



**918 Panel
Biodiversity Management Plan**

Clarence Colliery

April 2026

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DOCUMENT CONTROL

DOCUMENT DETAILS	Name: 918 Panel Biodiversity Management Plan Authors: Tara Boreham / Pippa James / Rebecca Cocks (RPS AAP Consulting Pty Ltd) Number: 918 EP-BMP Revision No.: FINAL Document Status: Submission to DPPI for assessment
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APPROVAL DETAILS	Revision No.	Date Sent	Details of Approval	Reviewed By	Approval Date
	N/A	26 February 2026	Draft	Chris Armit	TBC
	N/A	24 April 2026	Final	Approvals Coordinator	

CIRCULATION DETAILS	Name	Department	Circulation Date
	Conservation Planning Officer	CPHR	26/2/2026 24/4/2026
	Parks Officer	NPWS	26/2/2026 24/4/2026
	Team Leader – Resource assessments	DPPI	26/2/2026 24/4/2026

1 INTRODUCTION

Clarence Colliery (**Clarence**) is an underground coal mining operation located 10 kilometres (**km**) east of Lithgow in the Western Coalfield of New South Wales. Clarence is operated and managed by Centennial Coal Company Pty Limited (**Centennial Coal**). Clarence operates under Development Consent Conditions for State Significant Development (**SSD**) DA 504-00 (and modifications) which was granted in 2005 by the New South Wales (**NSW**) Department of Infrastructure, Planning and Natural Resources (more recently known as NSW Department of Planning, Housing and Infrastructure; **DPHI**).

This Biodiversity Management Plan (**BMP**) is a component of the 918 Panel Extraction Plan (**EP**) and has been developed in accordance with Condition 2 g(iv) of Schedule 3 of DA 504-00. This BMP has also been prepared in accordance with DPE's (2022) *Extraction Plan Guideline*. This BMP has been prepared for the EP Area for Panel 918 as defined by the regulatory requirements in **Section 2**.

1.1 Extraction Plan Area

The 918 panel will be extracted via Panel and Pillar Partial Extraction (**PPPE**) using shortwall. The panel contains three sub-panels known as 918A, 918B1 and 918B2 which will be extracted off the 918 Panel. Extraction of the panel (i.e., three sub-panels) will result in subsidence no greater than 100 mm in accordance with Condition 1 of Schedule 3 of DA 504-00. See **Figure 1**.

The EP Area has been calculated by combining the areas bounded by the outer edge of the second workings of Panels 918A, 918B1 and 918B2, and the 35° angle of draw line, which is generally outside the predicted 20 mm subsidence limit from the outer edge of these panels. The EP Area for Panel 918 is shown in **Figure 1**.

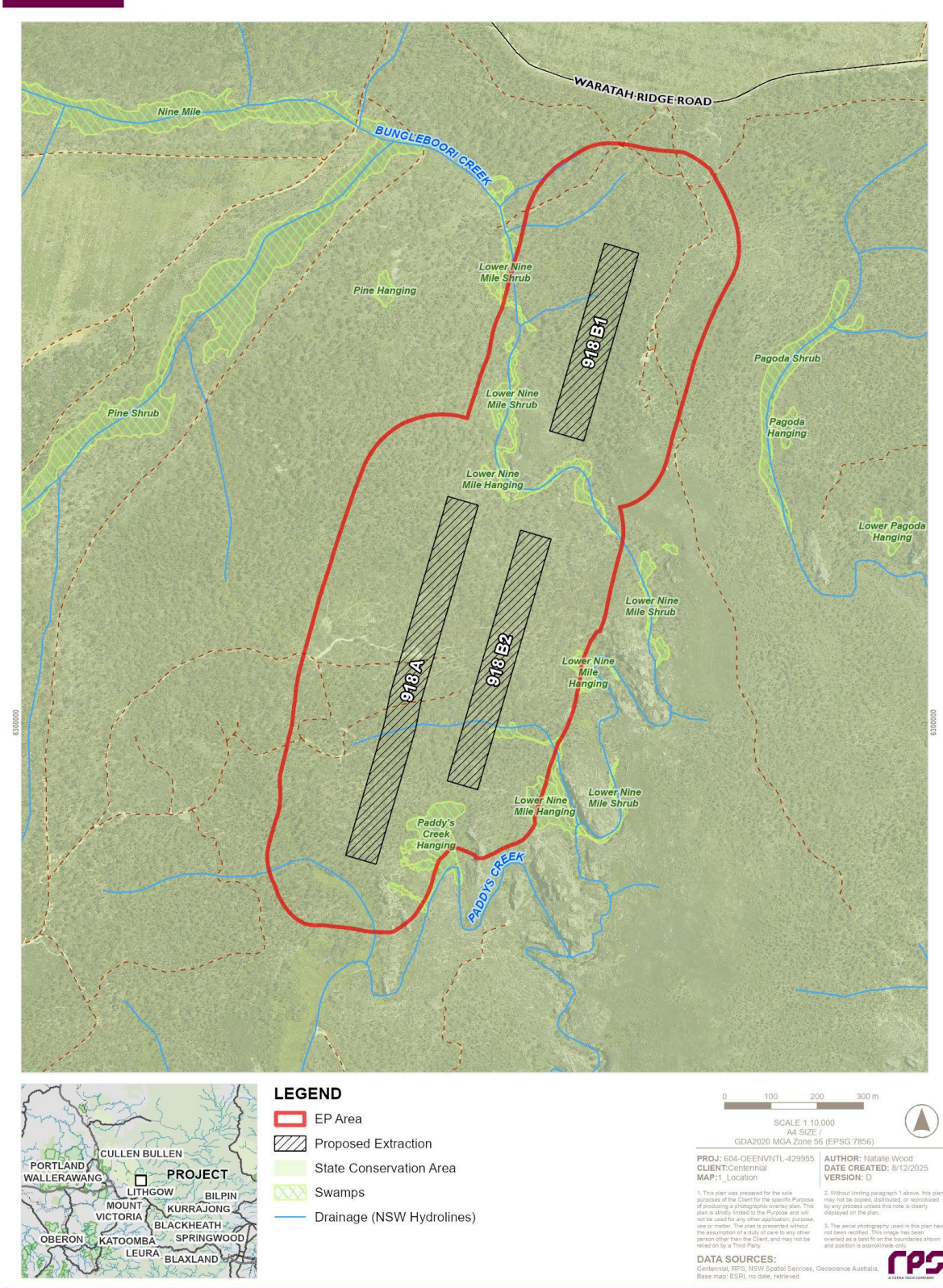


FIGURE 1: PROJECT AREA LOCATION

Figure 1 EP Area for 918 sub panels and Project Location

1.2 Purpose

The purpose of this BMP is to outline the monitoring and management measures, including the prescribed actions and responsibilities, required to detect and appropriately manage potential subsidence-related impacts to biodiversity from the 918 Panel second workings.

1.3 Scope

This BMP has been prepared to meet the requirements for inclusion of a BMP within the 918 Panel EP in accordance with Schedule 3, Condition 2 g(iv) of DA 504-00 and applies to the management of biodiversity within the EP Area.

This BMP addresses the monitoring and management of potential subsidence-related impacts on aquatic and terrestrial flora and fauna with a specific focus on threatened species and populations and their habitats, endangered ecological communities (**EECs**)/ critically endangered ecological communities (**CEECs**) and groundwater-dependent ecosystems (**GDEs**).

1.4 Consultation

A letter requesting input during the plan development phase was provided to the NSW Biodiversity, Conservation and Science Directorate (**BCS**) (now Conservation Programs, Heritage and Regulation - CPHR) on 1 March 2022.

A copy of the draft 918 and 920 BMP was provided to BCS, National Parks and Wildlife Service (**NPWS**) and DPPI on 21 December 2022. A revised version of the 918 and 920 BMP was provided to BCS, NPWS and DPPI on 16 November 2023 for consultation. An onsite meeting and field visit was held with NPWS and BCS on 23 November 2023 to present and discuss the proposed mining activities associated with the EP and the surface features present within the EP Area. Feedback was received from NPWS and BCS on 9 February and 9 May 2024. A summary of consultation undertaken is provided in **Appendix 1**.

This BMP has been updated to consider the feedback from NPWS and BCS and forms a component plan of the 918 Panel EP documentation. A copy of the draft 918 BMP was provided to CPHR, National Parks and Wildlife Service (**NPWS**) and DPPI on 26 February 2026. Evidence and a summary of the 918 Panel BFMP consultation carried out is provided in Appendix 1 – Consultation. A copy of the final 918 BFMP was provided to DPPI on the 24 April 2026, via the DPPI planning portal with the associated 918 Panel Extraction Plan documents.

2 REGULATORY REQUIREMENTS

Clarence expects that its activities and operations are conducted in accordance with relevant legislation and the requirements of statutory authorities. Legislative and regulatory requirements are realised through the imposition of conditions on the development consent, licences or mining approvals.

Clarence operations will be conducted in accordance with applicable State approvals (DA 504-00). Clarence maintains a register of relevant environmental legislative and regulatory requirements which will be reviewed and maintained in the Centennial Compliance Database.

Clarence operates under several different approvals which are identified in the Environmental Management Strategy (EMS). The requirements specific to this BMP regarding the EP Guidelines and development consent (DA 504-00) are presented below in **Sections 2.1**.

2.1 Development Consent and Statement of Commitments

The Development Consent (DA 504-00) conditions provide details of the biodiversity matters which need to be provided for in this BMP. These matters, together with the section of this BMP in which each matter is addressed, are set out in **Table 1**.

Table 1 Development Consent DA 504-00 Conditions

Development Consent	Development Consent Condition	Section Addressed
DA 504-00 (Consolidated conditions as of MOD 7; October 2021)	Schedule 3 Condition 2. g(iv) Each EP must include a Biodiversity Management Plan which: <ul style="list-style-type: none"> • has been prepared in consultation with BCS; • establishes baseline data for existing habitat within the subsidence area, including water table depth, vegetation condition, stream morphology, key fish habitat and threatened species habitat; and • provides for the adaptive management of potential impacts and environmental consequences of the proposed second workings on aquatic and terrestrial flora and fauna, with a specific focus on threatened species, populations and their habitats, Threatened Ecological Communities (TECs) and groundwater dependent ecosystems (GDEs). 	Appendix 1 Section 3 and Appendix 3 Section 6 Section 7 Section 8

2.1.1 Extraction Plan Guidelines

The Extraction Plan Guidelines (DPE 2022a) identifies requirements for Extraction Plan Sub Plans. The requirements of this Guideline and the sections of the BMP in which they are addressed are presented in **Table 2**.

Table 2 Extraction Plan Guideline Requirements

Extraction Plan Guideline Requirement (Sub-Plans)	Section Addressed
An overview of relevant landscape features, heritage sites, environmental values, built features or other values to be managed under the sub plan	Section 3
Setting out the consents performance measures directly relevant to the features or values to be managed under the sub-plan	Section 4
Setting out clear objectives to ensure the delivery of the performance measures and all other relevant statutory requirements	Section 1.3 and 2.1
Proposing performance indicators to establish compliance with these performance measures and statutory requirements	Section 4 Table 3 Table 14
Describe the relevant features or values to be managed under the sub-plan, and their significance	Section 3
Describe all currently predicted subsidence impacts and environmental consequences relevant to the features, and values to be managed under the sub-plan	Section 3
Describe all measures planned to remediate these impacts and/or consequences, including any measures proposed to ensure that impacts and/or consequences comply with performance measures and/or the applicant’s commitments	Section 7
Describe the existing baseline monitoring network and baseline monitoring results, including pre-subsidence photographic surveys of key landscape features and key heritage sites which may be subject to significant subsidence impacts (such as significant watercourses, swamps and Aboriginal heritage sites);	Section 5 Appendix 3
Describe the proposed environmental monitoring of subsidence impacts and environmental consequences;	Section 5
Describe the proposed monitoring of remediation measures;	Section 5
Describe adaptive management;	Section 6
Listing responsibilities for implementation of the plan; and	Section 9
An attached Trigger, Action, Response Plan (TARP; effectively a tabular summary of most of the above).	Appendix 2
Risk assessment and risk management	Appendix 2 See also Extraction Main Report Section 2.4 and Appendix 4.

2.1.2 Subsidence Performance Measures

This BMP provides the management strategies, controls and monitoring programs to be implemented for the management of potential impacts and environmental consequences on the biodiversity values with the potential to be affected by extraction of the 918 Panel. It provides performance criteria in **Table 3**, the exceedance of which would trigger additional investigation in accordance with the Adaptive Management Procedure (see **Section 6** and the EP Main Report).

Table 3 Performance Criteria

Surface Features		Performance Criteria	
Threatened species, threatened populations, TECs and GDEs		Negligible or insignificant environmental consequences	
Subsidence Performance Measures			
Coal Extraction	Vertical subsidence	Tilt	Strain
First Workings	20 mm	1.0 mm/m	1.0 mm/m
Partial Extraction	100 mm	3.0 mm/m	2.0 mm/m

For the purposes of this management plan, ‘Negligible’ is defined as small and unimportant, such as not to be worth considering. JBSG (2026) define ‘Insignificant’ as “Impact is so small or unimportant as to be not worth considering; insignificant”. Clarence’s partial extraction experience where vertical subsidence has been 100 mm or less, has resulted in negligible or insignificant environmental consequences.

3 BIODIVERSITY FEATURES AND PREDICTED IMPACTS

This section provides an overview of the key biodiversity features overlying the EP Area. A description of the relevant features, including vegetation communities, Endangered Ecological Communities (EECs), GDEs, threatened flora and fauna and their habits, and aquatic ecology is provided in **Section 3**.

This information is based on the baseline data collected to validate vegetation mapping and measure the vegetation integrity of sensitive ecological receivers. The following information sources were also consulted to establish baseline data:

- Vegetation of the Western Blue Mountains (including the Capertee, Cox's, Jenolan and Gurnang Areas) (V.1.1) [Department of Environment and Conservation (**DEC**)] (DEC 2006);
- NSW State Vegetation Type Map (DPE 2022c);
- Clarence Seasonal Fauna Monitoring 2019 – 2021 [various reports prepared by Biodiversity Monitoring Services (**BMS**)] (BMS 2014); 2022a, 2022b, 2023a, 2023b; 2023c;
- Clarence Seasonal Flora Monitoring 2017 – 2021 [various reports prepared by Gingra Ecological Surveys (**GES**)] (Gingra 2017-2021);
- Clarence Seasonal Aquatic Monitoring 2021 – 2023 [various reports prepared by Marine Pollution Research (**MPR**)] (MPR 2016 – 2021; 2022a, 2022b, 2023a, 2023b);
- Clarence Environmental Monitoring Program (Centennial Clarence 2021);
- Biodiversity Management Plan Western Region (Centennial Clarence 2019); and
- Seasonal Fauna Monitoring Program, Clarence Colliery. Various reports prepared for Clarence Colliery Pty Ltd (BMS 2004-2021).

Section 3 describes the predicted subsidence-related impacts on the features described in **Section 3.2** and **3.3**; and thus, a basis for the management and monitoring measures described in this BMP.

3.1 Overview

The surface of the entire EP Area is situated within the Garden of Stone State Conservation Area (**GoS SCA**) which is managed by NPWS. The GoS SCA is reserved under the *National Parks and Wildlife Act 1974 (NPW Act)*. All parks reserved under the NPW Act in NSW are managed to achieve the objects of the NPW Act. These objects are centred on conserving the natural and cultural values of the park, as well as fostering public appreciation, understanding and enjoyment of these values (DPE 2022b) and include (as set out in section 2A(a)(i) – (iv) of the NPW Act):

- a) the conservation of nature, including, but not limited to, the conservation of—
 - (i) habitat, ecosystems and ecosystem processes, and
 - (ii) biological diversity at the community, species and genetic levels, and
 - (iii) landforms of significance, including geological features and processes, and
 - (iv) landscapes and natural features of significance including wilderness and wild rivers,

Section 30G of the NPW Act relates to SCAs with section 30G(1) of the NPW Act setting out the purpose of reserving land as an SCA to identify, protect and conserve areas:

- a) that contain significant or representative ecosystems, landforms or natural phenomena or places of cultural significance, and
- (b) that are capable of providing opportunities for sustainable visitor or tourist use and enjoyment, the sustainable use of buildings and structures or research, and
- (c) that are capable of providing opportunities for uses permitted under other provisions of this Act in such areas, including uses permitted under section 47J,

so as to enable those areas to be managed in accordance with the principles set out in 30(G)(2)(a) – (f) of the NPW Act. This includes providing for the undertaking of permitted uses, of which mining is one, under other provisions of the NPW Act within SCAs. Section 47(J) of the NPW Act sets out the provisions that relate to mining, meaning that mining is not a prohibited activity under the NPW Act, and unless specifically provided for in S47, nothing affects the right, title or interest of any person in respect of minerals.

In summary, the classification of the surface of the land over the EP Area as a SCA requires it to be managed in accordance with the management principles under the NPW Act for state conservation areas. These principles require the park to be managed for conservation and public appreciation and enjoyment, while also enabling the continued operation of existing mining infrastructure within the park and the continuation of economically important coal mining operations beneath the park (DPE, 2022b).

3.1.1 Land Use

It is important to identify the impacts of non-mining-related land use during an assessment of mining-related impacts. When monitoring data identifies a performance indicator exceedance, the Trigger Action Response Plan (**TARP**) is activated. It is necessary to assess these non-mining-related impacts before any impact investigation is undertaken.

The Newnes Plateau ('the plateau') above Clarence has been subject to a variety of land uses, many of which are now prohibited following establishment of the SCA. These non-mining-related land uses can result in disturbance to ecosystems. They include:

- Forestry activity – Forestry was the most intense land use on the plateau and included tree logging, track construction, undergrowth clearing and burning. These activities have the potential to lead to significant land changes through increased run-off and sediment transport, vegetation removal, weed invasion and altered fire regimes. These impacts are experienced throughout the plateau.
- Sand quarry – A sand quarry owned by Clarence Sands is located in the upper catchment of Paddys Creek, upstream of the EP Area.
- Chemical munitions clean-up project – A clean-up operation is currently being undertaken by contractors for the Commonwealth Department of Defence to remove stockpiled World War 2-era chemical weapons. The clean-up site is located approximately 400 metres (m) to the north of the EP Area.
- Four-wheel drive and motor bike activity – The plateau has historically been freely accessible to the public including recreational four-wheel drive users and motor bike riders. These activities

have been unregulated, resulting in the development of tracks. These tracks are unplanned and unmaintained and can accelerate runoff, erosion and weed invasion.

- Feral animal activity – Foraging activities cause land disturbance (feral animal observations included horses, pigs and dogs), accelerate erosion which can decrease water quality in drainage lines.
- Firewood collection – Removal of habitat structure, enhancement of erosion and interruption to nutrient cycling.
- General public access – This can lead to an increased incidence of bushfires, introduction of weeds and feral animals and accumulation of rubbish.

3.2 Terrestrial ecology

3.2.1 Habitat Types

The terrestrial biodiversity values within the EP Area are presented in **Section 3.2.3**. The broader landscape comprises several habitat types characterised by open forest, heath, cliffs, pagodas and exposed rocky areas, riparian zones and swamps. Of these, the EP Area contains the following broad habitat types:

- Freshwater wetlands (swamps);
- Dry sclerophyll forest;
- Fringing swamp woodlands; and
- Montane heath and sandstone outcrops (e.g., rock pagodas and caves).

Habitat features provided by the above broad habitat types include open or closed forests, hollow bearing trees, exposed rocky outcrops, pagodas, aquatic habitats (ephemeral and flowing water, **Section 3.3**), ground timber, flowering/fruited vegetation (e.g., food resources) and vegetation structure for shelter (e.g., dense shrubs, groundcover and leaf litter).

Over the summer of 2019-2020, habitat associated with the EP Area was severely affected by uncontrolled bushfires that spread across the Newnes Plateau and wider Wollemi and Blue Mountains areas. The 'Gospers Mountain Fire' (as it was known), was reported as the largest forest fire in Australian history and is estimated to have burned through more than 512,000 ha before joining with several other fires to burn close to 900,000 ha. The blaze burnt across the Lithgow, Hawkesbury and Central Coast regions from October 2019 to February 2020. The EP Area is within the area affected by this fire, resulting in the widespread simplification of vegetation structure and habitat resources. Short to medium-term reductions in vegetation, fallen timber, groundcover and leaf litter, which provide important shelter and foraging resources for various fauna species, have been widely observed across the EP Area. It is expected that several years of vegetative regrowth within these burnt areas is required before biodiversity values approach pre-fire conditions.

3.2.2 Management Units

The aforementioned habitat types form the basis of four management units (which includes swamp and the three sub-management units associated with woodland and heath more broadly) as follows:

- Management Unit 1 – Swamp;
- Management Unit 2 – Dry Sclerophyll Forest;
- Management Unit 3 – Fringing Swamp Woodland; and
- Management Unit 4 – Montane Heath.

Firstly (Management Unit 1), the swamp (Temperate Highland Peat Swamp on Sandstone (**THPSS**) environments), represents sensitive ground water dependant biota which can be impacted by subsidence and hydrology changes. Biodiversity values relevant to aquatic ecology are also detailed in **Section 3.3**. Secondly (Management Unit 2), a woodland management unit that reflects the majority of the EP Area and comprises mostly sclerophyllous montane forests. The environment in this management unit is generally not regarded as sensitive to subsidence. Nevertheless, the woodland environment management unit contains riparian habitats that may be sensitive to hydrology changes, and subsidence-related impacts. Thirdly (Management Unit 3), sclerophyll forest which form transition zones from swamp to woodland (i.e., fringing swamp woodlands). This habitat is generally not regarded as sensitive to subsidence. Nevertheless, riparian habitats may be susceptible to hydrology changes, and subsidence-related impacts. Lastly (Management Unit 4), montane heath habitats contain the majority of sandstone outcrops, cliffs, pagodas and which may be susceptible to subsidence-related impacts such as rock falls. This management unit is not as sensitive as Management Unit 1 given the hydrology present within Unit 1.

The sensitivity to subsidence impacts of these habitat types and management units is strongly related to:

- The magnitude of subsidence caused by the partial extraction second workings of the mine layout; and
- Dependence on water resources and subsidence effects on those water resources.

Regarding the above points, **Section 3** provides details around the predicted subsidence impacts.

3.2.3 Vegetation Communities and Habitat

Vegetation communities were typified using the State Vegetation Type Map (**SVTM**; NSW DCCEEW 2025) regional-scale map of NSW Plant Community Types and previous vegetation mapping by DEC (2006). The SVTM maps the distribution of each Plant Community Type (**PCT**), Vegetation Class and Vegetation Formation with data input from the NSW BioNet Flora Survey Plots – PCT Reference Sites (NSW DCCEEW 2023). Subsequent flora surveys were undertaken that involved ground-truthing of vegetation communities through rapid data points (**RDPs**) which document the most dominant flora species of the canopy, midstorey and ground stratum within a 10 m radius of the point. Data was compiled into GIS and overlain on a range of aforementioned data sets. These data layers and the floristic data were then used to predict the vegetation type present within polygons. Fine-scale (a scale of approximately 1:5000) alterations using aerial photo interpretations (**API**) were subsequently undertaken to improve polygon accuracy. This was undertaken digitally (i.e. on screen) using API techniques, involving the delineation of polygons based on similarities and differences between patterns observed in the vegetation as seen in the air photo.

A total of 11 DEC Mapping Units (**MU**) and seven PCTs have been identified within the EP Area (**Figure 2**) which have been stratified into four management units outlined in **Section 3.2.2** above.

Furthermore, one PCT is commensurate with listed *Biodiversity Conservation Act 2016 (BC Act)* and *Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* listed threatened ecological communities. This is captured within Management Unit 1 – Swamp, which contains the Newnes Plateau Shrub and Hanging Swamps and the THPSS vegetation communities (**Table 4**).

Table 4 Vegetation Communities within EP Area

Management Unit	Mapping Unit (DEC 2006)	PCT	BC Act listing	EPBC Act listing	Area (ha)
1 – Swamp	50 Newnes Plateau Shrub Swamp (NPSS)	3945 Newnes Plateau Shrub Swamp	Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion EEC	Temperate Highland Peat Swamp on Sandstone (THPSS) EEC	1.30
	51 Newnes Plateau Hanging Swamp (NPHS)	3945 Newnes Plateau Shrub Swamp	Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion EEC	Temperate Highland Peat Swamp on Sandstone (THPSS) EEC	2.43
2 - Dry Sclerophyll Forest	7 Newnes Plateau Narrow-Leaved Peppermint – Mountain Gum – Brown Stringybark Layered Forest	3688 Newnes Plateau Silvertop Ash Woodland	Not listed	Not listed	42.80
	7 Newnes Plateau Narrow-Leaved Peppermint – Mountain Gum – Brown Stringybark Layered Forest	3694 Upper Blue Mountains Ridgetop Woodland	Not listed	Not listed	0.25
	8 Newnes Sheltered Peppermint - Brown Barrel Shrubby Forest	3695 Western Blue Mountains Peppermint Sheltered Forest	Not listed	Not listed	0.26
	26 Newnes Plateau Narrow-Leaved Peppermint – Silvertop Ash Layered Open Forest	3688 Newnes Plateau Silvertop Ash Woodland	Not listed	Not listed	26.12
	26 Newnes Plateau Narrow-Leaved Peppermint – Silvertop Ash Layered Open Forest	3694 Upper Blue Mountains Ridgetop Woodland	Not listed	Not listed	1.37

Management Unit	Mapping Unit (DEC 2006)	PCT	BC Act listing	EPBC Act listing	Area (ha)
	29 Sandstone Slopes Sydney Peppermint Shrubby Forest	3695 Western Blue Mountains Peppermint Sheltered Forest	Not listed	Not listed	0.69
	45 Newnes Plateau Tea Tree - Banksia - Mallee Heath	3691 Upper Blue Mountains Fringing Swamp Woodland	Not listed	Not listed	3.23
3 – Fringing Swamp Woodland	14 Tableland Mountain Gum - Snow Gum - Daviesia Montane Open Forest	3946 Newnes Plateau Swamp Woodland	Not listed	Not listed	1.48
	26a Newnes Plateau Gum Hollows variant: Brittle Gum - Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest	3691 Upper Blue Mountains Fringing Swamp Woodland	Not listed	Not listed	2.12
4 – Montane Heath	43 Pagoda Rock Sparse Shrubland	3865 Western Blue Mountains Pagoda Scrub	Not listed	Not listed	3.27
	44 Sandstone Plateaux Tea Tree - Dwarf Sheoak - Banksia Rocky Heath	3862 Newnes Plateau Rockplate Heath	Not listed	Not listed	1.98
	Not classified (Roads and Tracks)		N/A	N/A	0.21
Total					87.51

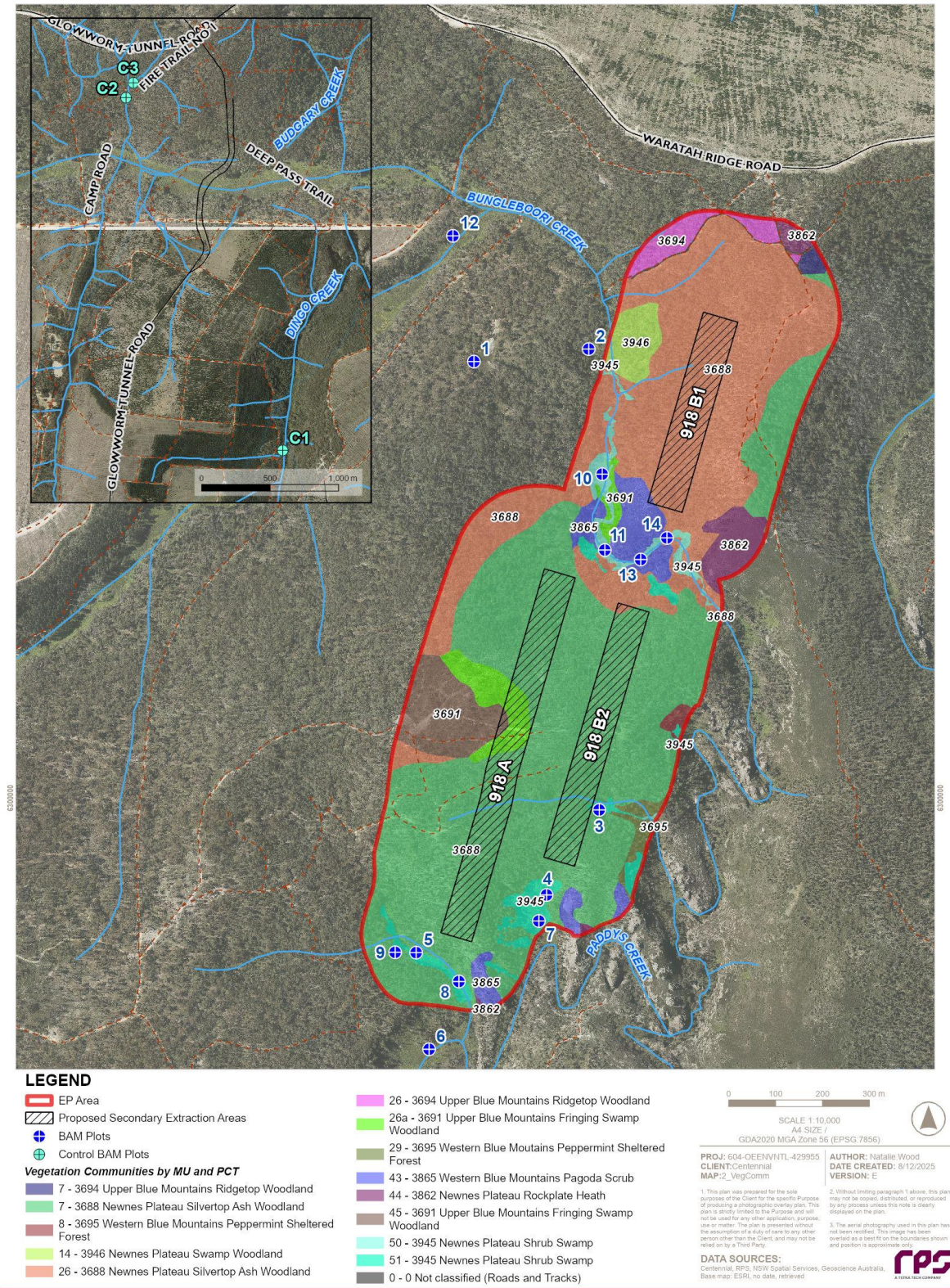


FIGURE 2: VEGETATION COMMUNITIES WITHIN THE EP AREA

Figure 2 Vegetation Communities within the EP Area

3.2.3.1 Threatened Ecological Communities

3.2.3.1.1 BC Act listed Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion

PCT 3945 is part associated with the BC Act listed Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion. PCT 3945 relates to the NSW Newnes Plateau Shrub Swamp TEC where it is located on Newnes Plateau as per paragraph 1 and 9 in the Final Determination. Therefore PCT 3945 conforms to the BC Act listed Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion.

3.2.3.1.2 EPBC Act listed Temperate Highland Peat Swamps on Sandstone

PCT 3945 is part associated with EPBC Act listed Temperate Highland Peat Swamps on Sandstone. BC Act listed Newnes Plateau Shrub Swamp in the Sydney Basin Bioregion is listed as a component of the EPBC Act TEC in the listing advice of this community (TSSC 2005). Furthermore PCT 3945 relates to the Commonwealth Temperate Highland Peat Swamps on Sandstone TEC where it occurs at elevations below 1100 m above sea level (asl). Therefore, PCT 3945 conforms to EPBC Act listed Temperate Highland Peat Swamps on Sandstone.

3.2.3.1.3 BAM Plots

Twelve floristic plots were undertaken in accordance with the Biodiversity Assessment Methodology (BAM; DPE 2020a) to provide an assessment of baseline condition over two years for EECs within the EP Area (Table 7). BAM plot assessment is a recognised floristic assessment methodology through the Biodiversity Offset Scheme (BOS) and as such is endorsed by both the NSW and Commonwealth Governments for assessing major projects under the NSW Assessment Bilateral Agreement. The BAM methodology, as described in Appendix 3, is therefore considered a suitable method of assessing floristic changes within the EP Area.

The BAM method involves estimating the vegetation composition, structure and function to determine the vegetation integrity. Flora species observed within the 20 x 20 m (400 m²) plot were assigned to a growth form as listed in Table 6 and given a score of abundance and coverage. High threat weed species were identified. The method used to measure these attributes is detailed in the BAM 2020 (DPE 2020a). Vegetation condition scores comprising of a composition score, structure score, function score and vegetation integrity (VI) score were calculated using the BAM Calculator (BAM-C).

Landscape context necessary for understanding vegetation communities and using the BAM-C are displayed in Table 5.

Table 5 Landscape context of the management area

Feature	Landscape context
Interim Biogeographic Regionalisation for Australia (IBRA)	Sydney Basin
IBRA Sub Region	Wollemi
NSW (Mitchell) Landscape (DECC 2002)	Newnes Plateau
Percent native vegetation cover	90
Connectivity features	Connectivity through Garden of Stone SCA
Rivers and streams	Multiple first, second and third order streams

The start and end points of each BAM plot (i.e., 50 m central transect) were marked with wooden stakes and labelled. Location data for each of these points was recorded using a differential GPS. Photographs were taken of each BAM plot from a standardised point at an approximate height of 1.5 m. A horizontal field of view of approximately 40 degrees was achieved, which is within the central angle of view for human vision (i.e., 40-60 degrees).

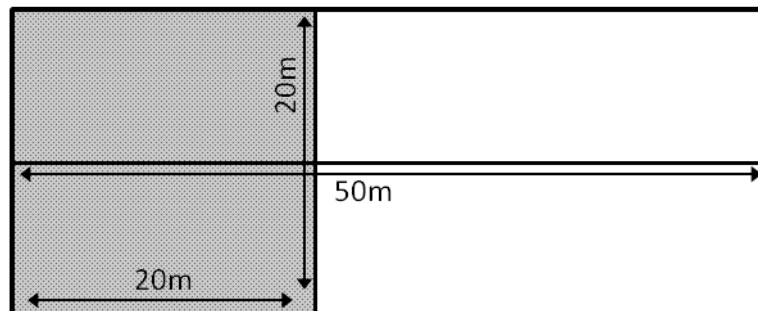


Plate 1 BioMetric plot dimensions

Table 6 BAM growth form groups and attributes

Composition (20 x 20 m plot)	Structure (20 x 20 m plot)	Function (20 x 50 m plot)
a) Tree Richness (TR)	a) Tree Cover (TC)	a) Number of large trees (No.LT)
b) Shrub Richness (SR)	b) Shrub Cover (SC)	b) Tree regeneration (TR)
c) Grass and grass-like Richness (GGR)	c) Grass and grass-like Cover (GGC)	c) Tree stem size class (TSSC)
d) Forb Richness (FR)	d) Forb Cover (FC)	d) Total length of fallen logs (TLFL)
e) Fern Richness (FeR)	e) Fern Cover (FeC)	e) Litter cover (1m ² subplots x 5) (LC)
f) Other Richness (OR)	f) Other Cover (OC)	f) High threat exotic vegetation cover (HTE)
		g) Hollow-bearing trees (HBT)

- **Vegetation structure:** The structural complexity and age structure of vegetation was quantified by counting the number of large trees (i.e. > 50 cm diameter at breast height [DBH]), presence of tree canopy species regeneration and tree stem size classes (i.e. presence of trees with a DBH of 5-9 cm, 10-20 cm, 20-30 cm, 30-50 cm, 50-80 cm and >80 cm). This was measured for the 1,000 m² plot;
- **Hollow-bearing Trees:** The number of hollow-bearing trees were counted within the 1,000 m² plot;
- **Fallen Log Length:** The total linear length of fallen logs exceeding 10 cm in diameter were measured within the 1,000 m² plot;
- **Litter Cover:** The per cent cover of dead litter cover was estimated in five, 1 m² quadrats within the 1,000 m² plot.

These plots were spatially stratified and included both shrub (MU 50) and hanging (MU 51) swamps throughout the EP Area to ensure a representative measure of baseline condition was achieved for these ecologically sensitive vegetation communities. Having a representative baseline condition for these EECs allows for detection of future impacts associated with the extraction of the 918 Panel

should they unexpectedly occur. Plot establishment date and baseline data for TEC monitoring is provided in **Appendix 3**. Vegetation communities and locations of BAM plots are shown in **Figure 2**.

Table 7 BAM plots installed throughout the 918 EP Area

Plot	Eastings	Northings	MU - PCT	Condition	Management Unit
1	242001	6300931	MU 50 - 3945 Newnes Plateau Shrub Swamp	Moderate to Good	1– Swamp
3	242268	6299975			
4	242155	6299794			
5	241878	6299671			
7	242139	6299738			
8	241968	6299609			
9	241833	6299671			
13	242356	6300509			
14	242412	6300555			
2	242245	6300958			
6	241905	6299465			
10	242274	6300691			
11	242280	6300529			
12	232863	6318985			
C1*	244978	6304387	MU 50 - 3945 Newnes Plateau Shrub Swamp	Moderate to Good	
C2*	243834	6306962			
C3*	243888	6307070			

Note: * refers to Control site

3.2.3.2 Groundwater Dependent Ecosystems

GDEs are well-defined by Eamus (2009) with a summary definition for these systems provided below:

“There are many types of GDEs, but they can all be classed into one of two types. The first class of GDE relies on the surface expression of groundwater. Swamps, wetlands and rivers are ecosystems that rely on the discharge of groundwater to the surface, either into a river or into a swamp or wetland. Rivers and streams that flow all year (perennially flowing) are generally groundwater-dependent because a significant proportion of their daily flow is derived from groundwater discharging into the river course. When groundwater availability declines, river flow is reduced and swamps and wetlands may become dry, temporarily or permanently. The second class of GDEs rely on the availability of groundwater below the surface but within the rooting depth of the vegetation. These terrestrial ecosystems include riparian forests all across Australia, banksia woodlands of Western Australia, eucalypts on the floodplains of the Murray River and plantation forests in South Australia, Victoria and New South Wales. They all require a supply of groundwater within the root zone.”

Some vegetation communities within the EP Area are consistent with both the first and second classes of GDE defined by Eamus (2009) above. The PCT 3945 Newnes Plateau Shrub Swamp ecosystems present relies on the discharge of groundwater to the surface from both regional groundwater flows and/or shallow aquifers. Riparian vegetation within the EP Area is also likely to be at least facultatively dependent on sub-surface flows (i.e., have rooting zones which overlap the sub-surface water interface) or are located such that surface flows originate from sub-surface flows.

The swamp ecosystem GDEs within the EP Area include:

- **Management Unit 1 – Swamp:** PCT 3945 Newnes Plateau Shrub Swamp.

PCT 3945 is present as both MU 50 Newnes Plateau Shrub Swamp, which is typically dependent upon groundwater flows and MU 51 Newnes Plateau Hanging Swamp, which is typically dependent upon perched aquifers. Shrub swamps form at the base of valleys that are subject to temporary or permanent waterlogging from groundwater, surface water runoff and rainfall. Hanging swamps form on the sides of valleys where perched groundwater discharges and are subject to infrequent waterlogging from perched groundwater, surface water runoff and rainfall. The 918 EP Area contains several hanging swamps and a limited section of shrub swamp (**Figure 3**). These Newnes Plateau swamps (both shrub and hanging swamps) are commensurate with the BC Act listed Newnes Plateau Shrub Swamps in the Sydney Basin Bioregion EEC and the EPBC Act listed THPSS EEC as explained in **Section 3.2.3.1**. THPSS has been mapped as either shrub swamps or hanging swamps in **Figure 3**.

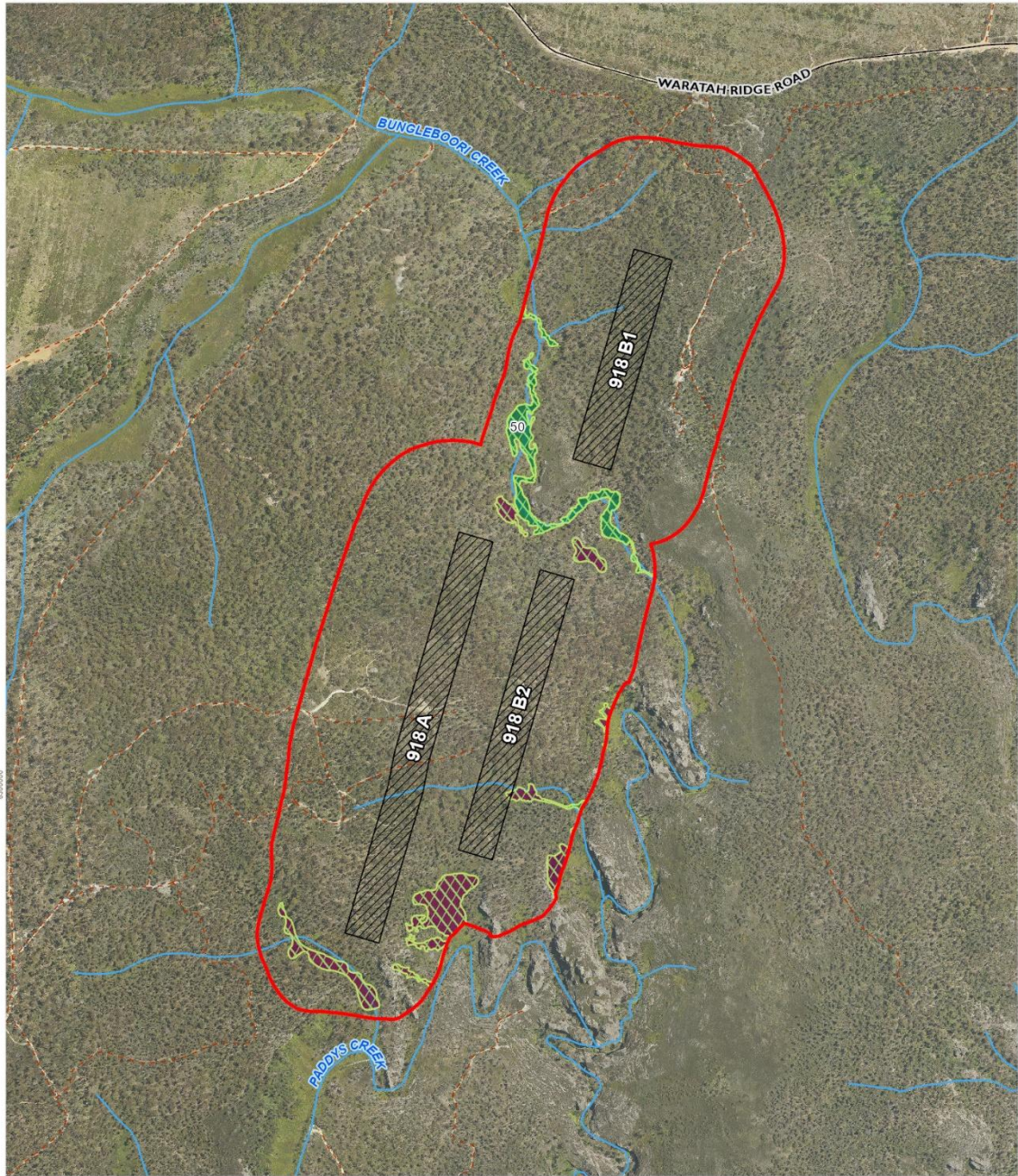
As Management Unit 1 – Swamp is a GDE and EEC, this habitat is deemed the most sensitive potential impacts of mining.

3.2.3.2.1 Facultative Ground Water Dependent Ecosystems

Facultative GDEs within the EP Area, where some floristic elements of these communities may depend upon groundwater where it is expressed toward or at the strata surface, include:

- Management Unit 2 – Dry Sclerophyll Forest
 - PCT 3688 Newnes Plateau Silvertop Ash Woodland (it occurs in riparian areas);
- Management Unit 3 – Fringing Swamp Woodland
 - PCT 3946 Newnes Plateau Swamp Woodland;
 - PCT 3691 Upper Blue Mountains Fringing Swamp Woodland;

- Management Unit 4 – Montane Heath:
 - PCT 3862 Newnes Plateau Rockplate Heath (where groundwater seepage is expressed, typically in rocky areas); and
 - PCT3865 Western Blue Mountains Pagoda Scrub (where groundwater seepage is expressed, typically in rocky areas).



LEGEND

- EP Area
- Proposed Secondary Extraction Areas
- THPSS
- Newnes Plateau Shrub Swamp (MU50)
- Newnes Plateau Hanging Swamp (MU51)

0 100 200 300 m

SCALE 1:10,000
A4 SIZE

GDA2020 MGA Zone 56 (EPSG:7856)

PROJ: 604-OEENVITL-429955
CLIENT: Centennial
MAP: 3_THPSS_EEC

AUTHOR: Natalie Wood
DATE CREATED: 6/12/2025
VERSION: D

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DATA SOURCES:
Centennial, BPS, NSW Spatial Services, Geoscience Australia,
Base map: EDRN, no date, retrieved



FIGURE 3: TEMPERATE HIGHLAND PEAT SWAMP ON SANDSTONE (THPSS) (EEC)

Figure 3 Management Unit 1 – Newnes Plateau Shrub Swamp EEC within the EP Area

3.2.3.3 Threatened flora

Threatened flora within the EP Area have been characterised from searches on the BioNet database (NSW DCCEEW 2025), RPS's internal database where threatened flora records from previous surveys in the locality have been compiled as well as opportunistic sightings from EcoResolve (EcoResolve 2023). Generally, threatened flora have been opportunistically surveyed and no targeted surveys have been carried out within the 918 EP Area. Threatened flora records were then cross-checked with vegetation community mapping.

A total of 15 threatened flora species have the potential to occur within the EP Area, or occur within 10km of the EP Area, assigned a count in **Table 8** below. Four threatened flora species were found to occur within the EP Area indicated by the shaded rows (see also **Figure 4**).

Table 8 Threatened Flora species recorded within 10km of the EP Area or with the potential to occur

Scientific Name	Common Name	BC Act listing	EPBC Act listing	Count (DCCEEW BioNet 2024)	Management Unit
<i>Acacia meiantha</i>		Endangered	Endangered		2, 3
<i>Boronia deanei</i>	Deane's Boronia	Vulnerable	Vulnerable	9017	1
<i>Caesia parviflora</i> var. <i>minor</i>	Small Pale Grass-lily	Endangered		300	2, 3
<i>Carex klaphakei</i>	Klaphake's Sedge	Endangered			1
<i>Dillwynia tenuifolia</i>		Vulnerable			2, 3
<i>Genoplesium superbum</i>	Superb Midge Orchid	Endangered		1	2, 3
<i>Lastreopsis hispida</i>	Bristly Shield Fern	Endangered			2, 3
<i>Persoonia acerosa</i>	Needle Geebung	Vulnerable	Vulnerable		2, 3
<i>Persoonia hindii</i>		Endangered	Not listed	5461	2, 3
<i>Persoonia marginata</i>	Clandulla Geebung	Vulnerable	Vulnerable	2	2, 3
<i>Prasophyllum pallens</i>	Musty Leek Orchid	Vulnerable	Vulnerable	76	2, 3
<i>Pultenaea glabra</i>	Smooth Bush-Pea	Vulnerable	Vulnerable	5	2, 3
<i>Velleia perfoliata</i>		Vulnerable	Vulnerable		2, 3
<i>Veronica blakelyi</i>		Endangered	Not listed	2396	1, 2, 3
<i>Xerochrysum palustre</i>	Swamp Everlasting	Not listed	Endangered		1

Shading denotes species detected in EP Area.

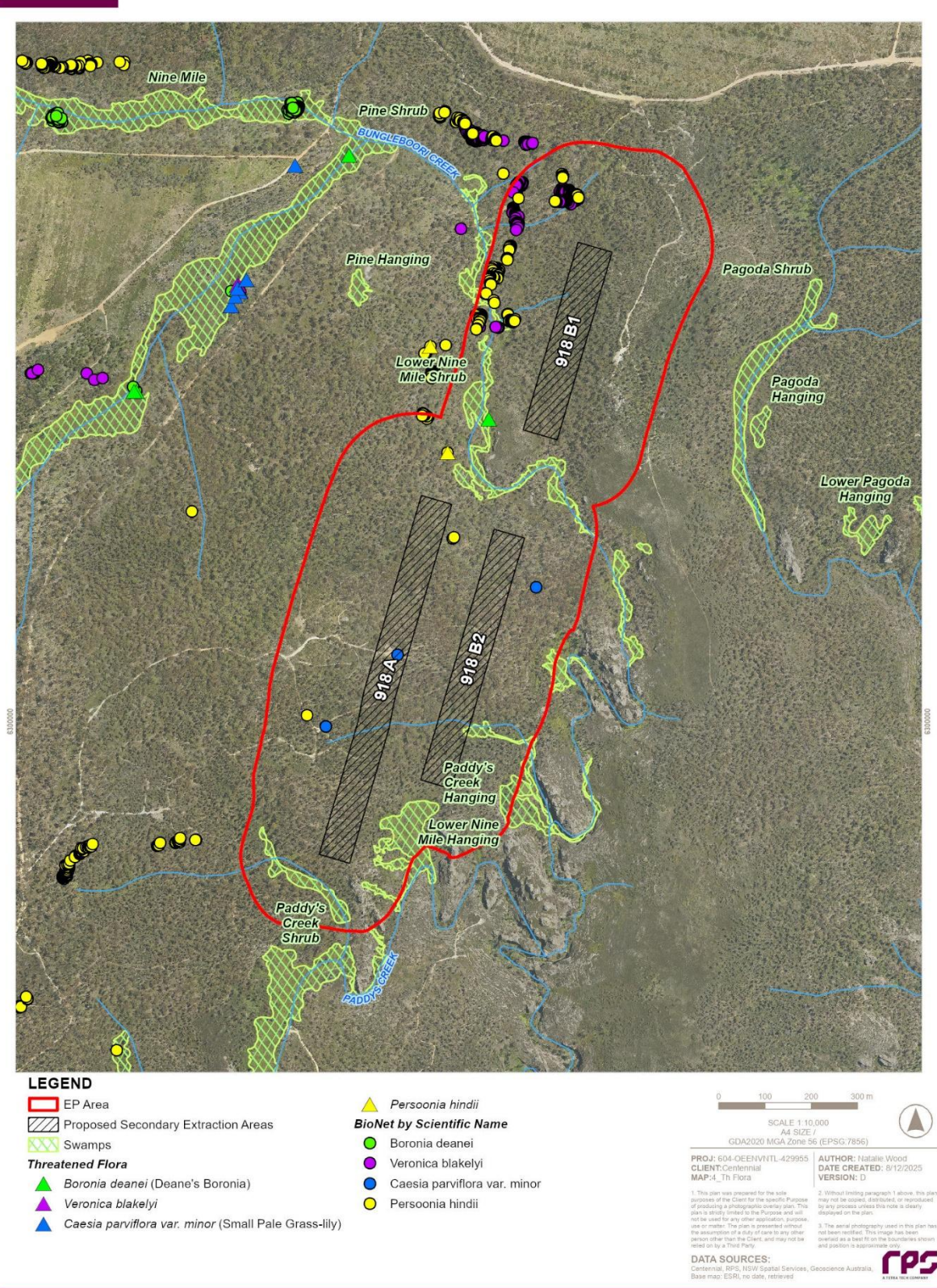


FIGURE 4: THREATENED FLORA

Figure 4 Threatened Flora recorded in or near the EP Area

3.2.3.4 Threatened fauna

Long-term seasonal monitoring sites have been established at Clarence Colliery since 2004 to identify potential impacts of mining induced subsidence on native fauna within various Subsidence Management Plan (SMP) areas (BMS 2022a, 2022b, 2023a, 2023b, 2023c). The aim of the surveys to date has been to collect terrestrial fauna base-line data across the Clarence Colliery consent areas (both pre-mining and post mining) to be used to monitor changes (if any) in populations that may occur over time. Information regarding the presence of fauna, species diversity, population numbers and habitat characteristics were also obtained. Fauna surveys conducted as ongoing annual monitoring for Clarence used the following techniques:

- Ground Elliott traps;
- Tree-mounted Elliott traps;
- Hair funnels;
- Ground Tomahawk traps;
- Tree-mounted Tomahawk traps;
- Large Elliott traps;
- Glider tubes;
- Pitfall traps;
- Remote Infrared (IR) cameras;
- Anabat recording;
- Call broadcasting;
- Bird counts;
- Litter searches;
- Amphibian searches;
- Reptile searches; and
- Rock turning.

The application of these methods for targeting threatened species is detailed in **Table 9**. Further detailed information of fauna monitoring is provided in **Appendix 3**.

Table 9 Fauna survey methods

Fauna group	Targeted survey methodology
Threatened amphibians	Searching preferred habitat, pit trapping, call analysis, reptile funnels
Threatened reptiles	Searching preferred habitat, searching under rocks, pit trapping, reptile funnels, tiles
Threatened diurnal birds	General observation, call recognition
Threatened nocturnal birds	General observation, tree traps, spotlighting, call broadcasting, hair tubes, pit trapping, detection of characteristic sap cuts and scratches on trunks, scat identification
Threatened arboreal marsupials	General observation, ground traps, spotlighting, searching for characteristic diggings, hair tubes, recognition of tracks, scat identification
Threatened small ground mammals	Elliott trapping, pit trapping, hair tubes, recognition of tracks
Threatened bats	Ultrasonic call detection (Anabat)

Fauna group	Targeted survey methodology
Threatened invertebrates	Searches in preferred habitats

Fauna monitoring undertaken since 2004, within the Clarence Colliery Consent Area has identified a total of 239 native fauna species and nine exotic fauna species. Of these species, 34 are listed as threatened under the BC Act, and 11 are listed as threatened and/or migratory under the EPBC Act. Threatened species detected either within the Clarence or adjacent Springvale mine lease are detailed in **Table 10**. Threatened fauna found within the EP Area and immediate surrounds are shown in **Figure 5**. Established fauna monitoring locations are shown in **Figure 6**. A full fauna inventory is provided in **Appendix 3**.

It is important to note that these fauna surveys were conducted across the entire Clarence Colliery Consent Area as well as the adjacent Springvale mine lease area and were not contained solely within the EP Area for the 918 Panel. However, given the contiguous habitats across the Clarence Colliery Consent Area and the mobility of fauna, it is likely that most fauna species detected during surveys could occur within the EP Area.

Additional targeted surveys have been conducted within the 918 EP Area for Giant Dragonfly (*Petalura gigantea*) and Blue Mountains Water Skink (*Eulamprus leuraensis*) by Marine Pollution Research (MPR). Both species have been recorded adjacent to the EP Area. As recommended by the Independent Expert Advisory Panel for Mining in November 2025 surveys were conducted to collect environmental DNA (eDNA) through water samples to detect the presence/absence of the two target species. Water samples were filtered through Smith Root 5-micron self-preserving filters, with the aim to process 10 L or more of in-situ water samples through each filter to collect eDNA. Collected samples were processed through qPCR assay or metabarcoding to determine the presence or absence of each species in swamp habitat (Management Unit 1) within the 918 EP Area. Monitoring locations are shown in **Figure 6**.

Table 10 Threatened fauna detected within or nearby EP Area

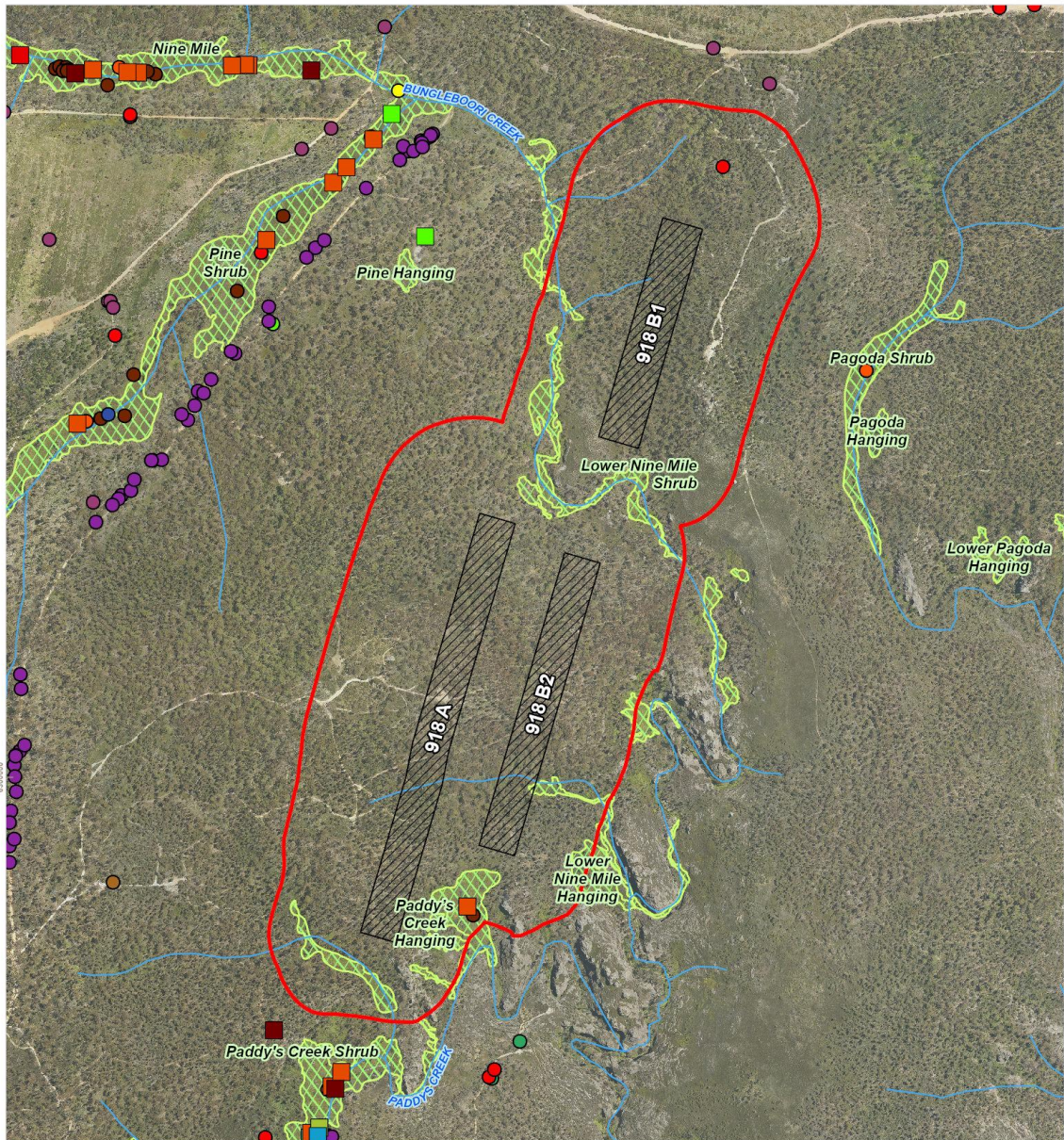
Common Name	Scientific Name	BC Act listing	EPBC Act listing	Management Unit
Amphibians				
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Vulnerable	Vulnerable	1, 2, 3
Birds				
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable		2,3
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Endangered	Endangered	2,3
Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	Vulnerable	Vulnerable	2,3
Speckled Warbler	<i>Chthonicola sagittata</i>	Vulnerable		2,3
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable		2,3
Little Lorikeet	<i>Glossopsitta pusilla</i>	Vulnerable		2,3
Little Eagle	<i>Hieraaetus morphnoides</i>	Vulnerable		2,3

Common Name	Scientific Name	BC Act listing	EPBC Act listing	Management Unit
White-throated Needletail	<i>Hirundapus caudacutus</i>		Vulnerable, Migratory	2,3
Square-tailed Kite	<i>Lophoictinia isura</i>	Vulnerable		2,3
Hooded Robin	<i>Melanodryas cucullata cucullata</i>	Endangered		2,3
Black-chinned Honeyeater	<i>Melithreptus gularis gularis</i>	Vulnerable		2,3
Turquoise Parrot	<i>Neophema pulchella</i>	Vulnerable		2,3
Barking Owl	<i>Ninox connivens</i>	Vulnerable		2,3
Powerful Owl	<i>Ninox strenua</i>	Vulnerable		2,3
Scarlet Robin	<i>Petroica boodang</i>	Vulnerable		2,3
Flame Robin	<i>Petroica phoenicea</i>	Vulnerable		2,3
Pilotbird	<i>Pycnoptilus floccosus</i>	Vulnerable	Vulnerable	2,3
Diamond Firetail	<i>Stagonopleura guttata</i>	Vulnerable		2,3
Masked Owl	<i>Tyto novaehollandiae</i>	Vulnerable		2,3
Sooty Owl	<i>Tyto tenebricosa</i>	Vulnerable		2,3
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable		2,3
Invertebrates				
Petalura gigantea	<i>Giant Dragonfly</i>	Endangered		1
Mammals				
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Vulnerable		2,3, 4
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Endangered	Vulnerable	2,3, 4
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Vulnerable	Endangered	2,3
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable		2,3, 4
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Vulnerable		2,3, 4
Southern Myotis	<i>Myotis macropus</i>	Vulnerable		2,3, 4
Southern Greater Glider	<i>Petauroides volans</i>	Endangered	Endangered	2,3
Squirrel Glider	<i>Petaurus norfolcensis</i>	Vulnerable		2,3
Koala	<i>Phascolarctos cinereus</i>	Endangered	Endangered	2,3
Yellow-bellied Sheath-tail-bat	<i>Saccolaimus flaviventris</i>	Vulnerable		2,3, 4
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Vulnerable		2,3, 4
Reptiles				
Blue Mountains Water Skink	<i>Eulamprus leuraensis</i>	Endangered	Endangered	1
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	Endangered	Vulnerable	4

Common Name	Scientific Name	BC Act listing	EPBC Act listing	Management Unit
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	Vulnerable		2, 3, 4

Shading denotes species detected in or directly adjacent the EP Area.

The purpose of the monitoring programs carried out since 2004 across the Clarence Colliery Consent Area has been to detect any changes in populations, presence, absence caused by partial extraction mining activities resulting in up to 100 mm of subsidence. The results from this monitoring have found that as a result of 100 mm of subsidence, there has been no (negligible and/or imperceptible) impacts caused by mining.



LEGEND

EP Area

Proposed Secondary Extraction Areas

Threatened Fauna

- Blue Mountains Water Skink, (*Eulamprus leuraensis*)
- Eastern Bent-wing-bat, (*Miniopterus orianae oceanensis*)
- Eastern Pygmy-possum, (*Cercartetus nanus*)
- Flame Robin, (*Petroica phoenicea*)
- Gang-gang Cockatoo, (*Callocephalon fimbriatum*)
- Giant Dragonfly, (*Petalura gigantea*)
- Large-eared Pied Bat, (*Chalinotobus dwyeri*)

BioNet by Common and (Scientific)

- Blue Mountains Water Skink (*Eulamprus leuraensis*)
- Dusky Woodswallow (*Artamus cyanopterus cyanopterus*)
- Eastern False Pipitrelle (*Falsistrellus tasmaniensis*)
- Eastern Pygmy-possum (*Cercartetus nanus*)
- Flame Robin (*Petroica phoenicea*)
- Gang-gang Cockatoo (*Callocephalon fimbriatum*)
- Greater Broad-nosed Bat (*Scoteanax rueppellii*)
- Large Bent-winged Bat (*Miniopterus orianae oceanensis*)
- Large-eared Pied Bat (*Chalinotobus dwyeri*)

- Little Lorikeet (*Glossopsitta pusilla*)
- Pilotbird (*Pycnophilus floccosus*)
- Powerful Owl (*Ninox strenua*)
- Scarlet Robin (*Petroica boodang*)
- South-eastern Glossy Black-Cockatoo (*Calyptorhynchus lathami lathami*)
- Southern Greater Glider (*Petauroides volans*)
- Turquoise Parrot (*Neophema pulchella*)
- Varied Sittella (*Daphoenostita chrysoptera*)
- White-throated Noddytail (*Hirundopus caudacutus*)
- Yellow-bellied Sheath-tail-bat (*Saccolaimus flaviventris*)



SCALE 1:10,000
A4 SIZE
GDA2020 MGA Zone 56 (EPSG:7856)

PROJ: 604-OEENIVNLT-429955
CLIENT: Centennial
MAP: 5_Th Fauna

AUTHOR: Natalie Wood
DATE CREATED: 8/12/2025
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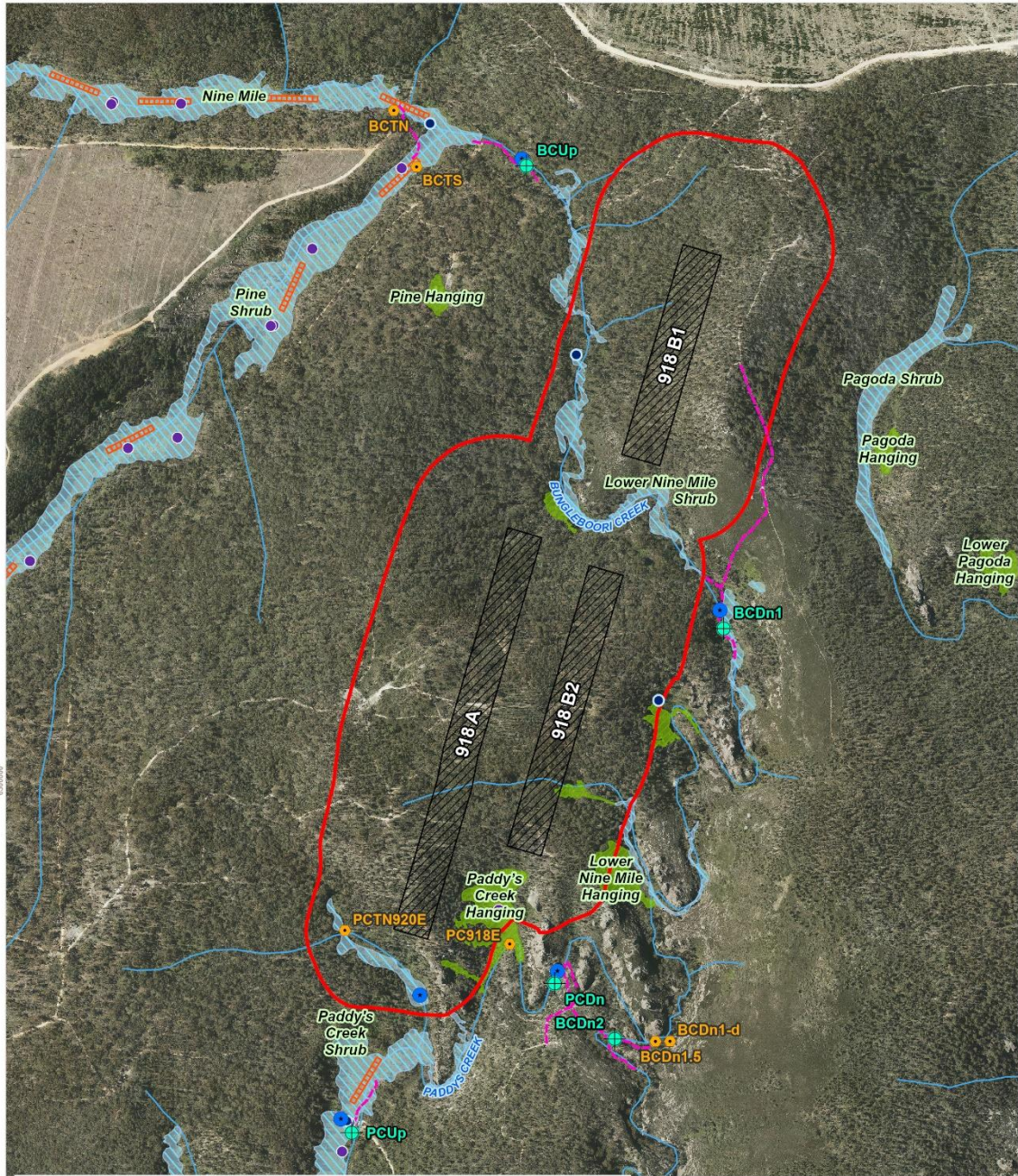
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FIGURE 5:: THREATENED FAUNA

Figure 5 Threatened Fauna recorded in or near the EP Area



LEGEND

- EP Area
- Proposed Secondary Extraction Areas
- Swamps**
- Hanging
- Shrub
- Giant Dragonfly transect and eDNA monitoring
- Blue Mountains Water Skink monitoring location
- Proposed eDNA monitoring locations
- Biodiversity monitoring locations
- Aquatic Ecology Monitoring
- Water Quality Monitoring
- Fauna survey tracks (MPR)

0 100 200 300 m
SCALE 1:10,000
A4 SIZE
GDA2020 MGA Zone 56 (EPSG:7856)

PROJ: 604-OEENVNTL-429955
CLIENT: Centennial
MAP: 0_BMWS_GDF
AUTHOR: NATALIE WOOD
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FIGURE 6: TERRESTRIAL AND AQUATIC FAUNA MONITORING LOCATIONS

Figure 6 Terrestrial and Aquatic Monitoring Locations within the 918 EP Area

3.2.3.4.1 Habitat features

Cliffs and pagodas provide important habitat for several reptile and microbat species. For instance, the threatened *Hoplocephalus bungaroides* (Broad-headed Snake) shelters under rock slabs and in rock crevices during cooler months, which are also important foraging and shelter habitat for *Varanus rosenbergi* (Rosenberg's Goanna). Rock crevices and caves (especially with honeycombing present), such as those associated with rock features in the EP Area, can also provide important roost habitat for cave-associated threatened microbats including *Chalinolobus dwyeri* (Large-eared Pied Bat), *Myotis macropus* (Southern Myotis), *Miniopterus orianae oceanensis* (Eastern Bentwing-bat) and *Vespardelus troughtoni* (Eastern Cave Bat). *Tyto novaehollandiae* (Masked Owl) also commonly roosts in cave habitats such as those in the EP Area.

Rock features within the EP Area are primarily concentrated along Bungleboori Creek and the lower reaches of Paddys Creek and are generally captured in Management Unit 4 – Montane Heath. In general, the cliffs and associated features increase in height as the creeks cut down through the Banks Wall Sandstone. The majority of the more significant features are located outside of the EP Area.

3.3 Aquatic Ecology

The 918 Panel EP Area is located within the Lithgow and greater Warragamba Catchment area, which covers an area of 9,050 km². The catchment is bounded to the west by the Great Dividing Range, stretching north of Lithgow at the head of Coxs River in the Blue Mountains.

The EP Area is in the upper Bungleboori Creek catchment, including a tributary of Paddys Creek. The proposed EP 918 mining footprint has been amended to avoid extraction underneath Bungleboori Creek, which contains intermittently occurring shrub swamps and incised creek drainage channels (**Figure 6**). There is one small unnamed 1st order sub-catchment tributary to Bungleboori Creek which overlies the mining footprint (**Figure 6**), flowing from the west to join Bungleboori Creek just above its confluence with Paddys Creek.

Paddys Creek originates on the Newnes Plateau in the Blue Mountains Range near State Mine Gully at elevations reaching 1190 m AHD. The headwaters of Paddys Creek catchment border the upper Bungleboori Creek catchment to the south and flows in a north easterly direction for around 4.1 km before merging with Bungleboori Creek. Whilst there are no pine plantation compartments within the Paddys Creek catchment area, the two main sub-catchment branches accommodate Clarence Sands Quarry in their upper limits (**Figure 6**). The longer northern sub-catchment supports a NPSS upstream of the site that extends for approximately 1,300 m in length, and the smaller southern sub-catchment contains a NPSS that is around 660 m in length. The latter continues further downstream from the confluence of the sub-catchments for a distance of 520 m, after which the stream channel becomes incised and meandering through bedrock escarpment and gullies in its lower limits. A small tributary to Paddys Creek overlies the 918 Panel EP Area (see site PCTN920E in **Figure 6**). It merges with Paddys Creek at the downstream limits of the NPSS distribution in the main channel. The 918 mining footprint has been amended to avoid partial extraction second workings underneath this tributary and associated shrub swamp.

Aquatic fauna habitats provided by these tributaries include large rocks, fallen logs, dense vegetation and overhanging native plants. These creeks are known to offer important habitat for frogs and reptiles that associate with water bodies (potentially including the Giant Burrowing Frog). Pooled water along these watercourses also provides suitable habitat for small fishes and aquatic invertebrates. Shrub and hanging swamps in or nearby riparian areas for these creeks also present niche habitat associated with peat soils and dense foliage that provide habitat for several endemic species including the Blue Mountains Water Skink, Giant Dragonfly (note that swamp associated species are considered in the terrestrial component of this BMP) and potentially Adams Emerald Dragonfly (*Archaeophya adamsi*; as per MPR 2022a).

A baseline aquatic ecology assessment for the EP Area was undertaken by Marine Pollution Research Pty Ltd in Spring 2021 (MPR 2022a) to:

- To develop an understanding of the aquatic ecological attributes (including key fish habitat, stream health and flow and channel stability) of the Newnes Plateau Shrub Swamps and creeks which overly the EP area to enable impact assessment and provide suitable mitigation and offset measures where necessary or desirable; and
- To provide additional aquatic site base-line data that can be utilised to monitor potential impacts of continued and new mining and that can be used to develop suitable TARPS to be incorporated into the 918 EP BMP.

Aquatic ecology surveys have continued since 2021 each spring and autumn in accordance with the AusRivAS standards, culminating in at least two years of baseline data. This program involved using the following methods:

- Macroinvertebrate Sampling [including use of standardised Australian River Assessment System (AUSRIVAS) sampling protocol];
- Sampling for fish and other vertebrates (using baited fish traps);
- Field Water Quality Sampling [submersible data logger (SDL) and physical observations]; and
- Site Riparian-Channel-Environment (RCE) and Aquatic Plant Descriptions.

Aquatic ecology sampling sites were chosen based on repeatable (and safe) accessibility, water availability year-in/year-out as well as choosing sites that are not too influenced by other impacts (e.g., erosion/pine plantations). Summary of the survey effort is provided in **Table 11** with survey locations shown in Figure 6.

Table 11 Aquatic ecology sampling program: Spring 2021 2022 and 2023

Catchment	Site	Easting	Northings	SDL ¹	Aquatic Ecology ²
Bungleboori Creek	BCTS	241974	6301186	X	
	BCTN	241930	6301295	X	
	BCUp	242186	6301195		X
	BCDn1	242568	6300294		X
	BCDn1.5	242436	6299496	X	
	BCDn2	242357	6299501		X

Catchment	Site	Eastings	Northings	SDL ¹	Aquatic Ecology ²
	BCDn3	244483	6298401		X
Paddys Creek	PCTW	241675	6299121	X	
	PCTS	241769	6299127	X	
	PCUp	241848	6299325		X
	PCTN920E	241819	6299700	X	
	PCT918E	242154	6299684	X	
	PCDn	242241	6299608		X
1. SDL = Submersible data logger 2. Aquatic Ecology = Macroinvertebrate Sampling, Sampling for fish and other vertebrates, Field Water Quality Sampling and Site Riparian-Channel-Environment (RCE) and Aquatic Plant Descriptions.					

No threatened aquatic flora or fauna have been detected during the baseline aquatic survey (MPR 2022a). Both the 2023 spring and autumn surveys, similarly, did not locate any threatened aquatic flora or fauna (MPR, pers.comm. 2023)

Aquatic Ecology Control sites

During the baseline aquatic ecology assessment for the EP Area that was undertaken by Marine Pollution Research Pty Ltd in Spring 2021 (MPR 2022a), sites were also sampled in Carne Creek East, Dingo Creek and Dingo Creek East that are suitable control sites for aquatic monitoring. These sites are detailed in **Table 12** below.

Table 12 Control sites established for aquatic ecology monitoring

Catchment	Site	Eastings	Northings	SDL ¹	Aquatic Ecology ²
Carne Creek East	CECDn	243,244	6,303,488	x	x
Dingo Creek	DCDn	244,801	6,303,631	x	x
Dingo Creek East	DECDn	246264	6,303,597	x	x
1. SDL = Submersible data logger 2. Aquatic Ecology = Macroinvertebrate Sampling, Sampling for fish and other vertebrates, Field Water Quality Sampling and Site Riparian-Channel-Environment (RCE) and Aquatic Plant Descriptions.					

3.3.1 Subsidence Predictions

The mine design adopts first workings (bord and pillar) and second workings (Panel and Pillar Partial Extraction using shortwall (**PPPE**) mining technique (a partial extraction mining method), designed to maintain a level of surface subsidence consistent with the requirements and criteria set out in DA504-00, as presented in Table 13.

Table 13 Subsidence Impact Assessment Criteria

Level of Extraction	Subsidence	Tilt	Horizontal Strain (compressive and tensile)
First Workings	20 mm	1.0 mm/m	1.0 mm/m
Partial Extraction	100 mm	3.0 mm/m	2.0 mm/m

The proposed second workings within this EP are located within the partial extraction areas referred in Appendix 2 of DA504-00.

Subsidence Predictions have been carried out by Strata Control Technology (SCT) (SCT 2026) and MSEC (MSEC 2026). SCT (2026) and MSEC (2026) used numerical modelling and analyses of observed angles of draw to provide vertical subsidence, tilts and strain predictions (**Table 14**) which are compared below to the subsidence impact criteria listed in the Development Consent (Schedule 3, Condition 1 of DA 504-00).

Table 14 Subsidence Predictions for 918 Panel second workings

	Vertical Subsidence	Tilts	Strains (Compressive and Tensile)
DA 504-00 (impact assessment criteria)	100 mm	3 mm/m	2 mm/m
SCT 2026 & MSEC 2026 (predictions)	76 mm	0.6 mm/m	0.3 mm/m

A subsidence impact assessment completed by MSEC (MSEC 2026), found that *“The natural and built features are predicted to experience low levels of vertical subsidence and horizontal movements. The corresponding curvatures and strains are expected to be in the order of survey tolerance, i.e. not measurable. Adverse physical impacts to the natural and built features are not expected due to the extraction of the proposed sub-panels.”*

3.3.1.1 Height of Fracturing

It is important to note, that the Mount York Claystone is a regionally significant aquitard and is an important geological unit in the stratigraphy above the Katoomba seam as important aquifers overlie it. The Mount York Claystone consists of interbedded claystone, siltstone and sandstone beds, typically with a total interval thickness of around 20 m and a gradational contact to the underlying Burra-Moko Head Sandstone. The Mount York Claystone lies above the Katoomba seam (mining horizon of the 918 Panel) by 110 m within the EP Area (SCT 2026).

SCT (2026) reports that the groundwater system at Clarence consists of an upper (shallow and perched) water table and a lower (deep) water table. The Mount York Claystone forms the boundary between the lower boundary of the upper water table. The shallow system is important from both an ecological and economic perspective as it supports groundwater users and GDEs. Surface alluvium and weathered rock overlying fine-grained claystone / shale layers (Burralow Formation) support TECs that rely on the shallow / upper aquifers (within the Burralow formation), including:

- *Newnes Plateau Shrub Swamps (NPSS) in valleys; and*
- *Newnes Plateau Hanging Swamps (NPHS) at the margins of plateau areas.*

For the above mentioned reasons, the maintenance of the Mount York Claystone integrity is very important to avoid disruption to the shallow / upper aquifers located higher up in the stratigraphy.

SCT (2026) advises that modelling assessment indicates mining-induced caving fractures extend to a maximum of 90 m above the mining horizon. It is also advised that pore pressure reduction is likely to occur below the Mt York Claystone but not reduce pore pressure in the perched and shallow water tables.

The potential impacts to the four management units and key biodiversity values related to the predicted subsidence, predicted heights of fracturing and the conclusions from the groundwater modelling undertaken by JBSG (2026) are discussed below in **Sections 3.3.2 to 3.3.5**. Key features discussed include swamps, creeks, cliffs and pagodas and steep slopes, and threatened flora and fauna.

3.3.2 Management Unit 1 – Swamps

Management Unit 1 consists of PCT 3945 Newnes Plateau Shrub Swamp which is a GDE and consistent with the BC Act listing and THPSS EBPC Act listing. It also contains a large majority of the perennial streams in the EP Area flowing into Bungleboori Creek. As such, this management unit is the most sensitive to potential impacts of mining and forms the focus of Biodiversity Monitoring Program (**Section 5**).

3.3.2.1 Groundwater Dependent Ecosystems

Since 1998, the strategy relating to mine design at Clarence for the protection of the swamp GDEs has involved:

- maintaining the integrity of the Mount York Claystone (MYC) aquitard such that the shallow/ upper groundwater system is unaffected by mining;
- limiting vertical subsidence and tilts, such that surface / near-surface flow is unaffected,
- the creation of long term stable spine pillar sets and barrier pillars to support the overlying strata; and
- avoiding surface cracking by maintaining tensile and compressive strains of <2 mm/m consistent with government guidelines (DoE 2014). Surface strains are typically <0.5 mm/m.

The proposed partial extraction of the 918 Panel continues the above mentioned strategy. One important consideration within the mine design process is that there are many mixed swamps in the EP Area, which, due to their length, commence and are generally best developed (i.e., larger) on the Burralow Formation, but continue down through the Wentworth Falls Claystone into the Banks Wall Sandstone. As such, it was recognised that protection of the MYC aquitard (which generally lies 110 m – 120 m above the coal seam) and the overlying Burralow Formation aquitards is important. Additional

consultation and mine design amendments were conducted throughout 2023 and 2024 and resulted in a proposed mine design that actively avoids partial extraction second workings beneath GDE and swamp habitat.

Pine Swamp, Nine Mile Swamp, Paddys Creek Swamp and Lower Nine Mile Swamp are National and State listed groundwater dependent ecosystems. Those swamps are also listed in the relevant schedule of the Water Sharing Plan. Modelling indicates that the predicted impact of extraction of the 918 panel on these swamps will be insignificant.

MSEC (2026) states: *“The maximum predicted tilt for the swamps is 0.5 mm/m (i.e. 0.05 % or 1 in 2000). The maximum predicted tilt along the alignment of the streams within the swamps is less 0.5 mm/m (i.e. 0.05 % or 1 in 2000). The predicted mining-induced tilts are very small compared to the average natural grades of the streams within the Study Area which vary between 30 mm/m (i.e. 3.0 % or 1 in 33) and 155 mm/m (i.e. 15.5 % or 1 in 6).*

It is unlikely, therefore, that the mining-induced tilts would have an adverse impact on ponding, flooding and scouring of the swamps.”

JBS&G (2026b) modelled the predicted reduction of flow, water level and water quality on GDEs within the vicinity of 918 Panel. The report states “Modelling indicates that there will be insignificant change to surface water flow in the Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary catchments, due to the implementation of the Extraction Plan for 918 Panel. Modelling indicates there will be insignificant change to water quality (salinity) in the Pine Swamp, Paddys Creek Swamp, Bungleboori Creek and Paddys Creek Tributary catchments, due to implementation of Extraction Plan for 918 Panel.”

RPS has considered the potential for these changes to tilt (0.05% change), surface water flows (insignificant change) and salinity (insignificant change) to impact the THPSS located within the 918 Panel extraction plan area. Based on the MSEC and JBS&G findings, it is unlikely that ecological impacts to THPSS would result from the extraction of 918 Panel.

Note that NPSS have been undermined by partial extraction operations at Clarence since 1998, including (but not limited to) parts of Paddys Creek East Swamp, Pagoda Swamp, Happy Valley and Happy Valley Upper Swamps and a small hanging swamp above 908 Panel to the east of the EP Area. To date, there is no known evidence of mining-related damage to any such features above areas that have been subject to partial extraction mining activities at Clarence Colliery (Centennial Clarence 2025).

3.3.2.2 Creeks

The mining layout has been designed to avoid partial extraction beneath the fourth order stream of Bungleboori creek as designated in DA504-00 Appendix 2 first workings subsidence protection zone.

MSEC (2026) predicts that the total vertical subsidence movements for the streams will be minimal, with no measurable tilts or curvatures.

It is further stated that *“It is unlikely, therefore, that the mining-induced tilts would have an adverse impact on ponding, flooding and scouring of the streams. No adverse impacts to streams have previously been observed due to partial extraction directly beneath streams at Clarence”*. Additionally, it is considered unlikely that fracturing of bedrock would occur beneath surface soils, thusly impacting the groundwater and surface water availability and movement.

Bungleboori Creek, Farmers Creek Dam and the Greater Blue Mountains World Heritage Area are relevant surface water features in the vicinity of the EP Area. Modelling indicates that extraction of the 918 panel will lead to an insignificant impact on surface water flow with respect to these surface water features.

3.3.3 Management Unit 2 – Dry Sclerophyll Forests and 3 – Fringing Swamp Woodland

Management Units 2 and 3 contain habitats that are considered to be facultative ecosystems where the vegetation occurs along riparian areas or consist of fringing swamp woodland. The majority of perennial creeklines are contained within Management Unit 1 – Swamps, however some first order ephemeral streams occur within Management Unit 2 and 3. Given the low levels of subsidence predicted, the risk of adverse impacts on these forested communities are considered to be low.

3.3.4 Management Unit 4 – Montane Heath

3.3.4.1 Cliffs, Pagodas and Rock outcrops

The mining layout has been designed to avoid undermining the cliff, pagoda and major rock outcrop features in the area (MSEC 2026), which are concentrated along Bungleboori Creek outside of the EP Area and the lower reaches of Paddys Creek.

According to the subsidence report MSEC (2026) conclude that “*The cliffs, minor cliffs and pagodas are predicted to experience very low-level subsidence effects due to the extraction of the proposed 918 Panels. The mining-induced tilts, curvatures and strains are not expected to be measurable*” (see also Section 3.3.1).

3.3.4.2 Steep Slopes

Steep slopes are defined as an area of land having a gradient between 1 in 3 (33% or 18.3°) and 2 in 1 (200% or 63.4°). Previous mining activities conducted by Clarence have not resulted in adverse impacts to steep slopes, even in instance of partial extraction directly beneath steep slopes. MSEC 2026 conclude that “*It is therefore considered unlikely that adverse impacts would occur to the steep slopes within the Study Area due to the extraction of the 918 sub-panels, even if the actual movements exceeded the predictions by a factor of two times*”.

3.3.5 Threatened Species

3.3.5.1 Threatened flora

Four threatened flora species have been found to occur within the EP Area; *Boronia deanei*, *Caesia parviflora* var. *minor*, *Persoonia hindii* and *Veronica blakelyi*. *Caesia parviflora* var. *minor* and *Persoonia hindii* and *Veronica blakelyi* occur across Management Units 2 and 3. *Veronica blakelyi* also occurs in Management Unit 1, however is not wholly reliant on the swamp ecosystems, and tolerates both damp and dry soils. There is the potential for threatened plant species to be affected by changed hydrology and surface flows, however modelling predicts that extraction of the 918 Panel will lead to an insignificant impact on surface water flow and are unlikely to be impacted.

Boronia deanei is a swamp obligate species and is constrained to Management Unit 1. *B. deanei* has been recorded in low numbers across the EP Area in Lower Nine Mile swamp. Key Threatening Processes for this species include:

- Drying of swamps due to drought and climate change reducing quality of habitat; and

- Coal and coal seam gas exploration and extraction causing subsidence and drainage of swamps, leading to changed hydrology and swamp ecosystem collapse (DPE 2023a).

Fire ecology, as it relates to *Boronia deanei*, is poorly understood. However fires of high intensity or frequency are considered a threat to this species' limiting population's ability to reach maturity and set seed (DPE 2023a).

Modelling predicts that the subsidence impacts from the partial extraction of the 918 Panel on these swamps will be insignificant in Nine Mile Swamp, Paddys Creek Swamp and Lower Nine Mile Swamp.

Furthermore, Newnes Plateau Shrub Swamps have been undermined by partial extraction operations at Clarence since 1998. To date, there is no known evidence of mining-related damage to any such features above areas that have been subject to partial extraction mining activities at Clarence Colliery. *B. deanei* habitat in the EP area is therefore unlikely to substantially decline.

3.3.5.2 Threatened fauna

Results of fauna monitoring in the Clarence Colliery Consent Area suggest that given the low levels of subsidence from previous mining at Clarence Colliery, the risk of adverse impacts on fauna within this area is considered to be low (BMS 2023c). Analysis of fauna populations in the CLW, the Eastern SMP and Outbye SMP Areas, 800 Area and 900 area suggest that there is little conclusive evidence to suggest that changes are due to mining. Generally, changes in diversities have been found to be primarily due to climatic changes, though some evidence of lower diversity measures in undermined sites is shown (BMS 2022a, 2022b, 2023a, 2023b, 2023c). It is postulated that fauna population numbers are determined by climate, fire and predators, feral horses also add to that pressure (BMS 2023b).

Two swamp obligate fauna species occur adjacent to the 918 EP Area, the Giant Dragonfly and Blue Mountains Water Skink. Further surveys have been proposed to determine the presence/absence of these species within the EP Area. The Giant Dragonfly live and breed in permanent swamps and bogs with open vegetation, with females laying their eggs within damp moss and leaf litter. Similarly, the Blue Mountains Water Skink is found in permanently wet shrub or sedge swamps with boggy soils. Both species are listed as species at risk of Serious and Irreversible Impacts (SAII) due to their highly specific habitat requirements to maintain suitable swamp habitat. Predicted subsidence and groundwater modelling suggests that these species are unlikely to be adversely impacted by the extraction activities within the 918 EP Area.

4 PERFORMANCE MEASURES AND INDICATORS

Compliance with biodiversity performance measures is determined through the comparison of monitoring data with performance indicators. Performance measures for the EP Area are outlined in **Table 15** together with the corresponding monitoring program described in **Section 5**. The monitoring program will be used to demonstrate that the environmental performance satisfies relevant performance measures.

4.1 Assessment of Subsidence Performance Measures

It is important to note that the overall subsidence monitoring program will provide the “*vital signs*” for the overall mining performance, including the performance measures presented in **Table 15**. With such a small subsidence magnitude already approved, even if the 100 mm subsidence criteria is reached (exceeding the predictions of 76 mm), and tilts of ≤ 3 mm/m and strains of ≤ 2 mm/m are reached (exceeding the expected ≤ 0.6 mm/m tilt and ≤ 0.3 mm/m strain), environmental consequences are expected to be negligible and/or imperceptible. To this end, magnitudes of movement are the most sensitive and critical to ensure the environmental performance measures are achieved and the approved subsidence impact assessment criteria is not exceeded. Further details regarding the subsidence monitoring program can be found in the 918 Panel Subsidence Monitoring Program.

A summary of subsidence performance measures as they relate to biodiversity are presented in **Table 15** below.

Additional performance and monitoring measures include the measurement of underground workings (to ensure they confirm to design), monitoring pillar performance and the measurement of the overlying stratigraphy all the way to the surface.

Table 15 Performance Measures

Parameter: Biodiversity	Performance Criteria	Performance Indicators	Action response
Aquatic habitat and ecology	Negligible environmental consequences	<p>The performance indicators for escalating risk conditions are detailed within the TARP (see Appendix 2). In general, various TARP responses will be triggered if:</p> <ul style="list-style-type: none"> Subsidence monitoring identifies a significant exceedance of subsidence values; A statistical change is identified by biodiversity monitoring for related management plans that is greater than negligible and that the change is caused by subsidence; and/or A change in measured outcomes that is not negligible 	<p>If the performance indicators are triggered the data will be reviewed against the control site data (see Appendix 3) to infer whether the performance indicator exceedance is mining related.</p> <p>If impacts are deemed to be mining related further investigations will be undertaken.</p> <p>Targeted monitoring of sensitive biodiversity features in the affected area will be undertaken where appropriate. Monitoring will be designed at the time (as soon as possible) of detected triggers for impact in relation to the impacted habitat types and relevant threatened species.</p>

Parameter: Biodiversity	Performance Criteria	Performance Indicators	Action response
		occurs and that the measured outcome is caused by subsidence.	If required, undertake mine plan/design review and enact the Adaptive Management Procedure.
Threatened species, threatened populations, EECs and GDEs	Negligible environmental consequences	<p>The performance indicators for escalating risk conditions are detailed within the TARP (see Appendix 2). In general, various TARP responses will be triggered if:</p> <ul style="list-style-type: none"> • Subsidence monitoring identifies a significant exceedance in subsidence values; • Groundwater monitoring identifies an exceedance of trigger values caused by mining¹; • A statistical change ($p < 0.05$) is identified by biodiversity monitoring, that is greater than negligible and the change is found to be caused by subsidence; and/or • A change in measured outcomes that is not negligible occurs and that the measured outcome is caused by subsidence. 	<p>If the performance indicators are triggered the data will be reviewed against the control site data to infer whether the performance indicator exceedance is mining related. If impacts are deemed to be mining related further investigations and mine plan review will be undertaken. Targeted monitoring of sensitive biodiversity features in the affected area will be undertaken where appropriate. Monitoring will be designed at the time (as soon as possible) of detected triggers for impact in relation to the impacted habitat types and relevant threatened species.</p> <p>If required, undertake mine plan/design review and enact the Adaptive Management Procedure.</p>

¹ Groundwater monitoring, trigger vales and TARPs can be found in the 918 Panel Water Management Plan (GHD, 2026)

5 BIODIVERSITY MONITORING PROGRAM

Monitoring within the EP Area has been carried out prior to the commencement of the proposed partial extraction of the 918 Panel. The monitoring program consists of pre-mining/pre-impact data collection (i.e., ‘baseline’) and after mining (i.e., impact). The monitoring of control or reference sites has been collected and will form a part of ongoing data collection for a detailed analysis of potential impacts, should they occur.

Information contained in this BMP is focused on the habitats contained within Management Unit 1 – PCT 3945 Newnes Plateau Shrub Swamp as it the most sensitive to potential mining impacts. Reference to relevant components of Management Units is made, where needed, to address specific parts of the conditions of consent. A monitoring framework for these areas is outlined in the following sections.

Clarence will continue to employ the management strategies and mitigation measures that are currently in place to manage subsidence and mitigate associated impacts, including monitoring of surface features and infrastructure above active mining areas and monitoring of the “as mined” workings to ensure they comply with design. Subsidence management will continue to be via mine design developed by a geotechnical engineer and implemented by the mine, with ongoing monitoring providing the mechanism to measure against predictions, assess compliance with consented subsidence impact criteria and identify any impacts.

5.1 Monitoring Design

This monitoring program has been developed considering a **BACI** (Before-After, Control-Impact) methodology where practical and feasible. The principles of a BACI monitoring design have been adopted in this BMP. A BACI design involves data collection at monitoring sites where impacts are expected and corresponding control/ reference sites before and after the impact event (Underwood 1992). This monitoring design is preferred over a simple Before-After monitoring model because it enables causation to be assigned to observed change (e.g., distinguish between the effects of mining or some other unrelated environmental factor) rather than simply detecting change.

Baseline (before) data was collected to supplement existing datasets (see **Appendix 3**). Repeated sampling of BACI monitoring sites would be performed over time for the purposes of detecting and quantifying change. This process will evaluate the effectiveness of management activity and, where relevant, provide insight into how the management regime may be adapted to achieve the objectives of the BMP. The following sections outline the methodological and analytical elements of the monitoring program.

5.1.1 Baseline Data

Ecological surveys have been conducted by Eco Resolve (2023-2025), RPS (2021-2024) and Gingra Ecological Surveys (2017-2021) over the EP Area. Fauna surveys have been conducted adjacent to the EP Area in analogous habitat types by BMS (2004-2023) and RPS (2019-2023). Additional fauna surveys (Blue Mountains Water Skink and Giant Dragonfly; MPR, 2026, see Appendix 4) have been conducted to support the existing baseline dataset. These studies form a baseline dataset to inform the scope of future monitoring. Other assessments, such as previous monitoring work for Springvale Mine, have also been used to inform the design of the survey program.

The purpose of monitoring is to evaluate the actual impact of partial extraction mining activities against the performance criteria/ measures specified in the development consent (see **Section 2**). To allow detection of impacts, a baseline monitoring dataset was collected. This baseline data included:

- Revision of vegetation mapping (including THPSS type and extent; see **Section 3.2.3** and **Appendix 3 S13.1**);
- BAM plots (see **Section 3.2.3.1.3** and **Appendix 3 S13.1**);
- Review of threatened flora records (see **Section 3.2.3.3** and **Appendix 3 S13.2**);
- Fauna surveys (see **Section 3.2.3.4** and **Appendix 3 S13.3.1.2**); and
- Aquatic Ecology (see **Section 3.3**).

Locations of baseline monitoring efforts are provided in **Appendix 3** and **Appendix 4**. Monitoring activities will be generally consistent with the sampling methods and locations specified in the above investigations.

5.2 Monitoring Program

Each biodiversity value is to be monitored annually for up to five years after mining. Baseline data was collected across 2021 - 2026 as presented in **Appendix 3**. **Table 16** describes the monitoring stratification, parameters and frequency for each biodiversity value. The monitoring program focuses on detecting potential impacts to the habitats within Management Unit 1 - PCT 3945 Newnes Plateau Shrub Swamp as it is a high priority GDE and TEC and is sensitive to subsidence movements.

It is important to note that thorough fauna monitoring occurs in Clarence Colliery’s 700 (Eastern, Western and Outbye), 800 (Eastern Portion) and 900 Extraction Areas. Considering that the habitat types within the 918 EP Area are analogous, and no mining related changes to fauna populations have been detected (BMS 2023b) as a result of subsidence ≤ 100 mm (which is also expected for the 918 Panel), it is expected that mining impacts to biodiversity under this BMP will yield similar outcomes.

Despite this, annual biodiversity monitoring of two swamp obligate species is proposed, the Giant Dragonfly (*Petalura gigtantea*) and the Blue Mountains Water Skink (*Eulamprus leuraensis*). This BMP focuses on the monitoring of fauna habitats in Management Unit 1 (3945 Newnes Plateau Shrub Swamp) as these are the most sensitive to subsidence (see also **Section 4.1**). Methods and results of previous fauna monitoring within the greater Clarence Colliery Consent Area is provided in **Appendix 3**. Additional monitoring within the EP Area may be warranted in the event of a ‘condition RED’ exceedance in the Trigger Action Response Plan (TARP) as detailed in **Section 5.3**.

Table 16 Monitoring Program

Biodiversity Value	Monitoring locations/ Stratification Units	Monitoring Parameters	Monitoring Frequency
Vegetation communities and threatened species habitat assessments (EECs and GDEs) to assess potential impacts from extraction.	Management Unit 1 - PCT 3945 Newnes Plateau Shrub Swamp. See Apx Table 3 for monitoring locations.	BAM plots (DPE 2020a) to assess vegetation condition	Annually for 5 years

Biodiversity Value	Monitoring locations/ Stratification Units	Monitoring Parameters	Monitoring Frequency
Threatened flora - <i>Boronia deanei</i>	Management Unit 1 – PCT 3945 Newnes Plateau Shrub Swamp. See Section 3.2.3.3 for monitoring locations.	Presence/absence, count and condition assessments supported by photographic monitoring	Annually for 5 years in Spring
Blue Mountains Water Skink (<i>Eulamprus leuraensis</i>)	Management Unit 1 – PCT 3945 Newnes Plateau Shrub Swamp. See Appendix 4 for monitoring locations.	Funnel trapping in areas of suitable habitat relevant to the EP Area in addition to presence/absence through eDNA collection. See S5.2.1 for survey design details	Annually for 5 years conducted October to March
Threatened fauna – Giant Dragonfly (<i>Petalura gigantea</i>)	Management Unit 1 – PCT 3945 Newnes Plateau Shrub Swamp. See Appendix 4 for monitoring locations.	Opportunistic searches in suitable habitat relevant to the EP Area in addition to presence/absence through eDNA collection. See S5.2.2 for survey design details	Annually for 5 years conducted December to January (summer)
Aquatic Ecology (Macroinvertebrates, Water Quality and Site condition).	Larger Creeks with permanent flows within the EP Area (or immediately downstream if permanent water is not sufficiently available in this area). See Section 3.3 for monitoring locations.	Invertebrate species diversity and water quality – pH, EC (In accordance with NSW AUSRIVAS) Riparian-Channel-Environment (RCE) measure of site condition	Annually for 5 years ¹
¹ . For AUSRIVAS standardised sampling purposes, the ‘Autumn’ sample season is defined as March 15 to June 15 and ‘Spring’ is defined as September 15 to December 15.			

5.2.1 Giant Dragonfly (*Petalura gigantea*) survey methodology

Population monitoring for the Giant Dragonfly is to be undertaken annually using opportunistic searches and eDNA sampling methodology as used by MPR (2026); Appendix D. A total of six (6) sampling locations were established during baseline monitoring, with opportunistic searches for adult dragonflies, burrows and exuviate conducted whilst moving between locations in suitable swamp habitat. Sampling locations are located both within, upstream and downstream of the EP Area. Surveys will be undertaken annually during December to January.

Control sites in nearby Barrier Swamp have previously established and monitored for Giant Dragonfly for Springvale Coal Mine, which has underground mining operations adjacent to Clarence Coal Mine within the Newnes Plateau (Springvale Mine, 2016; RPS, 2019-2023). Control data can therefore be obtained from Springvale for the purpose of this BMP. Control locations for Giant Dragonfly are described in **Table 17**.

Table 17 Giant Dragonfly control locations

Swamp	Monitoring location	Easting	Northing
Barrier (Broad)	1	241909	6302791
	2	242087	6303056
	3	242110	6303254
	4	242149	6303456
	5	242054	6303930

5.2.1.1 Environmental DNA (eDNA)

eDNA is to be collected at each sample location using the methodology consistent with **Appendix 4** to provide greater confidence of the presence of the target species, especially in the absence of positive sightings. Note that eDNA sampling for Blue Mountains Water Skink is also done at these sample locations.

5.2.1.2 Data analysis

Species detection data is to be analysed statistically to identify differences in the species presence across monitoring years. The current years monitoring results will be statistically compared to the previous year's results and baseline and control site data. A two-sample *t*-test will be undertaken to identify differences in Giant Dragonfly detections between monitoring years and baseline. If a statistical change ($p < 0.05$) between the current year and either the previous year, baseline and/or control period is identified, then further investigation is warranted under the TARP (see **S4** for Performance Measures and **Appendix 2- TARP**).

5.2.2 Blue Mountains Water Skink (*Eulamprus leuraensis*) survey methodology

Population monitoring for the Blue Mountains Water Skink is to be undertaken annually using the trapping and eDNA methodology as used by MPR (2026); Appendix D. A total of 25 trap locations, consisting of one (1) trap per location were established during baseline monitoring. Traps are located both within, upstream and downstream of the EP Area.

5.2.2.1 Environmental DNA (eDNA)

eDNA is to be collected at each of the six samplings locations established under Giant Dragonfly monitoring methods (see **S5.2.1.1**) using the methodology consistent with **Appendix 4** to provide greater confidence of the presence/absence of the target species, especially in the absence of positive sightings.

5.2.2.2 Population survey method and data analysis

Trapping methodology for Blue Mountains Water Skinks will be broadly undertaken as described in **Appendix 4** to detect changes in population in the EP area. Surveys will be undertaken annually during October to March. An adverse impact on BMWS in the swamps located above mining operations is likely to be expressed by a decline in population size within the impact swamp relative to control swamps, and/or to the surveys in the previous year, including baseline studies.

Control sites in nearby Barrier Swamp have previously established and monitored for Blue Mountains Water Skink for Springvale Coal Mine, which has underground mining operations adjacent to Clarence Coal Mine within the Newnes Plateau (Springvale Mine, 2016; RPS, 2019-2023). Control data can

therefore be obtained from Springvale for the purpose of this BMP. Control locations for Blue Mountains Water Skink are described in Table 17.

Table 18 Blue Mountains Water Skink control location

Swamp	Monitoring location	Easting	Northing
Broad (Barrier)	1 (x15 traps placed approximately 4 – 7 m apart)	242028	6303000

5.2.2.3 Data analysis

The current years monitoring results will be statistically compared to baseline and control sites to detect change. A one-tailed t-test will be used to determine if skink populations are statistically declining (compared to baseline and control) with a level of significance benchmarked at 5% or $p=0.05$. If a statistical change ($p < 0.05$) is identified, then further investigation is warranted under the TARP (see **S4** for Performance Measures and **Appendix 2- TARP**).

5.3 Investigative Monitoring

5.3.1 Fauna

Additional monitoring within the EP Area may be warranted in the event of a 'condition RED' exceedance in the Trigger Action Response Plan (TARP) (see **Section 6** and **Appendix 2**). **Table 19** outlines the proposed survey methods, effort per stratification unit and duration/timing to be performed if a condition RED TARP exceedance is encountered. Survey methods are guided by the following state guidelines:

- NSW Survey Guide for Threatened Frogs A guide for the survey of threatened frogs and their habitats for the Biodiversity Assessment Method (DPE 2020b);
- Threatened reptiles Biodiversity Assessment Method survey guide (DPE 2022c);
- 'Species credit' threatened bats and their habitats NSW survey guide for the Biodiversity Assessment Method (DPE 2021); and
- Threatened biodiversity survey and assessment Guidelines for developments and activities (2004 working draft) (DEC 2004).

Results of investigative monitoring would be interpreted in conjunction with groundwater and subsidence monitoring results to confirm the cause of the detected impact to biodiversity values.

Table 19 Investigative Monitoring Methods, Locations and Timing: Terrestrial Ecology

Management Unit	Biodiversity Value	Survey Method	Survey Effort	Survey Period
2 - Dry Sclerophyll Forest 3 – Swamp Woodland 4 – Montane Heath	Threatened mammals	1 trapline consisting of: - Terrestrial Elliot A traps (25 per line) - Terrestrial Elliot B traps (25 per line) - Arboreal Elliot Trapping (6 per line) - Ultrasonic Bat Detector (1 stratification unit)	One trapline per stratification unit (PCT)	October to February
	Threatened nocturnal mammals and birds	Spotlighting	One 200 m transect per PCT over two nights	Spring/summer
	Threatened nocturnal mammals and birds	Call Playback		Spring/summer
	Threatened diurnal birds	Diurnal Bird Surveys	Four 30 minute point surveys recording species and abundance	Spring/summer
	Threatened amphibians	Aural-visual herpetofauna searches	480 minutes 4 nights	October to March
	Threatened reptiles	Aural-visual herpetofauna searches	480 minutes 4 nights	October to March

5.3.2 Flora

Species with potential to be impacted by subsidence, *Boronia deanei*, are focal species for monitoring (see **Table 16**), however additional monitoring within the EP Area may be warranted in the event of a 'condition RED' exceedance in the Trigger Action Response Plan (TARP) (see **Section 6** and **Appendix 2**).

Table 20 describes the recommended survey times for known threatened flora subject to ongoing monitoring, if a 'condition RED' exceedance in the TARP is triggered in attempt to detect mining-related impacts if in the unlikely event they occur. Future monitoring events may identify additional species required to be monitored, which are to be monitored as per the NSW DCCEEW approved monitoring period (DCCEEW 2025).

Table 20 Flowering periods of threatened flora within the EP Area

Threatened Flora Species	Recommended Survey Time											
	January	February	March	April	May	June	July	August	September	October	November	December
<i>Boronia deanei</i>												
<i>Caesia parviflora var. minor</i>												
<i>Veronica blakelyi</i>												
<i>Persoonia hindii</i>												

5.4 Groundwater Monitoring

The EP has been designed with the intention of minimising impacts to biodiversity and groundwater values by restricting subsidence to within subsidence impact criteria of the Development Consent (DA 504-00), ≤ 100 mm of vertical subsidence (see **Table 14**).

A ground and surface water monitoring program has been developed by Clarence, as detailed in the 918 Panel Water Management Plan (WMP; GHD 2026). The purpose of the WMP is to outline how Clarence will manage and monitor water resources within the EP Area, whilst protecting surrounding waterbodies and their dependent ecosystems in both the short and long term. The WMP describes the systems in place to manage surface and underground water associated with the mining activities at Clarence Colliery. It also describes the monitoring program in place to measure the performance of the water management system.

This BMP will not duplicate the monitoring set out in the 918 EP WMP (GHD 2026).

6 ADAPTIVE MANAGEMENT

With an adaptive management approach, the goal to be achieved is set, so there is no uncertainty as to the outcome. Conditions requiring adaptive management do not lack certainty, but rather they establish a regime which would permit changes within defined parameters to the way the outcome is achieved.

The Centennial Adaptive Management Framework is a process of ongoing testing, learning, monitoring and managing, and relies on:

- Description of the environmental value and its role in the landscape, including aspects of an operation that may result in a significant impact to the environmental value (not all aspects of a project will generate impacts).
- A model of the environmental response to certain management actions/decisions, supported by the description of the environment.
- Mechanisms to test the model.
- Engagement with relevant stakeholders in the description of the environment and development of models, model outcomes and management actions/decisions.
- Identification of clear management objectives for each environmental value.
- The ability to detect change within a set of parameters, before the exceedance of criteria, informing the necessity to change the impact causation such that criteria are not exceeded;
- Monitoring the system using best available technologies and multiple lines of evidence to:
 - Evaluate progress against objectives;
 - Determine the status of the system;
 - Increase understanding of the system; and
 - Refine the modelling where applicable.

To support the above mentioned Adaptive Management Framework, Clarence has developed an Adaptive Management Procedure to avoid repetition of any unpredicted / non-compliant 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 the Extraction Plan and contingency plans (contained within the respective TARPs) in the event that a specific trigger and/or performance indicator is exceeded. It is noted that the most sensitive performance indicator is subsidence monitoring as it acts as a “leading indicator” for any potential environmental consequences to biodiversity given that the predicted and approved levels of subsidence are so small (i.e. ≤ 100 mm).

For clarity, the **Adaptive Management Procedure** consists of:

- Engage subsidence /geotechnical engineer to review and assess subsidence monitoring data. Following review, analysis and recommendation, consider the following potential **Adaptive Management Actions** where applicable to ensure there are no exceedances of DA504-00 subsidence criteria:
 - Review, update, recalibrate the subsidence modelling/predictions (against all available information) to assess the likelihood that subsidence after four sub-panels will remain below the maximum predictions of the Extraction Plan and/or DA504-00 criteria i.e., ≤ 100 mm; and

- In consultation with a suitably qualified and experienced person review panel and sub-panel design and if necessary, modify void / pillar designs for future (unformed) panels.

This will be enacted on a sub-panel by sub-panel basis in accordance with the TARP as required. For example, if the first sub-panel (918A) results in a significant exceedance of subsidence prediction, the subsidence model would be reviewed, updated and calibrated with measured data from 918A extraction, and a revised subsidence prediction for planned mining in the 918 Panel mining area will be established. If the recalibrated subsidence model indicates that the planned mining may exceed the predicted DA504-00 consent criteria i.e., ≤ 100 mm, then planned void widths can be reduced and barrier pillar widths correspondingly increased for subsequent sub-panels. The final Adaptive Management Actions will be confirmed in consultation with a suitably qualified and experienced person

The above adaptive management procedure, coupled with the proposed monitoring program and the TARP provides an added layer of confidence, that in a worst case scenario where mining performance exceeds predictions, the monitoring program will quickly identify non-conformances allowing Clarence to act to ensure subsidence does not exceed 100 mm.

7 MEASURES TO BE IMPLIMENTED TO REMEDIATE POTENTIAL IMPACTS

Due to the minimal subsidence predicted from the 918 Panel partial extraction second workings and mine design criteria the need to implement remediation measures for potential impacts are considered unlikely. Clarence has over 20 years of partial extraction mining experience with ecological monitoring demonstrating an absence of impacts on ecological and habitat values. However, in the unlikely event that there is an impact that requires remediation, Clarence will undertake remediation in consultation with the NPWS, RR, CPHR and DCCEEW.

If:

- (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 a suitable biodiversity offset to compensate for the impact or environmental consequence would be determined to the satisfaction of the Secretary.

8 CONTINGENCY PLAN

A TARP has been developed using the performance indicators for land management (**Appendix 2**). The contingency plan for when 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.

9 ROLES AND RESPONSIBILITIES

The responsibility for implementation, monitoring and review of the BMP lies with the Environment and Community Coordinator. The ultimate responsibility for the implementation of the BMP lies with the Mine Manager, who shall make appropriate resources available. The roles and responsibilities are outlined in **Table 21**.

Table 21 Key Personnel and Accountabilities

Position	Responsibility
Mine Manager	<ul style="list-style-type: none"> Ensuring that sufficient resources are available to implement and execute the requirements of this BMP. Approving changes to the mine design if required as a result of the Adaptive Management Procedure.
Technical Services Manager	<ul style="list-style-type: none"> Ensuring that sufficient resources are available to implement and execute the requirements of this BMP; Reporting triggers/non-conformances to external stakeholders; Ensuring that the mine design is adhered to; Completing the subsidence monitoring as set out in the 918 subsidence Monitoring program; Co-ordinating the End of Sub Panel Reports for submission; Approving revised versions of this BMP; Enact and manage the Adaptive Management Procedure, including outcomes and recommendations, where required;
Environment and Community Coordinator (ECC)	<p>Implementation, monitoring and review of this BMP, including:</p> <ul style="list-style-type: none"> Coordinate environmental monitoring, reporting, inspections, environmental training, authority liaison, maintaining complaints register, community liaison; The implementation and adherence to this BMP; Reporting triggers/non-conformances internally to the Mine Manager as appropriate; Consultation during the review process with relevant stakeholders and distributing this BMP; Coordinating any remediation work as required; Coordinating the generation and submission of formal reporting requirements outlined in this BMP (e.g., Annual Environmental Monitoring Report and the Annual Review); Advising the Technical Services Manager and the Mine Manager regarding the need to employ adaptive management measures based on monitoring results and the TARP; requirements; and Reviewing this BMP.
Mine Surveyor	<ul style="list-style-type: none"> Undertake subsidence monitoring to support the BMP; and Report triggers/non-conformances to the ECC as appropriate.
Ecological Consultant	<ul style="list-style-type: none"> Undertake ecological monitoring to support the BMP; and Report triggers/non-conformances to the ECC as appropriate.

10 REPORTING

Reporting will be completed yearly for the life of this BMP in accordance with the Extraction Plan Guidelines (DPE 2022a), as summarised in **Table 22** below. Reports will be completed by the Environment and Community Coordinator.

An “End of Sub Panel Report” will also be prepared which will summarise relevant monitoring data collected as set out in this BMP.

Following the cessation of five years of annual monitoring under this Biodiversity Management Plan, a report will be submitted to DPHI, NPWS and CPHR. This report will outline if there has been a greater than negligible impact upon any threatened species or otherwise.

Table 22 Reporting Requirements

Report	Trigger	Requirements
Annual Report	Annual Report required under development consent	<p>The Applicant must prepare and submit an Annual Review to the Planning Secretary and the relevant agencies. This report must:</p> <ul style="list-style-type: none"> (a) identify the standards and performance measures that apply to the development; (b) describe the works carried out in the last 12 months; (c) describe the works that will be carried out in the next 12 months; (d) include a summary of the complaints received during the past year, and compare this to the complaints received in previous years; (e) include a summary of the monitoring results for the development during the past year, (f) include an analysis of these monitoring results against the relevant: <ul style="list-style-type: none"> impact assessment criteria; monitoring results from previous years; and predictions in the EIS; (g) identify any trends in the monitoring results over the life of the development; (h) identify any non-compliance during the previous year; and (i) describe what actions were or are being taken to ensure compliance.

Report	Trigger	Requirements
End of Sub Panel Report	Within 1 week of the completion of each sub panel	<p>Present a summary of the relevant Subsidence and environmental monitoring for the relevant sub-panel</p> <p>Provide a preliminary characterisation of any impact exceedances in accordance with the relevant TARP(s) and/or performance measures.</p> <p>Distinguish impact:</p> <ul style="list-style-type: none"> • Subsidence and environmental monitoring within or exceeding predictions; • those which exceed predictions but remain within performance measures and/or performance indicators; and • those which exceed performance measures and/or performance indicators. <p>Report to include:</p> <ul style="list-style-type: none"> • monitoring data analysis; • full description of any subsidence impacts that exceed predictions and/or performance measures; • location identification of unpredicted impacts using aerial photos with mine layout superimposed; • photos of the impact that exceeded predictions; • requirement to implement the Adaptive Management Procedure; and • mine design recommendations
Incident Notification/ Reporting	Any occasion or incident in accordance with consent condition or TARP	The Applicant must immediately notify the Department and any other relevant agencies immediately after it becomes aware of an incident. The notification must be in writing via the Department’s Major Projects portal and identify the development (including the development application number and name) and set out the location and nature of the incident.

11 CONTINUAL IMPROVEMENT AND REVIEW

Clarence will review this Plan within three months of the following:

- a) Submission of an incident report;
- b) Submission of an Annual Review;
- c) Submission of an audit report;
- d) Significant change in mine design/s or layout and/or the Adaptive Management Procedure is enacted; or
- e) Any modification to the conditions of this consent (unless the conditions require otherwise).

Continual improvement shall be achieved through monitoring, internal and external communication with stakeholders, implementation of corrective and preventative actions and through monitoring progress against the objectives included in the environmental management plans. During each report submission, a test of this document will be undertaken through comparing the predicted negligible impacts of subsidence on biodiversity values against actual outcomes.

Each variation to this Plan will be identified in the Document Control Table at the beginning of this document.

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13 APPENDICES

APPENDIX 1- CONSULTATION

Apx Table 1 Summary of Consultation 918-920 panels

Regulator	Summary of consultation	
Regulator	<i>Correspondence</i>	<i>Comments and/or Feedback</i>
NPWS and BCS	Email incl. draft with BMP attachment (21/12/2022).	Noted that BMP will be reviewed once entire EP is received.
	Meeting and presentation on 19/06/2023 introducing the 918-920 EP Area, mining technique, surface features and early monitoring.	Management of the State Conservation Area (SCA) and the proposed recreational infrastructure to be installed as per the Gardens of Stone State Conservation Area Plan of Management. Confirmation that subsidence would be no greater than 100 mm.
	Email incl. draft with BMP attachment (16/11/2023). Document uploaded on the Planning Portal (16/11/2022).	On 11/12/2023, NPWS and BCS noted that feedback would be provided 31/01/2024. On 30/01/2024, NPWS and BCS noted that feedback would be provided 02/02/2024. On 02/02/2024, NPWS and BCS noted that feedback would be provided 09/02/2024.
	Meeting and site visit on 23 rd November 2023.	Detailed presentation on the 918-920 extraction plan including, mining technique/mining methods proposed, justification for the mining technique, subsidence assessments/predictions and modelling calibration, proposed subsidence monitoring, environmental baseline outcomes, followed by site visit. Provision of DA504-00, length of panels confirmed to 1.5 km long, GIS file requirements, confirm land ownership status of a small parcel of land, provision of Lithgow Council pipeline (700 Area).
	Feedback provided by NPWS and BCS on 9 th February 2024.	Various clarifications requested and feedback recommended updates/revisions to the BMP (Appendix 1).
	Response from Clarence to NPWS and BCS providing response to NPWS and BCS Feedback on 20 March 2024.	See Appendix 1 and the relevant Sections of this BMP.
	Feedback provided by NPWS and BCS on 9 th May 2024.	Various clarifications requested and feedback recommended updates/revisions to the BMP (Appendix 1).
DPHI	Regular updates on the progress of the Extraction Plan throughout 2022 and 2023.	Confirmation that subsidence would be no greater than 100 mm. Undertake adequate consultation with relevant stakeholders.

Apx Table 2 Items Raised and addressed during consultation 918-920 panel

Item No.	Matters Raised	Comment and/or where addressed within the BMP
19	Correct the naming errors in the BMP.	Noted and amended.
20a	Revise the BMP to: summarise and discuss the outcomes of all previous ecological surveys and biodiversity monitoring programs to date, including trends, key species and issues arising.	See Appendix 3 .
20b	Revise the BMP to: using the information consolidated from the previous monitoring programs to date. Provide updated baseline values to monitor against.	See Appendix 3 and Section 5 .
20c	Revise the BMP to: provide supporting consolidated spatial data and available reports.	See Figure 4 and Figure 5 Available reports have not been provided, but can be accessed at https://www.centennialcoal.com.au/operations/clarence/ under the tab, Environmental Reporting and compliance. Annual reports contain biodiversity reports. Annual Reports are available for the years 2011 – 2024 at the above mentioned link.
21	Revise the BMP to address the status and land use of the GoS SCA as per section 2A(1)(a)-(d) and section 30G of the <i>National Parks and Wildlife Act 1974</i> .	See Section 3.1.1 .
22	Review the BMP to recategorize the variety of vegetation assemblages within the EP Area into more refined management zones.	See Section 3.2.2 ; Section 3.3.2 ; Section 3.3.3 ; and Section 3.3.4 .
23	Revise the assessment of groundwater dependency and subsidence susceptibility based on the refined management zones and revise the monitoring criteria and protocols for these zones accordingly.	Section 3.3.2 ; Section 3.3.3 ; and Section 3.3.4 .
24	Include all relevant biodiversity data collected across the EP Area, including but not limited to survey data collected by Eco Resolve and RPS.	Appendix 3 ; and Section 3 . Description of the baseline data: <ul style="list-style-type: none"> • Revision of vegetation mapping (including THPSS type and extent; see Section 3.2.3 and Appendix 3 Section 13.1); • BAM plots (see Section 3.2.3.1.3 and Appendix 3 Section 13.1); • Review of threatened flora records (see Section 3.2.3.3 and Appendix 3 Section 13.2) • Fauna surveys (see Section 3.2.3.4 and Appendix 3 Section 13.3.1.2); and • Aquatic Ecology (see Section 3.3).
25	Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features.	See Section 5.2 and Section 5.3 .
26	Provide clarity on how the species list in Table 6 was prepared.	Threatened flora within the EP Area have been characterised from searches on the BioNet database (DCCEEW 2024), RPS's internal database where

Item No.	Matters Raised	Comment and/or where addressed within the BMP
		threatened flora records from previous surveys in the locality have been compiled as well as opportunistic sightings from EcoResolve (EcoResolve 2023) and RPS BAM plots within the EP Area See also Figure 4 .
27	Discuss the sensitivity and susceptibility of threatened flora to subsidence related changes, and how this relates to the proposed monitoring program.	Section 3.2.2; Section 3.2.3.1.3; Section 3.2.3.2; Section 3.3.2; and Section 5.
28	Provide additional survey information for the species listed in Table 8 to demonstrate the level of survey effort that has occurred with the EP Area, and how this has informed the proposed monitoring program.	See Appendix 3 .
29	Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features within the EP area.	See Section 3.2.3.4 and Appendix 3 provides details on previous fauna monitoring within the greater Clarence Colliery Mining Area. Section 3 provides details on the expected levels of subsidence justifying the monitoring effort. Thorough fauna monitoring occurs in Clarence Colliery's 700 (Eastern, Western and Outbye), 800 (Eastern Portion) and 900 Extraction Areas. Considering that the habitat types within the 918 EP Area are analogous, and no mining related changes to fauna populations have been detected (BMS 2023b) as a result of subsidence ≤ 100 mm (which is also expected for the 918 Panel). As such no additional fauna monitoring is detailed for this BMP. Investigative monitoring has been proposed (Section 5.3)) should, in the unlikely event, that performance measures are exceeded as per the Trigger Action Response Plan (TARP) in Appendix 2 .



Gabrielle Allan
Team Leader
Energy, Resources and Industry
Department of Planning, Housing and Infrastructure
E-mail: gabrielle.allan@dpie.nsw.gov.au

Dear Ms Allan

Clarence Coal – Panels 918-920 Extraction Plan

Thank you for your request via the NSW Planning Portal dated 28 March 2024 to the Biodiversity, Conservation and Science Group (BCS) and National Parks and Wildlife Service (NPWS) of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) requesting advice on the Clarence Coal extraction plan for panels 918-920. This advice represents the views of both the BCS Group and NPWS of NSW DCCEEW.

NSW DCCEEW has previously reviewed the extraction plan and supporting documents, providing preliminary advice and recommendations to Centennial Clarence Colliery on 9 February 2024. A copy of this advice was also forwarded to the Department of Planning, Housing and Infrastructure (DPHI). The advice and recommendations of 9 February 2024 should be read in conjunction with this current response.

Our 9 February 2024 advice recommended changing the design of the shortwalls to avoid swamps and major streams. There have been no changes to the proposed panel design in response to our advice.

We note that there have been subsidence exceedances at Clarence Colliery. For example, a technical report provided in Appendix 8 of the extraction plan states that the secondary extraction of 906 panel increased maximum subsidence along the D subsidence line from 104mm to 131mm (SCT 2023). Under Schedule 3 condition 1 of the development consent for DA 504-00, subsidence cannot exceed 100mm. NSW DCCEEW recommends that the extraction plan for panels 918-920 is not approved until this exceedance has been investigated by DPHI.

In addition, the proposed method of shortwall mining has not been tested in the Newnes Plateau. We understand that shortwall mining is a variation on bord and pillar mining that is a form of miniwall or longwall not commonly used in Australia (IESC 2023). Given the untested nature of shortwall extraction and the recorded subsidence exceedances at Clarence Colliery, NSW DCCEEW lacks confidence in subsidence predictions and impact assessment for the shortwall mining technique proposed in the extraction plan.

NSW DCCEEW recommends that no new shortwall, longwall, or miniwall mining occurs under Newnes Plateau shrub swamps and hanging swamps or under major streams.

NSW DCCEEW's recommendations are provided in **Attachment A** and detailed comments are provided in **Attachment B**.

If you have any questions about this advice, please do not hesitate to contact Liz Mazzer Senior Conservation Planning Officer, via liz.mazzer@environment.nsw.gov.au or (02) 6883 5325.

Yours sincerely

A handwritten signature in black ink, appearing to read 'Sarah Carr', written in a cursive style.

Sarah Carr
Director North West
Biodiversity, Conservation and Science

9 May 2024

Attachment A – NSW DCCEEW Recommendations
Attachment B – NSW DCCEEW Detailed Comments

Attachment A

NSW DCCEEW recommendations

Proposal name – Environmental Impact Statement

BCS	Biodiversity, Conservation and Science Group
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, Environment and Water
DPHI	Department of Planning, Housing and Infrastructure
GoS SCA	Gardens of Stone State Conservation Area
IESC	Independent Expert Scientific Committee
NPWS	NSW National Parks and Wildlife Service
NSW DCCEEW	NSW Department of Climate Change, Energy, Environment and Water

Recommendations

- 1.1 Amend the extraction plan (EP) area to avoid secondary extraction under:
 - Newnes Plateau Shrub Swamps (including Lower Nine Mile and Paddy's Creek swamps)
 - Newnes Plateau Hanging Swamps
 - Bungleboori Creek
 - Paddy's Creek, and
 - other highly sensitive environments on Gardens of Stone State Conservation Area
- 2.1 Refer the subsidence predictions for the proposed 918 and 920 shortwalls, along with records of subsidence exceedances, to the Independent Expert Advisory Panel for Mining for independent assessment.
- 2.2 Revise subsidence assessments for the 918 and 920 panels to incorporate the recent subsidence exceedance of 31mm measured on the surface subsidence monitoring line ("D line") because of the extraction of panels 908, 910 and 906.
- 2.3 Investigate subsidence exceedances along D line before any approval of the extraction plan for 918-920 panels.
- 3.1 Refer the project to the Commonwealth DCCEEW for a controlled action determination.
- 4.1 Seek advice from the Independent Expert Advisory Panel for Mining regarding the potential impacts of the proposed extraction on water resources, especially in relation to concerns with inadequate monitoring and subjective monitoring interpretations.
- 5.1 All recommendations of the Independent Auditor (MCW Environmental 2021) should be implemented by Centennial Coal Clarence.
- 5.2 Centennial Coal Clarence should provide:
 - a. the baseline period/dates for all swamp or stream monitoring sites or aquifer monitoring bores affected/potentially affected by mining 918 and 920

-
- b. all reference swamp(s), stream(s) or bore(s) proposed for comparison of stream flows or aquifer levels after mining of 918 and 920 occurs, and
 - c. a before-after control-impact (BACI) assessment of past impacts, and a BACI design to enable objective assessment of impact to swamps, streams and bores above shortwalls 918 and 920.
- 6.1 Provide evidence of an extraction plan being the appropriate approval pathway for this mine layout that includes a change in mining method.

Attachment B

NSW DCCEEW detailed comments

Clarence Coal 918-920 extraction plan

1. The secondary extraction area should avoid sensitive landscape features

The proposed 918 and 920 panels will undermine sensitive landscape features including:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* listed temperate highland peat swamps on sandstone, which include the Newnes Plateau shrub swamp endangered ecological community, and Newnes Plateau hanging swamp.
- major creeks
- other highly sensitive environments on Gardens of Stone State Conservation Area

The extraction plan should be redesigned to avoid secondary extraction under sensitive landscape features.

NSW DCCEEW note that the panels will be extracted using a panel and pillar partial extraction mining method using the shortwall mining technique. Each panel has two sub panels known as 918A, 918B, 920A and 920B. The proposed mining will effectively create an underground void 85m wide, up to 2.3m in height and extend for a distance (length) of up to 1.6km.

For there to be no subsidence (or minimal subsidence) using this technique, the rock above the void will have to span the full width (i.e. 85m) and distance of the longwall (up to 1.6 km) and remain stable in-perpetuity. Even then there is still the potential for subsidence to exceed the approved threshold of 100mm subsidence.

The Gardens of Stone State Conservation Area (GoS SCA) was reserved on 6 May 2022 after the NSW Government made a landmark commitment to strengthen protection of this iconic landscape within the Western Blue Mountains. The GoS SCA has significant natural and cultural values important to the people of NSW, including Newnes Plateau shrub swamps, threatened and scientifically significant terrestrial and aquatic ecosystems, geological formations, major streams of Bungleboori Creek and Paddy's Creek, and important archaeological sites and Wiradjuri cultural values. GoS SCA adjoins the Maiyingu Marragu Aboriginal Place and the Greater Blue Mountains World Heritage Area.

NSW DCCEEW considers that the information provided in the extraction plan on the shortwall mining technique does not adequately consider risk of subsidence interactions with geological structures, and the effects of non-conventional subsidence on the incised drainage lines associated with Bungleboori and Paddy's Creeks.

There is no knowledge base on the threshold levels of subsidence required to promote/activate impacts associated with geological structures using the proposed shortwall extraction technique. Based on our review of the information provided, NSW DCCEEW believe that the likely subsidence impacts present a significant risk to the important and iconic landscape features in the extraction plan area.

NSW DCCEEW recommend that the proposed extraction area be amended to avoid secondary extraction under sensitive and significant landscape features including temperate highland peat swamps on sandstone (which include Newnes Plateau shrub swamps and Newnes Plateau hanging swamps) and major creeks. This could be done by implementing methods similar to the 'adaptive management techniques' as described by Centennial in the extraction plan report.

Modification of the extraction area to avoid these significant values will still allow for extraction of coal, whilst ensuring greater certainty of in-perpetuity protection of natural values and compliance with the DA 504-000 conditions approval, which require that extraction will not result in more than negligible environmental consequences.

Recommendation

1.1 Amend the extraction plan area to avoid secondary extraction under:

- Newnes Plateau Shrub Swamps (including Lower Nine Mile and Paddy's Creek swamps)
- Newnes Plateau Hanging Swamps
- Bungleboori Creek
- Paddy's Creek; and
- other highly sensitive environments on Gardens of Stone State Conservation Area

2. NSW DEECCW lacks confidence in subsidence predictions

NSW DEECCW is concerned that the extraction plan understates the potential impacts of the proposed 918 and 920 shortwalls on the GoS SCA and its natural assets. Impacts may be understated due to:

Untested extraction technique

The proposed method of shortwall mining has not been tested in the Newnes Plateau. The Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (IESC 2023) defines shortwall mining as:

"A variation on bord and pillar mining that is a form of miniwall or longwall but uses a continuous miner to cut the coal on extraction across the shortwall face. It is not currently used in Australia but there are shortwall projects under development".

The untested nature of shortwall mining in Australia, and particularly the Newnes Plateau, means that there may be unpredictable impacts.

Subsidence exceedances at Clarence Colliery

Schedule 3, condition 1 of the development consent for Clarence Colliery (DA 504-00) sets a subsidence limit of 100mm.

There have been subsidence exceedances at Clarence Colliery in areas where the more conservative bord and pillar extraction method is used.

Clarence Colliery has experienced multiple cases of subsidence greater than 100mm, for example:

- At the junction of 609 and 609B panels, the 609 and 609B area was flooded in 2010-2011 and subsidence increased sharply to approximately 100mm, before stabilizing at 110-115mm from 2014 onwards. The surface subsidence monitoring line (the "D Line") was decommissioned in late 2018.
- 612 Panel was extracted in early 2006. 600 Area flooded (2010-2011): approximately 20mm of additional subsidence over 612 Panel. Survey fluctuations over the last decade indicate a maximum of 110mm of subsidence.

- Section 4.3.1 of SCT (2023) identifies that the secondary extraction of 906 panel increased maximum subsidence along D line from 104mm to 131mm. The extraction plan main report does not identify that these exceedances have occurred. In addition, the subsidence assessments supporting the extraction plan (appendixes 5, 6, and 7) have not included up-to-date information about this subsidence exceedance in their subsidence calculations and predictions.

Interaction of subsidence with lineaments

Centennial Coal have presented evidence that directly undermining lineaments in the strata overlying Lithgow Coal seam can cause changes to standing water levels in swamps overlying the lineaments (Centennial Coal 2016, 2019).

This is discussed by the IESC when reviewing the Angus Place Mine extension project (2020), who stated:

- Mining-induced ground movements associated with lineaments (especially those of Types 1 and 2) have impacted swamps. The ability to reliably quantify these potential impacts is crucial, especially as the interaction of subsidence and lineaments can cause non-conventional ground movements that exceed conventional subsidence movements.
- Lineaments are noted to influence and often exacerbate subsidence-related movements and increase impacts to temperate highland peat swamps on sandstone (which include Newnes Plateau shrub swamps and Newnes Plateau hanging swamps) where they intersect a swamp or its recharge source.
- The previous IESC advice noted that these features should be better represented in the groundwater model (IESC 2014).
- Clearer explanation of the implementation of lineaments in the current groundwater model and in the uncertainty analysis is still needed, especially for the characterisation of the different types of lineaments.
- Swamps located above lineaments should be assessed for both long-term and temporary impacts up to at least 2,250m from the nearest longwall.
- Similarly, risks of these impacts should also be assessed where lineaments (especially Types 1 and 2) that may interact with mining-induced ground movements coincide with aquifers (e.g. the Buralow Formation, McHugh 2014) supplying groundwater to THPSS, including hanging swamps.

Section 3.2.5 of the extraction plan identifies that there are no type 1 lineaments projected or predicted within the proposed 918 and 920 panel workings. The predicted type 2 lineament is expected to be evident as in-seam structure and to penetrate the overlying strata to the surface. The extraction plan concludes that this is expected to affect seam level mining conditions but is not predicted to result in anomalous subsidence effects, due to very small ground movements associated with the proposed mining method.

Figure 4 of the extraction plan and figure 3.5b of Appendix 11 show the types of lineaments in the area of the proposed 918 and 920 panels. These show major lineaments in the proposed extraction area that are associated with Pine Swamp, the Lower Nine Mile swamps/Bungleboori Creek and the Paddys Creek Swamps/Paddys Creek.

NSW DEECCW considers that further investigation and review of subsidence predictions by independent experts is required.

In addition, the extraction plan for 918-920 should not be approved before the subsidence exceedance identified in SCT (2023) has been investigated by DPHI.

Recommendations

- 2.1 Refer the subsidence predictions for the proposed 918 and 920 shortwalls, along with records of subsidence exceedances, to the Independent Expert Advisory Panel for Mining for independent assessment.
- 2.2 Revise subsidence assessments for the 918 and 920 panels to incorporate the recent subsidence exceedance of 31mm measured on the surface subsidence monitoring line ("D line") because of the extraction of panels 908, 910 and 906.
- 2.3 Investigate subsidence exceedances along D line before any approval of the extraction plan for 918-920 panels.

3 A controlled action determination should be sought

In our advice of 9 February 2024, NSW DCCEEW recommended that the proposed extraction plan for 918-920 be referred to the Commonwealth DCCEEW to determine whether it is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This is due to the shortwall mining method being a new mining technique that will potentially impact Matters of National Environmental Significance, including temperate highland swamps on sandstone, Blue Mountains water skink, and the adjoining Greater Blue Mountains World Heritage Area.

Section 2.2.4 of the extraction plan provides brief responses to the NSW DCCEEW recommendations, stating:

"Referring to the Commonwealth is not a specific requirement of the Extraction Plan (EP) process. Clarence has consulted with DCCEEW".

The dates and types of consultation with Commonwealth DCCEEW is provided in Appendix 3 of the extraction plan. While Centennial Coal provided presentations to the Commonwealth DCCEEW, there is no indication that the need for referral was discussed.

Recommendation

- 3.1 Refer the project to the Commonwealth DCCEEW for a controlled action determination.

4 NSW DCCEEW lacks confidence in groundwater modelling

The extraction plan is accompanied by a groundwater model report (JBS&G 2023) which has not been validated. While significant effort has been made to develop and revise the groundwater model, the calibration of modelled groundwater to real (observed) groundwater levels remains poor, for example:

- Groundwater model does not measure Burrellow aquifers that support the Newnes Plateau shrub swamps and hanging swamps. Only dedicated piezometers measuring the Burrellow Formation aquifers can do this and Centennial Coal appear to have none in the vicinity of the 918-920 panels. In particular, there are no piezometers currently monitoring the Burrellow aquifers that feed the swamps in the Bungleboori and Paddys Creek catchments.
- Based on JSB&G's Figure 4.28, the model appears to overestimate observed aquifer levels with discrepancies in modelled and observed levels at times being >50m. Since other areas of the extraction plan suggest that the Burrellow Formation is ~50m thick in this area, this could potentially mean that the modelled water level could either be in the Burrellow formation or outside of the Burrellow formation. As such it provides very limited value in

assessing the potential (modelled) impact of the proposed mining at Clarence on aquifers within the Buralow Formation (or elsewhere in the modelling domain).

- There has been no systematic assessment of exactly where the disagreements between modelled and observed aquifer levels occur. The legend for Figure 4.28 simply cites groups of piezometers (Group 1, 2 & 3) but originally did not provide a spatial location to see how many of these are directly related to Clarence workings or whether any may already have been impacted by earlier mining, either at Clarence or elsewhere on the Newnes Plateau.
- Data provided to NPWS (*PiezometerGroupings_GroundwaterModel.csv*), indicates that approximately 129 piezometers have been "omitted" from JBS&G's groundwater model. No explanation has been provided for the reasons for excluding these piezometers, even though some (e.g. CLRP33) appear to be relatively close to the proposed extraction of 918 and 920 panels. The selective inclusion and exclusion of piezometers in the groundwater model needs to be investigated and justified prior to any approval being given to narrow longwall panels 918 & 920.
- Many proposed piezometers are yet to be installed and others have inadequate baseline data to characterise the 'natural' behaviour of the aquifers.

In addition, section 2.3.5 of Strata2 (2023) summarises the results from piezometers at boreholes CLRP 18 and 22, in the vicinity of 908 and 910 panels. Strata2 concludes that noticeable declines in piezometer levels during extraction of panels 908 and 910 were due to bushfire and a declining cumulative rainfall deficit.

NSW DEECCW notes that the obvious declines in aquifer levels at CLRP 18 and 22 occurred during the extraction of panels 908 and 910. There was no decline in the CLRP2 aquifer levels (used here as a reference piezometer) which were generally rising at these times. We also note that:

- The Gospers Mountain fire burnt through the Newnes Plateau in December 2019 and any effects of the fire on aquifer levels should be reflected across all piezometers.
- The effects of cumulative rainfall deficit should also be reflected across all piezometers.

Advice should be sought from the Independent Expert Advisory Panel for Mining regarding the potential impacts of the proposed extraction on water resources.

Recommendations

- 4.1 Seek advice from the Independent Expert Advisory Panel for Mining regarding the potential impacts of the proposed extraction on water resources, especially in relation to concerns with inadequate monitoring and subjective monitoring interpretations.

5 Current monitoring for the 918 and 920 panel area is inadequate

Current monitoring for the 918 and 920 panel area is unlikely to set an adequate baseline to enable monitoring against the consent conditions for DA 504-000. NSW DCCEEW notes that:

- The MCW Environmental (2021) independent audit of Clarence Colliery concluded that impact criteria for surface flows and groundwater baseflow to waterbodies including Marrangaroo Creek, Farmers Creek, Dargans Creek, Wolgan River, Dumbano Creek, Bungleboori Creek, and Wollangambe River have not been quantified.
- Centennial Coal has no groundwater monitoring of the Buralow aquifers in the vicinity of the 918 and 920 panels to enable assessment of impacts to the Buralow aquifers.
- Several piezometers near the 918 and 920 panels are compromised (i.e. no longer functional or yielding unreliable data).

- Adequate baseline information for important surface assets is either absent or lacking in temporal frequency and extent.
- There is no identified or ongoing monitoring of Blue Mountains water skink or giant dragonfly populations in the swamps above the 918 and 920 shortwall panels, to enable assessment of potential impacts to these species.

Recommendations

- 5.1 All recommendations of the Independent Auditor (MCW Environmental 2021) should be implemented by Centennial Coal Clarence.
- 5.2 Centennial Coal Clarence should provide:
 - a. the baseline period/dates for all swamp or stream monitoring sites or aquifer monitoring bores affected/potentially affected by mining 918 and 920
 - b. all reference swamp(s), stream(s) or bore(s) proposed for comparison of stream flows or aquifer levels after mining of 918 and 920 occurs, and
 - c. a before-after control-impact (BACI) assessment of past impacts, and a BACI design to enable objective assessment of impact to swamps, streams and bores above shortwalls 918 and 920.

6 Evidence of appropriate approval pathway should be provided

In our advice on 9 February 2024, NSW DCCEEW recommended consultation with DPHI on the appropriate approval pathway given the change in mining method is inconsistent with the approval conditions required as part of MOD7 to DA504-00.

The Panel and Pillar Partial Extraction (PPPE) method using shortwall mining techniques as currently proposed is not consistent with the 'partial pillar extraction' method identified under the MOD 7 assessment report for DA504-00 (DPIE, 2021) (page 8). The change in mining method has been outlined by Clarence Colliery's own subsidence modelling reports as justification as why additional subsidence modelling is required (Zhang, 2023).

The consultation Clarence Colliery has performed for this extraction plan is outlined in Appendix 3 of the Extraction Plan Report. While Clarence has outlined the consultation process with NSW DPHI (then NSW Department of Planning and Environment) including presentations and emails, there is no evidence that this includes discussion of the appropriate approval pathway or reasoning why NSW DPHI considers the proposed Panel and Pillar Partial Extraction method the same as the approved Partial Pillar Extraction method.

Recommendations

- 6.1 Provide evidence of an extraction plan being the appropriate approval pathway for this mine layout that includes a change in mining method.

References

Centennial Coal (2016). *Springvale Mine Extraction Plan Longwall 419 – Preamble*. July 2016.

Centennial Coal (2019) *Angus Place Mine Extension Project Amendment Report*. 6 December 2019.

DPIE (2021). *Clarence Colliery Modification 7 - Addition of Extraction Plan condition*. State Significant Development Modification Assessment (DA504-00 MOD 7). NSW Department of Planning, Industry and Environment. October 2021.

IESC (2020). *Advice to decision maker on coal mining project IESC 2020-113: Angus Place Mine Extension Project (EPBC 2013/6889 and SSD 5602) – Expansion*.

<https://iesc.environment.gov.au/system/files/iesc-advice-angus-place-2020-113.pdf>

IESC (2023) *Information Guidelines Explanatory Note: Subsidence associated with underground coal mining*. Commonwealth of Australia, 2023.

JBS&G (2023) *Clarence Colliery Pty Ltd 918-920 Extraction Plan Groundwater Model Report 15 November 2023* JBS&G61645-149994/R01Rev0

MCW Environmental (2021). *Independent Environmental Audit 2020 Clarence Colliery*. January 2021

SCT (2023). *High level review of likely subsidence and groundwater impacts from mining 918-920 panels, Clarence Colliery*. SCT Operations Pty Ltd ref CLR5492C

Strata2 (2023) *Clarence Colliery Geotechnical Design and Subsidence Report for the 918 and 920 Panels*. September 2023 Report No: CLA-053-Rev5

Zhang, C. (2023). *Numerical modelling assessment of mine subsidence related to shortwall extractions*. University of New South Wales (UNSW). Report No. 2023CL01. July 2023.



Your ref: PAE-65013970, PAE-65013963 & PAE-64848465

Our ref: DOC23/1056964

Mr Christopher Armit
Approvals Coordinator
Centennial Clarence Colliery
christopher.m.armit@centennialcoal.com.au

Dear Chris

Clarence Coal Panels 918 – 920 Extraction Plan

Thank you for your submissions on 16, 18, 19 and 22 November 2023 and 10 January 2024 to the Biodiversity, Conservation and Science Group (BCS) and National Parks and Wildlife Service (NPWS) of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) requesting advice on the draft Clarence Coal Extraction Management Plan (EP) for panels 918 – 920 and supporting sub-plans, as required by the project consent. This response includes comments from both BCS and NPWS.

The following management plans and monitoring plans were submitted for NSW DCCEEW consultation:

- Extraction Plan
- Built Features Management Plan
- The Land Management Plan
- Water Management Plan
- Public Safety Management Plan
- Biodiversity Management Plan
- Subsidence Monitoring Program and supporting modelling reports and reviews

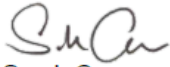
The submission on 10 January 2024 related to the Public Safety Management Plan and Built Features Management Plan. NPWS provided comment on these two plans in April 2023. NPWS has completed its review against its prior comments and advise that there are no additional specific comments on these plans at this time.

We recommend that you prepare an updated extraction plan that incorporates the recommendations listed in **Attachment A** and our detailed comments which are provided in **Attachment B**.

NSW DCCEEW are happy to meet to discuss our comments and recommendations prior to the formal submission of the EP and supporting sub-plans to the Department of Planning, Housing and Infrastructure (DPHI).

If you have any further questions about our advice, please contact Samantha Wynn, Senior Team Leader Planning North West, Biodiversity Conservation Division, on 6868 3565 or at rog.nw@environment.nsw.gov.au.

Yours sincerely



Sarah Carr

**Director North West
Biodiversity, Conservation and Science Group**

9 February 2024

Enclosure

1. Attachment A – DCCEEW Summary of Recommendations
2. Attachment B – DCCEEW detailed comments EP panels 918 - 920

cc: DPHI Jessie Evans: jessie.evans@planning.nsw.gov.au
NPWS Ange Lonergan: ange.lonergan@npws.nsw.gov.au



NSW DCCEEW Summary of Recommendations

Clarence Coal Panels 918 – 920 Extraction Plan

BC Act	<i>Biodiversity Conservation Act 2016</i>
BCS	Biodiversity, Conservation and Science Group
BMP	Biodiversity Management Plan
CEEC	Critically Endangered Ecological Community
Commonwealth DCCEEW	Commonwealth Department of Climate Change, Energy, the Environment and Water
DPHI	Department of Planning, Housing and Infrastructure
DPIE	Department of Planning, Industry and Environment (<i>now known as DPHI</i>)
EEC	Endangered Ecological Community
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
EP	Extraction Plan for panels 918 - 920
GoS SCA	Gardens of Stone State Conservation Area
GBMWA	Greater Blue Mountains World Heritage Area
LMP	Land Management Plan
MNES	Matters of National Environmental Significance
MYC	Mount York Claystone
NPHS	Newnes Plateau Hanging Swamps
NPSS	Newnes Plateau Shrub Swamps
NPWS	National Parks and Wildlife Service
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
PPPE	Panel and Pillar Partial Extraction
SMP	Subsidence Monitoring Program
TARP	Trigger Action Response Plan
THPSS	Temperate Highlands Peat Swamp on Sandstone (as EPBC Act listed)
WMP	Water Management Plan

NSW DCCEEW recommendations on the draft Extraction Plan and supporting plans

Panels 918 – 920 Draft Extraction Plan (EP)

1. Consult with DPHI on the appropriate approval pathway for a change to the approved mining method.
2. Refer the project to the Commonwealth DCCEEW for a controlled action determination.
3. Amend the EP area to avoid secondary extraction under:
 - Newnes Plateau Shrub Swaps (NPSS)
 - Newnes Plateau Hanging Swamps (NPHS)
 - Temperate Highlands Peat Swamp on Sandstone (THPSS)
 - Pine Swamp
 - Nine Mile Swamp
 - Bungleboori Creek
 - Paddy's Creek; and
 - other highly sensitive environments on Gardens of Stone State Conservation Area (GoS SCA).
4. Revise the EP to provide:
 - a) Details of the risk, or margin of risk, of subsidence induced cracking impacts on the Mount York Claystone (MYC)
 - b) Detail on the roof and floor strata, and how this will impact long term stability and contribute to keeping subsidence within approved limits
 - c) An evidence-based discussion on the horizontal movements within 50m, and between 50m and 150m, of the panel boundaries. This should include an analysis of the risk of fracturing and interactions of geological faults and lineaments.
5. Revise the Environmental Monitoring Program to be consistent with all sub-plans. This should include recognition of threatened species, populations, ecological communities and groundwater dependent ecosystems.

Panels 918 – 920 Water Management Plan (WMP)

6. Revise the EP to provide an assessment on the environment consequence to swamps and groundwater dependent ecosystems resulting from predicted groundwater declines in the water tables. This should include individual assessments for the natural features raised in this response.
7. Revise the EP and Biodiversity Management Plan to clearly detail how groundwater declines and environmental consequences for groundwater dependent natural features will be monitored.
8. Implement the recommendations of the Independent Auditor (MCW Environmental 2021).
9. Provide additional detail on intended discharges to the Wollangambe River and impacts to biodiversity.

Panels 918 – 920 Subsidence Monitoring Program (SMP)

10. Clarify the 900 Subsidence Management Plan boundary area and provide the supporting ArcGIS compatible spatial data.
11. Seek approval from NPWS as the landowner prior to selecting the final Global Navigation Satellite System (GNSS) monitoring locations.
12. Clarify the installation location of the GNSS units to the south east, and justify why monitoring is not proposed outside the 26.5-degree angle of draw in other locations.
13. Revise the SMP to include:
 - a) additional subsidence monitoring crosslines for Bungleboori Creek and Paddy's Creek swamps
 - b) provide justification of the pillar geotechnical monitoring proposed and ensure clear triggers are imbedded in the Trigger Action Response Plan (TARP), especially around subsidence and fracturing that may affect the MYC.
14. Revise the SMP to identify the key target areas and provide a detailed visual subsidence inspection methodology and program.
15. Update the TARP to include 'span flexibility' or similar, to allow spans to be reduced if impacts occur that are not expected.

Panels 918 – 920 Subsidence Modelling Reports

16. Provide additional information to support and justify the conclusions of the Strata2 subsidence modelling, including:
 - a) address the risk of failure and existing evidence of strain concentration at the MYC horizon (or other formations – i.e., Caley Formation) and potential impact on hydrology
 - b) specify the extent of the 'Fractured Zone' for the mine layout that is being proposed and its impact on swamp or surface rock formations
 - c) clarify if the EP area is subject to a persistent fault zone.
17. Define and link model outcomes to justify compliance with the environmental consequence required by Schedule 3, condition 2 of DA 504-00 as part of the subsidence predictions.
18. Provide additional information to support and justify the conclusions of the UNSW subsidence modelling, including:
 - a) provide tilt and strain predictions
 - b) confirm the risk to the MYC layer, providing for the preferred scenario that will avoid all potential impacts to the MYC
 - c) confirm the risk of joint opening, slipping and shearing occurring during the proposed mining operations
 - d) confirm how the model has addressed overburden strata conditions and detail the level of risk attached to pillar failure
 - e) detail the risk and magnitude of impacts attached to pillar failure and what that would look like in terms of subsidence and environmental consequences for GoS SCA.

Panels 918 – 920 Biodiversity Management Plan (BMP)

19. Correct the naming errors in the BMP.
20. Revise the BMP to:

- a) summarise and discuss the outcomes of all previous ecological surveys and biodiversity monitoring programs to date, including trends, key species, and issues arising
 - b) using the information consolidated from previous monitoring programs to date, provide updated baseline values to monitor against
 - c) provide supporting consolidated spatial data and available reports.
21. Revise the BMP to address the status and land use of the GoS SCA as per section 2A(1)(a)-(d) and section 30G of the *National Parks and Wildlife Act 1974*.
 22. Revise the BMP to recategorise the variety of vegetation assemblages within the EP area into more refined management zones.
 23. Revise the assessment of groundwater dependency and subsidence susceptibility based on the refined management zones and revise the monitoring criteria and protocols for these zones accordingly.
 24. Include all relevant biodiversity data collected across the EP area, including but not limited to survey data collected by Eco Resolve and RPS.
 25. Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features.
 26. Provide clarity on how the species list in Table 6 was prepared.
 27. Discuss the sensitivity and susceptibility of threatened flora to subsidence related changes, and how this relates to the proposed monitoring program.
 28. Provide additional survey information for the species listed in Table 8 to demonstrate the level of survey effort that has occurred with the EP area, and how this has informed the proposed monitoring program.
 29. Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features within the EP area.

Panels 918 – 920 Land Management Plan (LMP)

30. Include further detail and definition on the natural features which form part of the LMP monitoring framework.
31. Clarify the presence of cliffs, minor cliffs, pagodas, steep slopes and gorges, and provide an assessment of their value and sensitivity to subsidence.
32. Provide further definition on the steep slopes and cliffs in the south and western parts of the EP area. If these features are not considered to be gorges, provide justification behind this determination.
33. Define environmental consequence and provide relevant benchmark or baseline information.
34. Provide more detail to justify the assignment of the low-risk ratings.
35. Revise application of colour grading to ensure that features can be easily distinguished.
36. Update the TARP to include environmental triggers related to the LMP.
37. Update the TARP to indicate adaptive management approaches if consequences are high. This should include measures to stop operations until matters are resolved.

NSW DCCEEW Detailed Comments and Recommendations

Clarence Coal Panels 918 – 920 Extraction Plan

Panels 918 – 920 Extraction Plan Main Report

Change to the mining method may not be consistent with DA Approval 504-00

Modification 7 of the consent for SSD DA 504-00 added condition 2 to the development consent requiring an EP for all second workings that were not covered by an existing approved subsidence management plan.

In their decision report, the Department of Planning, Industry and Environment (DPIE) states:

“The Department also notes that the DA504-00 identifies areas proposed for first workings (bord and pillar mining only) and second workings (partial pillar extraction) and any submitted EPs would need to be consistent with the approved mining method.”

The proposed EP will use a Panel and Pillar Partial Extraction (PPPE) method with shortwall mining techniques. NSW DCCEEW is of the view that this is not consistent with the ‘partial pillar extraction’ method as currently approved under SSD DA 504-00. Additionally, it remains unclear if a complete change of method would be in accordance with the DA approval.

The UNSW Subsidence Report states that the PPE method is a new mining technique, as evidenced in the following statements:

“This report presents a 2D numerical modelling approach to assess the subsidence of the new mining technique “.

“Considering the change of mining method, geotechnical assessments of some of the key issues will help improve the understanding of the interactions of the panel and pillar extractions and the overburden strata behaviour.”

NSW DCCEEW recommend that DPPI be consulted on the appropriate approval pathway for the proposal, as a project modification may be required.

Recommendation

1. Consult with DPPI on the appropriate approval pathway for a change to the approved mining method.

A controlled action determination should be sought

The proposed variation to a new mining method (similar to narrow longwalls) under the Clarence 918/920 EP has the potential to impact matters of national environmental significance (MNES). NSW DCCEEW recommends referral to the Commonwealth Department of Climate Change, Energy, the Environment and Water (Commonwealth DCCEEW) to determine whether it should now be considered a controlled action under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act).

Recommendation

2. Refer the project to the Commonwealth DCCEEW for a controlled action determination.

The secondary extraction area should be amended to reduce risk to protected landscape features

NSW DCCEEW note that the panels will be extracted using the partial extraction Panel and Pillar Partial Extraction (PPPE) mining method using the shortwall mining technique. Each panel has two sub panels known as 918A, 918B, 920A and 920B. The proposed mining will effectively create an underground void 85m wide, up to 2.3m in height and extend for a distance (length) of up to ~1.6km.

For there to be no subsidence (or minimal subsidence) using this technique, the rock above the void will have to span the full width (i.e. 85m) and distance of the longwall (up to 1.6 km) and remain stable in-perpetuity. Even then there is still the potential for subsidence to exceed the approved threshold of <100mm subsidence. NSW DCCEEW note that the Extraction Plan (EP) documents subsidence exceedances of >100mm with the more conservative bord and pillar and partial extraction methods used recently at Clarence. The proposal to implement a less conservative proposed method raises concern on the likelihood of subsidence exceedances.

The Gardens of Stone State Conservation Area (GoS SCA) was reserved on 6 May 2022 after the NSW Government made a landmark commitment to strengthen protection of this iconic landscape within the Western Blue Mountains. The GoS SCA has significant natural and cultural values important to the people of NSW, including Newnes Plateau Shrub Swamps (NPSS), threatened and scientifically significant terrestrial and aquatic ecosystems, geological formations, major streams of Bungleboori Creek and Paddy's Creek, and important archaeological sites and Wiradjuri cultural values. GoS SCA adjoins the Maiyingu Marragu Aboriginal Place and the Greater Blue Mountains World Heritage Area (GBMWhA).

NSW DCCEEW considers that the information provided in the EP on the PPPE technique does not adequately consider risk of subsidence interactions with geological structures, and the effects of non-conventional subsidence on the incised drainage lines associated with Bungleboori and Paddy's Creeks.

While subsidence is likely to be lower at Clarence than at Springvale or Angus Place mines, there is no knowledge base on the threshold levels of subsidence required to promote/activate impacts associated with geological structures using the proposed shortwall extraction technique. Based on our review of the information provided, NSW DCCEEW believe that the likely subsidence impacts present a significant risk to the important and iconic landscape features in the EP area.

NSW DCCEEW recommend that the proposed extract area be amended to avoid secondary extraction under:

- NPSS
- Newnes Plateau Hanging Swamps (NPHS)
- Temperate Highlands Peat Swamp on Sandstone (THPSS)
- Bungleboori Creek
- Paddy's Creek
- Pine Swamp
- Nine Mile Swamp; and
- other highly sensitive environments on GoS SCA.

Modification of the EP area to avoid these significant values will still allow for extraction of coal, whilst ensuring greater certainty of in-perpetuity protection of natural values and compliance with the DA 504-000 conditions approval, which require that extraction will not result in more than negligible environmental consequences.

Recommendation

3. Amend the EP area to avoid secondary extraction under:

- Newnes Plateau Shrub Swamps (NPSS)
- Newnes Plateau Hanging Swamps (NPHS)
- Temperate Highlands Peat Swamp on Sandstone (THPSS)
- Pine Swamp
- Nine Mile Swamp
- Bungleboori Creek
- Paddy's Creek; and
- other highly sensitive environments on Gardens of Stone State Conservation Area (GoS SCA).

Further details of the risks associated with the proposed mine design should be provided

The EP and the modelled outcomes in assigning the panel width of 85m claims to be based on long-term stability of the Burra-Moko head sandstone, resulting in the certainty in the protection of the Mount York Claystone (MYC) (i.e. remain intact) and protection of sensitive surface features and minimisation of surface subsidence expression.

Overall modelling confirmed that height of fracturing associated with the panels would only extend to the base of the MYC, although in some modelling scenarios fracturing extended into the MYC. There is no discussion of risk to the MYC or margin of risk provided in the subsidence reports. In the absence of data on which to base long-term behavioural outcomes, the EP provides insufficient evidence to support the statement.

In addition, the EP discussion on condition and fracturing uses a discontinuous modelling approach simulating overburden behaviours, as modelled and validated against data held by Clarence Colliery. The information provided around surface subsidence, rock mass failures, and stress changes in pillars does not seem to cover condition of the floor as it relates to the panels, nor any periodic weighting potential. Noting that the EP mentions that the immediate (undefined in the EP) roof strata of the seam consisted of interbedded sandstone and siltstone (as the Caley Formation), the floor is noted to vary in composition.

Previous publications on Clarence Colliery by Aspermont 2005 stated that the roof strata are “*excellent for development, but not ideal for longwalling*”¹. Given the IESC (2023)² define shortwall mining as “*A variation on bord and pillar mining that is a form of miniwall or longwall*”, details of the roof and floor conditions are an extremely important part of the EP.

Finally, the EP states that the application of PPPE allows for limited caving or fracturing heights, so vertical subsidence is deemed minimal (typically ~60mm in the long-term based on Strata2 and 87mm based on UNSW subsidence modelling). This analysis indicates that there will be little redistribution of horizontal stress or associated strain, and thus horizontal displacement will occur at the surface.

The EP provides no discussion on the effects of the likely 10-15mm of horizontal movement typically recorded within 50m of the panel boundary, reducing to 5-10mm between 50 and 150m from the panel boundary. The EP should assess the horizontal movement, risk of fracturing, and influence on the geological faults and lineaments present in the EP area.

¹ Aspermont (2005) Australian Longwall Magazine. Accessed via <https://www.miningmonthly.com/markets/international-coal-news/1268650/longwall-bane-bord-pillar-boon>

² IESC (2023) Information Guidelines Explanatory Note: Subsidence associated with underground coal mining, Commonwealth of Australia, 2023.

Recommendation

4. Revise the EP to provide:
 - a) details of the risk, or margin of risk, of subsidence induced cracking impacts on the Mount York Claystone (MYC)
 - b) detail on the roof and floor strata, and how this will impact long term stability and contribute to keeping subsidence within approved limits
 - c) an evidence-based discussion on the horizontal movements within 50m, and between 50m and 150m, of the panel boundaries. This should include an analysis of the risk of fracturing and interactions of geological faults and lineaments.

The Environmental Monitoring Program should be updated to include biodiversity values listed in other management plans

The Environmental Monitoring Program only identifies one Endangered Ecological Community under the *Biodiversity Conservation Act 2016* (BC Act) as being located in the EP area, namely Newnes Plateau Shrub Swamp. No other biodiversity values are discussed in the Environmental Monitoring Program, despite other values being identified in the Water Management Plan and Biodiversity Management Plans.

Recommendation

5. Revise the Environmental Monitoring Program to be consistent with all sub-plans. This should include recognition of threatened species, populations, ecological communities and groundwater dependent ecosystems.

Panels 918 – 920 Water Management Plan (WMP)

An assessment on the environmental consequence to swamps and groundwater dependent ecosystems should be provided

NSW DCCEEW is concerned about the likely variations to the water table level, groundwater and pressure in the aquifers/aquifers above the EP area. The ground water modelling presented in the EP indicates a small and transitory decline in the water tables associated with:

- THPSS
- Groundwater dependent ecosystems such as:
 - Pine Swamp
 - Nine Mile Swamp
 - Paddy's Creek Swamp
 - Lower Nine Mile Swamp
- Groundwater-surface water interaction within the Bungleboori Creek catchment.

The EP does not provide explanation on the likely environmental consequence of the groundwater declines for the above listed natural features. It also does not outline how this will be monitored as required by the DA 504-00 approval under Schedule 3, Section 2(g)(iii).

NSW DCCEEW note the recommendations of the Independent Auditor (MCW Environmental 2021³), and recommend that the WMP be updated to include reference to and implementation of:

³ MCW Environmental 2021. Independent Environmental Audit 2020 Clarence Colliery January 2021
MSEC (2015) Mine Subsidence Consulting Engineering Peer Review of Report on Subsidence Predictions and Impact Assessments for Airly Mine 18th March 2015

- a) the baseline period/dates for all swamp or stream monitoring sites or aquifer monitoring bores affected/potentially affected by mining 918/920;
- b) all reference swamp(s), stream(s) or bore(s) proposed for comparison of stream flows or aquifer levels after mining of 918/920 occurs; and
- c) a BACI assessment of past impacts and a BACI design going forward for objective assessment of impact to swamps, streams or bores above 918/920 (and to support the objective verification of the agreement with impact predictions and Approval performance measures).

Recommendations

6. Revise the EP to provide an assessment on the environment consequence to swamps and groundwater dependent ecosystems resulting from predicted groundwater declines in the water tables. This should include individual assessments for the natural features raised in this response.
7. Revise the EP and Biodiversity Management Plan to clearly detail how groundwater declines and environmental consequences for groundwater dependent natural features will be monitored.
8. Implement the recommendations of the Independent Auditor (MCW Environmental 2021).

Discharges of intercepted groundwater to the Wollangambe River should be discussed

NSW DCCEEW note that Clarence Colliery LDP002 introduces a high volume, point source of pollution to the Upper Wollangambe River. Clarence Colliery is currently discharging ~20 ML/day (or ~8 Olympic swimming pools per day) into the Wollangambe River under Environment Protection Licence 726 (EPL 726) administered by the NSW Environment Protection Authority (EPA). The discharge then flows downstream into the GBMWA approximately 1.5km downstream.

NSW DCCEEW also note that Clarence Colliery has regularly exceeded EPL 726 licence limits, particularly for Zinc, Nickel and Cobalt (MCW Environmental 2021⁴), and at this time continue to discharge to the Wollangambe River. Additional groundwater will be intercepted as a result of 918/920 longwalls. Clarification should be provided on the intention to continue discharge to the Wollangambe River including but not limited to volumes, quality, and impacts to biodiversity, including impacts to the GBMWA, as a result of the EP proposal.

Recommendations

9. Provide additional detail on intended discharges to the Wollangambe River and impacts to biodiversity.

Panels 918 – 920 Subsidence Monitoring Program (SMP)

The subsidence management plan boundary requires clarification

NSW DCCEEW have identified what appear to be a discrepancy between our orthorectified 900 Subsidence Management Plan boundary and the one provided directly by Centennial as part of the EP (Figure 1).

⁴ MCW Environmental 2021. Independent Environmental Audit 2020 Clarence Colliery January 2021
MSEC (2015) Mine Subsidence Consulting Engineering Peer Review of Report on Subsidence Predictions and Impact Assessments for Airly Mine 18th March 2015

The NSW DCCEEW orthorectified 900 Subsidence Management Plan boundary matches that illustrated by DPIE (2021⁵) whereas Centennial's Subsidence Management Plan boundary does not. Clarification of the Subsidence Management Plan 900 area should be provided, in addition to the provision of the supporting ArcGIS compatible spatial data.

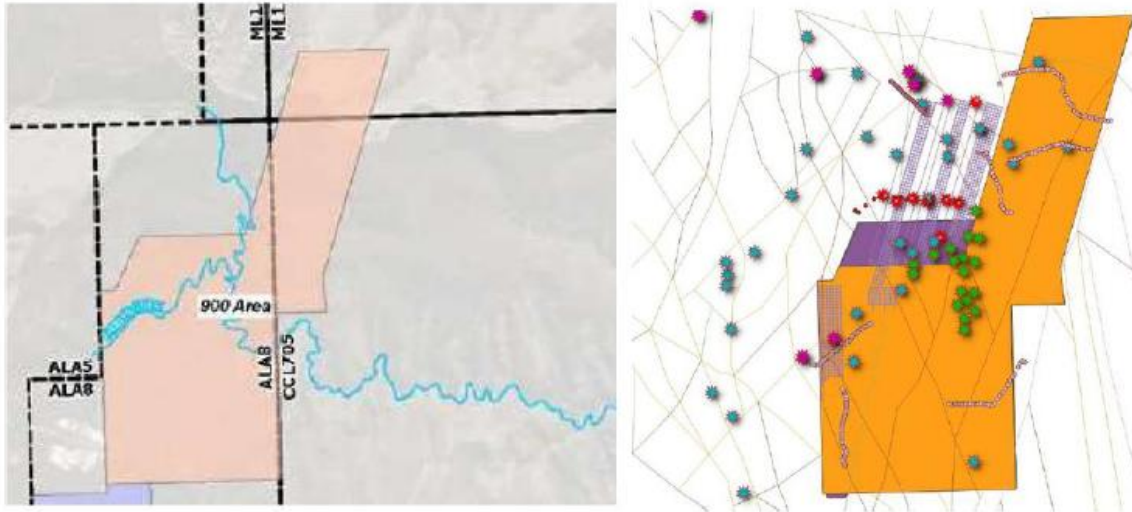


Figure 1 Comparison of approved Subsidence Management Plan boundary from DPIE 2021 (left) to orthorectified boundary held by DCCEEW in purple and boundary provided by Centennial Coal in orange (right).

Recommendation

10. Clarify the 900 Subsidence Management Plan boundary area and provide the supporting ArcGIS compatible spatial data.

The placement of additional GNSS units will require NPWS approval

NSW DCCEEW note the proposed locations of the 18 planned Global Navigation Satellite System (GNSS) units. Placement of the units will require NPWS approval as the landowner subject to the locations facilitating appropriate measurements.

Section 8.1.6 of the SMP states that GNSS monitoring sites will be established to the southeast of the 918 and 920 panels. This will include sites outside the 26.5-degree setback of mine workings – angle of draw, which will be used to measure non-conventional subsidence movements. There is no discussion or justification on the location selected, or why monitoring outside the 26.5-degree angle of draw is not being considered in other directions (i.e. north west).

Recommendations

11. Seek approval from NPWS as the landowner prior to selecting the final GNSS monitoring locations.
12. Clarify the installation location of the GNSS units to the south east, and justify why monitoring is not proposed outside the 26.5-degree angle of draw in other locations.

⁵ DPIE (2021) *Clarence Colliery Modification 7 Addition of Extraction Plan condition State Significant Development Modification Assessment (DA 504-00 MOD 7)*

Additional monitoring is required to assess subsidence

NSW DCCEEW remains concerned about the adequacy of the proposed subsidence monitoring and its ability to properly register subsidence in the EP area in relation to the swamps and waterways on GoS SCA.

To improve the adequacy of the monitoring program to detect upsidence and valley closure we recommend additional subsidence crosslines be established for Bungleboori Creek and Paddy's Creek swamps. This will enable monitoring of non-conventional subsidence movements and ensure subsidence in the EP area will not exceed the approved threshold of <100mm.

NSW DCCEEW recognises that proposed pillar geotechnical monitoring is planned which includes remote reading extensometers in the 918-panel pillar. The EP should justify the proposed location of the pillar monitoring, its link with the surface subsidence monitoring, and its ability to detect subsurface fracturing (for example fracturing of the MYC) and subsidence in the EP area.

Recommendation

13. Revise the SMP to include:

- a) additional subsidence monitoring crosslines for Bungleboori Creek and Paddy's Creek swamps
- b) provide justification of the pillar geotechnical monitoring proposed and ensure clear triggers are imbedded in the Trigger Action Response Plan (TARP), especially around subsidence and fracturing that may affect the MYC.

A visual subsidence inspection program should be provided

Section 8.1.3 of the SMP details that walkover subsidence inspections will occur, guided by the subsidence and environmental monitoring within key target areas (target areas are not specified). It also states that opportunistic walkover inspections and observations will be undertaken by mine personnel and contractors during routine monitoring visits within the EP area.

The above approach to visual subsidence inspections is vague, with no detail on the method, targets, frequency or reporting procedure of inspections. A robust visual inspection method and program of visual inspections is recommended to ensure early detection of issues.

Recommendation

14. Revise the SMP to identify the key target areas and provide a detailed visual subsidence inspection methodology and program.

The adaptive management plans should be updated to address panel width flexibility

The adaptive management plans associated with subsidence do not currently discuss or take advantage of the flexibility of panel width that is available with the proposed mining method. Inclusion of this in the TARP is recommended to take advantage of reducing panel spans to manage unexpected impacts.

Recommendation

15. Update the TARP to include 'span flexibility' or similar, to allow spans to be reduced if impacts occur that are not expected.

Panels 918 – 920 Subsidence Modelling Reports

Additional information should be provided to support the Strata2 modelling

NSW DCCEEW remains concerned about the application of the extraction models with their inherent limitations to justify the significant variation in mining method proposed. This includes the inherent risks from both surface and sub-surface fracturing leading to adverse impacts on aquifer integrity and hydrology. The shallow groundwater aquifer system is critical for the persistence of natural surface values in the GoS SCA.

Although the Katoomba Seam is separated from the MYC by 110m to 120m as part of the EP area, fracturing is still a consideration as the MYC forms the boundary between the shallow and deep groundwater systems. Section 2.3.4 of the Strata 2 modelling report (Strata2 2023⁶) defines the fractured zone at between 42m and 66m, based on an extraction height of 2m, but does not discuss the extent of the fractured zone or subsurface risks associated. It is not clear if the model has included faults or risk associated sheared joints. Strata2 assesses potential risks based on the performance criteria of <100mm of vertical subsidence as a worst-case scenario. However, the model provides no nexus with environmental consequences required by Schedule 3, condition 2 of the DA 504-00 consent.

Recommendations

16. Provide additional information to support and justify the conclusions of the Strata2 subsidence modelling, including:
 - a) address the risk of failure and existing evidence of strain concentration at the MYC horizon (or other formations – i.e., Caley Formation) and potential impact on hydrology
 - b) specify the extent of the 'Fractured Zone' for the mine layout that is being proposed and its impact on swamp or surface rock formations
 - c) clarify if the EP area is subject to a persistent fault zone.
17. Define and link model outcomes to justify compliance with the environmental consequence required by Schedule 3, condition 2 of DA 504-00 as part of the subsidence predictions.

Additional information should be provided to support the UNSW modelling

The UNSW modelling report (UNSW 2023⁷) has not provided tilt and strain predictions which are critical in demonstrating compliance with the DA 504-00. In addition, the UNSW modelling has confirmed a potential for fracturing to extend above the MYC. In the BMP the results from these modelling reports acknowledge that impacts to the MYC will likely have impacts on biodiversity values.

There is no clear information on the variability of influence on subsidence, only a statement that the results show other formations may have a higher impact on the maximum subsidence, with joint opening, slipping and shearing. NSW DCCEEW is concerned that, with progressive movements of the overburden strata, this may be more likely to occur.

The data provided on stress changes in the proposed mining pillars are only provided as estimates in the models. Pillar stress may incrementally increase during sub panel extraction. The modelling provided does not consider possible overburden strata conditions.

⁶ Strata2 (2023) CLARENCE COLLIERY Geotechnical Design and Subsidence Report for the 918 and 920 Panels SEPTEMBER 202 Report No: CLA-053-Rev5

⁷ UNSW (2023) Numerical modelling assessment of mine subsidence related to shortwall extractions Report No.:2023CL01 July 2023

Recommendation

18. Provide additional information to support and justify the conclusions of the UNSW subsidence modelling, including:
- provide tilt and strain predictions
 - confirm the risk to the MYC layer, providing for the preferred scenario that will avoid all potential impacts to the MYC
 - confirm the risk of joint opening, slipping and shearing occurring during the proposed mining operations
 - confirm how the model has addressed overburden strata conditions and detail the level of risk attached to pillar failure
 - detail the risk and magnitude of impacts attached to pillar failure and what that would look like in terms of subsidence and environmental consequences for GoS SCA.

Panels 918 – 920 Biodiversity Management Plan (BMP)

Administrative errors in the BMP should be corrected

NSW DCCEEW identified the following errors in the BMP and recommend that they be corrected:

- Section 6.1.1 (Overview) correct referencing to the 'Wollombi' area to 'Wollemi'.
- Section 6.1.1 (Table A4) correct referencing to the Sydney Basin, Wollemi' IBRA 'Subregion, not 'Wollombi'.
- Section 6.1.3.4 (Table 6) correct referencing to the *Biodiversity Conservation Act 2016* as the listing for *Persoonia hindii* is endangered, not vulnerable.

Recommendation

19. Correct the naming errors in the BMP.

Provide details on the interrelationship between the BMP and other monitoring plans

NSW DCCEEW has concerns about the lack of integration between previous reports, monitoring programs, and data held for the mine's existing operations.

The EP stated that the BMP was informed by survey and assessment undertaken by RPS for the EP Area, however this is not reflected in the BMP. The BMP provides no information, data, or explanation of outcomes around biodiversity monitoring to date. In addition, the BMP has not consolidated any biodiversity information or provided any updated baseline values to monitor against. The lack of information or clarity of values limits the effectiveness and implementation of the adaptive management. It also makes it difficult to define or effectually monitor performance and compliance around ecological consequences, as required by the consent conditions.

Recommendation

20. Revise the BMP to:
- summarise and discuss the outcomes of all previous ecological surveys and biodiversity monitoring programs to date, including trends, key species, and issues arising
 - using the information consolidated from previous monitoring programs to date, provide updated baseline values to monitor against
 - provide supporting consolidated spatial data and available reports.

The recognition of land use should include all natural and cultural values

Section 6.1.2 the BMP assigns and describes land use of GoS SCA based on the broad vegetation classes or units, which is not entirely correct. The GoS SCA land use is much more broadly applied to conservation of all natural and cultural values, in accordance with its reservation status under the *National Parks and Wildlife Act 1974*. Although NPWS acknowledges the land's history and past land use, its status is now State Conservation Area.

Recommendation

21. Revise the BMP to address the status and land use of the GoS SCA as per section 2A(1)(a)-(d) and section 30G of the *National Parks and Wildlife Act 1974*.

The classification of vegetation should be revised, and additional assessments undertaken

Table 4 of the BMP categorises all vegetation assemblages within the EP area into two management zones, woodland or TPSS. This is a very coarse consolidation of vegetation types within the EP area. For example, forest, shrubland, and heath vegetation communities have all been categorised as woodland. In addition, all vegetation categorised as woodland have also been classified as "not sensitive to subsidence impacts".

A revised categorisation of management zones should be provided for the different vegetation communities present within the EP area. A revised assessment of groundwater dependency and potential susceptibility to subsidence impacts should then be conducted.

Recommendations

22. Revise the BMP to recategorise the variety of vegetation assemblages within the EP area into more refined management zones.
23. Revise the assessment of groundwater dependency and subsidence susceptibility based on the refined management zones and revise the monitoring criteria and protocols for these zones accordingly.

Site specific data should be used to inform the monitoring program

NSW DCCEEW note that the BMP (section 6.1.1) has applied broad habitat types to a complex mosaic of different vegetation and habitat types in the EP area. We recommend that the BMP be updated to include site specific data to better inform site values and corresponding monitoring. This should include all relevant biodiversity assessment data, monitoring site data collected across the EP area including the ecological surveys conducted by Eco Resolve (2023)⁸ and RPS (2021)⁹, and any other relevant peer reviewed data sets.

The information above should be mapped (with ArcGIS compatible shapefiles (GDA 94) provided as part the BMP) and then used to inform the key species and significant vegetation types selected or targeted as part of the biodiversity monitoring program.

Recommendation

24. Include all relevant biodiversity data collected across the EP area, including but not limited to survey data collected by Eco Resolve and RPS.

⁸ Eco Resolve (2023). BAM plot data for plots 12, C1, C2 and C3 dated 8/6/2023

⁹ RPS (2021) Baseline data collection for Clarence Panels 918 and 920 Extraction Plan area. Prepared for Clarence Colliery Pty Ltd.

A detailed monitoring program for threatened species should be prepared

The BMP has not detailed a monitoring program for populations of threatened flora or fauna which are predicted to occur in the EP area. The upper catchment of Bungleboori Creek and Paddy's Creek contain intermittently occurring shrub swamps and incised creek drainage channels, known to contain habitat for threatened frogs and reptiles and provide refuges for small fish.

Geological features in this same locality include sensitive formations (made up of cliffs, pagodas, caves and outcrops) which represent refuge habitat for reptiles and mammals.

Recommendation

25. Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features.

The BMP should be revised to include additional discussion on threatened flora and how this relates to the proposed monitoring program

NSW DCCEEW note that *Veronica blakelyi* and *Caesia parviflora* var. *minor* are close to the north-eastern and northern section of the EP area. NPWS are finding these species are distributed more widely than previous records indicate, retaining a high likelihood that the species may occur more broadly across the EP area.

The BMP should provide clarification how the species in Table 6 have been identified e.g., result of independent surveys, opportunistic record, detection based on Bionet records etc. The BMP should also discuss the sensitivity and potential susceptibility of each threatened flora to subsidence related changes, including but not limited to changes in surface water flows and volumes, water draw down, and how this then relates to the proposed monitoring program.

Recommendations

26. Provide clarity on how the species list in Table 6 was prepared.
27. Discuss the sensitivity and susceptibility of threatened flora to subsidence related changes, and how this relates to the proposed monitoring program.

Mapping of threatened fauna survey locations should be provided

The threatened species detected from seasonal surveys within or nearby the EP area detailed in Table 8 identifies that three species, Blue Mountains Waster Skink, Giant Dragonfly and Gang-gang cockatoo, were the only threatened species detected within the EP area.

Additional details and a map showing all survey locations of the threatened species listed in Table 8 should be provided in addition to details of the corresponding survey effort, as it is unclear how much monitoring effort has occurred in the immediate EP area that is informing assumed species presence / absence. Any assumptions that have been made that inform the proposed monitoring program should be justified first and foremost by the monitoring effort in the immediate EP area, and then informed by supporting survey effort adjacent to the site.

Recommendation

28. Provide additional survey information for the species listed in Table 8 to demonstrate the level of survey effort that has occurred with the EP area, and how this has informed the proposed monitoring program.

The fauna monitoring program requires more details

The fauna species that are to be the focus of the monitoring program associated with the EP area should be clearly defined, with the proposed methods for monitoring provided.

The EP area underlies Bungleboori Creek in the upper catchment and Paddy's Creek. These features contain intermittently occurring shrub swamps and incised creek drainage channels known to contain threatened species habitat for many species of threatened fauna including the Blue Mountains Waster Skink and Giant Dragonfly.

Geological features in this same locality include sensitive formations (made up of cliffs, pagodas, caves and outcrops) which remain susceptible to subsidence-related impacts. These features provide significant habitat for several threatened fauna species.

Recommendation

29. Revise the BMP to include discussion and details of proposed monitoring of fauna reliant upon the creeks and catchment areas and supporting geological features within the EP area.

Panels 918 – 920 Land Management Plan (LMP)

The LMP should be revised to define and describe natural features

NSW DCCEEW note that no definition has been provided in section 6.1 of the Land Management Plan (LMP) on what natural features form part of the monitoring framework. For example, it is unclear if this extends to drainage (as specified in section 6.1.2.2), geology (section 6.1.2.3), and soils (section 6.1.2.4), as these are not consistently referenced or discussed throughout the LMP. These values should be defined to enable the application of appropriate management strategies, controls, monitoring and contingency measures.

Section 6 refers to the LMP having a specific focus on cliffs, pagodas, steep slopes, and gorges. These features, including a description of their value and sensitivity to subsidence, have not been described in the LMP. The LMP should be updated to identify and describe these features and assess how these features will respond to subsidence.

The LMP states that cliffs, minor cliffs and steep slopes in the EP area have been identified in the Strata2 (2023¹⁰) via LiDAR data, aerial photography and ground-truthing surveys. This data is displayed in Figure 2 in the LMP. The LMP states that no gorges have been identified, however it also refers to the presence of steep slopes and cliffs in the south and western parts of the EP area near Bungleboori and Paddy's creeks. If these features are not considered to be gorges, it would be beneficial if the LMP explicitly defines what these features are.

Recommendations

30. Include further detail and definition on the natural features which form part of the LMP monitoring framework.
31. Clarify the presence of cliffs, minor cliffs, pagodas, steep slopes and gorges, and provide an assessment of their value and sensitivity to subsidence.
32. Provide further definition on the steep slopes and cliffs in the south and western parts of the EP area. If these features are not considered to be gorges, provide justification behind this determination.

¹⁰ Strata 2 Consulting (2023). *Subsidence Predictions and Impact Assessment for Proposed 918 and 920 Panels*

The assigned environmental consequences and low risk rating require additional detail and justification

The LMP does not clearly define the environmental consequences as part of the performance measures in section 8.1.1. As the LMP relies extensively on pre and post mine comparison of physical features, the benchmark or baseline referred to in Table 11 should be clearly defined or referenced to allow determination of negligible or greater than negligible subsidence impacts.

Section 9 has not provided a description and justification for how the low-risk rating was assigned. Only a statement that a low-risk rating is based on the <100 mm subsidence prediction. The risk rating should also consider values, impacts and associated risk.

Recommendations

33. Define environmental consequence and provide relevant benchmark or baseline information.
34. Provide more detail to justify the assignment of the low-risk ratings.

The figures should be updated to enable better distinguishment of features

NSW DCCEEW is unable to distinguish and interpret the slopes analysis provided in Figure 2 as the colour grading that has been applied is largely indistinguishable. A revision to the colour grading is recommended to ensure features can be delineated.

Recommendation

35. Revise application of colour grading to ensure that features can be easily distinguished.

The TARP should be updated to include environmental triggers and adaptive management approaches

Sections 11 and 12 of the LMP state that an adaptive management approach has been designed to avoid repetition of any unpredicted subsidence and or environmental consequences. The TARP that accompanies this appears to be based on subsidence and public risk with no environmental consequence triggers appearing in the table. The performance measure states this is a factor and the monitoring program covers environmental monitoring.

Recommendations

36. Update the TARP to include environmental triggers related to the LMP.
37. Update the TARP to indicate adaptive management approaches if consequences are high. This should include measures to stop operations until matters are resolved.



Mr Christopher Armit
Approvals Coordinator
Centennial Clarence Colliery
100 Miller Street
Fassifern NSW 2283

Dear Mr Armit

Thank you for your request via the NSW Planning Portal dated 30 March 2026 to the Conservation Programs, Heritage and Regulation Group (CPHR) and National Parks and Wildlife Service (NPWS) of the NSW Department of Climate Change, Energy, the Environment and Water (NSW DCCEEW) requesting advice on the Clarence Colliery 918 Panel Extraction Plan and supporting sub-plans.

NSW DCCEEW has reviewed the plans and associated documentation and provide our detailed comments at Attachment B, and a consolidated summary of recommendations at Attachment A.

In summary, DCCEEW does not support approval of the Extraction Plan in its current form. While we recognise efforts to reduce potential impacts, significant concerns remain regarding the proposed introduction of shortwall mining, potential subsidence impacts, risks to water resources and groundwater-dependent ecosystems, and the adequacy of subsidence, groundwater and biodiversity monitoring and modelling.

In particular, DCCEEW considers that further work is required to demonstrate that the extraction plan is the appropriate approval pathway for the proposed change in mining method, to redesign the extraction area to avoid sensitive environmental features within the Gardens of Stone State Conservation Area, and to address demonstrated subsidence exceedances and modelling uncertainties through independent expert review.

DCCEEW also considers current groundwater and biodiversity monitoring frameworks to be inadequate to establish robust baselines or to ensure early detection and management of impacts to threatened ecological communities, swamps, streams and associated fauna. Implementation of independent audit recommendations and a robust before-after-control-impact (BACI) framework should be completed.

If you have any further questions about our advice, please contact Mr Daniel Granger, Senior Project Officer, National Parks and Wildlife Service, on 8837 6336 or mining.gossca@environment.nsw.gov.au.

Yours sincerely

David Crust
Director Blue Mountains
NSW National Parks and Wildlife Service

17 April 2026

CC: Gabriel Wardenburg, DPHI

Enclosure

1. Attachment A – DCCEEW Summary of Recommendations
2. Attachment B – DCCEEW detailed comments Clarence Colliery 918 extraction plan

Attachment A

DCCEEW's Summary of Recommendations

Clarence Colliery 918 Extraction Plan

BAM	Biodiversity Assessment Method
BC Act	<i>Biodiversity Conservation Act 2016</i>
BCS	Biodiversity, Conservation and Science Group
BMP	Biodiversity Management Plan
CEEC	Critically Endangered Ecological Community
DPHI	Department of Planning, Housing and Infrastructure
EEC	Endangered Ecological Community
EPBC Act	<i>Environmental Protection and Biodiversity Conservation Act 1999</i>
GoS SCA	Gardens of Stone State Conservation Area
NPSS	Newnes Plateau Shrub Swaps
NPWS	National Parks and Wildlife Service
NSW DCCEEW	NSW Department of Climate Change, Energy, the Environment and Water
THPSS	Temperate Highlands Peat Swamp on Sandstone (as EPBC listed)

Recommendations

- 1.1 Provide evidence of an extraction plan being the appropriate approval pathway for this mine layout that includes a change in mining method.
- 2.1 Amend the extraction plan area to avoid secondary extraction using the shortwall technique under:
 - Paddy's Creek Hanging Swamp;
 - Identified major lineaments; and
 - other highly sensitive environments on Gardens of Stone State Conservation Area
- 3.1 Refer the subsidence predictions for the proposed 918 shortwalls, along with more recent records of subsidence exceedances, to the Independent Expert Advisory Panel for Mining for independent assessment.
- 3.2 Revise subsidence assessments for the 918 panels to incorporate the recent subsidence exceedance of 93mm measured on the surface subsidence monitoring line ("D line") because of the extraction of panels 908, 910 and 906.
- 3.3 Further investigate the more recent subsidence exceedances along D line before any approval of the extraction plan for the 918 panels.
- 4.1 Amend the extraction plan area to avoid any secondary extraction under Paddy's Creek Hanging Swamp.

- 5.1 Seek advice from the Independent Expert Advisory Panel for Mining regarding the potential impacts of the proposed extraction on water resources, especially in relation to concerns of inadequate monitoring and subjective monitoring interpretations
- 6.1 Implement the recommendations of the Independent Auditor (MCW Environmental 2021)
- 6.2 Provide:
 - a. the baseline period/dates for all swamp or stream monitoring sites or aquifer monitoring bores affected/potentially affected by mining 918
 - b. all reference swamp(s), stream(s) or bore(s) proposed for comparison of stream flows or aquifer levels after mining of 918 occurs, and
 - c. a before-after control-impact (BACI) assessment of past impacts, and a BACI design to enable objective assessment of impact to swamps, streams and bores above shortwalls 918.
- 7.1 Apply the monitoring methods listed in Apx Table 16 of the Biodiversity Management Plan as the primary monitoring program for the project, not just if there is a 'condition RED'.
- 8.1 Only use eDNA monitoring to supplement the other fauna survey methods listed in Apx Table 16 of the Biodiversity Management Plan.
- 9.1 Add more biodiversity monitoring sites in Newnes Plateau shrub and hanging swamps
- 9.2 Apply the monitoring techniques listed in Table 16 to biodiversity monitoring sites
- 9.3 Include the locations, methods used, and monitoring history of all reference / control sites in the Biodiversity Management Plan.
- 10.1 Provide detail of intended methods to compare baseline datasets to monitoring datasets.
- 10.2 Include biodiversity performance measures, triggers, and actions in the TARP that directly relate to biodiversity monitoring.

Attachment B

NSW DCCEEW detailed comments

Clarence Colliery 918 extraction plan

Mining of coal at Clarence Colliery has been occurring for almost 50 years: In 1976, Blaxland Shire Council (now Lithgow City Council) approved an underground mining operation in the CCL 705 area of Clarence Colliery operations. The in-perpetuity approval permits partial and total extraction mining methods. Some seams in this area remain to be extracted.

In 1994, Lithgow City Council granted a second in-perpetuity development consent for ML 1353 and ML 1354 authorising longwall mining and some areas of partial extraction. Some seams in this area remain to be extracted.

In 2005, the NSW Minister for Planning approved the development of ML 1583 using partial extraction mining methods (DA 504-00). The 918/920 panels are in ML 1583. DA 504-00 is due to expire on 31 December 2026. DCCEEW is aware that an application has been lodged to extend mining operations under DA 504-00 to 31 December 2031 (modification 11). We are also aware of the proposal to consolidate all development applications for mining at Clarence Colliery (SSD-107894972).

It is noted that Clarence Colliery is proposing to introduce an entirely new form of mining for the 918 Panels which involves shortwall mining. The proposed method of shortwall mining has not previously been used in Australia (IESC 2023) and has not previously been tested on the Newnes Plateau.

1. Evidence of appropriate approval pathway should be provided

In our advice on 9 February 2024, NSW DCCEEW recommended consultation with DPHI on the appropriate approval pathway given the change in mining method is inconsistent with the approval conditions required as part of MOD7 to DA504-00.

The Panel and Pillar Partial Extraction (PPPE) method using shortwall mining techniques as currently proposed is not consistent with the 'partial pillar extraction' method identified under the MOD 7 assessment report for DA504-00 (DPIE, 2021) (page 8). The change in mining method has been outlined by Clarence Colliery's own subsidence modelling reports as justification to why additional subsidence modelling is required (Zhang, 2023).

The consultation Clarence Colliery has performed for this extraction plan is outlined in Appendix 3 of the Extraction Plan Report. While Clarence has outlined the consultation process with NSW DPHI (then NSW Department of Planning and Environment) including presentations and emails, there is no evidence that this includes discussion of the appropriate approval pathway or reasoning why NSW DPHI considers the proposed Panel and Pillar Partial Extraction method the same as the approved Partial Pillar Extraction method.

Recommendation

- 1.1 Provide evidence of an extraction plan being the appropriate approval pathway for this mine layout that includes a change in mining method.

2. The secondary extraction area should avoid sensitive landscape features

The proposed 918 panels will undermine sensitive landscape features including:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* listed temperate highland peat swamps on sandstone, which includes the Newnes Plateau hanging swamps (listed as endangered under the NSW *Biodiversity Conservation Act 2016*).
- tributary creeks
- other highly sensitive environments on Gardens of Stone State Conservation Area

The extraction plan should be redesigned to avoid any secondary extraction under sensitive landscape features.

NSW DCCEEW note that the panels are proposed to be extracted using the shortwall mining technique. The IESC (2023) defines shortwall mining as a variation on bord and pillar mining that is a form of miniwall or longwall but uses a continuous miner to cut the coal on extraction across the shortwall face.

The modified design for panel 918 now has three sub panels known as 918A, 918B1 & 918B2. The proposed mining will effectively create an underground void 75m to 83m wide, up to 2.3m in height and extend for distances (lengths) between 0.438km and 0.823km.

For there to be no subsidence (or minimal subsidence) using this technique, the rock above the void will have to span the full width (i.e. up to 83m) and distance of the longwall (up to ~1km) and remain stable in-perpetuity – and even if it did, then there is still potential for subsidence to exceed the approved threshold of 100mm subsidence for DA 504-000. It is noted that the most recent report by SCT (2026) has identified maximum subsidence of 193mm across panels 906-910 which is almost double the allowable subsidence under DA 504-000 (despite using a more conservative mining extraction technique than the shortwalls proposed for the 918 panels).

The Gardens of Stone State Conservation Area (GoS SCA) was reserved on 6 May 2022 after the NSW Government made a landmark commitment to strengthen protection of this iconic landscape within the Western Blue Mountains. The GoS SCA has significant natural and cultural values important to the people of NSW, including Newnes Plateau shrub swamps, threatened and scientifically significant terrestrial and aquatic ecosystems, geological formations, major streams of Bungleboori Creek and Paddy's Creek, and important archaeological sites and Wiradjuri cultural values. GoS SCA adjoins the Maiyingu Marragu Aboriginal Place and the Greater Blue Mountains World Heritage Area.

NSW DCCEEW considers that the information provided in the extraction plan on the shortwall mining technique does not adequately consider risk of subsidence interactions with geological structures, and the effects of non-conventional subsidence on the incised drainage lines associated with Bungleboori and Paddy's Creeks. It is noted that SCT (2026) have estimated valley closure of 110mm in the vicinity of Pagoda Swamp because of the 906-910 panels (which are a more conservative extraction technique than the shortwall mining technique proposed for the 918 panels). This puts closure levels close to those responsible for impacts (complete pool drainage) in the southern coalfield (MSEC 2013) – see Figure 1.

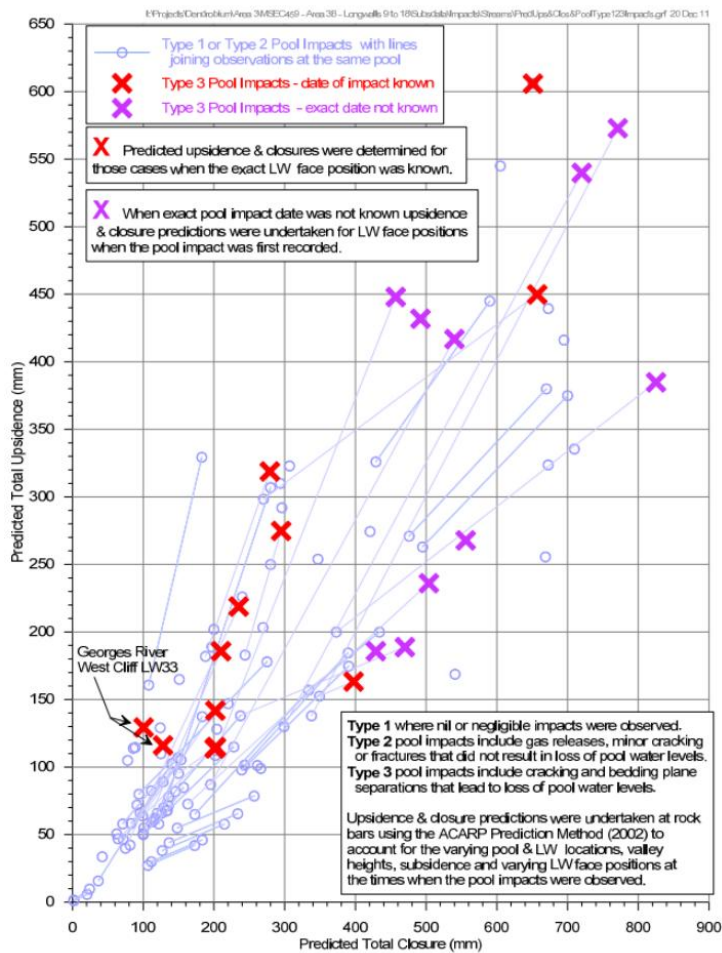


Fig. 5.10 Case Studies from the Southern Coalfield showing the Predicted Total Upsidence and Predicted Total Closure at the Times when Impacts were First Observed

Figure 1. Upsidence and valley closure levels associated with Type 3 pool impacts (complete pool drainage) in the southern coalfields. Source: MSEC (2013)

There is no knowledge base on the threshold levels of subsidence required to promote/activate impacts associated with geological structures using the proposed shortwall extraction technique. SCT (2026) identify several faults transecting Panel 918 and the interaction of subsidence with lineaments has previously been identified (e.g. MSEC 2019) as causing serious impacts up to ~2km from previous longwall mining¹ on the Newnes Plateau. Based on our review of the information provided, NSW DCCEEW believe that the likely subsidence impacts present a significant risk to the important and iconic landscape features in the extraction plan area.

NSW DCCEEW recommend that the proposed extraction area be amended to avoid secondary extraction under sensitive and significant landscape features including temperate highland peat swamps on sandstone (which includes Newnes Plateau shrub swamps and Newnes Plateau hanging swamps). It is also recommended that secondary extraction using the shortwall technique

¹ The impacts occurred when the longwalls were mined beneath the Deanes Creek lineament zone at distances between 1.5 km and 2.25 km from the swamps (MSEC 2019).

does not occur under the major lineaments identified by SCT (2026) and JBSG (2026), since these lineaments connect to the swamps and streams in this area of the Newnes Plateau. This could be done by implementing methods similar to the 'adaptive management techniques' as described by Centennial in the extraction plan report or by reverting to bord and pillar operations.

Modification of the extraction area to avoid these significant values will still allow for extraction of coal, whilst ensuring greater certainty of in-perpetuity protection of natural values and compliance with the DA 504-000 conditions approval, which require that extraction will not result in more than 100mm subsidence and have negligible environmental consequences.

Recommendation

2.1 Amend the extraction plan area to avoid secondary extraction using the shortwall technique under:

- Paddy's Creek Hanging Swamp;
- Identified major lineaments; and
- other highly sensitive environments on Gardens of Stone State Conservation Area

3. NSW DEECCW lacks confidence in subsidence predictions

NSW DEECCW is concerned that the extraction plan understates the potential impacts of the proposed 918 shortwalls on the GoS SCA and its natural assets. Impacts may be understated due to:

- a. Untested extraction technique
- b. Subsidence exceedances at Clarence Colliery, and
- c. Interaction of subsidence with lineaments

a. Untested extraction technique

The proposed method of shortwall mining has not been tested in the Newnes Plateau. The Independent Expert Scientific Committee on Unconventional Gas Development and Large Coal Mining Development (IESC 2023) defines shortwall mining as:

"A variation on bord and pillar mining that is a form of miniwall or longwall but uses a continuous miner to cut the coal on extraction across the shortwall face. It is not currently used in Australia but there are shortwall projects under development".

The untested nature of shortwall mining in Australia, and particularly on the Newnes Plateau, means that there may be unpredictable impacts.

b. Subsidence exceedances at Clarence Colliery

Schedule 3, condition 1 of the development consent for Clarence Colliery (DA 504-00) sets a subsidence limit of 100mm.

There have been subsidence exceedances at Clarence Colliery in areas where the more conservative bord and pillar extraction method is used.

DCCEEW/NPWS previously identified that Clarence Colliery has experienced multiple cases of subsidence greater than 100mm, for example:

- At the junction of 609 and 609B panels, the 609 and 609B area was flooded in 2010-2011 and subsidence increased sharply to approximately 100mm, before stabilizing at 115mm from 2014 onwards. The surface subsidence monitoring line (the “D Line”) was decommissioned in late 2018.
- 612 Panel was extracted in early 2006. 600 Area flooded (2010-2011): approximately 20mm of additional subsidence over 612 Panel. Survey fluctuations over the last decade indicate a maximum of 110mm of subsidence.
- Section 4.3.1 of SCT (2023) identified that the secondary extraction of 906 panel increased maximum subsidence along D line from 104mm to 131mm. The extraction plan main report does not identify that these exceedances have occurred. In addition, the subsidence assessments supporting the extraction plan do not appear to have included up to-date information about these subsidence exceedances in their subsidence calculations and predictions.

More recently, SCT (2026) has identified maximum subsidence of 193mm across panels 906-910 which is almost double the allowable subsidence under the DA 504-000 approval (and which occurred using a more conservative mining extraction technique than the shortwalls proposed for the 918 panels).

SCT (2026) additionally identified that:

- In October 2021 when both 910 and 908 panels had been mined, subsidence survey data from 900D line indicated maximum subsidence of 147mm.
- By July 2022, a further subsidence survey of 900D line conducted showed subsidence had increased from 147mm to 158mm.
- The secondary extraction of 906 Panel after 910 and 908 Panels has increased maximum subsidence along D Line from 147mm to 193mm.
- Extrapolation of the subsidence trough along the location of the Pagoda Swamp infers Pagoda Swamp was likely to experience subsidence of approximately 100-130mm (a breach of the DA 504-000 Approval)
- Modelled valley closure of 110mm in the vicinity of Pagoda Swamp as a result of the 906-910 panels.

Importantly, the recent high subsidence exceedances (maximum subsidence of 193mm across panels 906-910 - breaching the DA 504-000 Approval) have not been notified to NPWS/DCCEEW or placed on the DPHI Major Project website for the Clarence Colliery Mine.

c. Interaction of subsidence with lineaments

Centennial Coal have presented evidence that directly undermining lineaments in the strata overlying Lithgow Coal seam can cause changes to standing water levels in swamps overlying the lineaments (Centennial Coal 2016, 2019).

This is discussed by the IESC when reviewing the Angus Place Mine extension project (2020), who stated:

- Mining-induced ground movements associated with lineaments (especially those of Types 1 and 2) have impacted swamps. The ability to reliably quantify these potential impacts is crucial, especially as the interaction of subsidence and lineaments can cause nonconventional ground movements that exceed conventional subsidence movements.

- Lineaments are noted to influence and often exacerbate subsidence-related movements and increase impacts to temperate highland peat swamps on sandstone (which include Newnes Plateau shrub swamps and Newnes Plateau hanging swamps) where they intersect a swamp or its recharge source.
- The previous IESC advice noted that these features should be better represented in the groundwater model (IESC 2014).
- Clearer explanation of the implementation of lineaments in the current groundwater model and in the uncertainty analysis is still needed, especially for the characterisation of the different types of lineaments.
- Swamps located above lineaments should be assessed for both long-term and temporary impacts up to at least 2,250m from the nearest longwall.
- Similarly, risks of these impacts should also be assessed where lineaments (especially Types 1 and 2) that may interact with mining-induced ground movements coincide with aquifers (e.g. the Burrell Formation, McHugh 2014) supplying groundwater to THPSS, including hanging swamps.

Section 3.2.5 of the original 918 & 920 extraction plan suggested that there were no type 1 lineaments projected or predicted within the proposed 918 and 920 panel workings. The predicted type 2 lineament was expected to be evident as in-seam structure and to penetrate the overlying strata to the surface. The extraction plan concluded that this was expected to affect seam level mining conditions but was not predicted to result in anomalous subsidence effects, due to very small ground movements associated with the proposed mining method.

Figure 13 of SCT (2026) now shows several projected faults transecting the 918 panel. SCT (2026) specifically stated that:

Two 1-2m faults with major washout are located at the mining horizon and correlate with the location of Pagoda Swamp. It is likely that the faults form the lineament that the surface drainage and Pagoda Swamp are located on.

The JBS&G (2026) report identifies Type 1b lineaments traversing Panels 918A, 918B1 & 918B2 (see Figure 2). JBS&G (2026) define Type 1b lineaments as:

projected faults associated with major washout infill with seam to surface connectivity.

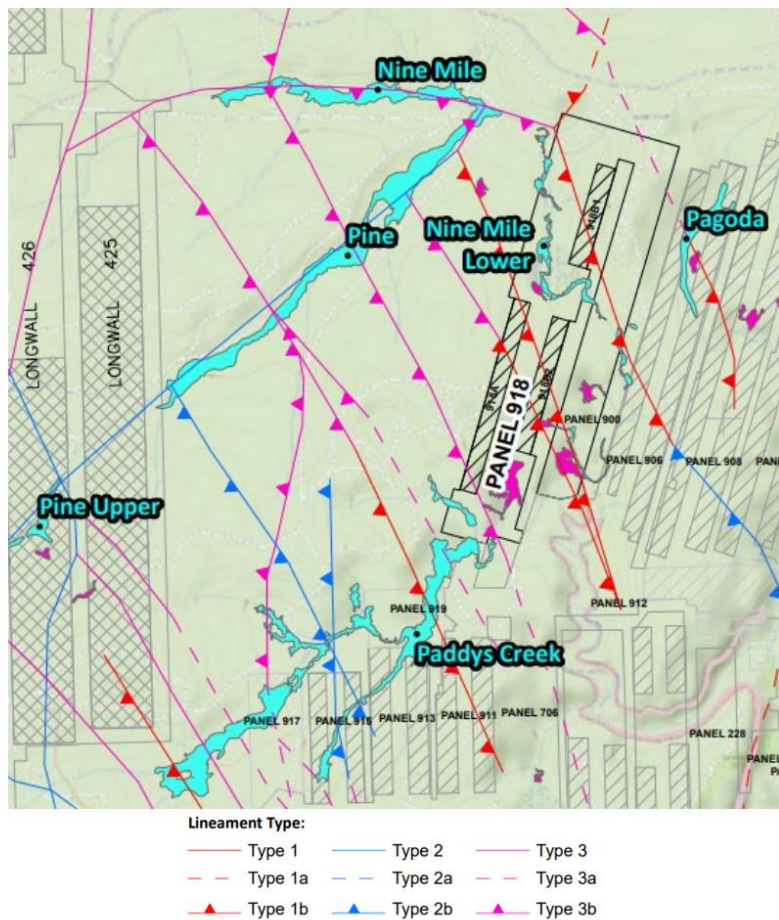


Figure 2. Type 1b lineaments traversing Panels 918A, 918B1 & 918B2. Source: JBS&G 2026.

Major lineaments in the proposed extraction area are also clearly linked/associated with Pine Swamp, the Lower Nine Mile swamps/Bungleboori Creek and the Paddys Creek Swamps/Paddys Creek.

NSW DEECCW considers that further investigation and review of subsidence predictions by independent experts is required.

In addition, the extraction plan for 918 should not be approved before the subsidence exceedances identified in SCT (2023) and SCT (2026) have been thoroughly investigated by DPHI and the Expert Advisory Panel for Mining.

Recommendations

- 3.1 Refer the subsidence predictions for the proposed 918 shortwalls, along with more recent records of subsidence exceedances, to the Independent Expert Advisory Panel for Mining for independent assessment.

- 3.2 Revise subsidence assessments for the 918 panels to incorporate the recent subsidence exceedance of 93mm measured on the surface subsidence monitoring line ("D line") because of the extraction of panels 908, 910 and 906.
- 3.3 Further investigate the more recent subsidence exceedances along D line before any approval of the extraction plan for the 918 panels.

4. Controlled action determination

In our advice of 9 February 2024, NSW DCCEEW recommended that the proposed extraction plan for 918-920 be referred to the Commonwealth DCCEEW to determine whether it is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).

This was due to the shortwall mining method being a new mining technique that will potentially impact Matters of National Environmental Significance, including temperate highland swamps on sandstone, Blue Mountains water skink, and the adjoining Greater Blue Mountains World Heritage Area.

Subsequent to this recommendation and Centennial's referral of the 918 & 920 proposal to the Commonwealth, on 30 October 2024 the Department of Climate Change, Energy, the Environment and Water (department), delegate for the Minister for the Environment and Water (Minister), determined the secondary extraction of coal from panels 918 and 920 using panel and partial pillar extraction at the Clarence Colliery, near Lithgow, (EPBC 2024/09856) (proposed action), is a controlled action under the EPBC Act and the controlling provisions were sections:

- a. Listed threatened species and communities (sections 18 and 18A)
- b. A water resource, in relation to unconventional gas development and large coal mining development (sections 24D and 24E).

The relevant impacts of the proposed action were to be assessed by preliminary documentation under Part 8, Division 4 of the EPBC Act.

As part of the reasoning for deciding the controlled action under the EPBC Act, the Commonwealth DCCEEW considered:

advice from OWS and GA which raised concerns about the conclusions reached in relation to the impacts to water resources and groundwater dependent ecosystems (GDEs), the adequacy of the monitoring design and the adaptive management response proposed to identify and avoid significant impacts to GDEs, including:

- *cumulative subsidence effects from nearby extraction panels,*
- *groundwater model complexity, adequacy of available data to constrain the model, and difficulty identifying the parameters controlling model responses, and appropriateness of a regional scale model for a swamp-scale assessment,*
- *the tendency of the groundwater model to overpredict groundwater levels at bores associated with shrub swamps,*
- *insufficient testing of geological, hydrogeological and numerical groundwater simulation assumptions in representing the PPPE method in the model,*

- *poor communication of results in terms of choice of metrics, graphs and maps, swamp water requirements and relevant impact thresholds to support the contention of negligible impacts to swamps,*
- *lack of alignment between proposed monitoring subsidence and fracture height sites and areas predicted to have the greatest subsidence,*
- *loose commitments to actions when triggers are exceeded, including the possibility of continuing mining if the 100 mm vertical subsidence limit is exceeded or fracturing extends into the Mount York Claystone.*

And

- *PPPE is referred to as a new mining method, not currently practised in Australia. This means there would not be local monitoring data from other sites to validate the model results and provide confidence that the model is reflecting all the relevant parameters,*
- *the Lithgow Environment Group submission suggests that partial extraction methods may have contributed to significant impacts on swamps in other areas,*
- *previous instances of subsidence underprediction in relation to Centennial Coal projects (e.g. at Airlie Mine) and inconsistencies in maximum subsidence reported for the nearby 906/908/910 panels.*

On 14 November 2025 a variation to Clarence Colliery panels 918 and 920 (EPBC Act referral 2024/09856) was accepted by the Commonwealth DCCEEW that was stated to be:

Varied proposed action

varied proposal	To undertake secondary extraction of coal from panel 918 using panel and partial pillar extraction at the Clarence Colliery, near Lithgow, NSW (See EPBC Act referral 2024/09856 and request to vary the proposal to take the action dated 20 October 2025).
variation	The varied action differs from the original proposed action by reducing the extent of the extraction, including: <ul style="list-style-type: none"> • removing all second workings associated with panel 920 • removing second workings in panel 918 beneath sensitive water-dependent ecosystems and some cliff features • reducing the widths of subpanels 918A and 918B2 from 85 m to 75 m and subpanel 918B1 from 85 m to 83 m.

It is noted that the wording of the variation relating to removing second workings in panel 918 beneath sensitive water-dependent ecosystems is misleading since second workings in panel 918B2 are still proposed underneath Paddys Creek Hanging Swamp (see Figure 3).

Additionally, Paddys Creek Hanging Swamp has only recently had a piezometer installed (CSP35; data record starts on 28/05/2025) and therefore does not have adequate baseline data to be able to assess mining impacts.

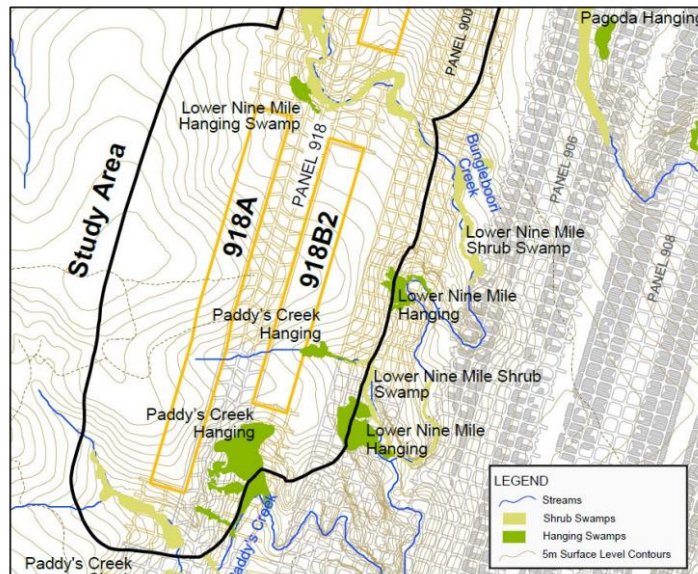


Figure 3. Location of swamps relative to Panels 918B2 and 918A. Source: MSEC (2026).

Recommendation

- 4.1 Amend the extraction plan area to avoid any secondary extraction under Paddy's Creek Hanging Swamp.

5. NSW DCCEEW lacks confidence in groundwater modelling

The extraction plan for Panels 918 & 920 were accompanied by a groundwater model report (JBS&G 2023) which had not been validated. While significant efforts have been made to develop and revise the groundwater model, the calibration of modelled groundwater to real (observed) groundwater levels remains poor, for example:

- The groundwater model does not adequately model the Buralow aquifers that support the Newnes Plateau shrub swamps and hanging swamps. Only dedicated piezometers measuring the Buralow Formation aquifers can do this and Centennial Coal appear to have only two such monitoring bores (CLRP41A & CLRP41R measuring the Buralow Formation at ~55m) in the vicinity of the 918 panels.
- Other relevant bores in the area that should be incorporated into groundwater modelling are:
 - CLRP27R (shallowest bore is Piezo #5 measuring the Banks Wall Sandstone at 90m)
 - CLRP40 (standpipe measuring the Banks Wall Sandstone at 70m)
- There are no piezometers directly monitoring the Buralow aquifers that feed the swamps in the Bungleboori and Paddys Creek catchments² (including Paddy's Creek Hanging Swamp).

² McHugh (2018) has previously identified the various aquifers that feed into these swamps with seven such identified aquitards in total (YS6, YS5a, YS5, YS4, YS3, YS2 and YS1). It is unclear which, if any, of these

According to the Panel 918 Extraction Plan groundwater model report (JBS&G 2026):

recalibration of the model for the immediately previous version of the model considered 10,846 parameters and 31,948 observations (JBS&G, 2025ab); and

the current version of the model (this report) considered 11,354 parameters and 26,712 observations.

The latest version of the groundwater model therefore considers 5,236 (or 16%) fewer direct observations but has a 508 (or 5%) increase in the number of modelled parameters. This model has still not been validated and GHD's (2026) peer review identifies several weaknesses with the modelling approach that have not been adequately addressed. In addition, the legend for Figure 4.7 (p131 of JBS&G 2026) suggests that the model assumes either '*non-goafing*' or '*limited goafing*' of Panels 918A, 918B1 & 918B2. This appears inconsistent with the description of the shortwall mining technique where significant goafing could be expected to occur. As noted above, the proposed mining will effectively create an underground void 75m to 83m wide, up to 2.3m in height and extend for distances (lengths) between 0.438km and 0.823km. For no goafing to occur, the strata above the void would have to span this void in perpetuity.

NSW DCCEEW's comments on the previous iteration of the groundwater model (DOC24/357218, Date 9 May 2014) were that:

- Based on JBS&G's Figure 4.28, the model appears to overestimate observed aquifer levels with discrepancies in modelled and observed levels at times being >50m. Since other areas of the extraction plan suggest that the Burrellow Formation is ~50m thick in this area, this could potentially mean that the modelled water level could either be in the Burrellow formation or outside of the Burrellow formation. As such it provides very limited value in assessing the potential (modelled) impact of the proposed mining at Clarence on aquifers within the Burrellow Formation (or elsewhere in the modelling domain).
- There has been no systematic assessment of exactly where the disagreements between modelled and observed aquifer levels occur. The legend for Figure 4.28 simply cites groups of piezometers (Group 1, 2 & 3) but originally did not provide a spatial location to see how many of these are directly related to Clarence workings or whether any may already have been impacted by earlier mining, either at Clarence or elsewhere on the Newnes Plateau.
- Data provided to NPWS (*PiezometerGroupings_GroundwaterModel.csv*), indicates that approximately 129 piezometers have been "omitted" from JBS&G's groundwater model. No explanation has been provided for excluding these piezometers, even though some (e.g. CLRP33) appear to be relatively close to the proposed extraction of 918 and 920 panels. The selective inclusion and exclusion of piezometers in the groundwater model needs to be investigated and justified prior to any approval being given to narrow longwall panels 918 & 920.
- Many proposed piezometers are yet to be installed, and others have inadequate baseline data to characterise the 'natural' behaviour of the aquifers.

These issues with the modelling were not addressed/discussed in the new Panel 918 Extraction Plan.

Instead, JBS&G (2026) presented a figure (Figure 4.24 p173) on the Steady-State Observed (Weighted) versus Modelled Heads (mAHD) and a figure (Figure 4.25 p174) on the Observed (Weighted) versus Modelled Heads (mAHD). JBS&G (2026) used Figure 4.24 to suggest a good model calibration, however, when this Figure is compared to the previous presentation (JBS&G 2023) of observed versus modelled data, Figure 4.24 (of JBS&G 2026) clearly excludes a very

aquifers are monitored by CLRP41A & CLRP41R, which will likely be directly impacted if/when panel 918A is extracted.

large number of relevant head observations. JBS&G (2026) also did not provide a clear explanation of the “weighting” applied to the observed data points that were included.

In contrast, Figure 4.25 (of JBS&G 2026) shows the Observed (Weighted) versus Modelled Heads (mAHD) for a much larger number of observations. Based on JBS&G’s Figure 4.25, the model still underestimates observed aquifer levels with discrepancies in modelled and observed levels at times being >50m (and in some cases approaching 200m). There has still been no systematic assessment or reporting of exactly where the significant disagreements between modelled and observed aquifer levels occur.

JBS&G (2026) also did not identify which piezometers were included/excluded from the most recent version of the model. The selective inclusion and exclusion of piezometers in the groundwater model can affect modelling outcomes and needs to be fully investigated and justified prior to any approval being given to Panels 918A, 918B1 & 918B2.

As a result of these concerns, NSW DCCEEW has low confidence in the groundwater model used to assess the groundwater impacts for the proposed extraction of Panel 918.

In our previous response on the Extraction Plan for Panels 918 & 920 (DOC24/676691 dated 22 August 2024), NSW DEECCW also noted that the obvious declines in aquifer levels at CLRP 18 and 22 occurred during the extraction of panels 908 and 910. In contrast, there was no decline in the CLRP2 aquifer levels (used here as a reference piezometer) which were generally rising at these times. We also noted that:

- The Gospers Mountain fire burnt through the Newnes Plateau in December 2019 and any effects of the fire on aquifer levels should be reflected across all piezometers.
- The effects of cumulative rainfall deficit should also be reflected across all piezometers.

SCT (2026) discussed the behaviour of CLRP22 (but not CLRP18), concluding:

A multi-piezometer string is installed in Borehole CLRP22 midway along the 910 panel (as shown on Figure 11), the first panel extracted. Figure 22 shows the piezometric profile measured in Borehole CLRP22 over the period of mining these panels. Figure 23 shows the piezometric pressure in Borehole CLRP22 plotted as a function of time.

Depressurisation at the top of the Burra Moko Head Sandstone is evident at 105m above the Katoomba seam.

A drop in head pressure in the upper Burra Moko Head Sandstone is observed in April 2020 when 910 Panel extraction was mid-panel and just before commencement of mining in 908 panel.

There is further reduction in pressure in the upper Burra Moko Head Sandstone as 908 Panel mines up to the piezometer.

It is important to note that under the DA 504-000 Approval Water Resources Impact Assessment Criteria 5.

The Applicant must ensure that the development does not result in any:

- (a) significant inflows to mine workings;*
- (b) reduction in pumping yield in privately-owned groundwater bores;*
- (c) reduction in surface flows and groundwater baseflow to upland swamps (Newnes Plateau Shrub Swamps) and wetlands; and*

(d) reduction in surface flows and groundwater baseflow to waterbodies including Marrangaroo Creek, Farmers Creek, Dargans Creek, Wolgan River, Dumbano Creek, Bungleboori Creek, and Wollangambe River (excluding reduction in flows associated with the proposed water transfer scheme), to the satisfaction of the Planning Secretary.

In a recent review of mining impacts on Marrangaroo Creek Swamp (Krogh 2026) it was noted that:

In many areas above previous Springvale Mine longwalls it is not only the lower aquifers in the Permian and Triassic strata that are being impacted, but also the upper Triassic strata of the Banks Wall Sandstone and Burrell Formation. These upper strata are often hydrologically connected to the endangered Newnes Plateau shrub and hanging swamp communities (e.g. see McHugh 2014, 2018; Krogh et al. 2022) and are also important in providing baseflow to the streams of the area. More recently, significant declines in aquifer levels have occurred for a large number of piezometers monitoring the Banks Wall Sandstone and Burrell Formation, especially those located directly above or within 600m of the longwalls (e.g. SPR1808, SPR1301, SPR1211, WB12101 and WB32101, PHS, SPR38, SPR37 and SPR64).

Advice should be sought from the Independent Expert Advisory Panel for Mining regarding the observed aquifer impacts from earlier Clarence mining and the potential impacts of the proposed extraction of 918 shortwall panels on swamps, wetlands, aquifers and water resources.

Recommendation

- 5.1 Seek advice from the Independent Expert Advisory Panel for Mining regarding the potential impacts of the proposed extraction on water resources, especially in relation to concerns of inadequate monitoring and subjective monitoring interpretations.

6. Current monitoring for the 918 panel area is inadequate

Current monitoring for the 918 panel area is unlikely to set an adequate baseline to enable monitoring against the consent conditions for DA 504-000. NSW DCCEEW notes that:

- The MCW Environmental (2021) independent audit of Clarence Colliery concluded that impact criteria for surface flows and groundwater baseflow to waterbodies including Marrangaroo Creek, Farmers Creek, Dargans Creek, Wolgan River, Dumbano Creek, Bungleboori Creek, and Wollangambe River have not been quantified.
- Centennial Coal has extremely limited groundwater monitoring of the Burrell aquifers in the vicinity of the 918 panels to enable assessment of impacts to the Burrell aquifers, especially those that feed the swamps.
- Several piezometers near the 918 panels are compromised (i.e. no longer functional or yielding unreliable data).
- Adequate baseline information for important surface assets is either absent or lacking in temporal frequency and extent.
- There is no identified or ongoing monitoring of Blue Mountains water skink or giant dragonfly populations in the hanging swamp above the 918B2 shortwall panel, to enable assessment of potential impacts (if any) to these species.

Recommendations

- 6.1 Implement the recommendations of the Independent Auditor (MCW Environmental 2021)
- 6.2 Provide:
 - a. the baseline period/dates for all swamp or stream monitoring sites or aquifer monitoring bores affected/potentially affected by mining 918
 - b. all reference swamp(s), stream(s) or bore(s) proposed for comparison of stream flows or aquifer levels after mining of 918 occurs, and
 - c. a before-after control-impact (BACI) assessment of past impacts, and a BACI design to enable objective assessment of impact to swamps, streams and bores above shortwalls 918.

7. The fauna monitoring program requires revision

Section 5.3.1 of the Clarence Colliery 918 Panel Biodiversity Management Plan states that more direct methods, including aural-visual herpetofauna searches and trapping for Blue Mountain water skink will only be used if an exceedance triggers 'condition RED' in the trigger, action, response plan (TARP).

Section 13.3 of Appendix A details ongoing annual monitoring for Clarence. Methods used to monitor fauna are outlined in Apx Table 16. It is not clear whether there is an intent to continue this annual monitoring.

Monitoring of fauna should primarily use the methods listed in Apx Table 16. This should be used as standard, not just if there is a 'condition RED' exceedance in the trigger, action, response plan.

Recommendation

- 7.1 Apply the monitoring methods listed in Apx Table 16 of the Biodiversity Management Plan as the primary monitoring program for the project, not just if there is a 'condition RED'.

8. eDNA monitoring cannot replace other fauna survey methods

The Biodiversity Management Plan indicates an intent to rely primarily on eDNA monitoring for fauna species such as Blue Mountains water skink and giant dragonfly.

Development consent DA 504-00 requires the biodiversity management plan to provide for adaptive management of mining with a focus on threatened species, populations and their habitats. eDNA monitoring will not provide the population data needed to satisfy this condition.

While eDNA may be useful for determining presence and absence of species, it cannot be used to monitor population changes. eDNA monitoring will not be adequate to determine whether biodiversity triggers have been exceeded.

eDNA can supplement more 'traditional' monitoring but cannot replace it.

Recommendations

- 8.1 Only use eDNA monitoring to supplement the other fauna survey methods listed in Apx Table 16 of the Biodiversity Management Plan.

9. Additional biodiversity monitoring sites are needed

Figure 6 of the Biodiversity Management Plan indicates that there are few proposed biodiversity monitoring sites located in Newnes Plateau shrub and hanging swamps.

There is only one biodiversity monitoring site in Lower Nine Mile shrub swamp, and one Blue Mountains water skink site in Paddy's Creek shrub swamp. There are 4 proposed eDNA sites located across Paddy's Creek and Lower Nine Mile shrub swamps, and in one hanging swamp.

Reference / control sites are mentioned in section 5 of the Biodiversity Management Plan but not identified.

DCCEEW considers the proposed sites will not provide adequate data for monitoring threatened species populations.

Recommendations

- 9.1 Add more biodiversity monitoring sites in Newnes Plateau shrub and hanging swamps
- 9.2 Apply the monitoring techniques listed in Table 16 to biodiversity monitoring sites
- 9.3 include the locations, methods used, and monitoring history of all reference / control sites in the Biodiversity Management Plan.

10. Include measurable, quantifiable triggers in the biodiversity TARP

The biodiversity trigger, action, response plan (TARP) lacks measurable and quantifiable triggers, instead relying on groundwater and surface water triggers.

Monitoring of sensitive biodiversity features, particularly those associated with temperate highland swamps on sandstone, also requires specific biodiversity triggers.

At present, the biodiversity TARP only includes one measurable trigger,

Red Level Trigger for threatened biodiversity if a statistical change ($p < 0.05$) is identified by biodiversity monitoring that is greater than negligible and the change is found to be caused by subsidence.

There is no detail regarding what methods will be used to compare baseline datasets to monitoring datasets. Appendix 3, Section 13.3.1.2 of the Biodiversity Management Plan states that ongoing annual fauna monitoring is used to estimate species diversity and calculate yearly comparisons 'where possible'. Annual monitoring should directly inform the TARP. Clear triggers and actions need to be based on actual flora and fauna monitoring.

This should include clear performance indicators and impact thresholds that can be determined through analysis of quantitative data collected as part of the monitoring program. Additional high-level information should be provided explaining how each method will be used to monitor specific performance indicators.

Recommendations

- 10.1 Provide detail of intended methods to compare baseline datasets to monitoring datasets.
- 10.2 Include biodiversity performance measures, triggers, and actions in the TARP that directly relate to biodiversity monitoring.

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Table 23 NSW DCCEEW 918 Consultation

April 2026 NSW DCCEEW (CPHR/NPWS) letter - Biodiversity related items

Item No.	Matters Raised	Comment and/or where addressed within the BMP
7.1	Apply the monitoring methods listed in Apx Table 16 of the Biodiversity Management Plan as the primary monitoring program for the project, not just if there is a 'condition RED'.	<p>Noted and amended for biodiversity under Management Unit 1 (Table 16, S5.2)</p> <p>Biodiversity monitored under Management Units 2, 3, and 4 have not been moved from Investigative Monitoring (Section 5.3, Table 19) to the routine biodiversity Monitoring Program (Section 5.2, Table 15).</p> <p>Management Units 2 and 3 contain habitats that are considered to be facultative ecosystems. These habitats are by nature, less sensitive to partial extraction mining activities when compared to Management Unit 1 (Swamps). Given the low levels of subsidence predicted, the risk of adverse impacts on these forested communities are considered to be low and therefore only investigate monitoring in the event of a 'condition RED' is considered justified in this instance.</p> <p>In regard to Management Unit 4 (Montane Heath), the mining layout has been designed to avoid undermining the cliff, pagoda and major rock outcrop features in the area, which form part of this Management Unit. In addition to this, the very low-level subsidence effects that are predicted (MSEC, 2026) are not considered to adversely impact these biodiversity features. Steep slopes also form part of Management Unit 4, and again it is considered that these features will not be adversely impacted by undermining (MSEC). Given the predicted very low-level impacts, investigative monitoring in the event of a 'condition RED' is again considered justified for biodiversity associated with Management Unit 4.</p> <p>Ecological Monitoring locations and types of monitoring was reviewed by the Independent Expert Advisory Panel for Mining (IEAPM) in November 2025 and agreed with this approach.</p>
8.1	Only use eDNA monitoring to supplement the other fauna survey methods listed in Apx Table 16 of the Biodiversity Management Plan.	<p>Giant Dragonfly and Blue Mountains Water Skink monitoring programs have been moved from Table 16 to Table 15.</p> <p>Under this change, Giant Dragonfly and Blue Mountains Water Skink will be monitored using more active methods (opportunistic searches and trapping, respectively) with eDNA used to supplement active monitoring methods. The Giant Dragonfly and Blue Mountains Water Skink eDNA locations were selected in consultation with the IEAPM</p>
9.1	Add more biodiversity monitoring sites in Newnes Plateau shrub and hanging swamps	<p>Between the withdrawal of the 918 and 920 Panels Extraction Plan and the 918 Panel Extraction Plan, two additional BAM plots were installed in the Management Unit 1, Edna sampling has been introduced, 3 additional swamp piezometers have been installed and significant increase of real-time subsidence monitoring has been proposed adjacent to the swamps. Ecological Monitoring locations and types of monitoring were reviewed by the IEAPM in November 2025.</p>

Item No.	Matters Raised	Comment and/or where addressed within the BMP
9.2	Apply the monitoring techniques listed in Table 16 to biodiversity monitoring sites	See response to item numbers 7.1 and 8.1
9.3	Include the locations, methods used, and monitoring history of all reference / control sites in the Biodiversity Management Plan	<p>Controls c1, c2 and c3 are BAM plots and have been described under Appendix 3, section 13.1</p> <p>Control sites have been previously established in nearby Broad (Barrier) swamp and monitored for Giant Dragonfly and Blue Mountains Water Skink for neighbouring Centennial operation, Springvale Mine. Co-ordinates for these locations have been added to section 5.2.1 and 5.2.2</p> <p>Control sites for aquatic monitoring have previously been established in Carne Creek East, Dingo Creek and Dingo Creek East. Co-ordinates have been added to Section 3.3.</p>
10.1	Provide detail of intended methods to compare baseline datasets to monitoring datasets.	Noted, added to New section 5.2.1 and 5.2.3 which addresses this
10.2	Include biodiversity performance measures, triggers, and actions in the TARP that directly relate to biodiversity monitoring	Noted, added to New section 5.2.1 and 5.2.3 which addresses this

APPENDIX 2- TARP

Biodiversity TARP

Key Element	Predictions / Commitments (EIS)	Consent Criteria	Triggers / Responses	Condition Green (Operations within Predictions & Approved Impacts)	Condition Amber (Operations within Approved Impacts but potentially exceeding predictions)	Condition Red (Operations Exceed Approved Impacts)
				Continue Operations & Monitoring as Normal	Review Processes & Adaptive Management as Required	Adaptive Management Process Fully Engaged
Sensitive biodiversity features: TEC / GDE Threatened Species, populations and their habitats Aquatic Biodiversity	No Adverse Impact	Generally in accordance with the DA504-00 Negligible environmental consequence (refer adjacent column)	Trigger	<ul style="list-style-type: none"> • Mining induced impacts to creeks and alluvial groundwater <u>not</u> identified by environmental monitoring (including surface flow gauging, water quality, related groundwater levels) and/or routine monitoring (as per Extraction Plan). • Monitoring indicates all parameters are within design criteria / Level Green trigger levels. 	<ul style="list-style-type: none"> • Subsidence monitoring program identifies potential for impact at surface in the vicinity of sensitive vegetation / habitat areas; however • Mining induced impacts to creeks and alluvial groundwater is <u>not</u> identified/not confirmed by routine environmental monitoring (including surface flow gauging, water quality, related groundwater levels) and/or routine monitoring (as per Extraction Plan); <p>And/or</p> <ul style="list-style-type: none"> • Amber Level triggers for surface water/groundwater (including alluvium) are triggered (potential for riparian vegetation impact requiring further investigation/assessment); 	<ul style="list-style-type: none"> • Mining induced impacts (beyond negligible approved levels compared to baseline) identified by: <ul style="list-style-type: none"> ○ environmental monitoring (including flow gauging, water quality and biodiversity); and/or ○ monitoring (as per Extraction Plan); and/or ○ by investigations and actions arising from Condition Amber; • Red Level triggers for surface water/groundwater (incl. alluvium and biodiversity) and/or subsidence are triggered; • Red Level triggers for subsidence: Alarm / notification from the GNSS monitoring network of the above triggers is received by Mine Surveyor / Technical Services Manager and Mine Manager i.e., vertical subsidence measured at any GNSS station is >100 mm vertical subsidence; • Post Mining Survey/s > 100 mm vertical subsidence; And/or • Red Level Trigger for threatened biodiversity if a statistical change (p < 0.05) is identified by biodiversity monitoring that is greater than negligible and the change is found to be caused by subsidence.
				<ul style="list-style-type: none"> • No Action required 	<ul style="list-style-type: none"> • Review and confirm monitoring data, cross check Biodiversity monitoring data against other related environmental data (e.g., control sites and benchmark data) and subsidence monitoring upon identification of the potential trigger. • Notify DPHI, NPWS and relevant stakeholders of current findings and proposed approach for investigation upon identification of the potential trigger. • As per the 918 Subsidence Monitoring Program Condition Amber: Engage subsidence /geotechnical engineer to review and assess subsidence monitoring data. Following review, analysis and recommendation, consider the following potential Adaptive Management actions where 	<ul style="list-style-type: none"> • In addition to Amber trigger level responses, Implement Adaptive Management process as detailed within the Extraction Plan. • Take all necessary steps to ensure that the exceedance ceases and does not recur. • Targeted field inspection by a qualified ecologist and the Clarence Environment & Community Coordinator with invitation to relevant stakeholders as soon as practicable after the trigger is confirmed to be mining induced.

Key Element	Predictions / Commitments (EIS)	Consent Criteria	Triggers / Responses	Condition Green (Operations within Predictions & Approved Impacts)	Condition Amber (Operations within Approved Impacts but potentially exceeding predictions)	Condition Red (Operations Exceed Approved Impacts)
				Continue Operations & Monitoring as Normal	Review Processes & Adaptive Management as Required	Adaptive Management Process Fully Engaged
				<p>applicable to ensure there are no exceedances of DA504-00 subsidence criteria:</p> <ul style="list-style-type: none"> ○ Review, update, recalibrate the subsidence modelling/predictions (against all available information) to assess the likelihood that subsidence after four sub-panels will remain below the maximum predictions of the Extraction Plan i.e., ≤100 mm; and ○ In consultation with the subsidence/geotechnical engineer, determine if it is necessary to modify the mine design to ensure compliance with EP / Development Consent criteria. Potential modifications include reducing width of void, increase width of barrier pillar amongst others. ○ Implementation of Adaptive Management actions as required. 		<ul style="list-style-type: none"> • Monitor impact for affected species/ ecological communities using relevant methods outlined in baseline dataset (see Section 5.3 of the BMP). • Investigate exceedance of subsidence prediction model. • Notify DPPI, NPWS and consult with relevant stakeholders as per Consent/ related approvals. • Explore all remediation options and submit a report to DPPI, NPWS outlining them. • Review mine plan / predictions / geotechnical and subsidence model against mine design criteria.
			Response	<ul style="list-style-type: none"> • No response required. • Continue Subsidence monitoring program. • Continue Biodiversity Monitoring Program. 	<ul style="list-style-type: none"> • Implement responses as per relevant Amber Level trigger/responses above (where triggered) for surface water/groundwater elements. • Where review of subsidence monitoring data indicates <i>potential for mining-induced impact</i>, or there is insufficient data to quantify the above, undertake targeted monitoring inspection over the relevant surface area to confirm and quantify the scale/extent/nature of potential surface impacts. • Undertake further investigations as appropriate to confirm the potential issue and analyse data with the aim of determining whether the exceedance is likely to be mining related. • Assess need for any increase to monitoring frequency or additional monitoring where relevant. • Continue monitoring programs. 	<ul style="list-style-type: none"> • Implement remediation measures to the satisfaction of the secretary. • Modify mining design, such as reducing extraction widths, increasing barrier pillar dimensions Written reporting as per Consent / relevant approvals. • Implement agreed ponding remediation in consultation with the landowner, using the most applicable options and best practice at the time. • If in the case that: <ul style="list-style-type: none"> (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 a suitable biodiversity offset to compensate for the impact or environmental consequence would be determined to the satisfaction of the Secretary.

APPENDIX 3- BASELINE DATA

13.1 Threatened Ecological Communities

Fourteen floristic plots were undertaken in accordance with the Biodiversity Assessment Methodology (BAM; DPE 2020a) to provide an assessment of baseline condition over two years for EECs within the EP Area (**Apx Table 4**).


These BAM plots were undertaken across 2021, 2022, 2023 (year 1) and 2024/2025 (year 2) within PCT 3945 (i.e., Newnes Plateau shrub and hanging swamp EECs) to measure baseline condition (i.e., Vegetation Integrity Score). These plots were spatially stratified and included both shrub (MU 50) and hanging (MU 51) swamps throughout the EP Area to ensure a representative measure of baseline condition was achieved for these ecologically sensitive vegetation communities. Having a representative baseline condition for these EECs allows for detection of future impacts associated with the extraction of Panels 918 should they unexpectedly occur.

Apx Table 3 BAM plots installed throughout the 918 EP Area

Plot	Eastings	Northings	MU - Plant Community Type	Condition	Date Installed
1	242001	6300931	MU 50 - 3945 Newnes Plateau Shrub Swamp	Moderate to Good	31 August 2021
3	242268	6299975			1 September 2021
4	242155	6299794			1 September 2021
5	241878	6299671			2 September 2021
7	242139	6299738			9 February 2022
8	241968	6299609			9 February 2022
9	241833	6299671			9 February 2022
2	242245	6300958			MU 51 - 3945 Newnes Plateau Shrub Swamp
6	241905	6299465	2 September 2021		
10	242274	6300691	10 February 2022		
11	242280	6300529	10 February 2022		
12	232863	6318985	8 June 2023		
13	242356	6300509	27 March 2025		
14	242412	6300555	27 March 2025		
C1	244978	6304387	MU 50 - 3945 Newnes Plateau Shrub Swamp	Moderate to Good	
C2	243834	6306962			8 June 2023
C3	243888	6307070			8 June 2023

13.1.1 BAM plot results – Plot Photos

Apx Table 4 Baseline BAM Plot photographs

Plot	Co-ordinates	Bearing	Start	End
1	S: 242001 6300931 E: 242047 6300936	84.53		


Plot	Co-ordinates	Bearing	Start	End
2	S: 242245 6300958 E: 242259 6300915	161.77		
3	S: 242268 6299975 S: 242313 6299967	100.28		





Plot	Co-ordinates	Bearing	Start	End
4	S: 242155 6299794 S: 242108 6299778	251.05		
5	S: 241878 6299671 E: 241916 6299642	126.98		

Plot	Co-ordinates	Bearing	Start	End
6	S: 241905 6299465 E: 241921 6299512	18.47		
7	S: 242138.87 6299738.37 E: 242116.74 6299782.62	342.13		

Plot	Co-ordinates	Bearing	Start	End
8	S: 241968.24 6299609.16 E: 241933.20 6299645.41	269.58		
9	S: 241832.52 6299671.36 E: 241878.34 6299684.80	272.41		

Plot	Co-ordinates	Bearing	Start	End
10	S: 242273.97 6300691.00 E: 242296.35 6300742.10	34.84		
11	S: 242279.58 6300529.31 E: 242260.14 6300577.52	286.51		

Plot	Co-ordinates	Bearing	Start	End
12	S: 232863.15, 6318984.65 E: 241920; 6301161	203		
13	S: 242356; 6300509	240		

Plot	Co-ordinates	Bearing	Start	End
14	S: 242412; 6300555	234		
C1	244977.89 6304387.19	37		

Plot	Co-ordinates	Bearing	Start	End
C2	243834.44 6306961.51	170		
C3	243887.55 6307070.14	311		

13.1.2 BAM plot results –2021/2022

Apx Table 5 Baseline BAM-C Input variables-Structural - Cover (%)

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	0.5	10.3	73.3	7.8	0.0	0.0
2	4.0	20.9	81.0	9.4	3.6	0.0
3	1.0	27.8	57.7	6.0	9.2	0.3
4	1.0	15.3	69.5	20.2	30.1	0.0
5	0.0	27.9	62.5	6.4	13.1	0.0
6	0.0	36.8	83.3	0.5	15.0	0.0
7	0.0	2.0	66.7	0.7	5.1	0.0
8	0.1	6.2	37.7	0.7	3.0	0.0
9	6.0	11.5	4.4	0.9	10.0	0.2
10	0.6	8.5	42.0	1.2	5.0	0.0
11	0.1	6.0	53.1	0.4	3.0	0.0
12	5.0	31.1	28.1	0.1	2.0	0.0
C1	2.0	33.3	24.8	0.6	11.1	0.0
C2	26.9	3.0	72.1	1.6	5.0	0.0
C3	0.0	32.2	27.6	0.0	10.0	0.0

Apx Table 6 Baseline BAM-C Input variables-Functional - Individuals

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	1	10	11	7	0	0
2	2	11	14	12	3	0
3	1	12	10	9	4	1
4	1	8	12	4	2	0
5	0	8	10	4	3	0
6	0	7	9	1	1	0
7	0	9	8	7	2	0
8	1	8	9	5	1	0
9	2	10	6	7	2	2
10	2	8	9	8	1	0
11	1	10	9	4	1	0
12	1	5	9	1	1	0
C1	1	12	11	6	3	0
C2	1	9	12	7	1	2
C3	0	8	6	0	1	0

Apx Table 7 Baseline BAM-C – Output (as per 17 March 2022; Version: 50)¹

Plot	Composition	Structure	Function ²	Integrity
1	81.3	50.8	-	64.3
2	90	61.6	-	74.5
3	95.4	51	-	69.8
4	78	50.9	-	63
5	75	55.4	-	64.5
6	54.5	76.9	-	64.8
7	80	44.5	-	59.7
8	76.3	17.4	-	36.4
9	88.9	3.0	-	16.3
10	82.2	22.4	-	42.9
11	84	32.2	-	52
12	57.7	30.5		42
Mean (\pm Standard Error)				76.9 (\pm 6.6)
C1	95.1	24.7		48.4
C2	96.2	91.4		93.8
C3	60.3	29.6		42.2
Mean (\pm Standard Error)				61.5 (\pm 16.3)

1. Input variables: IBRA Region = Sydney Basin; IBRA Sub-region = Wollemi; Mitchell Landscape = Newnes Plateau; % Native vegetation = 90% 2. Note that functional scores are not applicable to this PCT.

13.1.3 BAM plot results – 2023

Apx Table 8 Baseline BAM-C Input variables-Structural - Cover (%)

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	0.5	7.2	86.1	2.1	0.0	0.0
2	2.0	25.9	40.6	1.1	3.2	0.0
3	50.1	2.0	12.6	0.7	7.0	0.1
4	0.0	19.2	39.8	0.1	25.1	0.1
5	1.0	43.3	31.6	5.1	10.1	0.0
6	3.1	73.5	10.4	0.4	2.2	0.1
7	0.0	6.5	41.1	0.6	2.0	0.0
8	0.0	32.0	11.3	0.2	3.0	0.0
9	7.0	40.5	7.7	4.1	2.3	1.0
10	2.0	26.2	30.0	0.6	23.0	0.0
11	0.5	30.2	22.8	0.8	1.0	0.1
12	0.0	31.1	27.9	0.1	2.0	0.0
C1	2.0	33.2	24.8	0.6	11.1	0.0
C2	3.0	26.9	72.3	1.8	5.0	0.0
C3	0.0	32.2	28.6	0.0	10.0	0.0

Apx Table 9 Baseline BAM-C Input variables-Functional - Individuals

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	1	6	7	7	0	0
2	1	14	16	9	3	0
3	1	13	7	3	3	0
4	0	11	9	1	2	1
5	1	9	10	2	2	0
6	3	11	9	3	2	1
7	0	9	5	2	1	0
8	0	7	6	1	1	0
9	2	15	8	8	2	1
10	1	12	10	6	2	0
11	1	11	9	4	1	1
12	0	5	8	1	1	0
C1	1	11	11	6	3	0
C2	1	9	14	9	1	0
C3	0	8	7	0	1	0

Apx Table 10 Baseline BAM-C – Output (as per 07 August 2025; Version: 80)¹

Plot	Composition	Structure	Function ²	Integrity
1	83.4	95.6	-	89.3
2	97.3	56.2	-	73.9
3	78.1	6.2	-	22
4	67.4	54.1	-	60.4
5	74	43.6	-	56.8
6	82.7	7.8	-	25.4
7	60.7	56.8	-	58.7
8	58.6	8.3	-	22.1
9	99.5	12	-	34.5
10	95.1	34.3	-	57.1
11	86.4	21.5	-	43.1
12	53.2	30.2		40.1
Mean (\pm Standard Error)				48.6 (\pm 6.1)
C1	95.1	24.7		48.4
C2	96.8	93		94.9
C3	63.1	31.5		44.6
Mean (\pm Standard Error)				62.6 (\pm 16.2)

1. Input variables: IBRA Region = Sydney Basin; IBRA Sub-region = Wollemi; Mitchell Landscape = Newnes Plateau; % Native vegetation = 90% 2. Note that functional scores are not applicable to this PCT.

13.1.4 BAM plot results – 2024/2025

Apx Table 11 Baseline BAM-C Input variables-Structural - Cover (%)

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	2.7	6	101	2.3	0.1	0
2	2.5	50	44.9	2.8	20	0
3	5	52.1	23.3	0.3	17.5	0.1
4	1	36.3	36.6	0.1	20	0
5	0	50.5	47.3	0.7	10.4	0
6	1.2	36.6	61.8	1.8	7	0
7	0	32.4	45.1	1	0.7	0
8	0.4	64.6	33.1	0.6	8	0
9	15	62.3	12.8	1.2	8.5	0.4
10	1.4	41	43.1	2.7	7.1	0
11	3	52.3	45.3	1.3	7.4	0.2
12	2	58.7	35.3	0.5	15	0
13	7	75.6	90	2.7	40.6	0
14	11.3	49	41.7	1.7	35	0
C1	22.3	18.6	77	0	1	22.3
C2	28.2	59.9	5.3	5	0	28.2
C3	46.2	29	0.1	20	0	46.2

Table 12 Baseline BAM-C Input variables-Functional - Individuals

Plot	Tree	Shrub	Grass	Forbs	Ferns	Other
1	3	11	17	7	1	0
2	3	10	15	11	1	0
3	1	10	7	3	3	1
4	1	12	8	1	1	0
5	0	7	9	4	3	0
6	2	9	11	4	1	0
7	0	11	14	6	1	0
8	1	8	8	3	1	0
9	2	13	9	9	3	2
10	2	11	14	11	2	0
11	2	13	15	8	2	1
12	3	8	10	5	1	0
13	3	18	14	5	4	0
14	3	19	12	4	1	0
C1	3	8	10	5	1	0
C2	3	14	16	16	1	0
C3	0	10	8	1	1	0

ApX Table 12 Baseline BAM-C – Output (as per 07 August 2025; Version: 80)¹

Plot	Composition	Structure	Function ²	Integrity
1	99.4	96	-	97.7
2	100	67.3	-	82
3	78.1	22.1	-	41.5
4	70.8	47.6	-	58.1
5	78.3	68.3	-	73.1
6	88.6	87.5	-	88
7	91.2	64.6	-	76.8
8	77.8	40.5	-	56.1
9	100	9.9	-	31.5
10	100	63.7	-	79.8
11	100	65.3	-	80.8
12	92.8	45	-	64.6
13	94.4	96.8	-	95.6
14	89.1	59.1	-	72.6
Mean (±Standard Error)				71.3 (±4.8)
C1	92.8	21.7		44.8
C2	100	90.7		95.3
C3	66.9	32.2		46.4
Mean (±Standard Error)				62.2 (±11.7)

1. Input variables: IBRA Region = Sydney Basin; IBRA Sub-region = Wollemi; Mitchell Landscape = Newnes Plateau; % Native vegetation = 90% 2. Note that functional scores are not applicable to this PCT.

13.2 Threatened flora

Four threatened flora species were found to occur within the EP area as follows:

- *Boronia deanei*;
- *Caesia parviflora* var. *minor*;
- *Persoonia hindii*; and
- *Veronica blakelyi*.

Boronia deanei is a swamp obligate species and is constrained to Management Unit 1, therefore is the focus of the BMP. *B. deanei* has been recorded in low numbers (total of four plants) across the EP Area in Pine and Lower Nine Mile swamps.

At known locations, a permanent 20 x 20 m quadrat is to be established with the following metrics collected:

- Location;
- Date;
- Recorder;
- Number of *B. deanei* individuals; and
- Condition score of *B. deanei*:
 - 1 Severe damage / dieback;
 - 2 Many dead stems;
 - 3 Some dead branches;
 - 3 Some dead branches;
 - 4 Minor damage; or
 - 5 Healthy.

Apx Table 13 *Boronia deanei* monitoring location and treatment

Location	Easting	Northin g	Treatmen t	2023 Count	2023 Condition Score	2024 Count	2024 Condition Score
Nine Mile Lower	242295	6300652	918 EP Area	1	5	20	4
Barrier 3	242124	6303723	Control	34	4	26	5
Murrays 3	243829	6307034	Control	54	4	85	4
C3	243887. 55	6307070 .14	Control	20	5	37	4

13.3 Threatened fauna

Seasonal fauna monitoring has been established at Clarence Colliery since 2004 and monitored by Biodiversity Monitoring Services (BMS) for Clarence's 700 (Eastern, Western and Outbye), 800 (Eastern Portion) and 900 Areas. This monitoring encompassed both pre-mining baseline and post-mining performance monitoring. Baseline monitoring of fauna within Clarence 900 Area commenced in Spring 2014 (Sites A North and B South). An additional monitoring location was added in Paddys Swamp in Autumn 2018. Fauna monitoring data has been compiled from the following sources for the purpose of this baseline dataset:

- 800 Area Terrestrial Fauna Monitoring Report (2021 Final) for Clarence Colliery Pty Ltd (BMS 2022a);
- Clarence Outbye Application Area Terrestrial Fauna Monitoring Report (2021 Final) for Clarence Colliery Pty Ltd (BMS 2022b);
- 900 Area (Panels 913 and 917) Terrestrial Fauna Monitoring Report (2022 Final) for Clarence Colliery Pty Ltd (BMS 2023a);
- Eastern SMP Application Area Terrestrial Fauna Monitoring Report (2022 Final) for Clarence Colliery Pty Ltd (BMS 2023b); and
- Western SMP Application Area Terrestrial Fauna Monitoring Report (2022 Final) for Clarence Colliery Pty Ltd (BMS 2023c).

13.3.1.1 Monitoring locations

Sites were chosen to ensure sampling of fauna within areas where underground mining (partial extraction second workings) has occurred (treatment sites), and areas where mining will not occur (control sites). Monitoring locations are detailed in **Apx Table 14**.

It is important to note that this baseline monitoring program has focussed on the Newnes Plateau Shrub Swamp and Hanging Swamp environments as they are the most sensitive habitat overlying the proposed mining area. It is also noted, that by virtue of the fauna monitoring methods, woodland habitats are also surveyed.

Apx Table 14 Fauna monitoring locations

Site	Easting	Northin g	Landscape	Vegetation	Establis hment date	Mining date
CLW01	240634	6299166	Pagoda heath above steep-sided valley	Newnes Plateau Tea Tree – Banksia – Mallee Heath (high disturbance)	spring 2006	Mid 2018 (extraction)
CLW02	242610	6295587	Heath swamp within shallow-sided valley	Newnes Plateau Hanging Swamp (low disturbance), Newnes Plateau Gum Hollows variant: Brittle Gum – Mountain Gum, Scribbly Gum - Snow Gum Shrubby Open Forest (moderate disturbance)	spring 2006	March 2010 (extraction)
CLW03	241840	6297085	Heath swamp within steep-sided valley	Newnes Plateau Shrub Swamp (moderate disturbance)	spring 2006	Sept 2010 (development), Dec 2010 (extraction)
CLW04	241899	6297998	Heath swamp within steep-sided valley	Newnes Plateau Shrub Swamp (low disturbance), Newnes Plateau Narrow-leaved Peppermint – Silver-top Ash Layered Open Forest (high disturbance)	spring 2006	April 2015 (development), November 2015 (extraction)
CLW05	240772	6300158	Heath swamp within steep-sided valley	Newnes Plateau Shrub Swamp (moderate disturbance)	spring 2006	Dec 2018 (drawdown)

Site	Easting	Northin g	Landscape	Vegetation	Establis hment date	Mining date
CLW06	241657	6295513	Pagoda heath above steep-sided valley	Newnes Plateau Dwarf Sheoak – Banksia Heath (high disturbance)	spring 2006	March 2011 (development), December 2011 (extraction)
Nine Mile Swamp	242000	6301270	Heath Swamp within steep-sided valley	Newnes Plateau Shrub Swamp (moderate disturbance)	autumn 2018	N/A
Paddys Swamp	241375	6299055	Heath Swamp within steep-sided valley	Newnes Plateau Shrub Swamp (low disturbance)	autumn 2018	N/A
A North	241839	6299342	Heath Swamp within steep-sided valley	Newnes Plateau Shrub Swamp (low disturbance), Newnes Plateau Hanging Swamp (low disturbance)	Spring 2014	N/A
B South	241374	6298571	Woodland moving into heath swamp within shallow-sided valley	Newnes Plateau Shrub Swamp (moderate disturbance), Tableland Mountain Gum – Snow Gum – Daviesia Montane Open Forest (high disturbance)	Spring 2014	October 2022 (potential drawdown)
800 Swamp 1	247193	6296433	Heath Swamp within steep-sided valley	Newnes Plateau Hanging Swamp (moderate disturbance)	Autumn 2009	August 2022 (extraction)
800 Swamp 2	248940	6295833	Woodland with small patches of hanging swamp within steep-sided valley	Exposed Blue Mountains Sydney Peppermint – Silver-top Ash Shrubby Woodland, Newnes Plateau Hanging Swamp (low disturbance)	Autumn 2009	Dec 2013 (development)
800 Heath	247448	6295310	Ridgetop heathland	Newnes Plateau Dwarf Sheoak – Banksia Heath (low disturbance)	Autumn 2009	June 2016 (extraction)
Heath 1	245245	6299216	Pagoda heath above steep-sided valley	Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rocky Heath (low disturbance), Exposed Blue Mountains Sydney Peppermint – Silver-top Ash Shrubby Woodland (high disturbance), Newnes Plateau Hanging Swamp (low disturbance)	Autumn 2008	April 2018 (extraction)
Heath 2	245294	6297667	Woodland below Pagoda heath in steep-sided valley	Newnes Sheltered Peppermint – Brown Barrel Shrubby Forest (low disturbance), Sandstone Plateaux Tea Tree – Dwarf	Autumn 2008	1998 (development)

Site	Easting	Northin g	Landscape	Vegetation	Establis hment date	Mining date
				Sheoak – Banksia Rocky Heath (high disturbance)		
Gully	245497	6298910	Woodland above steep-sided valley	Exposed Blue Mountains Sydney Peppermint – Silver-top Ash Shrubby Woodland (high disturbance), Sandstone Plateaux Tea Tree – Dwarf Sheoak – Banksia Rocky Heath (low disturbance)	Autumn 2008	1998 (development)
BNS02	245560	6302277	Heath swamp within shallow-sided valley	Newnes Plateau Shrub Swamp (high disturbance), Tableland Mountain Gum – Snow Gum – Daviesia Montane Open Forest (high disturbance)	spring 2004	1999 (development)
PAG01	246827	6300071	Pagoda heath above steep-sided valley	Sandstone Plateau and Ridge Scribbly Gum – Silver-top Ash Shrubby Woodland (low disturbance)	spring 2004	N/A
PAG03	247064	6300657	Pagoda heath above steep-sided valley	Sandstone Plateau and Ridge Scribbly Gum – Silver-top Ash Shrubby Woodland (low disturbance)	spring 2004	September 2006 (development), December 2008 (extraction)

Apx Figure 1 Fauna monitoring locations



LEGEND

- EP Area
- Proposed Secondary Extraction Areas
- Biodiversity monitoring locations
- Fauna monitoring site (BMS)

0 0.5 1 1.5 Kilometres

SCALE 1:45,000

A4 SIZE

GDA2020 MGA Zone 56 (EPSG:7856)



PROJ: 604-OEENWNTL-429955
 CLIENT: Centennial
 MAP: A1_Fauna survey

AUTHOR: NATALIE WOOD
 DATE CREATED: 11/12/2025
 VERSION: B

1. This plan was prepared for the sole purposes of the Client for the specific Purpose of producing a photographic survey plan. This plan is strictly limited to the Purpose and will not be used for any other application, purpose, use or matter. The plan is presented without the assumption of a duty of care to any other person other than the Client, and may not be relied on by a Third Party.

2. Without limiting paragraph 1 above, this plan may not be copied, distributed, or reproduced by any process unless this notice is clearly displayed on the plan.
 3. The aerial photography used in this plan has not been certified. This image has been overlaid as a best fit on the coordinates shown and position is approximate only.

DATA SOURCES:
 Centennial: RPS, ISW Spatial Services, Geoscience Australia,
 Base map: ESRI, no date, retrieved



FIGURE A1: APPENDIX A - FAUNA MONITORING EFFORT

13.3.1.2 Monitoring methods

Fauna surveys conducted as ongoing annual monitoring for Clarence apply the techniques outlined in **Apx Table 15**. Results of the fauna monitoring are used to estimate species diversity and calculate yearly comparisons where possible (BMS 2023).

Apx Table 15 Fauna survey methods, target species and timing

Method	Fauna group	Description	Timing
Elliot traps	Threatened small ground mammals Threatened arboreal marsupials	Ground traps: Twenty-five small (8x10x33cm) Elliott traps are laid in straight lines for five days through the habitats at each site. This is equivalent to 100 trap nights over four consecutive nights at each site. The traps are baited with a mixture of rolled oats, peanut butter and devon, and a small piece of dacron is placed within each trap (as protection against the cold). A freezer bag is placed over the end of each trap to prevent the contents becoming wet from the rain. At each trap site a description of the physical characteristics of the habitat within a one metre radius is noted. This information is used in the analysis of habitat values. Arboreal traps: To sample any small arboreal mammals, five small Elliott traps are mounted on trees at equal distances along each transect (20 trap nights over five consecutive days at each site). Aluminium tree mounts are attached to trees and a baited Elliott trap attached to the mount. The tree trunk and trap are sprayed with a honey-water mixture to assist in attracting any nectar or sap feeding arboreal mammals. Again, dacron and freezer bags are used to combat the cold and wet conditions.	Autumn and spring
Cage traps	Threatened arboreal marsupials	Three Tomahawk cage traps are laid on the ground and three Tomahawk traps are mounted on trees at each site (24 trap nights). Two large Elliott traps are placed at each site (8 trap nights). The large Elliott traps and the Tomahawk traps are baited with apple, muesli bar and devon.	Autumn and spring
Spotlighting	Threatened small ground mammals Threatened amphibians	Two forms of spotlighting transect are undertaken. Tracks within the CLW Area are spotlighted from a moving vehicle. In addition, spotlighting on foot is undertaken at the detailed fauna survey sites.	Autumn, to summer
Glider traps/tubes	Threatened arboreal marsupials	Two vertical plastic tube traps are set up at each site and used as a tree mounted pitfall trap. These have been developed to trap small gliders (Squirrel and Sugar Gliders) and have been used successfully in coastal areas (Winning and King 2008).	Autumn and spring
Remote IR Cameras	Threatened arboreal marsupials	Tree mounted remote cameras (Reconyx and Swann) are used at selected sites to capture images of any animal using the area, particularly near the traps.	Autumn and spring
Bird census	Threatened diurnal birds	A 30 minute search undertaken at six locations where the observer walked around each site, as well as observing and listening for calls from a single point. At each site up to four periods of observation are	Autumn, to summer

Method	Fauna group	Description	Timing
		undertaken (two in the morning and two in the late morning). Taking into consideration the discussion in the working draft on methods to survey diurnal birds (DECC 2004).	
Call playback	Threatened nocturnal birds Threatened arboreal marsupials	Calls of several species of nocturnal birds and mammals are broadcast during the night in the general area. Calls are broadcast through a megaphone for approximately five minutes, with a ten minute listening time. Calls include Powerful Owl (<i>Ninox strenua</i>), Barking Owl (<i>Ninox connivens</i>), Masked Owl (<i>Tyto novaehollandiae</i>), Sooty Owl (<i>Tyto tenebricosa</i>), Southern Boobook (<i>Ninox boobook</i>), Tawny Frogmouth (<i>Podargus strigoides</i>), Eastern Barn Owl (<i>Tyto javanica</i>), White-throated Nightjar (<i>Eurostopodus mystacalis</i>), Koala (<i>Phascolarctos cinereus</i>), Yellow-bellied Glider (<i>Petaurus australis</i>), Squirrel Glider (<i>Petaurus norfolcensis</i>) and Sugar Glider (<i>Petaurus breviceps</i>).	Autumn, to summer
Pitfall traps	Threatened reptiles Threatened amphibians	Pitfall are established where the terrain allows (low rock substrate, not within flooded area etc.).	Autumn and spring
Herpetological searches	Threatened reptiles Threatened amphibians	Systematic searches for reptiles and amphibians are undertaken within each habitat type at each survey site. Litter is raked and rocks and logs turned over. Loose bark is prised from the trunks of dead trees. Each search took approximately 30 minutes and is repeated at each site. Searches for amphibians took place at night using spotlights (particularly after rain) and recognition of characteristic calls. Spotlighting searches are also attempted for reptiles.	Autumn and spring
Bat call detection	Threatened bats	An Anabat Express ultrasonic bat detector is placed at selected sites for two nights and any recorded bat calls analysed by Andrew Lothian and Glenn Hoye.	Autumn and spring
Animal track recognition	Threatened small ground mammals	Areas of sand on tracks are inspected for evidence of animal movement. Paw prints and other animal signs are identified and recorded.	Autumn and spring
Opportunistic observations	All	Any sightings of fauna are recorded whilst moving throughout the CLW Area and located using a Global Positioning System (GPS). Any scats are collected, and their contents analysed.	Autumn to summer
Targeted survey for the Giant Dragonfly and Blue Mountains Water Skink	Giant Dragonfly Blue Mountains Water Skink	A 1km radius is searched over a period of three days for signs of fauna. Searches target threatened species such as the Giant Dragonfly and Blue Mountains Water Skink. Both these species are associated with wet areas so the swamps and creeklines were searched at and around each site.	Summer
Habitat description	All	Measurements from descriptions of each Elliott trap site are used to provide an index of habitat condition which assess the following variables: Tree cover; Shrub cover; Sapling cover;	Autumn and spring

Method	Fauna group	Description	Timing
		Grass cover; Forb cover; Hollows Segdes Vine Litter Logs; and Rock.	

13.3.1.3 Monitoring results

A total of 248 fauna species, of which nine are exotic, have been recorded in the Clarence Colliery Consent Area since 2004 including:

- 14 amphibian species;
- 149 bird species;
- one invertebrate species;
- 49 mammal species; and
- 35 reptile species.

Of the fauna species recorded, 34 are listed as threatened under the *Biodiversity Conservation Act 2016* (BC Act), and 11 are listed as threatened and/or migratory under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). Given the contiguous habitats across the Clarence Colliery Consent Area and the mobility of fauna, it is likely that most fauna species detected during surveys will occur within the 918 EP Area. Fauna species recorded within the Clarence Colliery Consent Area, and their threat status is provided in **Apx Table 16**.

Results of fauna monitoring in the Clarence Colliery Consent Area suggest that given the low levels of subsidence from previous mining at Clarence Colliery, the risk of adverse impacts on fauna within this area is considered to be low (BMS 2023c). Analysis of fauna populations in the CLW, the Eastern SMP and Outbye SMP Areas, 800 Area and 900 area suggest that there is little conclusive evidence to suggest that changes are due to mining. Generally, changes in diversities have been found to be primarily due to climatic changes, though some evidence of lower diversity measures in undermined sites is shown (BMS 2022a, 2022b, 2023a, 2023b, 2023c). It is postulated that fauna population numbers are determined by climate, fire and predators". Feral horses also add to that pressure (BMS 2023b).

Apx Table 16 Fauna species recorded within Clarence Colliery Consent Area

Common Name	Scientific Name	NSW status	Comm. status
Amphibians			
Eastern Sign-bearing Froglet	<i>Crinia parinsignifera</i>		
Common Eastern Froglet	<i>Crinia signifera</i>		
Giant Burrowing Frog	<i>Heleioporus australiacus</i>	Vulnerable	Vulnerable
Eastern Banjo Frog	<i>Limnodynastes dumerilii</i>		
Brown-striped Frog	<i>Limnodynastes peronii</i>		
Spotted Grass Frog	<i>Limnodynastes tasmaniensis</i>		
Blue Mountains Tree Frog	<i>Litoria citropa</i>		
Lesueur's Frog	<i>Litoria lesueuri</i>		

Common Name	Scientific Name	NSW status	Comm. status
Peron's Tree Frog	<i>Litoria peronii</i>		
Leaf-green Tree Frog	<i>Litoria phyllochroa</i>		
Screaming Tree Frog	<i>Litoria quiritatus</i>		
Verreaux's Frog	<i>Litoria verreauxii</i>		
Bibron's Toadlet	<i>Pseudophryne bibronii</i>		
Smooth Toadlet	<i>Uperoleia laevigata</i>		
Birds			
Spiny-cheeked Honeyeater	<i>Acanthagenys rufogularis</i>		
Yellow-rumped Thornbill	<i>Acanthiza chrysorrhoa</i>		
Striated Thornbill	<i>Acanthiza lineata</i>		
Yellow Thornbill	<i>Acanthiza nana</i>		
Brown Thornbill	<i>Acanthiza pusilla</i>		
Buff-rumped Thornbill	<i>Acanthiza reguloides</i>		
Eastern Spinebill	<i>Acanthorhynchus tenuirostris</i>		
Collared Sparrowhawk	<i>Accipiter cirrocephalus</i>		
Brown Goshawk	<i>Accipiter fasciatus</i>		
Australian Owlet-nightjar	<i>Aegotheles cristatus</i>		
Green Catbird	<i>Ailuroedus crassirostris</i>		
Australian King-Parrot	<i>Alisterus scapularis</i>		
Pacific Black Duck	<i>Anas superciliosa</i>		
Red Wattlebird	<i>Anthochaera carunculata</i>		
Australian Pipit	<i>Anthus novaeseelandiae</i>		
Wedge-tailed Eagle	<i>Aquila audax</i>		
Black-faced Woodswallow	<i>Artamus cinereus</i>		
Dusky Woodswallow	<i>Artamus cyanopterus cyanopterus</i>	Vulnerable	
Masked Woodswallow	<i>Artamus personatus</i>		
White-browed Woodswallow	<i>Artamus superciliosus</i>		
Sulphur-crested Cockatoo	<i>Cacatua galerita</i>		
Fan-tailed Cuckoo	<i>Cacomantis flabelliformis</i>		
Brush Cuckoo	<i>Cacomantis variolosus</i>		
Yellow-faced Honeyeater	<i>Caligavis chrysops</i>		
Gang-gang Cockatoo	<i>Callocephalon fimbriatum</i>	Endangered	Endangered
South-eastern Glossy Black-Cockatoo	<i>Calyptorhynchus lathami</i>	Vulnerable	Vulnerable
Horsfield's Bronze-Cuckoo	<i>Chalcites basalis</i>		
Shining Bronze-Cuckoo	<i>Chalcites lucidus</i>		
Australian Wood Duck	<i>Chenonetta jubata</i>		
Speckled Warbler	<i>Chthonicola sagittata</i>	Vulnerable	
Brown Songlark	<i>Cincloramphus cruralis</i>		
Rufous Songlark	<i>Cincloramphus mathewsi</i>		
Spotted Quail-thrush	<i>Cinclosoma punctatum</i>		
Red-browed Treecreeper	<i>Climacteris erythroptus</i>		
Brown treecreeper	<i>Climacteris picumnus picumnus</i>		

Common Name	Scientific Name	NSW status	Comm. status
Grey Shrike-thrush	<i>Colluricincla harmonica</i>		
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>		
White-bellied Cuckoo-shrike	<i>Coracina papuensis</i>		
White-winged Chough	<i>Corcorax melanorhamphos</i>		
White-throated Treecreeper	<i>Cormobates leucophaea</i>		
Australian Raven	<i>Corvus coronoides</i>		
Little Raven	<i>Corvus mellori</i>		
Pied Butcherbird	<i>Cracticus nigrogularis</i>		
Grey Butcherbird	<i>Cracticus torquatus</i>		
Laughing Kookaburra	<i>Dacelo novaeguineae</i>		
Varied Sittella	<i>Daphoenositta chrysoptera</i>	Vulnerable	
Mistletoebird	<i>Dicaeum hirundinaceum</i>		
Cicadabird	<i>Edolisoma tenuirostris</i>		
Black-shouldered Kite	<i>Elanus axillaris</i>		
Blue-faced Honeyeater	<i>Entomyzon cyanotis</i>		
Galah	<i>Eolophus roseicapilla</i>		
Eastern Yellow Robin	<i>Eopsaltria australis</i>		
White-throated Nightjar	<i>Eurostopodus mystacalis</i>		
Dollarbird	<i>Eurystomus orientalis</i>		
Brown Falcon	<i>Falco berigora</i>		
Nankeen Kestrel	<i>Falco cenchroides cenchroides</i>		
Australian Hobby	<i>Falco longipennis</i>		
Peregrine Falcon	<i>Falco peregrinus</i>		
Eastern Shrike-tit	<i>Falunculus frontatus frontatus</i>		
Bar-shouldered Dove	<i>Geopelia humeralis</i>		
Peaceful Dove	<i>Geopelia striata</i>		
White-throated Gerygone	<i>Gerygone olivacea</i>		
Tawny-crowned Honeyeater	<i>Gliciphila melanops</i>		
Musk Lorikeet	<i>Glossopsitta concinna</i>		
Little Lorikeet	<i>Parvipsitta pusilla</i>	Vulnerable	
Magpie-lark	<i>Grallina cyanoleuca</i>		
Australian Magpie	<i>Gymnorhina tibicen</i>		
Whistling Kite	<i>Haliastur sphenurus</i>		
Pallid Cuckoo	<i>Heteroscenus pallidus</i>		
Little Eagle	<i>Hieraetus morphnoides</i>	Vulnerable	
White-throated Needletail	<i>Hirundapus caudacutus</i>	Vulnerable	Vulnerable, Migratory
Welcome Swallow	<i>Hirundo neoxena</i>		
Chestnut-rumped Heathwren	<i>Hylacola pyrrhopygia</i>		
White-winged Triller	<i>Lalage sueurii</i>		
Wonga Pigeon	<i>Leucosarcia melanoleuca</i>		
Lewin's Rail	<i>Lewinia pectoralis</i>		
Yellow-tufted Honeyeater	<i>Lichenostomus melanops</i>		
Square-tailed Kite	<i>Lophoictinia isura</i>	Vulnerable	

Common Name	Scientific Name	NSW status	Comm. status
Brown Cuckoo-Dove	<i>Macropygia phasianella</i>		
Superb Fairy-wren	<i>Malurus cyaneus</i>		
Variegated Fairy-wren	<i>Malurus lamberti</i>		
South-eastern Hooded Robin	<i>Melanodryas cucullata cucullata</i>	Endangered	Endangered
Lewin's Honeyeater	<i>Meliphaga lewinii</i>		
Brown-headed Honeyeater	<i>Melithreptus brevirostris</i>		
Black-chinned Honeyeater	<i>Melithreptus gularis gularis</i>	Vulnerable	
White-naped Honeyeater	<i>Melithreptus lunatus</i>		
Superb Lyrebird	<i>Menura novaehollandiae</i>		
Rainbow Bee-eater	<i>Merops ornatus</i>		
Jacky Winter	<i>Microeca fascians</i>		
Black Kite	<i>Milvus migrans</i>		
Black-faced Monarch	<i>Monarcha melanopsis</i>		
Satin Flycatcher	<i>Myiagra cyanoleuca</i>		
Restless Flycatcher	<i>Myiagra inquieta</i>		
Leaden Flycatcher	<i>Myiagra rubecula</i>		
Scarlet Honeyeater	<i>Myzomela sanguinolenta</i>		
Red-browed Finch	<i>Neochmia temporalis</i>		
Turquoise Parrot	<i>Neophema pulchella</i>	Vulnerable	
Yellow-throated Scrubwren	<i>Neosericornis citreogularis</i>		
White-eared Honeyeater	<i>Nesoptilotis leucotis</i>		
Barking Owl	<i>Ninox connivens</i>	Vulnerable	
Southern Boobook	<i>Ninox novaeseelandiae</i>		
Powerful Owl	<i>Ninox strenua</i>	Vulnerable	
Rockwarbler	<i>Origma solitaria</i>		
Olive-backed oriole	<i>Oriolus sagittatus</i>		
Golden Whistler	<i>Pachycephala pectoralis</i>		
Rufous Whistler	<i>Pachycephala rufiventris</i>		
Spotted Pardalote	<i>Pardalotus punctatus</i>		
Striated Pardalote	<i>Pardalotus striatus</i>		
Fairy Martin	<i>Petrochelidon ariel</i>		
Tree Martin	<i>Petrochelidon nigricans</i>		
Scarlet Robin	<i>Petroica boodang</i>	Vulnerable	
Red-capped Robin	<i>Petroica goodenovii</i>		
Flame Robin	<i>Petroica phoenicea</i>	Vulnerable	
Rose Robin	<i>Petroica rosea</i>		
Common Bronzewing	<i>Phaps chalcoptera</i>		
Brush Bronzewing	<i>Phaps elegans</i>		
Little Friarbird	<i>Philemon citreogularis</i>		
Noisy Friarbird	<i>Philemon corniculatus</i>		
White-cheeked Honeyeater	<i>Phylidonyris niger</i>		
New Holland Honeyeater	<i>Phylidonyris novaehollandiae</i>		
Crescent Honeyeater	<i>Phylidonyris pyrrhopterus</i>		

Common Name	Scientific Name	NSW status	Comm. status
Crimson Rosella	<i>Platycercus elegans</i>		
Eastern Rosella	<i>Platycercus eximius</i>		
Tawny Frogmouth	<i>Podargus strigoides</i>		
Australian Spotted Crake	<i>Porzana fluminea</i>		
Eastern Whipbird	<i>Psophodes olivaceus</i>		
Satin Bowerbird	<i>Ptilonorhynchus violaceus</i>		
White-plumed Honeyeater	<i>Ptilotula penicillata</i>		
Pilotbird	<i>Pycnoptilus floccosus</i>	Vulnerable	Vulnerable
Grey Fantail	<i>Rhipidura albiscapa</i>		
Willie Wagtail	<i>Rhipidura leucophrys</i>		
Rufous Fantail	<i>Rhipidura rufifrons</i>		
Channel-billed Cuckoo	<i>Scythrops novaehollandiae</i>		
White-browed Scrubwren	<i>Sericornis frontalis</i>		
Beautiful Firetail	<i>Stagonopleura bella</i>		
Diamond Firetail	<i>Stagonopleura guttata</i>	Vulnerable	Vulnerable
Southern Emu-wren	<i>Stipiturus malachurus</i>		
Pied Currawong	<i>Strepera graculina</i>		
Grey Currawong	<i>Strepera versicolor</i>		
Forest Kingfisher	<i>Todiramphus macleayii</i>		
Red-backed Kingfisher	<i>Todiramphus pyrrhopygius</i>		
Sacred Kingfisher	<i>Todiramphus sanctus</i>		
Painted Button-quail	<i>Turnix varius</i>		
Masked Owl	<i>Tyto novaehollandiae</i>	Vulnerable	
Sooty Owl	<i>Tyto tenebricosa</i>	Vulnerable	
Masked Lapwing	<i>Vanellus miles</i>		
Yellow-tailed Black-Cockatoo	<i>Zanda funereus</i>		
Bassian Thrush	<i>Zoothera lunulata</i>		
Silvereye	<i>Zosterops lateralis</i>		
Invertebrates			
Giant Dragonfly	<i>Petalura gigantea</i>	Endangered	
Mammals			
Feathertail Glider	<i>Acrobates pygmaeus</i>		
Agile Antechinus	<i>Antechinus agilis</i>		
Mainland Dusky Antechinus	<i>Antechinus mimetes</i>		
Brown Antechinus	<i>Antechinus stuartii</i>		
White-striped Freetail-bat	<i>Austronomus australis</i>		
Dingo, domestic dog	<i>Canis lupus</i>		
Eastern Pygmy-possum	<i>Cercartetus nanus</i>	Vulnerable	
Large-eared Pied Bat	<i>Chalinolobus dwyeri</i>	Endangered	Endangered
Gould's Wattled Bat	<i>Chalinolobus gouldii</i>		
Chocolate Wattled Bat	<i>Chalinolobus morio</i>		
Spotted-tailed Quoll	<i>Dasyurus maculatus</i>	Vulnerable	Endangered
Horse	<i>Equus caballus</i>		

Common Name	Scientific Name	NSW status	Comm. status
Eastern False Pipistrelle	<i>Falsistrellus tasmaniensis</i>	Vulnerable	
Cat	<i>Felis catus</i>		
Water-rat	<i>Hydromys chrysogaster</i>		
Brown Hare	<i>Lepus capensis occidentalis</i>		
Eastern Grey Kangaroo	<i>Macropus giganteus</i>		
Large Bent-winged Bat	<i>Miniopterus orianae oceanensis</i>	Vulnerable	
unidentified mastiff bat	<i>Molossidae sp.</i>		
House Mouse	<i>Mus musculus</i>		
Southern Myotis	<i>Myotis macropus</i>	Vulnerable	
Red-necked Wallaby	<i>Notamacropus rufogriseus</i>		
Gould's Long-eared Bat	<i>Nyctophilus gouldi</i>		
Rabbit	<i>Oryctolagus cuniculus</i>		
South-eastern Free-tailed Bat	<i>Ozimops planiceps</i>		
Eastern Free-tailed Bat	<i>Ozimops ridei</i>		
Long-nosed Bandicoot	<i>Perameles nasuta</i>		
Southern Greater Glider	<i>Petauroides volans</i>	Endangered	Endangered
Sugar Glider	<i>Petaurus breviceps</i>		
Squirrel Glider	<i>Petaurus norfolcensis</i>	Vulnerable	0
Koala	<i>Phascolarctos cinereus</i>	Endangered	Endangered
Common Ringtail Possum	<i>Pseudocheirus peregrinus</i>		
Bush Rat	<i>Rattus fuscipes</i>		
Swamp Rat	<i>Rattus lutreolus</i>		
Black Rat	<i>Rattus rattus</i>		
Eastern Horseshoe-bat	<i>Rhinolophus megaphyllus</i>		
Yellow-bellied Sheathtail-bat	<i>Saccolaimus flaviventris</i>	Vulnerable	
Greater Broad-nosed Bat	<i>Scoteanax rueppellii</i>	Vulnerable	
Eastern Broad-nosed Bat	<i>Scotorepens orion</i>		
Common Dunnart	<i>Sminthopsis murina</i>		
Pig	<i>Sus scrofa</i>		
Short-beaked Echidna	<i>Tachyglossus aculeatus</i>		
Common Brushtail Possum	<i>Trichosurus vulpecula</i>		
Large Forest Bat	<i>Vespadelus darlingtoni</i>		
Southern Forest Bat	<i>Vespadelus regulus</i>		
Little Forest Bat	<i>Vespadelus vulturnus</i>		
Bare-nosed Wombat	<i>Vombatus ursinus</i>		
Fox	<i>Vulpes vulpes</i>		
Swamp Wallaby	<i>Wallabia bicolor</i>		
Reptiles			
Eastern Three-lined Skink	<i>Acritoscincus duperreyi</i>		
Red-throated Skink	<i>Acritoscincus platynotus</i>		
Lesueur's Velvet Gecko	<i>Amalosia lesueurii</i>		
Jacky Lizard	<i>Amphibolurus muricatus</i>		
Highland Copperhead	<i>Austrelaps ramsayi</i>		

Common Name	Scientific Name	NSW status	Comm. status
Southern Rainbow-skink	<i>Carlia tetradactyla</i>		
Eastern Small-eyed Snake	<i>Cryptophis nigrescens</i>		
Copper-tailed Skink	<i>Ctenotus taeniolatus</i>		
Wood Gecko	<i>Diplodactylus vittatus</i>		
Cunningham's Skink	<i>Egernia cunninghami</i>		
Black Rock Skink	<i>Egernia saxatilis</i>		
Tree Skink	<i>Egernia striolata</i>		
Yellow-bellied Water-skink	<i>Eulamprus heatwolei</i>		
Blue Mountains Water Skink	<i>Eulamprus leuraensis</i>	Endangered	Endangered
Eastern Water-skink	<i>Eulamprus quoyii</i>		
Tree Dtella	<i>Gehyra variegata</i>		
Broad-headed Snake	<i>Hoplocephalus bungaroides</i>	Endangered	Endangered
Eastern Water Dragon	<i>Intellagama lesueurii</i>		
Dark-flecked Garden Sunskink	<i>Lampropholis delicata</i>		
Pale-flecked Garden Sunskink	<i>Lampropholis guichenoti</i>		
White's Skink	<i>Liopholis whitii</i>		
Tree-base Litter-skink	<i>Lygisaurus foliorum</i>		
South-eastern Morethia Skink	<i>Morethia boulengeri</i>		
Tiger Snake	<i>Notechis scutatus</i>		
Broad-tailed Gecko	<i>Phyllurus platurus</i>		
Red-bellied Black Snake	<i>Pseudechis porphyriacus</i>		
Tussock Skink	<i>Pseudemoia pagenstecheri</i>		
Eastern Brown Snake	<i>Pseudonaja textilis</i>		
Common Scaly-foot	<i>Pygopus lepidopodus</i>		
Mountain Dragon	<i>Rankinia diemensis</i>		
Weasel Skink	<i>Saproscincus mustelinus</i>		
Blotched Blue-tongue	<i>Tiliqua nigrolutea</i>		
Eastern Blue-tongue	<i>Tiliqua scincoides</i>		
Rosenberg's Goanna	<i>Varanus rosenbergi</i>	Vulnerable	
Lace Monitor	<i>Varanus varius</i>		

APPENDIX 4- BLUE MOUNTAINS WATER SKINK AND GIANT DRAGONFLY BASELINE SURVEYS

Baseline biodiversity monitoring of two swamp obligate species associated with Management Unit 1, the Giant Dragonfly (*Petalura gigtantea*) and the Blue Mountains Water Skink (*Eulamprus leuraensis*), were undertaken by Marine Pollution Research (MPR) in December 2025. The methods used, locations and results of these surveys are detailed in the attached report. The results of this survey form the baseline dataset for the EP Area for these species.