevant stakeholders as detailed below.

Table 2.2: Development Consent Required Consultation

Condition	Consultation requirement
6(g)	Include a Built Features Management Plan, which has been prepared in consultation with NSW Resources Regulator and the owners of affected built features (Ausgrid and Telstra).
6(h)	Include a Property Subsidence Management Plan for each privately-owned property affected by the proposed second workings, prepared in consultation with the landowner. Slope stability assessments at the proposed shown in Figure 2 of Appendix 5, or at any other proposed as nominated by the Secretary, which must be undertaken in consultation with NSW Resources Regulator by a suitably qualified geotechnical expert.
6(i)	Include a Water Management Plan, which has been prepared in consultation with EPA and DPIE Water
6(j)	Include a Biodiversity Management Plan, which has been prepared in consultation with The Environment, Energy and Science Group.
6(k)	Include a Land Management Plan, which has been prepared in consultation with any affected public authorities.
6(l)	Include a Heritage Management Plan, which has been prepared in consultation with Heritage NSW and Registered Aboriginal Parties.
6(m)	Include a Public Safety Management Plan, which has been prepared in consultation with NSW Resources Regulator.
6(n)	Include a Subsidence Monitoring Program, which has been prepared in consultation with NSW Resources Regulator.

2.1.3 Consultation Required by Mining Lease and Work, Health and Safety Legislation

A summary of consultation requirements required under both the mining leases and Work, Health and Safety Legislation is included in the various Key Component Plans to outline how each matter has been addressed.

2.1.4 Results and Outcomes of Consultation

The outcomes of consultation undertaken for the project is detailed in the relevant Key Component Plans with copies of consultation correspondence provided in appendices of the relevant Key Component Plans, including project presentations delivered by the mine to key stakeholders and relevant formal correspondence received from key stakeholders.

Additionally, **Section 4** includes a table summarising submission of draft copies of management plans (key component plans) to various stakeholders required by SSD-5144. The component plans required for this Extraction Plan have been finalised in consultation with required stakeholders, and accordingly are submitted as final versions for approval.

Stakeholder feedback provided has been reviewed and addressed as necessary as part of the development and review of this Extraction Plan and key component plans.

2.2 Review of Previous Subsidence Predictions, Impacts and Consequences

Subsidence effect and impact predictions for the features above proposed LW30-31 have been adapted from ACARP, 2003 and subsidence effect data from the Mandalong Mine to date (i.e. LWs 1 to 27). Mandalong Mine has extracted (and reported on) four 125 m wide longwalls, twenty-one 160 m wide longwalls and three 180 m wide longwalls in the West Wallarah Seam.

Based on experience from the Mandalong Mine and other longwall mines in the Lake Macquarie Area, it is likely that the development of subsidence will be reduced by the spanning potential of massive conglomerate and sandstone units that exist within the overburden. Borehole data indicates that the assessment area is situated within the Triassic Narrabeen Group and upper sequences of the Newcastle Coal Measures.

In the assessment area, the Mandalong Beam is typically 11 m to 27 m thick and located approximately 100 m above the longwalls. The strength and stiffness of the conglomerate unit has meant the overburden has been able to span between chain pillars and limit subsidence to between 0.5 m and 1.0 m. The presence of geological structure has allowed the Mandalong beam to break down into thinner units and cause subsidence to increase up to 1.3 m. The overall impacts to the surface features have not increased significantly as result of this behaviour.

The proposed increase in panel width to 200 m in the extraction area is also commensurate with the increase in depth of cover and will allow the previous sub-critical panel geometry to be maintained. As the proposed panels are sub-critical, it is likely that panel sag subsidence will be similar to or less than the chain pillar subsidence (due to natural compressive arching between the pillars).

2.2.1 Review of Measured Subsidence Effects for LW13 to 27

Mandalong Mine has developed and completed 28 longwall panels to-date (LW1 - 27 including LW24A) with similar mining geometries to those being proposed for the Extraction Plan (LW30 to 31). The first four panels were 125 m wide with cover depths ranging from 150 m to 290 m and had sub-critical to critical W/H ratios from 0.33 to 0.81. Panels 5 to 24A were increased in width to 160 m, with cover depths ranging from 160 m to 370 m for a sub-critical to critical W/H range of 0.43 to 1.0. Longwalls 25 to 27 were 180 m wide, with cover depths ranging from 270 m to 330 m and had a sub-critical W/H range of 0.54 to 0.67.

The mining heights for the above panels ranged from 3.5 m to 4.8 m in the West Wallarah Seam. The chain pillars were 41 m wide for the 125 m wide panels and 46 m wide for the 160 m wide panels. The development height for the pillars was 3.5 m, giving squat or strain hardening pillar w/h ratios of 10.5 to 13.1. The chain pillar widths were reduced back to 37 m for LW20 to 24A. The chain pillars for LW25 to 27 ranged between 43.4 m and 46 m with w/h ratios from 12.4 to 13.1.

To-date, maximum subsidence has ranged from 0.26 m and 0.60 m above the 125 m wide panels, 0.44 m and 1.27 m above the 160 m wide panels and between 0.87 m and 1.1 m above 180 m wide panels. Based on a review of LW1 to 27 subsidence data in Section 8.13 of DGS (2021), it has been assessed that the Subsidence Reduction Potential (SRP) of the Mandalong Beam has ranged between ‘High’, ‘Moderate’ and ‘Low’ over LW 1 to 27, with ‘Moderate’ or ‘Low’ SRP occurring when geological structure has effectively reduced the beam thickness and allowed strata deflections to increase.

2.3 EP Project Team Endorsement

This Extraction Plan has been prepared by Phil Enright – Mining Approvals Coordinator, with assistance from the following team outlined in **Table 2.3**. The appointment of the suitably qualified and experienced persons was endorsed by the Secretary’s nominee, Mr M Sprott – Director Resource Assessments DPIE on 22 October 2020.

Table 2.3: EP Project Team

Name	Position	Company	Role
Phil Enright	Mining Approvals Coordinator	Centennial Mandalong	Preparation of Extraction Plan - S4 Condition 6 Built Features Management Plan – S4 Condition 6 (g) Property Subsidence Management Plans – S4 Condition 6 (h) Land Management Plan - S4 Condition 6 (k) Public Safety Management Plan – S4 Condition 6 (m) Subsidence Monitoring Program - S4 Condition 6 (n) Trigger Action Response Plans - S4 Condition 6 (o) Contingency Plans - - S4 Condition 6 (p)
Jeffrey Dunwoodie	Environment and Community Coordinator	Centennial Mandalong	Assist preparation of Extraction Plan - S4 Condition 6 Assist preparation of Environmental Management Plans (Water, Heritage, Biodiversity and Land)
Iain Hornshaw	Approvals Manager	Centennial	Assist preparation of overall Extraction Plan and Key Component Plans.
Stuart Gray	Technical Director - Hydrogeology	GHD	Water Management Plan - S4 Condition 6 (i)
Tyler Tinkler	Water Engineer	GHD	
Ian Gilmore	Hydrogeologist	GHD	
Arne Bishop	Service Line Leader – Terrestrial & Aquatic Ecology	RPS	Biodiversity Management Plan – S4 Condition 6 (j)
Lauren Eather	Ecology Manager	RPS	
Hayden Beck	Senior Ecologist	RPS	
Alison Fenwick	Archaeologist	Umwelt	Heritage Management Plan S4, Condition 6(l)
Ashley O'Sullivan	Senior Archaeologist	Umwelt	
Nicola Roche	Manager Cultural Heritage	Umwelt	
Tim Adams	Principal Archaeologist – Historical Heritage	Umwelt	

3 OVERVIEW

3.1 Surface Environment

The EP Area is located to the south of the existing mine workings and comprises a surface area of approximately 230 hectares within the Lake Macquarie catchment. Across the EP Area, the ground surface elevation ranges from 40 m to 240 m. The depth of cover above the West Wallarah Seam in this area ranges from approximately 285 m to 500 m. The existing surface environment of the EP Area includes creeks, native bushland, steep slopes and archaeological heritage items. There are nine private properties with four dwellings to be potentially be affected by subsidence. Local roads, power lines, transmission lines, telecommunication networks and other associated infrastructure are also included in the area covered by this Extraction Plan.

3.1.1 Land Ownership

There are four houses on nine private lots within the EP Area that range in size from 30 ha to 52 ha. One residence exists directly above LW31 with three houses just inside of the angle of draw from LW30 or 31. The structures on the private properties include single storey weatherboard on strip/pad footings or sheet metal clad houses on slabs. There are also sheds, shipping containers and an above ground swimming pool. All sites have on-site effluent disposal systems, timber post and wire strand fencing and unsealed gravel driveways. There are also one Crown land lot (Yambo Trig. Station), Olney State Forest and one publicly owned lot (Central Coast Council) that range in size from 12 ha to 100 ha. Mandalong Mine owns some of the land below the northern end of LW30 and Morans Creek.

3.1.2 Surface Infrastructure

The EP Area has, Ausgrid power poles, sealed and unsealed private access roads, unsealed fire trails / tracks and two unsealed crown roads (Toepfers Road and Kiar Ridge Road).

Two TransGrid 330 kV Transmission Line easements (TL24 and TL25/26) are located to the north and west of the EP Area. Centennial Mandalong is consulting with TranGrid regarding current and proposed mining.

The majority of the surface of the proposed mining area is private land holdings with some areas of the Olney State Forest to the south of LWs 30-31.

3.1.3 Landscape Features

There are several sandstone and pebbly sandstone rock outcrops/faces along the upper slopes of the ridges that typically range between 2 m and 5 m high with some between 5 m and 10 m high. Sandstone boulders from 1 m to 5 m high were noted on the slopes below the rock faces and on the ridge crests. Several caves and/or overhangs between 6 m and 14 m wide and 4 m to 15 m deep exist in the rock faces and boulders.

There are 25 registered Aboriginal Heritage Sites (rock shelters, grinding grooves, scarred trees and an open camp site) and one European Heritage Site (log landing) within the EP Area.

3.2 Mine Planning and Design

3.2.1 Proposed Mining Geometry and Parameters

Longwall panels 30 – 31 have been designed based on the following:

- Each panel will have panel void widths of 200 m.
- The chain pillars are parallelepiped (diamond-shaped) in plan with an acute angle between ribs of 70º. The minimum chain pillar widths between the panels will range between 51 m and 53 m and have a length of 99.4 m (solid). The solid-side chain pillars for LW30 will be 46 m wide.
- The cover depths over the longwalls range from 285 m in the north-east below Moran's Creek and increase to 500 m in the south-west beneath the elevated ridges.
- The average cover depth is approximately 390 m.

- The West Wallarah (WW) seam thickness ranges from 3.5 m to 3.8 m.
- The longwall extraction height will be similar to the seam thickness (+/- 0.1 m).
- The first workings roadways will be nominally 5.2 m wide and 3.5 m high.

The panel width to cover depth ratio (W/H) for the proposed longwall panels will range from 0.39 to 0.7, indicating 'sub-critical' subsidence behaviour is likely to occur over the panels.

Figure 1.2 illustrates the proposed panels in the landscape. A summary of the mining geometry in the LW30-31 EP Area is presented in **Table 3.1** below.

Table 3.1: Proposed Longwall Mining Geometry

Panel No	Panel Width W (m)	Cover Depth H (m)	W/H	Chain Pillar Width Wep (m)	Seam Thickness (m)	Mining Height T (m)	Pillar Wep/h (h=3.5m)
30	200	285-440	0.70-0.50	46, 51	3.5-3.8	3.4-3.6	13.1, 14.5
31	200	290-470	0.69-0.43	53	3.5-3.7	3.4-3.5	15.1

The longwall panels will be extracted in sequence from east to west and retreat from the south to north beneath the surface features.

3.2.2 Geology and Stratigraphy

The EP Area is located within the Triassic Narrabeen Group and Permian Newcastle Coal Measures. The geology within the mining lease consists of thinly to massively bedded sedimentary strata that belong to the early Triassic Narrabeen Group (Terrigal, Patonga Claystone, Tuggerah Formation, Munmorah Conglomerate and Dooralong Shale) and late Permian Moon Island Beach Sub-group (Vales Point Seam, Karignan Conglomerate, Wallarah/Great Northern Seams and Awaba Tuff). Quaternary Alluvium (sands, silts and clays) to depths of up to 10 m exist along several of the creeks within the study area.

The low height rock outcrops on the ridges within the assessment area are associated with the sandstone beds of the Terrigal Formation. The underlying Patonga Claystone is dominated by mudstone and siltstone with a few sandstone beds and the Tuggerah Formation comprises interbedded sandstone and shale with minor conglomerate.

3.2.3 Overburden Lithology

The overburden strata include interbedded sandstone, siltstone, mudstone, and pervasive conglomerate units (Munmorah Conglomerate). Sandstone, siltstone, carbonaceous mudstone and coal form the immediate roof, while the floor will consist of competent tuffaceous sandstone and siltstone.

The Wallarah and Great Northern Seams are wholly combined within the EP Area and is known as the West Wallarah (WW) Seam. The West Wallarah Seam splits into the Wallarah + Great Northern A (WGN) Seams and Great Northern C Seam to the east of the proposed longwalls and main heading.

The Awaba Tuff generally exists immediately below the WW Seam only and has been responsible for several time-dependent subsidence development events around the Lake Macquarie Coalfields in the recent past (Awaba, Cooranbong and Newvale Collieries). There have been no time-dependant subsidence developments below chain pillars at the Mandalong Mine to-date however, which indicates that the Awaba Tuff is likely to have high slake durability in the EP Area.

The borehole core logs indicate that the Awaba Tuff comprises moderately hard claystone with minor soft, puggy units < 100 mm thick. Laboratory test results demonstrate the tuff has Moderate to High UCS strength with low moisture sensitivity.

3.2.4 Geological Structures

Mandalong Mine is located to the west of the Macquarie Syncline, with bedding dipping towards the south and south-west at 1o to 3º. Regional structure encountered during mining at Mandalong comprises normal faults striking NW-SE with throws of 1 m to 2 m and low angle thrust faults are known to exist in the region on a NE strike. Aeromagnetic surveys have identified several igneous dykes striking mainly NW with some NE features that are approximately 500 m to 2000 m apart. Two sub-vertical diatremes (sub-vertical igneous plugs) have also been identified at seam level and have precluded mining to the west of the EP Area.

3.2.5 Mining Method

Extraction of coal within the EP Area is proposed to be undertaken by retreat longwall mining. This involves the removal of coal between first workings pillars and usually results in goaf formation as spans between pillars are significantly increased.

3.2.6 Mine Schedule

The EP Area includes two longwall panels and the South-West Heading development. The longwalls are currently scheduled to be extracted in less than one year. Secondary extraction is currently scheduled to commence in LW30 in July 2021 and complete LW31 in April 2022 as outlined in **Table 3.2** below. The rate of extraction in each panel is subject to local geological and geotechnical conditions encountered.

Table 3.2: Longwall Mining Schedule

Longwall	Start Date	Finish Date
30	July 2021	October 2021
31	November 2021	February 2022

3.2.7 Resource Recovery

The West Wallarah Seam ranges between 3.5 m to 3.6 m within the EP Area. The longwall equipment is able to cut up to a maximum seam height of 4.8 m, therefore the full seam thickness will be mined. The total recoverable reserves from the extraction area is 3,669,083 tonnes, including 486,266 tonnes recovered from development of the maingate and tailgate roadways and 3,182,817 tonnes from the longwall panels.

The proposed extraction of Longwalls 30 to 31 has no detrimental impact on the potential to mine economically recoverable coal in the remainder of the lease area. The Mine's overall longwall planning strategy targets maximising resource recovery within the identified constraints and the geotechnical and geological characteristics of the lease area.

Table 3.3: Longwall Panel Resource Recovery

Panel	Length (m)	Longwall face width (m)	Longwall Void width (m)	Tonnes
LW30	1448	190	200	1,426,566
LW31	1877	190	200	1,756,251
Development roadways				486,266
Total ROM Tonnes				**3,669,083**

3.3 Subsidence Predictions

Mandalong Mine has well established mine design and subsidence model, with over 80km of subsidence monitoring lines established to provide data for progressive SMP/EP Areas which has been developed and refined since the commencement of longwall mining in 2005. Revised subsidence predictions and assessment has been provided by Ditton Geotechnical Services (Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 - MAN-005/2, 2021). These predictions were reviewed as part of a variation to the LW30-31 Extraction Plan provided by Ditton Geotechnical Services (Subsidence Assessment for the Proposed Shortening of LW30 as a Variation to the LW30 & 31 Extraction Plan – MAN-005/8, 2021). The shortening of LW30 reduces the extent of the subsidence effects around the starting location of LW30. The magnitudes of the maximum panel subsidence effects remain unchanged for the longwalls.

3.3.1 Prediction Methods

The Subsidence Assessment report includes an assessment of subsidence effects and potential impacts of LW30 to 31 only on the surface and subsurface features within the assessment area based on the following methodology:

(i) The development of a geotechnical model of the overburden and immediate roof-pillar floor system using available borehole log and testing data.

(ii) Prediction of maximum subsidence effect parameters for the proposed longwalls.

(iii) Review of Mandalong Mine's subsidence data and impacts associated with LW 1 - 27.

(iv) Prediction of first and final subsidence effect profiles and final contours and assessment of the potential impacts to existing and proposed features or developments.

(v) Prediction of post-mining surface levels.

(vi) Potential surface cracking widths and their general location.

(vii) Prediction of sub-surface heights of continuous and discontinuous fracturing above the proposed longwall panels.

(viii) Potential ponding depth locations.

(ix) Potential surface gradient changes and erosion / slope stability impacts.

(x) Valley Closure and Uplift potential along watercourses.

(xi) Far-field horizontal displacements and strains.

(xii) Predicted impacts and management strategies required for the environment, developments and Aboriginal and European Heritage sites.

Two empirically-based prediction models (ACARP, 2003 and SDPS®) have been used to generate first and final subsidence profiles and contours above the proposed longwall panels after mining is complete. Surfer 8®software has then been used to generate subsidence, tilt, horizontal displacement and strain contours above the panels from the SDPS® output files.

The subsidence predictions models used in this study are summarised below:

- ACARP, 2003 - An empirical model that was originally developed for predicting maximum single and multiple longwall panel subsidence, tilt, curvature and strain in the Newcastle Coalfield. The model database included measured subsidence parameters and overburden geology data, which have been back analysed to predict the subsidence reduction potential (SRP) of massive lithology in terms of 'Low', 'Moderate' and 'High' SRP categories.

  The model database also includes chain pillar subsidence, inflexion point distance, goaf edge subsidence and angle of draw prediction models, which allow subsidence profiles to be generated for any number of panels and a range of appropriate confidence limits. The Upper 95% Confidence Limit (U95%CL) has been adopted in this study for predictions of the Credible Worst-Case values.

  The model has been updated by DgS since 2007 to allow the original ACARP, 2003 model to be applied to other Australian Coalfields and improve its robustness over a greater range of mining geometries and geologies.

- SDPS®, 2007 - A US developed (Virginia Polytechnical Institute) influence function model for subsidence predictions above longwalls or pillar extraction panels. The model requires calibration to measured subsidence profiles to reliably predict the subsidence and differential subsidence profiles required to assess impacts on surface features.

  The model also includes a database of percentage of hard rock (massive sandstone / conglomerate) that effectively reduces subsidence above super-critical and sub-critical panels due to either bridging or bulking of collapsed material. This is consistent with the ACARP, 2003 model's prediction methodology.

Based on regression analysis techniques, curves of 'best fit' have been used to estimate Mean and Credible Worst-Case (Upper 95% Confidence Limits) for the subsidence effects due to the proposed longwalls. The curves are based on measured subsidence data in the NSW Coalfields and key mining geometry parameters (refer ACARP, 2003). The Mandalong mining experience to-date has also been reviewed against the design curves.

The prediction method allows specialist consultants to assess the potential range of impacts to a given feature in a probabilistic manner. Impact Management Plans and strategies can then be developed that allows appropriate Trigger Action Responses and mine planning adjustments or mitigation measures necessary to deliver satisfactory outcomes to stakeholders.

The following sections provide brief overviews of conventional and non-conventional mine subsidence movements. For further discussions and details, including the methods that have been used to predict these movements, refer to DGS (2021).

3.3.2 Predicted Conventional Subsidence Movements

The predicted mean and U95%CL subsidence effect results for LW30 to 31 are summarised below:

- **First maximum panel subsidence** ranges from 0.55 m to 1.04 m (15% to 27% the mining height, T).
- **Final maximum panel subsidence** ranges from 0.98 m to 1.33 m (26% to 35%T).
- **First maximum chain pillar subsidence** ranges from 0.50 m to 0.97 m (13% to 27% of the mining height, T).
- **Final maximum chain pillar subsidence** range from 0.62 m to 1.12 m (17% to 31% of the mining height, T).
- **Maximum panel tilt** ranges from 6 to 15 mm/m (mean values) and 9 mm/m to 22 mm/m (U95%CL values).
- **Maximum panel concave curvatures** range from 0.30 km-1 to 0.59 km-1 (mean values) or radii of curvature of 3.4 km to 1.7 km. U95%CL values range between 0.45 km-1 and 0.88 km-1 or radii of curvature of 2.25 km to 1.14 km.
- **Maximum panel convex curvatures** range from 0.23 km-1 to 0.46 km-1 (mean values) or radii of curvature 4.3 km to 2.16 km. U95%CL values range between 0.35 km-1 and 0.69 km-1 or radii of curvature of 2.85 km to 1.44 km.
- **Maximum panel compressive strains** range from 3 to 6 mm/m (mean values) and from 5 to 9 mm/m (U95%CL values).
- **Maximum panel tensile strains** range from 3 to 5 mm/m (mean values) and from 4 to 7 mm/m (U95%CL values).

3.3.3 Predicted Far-Field Movements

Far-field movements are dependent on (i) cover depth, (ii) distance from the goaf edges, (iii) maximum subsidence over the extracted area, (iv) topographic relief and (v) horizontal stress field characteristics.

Two models (Model 1 and 2) have been developed which relate U95%CL FFD displacement and strains to the distance 'x' from the longwall extraction limits that has been normalised to cover depth (x/H). Model 1 predicts movements based on maximum panel subsidence, whereas Model 2 uses the cover depth as follows:

- Model 1 FF Displacement: u/Smax = 0.0558e-1.376(x/H)
- Model 1 FF Strains: e/Smax = 1.4622e-1.9201(x/H)
- Model 2 FF Displacement: u/H = 0.65e-1.4(x/H) (cross line data); 0.5e-1.4(x/H) (centre line data)
- Model 2 FF Strains: e/H = 0.005e-1.053(x/H) (cross line and centre line data)

The models indicate that measurable FFD movements (20 mm) generally occur for distances up to 3 or 4 times the cover depth from longwall extraction limits. The model also indicate that measurable (but diminishing) strains can also occur outside the limits of longwall extraction for distances up to one cover depth (based on the Upper 95% Confidence limit curve). It is assessed that strains will be <1 mm/m at a distance equal to 0.5 x cover depth in the Newcastle Coalfield, and therefore unlikely to cause damage beyond this distance.

3.3.4 Non-conventional Ground Movements

Valley closure movements along water courses or along the crests of steep slopes that have been undermined may also see cracking due to 'uplift' or buckling of creek beds from compressive strain concentration. Valley closure impacts have not been detected above previous longwalls at Mandalong with measured compressive strains ranging between 3 and 6 mm/m.

Surface cracking has been rare on crests and ridges, and it is likely to be due to the presence of thinly bedded, near surface strata of the Tuggerah and Patonga Claystone Formations that tend to 'shear' into thinner beams during subsidence development instead of generating fresh vertical cracks.

3.3.5 Reliability of Predicted Subsidence

The reliability of the model has been assessed using regression analysis techniques and estimates of mean and standard deviation or error of curves of 'best fit' through the data base sets. The mean and Upper 95% Confidence Limits (U95%CL) of each prediction can then be provided.

3.4 Predicted Subsidence Effects and Subsidence Impacts

The predicted subsidence effects for the proposed longwalls LW30 to 31 are compared against the approved LW30 to 33 predictions (Mod 9) given in **DgS, 2020** in **Table 3.4**.

Table 3.4 - Predicted Maximum Subsidence Effect Comparison between the Modified and Approved Longwall Layouts

Parameter*	Units	Approved Mining Layout for LW30 to 33 [Mod 9] (DgS, 2020)	Extraction Plan Layout for LW30 to 31 (this study)
Final Panel Subsidence	m	0.55 - 1.33	0.55 - 1.33
Final Chain Pillar Subsidence	m	0.60 - 1.13	0.60 - 1.13
Tailgate Chain Pillar Stress	MPa	27.9 - 47.0	27.9 - 47.0
Tailgate Chain Pillar FoS	-	2.08 - 1.26	2.08 - 1.26
Final Tilt	mm/m	6 - 22	6 - 22
Final Convex Curvature^	km^{-1}	0.2 - 0.7	0.2 - 0.7
Final Tensile Strain	mm/m	2 - 7	2 - 7
Final Concave Curvature^	km^{-1}	0.3 - 0.9	0.3 - 0.9
Final Compressive Strain	mm/m	3 - 9	3 - 9
Final Goaf Edge Subsidence	m	0.17 - 0.26	0.17 - 0.26
Final Angle of Draw to 20 mm of Subsidence	o	27.5° - 45°	27.5° - 45°

* - mean & Upper 95% Confidence Limit values; ^ - Curvatures = 0.1 x Strain (conservative).

Table 3.4 above indicates the predictions and subsequent environmental consequences for the Extraction Plan and Mod 9 layouts are the same. The Key Component Plans further consider the subsidence effects on the built and natural environment with respect to the approved performance criteria under Mod 9.

3.5 Performance Objectives

Performance objectives in relation to the subsidence impacts are presented below. These objectives have been used when developing the management strategies incorporated in this Extraction Plan.

3.5.1 Performance Measures

The primary objective of the mine design is to prevent any significant mine induced risk to surface features by providing low levels of subsidence. This minimises potential for environmental impacts and allows built features including private dwellings to remain safe, serviceable and repairable.

Performances measures for the LW30-31 Extraction Plan are provided in Tables 6 and 7 of Condition 1 and 4 in Schedule 4 of Development Consent SSD-5144.

- Performance measures relating to built features are shown in **Table 3.5**.
- Performance measures relating to natural and heritage features are shown in **Table 3.6.**

Table 3.5 - Subsidence Impact Performance Measures – Built Features

Key Public Infrastructure	
M1 Motorway	Always safe and serviceable.
Main Northern Railway	
330 kV power supply infrastructure	Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.
Other Built Infrastructure	
Power lines and power poles	Always safe.
Telecommunications infrastructure	Serviceability should be maintained wherever practicable.
Privately-owned residences	
Local Roads	Loss of serviceability must be fully compensated.
Other built features and improvements, (including access roads, farm dams, swimming pools, tracks and fences)	Damage must be fully repairable, and must be fully repaired or else replaced or fully compensated.
Public Safety	
Public Safety	Negligible additional risk.

Notes:

- *Key public infrastructure is shown in Figure 2 of Appendix 2 and in Figure 1 of Appendix 5*
- *Other built infrastructure is shown in Figure 1 of Appendix 5.*
- *The Applicant will be required to define more detailed performance indicators for each of these performance measures in the Built Features Management Plan, Property Subsidence Management Plans and Public Safety Management Plan (see condition 6 below).*
- *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.*
- *Requirements regarding safety or serviceability do not preclude preventative or mitigatory actions being taken prior to or during mining in order to achieve or maintain these outcomes.*
- *Requirements under this condition may be met by measures undertaken in accordance with the Mine Subsidence Compensation Act 1961.*

Table 3.6 - Subsidence Impact Performance Measures – Natural and Heritage Features

Watercourses	
3rd Order and above streams Groundwater-dependent Ecosystems	• No connective cracking between the surface, or the base of the alluvium, and the underground workings. • No subsidence impact or environmental consequence greater than minor.
1st and 2nd Order streams	• No subsidence impact or environmental consequences greater than predicted in the documents listed in condition 2(b) of Schedule 2. • No connective cracking between the surface and the underground workings.

Aquatic and riparian ecosystems, including affected sections of Morans Creek, Wyee Creek, Tobins Creek and Mannering Creek.	• Maintain or improve baseline channel stability. • Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and *Using the ANZECC Guidelines and Water Quality Objectives in NSW* procedures (DECC 2006), or their latest versions.
Land	
Steep slopes and rock outcrops	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Agriculture	• No loss of agricultural productivity greater than minor.
Biodiversity	
Threatened species, threatened populations and endangered ecological communities	• Negligible environmental consequences.
Heritage sites	
Stone Arrangement RPS TBM 32	• Negligible subsidence impacts or environmental consequences
All other Aboriginal Cultural Heritage sites/items at the site	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.
Mine workings	
First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts or negligible environmental consequences	• To remain long-term stable and non-subsiding.
Second workings	• To be carried out only within the approved mine plan, in accordance only with an approved Extraction Plan.

Notes:

- *Classification of streams in accordance with Strahler stream order system.*
- *Detailed performance indicators (including impact assessment criteria) for each of these performance measures will be detailed in the various management plans that are required under this consent.*
- *Measurement and/or monitoring of compliance with performance measures and performance indicators is to be undertaken using generally accepted methods that are appropriate to the environment and circumstances in which the feature or characteristic is located. These methods are to be fully described in the relevant management plans. In the event of a dispute over the appropriateness of proposed methods, the Secretary will be the final arbiter.*

3.5.2 Performance Indicators

To establish compliance with the performance measures outlined in **Table 3.5** and **Table 3.6**, Mandalong Mine has established performance indicators for each feature. Escalating triggers and levels of investigation, via Trigger Action Response Plans (TARPs), have also been established in accordance with the trigger values as outlined in **Table 3.7**.

Together the Subsidence Monitoring Program, which has been developed in consultation with the affected stakeholders, and the TARPs establish the appropriate subsidence monitoring, parameters and associated trigger levels to demonstrate that subsidence performance satisfies the Subsidence Performance Measures.

Table 3.7: Performance Indicators & TARP Risk Management Scenarios

Performance Indicator	General Description	Action / Response
Level 1: Condition Green	**Operations within predictions, and within approved impacts**.	Continued operations and monitoring as normal.
Level 2: Condition Amber	**Operations within approved impacts but potentially exceed / exceed predictions**.	Review and investigation processes are engaged, with adaptive management as required.

Level 3: **Condition Red**	**Operations exceed approved impact.** *The approved Performance Measures (criteria thresholds) of Development Consent (and any other relevant approvals) are listed in Condition Red.*	Adaptive Management measures are fully engaged as per the TARP and relevant sections of the Extraction Plan and the SMP.

3.6 Subsidence Management Strategies and Measures

Potential environmental consequences during the mining of LW30-31 will be managed in accordance with the relevant requirements of Project Approval (SSD-5144) and other approvals, through:

- **Avoidance/Mitigation Through Mine Design** – the layout of LW30-31 has been developed to meet the subsidence impact performance measures.
- **Subsidence Monitoring** – visual and survey monitoring and reporting will be conducted to confirm predictions of subsidence effects and potential subsidence impacts and environmental consequences (**Section 4.9**).
- **Management Measures and Remediation** – implementation of management measures and/or remediation, as required, to address subsidence impacts and/or environmental consequences (in consideration of the potential impacts of the unmitigated impact, including the potential for self-healing or long-term degradation, and the potential impacts of the remediation).
- **Trigger Action Response Plan (Contingency Plans)** – implementation of Trigger Action Response Plans in the event an exceedance of a subsidence impact performance measure or if an unexpected impact is detected (**Section 5.5**), including consideration of identified potential contingency measures.
- **Adaptive Management** – adaptive management will be implemented where appropriate by reviewing and evaluating the effectiveness of management strategies, and adjusting management strategies to improve performance, particularly following an exceedance of a subsidence (**Section 5.6**).
- **Reporting and Review** – procedures for investigations of incidents (including all exceedances of performance measures) and appropriate response, as well as procedures for quality assurance and review of the management system (**Sections 5.1 and 5.2**).

4 KEY COMPONENT PLANS

4.1 Risk Assessments

4.1.1 Methodology

Centennial Mandalong has adopted the Stature Risk Assessment Program which was developed to ensure consistency in all risk assessments across the Centennial Coal operations. The Stature Risk Assessment Program sets out a consequences table and risk ranking matrix for managing identified risks consistent with AS/NZS ISO 31000:2009.

All operational processes undertaken at Centennial Mandalong operations are subject to the risk assessment process prior to implementation. The process for risk and change management is undertaken according to the methodology and tools contained within **HSMS-SE-1024-Risk Management Arrangements** and **HSMS-SE-1082- Change Management System**.

Centennial Mandalong has undertaken a series of dedicated risk assessments directly in support of this Extraction Plan which provide a risk framework basis for development of the component management plans. The risk assessments and management plans were also developed with reference to the guideline for *Managing the Risk of Subsidence* (NSW Department of Industry - Resources Regulator, 2017). These risk assessments conducted include:

- WRAC Risk Assessment (No. 1001025001) - **Subsidence WHS**

- Required by the Work Health Safety (Mines and Petroleum Sites) Regulation 2014 to develop control measures to manage the **risk to health and safety associated with subsidence**. As outlined in WHS Regulation (Mines and Petroleum Sites) Schedule 1 Clause 3C, the following matters were considered in developing the control measures to manage the risks of subsidence:

  (a) the characteristics of all relevant surface and subsurface features,

  (b) the characteristics of all relevant geological, hydrogeological, hydrological, geotechnical, topographic and climatic conditions, including any conditions that may cause elevated or abnormal subsidence or the formation of sinkholes,

  (c) the characteristics of any previously excavated or abandoned workings that may interact with any proposed or existing mine workings,

  (d) the existence, distribution, geometry and stability of significant voids, standing pillars or remnants within any old pillar workings that may interact with any proposed or existing mine workings,

  (e) the predicted and actual nature, magnitude, distribution, timing and duration of subsidence,

  (f) the rate, method, layout, schedule and sequence of mining operations.

In addition, **three separate risk assessments were undertaken** specifically for the Extraction Plan and associated management plans. The three risk assessments were:

- RA No. 1001284063 – **Environmental Features**
  - Surface water, ponding and flooding
  - Groundwater
  - Land – steep slopes, surface cracking, rock rollout, agricultural land capability
  - Biodiversity – GDE's, wetlands, threatened flora and fauna
  - Heritage – Aboriginal and European

- RA No. 1001284061 – **Built Features**
  - Public Roads – Kiar Ridge Rd and Toefpers Rd
  - Telstra Communications
  - Ausgrid 11kV powerlines
  - Unsealed roads and tracks
  - State Survey Marks
  - Flooding at 1 year and 100 year ARI storm events

- RA No. 1001285007 – **Property Subsidence Management Plans (private property)**
  - Dwellings and buildings
  - Agricultural land capability
  - Dams, fences, access roads, bridges
  - Flooding (property, dwelling, access routes and land at 1 year and 100 year ARI storm events)
  - Creeks, drainage, remnant ponding
  - Steep slopes, surface cracking, rock rollout.

Copies of the above risk assessments are provided in **Appendix 2** to this EP (Volume 1). These assessments build upon the experience and results of substantial previous risk assessments during previous Extraction Plans and the most recent Extraction Plan for LW25-31. Extraction Plan risk assessment and environmental risk assessments undertaken as part of planning approvals as integral components in the environmental impact assessments process (including a detailed WRAC risk assessment undertaken for the EIS for SSD-5144 in early 2013 (RA No. 10000536001, Appendix I to the EIS for SSD-5144).

Mandalong Mine has well established Infrastructure Management Plans, which have been developed and refined since the commencement of longwall mining in 2005. The risks to surface features from the development of mine subsidence within the EP area are detailed for each infrastructure item using the subsidence predictions and assessment for LW30-31 provided by Ditton Geotechnical Services (2021) as detailed in **Section 3.3** of this document.

The risk assessment team also considered the tolerance of landscape features to subsidence impact. Two case studies were modelled:

1. Maximum Subsidence Prediction (mean); and
2. Credible Worst-Case Subsidence (Upper 95% Confidence Limits).

Table 4.1: Subsidence Risk Assessments - Sensitivities

Prediction	Cause
Maximum Predicted Subsidence (Mean)	Expected geotechnical conditions
Maximum Predicted Subsidence (Credible Worst-Case, U95% CL)	Geotechnical conditions worse than anticipated

4.1.2 Potential risks identified for the LW30-31 EP Area

Potential risks identified by the key risk assessments undertaken as noted above are detailed in the above risk assessment documents (refer **Appendix 2** to this EP), and are also outlined in each respective component management plan to the EP.

4.1.3 Summary of Risk Assessment Outcomes

A risk ranking (low, moderate, significant, high or extreme) was assigned to each risk/hazard identified in the above risk assessments undertaken in support of the LW30-31 EP in accordance with the risk classifications under the Centennial Coal Risk Standard.

The risk ranking for all features was assessed as Low to Significant at the maximum predicted subsidence.

The risk assessments undertaken for the extraction plan and subsequently identified control measures to ensure the potential for these risks to occur is appropriately controlled to ensure infrastructure is maintained as Safe, Serviceable and Repairable as a minimum and in many cases no significant impact at all was predicted.

4.2 Overview of Key Component Plans

Centennial has developed an integrated, holistic approach to subsidence management for key risks within its operations at a regional, site and EP Area level in order to provide an appropriate and systematic management approach.

- Regional management plans provide a framework for strategic management under which site plans and EP Area plans are established in accordance with consent conditions.
- Site management plans typically cover all aspects of mining operations (including surface operations and non-subsidence related aspects) as required by other conditions of the development consent.
- Management Plans for individual EP Areas (key component plans) are developed specifically to address Condition 6 (Extraction Plan) in Schedule 4 of SSD-5144 which has a specific focus in terms of both location and context as well as environmental management of subsidence and underground mining operations specifically related to the EP Area.

Set out in the following sections and summarised in

Table 4.2 below are the key component plans developed as part of this Extraction Plan. The plans have been developed in consultation with government agencies and stakeholders as required under Development Consent SSD-5144.

Table 4.2: Component Plans, Consultation and Status at time of EP Submission

Management Plan	Summary of Consultation				Status at EP Submission
	Consultation Required	*Comments Requested (and date)*	*Comments Received (and date)*	*Comments / Issues Raised*	
Water Management Plan	EPA DPIE Water (NRAR)	23/12/2020 23/12/2020 21/06/2021	18/01/2021	No further details required	**Final**
Land Management Plan	Forestry Corporation of NSW	19/02/2021	19/02/202	Email confirming satisfied with the LMP	**Final**
	Central Coast Council	19/02/2021	9/03/2021	Provided letter confirming a review of the Land Management Plan has been completed	
	DPIE Crown Lands	19/02/2021	4/03/2021	Email confirming DPIE Crown Lands are satisfied with LMP	
Biodiversity Management Plan	BCD	22/12/2020	9/02/2021	BCD has been unable to review the plan (due to workload pressures) and will not be providing comment on the plan.	**Final**
Heritage Management Plan	Heritage NSW RAPs	15/02/2021 15/02/2021	 25/02/2021	 Support HMP	**Final**
Built Features Management Plan	RR	23/02/2021 Site meeting and inspection	23/02/2021	No issues raised. Assessment during HRA notification.	**Final**
	Telstra	15/02/2021	18/02/2021	Email confirming satisfaction with Communications Management plan.	**Final**
	Ausgrid	19/03/2021	24/03/21	Email confirming satisfaction with plan including mitigation works.	**Final**
	Crown Lands	18/02/2021	25/03/2021	Email confirming satisfaction with Public Roads Management Plan	**Final**

Management Plan	Summary of Consultation				Status at EP Submission
	Consultation Required	*Comments Requested (and date)*	*Comments Received (and date)*	*Comments / Issues Raised*	
Public Safety Management Plan	RR	23/02/2021 Site meeting and inspection.	23/02/2021	No issues raised. Assessment during HRA notification.	**Final**
Subsidence Monitoring Program	RR	23/02/2021 Site meeting and inspection	23/02/2021	No issues raised. Assessment during HRA notification.	**Final**

4.3 Water Management Plan

A Water Management Plan (WMP) (GHD, 2021) has been prepared for the LW30-31 EP in accordance with the following and in consultation with the EPA and NRAR:

- Condition 6(i) in Schedule 4 of SSD-5144;
- Statements of Commitment of the EIS for SSD-5144;
- EPL365;
- Groundwater Bore Licences; and
- Mandalong Mine: Water Management Plan (GHD, 2017)

Details on the environment characterising (climate, topography and hydrogeology, geology and hydrology) relevant to the study area have also been provided in (GHD, 2021).

The scope of the EP WMP for LW30-31 addresses management and monitoring of potential subsidence impacts on surface and groundwater water resources within the EP area, including but not limited to all water courses and aquifers in the EP Area. The WMP provides information on (but not limited to) the following:

- Surface water monitoring for:
  - Surface water quality
  - Flow monitoring
  - Stream and flow path inspections
- Groundwater monitoring of:
  - Water quality and levels in the established groundwater piezometer network
  - Underground water transfers
  - Groundwater inflows to the mine
- Baseline data for the above surface and groundwater
- Identification of registered groundwater bores
- Impact Assessment and Performance Criteria for surface and groundwater (including stream health)
- Managing outcomes of modelling assessments for:
  - Potential flooding in the EP Area;
  - Groundwater quantity and quality, and mine water inflows.
- Water management measures for surface and groundwater
- Detailed Trigger Action Response Plans

Surface and groundwater features and monitoring locations (including watercourse stability monitoring) under the WMP and related Subsidence Monitoring Program for LW30-31 are illustrated in the WMP.

4.3.1 Supporting Study – LW30-31 Flood Assessment

A flood model has been developed to identify and quantify the potential changes to the nature of flooding as a result of mining activities at Mandalong Mine. The model is a two-dimensional hydrodynamic flood model implemented in RMA-2 and simulates the depth, velocity and shear (tractive) stress of flood flows, accounting for observed and predicted subsidence. The results of the model are used to estimate the potential impacts of mining on flooding, watercourse stability and ponding.

The model was updated to compare the potential impacts of the Modification 9 of SSD 5144 mine layout on flooding and watercourse stability to the approved SSD 5144 Modification 5 (Umwelt 2020).

Table 4.3: Water Feature Performance Indicators

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Watercourse quality	SSGVs	Within or below SSGVs	Undertake surface water quality monitoring in accordance with section 2.1.1 of WMP.	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
Watercourse flow	Historical dry weather flow volume	Above or within 50th percentile historical dry weather flow volume	Undertake surface water flow monitoring in accordance with section 2.1.2 of WMP.	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
Incisional processes and instabilities Waterway bed condition	Erosional processes	Occurrence of erosional processes does not occur as a result of subsidence	Undertake flood monitoring program in accordance with section 2.1.4 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
Waterway cross sectional area	Cross sectional area change	Change in cross sectional area does not vary beyond the predictions of the subsidence modelling undertaken as part of impact assessment	Undertake flood monitoring program in accordance with section 2.1.4 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
Stream gradient	Stream gradient change	Change in stream gradient does not vary beyond the predictions of the subsidence modelling undertaken as part of impact assessment.	Undertake flood monitoring program in accordance with section 2.1.4 of WMP	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
3rd order and above streams GDEs	Subsidence impacts	No connective cracking between the surface, or the base of the alluvium, and the underground workings. No subsidence impact of environmental consequence greater than minor	Undertake stream and flow path monitoring in accordance with section 2.1.3	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
1st and 2nd order streams	Subsidence impacts	No subsidence impact of environmental consequences greater than predicted by impact assessment. No connective cracking between the	Undertake stream and flow path monitoring in accordance with section 2.1.3	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
		surface and the underground workings.		
Groundwater level	Groundwater level trigger values	Above trigger values. No complaints regarding groundwater access	Undertake groundwater monitoring in accordance with Section 2.2	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)
Groundwater quality	Groundwater level trigger values	Within or below trigger values. No complaints regarding groundwater quality.	Undertake groundwater monitoring in accordance with Section 2.2	In accordance with WMP Trigger Action Response Plans (WMP Appendix F)

4.4 Land Management Plan

The Land Management Plan has been developed in accordance with Condition 6(k) in Schedule 4 of the Development Consent for SSD-5144.

The purpose of the Land Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on landscape features that will be affected by the secondary extraction of LW30 to 31.

The landscape features managed by the Land Management Plan are steep slopes, rock outcrops and agricultural land. The other landscape features located within the EP Area are detailed in **Table 4.4** along with their relevant management plan and monitoring programs.

Table 4.4: Landscape Feature Performance Indicators

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
Steep slopes and rock outcrops	Surface cracking or movement of rock outcrops.	No significant surface cracking or movement of rock outcrops.	Monitoring features prior to, during and post secondary extraction. Weekly visual inspections of steep slope areas, rock outcrops and access tracks will be conducted when located within the active subsidence zone.	In accordance with LMP Trigger Action Response Plans (LMP Appendix 1)
Creeks and water courses	Change to creek line gradients, alignment or existing ponding	Minor changes to creek line gradients. Negligible change to channel alignment	Undertake flood modelling and assessment to identify and potential changes to overland	In accordance with LMP Trigger Action Response Plans (LMP Appendix 1)

Feature	Performance Measure (Approved Impact)	Performance Indicator	Monitoring	Management
		Negligible change to existing ponding within creek channel.	flow paths, channel alignments and remnant ponding.	
Property access roads	Safe, serviceable and repairable (SSR). Negligible visible impact on gravel access roads. Possible hairline cracking on sealed roads. No change to flood hazard category.	Impacts to access roads Increased flood hazard category.	Establish subsidence monitoring on property sites if an increase in flood hazard is predicted. Conduct post-mining surveys following the development of subsidence.	In accordance with LMP Trigger Action Response Plans (LMP Appendix 1)
Land Use Impact	Negligible change to flood free agricultural land for stock storage or stock access. Negligible impact to agricultural productivity or use of the land or an enterprise. Negligible change to existing ponding or remnant ponding No or minor impact to buildings or improvements. Negligible increase in soil or tunnel erosion.	Impact to landuse from subsidence or increased flooding or ponding beyond predicted or approved impacts.	Establish subsidence monitoring on property sites. Conduct post-mining surveys following the development of subsidence.	In accordance with LMP Trigger Action Response Plans (LMP Appendix 1)
Farm dams	Tensile Strain <4mm/m Not likely to impact dam seal. Minor reduction in dam capacity from tilting	Impact to farm dams from subsidence beyond predicted or approved impacts.	Undertake pre-mining inspection of dam and drainage paths.	In accordance with LMP Trigger Action Response Plans (LMP Appendix 1)

4.5 Biodiversity Management Plan

A Biodiversity Management Plan (BMP) has been prepared for the LW30-31 EP in accordance with Condition 6(j) in Schedule 4 of SSD-5144, in consultation with BCS.

The BMP outlines the monitoring and management measures, including the prescribed actions and responsibilities, required to detect and appropriately manage potential subsidence-related impacts to biodiversity resulting from LW 30-31. The BMP addresses potential subsidence-related impacts to biodiversity

resulting specifically from secondary extraction within the EP Area, including habitats, threatened flora and fauna, Endangered Ecological Communities (EECs), and aquatic ecosystems.

This BMP provides the management strategies, controls and monitoring programs to be implemented for the management of potential impacts and environmental consequences on land and landforms affected by subsidence from the Extraction Plan. The BMP aims to ensure the performance measures are not exceeded.

Table 4.5: Biodiversity Performance Criteria

Land	Performance Criteria
Threatened species, threatened populations and endangered ecological communities and groundwater dependant ecosystems	Negligible environmental consequences

"Negligible" is defined as per SSD-5144 "small and unimportant, such as not to be worth considering".

Compliance with the biodiversity performance measures is determined through the comparison of monitoring data with the performance indicators. Performance indicators for the EP Area are outlined in Table 8 of the BMP together with the corresponding monitoring program described in Section 8 of the BMP. The monitoring program will be used to demonstrate that the environmental performance satisfies relevant performance indicators. Required actions and responsibilities are defined to ensure detection of any potential biodiversity impacts from mining induced subsidence.

A Trigger Action Response Plan (TARP) has been developed using the performance indicators for land management (Appendix 2 of the BMP). The contingency plan where a performance indicator has been exceeded is outlined in the TARP. A trigger will result in additional investigations to determine if the exceedance is related to non-mining-factors or is a consequence of mining activity. The response to these exceedances will follow the TARP. Management / corrective actions can be implemented where required to remedy these non-conformities and report accordingly.

4.5.1 Ecological Communities and Groundwater Dependent Ecosystems

One Threatened Ecological Communities (TEC) was found within the EP Area, being Lowland Rainforest in NSW North Coast and Sydney Basin Bioregions (PCT 1528; BC Act: Endangered EPBC Act: Not Listed). Note that although PCT 1556 can be commensurate of River-Flat Eucalypt Forest on Coastal Floodplains of the New South Wales North Coast, Sydney Basin and South East Corner Bioregions TEC, as the Extraction Area is not located on a floodplain, this vegetation is not considered to be consistent with this TEC.

Some vegetation communities are present within the EP Area that are consistent with the second class of GDE. That is, some vegetation types within the EP Area are dependent on sub-surface flows (i.e. have rooting zones which overlap the sub-surface water interface, such as floodplain vegetation) or are located such that surface flows originate from sub-surface flows (e.g. areas of impeded drainage such as Melaleuca stands).

The potential PCTs within the EP Area include:

- PCT 1528 Jackwood - Lilly Pilly -Sassafras riparian warm Temperate rainforest of the Central Coast;
- PCT 1556 Tallowwood – Smooth-braked Apple – Blackbutt grass tall open forest of the Central and lower North Coast;
- PCT 1568 Blackbutt – Turpentine Sydney Blue Gum mesic tall open forest on ranges of the Central Coast; and
- PCT 1573 Sydney Blue Gum – Lilly Pilly mesic tall open forest of coastal ranges and tablelands escarpment.
- PCT 1588 Grey Ironbark – Broad-leaved Mahogany – Forest Red Gum shrubby open forest on Coastal Lowlands of the Central Coast.

There are no GDEs within the EP Area and greater Southern Extension Area that are listed in Schedule 4 of the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2009. The shallowest depth of cover between a potential GDE and the coal seam is approximately 305 m (DgS 2020).

4.6 Heritage Management Plan

A Heritage Management Plan (HMP) has been prepared to support the Extraction Plan for LWs 30-31 and addresses specific heritage components of Development Consent SSD-5144. Schedule 4, Condition 6(l) of SSD-5144 requires Centennial Mandalong to develop and implement a HMP as part of the EP for LW30-31. This condition requires that the HMP be prepared in consultation with Heritage NSW and the registered Aboriginal parties to manage the potential environmental consequences of the proposed second workings on Aboriginal and non-Aboriginal heritage items and reflect the requirements of condition 22 of Schedule 3.

Mandalong Mine currently operates in accordance with the Centennial Northern Region Aboriginal Cultural Heritage Management Plan (ACHMP), with additional Heritage Management Plans (HMPs) developed to inform Extraction Plans for prior extraction.

This HMP has been developed to meet the requirements of Condition 6(l) and ensure consistency with the approved ACHMP and prior HMP. It identifies the monitoring and mitigation measures for heritage sites within the Project Area that are required to be implemented to demonstrate that the relevant performance measures are achieved.

One historic heritage site, being a log landing site associated with early timber getting, was identified above LW30. It is understood that the sites have low historical value due to their poor condition generally.

There are 25 Aboriginal cultural heritage sites within the EP Area from LW30–31. The sites within the EP Area include:

- One Artefact Scatter site.
- Three Rock Shelters with Art or PAD
- Twelve Rock Shelters
- Nine grinding groove sites.

The sites are mainly located on the steep slopes and ridges or at the rock bar locations along the watercourses. The Aboriginal cultural heritage sites were inspected over four days in April/May 2021 by a principal geotechnical engineer to photograph and record their current condition and determine if there were any mitigating features such as isolating joints, bedding partings or favourable geometry that could reduce the likelihood of impact due to mine subsidence.

Table 4.6 summarises the sites and predicted impacts based on the final shortened layout of LW30.

Table 4.6: Cultural Heritage Sites and Predicted Impacts

Site Name	AHIMS Number	Site Feature	Predicted Tilts (mm/m)	Predicted Horizontal Strains (mm/m)	Predicted Vertical Subsidence (m)	Likelihood of Impact
Buttonderry Creek	45-3-1226	Grinding Groove	10.1	1.3 (1.5)	0.45	Possible
Moran's Creek	45-3-1228	Art (Pigment/ Engraved), Habitation Structure	0.5	0.0	0.05	Very Unlikely
MS9-OH-1		Not an archaeological site	4.2	-1.7 (1.5)	0.81	Possible
MS9-GG-1	45-3-4551	Grinding Groove	1.9	3.7	0.79	Likely
MS9-GG-2	45-3-4552	Grinding Groove	3.3	-1.5 (1.5)	0.82	Possible
MS9-GG-3	45-3-4545	Grinding Groove	14.1	4.6	0.37	Likely
MS9-RS-1	45-3-4547	Habitation Structure	5.4	-1.4 (1.5)	0.73	Possible
MS9-RS-2	45-3-4546	Habitation Structure	0.4	0.0	0.04	Very Unlikely

Site Name	AHIMS Number	Site Feature	Predicted Tilts (mm/m)	Predicted Horizontal Strains (mm/m)	Predicted Vertical Subsidence (m)	Likelihood of Impact
MS9-RS-3	45-3-4544	Habitation Structure	0.4	0.0	0.03	Very Unlikely
MS10-GG-1	45-3-4548	Grinding Groove	0.3	0.0	0.03	Very Unlikely
MS10-GG-2	45-3-4549	Grinding Groove	0.3	0.0	0.03	Very Unlikely
MS10-GG-3	45-3-4550	Grinding Groove	0.3	0.0	0.02	Very Unlikely
RPS MAND STH CYL05	45-3-3492	Grinding Groove	9.9	2.8	0.32	Possible
RPS MAND STH PS01	45-3-3586	Habitation Structure (with no deposit or objects)	10.9	0.13p	0.53	Very Unlikely
RPS MAND STH PS02	45-3-3639	Aboriginal Resource and Gathering (rock overhang)	6.2	2.3	0.2	Possible
RPS MAND STH PS03	45-3-3640	Aboriginal Resource and Gathering (rock overhang)	0.7	0.6	0.08	Very Unlikely
RPS MAND STH PS04	45-3-3641	Aboriginal Resource and Gathering (rock overhang)	0.5	0.4	0.07	Very Unlikely
RPS MAND STH PS05	45-3-3642	Aboriginal Resource and Gathering (rock overhang)	5.1	2.2	0.17	Possible
RPS MAND STH PS25	45-3-3511	Artefact	1.2	-2.3(1.5)	0.84	Possible cracking, very unlikely erosion
RPS MAND STH PS26	45-3-3512	Grinding Groove	4.1	2.2	0.13	Possible
RPS MAND STH PS27	45-3-3594	Habitation Structure (with no deposit or objects)	3.2	1.8	0.11	Possible
RPS MAND STH PS28	45-3-3513	Potential Archaeological Deposit (PAD)	13.1	-0.2 (1.5)	0.76	Possible
RPS MAND STH PS29	45-3-3595	Habitation Structure (with no deposit or objects)	2.7	0.4	0.84	Very Unlikely
RPS MAND STH TBM29	45-3-3536	Artefact Scatter	0.4	0.2	0.01	Very Unlikely
RPS MAND STH PS32	45-3-3514	Potential Archaeological Deposit (PAD)	0.4	0.0	0.03	Very Unlikely

A series of risk control measures and procedures has been outlined in Sections 11 and 12 of the HMP. The implementation of the risk control and procedures will be through the Trigger Action Response Plan and the three-phase monitoring system detailed in Centennial's Northern Region Aboriginal Cultural Heritage Management Plan (RPS 2016):

- Phase 1 monitoring to be undertaken on all archaeological sites prior to site undermining;
- Phase 2 is to be initiated after the completion of the undermining. Phase 2 monitoring will be required on all archaeological sites on the EP Area.
- Phase 3 is to be undertaken approximately 8 months after the mining activity has finished;
- Phase 3a may be required in cases where final subsidence is not achieved until after a number of longwall extractions have taken place.

In the event of unpredicted impacts or deviation in the mine conditions from normality, site personnel will follow the corrective actions outlined in the TARP. Whilst not expected, should any previously unidentified Aboriginal heritage sites/items be encountered, Mandalong Mine will follow the procedures outlined in Section 11 of the Northern Region Aboriginal Cultural Heritage Management Plan.

4.7 Built Features Management Plan

The Built Features Management Plan (BFMP) has been developed as a key component of the Extraction Plan in accordance with Condition 6(g) in Schedule 4 of SSD-5144, and is contained in Volume 3 of the EP. The purpose of the Built Features Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential subsidence impacts on built features affected by the secondary extraction of LW30-31.

As required, the BFMP has been prepared in consultation with relevant stakeholders and infrastructure owners to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings. Subsequently a number of sub-plans for individual built features support the BFMP as outlined in **Table 4.7** below.

The BFMP:

- addresses key public infrastructure items (with particular consideration to tension/angle/suspension towers on transmission lines), and other public infrastructure;
- recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and
- in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure.

Table 4.7: Built Features within the LW30-31 EP Area and Relevant Management Plans

Feature	Identification and Assessment	Management and Monitoring
Public Roads **Crown Lands**	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021).	**Public Roads Management Plan** Built Features Management Plan Public Safety Management Plan Subsidence Monitoring Program
Telstra Communication Network	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Telstra Communications Assessment Report for Extraction Plan LW30-33 (Comms Network Solutions, 2020)	**Communication Management Plan** Built Features Management Plan Public Safety Management Plan Subsidence Monitoring Program

Feature	Identification and Assessment	Management and Monitoring
Ausgrid 11 kV Powerlines	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Ausgrid assessment	**Powerline Management Plan** Public Safety Management Plan Built Features Management Plan Subsidence Monitoring Program
Private Dwellings	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Flood Impact Assessment - Full Subsidence Over Longwalls 1 to 33, 2020 (Umwelt, 2020) Pre-mining Dwelling Structural Assessments – Leigh Appleyard Chartered Professional Engineer Centennial Mandalong Extraction Plan LW30-31 Land and Agricultural Resource Assessment (SLR, 2020)	**Property Subsidence Management Plans (PSMP)** Public Safety Management Plan Subsidence Monitoring Program
Unsealed tracks – steep slopes	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021). Centennial Mandalong Extraction Plan LW30-33 Land and Agricultural Resource Assessment (SLR, 2020).	**Land Management Plan** Public Safety Management Plan Subsidence Monitoring Program
State Survey Marks	SCIMS Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021)	**Built Features Management Plan**

4.7.1 Communications Management Plan

The Communications Management Plan (CMP) for LW30-31 EP has been developed in consultation with Telstra Network Integrity Services (NIS) representatives to minimise potential for impacts on Telstra communications networks (refer **Appendix 5**). The CMP follows on from existing approved management plans prepared for previous SMP and EP areas at Mandalong Mine. The plan manages the following network assets:

- Local CAN Aerial Copper Cable Network
- Pits, Conduits and Elevated Joints

An audit and of the communications network was carried out by Comms Network Solutions (2020) on behalf of Telstra NIS and an assessment of likely impact to the communications infrastructure based on the maximum predicted subsidence (mean and Upper 95% Confidence Limits) from the extraction of LW30-33.

Appropriate monitoring (including baseline) has been developed in consultation with the asset owner to meet the required performance measures as detailed within the CMP plan and summarised in the Subsidence Monitoring Program. A detailed TARP was developed during preparation of the CMP in consultation with Telstra.

4.7.2 Public Roads Management Plan

The Public Roads Management Plan (PRMP) for LW30-31 EP has been developed in consultation with LMCC and Crown Lands with the aim of minimising the potential for impacts on local roads within the EP Area as illustrated on **Figure 4.1**.

This plan follows on from existing approved management plans prepared for previous SMP and EP Areas at Mandalong Mine. The plan manages the potential risks identified in Section 7 of the PRMP. Impact predictions and assessment is detailed in Section 8 of the PRMP.

Appropriate management and monitoring measures (including baseline) have been developed in consultation with the asset owners to meet the required performance measures as detailed within the PRMP. Management measures including mitigation works for potential flooding are detailed within the PRMP.

A detailed TARP was developed during preparation of the PRMP in consultation with Crown Lands and is presented in Appendix 1 to the PRMP.

Figure 4.1 shows the location of the public roads within the EP Area.

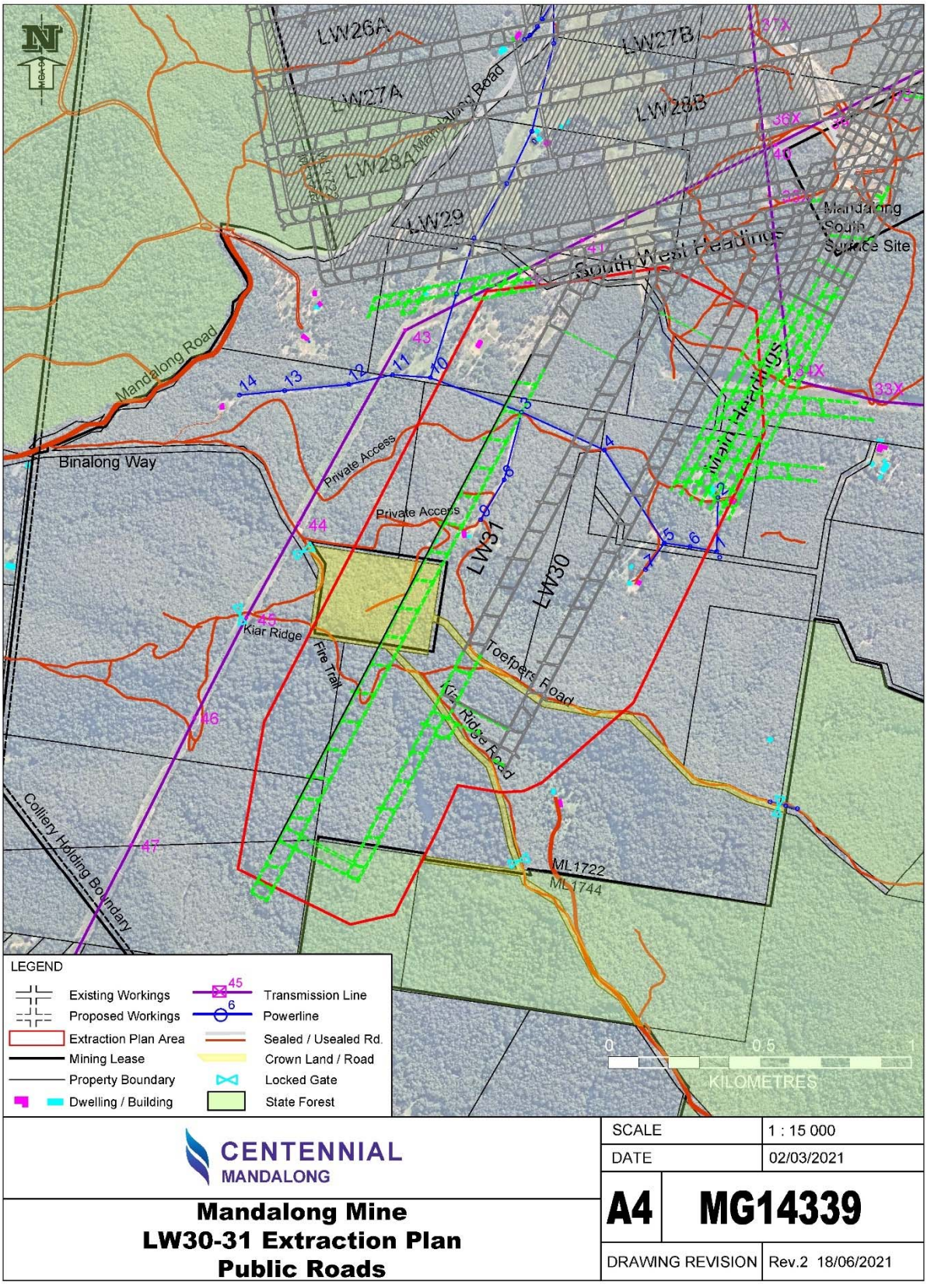

Figure 4.1: LW30-31 Public Roads

4.7.3 Powerline Management Plan (Ausgrid)

A Powerline Management Plan for LW30-31 EP has been developed in consultation with Ausgrid representatives to minimise potential for impacts on low voltage powerlines (11kV) pole mounted powerlines servicing a limited number of rural residential properties (refer **Figure 4.2**).

Ausgrid have carried out modelling using overhead line design software of the existing electrical overhead network in the vicinity of LW30-31 and identified mitigation works are required to be completed prior to the poles being impacted by subsidence. Ausgrid will conduct the mitigation works prior to subsidence affecting the powerline network, with typical works including installing rollers, replacing cross-arms and removing stays. Centennial will record the pre and post condition of Ausgrid power poles using Centennial's 3D scanning theodolite (Trimble SX10) and provide the information to Ausgrid.

The mitigation works, including modelling and any necessary subsidence remediation works will be conducted by Ausgrid or their approved contractor. Centennial Mandalong will reimburse Ausgrid for the cost of conducting these works.

A detailed TARP was developed during preparation of the Powerline MP in consultation with Ausgrid as presented in Appendix 1 to the Powerline MP.

A full copy of the Powerline Management Plan is contained in Volume 3 of the EP.

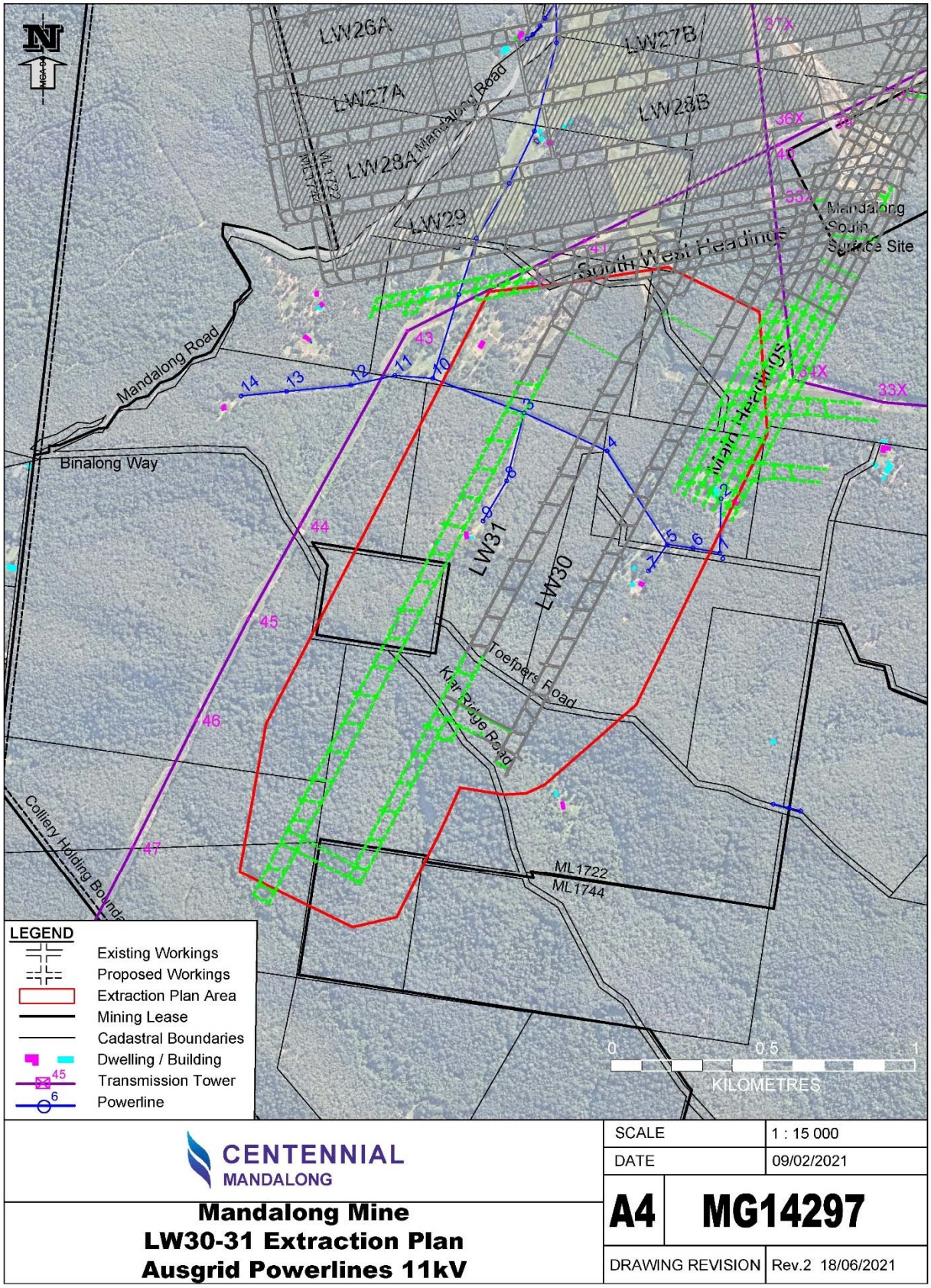

Figure 4.2: Ausgrid Powerlines 11kV

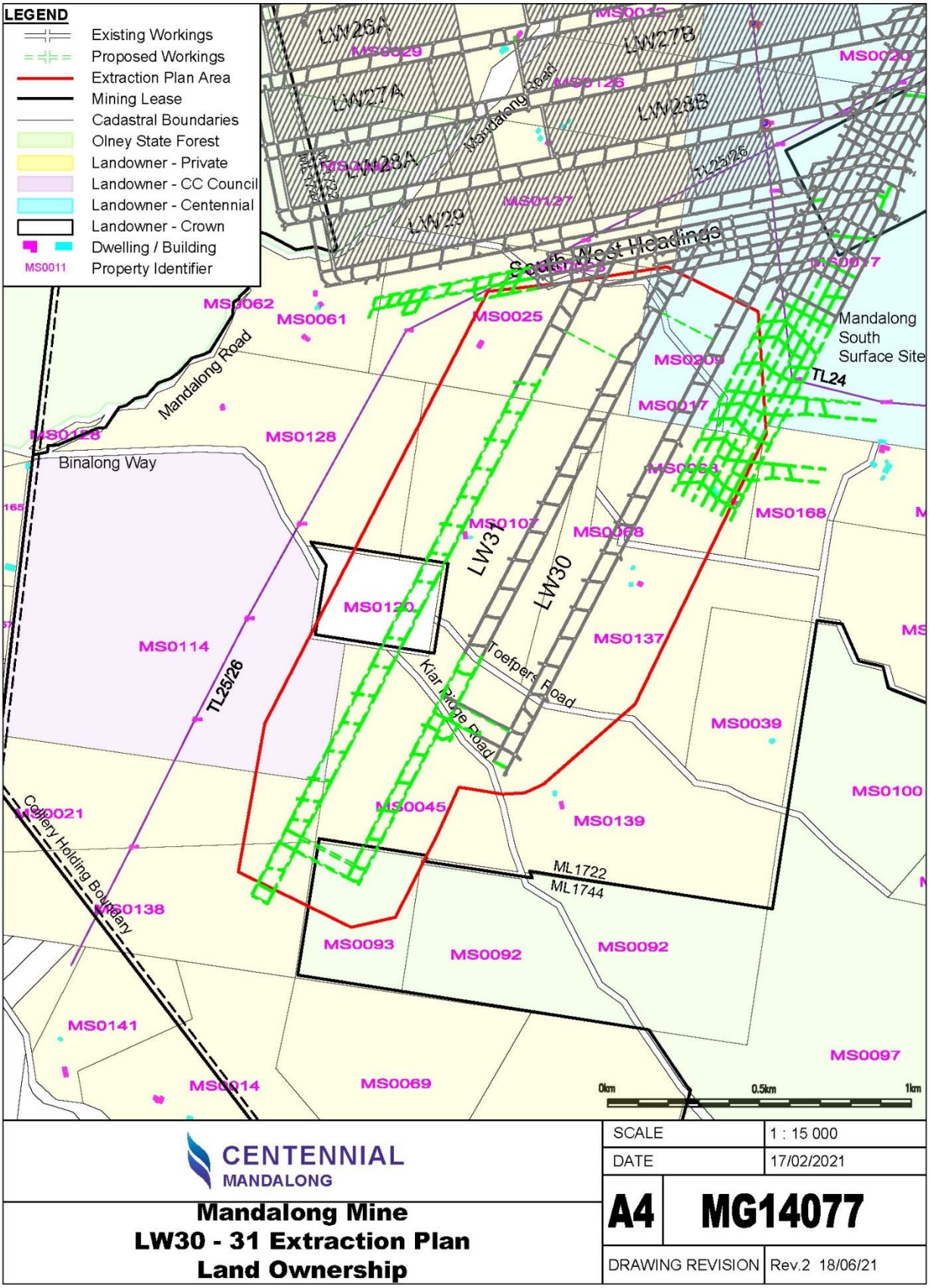

Figure 4.3: Land Ownership Across the EP Area

4.7.4 Property Subsidence Management Plans (PMSPs)

Property Subsidence Management Plans (PSMP) have been prepared for the nine private landowners located within the LW30-31 EP Area. Consultation with the relevant landholders has been undertaken in accordance with Condition 6(h) of Schedule 4 of SSD-5144. Copies of the PSMPs, including all consultation undertaken during their preparation, are provided electronically in **Volume 3** of the EP. **Figure 4.3** illustrates land ownership across the EP Area.

In accordance with Condition 6(h), the PSMPs include:

- A detailed structural inspection of residences and all other structures on the property;
- A detailed subsidence impact assessment for the property, including (where relevant):
    - A flood impact assessment, including a prediction of the minimum freeboard of the residence in a 1 in 100 year ARI flood event, and, where this prediction shows the minimum freeboard at the residence to be less than 0.5 m in a 1 in 100 year ARI flood event:
        - recommends such works to raise, remediate or relocate the residence and/or provide suitable access to the property, prior to undermining the residence; or
        - where these works are unable to be undertaken, offers to acquire the whole of the property, or such part of the property requested by the landowner where subdivision is approved, in accordance with conditions 3 and 4 of Schedule 5;
    - Slope stability assessments at the properties shown in Figure 2 of Appendix 5, or at any other property as nominated by the Secretary, which must:
        - be undertaken at least 12 months prior to undermining the property;
        - be undertaken in consultation with DRE, by a suitably qualified geotechnical expert;
        - recommend measures to manage and/or mitigate the risks and impacts associated with slope instability and rock roll-out at the residence, and the risk to the safety of persons; and
        - include a timeframe for the implementation of the recommended measures;
    - Soil erosion assessment, which recommends measures to avoid, mitigate and otherwise respond to increased soil erosion impacts; and
- Appropriate measures, commitments and timeframes to mitigate, repair, replace or otherwise compensate the impacts to the property.

4.8 Public Safety Management Plan / Principal Hazard Management Plan

The Public Safety Management Plan has been developed as a component of the Extraction Plan in accordance with Condition 6(m) in Schedule 4 of SSD-5144.

The purpose of the Public Safety Management Plan is to provide the management strategies, controls and monitoring programs to be implemented for the management of potential risks from subsidence related impacts that may affect public safety, specifically from the secondary extraction of LW30 to 31.

Additionally, the Public Safety Management Plan has also been prepared to address the requirements of the Work Health and Safety (Mines and Petroleum Sites) Regulation 2014 (Clause 23 and 24) to manage subsidence as principal mining hazard. Regulatory requirements applicable to the development of the Public Safety Management Plan to manage subsidence related risks to public safety, including to private property and public infrastructure are outlined in the Public Safety Management Plan.

The features identified within the EP Area relevant to public safety are managed under a number of supporting plans in addition to the Public Safety Management Plan as noted in **Table 4.8** below. Trigger Action Reponses Plans associated with these aspects are outlined in **Section 5.5** of this EP.

Table 4.8 – Public Safety Features within the LW30-31 EP Area and Relevant Management Plans

Feature	Identification and Assessment	Management and Monitoring
Public Roads	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021).	**Public Roads Management Plan** Built Features Management Plan Subsidence Monitoring Program
Telstra Communication Network	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Telstra Communications Assessment Report for Extraction Plan LW30-33 (Comms Network Solutions, 2020)	**Communication Management Plan** Built Features Management Plan Subsidence Monitoring Program
Ausgrid Powerlines	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Ausgrid assessment	**Powerline Management Plan** Built Features Management Plan Subsidence Monitoring Program
Steep Slopes and Rock Outcrops	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021)	**Land Management Plan** Property Subsidence Management Plans (PSMP) Subsidence Monitoring Program
Private Dwellings	Subsidence Predictions and Impact Assessment for Proposed LW30 and 31 MAN-005/2 (Ditton Geotechnical Services, 2021) Flood Impact Assessment - Full Subsidence Over Longwalls 1 to 33, 2020 (Umwelt, 2020) Pre-mining Dwelling Structural Assessments – Leigh Appleyard Chartered Professional Engineer Centennial Mandalong Extraction Plan LW30-31 Land and Agricultural Resource Assessment (SLR, 2020)	**Property Subsidence Management Plans (PSMP)** Subsidence Monitoring Program

4.9 Subsidence Monitoring Program

An integrated Subsidence Monitoring Program for LW30-31 has been developed as a component of the Extraction Plan in accordance with Condition 6 (n) of Schedule 4 of SSD-5144.

The purpose of the Subsidence Monitoring Program is to set out the program for monitoring the subsidence movements and effects associated with second workings within the EP Area and to provide consolidated summaries of monitoring for natural and built features.

The Subsidence Monitoring Program is described further below and a copy is included in **Volume 3** of the EP.

Table 4.9 provides a summary of the subsidence and environmental monitoring program that will be undertaken to manage the effects of subsidence on identified features. For further details refer to ***Volume 2: Component Management Plans***.

Table 4.9: Summary of Built Features Monitoring Program

Feature	Location	Monitoring Method	Parameter	Monitoring Frequency and Duration
Crown Roads Public Roads Management Plan **Private Access Roads** PSMP **Telstra Communications Network** Communications Management Plan **Ausgrid Powerlines** Powerline Management Plan	**Crown Roads** Toefpers Rd Kiar Ridge Rd **Private Access Roads** Private properties **Powerline easements** 11kV powerline	**Crossline 23** Star posts on Centennial property at 10m spacing **Crossline 24 and Crossline 25** Star posts adjacent to road at 10m spacing	Vertical subsidence, tilt and strain.	Baseline Prior to mining LW30 and LW31. Post Mining 2 months after mining LW30 and LW31. Stable Zone 2 yearly.
		Visual Inspection	Presence of mine-induced damage: • surface tensile cracking in pavement • surface compressive shearing in pavement • surface cracking in fill embankments • erosion of local slope stability for fill embankment if cracking occurs • cracking to culverts and under-road pipes • road drainage Risk to public safety Powerline –tilting pole, damage cross arms, insulators; change in conductor sag/tension; ground clearance. Communications - aerial cable, tilting pole; change in conductor sag/tension; ground clearance; damage to connections.	Active Zone Weekly visual inspection while road and adjacent powerlines and communications are within the active subsidence zone. Post Mining Monthly visual inspection for the following six months or until the commencement of weekly inspections for the next longwall panel.
		Telstra Visual inspection of infrastructure conducted by Comms Network Solutions.	Inspection of aerial cables, poles, pits, cables, joints and conduits.	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
		Ausgrid	Overhead powerline modelling using LIDAR data. 3D laser scanning of power poles	Baseline Prior to mining LW30 and 31 Post mining After the completion of mining LW30-31.

Feature	Location	Monitoring Method	Parameter	Monitoring Frequency and Duration
Steep Slopes Land Management Plan	Private properties Centennial Olney State Forest	Visual Inspection	Presence of mine-induced damage – surface cracking and rock falls, damage to tracks and drainage	Active Zone Weekly visual inspection of steep slopes from public and private access roads. Post Mining Visual inspection following completion of each LW panel.
Private Dwellings PSMP LW30-31	Centennial Ref. MS0025 MS0107 MS0137 MS0139	Monitoring points installed as agreed in consultation with each landowner: • Four points in ground surrounding dwelling • Pins installed at dwelling corners • Points on dams and other structures • As agreed in PSMP	Vertical subsidence, tilt and strain	Baseline Prior to being affected by mining LW30-31 Post Mining 2 months after mining LW30-31
		Visual Inspection	Pre-mining Structural Assessment by civil/structural engineer Pre-mining Inspection SA NSW Centennial Mandalong Inspection	Baseline Prior to being affected by mining LW30-31
			Post-mining SA NSW Inspection (where claim is lodged for subsidence damage) Centennial Mandalong	Post Mining Following completion of subsidence or request by landowner

Table 4.10: Summary of Environmental Monitoring Program

Feature	Management Plan	Monitoring Component / Location	Monitoring Method	Parameter	Frequency and Duration
Steep slopes	Land Management Plan Public Safety Management Plan PSMP	Private and Centennial property	Visual Inspection	Presence of mine-induced damage, surface cracking and rock falls, damage to tracks and drainage	Baseline Prior to mining LW30-31 Active Zone Weekly visual inspection of steep slopes along public and private access roads. Post Mining Visual inspection following completion of each LW panel.
Agricultural Land	Land Management Plan PSMP	Private property Farm dams and drainage paths	Conventional monitoring PSMP Visual inspection	Vertical subsidence, tilt and strain.	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
Potential Remnant Ponding	Land Management Plan PSMP Flood Assessment	Property ref. and Flood Assessment Location: MS0019 Location 'A'(LW25) MS0050 Location 'B' (LW25) MS0012 Location 'C" (LW26) MS0012 Location 'D' (LW27) MS0025 Location 'H' (LW25) MS0065 Location 'G' (LW31)	Visual inspection PSMP Flood Path Inspections NearMap satellite imagery Plan MG12274	Increase in existing ponding New ponding locations	Baseline Prior to mining LW25-31 Post Mining 2 months after mining LW25-31
Dispersible Soils	Land Management Plan PSMP	Private Property	Visual and photographic monitoring	Increase in erosion	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
		Earthworks for subsidence repair	Sodic subsoils where exchangeable sodium is <5	Remnant ponding or drainage repairs.	Post rehabilitation, 6 and 12 months
Groundwater	Water Management Plan	Mandalong Groundwater Bore Monitoring Network	Water Level (bgl), Water quality	Water Level (bgl), Water quality parameters	Quarterly Annual for metals

Feature	Management Plan	Monitoring Component / Location	Monitoring Method	Parameter	Frequency and Duration
Water Courses	Water Management Plan	Morans Creek tributaries	Visual inspection and subsidence monitoring on private property as per PSMP and landowner access agreement	Erosion, flow conveyance, ponding.	Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31
			Flood Path Monitoring - Visual inspection	Erosion, flow conveyance, ponding	Six monthly Flood Path Inspection After flood event
			Flood Monitoring – flood level at Point Locations 1, 2, 3 and 4. Mandalong Rd.	Water level at flood depth indicators, photographs, road closure, anecdotal evidence.	Following rainfall event exceeding 100mm in 24 hours – equivalent 1 year ARI Storm Event
Aboriginal Heritage	Heritage Management Plan and Centennial Coal Northern Region ACHMP	25 heritage sites located over LW30-31 EP Area	Survey control points, digital photography and condition report.	Vertical subsidence, tilt photography, condition report	Three phase monitoring Baseline Prior to mining LW30-31 Post Mining 2 months after mining LW30-31 8 months after completion of subsidence.
Flora & Fauna	Biodiversity Management Plan	Terrestrial Biodiversity *Rhodamnia rubescens, Corybas dowlingii* and any other threatened flora species identified during ongoing surveys with potential to occur in riparian areas.	Representative sample of known locations of *R. rubescens*, monitored against reference populations	Condition assessments	Baseline Prior to mining During and Post Mining Annually and for two years post mining.
		Terrestrial Biodiversity Vegetation communities and threatened species habitat assessments (EECs and GDEs) to assess potential impacts from predicted ponding	PCT 1523 PCT 1568 PCT 1573 PCT 1723 PCT 1588	Biometric plots to assess vegetation condition.	

Feature	Management Plan	Monitoring Component / Location	Monitoring Method	Parameter	Frequency and Duration
		Terrestrial Biodiversity Cave-associated threatened bats	Representative sampling of bat activity adjacent to suitable cave habitat, ideally monitored against reference populations.	Bat activity levels (i.e. bat echolocation call frequency) Cave entrance watch at dusk; Harp trapping (if maternity roost of threatened cave-associated bat suspected)	Annually (during spring)
		Terrestrial Biodiversity Brush-tailed Rock Wallaby	Representative sampling of Brush tailed Rock Wallaby adjacent to suitable habitat, ideally monitored against reference populations	Brush-tailed Rock Wallaby activity using infrared camera traps (if found to be present during baseline monitoring)	Following 100mm or more rain in 24 hour period (Oct.-Mar.)
		Aquatic Biodiversity Water Quality and Macroinvertebrate Surveys	Larger Creeks with permanent flows within the EP Area (or immediately downstream if permanent water is not sufficiently available in this area).	Invertebrate species diversity and water quality – pH, EC (In accordance with NSW AUSRIVAS)	
		Aquatic Biodiversity Amphibian Surveys	Creeks and dams within the EP Area	Diurnal and nocturnal amphibian searches during spring and summer over 4 nights	
Surface Water	Water Management Plan	Morans Creek SW003, SW004, SW006 and SW011	Grab sample	**Physicochemical parameters:** electrical conductivity (EC), pH, total suspended solids (TSS), turbidity. **Nutrients:** ammonia, total nitrogen, total phosphorus. **Metals (dissolved and total):** aluminium, arsenic, boron, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc. **Others:** oil and grease.	Quarterly

Feature	Management Plan	Monitoring Component / Location	Monitoring Method	Parameter	Frequency and Duration
		SWMP06, SWMP07 and SWMP08	Grab sample	**Physicochemical parameters:** EC, hardness, pH, total dissolved solids, TSS, turbidity. **Nutrients:** ammonia, biochemical oxygen demand, total Kjeldahl nitrogen (TKN), total nitrogen, total phosphorus. **Major ions:** alkalinity, calcium, chloride, magnesium, potassium, sodium, sulfate. **Metals (dissolved and total):** aluminium, arsenic, barium, boron, cadmium, chromium, cobalt, copper, iron, lead, manganese, mercury, nickel, selenium, silver, zinc. **Others:** cyanide, fluoride, oil and grease.	Quarterly

All forms of subsidence monitoring will be undertaken by appropriately qualified and experienced personnel. The results from the subsidence monitoring program will be evaluated by appropriately qualified and experienced personnel against the performance measures and subsidence predictions.

5 IMPLEMENTATION

5.1 Reporting Framework

Reporting is undertaken in accordance with the specific requirements of relevant approvals and licences including SSD-5144 and EPL365, and generally in accordance with the Guidelines for the Preparation of Extraction Plans (NSW Department of Planning & Environment, 2015), as summarised in **Table 5.1.**

Table 5.1: Reporting Requirements

Report	Trigger	Requirements	Stakeholders
Incident Reporting	Any occasion or incident in accordance with consent condition or TARP.	In accordance with requirements of consent condition or TARP.	RR DPIE

Report	Trigger	Requirements	Stakeholders
Bi-Monthly Subsidence Impact Reporting	If a new impact is identified, compile after monthly subsidence.	Distinguish impact: • within predictions; • those which exceed predictions but remain within performance measures and/or performance indicators; and • those which exceed performance measures and/or performance indicators. Report to include: • full description; • location identification using aerial photos with longwall layout superimposed; • photos of the impact; and • preliminary characterisation of the impact in accordance with the relevant TARP(s).	Local Councils Ausgrid Ditton Geotechnical Services SA NSW CCC Telstra
Annual Review	Annual Report required under development consent SSD-5144.	Report to include: • six-monthly reports of impacts and environmental monitoring results; • monitoring results; and • summary of subsidence impacts.	RR DPIE CCC Local Councils Ausgrid
Community Consultative Committee (CCC)	CCC meetings are typically held three times per year.	Subsidence and environmental performance is included as an agenda item at each meeting.	CCC
Mining Notifications	One month prior to mining beneath infrastructure or property.	Scheduled date that mining beneath the infrastructure or property and the duration within the active subsidence zone.	Local Councils, Forestry Corp., Telstra, Ausgrid, Crown Lands, Private landowners.

5.2 Review of Extraction Plan

Typically Extraction Plans are reviewed every three years or in the event that the following occur. Given the timing of LW30-31 completion expected in less than three years, the latter is more likely to occur as follows:

- Stakeholders raise issues that necessitate a review;
- Relevant statutory changes affecting management requirements (e.g. modification to related approvals or licences);
- Significant change in mine design or layout;
- For each new Extraction Plan mining area;
- Where triggered by a TARP, including where unpredicted impacts or consequences have required implementation of contingency actions under this plan;
- Monitoring, incident, or audit processes demonstrate that a review is warranted;
- Review is triggered as per Development Consent requirements noted immediately below; or
- Where triggered by circumstances in either Clause 10, Clause 38 and Clause 128 of WHS (Mines and Petroleum Sites) Regulation.

Regular review of the Extraction Plan and/or any of the sub-plans is required by Development Consent SSD-5144 (Schedule 6, Condition 7). In particular, Centennial Mandalong is required to review, and if necessary revise, the strategies, plans, and programs of this Extraction Plan within 3 months of the submission of an:

- **Annual Review** under Schedule 6, Condition 12;
- **Incident Report** under Schedule 6, Condition 10;
- **Audit Report** under Schedule 6, Condition 13; and
- **Any modification** to the conditions of Development Consent unless conditions require otherwise.

Any revision to the Extraction Plan including component sub-plans must be submitted to the Secretary, DPE for approval within four (4) weeks of the review.

Amendments to the Extraction Plan will be undertaken in consultation with relevant stakeholders. Following changes (or as otherwise required above) a copy of the amended Extraction Plan will be forwarded to the Secretary of the DPIE for approval.

5.3 Review of Other Management Plans

In January 2016, approval was received from the Department of Planning & Environment (DPE) and also from the Division of Resources & Energy for Centennial Mandalong's proposal to develop a combined Rehabilitation Management Plan / Mining Operations Plan.

The document was prepared in accordance with the Department of Industry – Division of Resources and Energy (DRE) publication titled ESG3: Mining Operations Plan (MOP) Guidelines (2013) and was also prepared to satisfy the requirements of a Rehabilitation Management Plan (RMP) (required by Schedule 3, Condition 33 of Development Consent SSD-5144 and Schedule 3 Condition 29 of Development Consent SSD-5145). The RMP / MOP document was prepared by Centennial Mandalong and approved by DRE on 30 November 2016 and by DPE on 2 February 2017.

A revised version of the RMP / MOP (Amendment A) was submitted to DRE for approval on 5 April 2017 and to DPE on 8 June 2017. Approval was received from DRE on 12 April 2017 and from DPE on 23 June 2017.

A further revision of the RMP / MOP (Amendment B) was approved by DRG on 8 March 2018 and by DPE on 10 April 2018.

A further revision of the RMP / MOP (Amendment C) was approved by RR on 5 February 2021 and by DPIE on 23 December 2020.

A further revision of the RMP / MOP (Amendment D) was submitted to RR on 24 May 2021 and to DPIE on 31 May 2021.

SSD-5144, Schedule 4 Condition 6 (q) requires that the Extraction Plan includes details on the proposed revisions of the Rehabilitation Management Plan. An update to the MOP/RMP is required following the approval of Mod 9 (Amendment D). The LW30-31 EP Area is consistent with the information and plans provided in the RMP / MOP (Amendment D).

5.4 Key Responsibilities

The responsibility for implementation, monitoring and review of the Extraction Plan lies with the nominated document owner. The ultimate responsibility for the implementation of the Plan lies with the Mine Manager, who shall make appropriate resources available. The roles and responsibilities for the Mandalong LW30-31 Extraction Plan are outlined below:

Delegation of roles or responsibilities may be determined by the Mine Manager at any time.

Table 5.2: Key Roles and Responsibilities

Position	Responsibility
Mine Manager	▪ Authorisation of the Extraction Plan; ▪ Compliance with the conditions of EPL 365 and Development Consent SSD-5144; ▪ Ensuring that sufficient resources are available to implement and execute the requirements of this Plan; and ▪ Reporting triggers/non-conformances to external stakeholders.
Mining Approvals Coordinator	▪ Coordinate the subsidence monitoring program associated with this Extraction Plan and relevant component plans;

Position	Responsibility
	▪ Assist implementation of the mine design and TARPs; ▪ Coordinate the management of subsidence impacts in accordance with the Extraction Plan, Management Plans, EMS and Procedures; ▪ Maintain the Centennial Mandalong Compliance Database; ▪ Consult with the landowners, infrastructure owners and relevant government departments including Ausgrid, Telstra, Local Councils, SA NSW, DPIE, and RR. ▪ Reporting triggers/non-conformances internally to the mine manager as appropriate; ▪ Coordinating any mitigation and/or remedial work as required; ▪ Reporting to DPIE and NSW RR of subsidence performance upon completion of specified monitoring intervals; and ▪ Coordinate review and audit of the Extraction Plan.
Subsidence Surveyor	▪ Establishment of subsidence monitoring in accordance with the Subsidence Monitoring Program. ▪ Review and assess subsidence monitoring results ▪ Notify the Mining Approvals Coordinator of any identified public safety issues ▪ Provide the monitoring results to the Mining Approvals Coordinator, Ditton Geotechnical Services, RR, Ausgrid, Telstra, Local Councils and SA NSW
Survey Department	▪ When required, conduct inspections within the applicable subsidence zone to the standard required, using the subsidence inspection checklist ▪ Promptly notify the Mining Approvals Coordinator of any issue identified during a subsidence inspection.
Environment and Community Coordinator	Implementation, monitoring and review of this plan, including: ▪ The carrying out of targeted inspections; ▪ Reporting triggers/non-conformances internally to the Mine Manager / Mining Approval Coordinator as appropriate; ▪ Consulting with landowners, landholders and managers regarding any land management issues arising from subsidence within the EP Area; ▪ Consultation during the review process with relevant stakeholders and distributing this Extraction Plan and relevant component plans; ▪ Coordinating environmental aspects of any remediation work as required; ▪ Assist in the generation and submission of formal reporting requirements outlined in this Plan; and ▪ Registration of community complaints and regulatory liaison in the Environment & Community Database (ECD).

5.5 Trigger Action Response Plans

Centennial Mandalong has developed Trigger Action Response Plans (TARPs) for the relevant Management Plans prepared to support the LW30-31 EP.

These TARPs are developed in consultation with stakeholders as required and use escalating triggers and responses to meet the relevant performance measures applicable under SSD-5144 for each aspect/feature. The TARPs build upon the well-established TARPs and management plans previously developed for prior SMP/EP areas. Triggers described in the TARPs are typically monitored by the Subsidence Monitoring Program (document MEMS-EP-9000-SMP-9080).

TARPs have been developed to implement relevant management plans in support of the LW30-31 EP as summarised in **Table 5.3** below.

Table 5.3: TARP's and Associated Management Plans – LW30-31 EP

Management Plan	Relevant TARP*
Land	Creeks and Watercourses TARP
	Farm dams TARP
	Farm fences TARP
	Land Use Impacts TARP
	Steep Slopes TARP
Water	Groundwater environment TARP
	Groundwater level TARP
	Watercourse and Flooding TARP
	Geomorphic condition and watercourse stability TARP
	Aquatic ecology TARP
Biodiversity	Biodiversity – EEC, GDE, Threatened Species Habitat TARP
Heritage	Aboriginal Heritage TARP
	Historic Heritage TARP
Public Safety	Steep Slopes TARP*
	Public Roads TARP
	Powerlines TARP
	Telstra Communications Network TARP
	Dwelling Tilt TARP
	Dwelling Strain TARP
Built Features	Public Roads TARP*
	Powerlines TARP*
	Telstra Communications Network TARP*
	Dwelling Tilt TARP*
	Dwelling Strain TARP*
Property Subsidence Management Plans	Dwelling Tilt TARP*
	Dwelling Strain TARP*
	Creeks and Watercourses TARP*
	Farm dams TARP*
	Farm fences TARP*
	Land Use Impacts TARP*
	Steep Slopes TARP*
	Property Access Roads TARP
	Property Dwelling Flood Hazard TARP
	Surface Improvements TARP

** Individual TARPs are used in multiple management plans where relevant as noted above.*

5.6 Adaptive Management

In addition to the conservative sub-critical longwall panel design specifically designed to provide reduced levels of subsidence and impact, Centennial Mandalong developed an adaptive management approach designed to avoid repetition of any unpredicted subsidence and or environmental consequences. This system involves the monitoring and evaluation of impacts to built and natural features against the performance indicators established under this Extraction Plan and contingency plans (TARPs) in the event that a performance indicator is exceeded.

6 REFERENCES

Comms Network Solutions. (2020). *Telstra Communications Assessment Report for Extraction Plan LW30-33.*

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GSS Environmental. (2013). *Mandalong Southern Extension Project Environmental Impact Statement .*

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SLR. (2018). *Centennial Mandalong Extraction Plan LW25-31 Land and Agricultural Resource Assessment.*

SLR. (2020). *Centennial Mandalong Land and Agricultural Resource Assessment LW30-LW33.*

Umwelt. (2020). *Flood Impact Assessment, Mandalong Southern Extension Project Modification 9.*

Umwelt. (2021). *Heritage Management Plan for LWs 30-31.*

Appendix 1 Subsidence Compliance and Obligations Register

The Mandalong Southern Extension Project development application SSD-5144 was originally approved by the Planning Assessment Commission (PAC) on 12 October 2015 pursuant to Section 89E of the Environmental Planning and Assessment Act 1979 subject to conditions in Schedules 2 to 6, and subsequently modified (MOD5 approved 1 August 2017).

Schedule 4 Environmental Conditions – Underground Mining, provides a number of conditions relating specifically to subsidence management including the preparation of this Extraction Plan under Condition 6 of Schedule 4, and are outlined below. Additional conditions relating to the extraction plan are included in ***Schedule 5 – Additional Procedures***.

Development Consent Schedule 4 Condition Requirements

Condition	Condition Requirement		Section Addressed
1	The Applicant must ensure that the development complies with the performance measures in Table 6, to the satisfaction of the Secretary.		This EP Section 3.5
Table 6 Subsidence Impact Performance Measures	***Watercourses***		Key Component Plans
	3rd Order and above streams Groundwater-dependent Ecosystems	• No connective cracking between the surface, or the base of the alluvium, and the underground workings. • No subsidence impact or environmental consequence greater than minor.	
	1st and 2nd Order streams	• No subsidence impact or environmental consequences greater than predicted in the documents listed in condition 2(b) of Schedule 2. • No connective cracking between the surface and the underground workings.	
	Aquatic and riparian ecosystems, including affected sections of Morans Creek, Wyee Creek, Tobins Creek and Mannering Creek	• Maintain or improve baseline channel stability. • Develop site-specific in-stream water quality objectives in accordance with ANZECC 2000 and Using the ANZECC Guidelines and Water Quality Objectives in NSW procedures (DECC 2006), or their latest versions.	
	Land		
	Steep slopes and rock outcrops	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.	
	Agriculture	• No loss of agricultural productivity greater than minor.	
	Biodiversity		
	Threatened species, threatened populations and endangered ecological communities	• Negligible environmental consequences.	
	Heritage sites		
	Stone Arrangement RPS TBM 32	• Negligible subsidence impacts or environmental consequences	
	All other Aboriginal Cultural Heritage sites/items at the site	• No subsidence impact or environmental consequence greater than predicted in the documents listed in condition 2(b) of Schedule 2.	

<table>
<tr><th>Condition</th><th>Condition Requirement</th><th>Section Addressed</th></tr>
<tr><td></td><td>
<table>
<tr><td>Mine workings</td><td></td></tr>
<tr><td>First workings under an approved Extraction Plan beneath any feature where performance measures in this table require negligible subsidence impacts or negligible environmental consequences</td><td>• To remain long-term stable and non-subsiding.</td></tr>
<tr><td>Second workings</td><td>• To be carried out only within the approved mine plan, in accordance only with an approved Extraction Plan.</td></tr>
</table>
</td><td></td></tr>
<tr><td>2</td><td>The Applicant must assess and manage development-related risks to ensure that there are no exceedances of the performance measures in Table 6. Any exceedance of these performance measures constitutes a breach of this consent and may be subject to penalty or offence provisions under the EP&A Act or EP&A Regulation, notwithstanding actions taken pursuant to condition 3 below. Where any exceedance of these performance measures has occurred, the Applicant must, at the earliest opportunity:
(a) take all reasonable and feasible steps to ensure that the exceedance ceases and does not recur;
(b) consider all reasonable and feasible options for remediation and submit a report to the Department describing those options and any preferred remediation measures or other course of action; and
(c) implement remediation measures as directed by the Secretary, to the satisfaction of the Secretary</td><td>This EP</td></tr>
<tr><td>3
Offsets</td><td>If the Applicant exceeds the performance measures in Table 6 and the Secretary determines that:
(a) it is not reasonable or feasible to remediate the impact or environmental consequences; or
(b) remediation measures implemented by the Applicant have failed to satisfactorily remediate the impact or environmental consequence, then the Applicant shall provide a suitable offset to compensate for the impact or environmental consequence,
Then the Applicant must provide suitable offset to compensate for the impact or environmental consequence to the satisfaction of the Secretary.
Note: An offset required under this condition must be proportionate with the significance of the impact or environmental consequence.</td><td>Section 4

Section 5.5 (TARPs)</td></tr>
<tr><td>4</td><td>The Applicant must ensure that the development does not cause any exceedances of the performance measures in Table 7, to the satisfaction of the Secretary.</td><td>Section 4

Key Component</td></tr>
<tr><td>Table 7 - Subsidence Impact Performance Measures</td><td>
<table>
<tr><td>Key Public Infrastructure</td><td></td></tr>
<tr><td>M1 Motorway
Main Northern Railway
330 kV power supply infrastructure</td><td>Always safe and serviceable.

Damage that does not affect safety or serviceability must be fully repairable, and must be fully repaired.</td></tr>
</table>
</td><td></td></tr>
</table>

Condition	Condition Requirement		Section Addressed
	Other Built Infrastructure		
	Power lines and power poles	Always safe.	
	Telecommunications infrastructure		
	Privately-owned residences	Serviceability should be maintained wherever practicable.	
	Local Roads		
	Other built features and improvements, (including access roads, farm dams, swimming pools, tracks and fences)	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	Negligible additional risk.	
5	Any dispute between the Applicant and the owner of any built feature over the interpretation, application or implementation of the performance measures in Table 7 is to be settled by the Secretary, following consultation with DRE. Any decision by the Secretary shall be final and not subject to further dispute resolution under this consent.		Noted
6 Extraction Plan	The Applicant must prepare and implement an Extraction Plan for all second workings on site, to the satisfaction of the Secretary. Each Extraction Plan must:		
	(a) be prepared by suitably qualified and experienced persons whose appointment has been approved by the Secretary;		Section 2.3
	(b) be approved by the Secretary before the Applicant carries out any of the second workings covered by the plan;		Noted
	(c) include detailed plans of existing and proposed first and second workings and any associated surface development;		
	(d) include detailed performance indicators for each of the performance measures in Tables 6 and 7		Section 3.5 Key Component Plans
	(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 the commencement date of this consent;		Sections 3.3 and 3.4 (Ditton Geotechnical Services, 2021)
	(f) describe the measures that would be implemented to ensure compliance with the performance measures in Tables 6 and 7, and manage or remediate any impacts and/or environmental consequences;		Sections 4 and 5 Component Plans & TARPs Volume 3
	(g) include a Built Features Management Plan, which has been prepared in consultation with DRE and the owners of affected built features, to manage the potential subsidence impacts and/or environmental consequences of the proposed second workings, and which: • addresses in appropriate detail all items of key public infrastructure (with particular consideration to tension/angle/suspension towers on transmission lines), and other public infrastructure; • has been prepared following appropriate consultation		Section 4.7 BFMP

Condition	Condition Requirement	Section Addressed
	with the owner/s of potentially affected feature/s; • recommends appropriate remedial measures and includes commitments to mitigate, repair, replace or compensate all predicted impacts on potentially affected built features in a timely manner; and • in the case of all key public infrastructure, and other public infrastructure except roads, trails and associated structures, reports external auditing for compliance with ISO 31000 (or alternative standard agreed with the infrastructure owner), and provides for annual auditing of compliance and effectiveness during extraction which may impact the infrastructure;	
	(h) include a Property Subsidence Management Plan for each privately-owned property affected by the proposed second workings, prepared in consultation with the landowner, which includes: • a detailed structural inspection of residences and all other structures on the property; • a detailed subsidence impact assessment for the property, including (where relevant): o a flood impact assessment, including a prediction of the minimum freeboard of the residence in a 1 in 100 year ARI flood event, and, where this prediction shows the minimum freeboard at the residence to be less than 0.5 m in a 1 in 100 year ARI flood event: ▯ recommends such works to raise, remediate or relocate the residence and/or provide suitable access to the property, prior to undermining the residence; or ▯ where these works are unable to be undertaken, offers to acquire the whole of the property, or such part of the property requested by the landowner where subdivision is approved, in accordance with conditions 3 and 4 of Schedule 5; o slope stability assessments at the properties shown in Figure 2 of Appendix 5, or at any other property as nominated by the Secretary, which must: ▯ be undertaken at least 12 months prior to undermining the property; ▯ be undertaken in consultation with DRE, by a suitably qualified geotechnical expert; ▯ recommend measures to manage and/or mitigate the risks and impacts associated with slope instability and rock roll-out at the residence, and the risk to the safety of ▯ persons; and ▯ include a timeframe for the implementation of the recommended measures; o soil erosion assessment, which recommends measures to avoid, mitigate and otherwise respond to increased soil erosion (including tunnel erosion) impacts; and	Section 4.7.4 PSMPs

Condition	Condition Requirement	Section Addressed
	• appropriate measures, commitments and timeframes to mitigate, repair, replace or otherwise compensate the impacts to the property;	
	(i) include a Water Management Plan, which has been prepared in consultation with EPA and DPI Water, which provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on watercourses and aquifers, including: • detailed baseline data on groundwater levels, yield and quality in the region, and in privately- owned groundwater bores that could be affected by the second workings; • surface water 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 on stream morphology and stream flows, and assessment of any changes resulting from subsidence impacts, including scouring and ponding; • a program to monitor flooding (including updated flood modelling); with recommendations to minimise, manage and mitigate (whether prospectively or retrospectively) flood impacts on residences, private properties, roads, other infrastructure and other built features; • a groundwater monitoring program which: o includes a comprehensive monitoring bore network, ensuring all bore casings are above ground level and are purged before sampling; o samples on a monthly basis for the first two years of the development, and quarterly thereafter, unless directed by the Secretary; o monitors and reports on: □ groundwater inflows to the mine; □ background changes in groundwater yield/quality against mine-induced changes; and □ impacts to: - regional and local (including alluvial) aquifers; - groundwater supply to private bores; and - groundwater dependent ecosystems and riparian vegetation; • a program to validate the groundwater model for the development, and compare monitoring results with modelled predictions; and • a plan to respond to any exceedances of the groundwater assessment criteria;	Section 4.3 WMP
	(j) include a Biodiversity Management Plan, which has been prepared in consultation with OEH, which establishes baseline data for existing habitat, including water table depth, vegetation condition, stream morphology and threatened species habitat, and provides for the management of the potential impacts and/or environmental consequences of the proposed second workings on aquatic and terrestrial flora and	Section 4.5 BMP

Condition	Condition Requirement	Section Addressed
	fauna, with a specific focus on threatened species, populations and their habitats; endangered ecological communities; and water dependent ecosystems;	
	(k) include a 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;	Section 4.4 Land MP
	(l) include a Heritage Management Plan, which has been prepared in consultation with OEH and Registered Aboriginal Parties, to manage the potential environmental consequences of the proposed second workings on both Aboriginal and non-Aboriginal heritage items, and reflects the requirements of condition 22 of Schedule 3;	Section 4.6 Heritage MP
	(m) include a Public Safety Management Plan, which has been prepared in consultation with DRE, to ensure that the proposed second workings do not impact on public safety;	Section 4.8 Public Safety MP
	(n) include a Subsidence Monitoring Program, which has been prepared in consultation with DRE; to: • provide data to assist with the management of the risks associated with conventional and non-conventional subsidence; • validate the subsidence predictions; • analyse the relationship between the predicted and resulting subsidence effects and predicted and resulting impacts under the plan and any ensuing environmental consequences; and • inform the Contingency Plan and adaptive management process;	Section 4.9 SM Program
	(o) Trigger Action Response Plans addressing all features in Tables 6 and 7, which contain: • appropriate triggers to warn of the development of an increasing risk of exceedance of any performance measure; • specific actions to respond to high risk exceedance of any performance measure to ensure that the measure is not exceeded; and • an assessment of remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Section 5.5 Key Component Plans
	(p) include a Contingency Plan that expressly provides for; • adaptive management where monitoring indicates that there has been an exceedance of any performance measure in Tables 6 and 7, or where any such exceedance appears likely; and • an assessment of the remediation measures that may be required if exceedances occur and the capacity to implement the measures;	Section 5.6 Key Component Plans
	(q) proposes appropriate revisions to the Rehabilitation Management Plan required under condition 33 of Schedule 3; and	Section 5.3
	(r) include a program to collect sufficient baseline data for future Extraction Plans.	Key Component Plans

Condition	Condition Requirement	Section Addressed
	The Applicant must implement the approved Extraction Plan as approved from time to time by the Secretary.	Acknowledged
	Notes: • This condition does not apply to mining operations covered by an approved Subsidence Management Plan in place at the date of commencement of this consent. • In accordance with condition 5 of Schedule 6, the preparation and implementation of Extraction Plans may be staged, with each plan covering a defined area of underground workings. In addition, these plans are only required to contain management plans that are relevant to the specific underground workings that are being carried out.	Acknowledged This Plan for LW30-31 EP Area.
6A	The Applicant must commission an independent expert whose appointment has been endorsed by the Secretary, to carry out a review of the groundwater model for the development. This review must include a: (a) review of all available monitoring data; (b) comparison of predicted and actual groundwater impacts; and (c) review of the effectiveness of the groundwater model. The review must be undertaken and reported to the satisfaction of the Secretary. The report must be submitted to the Secretary and DPI Water prior to the approval of any Extraction Plan relating to Longwalls 24 and/or 24A	Section 4.3 Water MP
7	The Applicant must ensure that the management plans required under conditions 6(g)-(q) above include: (a) an assessment of the potential environmental consequences of the Extraction Plan, incorporating any relevant information that has been obtained since the date of commencement of this consent; and (b) a detailed description of the measures that would be implemented to remediate predicted impacts.	Sections 4 and 5 Key Component Plans
8 Archaeological Surveys	The Applicant must: (a) use its best endeavours to undertake archaeological surveys of privately-owned land which was not surveyed in the documents listed in condition 2(b) of Schedule 2, prior to subsidence impacts occurring on that land; (b) analyse the significance of any heritage sites/items identified during the surveys; and (c) include appropriate measures to avoid, minimise and/or mitigate impacts to the identified sites/items in the Heritage Management Plan required under condition 6(l) above, to the satisfaction of the Secretary	Section 4 Heritage MP
9 Grinding Groove Trial Mitigation	Prior to the extraction of Longwall 25, the Applicant shall undertake trial mitigation works at grinding groove sites RPS DF04 and RPS PS11, in consultation with Forestry Corporation of NSW, OEH and Registered Aboriginal Parties, and to the satisfaction of the Secretary.	Grinding Grooves DF04 and PS11 - Trial Mitigation Report (RPS, 2018)
10 Grinding Groove Trial Mitigation	The Applicant must: (a) monitor the effectiveness of the trial mitigation works during and following the extraction of Longwall 25; (b) provide a report on the monitoring to the Secretary, OEH and Registered Aboriginal Parties; and	Grinding Grooves DF04 and PS11 - Trial Mitigation Report (RPS, 2018)

Condition	Condition Requirement	Section Addressed
	(c) use the report to inform the impact avoidance, management and mitigation strategies in future Extraction Plans covering other grinding groove sites, to the satisfaction of the Secretary.	
11 Rock Shelter Monitoring	The Applicant must implement a monitoring program of subsidence effects at rock shelter sites 45-3-1228 and 45-3-1233 in the Extraction Plan for Longwall 34 or, if access to these sites is not granted by the landowner, other rock shelter sites as agreed to in writing with the Secretary. This monitoring shall be: (a) undertaken by a suitably qualified archaeologist, whose appointment has been approved by the Secretary, (b) undertaken in consultation with OEH and Registered Aboriginal Parties; and (c) used to inform impact management of rock shelter sites under future Extraction Plans required under this consent, to the satisfaction of the Secretary.	Section 4.6 HMP
12 First Workings	The Applicant may carry out first workings on site, other than in accordance with an approved Extraction Plan, provided that DRE is satisfied that the first workings are designed to remain stable and non-subsiding, except insofar as they may be impacted by approved second workings.	Letter sent to RR on 26/10/20 seeking first workings approval.
13 Payment of Reasonable Costs	The Applicant must pay all reasonable costs: (a) incurred by the Department to engage suitably qualified, experienced and independent experts to review the adequacy of any aspect of an Extraction Plan; and (b) to the owner of privately-owned land subject to a Property Subsidence Management Plan under condition 6(h) above, to obtain legal and/or other advice on the Property Subsidence Management Plan.	Acknowledged Centennial has offered and provided all affected landowners with combined consideration payment for legal advice and PSMP participation.

Schedule 5 Additional Procedures Relating to the Extraction Plan

Condition	Condition Requirement	Section Addressed
1 Notification of Landowners	As soon as practicable after obtaining monitoring results showing: (a) an exceedance of any relevant criteria in Schedule 3, the Applicant must notify affected landowners in writing of the exceedance, and provide regular monitoring results to each affected landowner until the development is again complying with the relevant criteria; and (b) an exceedance of any relevant air quality criteria in Schedule 3, the Applicant must send a copy of the NSW Health fact sheet entitled "Mine Dust and You" (as may be updated from time to time) to the affected landowners and/or existing tenants of the land (including the tenants of any mine-owned land).	PSMPs Section 4 Volume 3

Condition	Condition Requirement	Section Addressed
2 Independent Review	If an owner of privately-owned land considers the development to be exceeding the relevant criteria in Schedule 3, then he/she may ask the Secretary in writing for an independent review of the impacts of the development on his/her land. If the Secretary is satisfied that an independent review is warranted, then within 2 months of the Secretary's decision the Applicant must: (a) commission a suitably qualified, experienced and independent person, whose appointment has been approved by the Secretary, to: • consult with the landowner to determine his/her concerns; • conduct monitoring to determine whether the development is complying with the relevant criteria in Schedule 3; and • if the development is not complying with these criteria, identify and implement measures to ensure compliance with the relevant criteria; and (b) give the Secretary and landowner a copy of the independent review.	Acknowledged PSMPs
3 Land Acquisition	Within 3 months of receiving a written request from a landowner with acquisition rights, the Applicant must make a binding written offer to the landowner based on: (a) the current market value of the landowner's interest in the land at the date of this written request, as if the land was unaffected by the project, having regard to the: • existing and permissible use of the land, in accordance with the applicable planning instruments at the date of the written request; and • presence of improvements on the land and/or any approved building or structure which has been physically commenced at the date of the landowner's written request, and is due to be completed • subsequent to that date; • (b) the reasonable costs associated with: • relocating within the Lake Macquarie City Council or Central Coast Council local government areas, or to any other local government area determined by the Secretary; and • obtaining legal advice and expert advice for determining the acquisition price of the land, and the terms upon which it is to be acquired; and (c) reasonable compensation for any disturbance caused by the land acquisition process. However, if at the end of this period, the Applicant and landowner cannot agree on the acquisition price of the land and/or the terms upon which the land is to be acquired, then either party may refer the matter to the Secretary for resolution. Upon receiving such a request, the Secretary will request the President of the NSW Division of the Australian Property Institute to appoint a qualified independent valuer to: • consider submissions from both parties; • determine a fair and reasonable acquisition price for the land and/or the terms upon which the land is to be acquired, having regard to the matters referred to in paragraphs (a)-(c) above;	Acknowledged PSMPs

Condition	Condition Requirement	Section Addressed
	• prepare a detailed report setting out the reasons for any determination; and • provide a copy of the report to both parties. Within 14 days of receiving the independent valuer's report, the Applicant must make a binding written offer to the landowner to purchase the land at a price not less than the independent valuer's determination. However, if either party disputes the independent valuer's determination, then within 14 days of receiving the independent valuer's report, they may refer the matter to the Secretary for review. Any request for a review must be accompanied by a detailed report setting out the reasons why the party disputes the independent valuer's determination. Following consultation with the independent valuer and both parties, the Secretary will determine a fair and reasonable acquisition price for the land, having regard to the matters referred to in paragraphs (a)-(c) above, the independent valuer's report, the detailed report of the party that disputes the independent valuer's determination and any other relevant submissions. Within 14 days of this determination, the Applicant must make a binding written offer to the landowner to purchase the land at a price not less than the Secretary's determination. If the landowner refuses to accept the Applicant's binding written offer under this condition within 6 months of the offer being made, then the Applicant's obligations to acquire the land shall cease, unless the Secretary determines otherwise.	
4.	The Applicant must pay all reasonable costs associated with the land acquisition process described in condition 3 above, including the costs associated with obtaining Council approval for any plan of subdivision (where permissible), and registration of this plan at the Office of the Registrar-General	Acknowledged PSMPs

Statement of Commitments of SSD-5144 (as modified)

Issue	Commitment	Section Addressed
Subsidence Monitoring and Management	Six months prior to the development of longwall 25, Centennial Mandalong will prepare the first Extraction Plan to manage subsidence associated with the proposed mining in the Southern Extension Area.	This EP.
	As part of the development of each Extraction Plan, Centennial Mandalong will update the Public Safety Management Plan, Public Roads Management Plan, Telstra Management Plan and Powerline Management Plan in consultation with relevant infrastructure owners	Key Component Plans Section 4.
Environmental Management	Centennial Mandalong will continue to report environmental monitoring results on Centennial's website in accordance with the POEO Act requirements	Section 5.1 Key Component Plans
	Each year, Centennial Mandalong will prepare an Annual Review, which will report environmental monitoring results and evaluate performance for the previous 12 month period, to be distributed to the relevant government agencies and the Mandalong Mine Community Consultative Committee.	Section 5.1
	***Note by Centennial**: Detailed Statements of Commitment specifically relating to supporting Environmental Management Plans (EMP) required for the Extraction Plan (eg Water, Biodiversity, Heritage) and where those are addressed are detailed within each EMP.*	Detailed within each EMP for the EP. Refer Section 4.

Mining Lease Conditions

The EP Area for LW30-31 is associated with three approved mining leases held by Centennial Mandalong; **ML1722** and **ML1744**. The relevant conditions relating to the Extraction Plan are summarised below.

Mining Leases 1722 and 1744

Condition	Condition Requirement	Section Addressed
ML1722 and ML1744 Condition 5	**Environmental Incident Report** (a) The lease holder must notify the Department of all: (i) breaches of the conditions of this mining lease or breaches of the Act causing or threatening material harm to the environment; and (ii) breaches of environmental protection legislation causing or threatening material harm to the environment (as defined in the Protection of the Environment Operations Act 1997), arising in connection with significant surface disturbing activities, including mining operations, mining purposes and prospecting operations, under this mining lease. The	Acknowledged

Condition	Condition Requirement	Section Addressed
	notification must be given immediately after the lease holder becomes aware of the breach. Note. Refer to www.resources.nsw.gov.au/environment for notification contact details. (b) The lease holder must submit an Environmental Incident Report to the Department within seven (7) days of all breaches referred to in condition 5(a)(i) and (ii). The Environmental Incident Report must include: (i) the details of the mining lease; (ii) contact details for the lease holder; (iii) a map identifying the location of the incident and where material harm to the environment has or is likely to occur; (iv) a description of the nature of the incident or breach, likely causes and consequences; (v) a timetable showing actions taken or planned to address the incident and to prevent future incidents or breaches referred to in 5(a). (vi) a summary of all previous incidents or breaches which have occurred in the previous 12 months relating to significant surface disturbing activities, including mining operations, mining purposes and prospecting operations under this mining lease. Note. The lease holder should have regard to any relevant Director General's guidelines in the preparation of an Environmental Incident Report. Refer to www.resources.nsw.gov.au/environment for further details. (c) In addition to the requirements set out in conditions 5(a) and (b), the lease holder must immediately advise the Department of any notification made under section 148 of the Protection of the Environment Operations Act 1997 arising in connection with significant surface disturbing activities including mining operations, mining purposes and prospecting operations, under this mining lease.	
ML1722 and ML1744 Condition 6	**Extraction Plan** (a) In this condition: (i) approved Extraction Plan means a plan, being: A. an extraction plan or subsidence management plan approved in accordance with the conditions of a relevant development consent and provided to the Secretary; or B. a subsidence management plan relating to the mining operations subject to this lease: I. submitted to the Secretary on or before 31 December 2014; and	This Extraction Plan LW30-31 Built Features Management Plan LW30-31 Public Safety Management Plan LW30-31 Subsidence Monitoring Program LW30-31

Condition	Condition Requirement	Section Addressed
	II. approved by the Secretary. (ii) relevant development consent means a development consent or project approval issued under the Environmental Planning & Assessment Act 1979 relating to the mining operations subject to this lease. (b) The lease holder must not undertake any underground mining operations that may cause subsidence except in accordance with an approved Extraction Plan. (c) The lease holder must ensure that the approved Extraction Plan provides for the effective management of risks associated with any subsidence resulting from mining operations carried out under this lease. (d) The lease holder must notify the Secretary within 48 hours of any: (i) incident caused by subsidence which has a potential to expose any person to health and safety risks; (ii) significant deviation from the predicted nature, magnitude, distribution, timing and duration of subsidence effects, and of the potential impacts and consequences of those deviations on built features and the health and safety of any person; or (iii) significant failure or malfunction of a monitoring device or risk control measure set out in the approved Extraction Plan addressing: A. built features; B. public safety; or C. subsidence monitoring.	
ML1722 and ML1744 Condition 7	**Resource Recovery** The lease holder must optimise recovery of the minerals that are the subject of this mining lease to the extent economically feasible.	Section 3.2.7

Environment Protection Licence (EPL) 365

Mandalong Mine operates under Environment Protection Licence (EPL) 365, which permits coal handling and production to a scale of up to 6.5 million tonnes per annum in line with Development Consent SSD-5144 (>5 Mtpa classification).

There are no specific EPL conditions relating to the preparation of this EP, however conditions related to specific aspects such as water management and monitoring are detailed within the relevant management plans as well as in this EP.

Work, Health and Safety (WHS) Legislation (subsidence related)

Mandalong Mine has developed a safety management system framework (MS-1001) that integrates plans, policies and procedures that enables a systematic approach to establishing and maintaining effective systems to manage health and safety consistent with WHS legislation and AS/NZS 4804:2001.

The following Work, Health and Safety (WHS) requirements have been considered for the Extraction Plan principally within the context of subsidence related risks to public safety, including to private property and public infrastructure.

Work, Health and Safety Legislation

WHS Legislation and Clause	Condition Requirement	Section Addressed
WHS Regulation 2017 Clause 34	**Duty to identify hazards** A duty holder, in managing risks to health and safety, must identify reasonably foreseeable hazards that could give rise to risks to health and safety.	EP Section 4.1 Key Component Plans Extraction Plan Appendix 2 -Risk Assessments
WHS Regulation 2017 Clause 35	**Managing risks to health and safety** A duty holder, in managing risks to health and safety, must: (a) eliminate risks to health and safety so far as is reasonably practicable, and (b) if it is not reasonably practicable to eliminate risks to health and safety, minimise those risks so far as is reasonably practicable.	EP Section 4.1 Key Component Plans Extraction Plan Appendix 2 -Risk Assessments
WHS Regulation 2017 Clause 36	**Hierarchy of control measures** (1) This clause applies if it is not reasonably practicable for a duty holder to eliminate risks to health and safety. (2) A duty holder, in minimising risks to health and safety, must implement risk control measures in accordance with this clause. (3) The duty holder must minimise risks, so far as is reasonably practicable, by doing 1 or more of the following: (a) substituting (wholly or partly) the hazard giving rise to the risk with something that gives rise to a lesser risk, (b) isolating the hazard from any person exposed to it, (c) implementing engineering controls. (4) If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by implementing administrative controls. (5) If a risk then remains, the duty holder must minimise the remaining risk, so far as is reasonably practicable, by ensuring the provision and use of suitable personal protective equipment. **Note.** A combination of the controls set out in this clause may be used to minimise risks, so far as is reasonably practicable, if a single control is not sufficient for the purpose.	EP Section 4.1 Extraction Plan Appendix 2 -Risk Assessments
WHS Regulation 2017	**Maintenance of control measures** A duty holder who implements a control measure to eliminate or minimise risks to health and safety must	Key Component Plans

WHS Legislation and Clause	Condition Requirement	Section Addressed
Clause 37	ensure that the control measure is, and is maintained so that it remains, effective, including by ensuring that the control measure is and remains: (a) fit for purpose, and (b) suitable for the nature and duration of the work, and (c) installed, set up and used correctly.	
WHS Regulation 2017 Clause 38	**Review of control measures** (1) A duty holder must review and as necessary revise control measures implemented under this Regulation so as to maintain, so far as is reasonably practicable, a work environment that is without risks to health or safety. (2) Without limiting subclause (1), the duty holder must review and as necessary revise a control measure in the following circumstances: (a) the control measure does not control the risk it was implemented to control so far as is reasonably practicable, (b) before a change at the workplace that is likely to give rise to a new or different risk to health or safety that the measure may not effectively control, (c) a new relevant hazard or risk is identified, (d) the results of consultation by the duty holder under the Act or this Regulation indicate that a review is necessary, (e) a health and safety representative requests a review under subclause (4). (3) Without limiting subclause (2) (b), a change at the workplace includes: (a) a change to the workplace itself or any aspect of the work environment, or (b) a change to a system of work, a process or a procedure. (4) A health and safety representative for workers at a workplace may request a review of a control measure if the representative reasonably believes that: (a) a circumstance referred to in subclause (2) (a), (b), (c) or (d) affects or may affect the health and safety of a member of the work group represented by the health and safety representative, and (b) the duty holder has not adequately reviewed the control measure in response to the circumstance.	EP Section 5.2 Key Component Plans Extraction Plan Appendix 2 -Risk Assessments
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 9	**Management of risks to health and safety** (cl 617 model WHS Regs) (1) A person conducting a business or undertaking at a mine must manage risks to health and safety associated with mining operations at the mine in accordance with Part 3.1 of the WHS Regulations. (2) A person conducting a business or undertaking at a mine must ensure that a risk assessment is conducted in accordance with this clause by a person who is competent to conduct the particular risk assessment having regard to the nature of the hazard. (3) In conducting a risk assessment, the person must have regard to: (a) the nature of the hazard, and	EP Sections 4 and 5 Key Component Plans

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(b) the likelihood of the hazard affecting the health or safety of a person, and (c) the severity of the potential health and safety consequences. (4) Nothing in subclause (3) limits the operation of any other requirement to conduct a risk assessment under this Regulation. (5) A person conducting a business or undertaking at a mine (who is the mine operator of the mine or who is a contractor) must keep a record of the following: (a) each risk assessment conducted under this clause and the name and competency of the person who conducted the risk assessment, (b) the control measures implemented to eliminate or minimise any risk that was identified through any such risk assessment. (6) A person conducting a business or undertaking at a mine is not required to keep a record of a risk assessment if: (a) the risk assessment is one that an individual worker is required to carry out before commencing a particular task, and (b) the person keeps a record of risk assessments that addresses the overall activity being undertaken (of which the task forms a part) such as risk assessments carried out in relation to the development of the safety management system for the mine or for a principal mining hazard management plan. (7) The record kept under subclause (5): (a) if kept by a mine operator—forms part of the safety management system of the mine and the records of the mine, or (b) if kept by a contractor who has prepared a contractor health and safety management plan—forms part of the plan.	
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 10	**Review of control measures** (cl 618 model WHS Regs) (1) A person conducting a business or undertaking at a mine must review and as necessary revise control measures implemented under clause 9 in the following circumstances: (a) an audit of the effectiveness of the safety management system for the mine indicates a deficiency in a control measure, (b) a worker is moved from a hazard or assigned to different work in response to a recommendation contained in a health monitoring report provided under Part 3, (c) an incident referred to in clause 128 occurs, (d) any other incident occurs that is required to be notified to the regulator under the WHS laws. (2) The mine operator of a mine must ensure that a control measure that is the subject of a request by a health and safety representative under clause 38 (4) of the WHS Regulations is reviewed and as necessary revised, whether the request is made to the mine operator or notified to the mine operator under	EP Sections 4.1 and 5.2 Key Component Plans MS-1001

WHS Legislation and Clause	Condition Requirement	Section Addressed
	subclause (3) by another person conducting a business or undertaking at the mine. (3) A person conducting a business or undertaking at the mine who is not the mine operator of the mine must immediately notify the mine operator of a request made to the person under clause 38 (4) of the WHS Regulations. (4) A health and safety representative for workers at the mine may request a review of a control measure under clause 38 (4) of the WHS Regulations as if the circumstances referred to in subclause (1) were included as a circumstance in clause 38 (4) (a) of the WHS Regulations.	
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 23 Identification of principal mining hazard management plan	(1) The mine operator of a mine must identify all principal mining hazards associated with mining operations at the mine. (2) The mine operator must conduct, in relation to each principal mining hazard identified, a risk assessment that involves a comprehensive and systematic investigation and analysis of all aspects of risk to health and safety associated with the principal mining hazard. (3) The mine operator, in conducting a risk assessment under subclause (2), must: (a) use investigation and analysis methods that are appropriate to the principal mining hazard being considered, and consider the principal mining hazard individually and also cumulatively with other hazards at the mine.	Centennial Risk Management System – consistent with AS/NZS ISO 31000:2009 Risk Assessments in Appendix 2 Extraction Plan Subsidence WHS No. 1001025001 Environment LW30-31 No. 1001284063 Built Features LW30-31 No. 1001284061 PSMPs LW30-31 No. 1001285007
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 24 Preparation of principal mining hazard management plan	(1) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine in accordance with this clause and Schedule 1. (2) A principal mining hazard management plan must: (a) provide for the management of all aspects of risk control in relation to the principal mining hazard, and (b) so far as is reasonably practicable, be set out and expressed in a way that is readily understandable by persons who use it.. (3) A principal mining hazard management plan must: (a) describe the nature of the principal mining hazard to which the plan relates, and (b) describe how the principal mining hazard relates to other hazards associated with mining operations at the mine, and (c) describe the analysis methods used in identifying the principal mining hazard to which the plan relates, and (d) include a record of the most recent risk assessment conducted in relation to the principal mining hazard, and (e) describe the investigation and analysis methods used in determining the control measures to be implemented, and	Extraction Plan LW30-31 Public Safety Management Plan

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(f) describe all control measures to be implemented to manage risks to health and safety associated with the principal mining hazard, and (g) describe the arrangements in place for providing the information, training and instruction required by clause 39 of the WHS Regulations in relation to the principal mining hazard, and (h) refer to any design principles, engineering standards and technical standards relied on for control measures for the principal mining hazard, and (i) set out the reasons for adopting or rejecting each control measure considered. (4) The mine operator of a mine must consider the following when preparing a principal mining hazard management plan for a principal mining hazard at the mine: (a) the matters set out in Schedule 1 in respect of the principal mining hazard, and any other matter relevant to managing the risks associated with the principal mining hazard at the mine.	
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 67 Subsidence	(1) In complying with clause 9, the mine operator of an underground coal mine must manage risks to health and safety associated with subsidence at the mine. (2) Without limiting subclause (1), the mine operator must ensure that: (a) so far as is reasonably practicable, the rate, method, layout, schedule and sequence of mining operations do not put the health and safety of any person at risk from subsidence, and (b) monitoring of subsidence is conducted, including monitoring of its effects on relevant surface and subsurface features, and (c) any investigation of subsidence and any interpretation of subsidence information is carried out only by a competent person, and (d) all subsidence monitoring data is provided to the regulator in the form and at the times required by the regulator, and so far as is reasonably practicable, procedures are implemented for the effective consultation, co-operation and co-ordination of action with respect to subsidence between the mine operator and relevant persons conducting any business or undertaking that is, or is likely to be, affected by subsidence	This EP document Key Component Plans TARPs Extraction Plan Appendix 2 - Risk Assessments
WHS Regulation (Mines and Petroleum Sites) 2014 Clause 128 Duty to notify regulator of certain incidents	(1) The operator of a mine or petroleum site must take all reasonable steps to ensure that the regulator is notified in accordance with this clause after becoming aware of an incident (other than a notifiable incident) arising out of the carrying out of mining operations or petroleum operations at the mine or petroleum site, but only if the incident: (a) results in illness or injury that requires medical treatment within the meaning of clause 13 of Schedule 9, or (b) is a high potential incident. (5) In this clause:	EP Section 5.1 Key Component Plans TARPs Public Safety Management Plan

WHS Legislation and Clause	Condition Requirement	Section Addressed
	high potential incident means any of the following: (m) any indication from monitoring data of the development of subsidence which may result in any incident referred to in clause 179 (a) (xvi) - a failure of ground, or of slope stability control measures, or 179 (a) (xvii) - rock falls, instability of cliffs, steep slopes or natural dams, occurrence of sinkholes, development of surface cracking or deformations or release of gas at the surface, due to subsidence.	
WHS Regulation (Mines and Petroleum Sites) 2014 Schedule 1 Subsidence Clause 3C Principal hazard management plans – additional matters to be considered	**Subsidence** The following matters must be considered in developing the control measures to manage the risks of subsidence: (a) the characteristics of all relevant surface and subsurface features, (b) the characteristics of all relevant geological, hydrogeological, hydrological, geotechnical, topographic and climatic conditions, including any conditions that may cause elevated or abnormal subsidence or the formation of sinkholes, (c) the characteristics of any previously excavated or abandoned workings that may interact with any proposed or existing mine workings, (d) the existence, distribution, geometry and stability of significant voids, standing pillars or remnants within any old pillar workings that may interact with any proposed or existing mine workings, (e) the predicted and actual nature, magnitude, distribution, timing and duration of subsidence, (f) the rate, method, layout, schedule and sequence of mining operations.	This Extraction Plan Extraction Plan - Appendix 3 (Ditton Geotechnical Services, 2021) Key Component Plans
WHS Regulation (Mines and Petroleum Sites) 2014 Schedule 3 Clause 16 High Risk Activities	**Secondary extraction or pillar extraction, splitting or reduction** (1) The following are identified as high risk activities: (a) secondary extraction by longwall mining, shortwall mining or miniwall mining, (b) pillar extraction, (c) pillar splitting, (d) pillar reduction. (2) The waiting period for any such activity is 3 months. (3) The information and documents that must be provided in relation to any such activity are as follows: (a) details of the authoritative sources used in determining that the proposed method of work can be done safely, (b) engineering plans showing the manner and sequence of extraction, endorsed by the individual nominated to exercise the statutory function of mining engineering manager at the mine, (c) information about the land above or in the vicinity of the proposed activity including land use and details of who owns or occupies any land that may be affected by subsidence,	This Extraction Plan High Risk Activity Notification for LW30-31

WHS Legislation and Clause	Condition Requirement	Section Addressed
	(d) in the case of a pillar extraction, details of the procedures for the recovery of buried and immobile mining plant in or around a goaf, (e) details of how the risks to the health and safety of workers and other persons from subsidence caused by the activity will be managed.	

Appendix 2 Subsidence and Environmental Risk Assessment

Appendix 3 Subsidence Predictions and Impact Assessment Report

Appendix 4 Extraction Plan Master Trigger Action Response Plan

Appendix 5 Supporting Technical Studies (Flood, Land and Agriculture and Telstra)