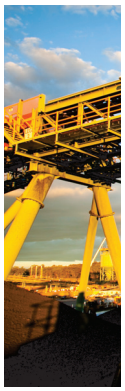

MOOLARBEN COAL COMPLEX OC3 EXTENSION PROJECT

SUBMISSIONS REPORT

MAIN TEXT

YANCOAL
兖煤澳大利亚有限公司
MOOLARBEN COAL

EXECUTIVE SUMMARY

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

Moolarben Coal Operations Pty Ltd (MCO) is proposing to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements (the Project). This extension would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of run-of-mine (ROM) coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

MCO (2022) prepared the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the NSW *Environmental Planning and Assessment Act 1979*.

The Project EIS was placed on public exhibition by the then Department of Planning and Environment (now known as the Department of Planning, Housing and Infrastructure) from 17 November to 14 December 2022. During this period, government agencies, organisations and members of the public were invited to provide submissions on the EIS.

A total of 90 submissions on the Project were received during the public exhibition period, comprising 15 submissions (17%) from government agencies, 18 submissions (20%) from organisations and 57 submissions (63%) from members of the public. Of these submissions:

- 2 submissions (2%) were in support of the Project, both from members of the public;
- 15 submissions (17%) were comments, all from government agencies; and
- 73 submissions (81%) objected to the Project, 55 from members of the public and 18 from organisations.

Key matters raised in submissions included groundwater, surface water, biodiversity, social, Aboriginal cultural heritage, agriculture, greenhouse gas emissions, economic, amenity and road transport.

In response to submissions received on the EIS, MCO has amended the Project to reduce the indicative surface disturbance extent and incorporate additional avoidance and minimisation measures relative to the EIS. The areas proposed for further avoidance have been targeted to further avoid key threatened species habitat and largely contiguous remnant woodland vegetation, as well as providing further setback from rocky habitat features and the Munghorn Gap Nature Reserve.

Approval of the Project would provide a net increase in native woodland in the Moolarben Valley of 557 ha due to managed regeneration and revegetation within the Habitat Enhancement Area as well as rehabilitation of the final landform. This is in addition to MCO's statutory obligations for biodiversity offsets under the NSW *Biodiversity Conservation Act 2016*.

Approval of the Project would also provide a reduction in the number of final voids in the Moolarben Valley from one to zero, as the Project proposes to backfill the currently approved OC3 final void.

As a result of the proposed amendments, in particular the reduced indicative surface disturbance extent, the environmental impacts of the Project would largely be reduced compared to that presented in the EIS. Accordingly, the conclusion in the EIS that, on balance, the Project is a logical extension of an existing mining operation that would develop internationally in-demand resources, while minimising environmental impacts, and is in the public interest, remains unchanged.

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1 INTRODUCTION

1.1 BACKGROUND

The Moolarben Coal Complex is an existing mining operation located approximately 40 kilometres (km) north of Mudgee, New South Wales (NSW) (Figure 1-1).

The Moolarben Coal Complex is operated by Moolarben Coal Operations Pty Ltd (MCO) on behalf of the Moolarben Joint Venture (Moolarben Coal Mines Pty Ltd [MCM], Yancoal Moolarben Pty Ltd [YM] and a consortium of Korean power companies). MCO, MCM and YM are wholly owned subsidiaries of Yancoal Australia Limited (Yancoal).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038 with a combined coal production rate of 22 million tonnes per annum (Mtpa) in accordance with Project Approval (05_0117) (Stage 1) (as modified) and Project Approval (08_0135) (Stage 2) (as modified). The Moolarben Coal Complex comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities) (Figure 1-2).

MCO is proposing to extend open cut mining operations immediately south of the approved OC3 open cut pit as well as develop four new open cut pits to the east and south-east of the approved OC3 mining area, within existing mining tenements (the Project) (Figure 1-2).

The extended open cut mining operations would provide approximately 10 years of mining (from 2025 to 2034), maximise use of the existing mining fleet and maintain steady production of Run-of-Mine (ROM) coal at the Moolarben Coal Complex post-completion of mining within the approved OC3 mining area.

1.2 PROJECT ENVIRONMENTAL IMPACT STATEMENT

MCO (2022) prepared the Moolarben Coal Complex OC3 Extension Project Environmental Impact Statement (the EIS) for the Project to support the assessment process under the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act).

The Project EIS was placed on public exhibition by the then NSW Department of Planning and Environment (DPE) (now the NSW Department of Planning, Housing and Infrastructure [DPHI]) from 17 November to 14 December 2022. During this period, government agencies, organisations and members of the public were invited to provide submissions on the EIS to DPHI.

MCO has prepared this Submissions Report to directly address matters raised in the government, organisation and public submissions on the Project EIS.

1.3 PROPOSED PROJECT AMENDMENTS

In response to submissions received on the Project EIS, MCO is proposing to amend the Project indicative surface disturbance extent. The amended Project indicative surface disturbance extent has been reduced to incorporate additional avoidance measures relative to the EIS. The additional avoidance areas and amended Project indicative surface disturbance extent compared to the EIS is shown on Figure 1-3.

Separate to this Submissions Report, MCO has prepared an Amendment Report for the Project to document the amended Project description and revised potential environmental impacts.

In summary, when compared to the EIS, the proposed amendments to the Project include:

- A reduction in the extent of proposed disturbance (from approximately 825 hectares [ha] to 675 ha).
- A reduction in the extent of proposed open cut mining.
- A reduction in total resource extracted from 40 million tonnes (Mt) to approximately 30 Mt over the life of the Project.

LEGEND
- State Forest
- National Park /Nature Reserve
- Local Government Boundary
- Exploration Licence Boundary
- Mining Lease Boundary
- Mining Operation
- Indicative Amended Project Surface Disturbance Extent

Source: NSW Spatial Services (2021)
MCO (2023)

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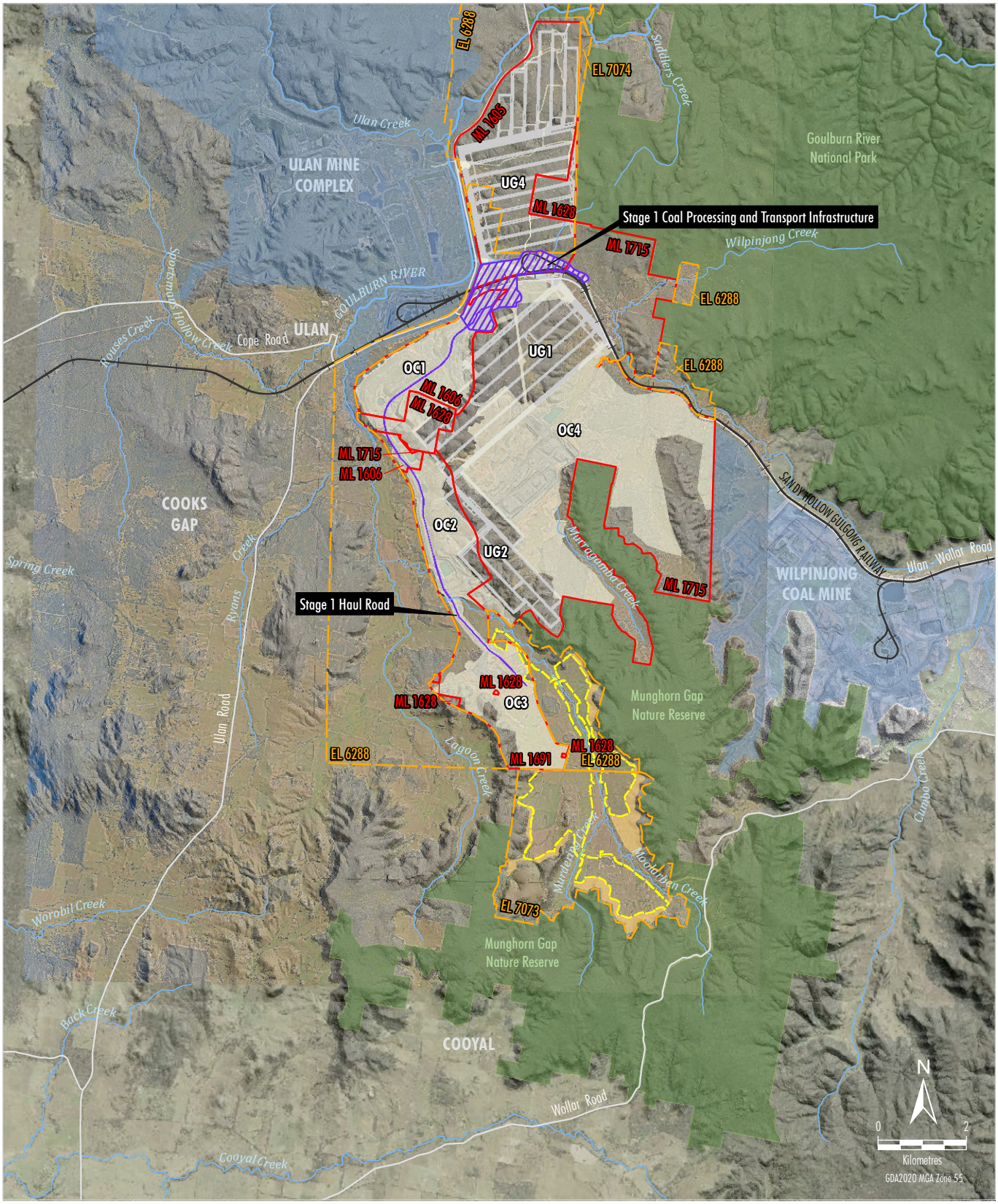
Project Location

Figure 1-1

MCM-20-18 OC3 Ext AR SR_201A



MCM-20-18 OC3 Ext AR SR_202A

LEGEND

- National Park/Nature Reserve
- Other Mining Operation
- Exploration Licence Boundary
- Mining Lease Boundary

Existing/Approved Development

- Underground Longwall Layout
- Moolarben Coal Complex Disturbance Footprint
- Stage 1 Coal Processing and Transport Infrastructure Footprint

OC3 Extension Project - Amended

- Indicative Amended Project Surface Disturbance Extent
- Additional Avoidance/Minimisation for the Amended Project

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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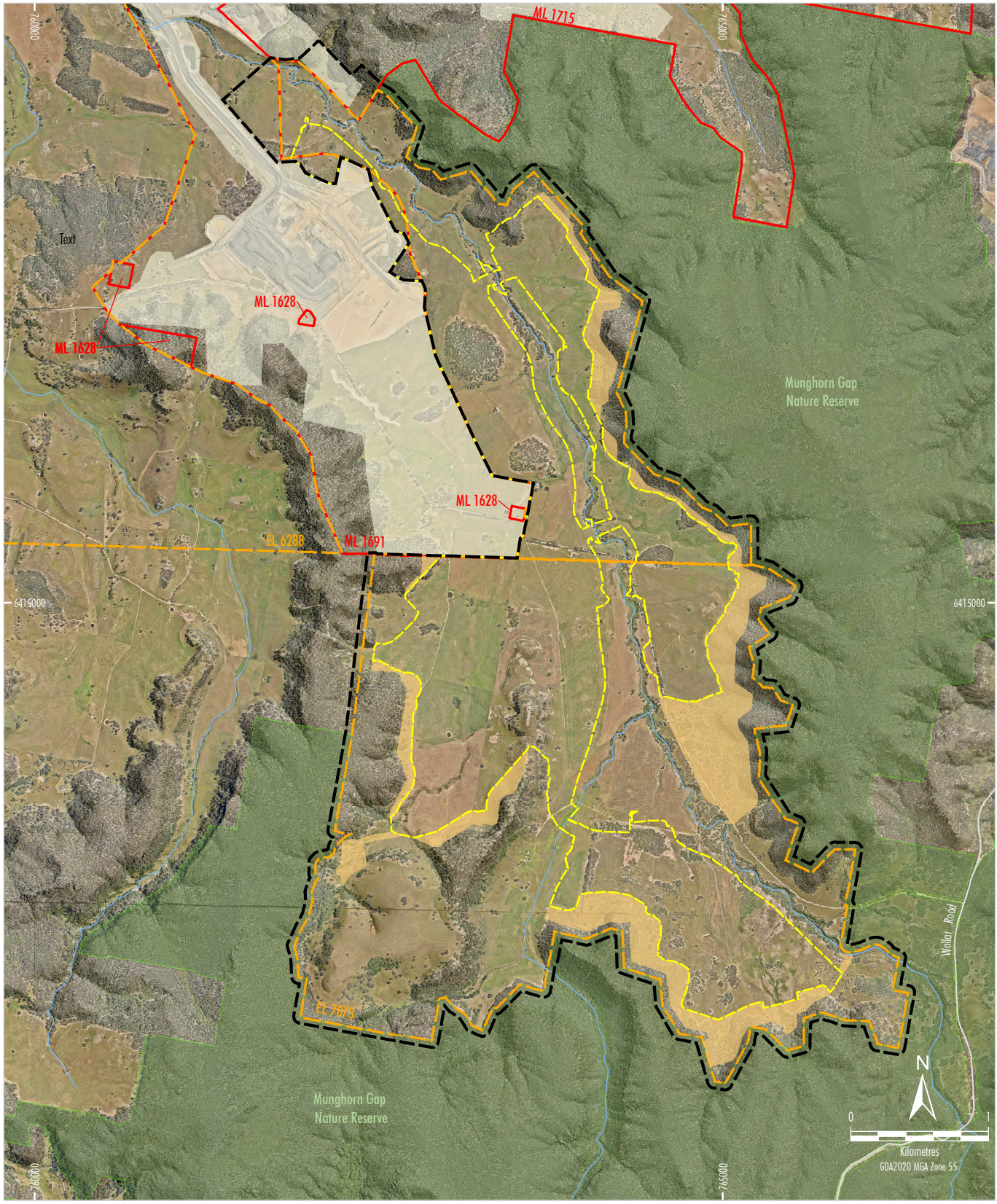
Approved Moolarben Coal Complex and Proposed Open Cut Extension

Figure 1-2



MCM-20-18 OC3 Ext AR SK_203A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- OC3 Extension Project - Amended
- Project Study Area
- Indicative Amended Project Surface Disturbance Extent
- Additional Avoidance/Minimisation for the Amended Project

Source: MCO (2023); NSW Spatial Services (2021); Department of Planning, Industry & Environment (2021); Orthophoto Mosaic: MCO (2021)

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Amended Project Footprint

Figure 1-3

- A reduction in the peak annual ROM mining rate from 9 Mt to 8.5 Mt over the life of the Project.
- No change to the duration of the mine life (i.e. between approximately 2025 to 2034), peak workforce, or hours of operation of the mine.
- No change to the proposed final landform integration with the approved OC3 mining area (including no final voids in the rehabilitated final landform).
- A revised conceptual post-mining land use which incorporates additional areas of native woodland (i.e. from approximately 325 ha to 535 ha).
- An increase to the proposed Habitat Enhancement Area extent (from approximately 160 ha to 188 ha) which would be revegetated during mining.

The revised revegetation and rehabilitation strategy means the amended Project, if approved, would result in:

- A net gain in native woodland in the Moolarben Valley of approximately 22 ha during mining due to revegetation within the Habitat Enhancement Area (i.e. approximately 113 ha of woodland to be cleared for the amended Project vs 135 ha of revegetation within the revised Habitat Enhancement Area extent).
- An overall net gain in native woodland in the Moolarben Valley of approximately 557 ha post-mining when considering revegetation during mining and rehabilitation of the final landform.
- A reduction in the number of voids in the Moolarben Valley from one to zero, as the Project proposes to backfill the currently approved OC3 final void, and provide a free-draining final landform (i.e. no residual voids).

Residual potential impacts on biodiversity would be offset in accordance with the BC Act (in addition to proposed revegetation with the Habitat Enhancement Area and rehabilitation of the final landform). MCO is expecting land based offset options to be available to secure the Project's total offset liability for the Regent Honeyeater and Koala (and potential for other threatened species following targeted surveys), including options to establish land-based offsets using Moolarben-owned land in the region. MCO is also investigating two potential "onsite" offset areas within the Project Study Area.

Further detail on the avoidance and minimisation measures incorporated in the amended Project are provided in the Amendment Report.

1.4 STRUCTURE OF THIS DOCUMENT

The Submissions Report has been prepared in consideration of the *State Significant Development Guidelines – Preparing a Submissions Report* (DPE, 2022). The remainder of this document is structured as follows:

Section 2	Provides an analysis of the submissions received during the public exhibition period.
Section 3	Summarises the actions taken since lodgement of the EIS, including additional engagement activities, proposed amendments to the Project and further assessment.
Section 4	Provides responses to the issues raised in the submissions.
Section 5	Provides an updated evaluation of the Project.
Section 6	Lists the documents referenced in the Submissions Report.

Attachments 1 and 2 contain supporting information, including a register of the submissions received and specialist reports:

Attachment 1	Register of Submitters.
Attachment 2	Supplementary Stygofauna Testing Report.

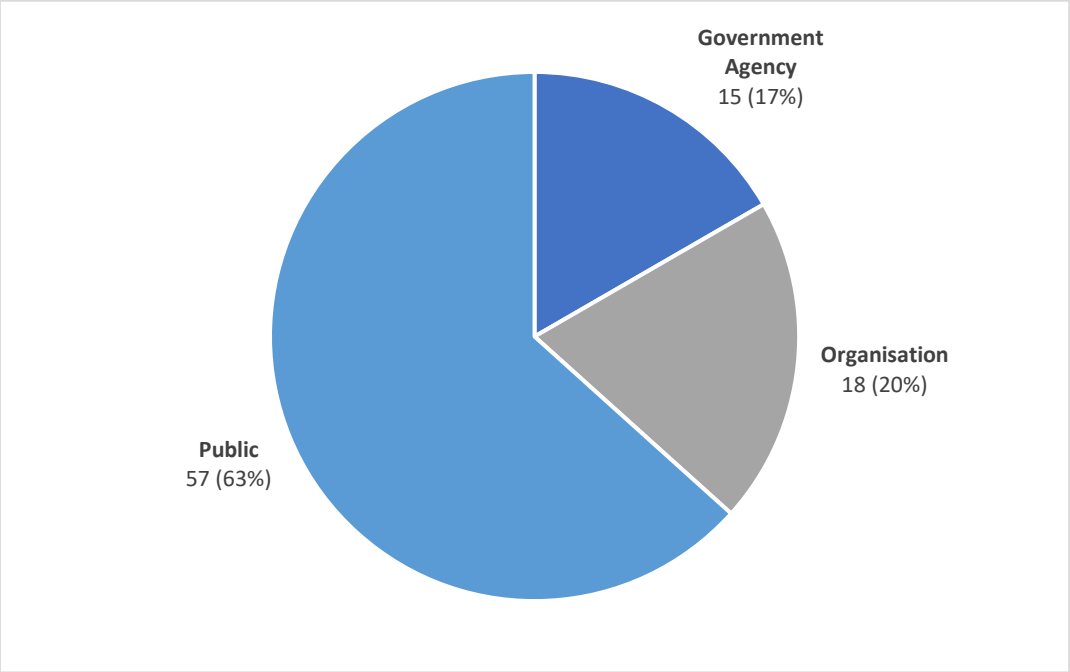
2 ANALYSIS OF SUBMISSIONS

2.1 NUMBER OF SUBMISSIONS

A total of 90 submissions on the Project were received from government agencies, organisations and members of the public. The following provides a breakdown of the submissions by submitter category (Chart 2-1):

- 57 submissions (63 percent [%]) from members of the public;
- 15 submissions (17%) from government agencies; and
- 18 submissions (20%) from organisations.

Chart 2-1
Summary of All Submissions



A register of the submitters is provided in Attachment 1.

Of these submissions:

- 2 submissions (2%) were in support of the Project, both from members of the public;
- 15 submissions (17%) were comments, all from government agencies; and
- 73 submissions (81%) objected to the Project, of which 55 were from members of the public and 18 were from organisations.

2.2 GOVERNMENT AGENCY SUBMISSIONS

A total of 15 submissions were received from government agencies, including:

- DPE – NSW Biodiversity, Conservation and Science Directorate (BCS) (now the NSW Department of Climate Change, Energy, the Environment and Water [NSW DCCEEW]) and NSW National Parks and Wildlife Services (NPWS);
- Heritage NSW (now NSW DCCEEW);
- DPE – Water (now NSW DCCEEW);

- DPE – Science, Economics and Insights Net Zero Emissions Modelling (NZEM) (now NSW DCCEEW);
- DPE – Crown Lands (now DPHI – Crown Lands);
- DPE – Hazards (now DPHI);
- Department of Primary Industries (DPI) – Fisheries;
- DPI – Agriculture;
- Environment Protection Authority (EPA);
- Fire and Rescue NSW (FRNSW);
- Department of Regional NSW – Mining, Exploration and Geoscience (MEG) and Resources Regulator;
- Mid-Western Regional Council;
- Australian Rail Track Corporation (ARTC); and
- Transport for NSW.

The Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development (IESC) provided advice to the decision maker regarding the Project. The IESC advice is included in the analysis above.

Of these 15 submissions, eight had no assessment-related comments on the Project, including:

- DPE – Hazards;
- DPI – Fisheries;
- DPI – Agriculture;
- EPA;
- FRNSW;
- MEG and Resources Regulator;
- ARTC; and
- Transport for NSW.

2.3 PUBLIC AND ORGANISATION SUBMISSIONS

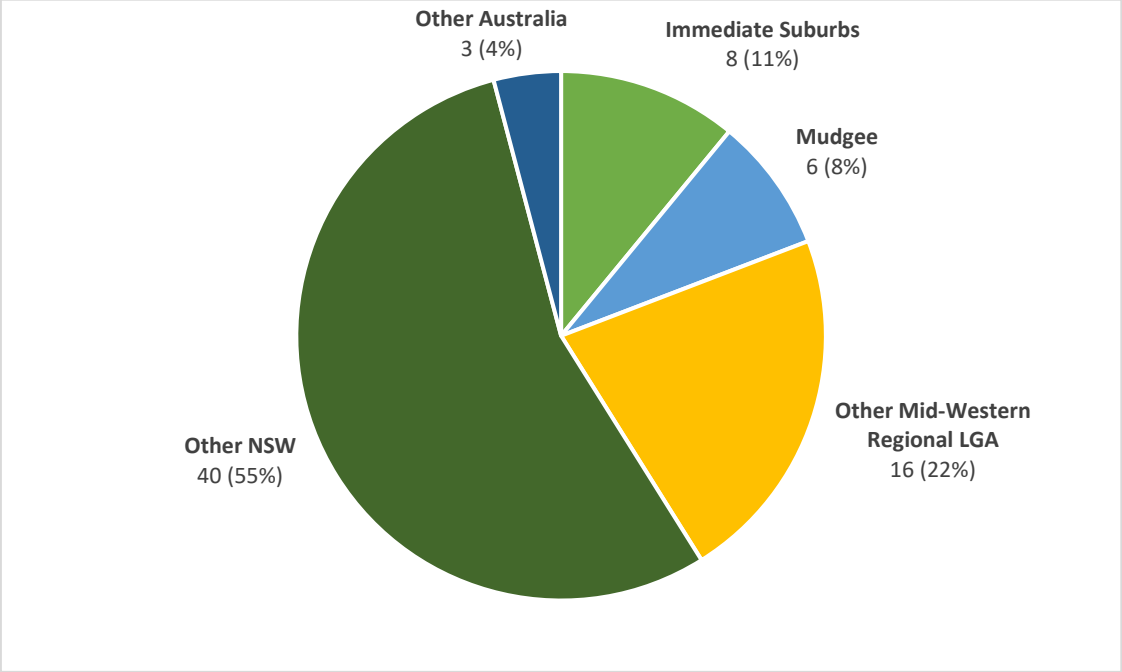
A total of 57 submissions were received from members of the public, of which two supported the Project and 55 objected to the Project.

A total of 18 submissions were received from organisations, all of which objected to the Project.

Chart 2-2 presents a summary of the objecting public and organisation submissions by location. Public and organisation submissions that objected to the Project were from a range of locations including the immediate localities (i.e. less than 5 km from the Project), the Mudgee township (approximately 40 km south-west of the Project area), other areas within the Mid-Western Regional Local Government Area (LGA), other areas in NSW and interstate locations.

Of the two public submissions which supported the Project, one of them was from the Mudgee Township (approximately 40 km south-west of the Project area) and one was from another area in NSW.

Chart 2-2
Objecting Public and Organisation Submissions by Location



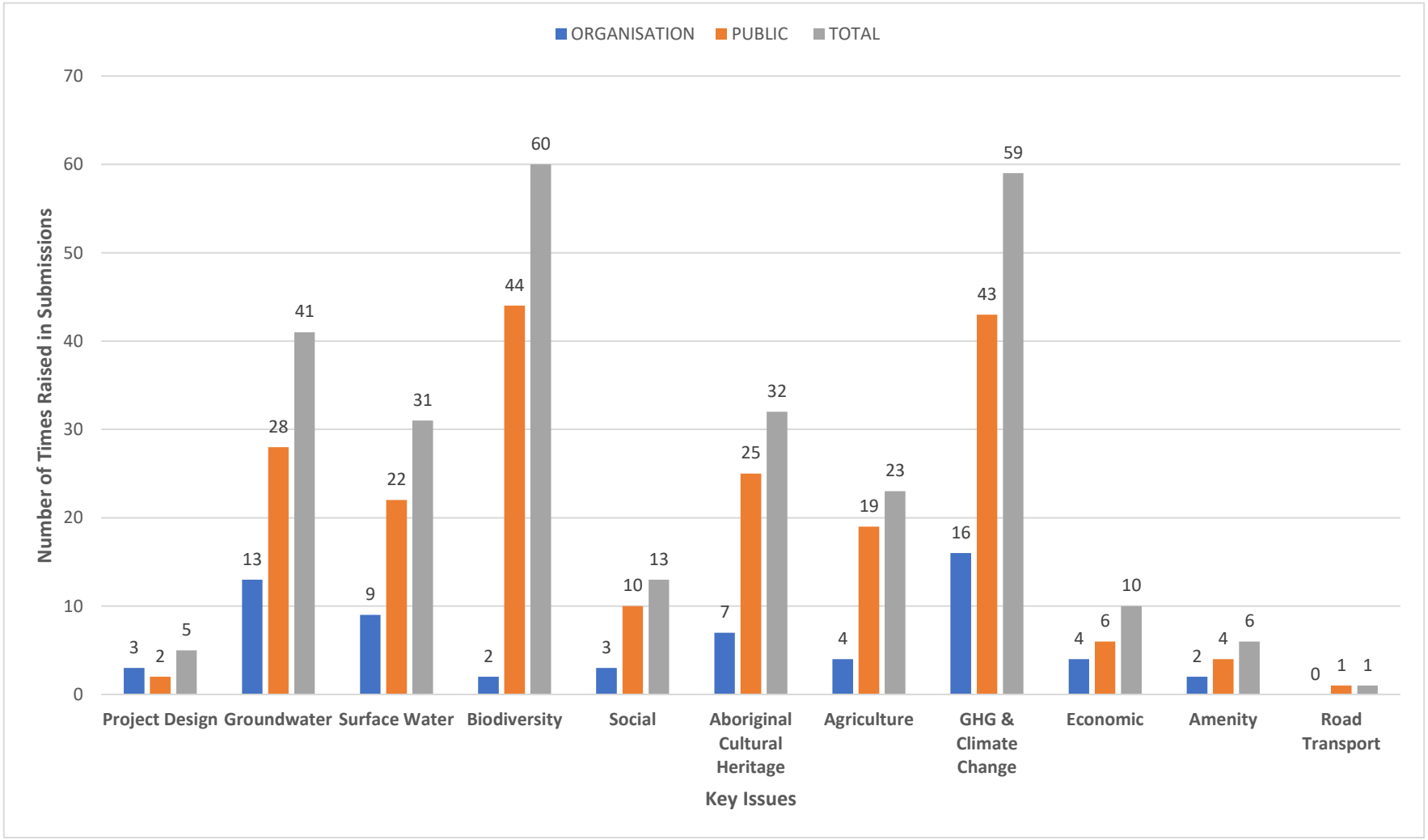
2.4 KEY MATTERS RAISED IN SUBMISSIONS

The most commonly raised matters in relation to the Project are illustrated in Chart 2-3. The following key matters were raised in the submissions:

- Project design;
- groundwater;
- surface water;
- biodiversity;
- social;
- Aboriginal cultural heritage;
- agriculture;
- greenhouse gas (GHG) and climate change;
- economic;
- amenity; and
- road transport.

A register of submissions, key issues raised in each submission and where each issue is addressed in this Submissions Report is provided in Attachment 1.

Chart 2-3
Key Issues Raised by Submission



3 ACTIONS TAKEN SINCE LODGEMENT OF THE PROJECT EIS

3.1 ENGAGEMENT ACTIVITIES

Since lodgement of the EIS, MCO has continued to engage with key stakeholders, including government agencies, local organisations and community members regarding the Project. The consultation with each of these stakeholders is summarised in the following sections.

3.1.1 Relevant Government Agencies

During the EIS exhibition period, MCO offered Project briefings to a number of government agencies (who provided input to the Secretary's Environmental Assessment Requirements [SEARs]) to provide an opportunity to discuss relevant EIS findings.

NSW Department of Planning, Housing and Industry

MCO has continued to consult with DPHI on the Project since lodgement of the EIS regarding assessment issues raised in submissions and to provide regular updates on the status of preparation of the Submissions and Amendment Reports, including:

- A briefing meeting on 24 April 2023 to discuss the Project and key submissions received on the EIS.
- A briefing meeting on 24 August 2023 to provide an update on the Project, outcomes of agency consultation to date and an overview of the proposed amendments to the Project.
- Briefing meetings on 23 November 2023 and 26 February 2024 to provide an overview of the outcomes of updated environmental assessment of the amendments to the Project.

Resource Regulator

MCO held a Project briefing with the Resource Regulator and Rehabilitation and Securities Panel on 1 December 2022. At the briefing, MCO provided an overview of the Project, key outcomes of the EIS, the proposed final landform, post-mining land use, rehabilitation and mine closure details.

Heritage NSW

A briefing meeting was held with Heritage NSW on 27 March 2023 to provide an overview of additional works completed since lodgement of the EIS (including further field survey) and the proposed approach to address the submission.

On 21 August 2023, a letter was provided to Heritage NSW in accordance with the *Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW* (DECCW, 2010a) to notify of proposed test excavations to be completed for the Project, and offer a briefing meeting to discuss.

A meeting was then held with Heritage NSW on 30 August 2023 to provide a further update on additional works undertaken since lodgement of the EIS, including field surveys, geomorphological assessment and ongoing consultation with Registered Aboriginal Parties (RAPs). Details of the proposed test excavation program were also provided, and the approach to update the Aboriginal Cultural Heritage Assessment (ACHA) was discussed.

Commonwealth Department of Climate Change, Energy, Environment and Water

A briefing with the Commonwealth Department of Climate Change, Energy, Environment and Water (Cth DCCEEW) was held on 15 September 2023 to provide an update on the Project and overview of the proposed amendments.

3.1.2 Mid-Western Regional Council

A planning agreement between MCO and Mid-Western Regional Council (MWRC) has been executed for the Project. As part of this agreement, MCO has provided a community contribution payment to MWRC to support construction of a bicycle Pump Track in Mudgee. MCO has also provided regular updates on the Project to the MWRC as part of ongoing consultation for the Moolarben Coal Complex operations.

3.1.3 Other Community Consultation

Since lodgement of the EIS, MCO has also undertaken broader engagement regarding the Project as follows:

- Project updates have been provided regularly to the Moolarben Coal Complex Community Consultative Committee at scheduled quarterly meetings (in November 2022 and March, June, September and November 2023, and March 2024).
- Notification of public exhibition of the EIS in November and December 2022.
- Hosting a drop-in information session at the Cooyal Community Hall on 7 December 2022 to provide an opportunity to discuss the outcomes presented in the EIS.
- Update of the MCO website and distribution of a Project newsletter in November and December 2022 to provide an overview of the Project following lodgement of the EIS.
- Distribution of a Project newsletter in March 2024 to provide an update on the Project and overview of proposed amendments.
- Ongoing consultation with Registered Aboriginal Stakeholders in accordance with the *Aboriginal cultural heritage consultation requirements for proponents 2010* (DECCW, 2010b) regarding public exhibition of the EIS, additional fieldwork and assessment to address submissions and the revised ACHA report.
- Ongoing consultation with the adjacent Ulan Mine Complex and Wilpinjong Coal Mine regarding updates on the status of the Project and proposed amendments.
- Ongoing consultation with Yancoal and Moolarben Coal Complex employees and contractors.

3.2 PROJECT AMENDMENTS AND FURTHER ENVIRONMENTAL ASSESSMENT

3.2.1 Project Amendments

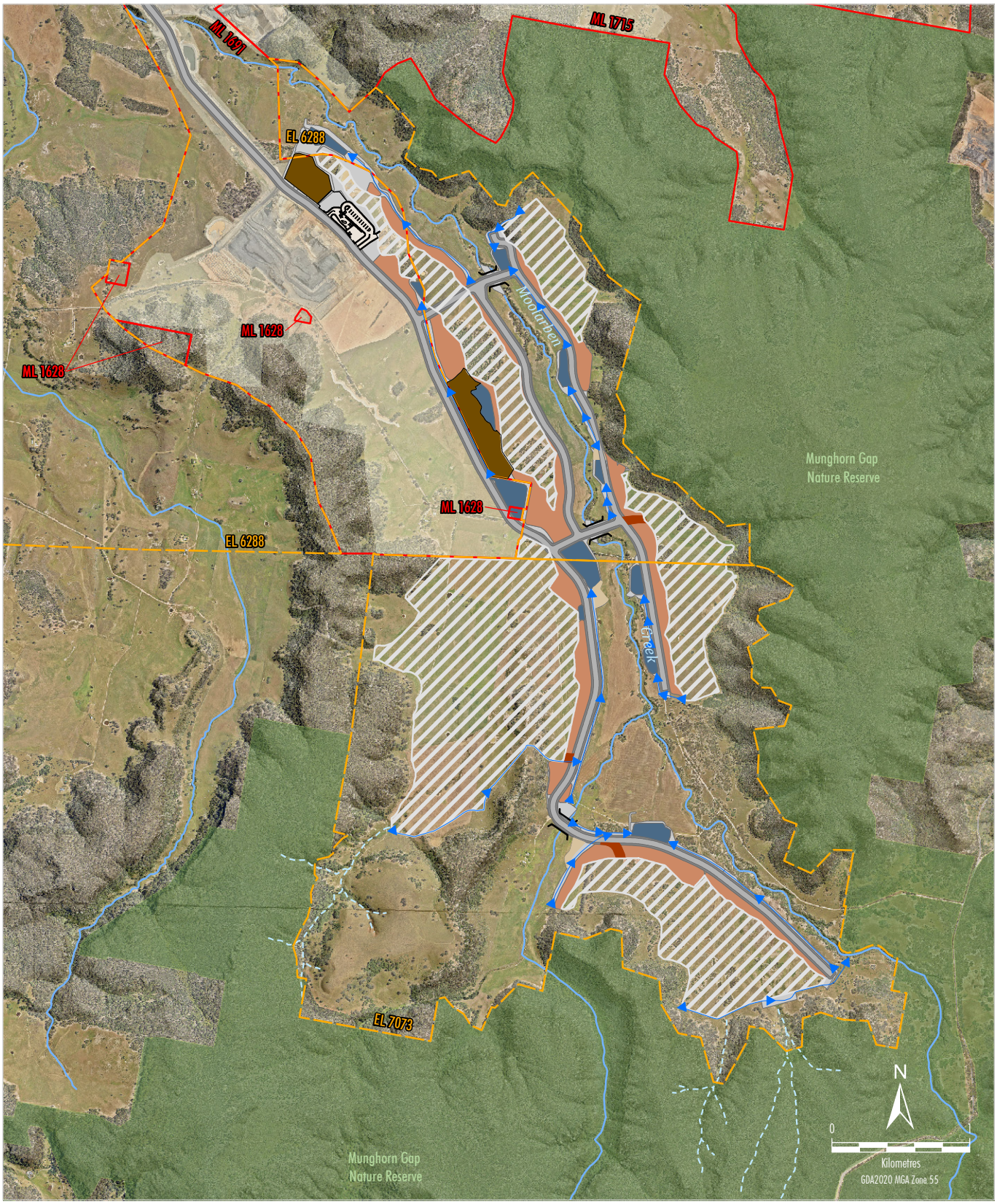
Overview

Following the EIS exhibition period, submissions raised concerns with potential direct impacts to threatened species habitat, particularly SAII entities, as well as potential indirect impacts to the Munghorn Gap Nature Reserve.

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to further avoid and/or minimise impacts to threatened species habitat. The indicative surface disturbance extent for the amended Project is presented on Figure 1-3 and a revised Project general arrangement is presented on Figure 3-1.

The areas proposed for further avoidance and minimisation have targeted key threatened species habitat for potential SAII entities, largely contiguous remnant woodland vegetation, as well as further setback from the Munghorn Gap Nature Reserve and rocky habitat features. These areas are on the outer edge of the Project mining area such that the extent of open cut mining has been reduced while maintaining a feasible and economically viable mine plan.

The reduced extent of the open cut mining areas has an associated reduction in the available coal resource of approximately 10 Mt (i.e. total ROM extraction reduced from approximately 40 Mt to 30 Mt), with an associated reduction in royalty payments of $63 million ($AU2024).



MCM-20-18 OC3 Ext AR SR_204A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- OC3 Extension Project - Amended
- Indicative Open Pit Extent
- Indicative ROM Pad
- Culvert
- Indicative Haul Roads and Infrastructure Corridor
- Indicative Infrastructure Area
- Indicative Construction/Rehabilitation Material Stockpiles
- Conceptual Flood Levee Embankment
- Conceptual Water Management Infrastructure
- Indicative Vehicle Access
- Conceptual Surface Water Drain

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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General Arrangement of the Amended Project

Figure 3-1

The amended Project design achieves the following:

- Avoidance of any mining-related disturbance within 100 metres (m) of the Munghorn Gap Nature Reserve (noting the EIS proposed no open cut mining within 50 m of the Munghorn Gap Nature Reserve).
- Avoidance of any clearance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species (i.e. Large-eared Pied Bat and Eastern Cave Bat) and the Broad-headed Snake (noting the EIS proposed avoidance of any clearance of mapped rocky habitat).
- Approximately 59% (i.e. 50 ha) less disturbance of the woodland component of Box-Gum Woodland CEEC compared to the Project EIS.
- Approximately 56% (i.e. 103 ha) less disturbance of Regent Honeyeater Important Habitat Mapping compared to the Project EIS.

Further details of the amended Project and key avoidance and minimisation measures are described in the Amendment Report.

Additional Mitigation Measures

Blast design parameters have been reviewed, with input from PSM Consult Pty Limited (PSM) (2024), to develop vibration thresholds to protect sensitive geological features (including within the Munghorn Gap Nature Reserve and mapped rocky habitat on ridgeline areas adjacent to the amended Project and outside the Munghorn Gap Nature Reserve) from indirect blast vibration impacts.

The Project EIS proposed to establish a Habitat Enhancement Area of approximately 160 ha within riparian zones along Moolarben Creek and Murdering Creek, outside the proposed indicative surface disturbance extent. To further mitigate potential impacts to threatened species habitat, the amended Project would extend the Habitat Enhancement Area by approximately an additional 28 ha (to a total of 188 ha) (Figure 3-2). Approximately 135 ha of Derived Native Grassland (DNG) and cleared land within the Habitat Enhancement Area is proposed to be revegetated to provide habitat values consistent with the remnant woodland.

In consideration of the revised extent of native woodland clearance proposed for the amended Project (i.e. approximately 113 ha, compared to 230 ha proposed for the EIS), revegetation of DNG/cleared land to woodland within the extended Habitat Enhancement Area (i.e. approximately 135 ha) would provide a net increase in woodland in the Moolarben Valley of approximately 22 ha during mining. This is prior to any consideration of proposed native woodland rehabilitation within the Project indicative surface disturbance extent.

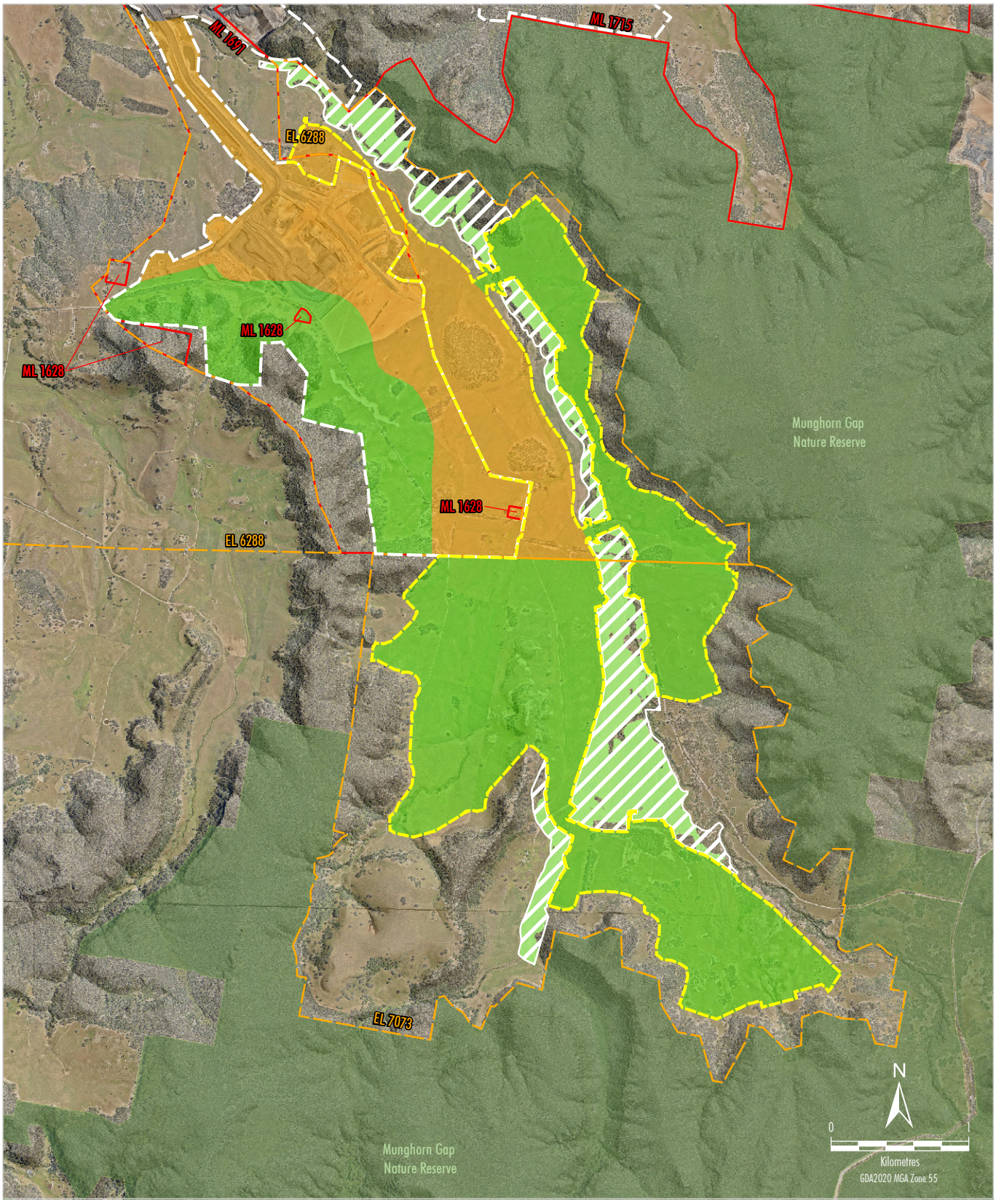
As a component of the review of the Project design, MCO has also identified opportunities to improve the conceptual post-mining land uses by increasing the area rehabilitated to native woodland vegetation from approximately 325 ha to 535 ha (Figure 3-2). With the proposed revegetation within the extended Habitat Enhancement Area (i.e. net increase of approximately 22 ha during mining) and rehabilitation (i.e. approximately an additional 535 ha), there is a long-term net increase in native woodland in the Moolarben Valley of approximately 557 ha.

Offset Strategy

Residual potential impacts on biodiversity would be offset in accordance with the NSW *Biodiversity Conservation Act 2016* (BC Act), including retirement of credits, funding of a biodiversity conservation action and/or payment into the Biodiversity Conservation Fund.

MCO is expecting land based offset options to be available to secure the Project's total offset liability for the Regent Honeyeater and Koala (and potential for other threatened species following targeted surveys), including options to establish land-based offsets using Moolarben-owned land in the region.

MCO is also investigating two potential "onsite" offset areas within the Project Study Area, associated with Regent Honeyeater Important Habitat Mapping, Box-Gum Woodland CEEC and other recorded threatened species and their habitat (including Large-eared Pied Bat, Eastern Cave Bat, Pink-tailed Legless Lizard, Squirrel Glider and Koala).



MCM-20-18 OC3 Ext AR SR_205A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- OC3 Extension Project - Amended
- Indicative Amended Project Surface Disturbance Extent

Conceptual Post-mining Land Use Areas

- Agricultural Pasture
- Native Woodland

Habitat Enhancement Area

- Indicative Habitat Enhancement Area
- Indicative Revegetation Area Extent

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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Conceptual Post-mining Land Use Areas

Figure 3-2

3.2.2 Further Environmental Assessment

MCO has undertaken a review of the reduced potential environmental impacts of the amended Project to identify key aspects where the revised environmental impacts require formalisation (e.g. reduced disturbance and associated change in biodiversity offset credits).

Additional assessment of the environmental impacts has been undertaken by specialists, including:

- Updated Biodiversity Development Assessment Report (BDAR) (Appendix C of the Amendment Report).
- SAII Expert Reports (Appendix D of the Amendment Report).
- Updated ACHA (Appendix E of the Amendment Report).
- Groundwater Review (Appendix F of the Amendment Report).
- Surface Water Review (Appendix G of the Amendment Report).
- Noise and Blast Impact Review (Appendix H of the Amendment Report).
- Blast Vibration Impact Assessment (Appendix I of the Amendment Report).
    - LiDAR Analysis (Appendix A of the Blast Vibration Impact Assessment).
    - Geotechnical Review (Appendix B of the Blast Vibration Impact Assessment).
- Air Quality and Greenhouse Gas Addendum Report (Appendix J of the Amendment Report).
- Addendum Economics Assessment (Appendix K of the Amendment Report).
- Additional Stygofauna Survey (Attachment 2 of this Submissions Report).

Outcomes of additional assessment and updated mitigation and management measures for the amended Project are incorporated in the response to submissions (Section 4) and described in the Amendment Report.

4 RESPONSES TO SUBMISSIONS

4.1 GOVERNMENT AGENCY SUBMISSIONS

Responses to comments from Government agency submissions are provided below for BCS and NPWS, Heritage NSW, NZEM, DPE – Water, DPE – Crown Lands, MWRC and the IESC.

Submissions received from other agencies had no assessment-related comments on the Project to respond to and therefore their comments are noted and a specific response has not been provided. Key comments from the submissions received from the EPA, MEG and Resource Regulator, Transport for NSW and DPI – Agriculture are provided below.

Environment Protection Authority

The EPA submission noted the conclusion of the EIS that potential impacts on water air, and noise resulting from the Project would be within limits stipulated by the Moolarben Coal Complex Project Approvals (05_0117 and 08_0135) and existing EPL 12932. EPA also stated:

> *… The EPA recommends that, in light of the PNTLs being less stringent than the existing Project Approval Noise criteria, the noise limits in those approvals be retained.*
>
> *The EPA also recommends that the relevant air, noise, blasting and water management plans be updated to reflect the activities covered by the project should project approval be granted.*

MEG and Resources Regulator

The submission from MEG and the Resources Regulator stated:

> *MEG considers the Project to be an efficient use of resources and that it will provide an appropriate return to the NSW Government.*
>
> *MEG is satisfied that, should the operational outcomes be achieved, the proposed mine design and mining method submissions adequately recover resources and will provide an appropriate return to the state.*

Transport for NSW

The Transport for NSW submission stated:

> *TfNSW considers that in our technical assessment of the EIS, specifically the Road Transport Assessment by TTPP (Job No. 21195, Version Final, dated 2/11/2022) that the 'baseline' for impact assessment is unchanged and that the proposal is unlikely to increase demand for road infrastructure, transport facilities and services in this location.*
>
> *It is noted that a Traffic Management related consent condition has been imposed as part of previous Moolarben Coal Expansion & Moolarben Coal Project approvals. For consistency purposes, it is recommended that this condition be replicated as part of any approval issued.*

DPI - Agriculture

The submission from DPI – Agriculture stated:

> *It is considered the proposal will not have a significant impact on any agricultural land use or agricultural production and therefore NSW DPI have no comments or additional requirements for this proposal.*

4.1.1 Biodiversity, Conservation and Science Directorate and National Parks and Wildlife Services

Issue

The total impact resulting from the project has not been adequately assessed

Recommendation 1.1

Undertake habitat mapping for sandstone specialist threatened species habitat within the areas likely to receive vibration impacts from blasting. This should be undertaken after a revised damage criterion is established, as recommended in Heading 2.

Response

MCO would implement reasonable and feasible measures to minimise blasting impacts, and so the 'predicted geological vibration damage' area mapped by BCS on Figure 1 of the BCS and NPWS submission is not an accurate depiction of the extent of impacts likely to occur from the Project.

MCO has proposed to adjust blast designs during Project operations to comply with a conservative vibration upper limit of 50 millimetres per second (mm/s) (peak particle velocity [PPV]) at the nearest mapped rocky habitat (Appendix I of the Amendment Report), unless further geotechnical investigation supports a higher value. As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no physical impact to mapped rocky habitat or other sensitive geological features distinguishable from natural processes (PSM, 2024). Niche (2024a) conclude the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project.

The BDAR (Niche, 2022a) presented habitat mapping for relevant sandstone specialist threatened species (i.e. Large-eared Pied Bat, Eastern Cave Bat, Pink-tailed Legless Lizard and Broad-headed Snake) within the Study Area. No wider habitat mapping was required for the revised BDAR (Niche, 2024a) as the closest (>100 m) rocky habitat from the indicative surface disturbance extent will be protected via the blast limits for the Project. It is noted some updates to the extent of rocky habitat have been included as an outcome of LiDAR review of sensitive geological features and ground truthing. This is further described in Recommendation 2.1.

Further to the above, the Little Bent-winged Bat, Red Crowned Toadlet, Spotted-tailed Quoll and Brush-tailed Rock-wallaby were not recorded during the surveys for the Project and therefore no additional habitat mapping is required. The Large Bent-winged Bat was recorded likely foraging but not roosting in the Study Area.

Recommendation 1.2

Describe the nature, extent, frequency, duration and timing of prescribed impacts that may occur for each species in accordance with Section 8.3 of the BAM.

Response

Table 17 of the BDAR (Niche, 2022a) lists the following species that use 'Karst, caves, crevices, cliffs, rocks or other geological features of significance':

- Pink-tailed Legless Lizard (scattered surface rock within the indicative surface disturbance extent);
- Broad-headed Snake (rocky habitat outside of the indicative surface disturbance extent);
- Large-eared Pied Bat (rocky habitat outside of the indicative surface disturbance extent); and
- Eastern Cave Bat (rocky habitat outside of the indicative surface disturbance extent).

The nature, extent, frequency, duration and timing of prescribed impacts that may occur to each of these species is addressed in Section 5.3 of the revised BDAR (Niche, 2024a).

Recommendation 1.3

For areas outside of NPWS estate, offset residual prescribed impacts in accordance with Section 6.1.2(b) of the Biodiversity Conservation Regulation 2017 and Section 8.6 of the BAM.

Response

The revised BDAR (Niche, 2024a) has calculated the offset requirement for the Project in accordance with the Biodiversity Assessment Method (BAM) (DPIE, 2020). No additional offsets are proposed for prescribed impacts, with the exception of the clearance of surface rock potentially used by the Pink-tailed Legless Lizard on Category 1 - exempt land. Section 4.4.1 of the revised BDAR (Niche, 2024a) states:

> *As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no physical damage distinguishable from natural process (PSM 2024). Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project.*

In relation to the clearance of surface rock potentially used by the Pink-tailed Legless Lizard on Category 1 - exempt land (already cleared land), it is noted that there is no set methodology for the quantification of the residual impacts under the BAM (DPIE, 2020). In absence of this, a conservative number of credits has been calculated assuming the already cleared land has the values of a native grassland. Section 5.3.4 of the revised BDAR (Niche, 2024a) states:

> *Approximately 1.3 ha of potential Pink-tailed Legless Lizard surface rocky habitat overlaps Category 1 – exempt land. However, when the species 50 m buffer of rocky areas habitat constraint was applied to this rocky habitat, approximately 25.3 ha overlaps the Category 1 – exempt land.*
>
> *As credits cannot be generated within the BAM-C for impacts to non-native vegetation, an offset for impacts to potential habitat within the lowest condition native grassland habitat present (PCT 281_DNG-Low with a VI score of 32.7) was used to estimate the offset requirement for impacts to Pink-tailed Legless Lizard habitat within Category 1 - exempt land. Impacts to Pink-tailed Legless Lizard habitat within PCT 281_DNG-Low vegetation zone generated a requirement of 16 credits per hectare. It should be noted that the Category 1 - exempt land is of relatively poor quality with a VI score of 15 or less (less than half the VI score of the PCT 281 – DNG low).*
>
> *Within the Development Footprint, the Pink-tailed Legless Lizard species polygon includes Category 1 – exempt land as follows:*
>
> - *Stage 1: 12.2 ha*
> - *Stage 2: 12.7 ha*
> - *Stage 3: 0.4 ha.*
>
> *Based on credit requirement of 16 credits per hectare, a total of 404.8 credits (rounded up to 405 credits) would be required to offset prescribed impacts to the Pink-tailed Legless Lizard based on the following staging:*
>
> - *Stage 1: 195.2 credits*
> - *Stage 2: 203.2 credits*
> - *Stage 3: 6.4 credits.*

Recommendation 1.4

For areas within NPWS estate that will receive vibration impacts, establish setbacks between open-cut pits and all geological features, such that no impacts are expected to occur. This should be undertaken after a revised damage criterion is established, as recommended in Heading 2.

Response

MCO has reviewed and amended the Project design in response to submissions received on the Project EIS. The amended Project is now proposed to include additional setbacks such that there would be no direct disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake within and adjacent to the Project area and within the Munghorn Gap Nature Reserve. The amended Project would now also avoid all mining-related disturbance within 100 m of the Munghorn Gap Nature Reserve.

In response to comments about the protection of geological features in the Munghorn Gap Nature Reserve, MCO has also developed specific blast vibration limits, with input from blast, geotechnical and ecology specialists, to manage and mitigate potential indirect impacts to rocky habitat and associated threatened species during mining:

- Blast vibration would be limited to 50 mm/s PPV at mapped rocky habitat, unless further geotechnical investigation supports a higher value.
- Management of blast design and execution would be implemented for blasts located nearest to mapped rocky habitat to achieve the vibration limit. Additional blast vibration monitoring would be implemented.

The Project as presented in the EIS avoided direct disturbance of all mapped rocky habitat associated with sandstone specialist threatened species. The amended Project design now incorporates a 100 m setback of all disturbance (including open cut pit extents) from mapped rocky habitat. As a result, the potential for impacts as a result of blast vibration at mapped rocky habitat would be reduced, due to the greater distance from the proposed open cut pit extents when compared to the Project EIS.

As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blast vibration would result in no physical impact to mapped rocky habitat or other sensitive geological features distinguishable from natural processes (PSM, 2024). Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project (Niche, 2024a).

The amended Project is considered to provide the most beneficial outcome to address comments received on the Project EIS, by reducing impacts on threatened species habitat while continuing to achieve the Project design objectives, albeit with reduced resource recovery.

Higher value threatened species habitat remaining within the amended Project indicative surface disturbance extent comprises isolated stands and scattered patches of woodland separated by areas of Category 1 – exempt land or DNG (i.e. not contiguous areas or corridors). It would not be reasonable or feasible to avoid all of this habitat as the discontinuous nature would reduce the viability of the Project.

The BCS and NPWS submission recommended MCO consider additional strategies to minimise impacts to biodiversity values. In particular, BCS and NPWS recommended MCO apply a setback of 500 m to the boundary of the Munghorn Gap Nature Reserve. This setback would make the eastern and south-western pits uneconomic. MCO has reviewed the NPWS guideline *Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities* (NPWS, 2020) and considers that the amended Project has been designed to satisfy the aims of this guideline.

Section 5.5 of the revised BDAR (Niche, 2024a) states:

> *There would be a minimum of 100 m from the edge of any open cut pit to the boundary of the Nature Reserve. The Development Footprint is at least 100 m from the boundary of the Nature Reserve (a buffer of which is vegetated) and ranges from 100 to 300 m from the Nature Reserve within the east and south of the Project (Stage 2 and 3). The buffer between Stage 1 area and the Nature Reserve is about 450 m.*
>
> *…*
>
> *Accordingly, sensitive geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve) would be expected to experience limited to no vibration as a result of this limit.*

Section 5.3.1 of the revised BDAR (Niche, 2024a) states:

> *As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no distinguishable impacts from natural process (PSM, 2024). Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project.*

Recommendation 2.1

Undertake a ground-truthing survey for sensitive geological features surrounding the project which are expected to receive vibration impacts.

Response

Light Detection and Ranging (LiDAR) data was analysed by Mine Subsidence Engineering Consultants (Appendix I of the Amendment Report). The LiDAR mapping identified potential natural geological features such as cliffs, minor cliffs and rock face features that may be utilised by sandstone specialist threatened species within and surrounding the Project. The mapped LiDAR features were defined as per the definitions in the Moolarben Coal Complex Stage 2 Project Approval (08_0135):

- Cliffs – A continuous rock face, including overhangs, having a minimum length of 20 m, a minimum height of 10 m and a minimum slope of 2 in 1 (>63.4 degrees [°]);
- Minor cliffs – A continuous rock face, including overhangs, which has a:
  - minimum length of 20 m and a height between 5 m and 10 m, or a maximum length of 20 m and a minimum height of 10 m; and
  - minimum slope of 2 to 1 (>63.4°).
- Rock face features – A continuous rock face, including overhangs, which has a:
  - minimum length of 20 m and a height between 3 m and 5 m, or a maximum length of 20 m and a minimum height of 5 m; and
  - minimum slope of 2 to 1 (>63.4°).

Features mapped using LiDAR data were reconciled against habitat mapping for the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake, and a ground-truthing survey of expanded mapping of Rocky Habitat was undertaken by Niche ecology specialists to confirm identified features outside of the mapped rocky habitat extent, as detailed in Section 2.1.4 of the revised BDAR (Niche, 2024a):

> *A 100 m buffer was applied to the geological features to identify potential breeding habitat for the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake. Potential breeding habitat was found to intersect the Development Footprint in five locations, where habitat for these species had not been previously mapped by AMBS (2023). As such, an additional on-site survey was conducted to ground-truth these areas and determine their suitability as potential habitat for Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake. It was determined that all five areas represent potentially suitable habitat for the Broad-headed Snake, and three of the areas represent potentially suitable habitat for the Large-eared Pied Bat and the Eastern Cave Bat.*
>
> *Based on the results of the LiDAR mapping and the ground-truthing survey, the species polygons for sandstone specialist species (the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake) were updated to incorporate the newly identified areas of potential habitat as determined from the LiDAR data.*

Recommendation 2.2

Prepare a site-specific vibration damage analysis, inclusive of revised damage criterion, modelled for the actual context of the project and its surrounding geological complexity.

Response

The Project as presented in the EIS avoided direct disturbance of all mapped rocky habitat associated with sandstone specialist threatened species. The amended Project incorporates a 100 m setback of all Project disturbance (including open cut pit extents) from mapped rocky habitat associated with sandstone specialist threatened species. As a result, the potential for impacts as a result of blast vibration at mapped rocky habitat would be reduced, due to the greater distance from the proposed open cut pit extents when compared to the Project EIS.

In order to undertake a site-specific vibration impact analysis for the clifflines surrounding the Project area, a "baseline" study of geological features nearer to the existing operational Moolarben Coal Complex was completed (Appendix I of the Amendment Report). The extent of the geological features identified is presented in Figure 4-1 and the extent of mapped rocky habitat is presented on Figures 4-2 and 4-3.

A review of vibration data from existing MCO blast monitoring stations at geological features BM2 and BM7 was conducted to analyse the effects of potential blast vibration on rock features proximal to open cut development areas. These monitoring sites are similar in location and geology to the geological features surrounding the Project area, with a significant amount of data that could be analysed to determine vibration levels previously experienced at geological features proximal to the existing approved Moolarben Coal Complex operations. Maximum and typical vibration recordings for these two shelter sites were noted.

Geotechnical specialists PSM completed an on-the-ground assessment to geotechnically characterise the key cliffs near the existing operational Moolarben Coal Complex, and assess the extent of any historical mining-related impact. Characterisation involved physically testing rock strength, assessing weathering patterns, bedding, geological strength (blockiness/massiveness), existing fracturing and matrix components (lithology), and discerning between distinct geomorphologies.

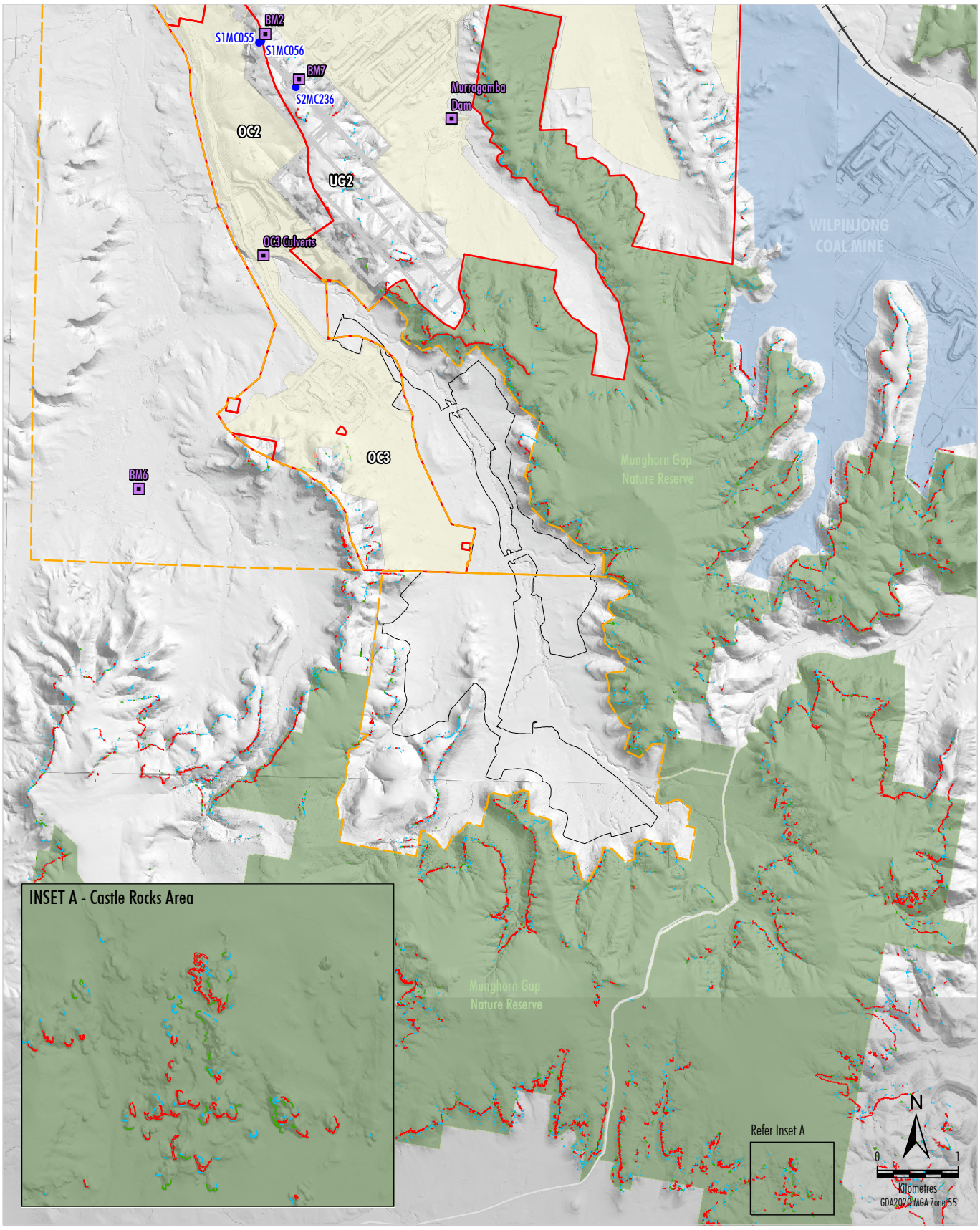
PSM assessed whether any historical impacts on the geological features near to the existing operational Moolarben Coal Complex were a result of blast interactions. The assessment considered potential factors such as observation of freshly exposed rock, recent rock fall with minimal weathering, signs of historical, non-blasting anthropogenic influence (e.g. rocks with different geology to their surroundings indicating that they have been shifted), weaker sections that would be more susceptible to vibration impacts but remain in place, and recently changed water flowpaths or pools. Factors were considered with reference to well-established impact criteria adapted from Dowding & Rozen (1978).

The impact assessment formed a site-specific baseline and provided an understanding of the level of vibration that would or would not cause an impact on similar geological features. Following the assessment, PSM concluded that vibration from blasting has caused no impacts on the geological features near to the existing operational Moolarben Coal Complex distinguishable from natural processes or other anthropogenic sources. This observation can therefore be considered in combination with the maximum and typical vibration experienced at these geological features (or predicted to have been experienced) as per MCO monitoring data.

PSM completed a characterisation of a number of geological features surrounding the Project area, in order to gain an understanding of the typical qualities of the cliffs, minor cliffs and rock face features in the area, and confirm their similarity to the geological features near to the existing operational Moolarben Coal Complex. As well as site-specific fieldworks, PSM undertook a literature review for published information relevant to the relationship between vibration and impact to geological features.

The literature review included a number of case studies from Australia and internationally that recorded either no impact, minor impact or major impact due to blasting. In some cases a vibration of 650 mm/s was recorded with no or insignificant identifiable impact to geological features. Additionally, PSM reviewed the precedent previously set for blast vibration limits for mining projects near geological features in other sedimentary settings throughout Australia.

In consideration of the characterisation, assessment and review summarised above, PSM conservatively recommended a vibration upper limit of 50 mm/s PPV at the nearest mapped rocky habitat (unless further geotechnical investigation supports a higher value). At a vibration level of 50 mm/s, it is expected that there would be no impact to the mapped rocky habitat or geological features located further into the Munghorn Gap Nature Reserve distinguishable from natural processes (Appendix I of the Amendment Report). Further detail on the mapped rocky habitat is provided in the response to Recommendation 2.1.



MCM_20-18 OC3 Ext AR SR_206A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary

Existing/Approved Development

- Underground Longwall Layout
- Moolarben Coal Complex Disturbance Footprint

OC3 Extension Project

- Indicative Project Surface Disturbance Extent
- Historically Mentioned ACHA Sites
- Blast Monitoring Site

MSEC LiDAR Review

- Cliffs
- Minor Cliffs
- Rockface Features

Source: MCO (2022); NSW Spatial Services (2021); MSEC (2023); Niche (2023)
Orthophoto: MCO (Jan 2021)

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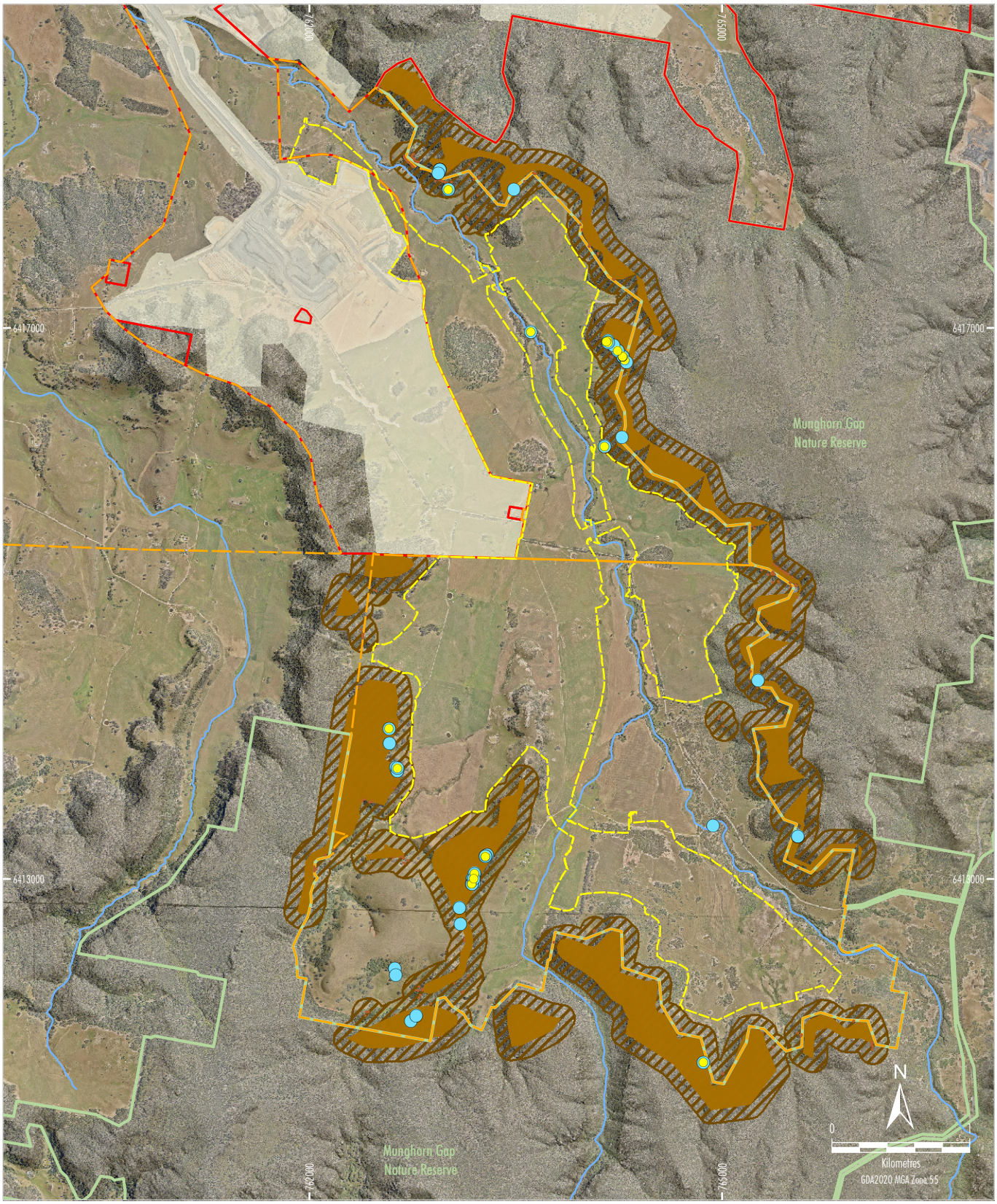
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Sensitive Geological Features
Identified via LiDAR Analysis

Figure 4-1



LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- Indicative Amended Project Surface Disturbance Extent

Eastern Cave Bat and Large-eared Pied Bat

- Mapped Rocky Habitat
- 100 m Buffer from Mapped Rocky Habitat (Breeding Habitat)
- Eastern Cave Bat Record
- Large-eared Pied Bat Record

Source: MCO (2023); NSW Spatial Services (2021); AMBS (2023)
Orthophoto: MCO (2021)

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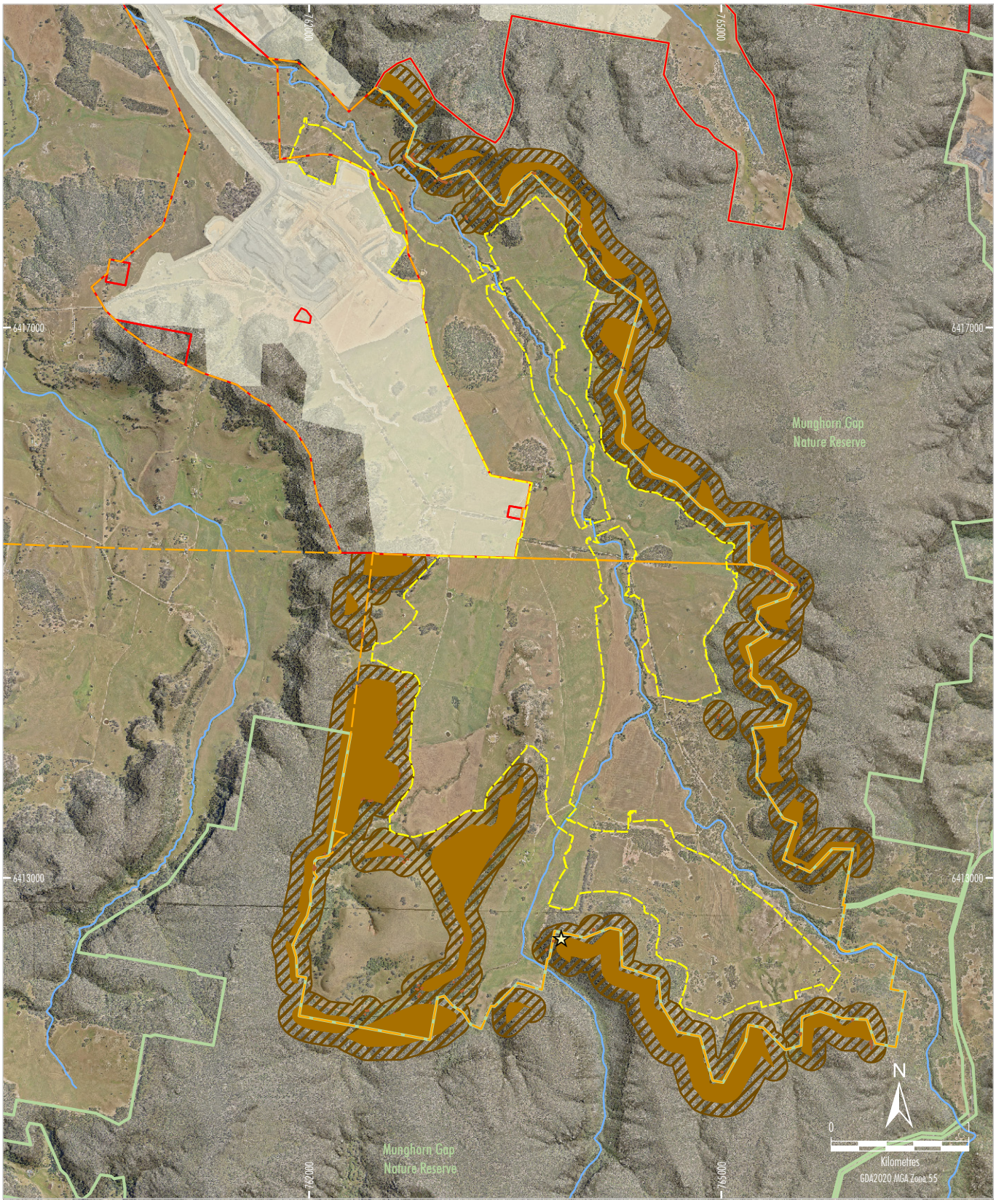
MOOLARBEN COAL COMPLEX

Eastern Cave Bat and Large-eared Pied Bat Habitat

Figure 4-2



MCM-20-18 OC3 Ext AR SR_208A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- Indicative Amended Project Surface Disturbance Extent

Broad-headed Snake

- Mapped Rocky Habitat
- 100 m Buffer from Mapped Rocky Habitat (Breeding Habitat)
- Broad-headed Snake Record

Source: MCO (2023); NSW Spatial Services (2021); AMBS (2023)
Orthophoto: MCO (2021)

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MOOLARBEN COAL COMPLEX

Broad-headed Snake Habitat

Figure 4-3

MCO will implement appropriate mitigation and management measures to comply with the conservative vibration upper limit of 50 mm/s PPV at mapped rocky habitat, unless further geotechnical investigation supports a higher value, including:

- pre-blast desktop assessment to identify the proximity of mapped rocky habitat to planned blasts, in order to inform vibration modelling and therefore blast design;
- site-specific vibration modelling per blast to calculate maximum instantaneous charge (MIC) required to meet the recommended vibration limit for nearest mapped rocky habitat;
- moderation of MIC to achieve the appropriate vibration limit for the nearest mapped rocky habitat;
- implementation of pre-split blasts where appropriate to reduce the propagation of vibration through the ground;
- continuation of existing vibration monitoring as described in the Blast Management Plan, and implementation of additional vibration monitoring at representative sites of mapped rocky habitat adjacent to the Project;
- ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary; and
- visual inspections of key representative mapped rocky habitat on a six-monthly basis to confirm that the target outcome of no physical impact to mapped rocky habitat (and therefore no physical impact to the Munghorn Gap Nature Reserve) as a result of blasting vibrations continues to be achieved.

As a result of the proposed vibration limit (as well as related mitigation and avoidance measures), it is considered likely that blasting vibration would result in no physical damage to mapped rocky habitat or other sensitive geological features distinguishable from natural processes. Therefore, the impacts of vibration are considered unlikely to result in a residual prescribed impact to the threatened species occupying sandstone habitats surrounding the Project (Niche, 2024a).

Recommendation 3.1

Determine an appropriate airblast criterion for threatened taxa within the vicinity of the project.

Response

Mining activities have occurred adjacent to the Munghorn Gap Nature Reserve since the commencement of operations for the Wilpinjong Coal Mine in 2006 and Moolarben Coal Complex in 2010.

During this time, a significant number of threatened species have been recorded directly adjacent to operating mine areas, as well as within the Munghorn Gap Nature Reserve, including during targeted surveys undertaken for the Project immediately adjacent to the existing OC3 mining area.

To minimise the potential impacts from blasting and vibration on mapped rocky habitat features, MCO would implement measures and reduce blasting criterion (i.e. vibration limit of 50 mm/s PPV at mapped rocky habitat features, unless further geotechnical investigation supports a higher value). Accordingly, sensitive geological features and other habitat located further from blasting than the mapped rocky habitat (e.g. within the Munghorn Gap Nature Reserve) would be expected to experience limited to no vibration as a result of this limit, as well as reduced airblast levels.

MCO would implement all reasonable and feasible measures to minimise noise, blast and vibration impacts from the Project as per existing environmental management plans for the Moolarben Coal Complex, which would be updated for the Project.

It is noted mining operations for the Wilpinjong Coal Mine are approved until 2034 and the Moolarben Coal Complex until 2038. Therefore, in the absence of the Project (which proposes mining to 2034), vibration and airblast impacts would continue to be experienced.

Recommendation 3.2

[In relation to blasting vibration]. *Describe the nature, extent and duration of short-term and long-term impacts for each threatened taxa likely to be disturbed, in accordance with Section 8.2 of the BAM.*

Response

Refer to MCO's response to Recommendations 1.3, 2.1 and 2.2.

Recommendation 3.3

If there is uncertainty related to the expected impacts that airblast disturbance may cause, a worst-case scenario should be assumed.

Response

Refer to the response to Recommendation 3.1.

Recommendation 4.1

Describe and justify, in detail, how vibration damage to biodiversity and geodiversity values are expected to be managed during the operation of the project, such that no impacts will occur.

Response

Refer to the response to Recommendation 2.2.

Recommendation 5.1

Describe and justify, in detail, how noise impacts to threatened species and their habitats are expected to be managed during the operation of the project, such that no impacts will occur.

Response

Mining activities have occurred adjacent to the Munghorn Gap Nature Reserve since the commencement of operations for the Wilpinjong Coal Mine in 2006 and Moolarben Coal Complex in 2010. Mining operations for the Wilpinjong Coal Mine are approved until 2034 and the Moolarben Coal Complex until 2038. Project mining operations are proposed until 2034, which is within the approved life of the Moolarben Coal Complex.

Therefore, in the absence of the Project, the Munghorn Gap Nature Reserve would continue to experience noise impacts from existing mining operations.

Mining operations are not the only source of noise impacts on the Munghorn Gap Nature Reserve. Noise impacts occur from a range of other anthropogenic noise sources on land proximal to the reserve such as noise from traffic, farming machinery, dirt bikes and licensed hunting activities.

Noise is an unavoidable short-term effect from open cut mining noting the Project life is only 10 years. Noise may temporarily disrupt individual animals near the mine during operations, however, there is unlikely to be any loss in biodiversity as a result of noise.

Noise from the Project would be managed to comply with specific noise limits to protect human health and amenity which would indirectly assist in minimising noise impacts to threatened species and their habitat.

Recommendation 6.1

Confirm that the total clearing required for the development has been included in the BDAR and accounted for in the BAM-C or that a worst-case scenario has been assumed.

Response

The indicative surface disturbance extent assessed in the revised BDAR (Niche, 2024a) encompasses the total clearing footprint required for the Project.

Issue

SAII criteria have been met and further avoidance of impacts should be undertaken

Recommendation 7.1

The consent authority note BCS advice in relation to SAII criteria for Microbats and the Broad-headed Snake when considering the adequacy of avoidance and minimisation to biodiversity impacts proposed, conditioning of the project and potential project approval.

Response

Large-eared Pied Bat / Eastern Cave Bat

MCO has reviewed and amended the Project to provide additional setbacks such that there would be no direct disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with the Large-eared Pied Bat and Eastern Cave Bat shown in Figure 4-2.

Further to the proposed avoidance measures, measures to mitigate impacts on the Large-eared Pied Bat and Eastern Cave Bat would be described in an updated or new Biodiversity Management Plan, including:

- measures to ensure the disturbance area setbacks from mapped rocky habitat for the Large-eared Pied Bat and Eastern Cave Bat are maintained;
- a program to monitor mapped rocky habitat, including:
  - measures to manage blast designs during Project operations to comply with a vibration limit of 50 mm/s at mapped rocky habitat for the Large-eared Pied Bat and Eastern Cave Bat (unless further geotechnical investigation supports a higher value);
  - measures to monitor blast vibration, including monitoring at representative sites of mapped rocky habitat adjacent to the Project;
  - ongoing review of monitoring data to confirm and update site-specific vibration modelling where necessary; and
  - visual inspections of key representative mapped rocky habitat on a 6-monthly basis to confirm that the target outcome of no physical impact to mapped rocky habitat as a result of blasting vibrations is met.
- a program to monitor Large-eared Pied Bat and Eastern Cave Bat in response to vibration;
- measures to be implemented within the Habitat Enhancement Area to enhance potential foraging habitat for the Large-eared Pied Bat and Eastern Cave Bat (to be commenced within the first year of mining), including:
  - active revegetation (planting);
  - fencing to exclude livestock (as required); and
  - managing weeds, animal pests and bushfire risk within approximately 51 ha of foraging habitat and approximately 20 ha of breeding habitat.
- identification of suitable Eucalypt species which could provide foraging habitat for the Large-eared Pied Bat and Eastern Cave Bat that would be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing rehabilitation on the mine final landform and revegetation within the Habitat Enhancement Area to evaluate the need for supplementary seeding/plantings.

Andrew Lothian and Glenn Hoye (Biodiversity Monitoring Services [BMS], 2024a) have prepared a review of the proposed impacts on the Large-eared Pied Bat and Eastern Cave Bat. Andrew Lothian (*B. Science/B. Commerce Hons. Ecology (UNSW), BAM Accredited Assessor (BAAS18110), NSW AUSRIVAS Accredited, ECANSW Certified Practicing Ecological Consultant, 1st Vice President ECANSW, MRZSNSW, MAMS, MABS, MNSWBA*) and Glenn Hoye (*BEng/BSc [Hons]*) have worked extensively with microbats, including at Moolarben, Ulan and Wilpinjong operations and in the locality for over 29 years. There are no other zoologists in NSW who have undertaken more bat studies in the local area.

The review explains (BMS, 2024a):

> *There are records of the Large-eared Pied Bat in 65 National Parks, Nature Reserves and Conservation Areas as well as 13 State Forests in NSW (Table 1) (NSW DCCEEW 2024c).*
>
> *…*
>
> *The Large-eared Pied Bat is well known from the local area as demonstrated by the records shown on Figure 6. Glenn Hoye has been surveying threatened bats in the local area over the past 29 years (Fly By Night Bat Surveys 1998; Fly By Night Bat Surveys 2020), and Andrew Lothian over the last 11 years. Further details on the experience of the authors are provided in Appendix A. Most of the survey work for the bat has been for mining companies, either at mine sites or offset areas, which is why the records are concentrated in those areas.*
>
> *Potential habitat for the species is widespread through the adjacent National Parks and Nature Reserves, as indicated by the cliff mapping on the NSW Topographic Map (Figure 6). There has been a lack of bat surveys within the National Parks and Nature Reserves (and Crown Land), where the majority of the local cliff habitat is located. While the Department of Agriculture, Water and the Environment (DAWE) (2021) note that the number of known breeding sites for this bat is limited, there are likely to be many breeding sites throughout the potential habitat given the extensive number of records within the extent of Figure 6.*

The review concludes:

> *The Large-eared Pied Bat and Eastern Cave Bat are listed as threatened entities at risk of an SAII under principle 4 of the NSW Biodiversity Conservation Regulation 2017. Both species are unlikely to respond to measures to improve their habitat and vegetation integrity and therefore their members are not replaceable. The trigger for considering SAII is disturbance within 100 m of the rocky habitat (particularly breeding roosts).*
>
> *The Project would not contribute significantly to the risk of the Large-eared Pied Bat and Eastern Cave Bat becoming extinct (i.e. no SAII) as the Project has been re-designed to avoid any direct clearance within 100 m of the mapped rocky habitat that is likely to contain breeding roosts. Mitigation strategies will be put in place to assess the occupation of man-made structures within the footprint, and remove bats from/prevent them from occupying structures in the lead up to removal.*
>
> *Potential indirect impacts on the rocky bat habitat would be managed by:*
>
> - *adjusting the blast designs during Project operations to comply with a conservative vibration limit of 50 mm/s at the nearest mapped rocky habitat (safe design 5% exceedance level PPV limit) as determined by specialist geotechnical engineers (PSM 2023) unless further geotechnical investigation supports a higher value;*
> - *implementing monitoring and mitigation measures to manage potential blast vibration impacts to mapped rocky habitat; and*
> - *implementing a monitoring program for Large-eared Pied Bat and Eastern Cave Bat.*
>
> *To mitigate and offset the loss of foraging habitat outside of the 100 m buffer of mapped rocky habitat, MCO would:*
>
> - *implement a Habitat Enhancement Area surrounding the Project (including 20.4 ha of the 100 m buffer and rocky habitat), involving revegetation, strategic removal of fencing (as required), weed management, animal pest management, and fire management;*
> - *undertake progressive rehabilitation and revegetation of disturbed areas following completion of active mining operations; and*
> - *provide species credits for the Large-eared Pied Bat and Eastern Cave Bat under the NSW Biodiversity Offset Scheme.*

Broad-headed Snake

The amended Project includes additional setbacks such that there would be no direct disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with the Broad-headed Snake as shown in Figure 4-3.

Further to the proposed avoidance measures, measures to mitigate impacts on the Broad-headed Snake would be described in an updated or new Biodiversity Management Plan, including:

- measures to ensure the disturbance area setbacks from mapped rocky habitat for the Broad-headed Snake are maintained;

- a program to monitor the Broad-headed Snake in response to vibration;
- measures to monitor and manage blast design to achieve the 50 mm/s blast vibration limit at mapped rocky habitat for the Broad-headed Snake (unless further geotechnical investigation supports a higher value);
- measures to be implemented within the Habitat Enhancement Area to enhance potential habitat for the Broad-headed Snake (to be commenced within the first year of mining), including:
  - active revegetation (planting);
  - fencing to exclude livestock (as required); and
  - managing weeds, animal pests and bushfire risk within approximately 20 ha of breeding habitat.
- measures to salvage and reuse large hollow-bearing trees/stags potentially suitable for the Broad-headed Snake on the mine final landform; and
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings.

Andrew Lothian (*B. Science/B. Commerce Hons. Ecology (UNSW), BAM Accredited Assessor (BAAS18110), NSW AUSRIVAS Accredited, ECANSW Certified Practicing Ecological Consultant, 1st Vice President ECANSW, MRZSNSW, MAMS, MABS, MNSWBA*) (BMS, 2024b) has prepared a review of the proposed impacts on the Broad-headed Snake.

The review concludes (BMS, 2024b):

> *Broad-headed Snake are listed as a threatened entity at risk of an SAII under Principle 4 of the NSW Biodiversity Conservation Regulation 2017. The species is unlikely to respond to measures to improve its habitat and vegetation integrity and therefore its members are not replaceable. The trigger for considering SAII is disturbance within 100 m of their rocky shelter/breeding habitat.*
>
> *The Project will not contribute significantly to the risk of the Broad-headed Snake becoming extinct (i.e. no SAII) as the Project has been re-designed to avoid any direct clearance within 100 m of the rocky constraint habitat, and indirect impacts (including offsite impacts) are unlikely to lead to extinction of the local population. This is not to say there will be no risk to loss of occupancy, just that the potential reductions will not significantly impact the local population's persistence. Low densities also mean the potential loss of discrete cliffline areas due to collapse are unlikely to impact the population overall.*
>
> *In order to further minimise the potential for blast vibrations to impact on rocky habitat, MCO will adjust its blast designs (as detailed above). During the operations, MCO would implement a Habitat Enhancement Area surrounding the Project, involving revegetation, fencing to exclude livestock (as required), weed management, animal pest management, and fire management. Since the BDAR (Niche 2022) was submitted, MCO is committing to increase the Habitat Enhancement Area, resulting in an overall total of 4.9 ha of Broad-headed Snake shelter/foraging habitat in the Habitat Enhancement Area.*
>
> *Progressive rehabilitation of disturbed areas following completion of active mining operations, including the reuse of salvaged large hollow-bearing trees/stags, will be conducted. Since the BDAR (Niche 2022) was submitted, MCO is committing to increase the rehabilitation of mined areas to woodland from 325 ha to 535 ha.*
>
> *As a dual credit species, ecosystem credits for woodland habitat with tree hollows are required to be retired under the NSW Biodiversity Offset Scheme. Modification of the footprint has been conducted, which now demonstrates avoidance of Broad-headed Snake species credit habitat within 100 m of rocky habitat. After avoiding direct and prescribed impacts on the species, and providing measures to minimise and mitigate indirect impacts, residual impacts are limited to ecosystem credits.*
>
> *Following the above avoid, minimise, mitigate and offset hierarchy should not result in any increased risk of extinction for the species at a local, Interim Biogeographic Regionalisation for Australia (IBRA) subregional/regional, State or Commonwealth scale. Nor should it trigger a Serious And Irreversible Impact on the Broad-headed Snake for this project.*

Recommendation 7.2

The proponent revise the currently presented development footprint and avoidance and minimisation strategies proposed to further reduce SAII to Microbats and the Broad-headed Snake.

Response

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to avoid and/or minimise impacts to additional areas of threatened species habitat. In relation to threatened bat species, the amended Project design achieves 100% avoidance of disturbance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species (i.e. Large-eared Pied Bat and Eastern Cave Bat) and the Broad-headed Snake as shown in Figure 4-2 and 4-3, respectively.

The location of key impact avoidance/minimisation measures from the amended Project design are shown in Figure 4-4.

Recommendation 8.1

The consent authority note BCS advice in relation to SAII criteria for Box Gum Woodland when considering the adequacy of avoidance and minimisation to biodiversity impacts proposed, conditioning of the project and potential project approval.

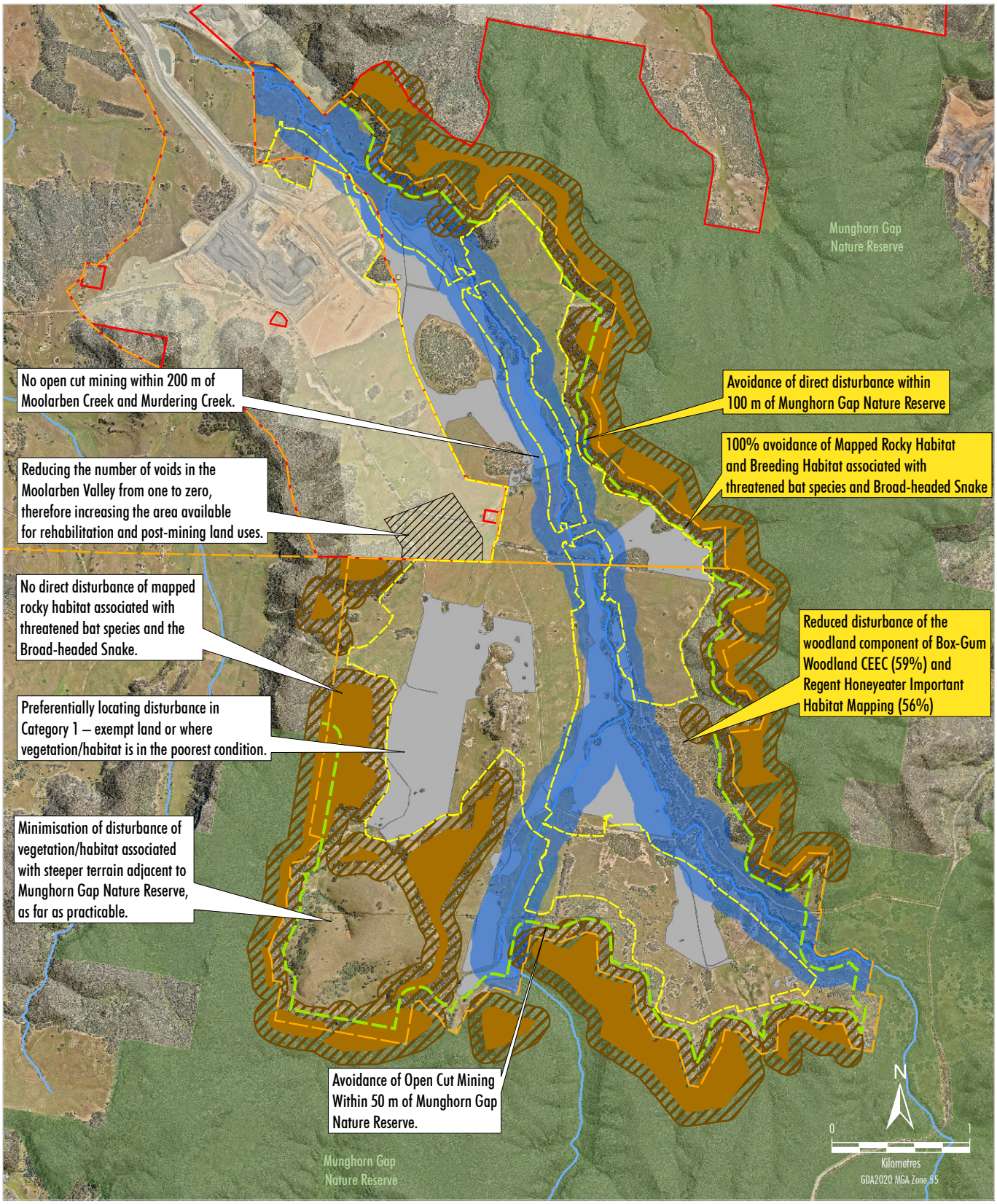
Response

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to avoid and/or minimise impacts to Box-Gum Woodland critically endangered ecological community (CEEC). In relation to the Box-Gum Woodland CEEC, the amended Project design achieves 59% reduction in disturbance of the woodland component of Box-Gum Woodland CEEC compared to the Project EIS, as shown in Figure 4-5.

Further to the proposed minimisation measures, measures to mitigate impacts on the Box-Gum Woodland CEEC would be described in and updated or new Biodiversity Management Plan, including:

- a vegetation clearance protocol to avoid accidental clearance of vegetation to be retained;
- measures to control priority and environmental weeds within the disturbance, revegetation and rehabilitation areas in a manner that would not adversely impact on nearby Box-Gum Woodland CEEC;
- measures to be implemented during construction and operations to identify and monitor priority and environmental weed infestations in the disturbance, revegetation and rehabilitation areas;
- measures to be implemented during construction and operations to manage the potential for plant pathogens in the disturbance, revegetation and rehabilitation areas;
- measures to be implemented during construction and operations to manage dust;
- measures to be implemented within the Habitat Enhancement Area to enhance the Box-Gum Woodland CEEC (to be commenced within the first year of mining), including:
  - active revegetation (planting), including species characteristic of Box-Gum Woodland CEEC;
  - fencing to exclude livestock (as required); and
  - managing weeds, animal pests and bushfire risk within approximately 109 ha (33 ha of woodland and 76 ha of DNG) of mapped Box-Gum Woodland CEEC.
- identification of plant species consistent with the Box-Gum Woodland CEEC that would be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform;
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings; and
- measures to reduce the risk of unplanned bushfire occurring with the Box-Gum Woodland CEEC.

Dr Colin Driscoll (Hunter Eco, 2024) has prepared a review of the proposed impacts on Box-Gum Woodland CEEC. Dr Colin Driscoll has been conducting vegetation mapping and classification surveys in various locations in NSW for 23 years including in the local area since 2012. This has also involved matching floristic content to listed threatened ecological communities, both State and Commonwealth including Box-Gum Woodland CEEC.



MCM-20-18 OC3 Ext AR SR_209A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint

OC3 Extension Project - Amended

- Indicative Amended Project Surface Disturbance Extent

Avoidance and Minimisation Methods

- No Proposed Open Cut Mining within 200 m of Moolarben and Murdering Creek
- Category 1 - Exempt Land
- Mapped Rocky Habitat for Threatened Bats and Broad-headed Snake
- Breeding Habitat for Threatened Bats and Broad-headed Snake (100 m Buffer from Mapped Rocky Habitat)
- 100 m Buffer from Munghorn Gap Nature Reserve
- Approved Final Void OC3 Mining Area

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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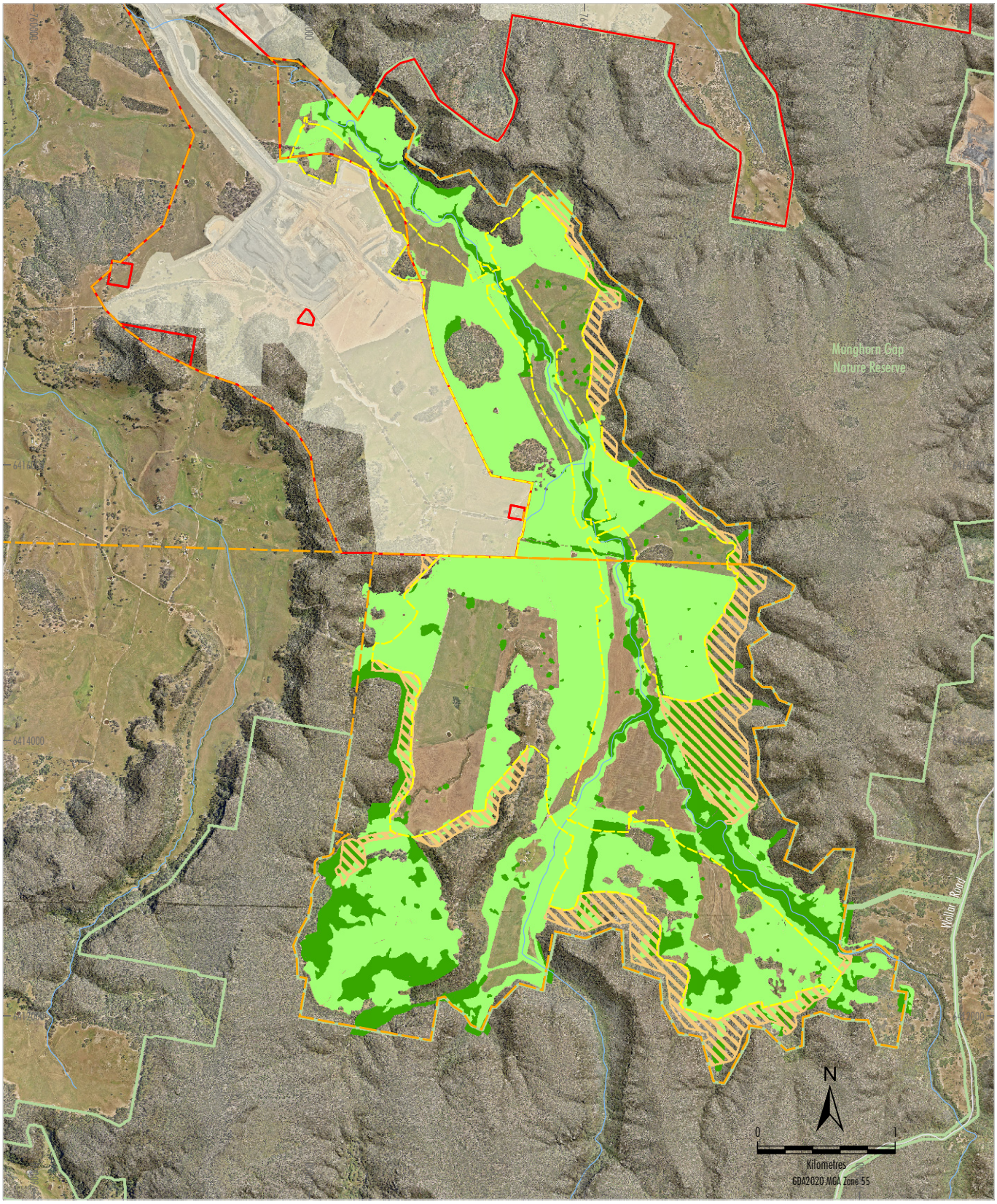
Additional Avoidance and Minimisation Measures for the Amended Project

Figure 4-4



MCOA-20-18 OC3 Ext AR SR_210A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- Indicative Amended Project Surface Disturbance Extent
- Additional Avoidance/Minimisation for Amended Project

Box-Gum Woodland CEEC

- Woodland
- Derived Native Grassland

Source: MCO (2023); NSW Spatial Services (2021); Eco Logical Australia (2023)
Orthophoto Mosaic: MCO (2021)

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Box-Gum Woodland CEEC
- Woodland and Derived Native Grassland

Figure 4-5

The review concludes:

> *This assessment has presented evidence to indicate that the impacts of the Project will not contribute significantly to the risk of the White Box – Yellow Box – Blakely's Red Gum Grassy Woodland and Derived Native Grassland becoming extinct either locally or State-wide on the grounds that:*
>
> - *The ecological community does not have a very limited distribution.*
> - *The ecological community has been shown to respond to measures to improve its habitat and vegetation integrity.*
> - *The TEC to be cleared is mostly derived grassland (366.9 ha, 91.5 %), with a smaller portion of woodland (34.22 ha, 8.5%).*
> - *There is in the order of 15,110,000 ha of TEC in NSW (TSSC 2020) meaning that the total TEC lost to the project is 0.0027 % of the total occurrence which would not place the TEC as a whole at risk of extinction.*
> - *The Project would not result in isolation of any TEC remnants.*

The Project includes the establishment of a Habitat Enhancement Area to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat (Figure 4-6). The existing land within the Habitat Enhancement Area has the following known values (i.e. priority revegetation):

- Approximately 51 ha of woodland, comprising approximately 33 ha of Box-Gum Woodland CEEC listed under the BC Act and Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act).
- Approximately 76 ha of DNG, all of which is Box-Gum Woodland CEEC listed under the BC Act and EPBC Act (which is proposed to be revegetated to woodland).
- Approximately 59 ha of currently cleared land that would also be subject to revegetation to woodland.
- Habitat for threatened species, including:
  - Approximately 51 ha of foraging habitat for the Eastern Cave Bat and Large-eared Pied Bat, of which approximately 20 ha is within 100 m of rocky habitat (i.e. breeding habitat).
  - Approximately 52 ha of mapped important habitat for the Regent Honeyeater.
  - Approximately 20 ha of habitat within 100 m of rocky habitat (i.e. breeding habitat) for the Broad-headed Snake.
- Records of the Squirrel Glider and Large-eared Pied Bat, as well as potential habitat for species recorded in the surrounds (e.g. Pink-tailed Legless Lizard, Broad-headed Snake and Koala).

The Habitat Enhancement Area would improve the condition of remnant vegetation, enhance habitat connectivity with the Munghorn Gap Nature Reserve and provide a net increase in native vegetation and associated species habitat in the Moolarben Valley during the life of the Project.

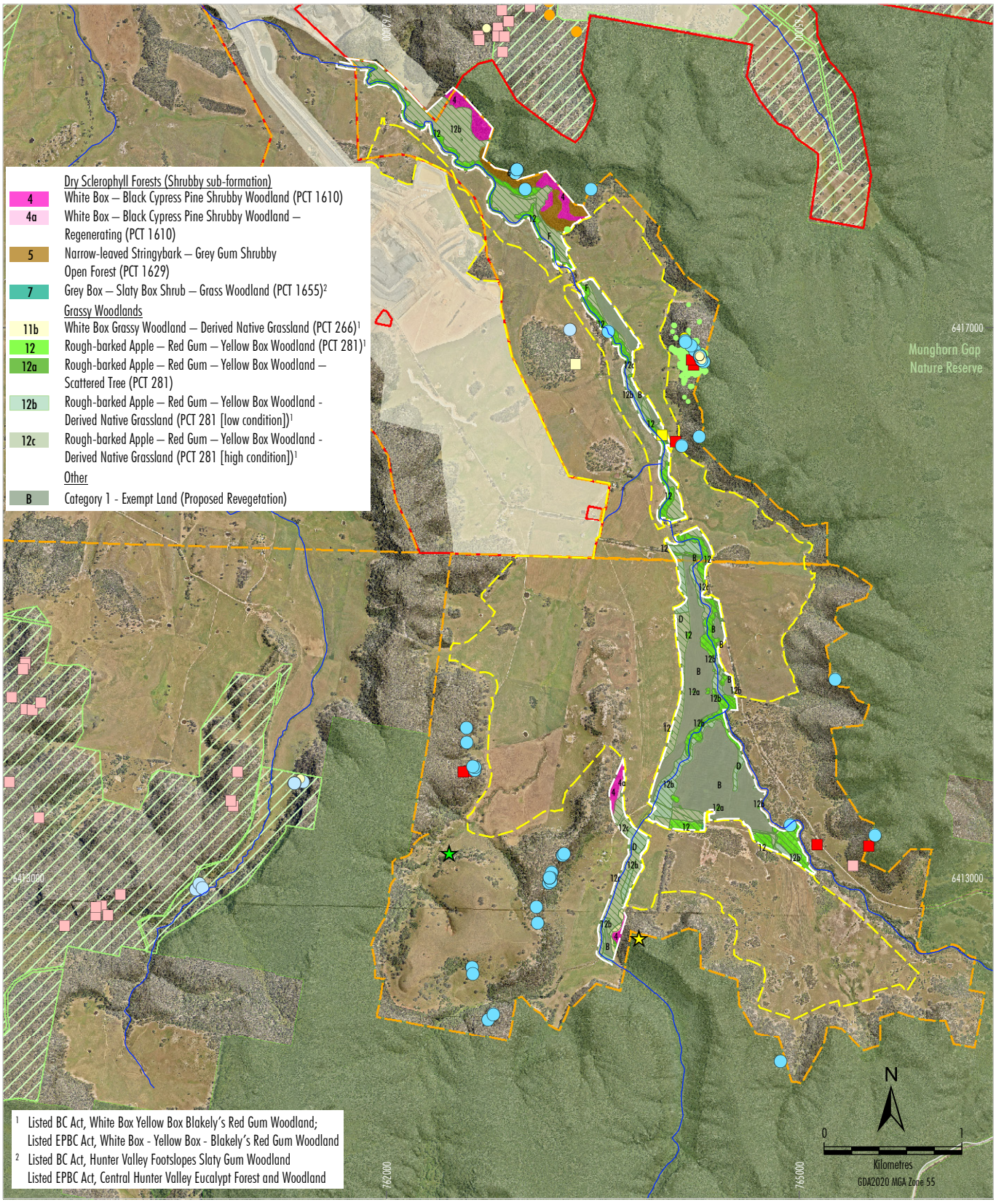
Recommendation 8.2

The proponent revise the currently presented development footprint and avoidance and minimisation strategies proposed to further reduce impacts to Box Gum Woodland.

Response

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to avoid and/or minimise impacts to Box-Gum Woodland CEEC. In relation to the Box-Gum Woodland CEEC, the amended Project design achieves 59% reduction in disturbance of the woodland component of Box-Gum Woodland CEEC compared to the Project EIS (Figure 4-6).

The location of key impact avoidance/minimisation measures from the amended Project design are shown in Figure 4-4.



Source: MCO (2023); NSW Spatial Services (2021); Eco Logical Australia (2023); AMBS (2023). Orthophoto Mosaic: MCO (2021)

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Habitat Enhancement Area Values

Figure 4-6

Recommendation 9.1

The consent authority note BCS advice in relation to SAII criteria for Regent Honeyeater when considering the adequacy of avoidance and minimisation to biodiversity impacts proposed, conditioning of the project and potential project approval.

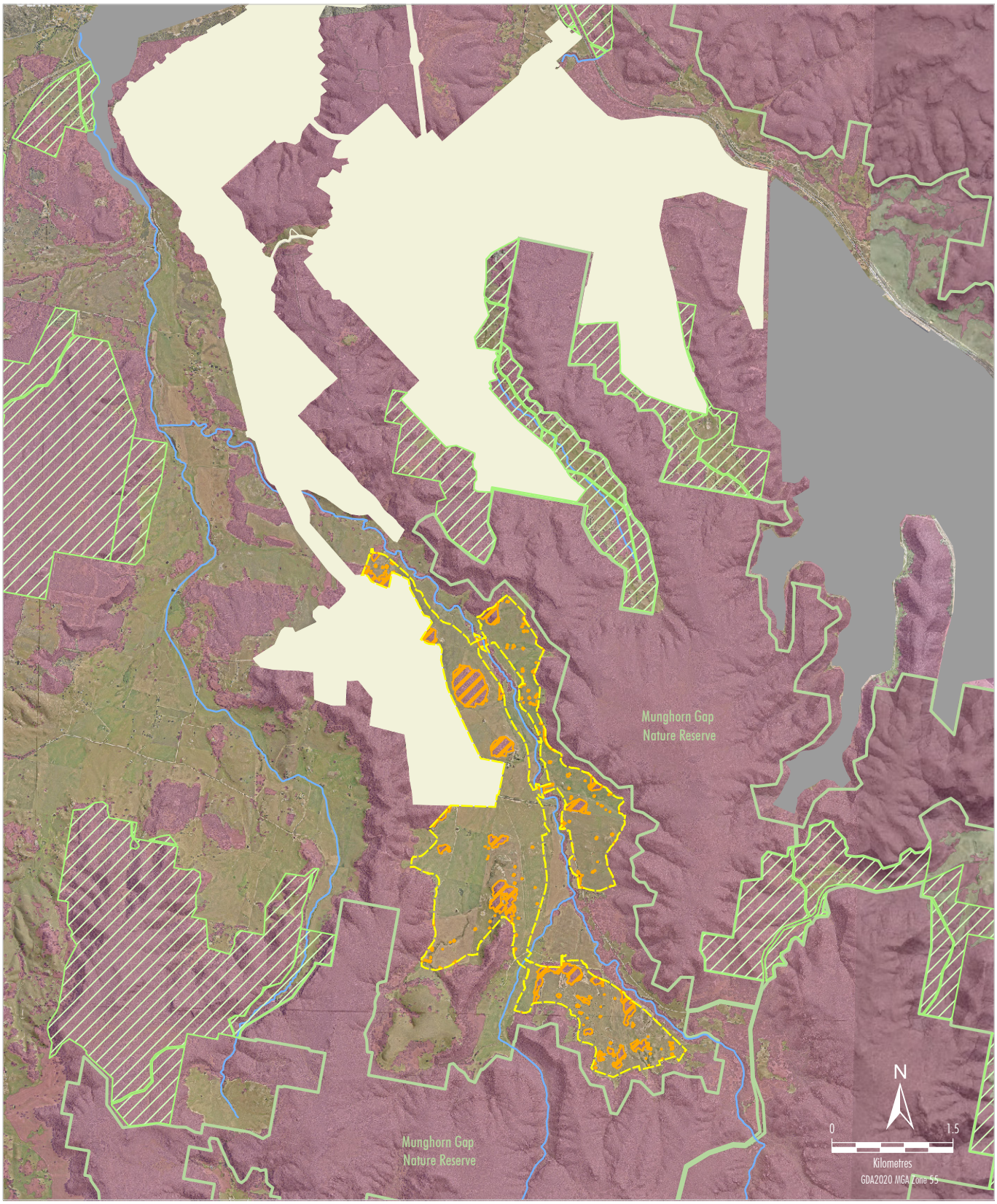
Response

The Project has been amended to avoid and/or minimise impacts to additional areas of threatened species habitat. In regard to the Regent Honeyeater, the amended Project design achieves 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the Project EIS as shown in Figure 4-7.

Further to the proposed minimisation measures, measures to mitigate impacts on the Regent Honeyeater would be described in an updated or new Biodiversity Management Plan, including:

- a vegetation clearance protocol to avoid accidental clearance of vegetation to be retained;
- measures to be implemented to manage Noisy Miners prior to and during Regent Honeyeater breeding season;
- measures to be implemented within the Habitat Enhancement Area to manage and enhance Mapped Important Habitat for the Regent Honeyeater (to be commenced within the first year of mining), including:
  - active revegetation (planting);
  - fencing to exclude livestock (as required); and
  - managing weeds, animal pests and bushfire risk within approximately 51 ha of mapped habitat.
- a program to monitor for signs of the Regent Honeyeaters in the breeding season;
- provision to evaluate methods to increase breeding success, if Regent Honeyeaters are found to be breeding at the site (including measures to minimise blasting impacts on trees while in use for Regent Honeyeater breeding);
- identification of suitable Eucalypt species which could provide foraging habitat for the Regent Honeyeater that would be included in areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform; and
- measures to monitor areas undergoing revegetation within the Habitat Enhancement Area and rehabilitation on the mine final landform to evaluate the need for supplementary seeding/plantings.

Dr Stephen Debus has prepared a review of the proposed impacts on the Regent Honeyeater, and is an ornithologist who has researched the conservation biology of woodland birds, including the Regent Honeyeater. Dr Debus' contributions to Australian ornithology has included central roles in the Bird Observers Club, the Australian Raptor Association and the Australian Bird Study Association. He has also participated in the Regent Honeyeater recovery team.



MCM-20-18 OC3 Ext AR SR_212A

LEGEND

- National Park/Nature Reserve
- Existing Biodiversity Offset Area
- Other Mining Operation
- Moolarben Coal Complex Disturbance Footprint
- Indicative Amended Project Surface Disturbance Extent
- NSW Government Regent Honeyeater Important Habitat Mapping
- NSW Government Regent Honeyeater Important Habitat Mapping Requiring Offset

Source: MCO (2023); DCCEEW (2023); BioNet Atlas (2023)
Orthophoto: MCO (2021)

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NSW Government Regent Honeyeater Important Habitat Mapping - Project Region

Figure 4-7

The review concludes (Debus, 2024):

> *It is not known if the potential habitat in the Development Footprint is used by the species.*
>
> *The most significant breeding population of the Regent Honeyeater appears now to be in the Lower Hunter, in the Tomalpin woodlands (Cessnock-Kurri Kurri), with recent breeding also recorded in Goulburn River National Park, and in the Murrumbo, Merriwa, Widden, Putty, Wolgan and Hawkesbury Valleys in 2019–20 (Ingwersen et al. 2020; 2021; Roderick et al. 2022).*
>
> *Regent Honeyeaters are occasionally sighted throughout their contemporary range (in which the Project is located), but known breeding activity is now restricted to sites not near the Project (after Heinsohn et al 2022; Crates et al. 2021). There is currently a low likelihood that any of the total NSW population would be lost as a result of the Project.*
>
> *The Project would not result in a decline in the EOO* [Extent of Occurrence] *and would result in a reduction in suitable habitat, not known to be occupied and equal to 0.01% of the approximately 556,841 ha of total Mapped Important Habitat (NSW DECCW, 2024b). The Project is unlikely to further reduce the population size, as it is unlikely to impact Regent Honeyeater individuals or cause a further reduction in breeding rates.*
>
> *Given the above considerations, the residual impact of the Project will not contribute significantly to the risk of the Regent Honeyeater becoming extinct).*
>
> *The habitat to be cleared is made up of fragmented patches within grazing paddocks and edges of extensive areas of habitat within Munghorn Gap Nature Reserve. The habitat is not currently under active management for the Regent Honeyeater.*
>
> *However, MCO is proposing a net increase in potential habitat. In areas that would not be cleared for the Project, MCO is proposing to manage and restore the habitat, through revegetation, fencing (as required), weed management, animal pest management, and fire management in the Habitat Enhancement Area (Figure 7). In areas that would be cleared for the Project, MCO is proposing to revegetate 535 ha of the post-mine landforms with woodland (Figure 7).*
>
> *Under the BC Act, the offset for the Regent Honeyeater would be a land-based offset area multiple times the area to be cleared. The BCT has confirmed that MCO could pay into the Biodiversity Offset Fund at a cost of approximately $17 million for the Regent Honeyeater credits. Alternatively, there is approximately 1,172 ha of Important Habitat Mapping on Moolarben-owned land being investigated by MCO as potential offset areas.*
>
> *Based on the above information, the Project's impacts to the Regent Honeyeater should not be regarded as SAII.*

Recommendation 9.2

The proponent revise the presented development footprint and avoidance and minimisation strategies proposed to significantly reduce proposed impacts to the Regent Honeyeater.

Response

The Project has been amended to avoid and/or minimise impacts to additional areas of threatened species habitat. In regard to the Regent Honeyeater, the amended Project design achieves 56% reduction in disturbance of Regent Honeyeater Important Habitat Mapping compared to the Project EIS as shown in Figure 4-7.

The location of key impact avoidance/minimisation measures from the amended Project design are shown in Figure 4-4.

Issue

Further justification and revision in the BDAR is required, inaccuracies in the BDAR can affect impact and credit outcomes

Recommendation 10.1

The proponent assess the potential impacts of the depletion of seasonal foraging, breeding and refuge resource within the project for the Koala and Squirrel Glider.

Response

Section 3.7.3 of the revised BDAR (Niche, 2024a) states:

> *While the Koala and Squirrel Glider likely utilise the resources within the Development Footprint, none of the resources to be impacted would be relied upon exclusively for breeding/movement across the landscape. Potential impacts regarding the depletion of seasonal foraging, breeding and refuge resources, have been avoided and minimised through the amended Project Development Footprint described in Section 4.2.*

Recommendation 10.2

The proponent assess the cumulative impacts of vegetation clearance and connectivity disruption for the Koala and Squirrel Glider.

Response

Cumulative impacts of vegetation clearance and connectivity are addressed in Sections 3.7.2, 5.1, 5.3 and 5.4 of the revised BDAR (Niche, 2024a).

The revised BDAR (Niche, 2024a) has calculated the offset requirement for the Project in accordance with the BAM (DPIE, 2020). The BAM and its underlying metrics and models is designed upon statewide datasets that are periodically updated by the BCS, with the current datasets being referred to by the Biodiversity Assessment Method Calculator (BAM-C) in its determination of suitable offset multipliers for individual potentially impacted Plant Community Types (PCTs) or Species Credit Species.

Recommendation 10.3

The proponent revise the presented development footprint and avoidance and minimisation strategies proposed to reduce proposed impacts to the Koala and Squirrel Glider.

Response

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to avoid and/or minimise impacts to additional areas of threatened species habitat, including the Koala and Squirrel Glider. The location of key impact avoidance/minimisation measures from the amended Project design are shown in Figure 4-4.

As a result of the proposed additional avoidance and minimisation for the amended Project, a further approximately 117 ha of Squirrel Glider and Koala habitat would not be disturbed (i.e. a reduction from approximately 230 ha to 113 ha).

The Project also includes the establishment of a Habitat Enhancement Area to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation (Figure 4-6). Habitat Enhancement Area has the following values relevant to the Koala and Squirrel Glider:

- approximately 51 ha of woodland, comprising 33 ha of Box-Gum Woodland CEEC listed under the BC Act and EPBC Act;
- approximately 76 ha of DNG, all of which is Box-Gum Woodland CEEC listed under the BC Act and EPBC Act (which is proposed to be revegetated to woodland);
- approximately 59 ha of currently cleared land that would also be subject to revegetation;
- records of the Squirrel Glider, as well as potential habitat for the Koala; and
- opportunity to expand and improve connectivity of the riparian vegetation along Moolarben Creek and Murdering Creek.

Recommendation 10.4

The consent authority note BCS advice in relation to impacts to the Koala and Squirrel Glider when considering the adequacy of avoidance and minimisation to biodiversity impacts proposed, conditioning of the project and potential project approval.

Response

Refer to the response to Recommendations 10.1 to 10.3.

Recommendation 11.1

Provide an explanation for the identification of Bush-stone Curlew within the proposed project.

Response

In January 2023 (prior to the BCS submission), AMBS Ecology and Heritage Pty Ltd (AMBS) informed BCS that the records were an error and should not have been submitted to the BioNet Atlas, as the species was not recorded. Section 3.5.3 of the revised BDAR (Niche, 2024a) states:

> *Three records of the Bush Stone-curlew were accidentally included within AMBS (2023) and subsequently added to BioNet. AMBS confirmed that the species was not recorded during the targeted surveys and the records are erroneous. The erroneous records have been marked as "Suspect" in BioNet, which removes the records from searches of the BioNet database for the public, registered users, and holders of sensitive species licences.*

Recommendation 11.2

If the species has been recorded on site prepare a species polygon in accordance with Section 5.2.5 of the BAM.

Response

A species polygon is not required as AMBS confirmed that the species was not recorded during the targeted surveys and the records are erroneous.

Recommendation 11.3

If the records have been erroneously detailed, update the appendix and apply to remove these records from BioNet.

Response

Refer to the response to Recommendations 11.1 and 11.2.

Recommendation 12.1

Update the BDAR to account for the identification of the Gang-gang Cockatoo within the proposed project.

Response

In January 2023 (prior to the BCS submission), AMBS informed BCS that the Gang-gang Cockatoo was recorded but no signs of breeding Gang-gang Cockatoo were detected. Table 34 of the revised BDAR (Niche, 2024a) states the following in relation to the *Gang-gang Cockatoo*:

> *Detected during targeted surveys, however no signs of breeding were identified during the field survey.*

Recommendation 12.2

If the species recorded were exhibiting breeding behaviour prepare a species polygon in accordance with Section 5.2.5 of the BAM.

Response

No species polygon is required. Refer to the response to Recommendation 12.1.

Recommendation 13.1

Revise the species polygon for Pomaderris cotoneaster to be in accordance with the BAM.

Response

Section 3.6.1 of the revised BDAR (Niche, 2024a) states:

> *The species polygon for Pomaderris cotoneaster was generated based on extensive targeted surveys conducted by ELA in 2021 (ELA 2023) after the identification of the species in the Study Area. Surveys confirmed that the species is present in one location of the Study Area, adjacent to the north-east of the Development Footprint (Figure 17a) and absent from other portions of the Study Area. The location in which it was recorded has the suitable microhabitats for the species. Within the Study Area, the species was found growing mostly within PCT 1629 (Remnant Forest), as well as PCT 281 (Remnant Woodland), PCT 478 (Remnant Forest) and PCT 1610 (Remnant Woodland). Based on the survey data, the species is expected to occur within the location it was recorded and is not expected to occur elsewhere. The suitable habitat is therefore considered to be the area that it was recorded and immediate adjoining areas where the species was not observed but is considered likely to occur.*
>
> *A 30 m buffer has been included around the area of suitable habitat where the species was observed. This additional buffer is not required by the BAM (i.e. the species polygon could be reduced by 30 m around the outside of the area of suitable habitat), but it has been added to encompass all suitable habitat. A 30 m buffer is applied around 'individual' species credit species (according to the BAM) so it is considered a reasonable buffer to apply. Areas of PCT 281 DNG (High and Low condition) within 30 m of the habitat were not included in species polygon, as these areas did not support suitable habitat (ELA 2023). The species polygon for Pomaderris cotoneaster within the Development Footprint is comprised of suitable habitat within PCT 1629 (Remnant Forest).*

Recommendation 14.1

In the absence of data supporting CEEC absence, land be designated as Category 2 – regulated land.

Response

In addition to EcoLogical Australia's (ELA) (2023) land categorisation assessment, a site-based floristic assessment was also undertaken by Niche from the 31 July 2023 to the 4 August 2023 to further review the categorisation of the land within the indicative surface disturbance extent (particularly within the areas identified as derived native grassland). Section 1.3 of the revised BDAR (Niche, 2024a) provides additional data supporting the absence of the Box-Gum Woodland CEEC.

Recommendation 14.2

If the proponent wishes to collect further evidence to justify the absence of Box Gum Woodland/Box Gum Grassland from portions of the project site, liaise with BCS to determine an acceptable approach.

Response

Box-Gum Woodland CEEC has been mapped by ELA and Niche in accordance with the listing under the BC Act and EPBC Act, a separate approach is not considered to be required.

Details of the land category assessment undertaken in the Project area, including Category 1 – exempt land mapping and supporting floristic data, were provided to BCS in May 2022. BCS reviewed the mapping and confirmed the methodology presented was appropriate for the initial identification of Category 1 – exempt land.

On this basis, disturbance for the Project was preferentially located in Category 1 – exempt land areas as reviewed by BCS to avoid/minimise impacts on biodiversity.

Recommendation 15.1

Provide additional field verified evidence to support allocation of Category 1 land in areas which do not appear to have received IGGAM survey.

Response

Refer to MCO's response to Recommendation 14.1.

Recommendation 16.1

Quantify credits to be offset for the Pink-tailed Worm Lizard habitat that will receive residual prescribed impacts resulting from the project.

Response

Refer to the response to Recommendation 1.3.

Recommendation 16.2

Consult with BCS to determine a method for the quantification of residual prescribed impact credits that will adequately compensate for the maximum potential impact resulting from the proposal.

Response

Refer to the response to Recommendation 1.3.

Recommendation 17.1

Revise the BDAR to appropriately assess the nature, extent and duration of short-term and long-term impacts and predict the consequences to GDEs and threatened entities reliant upon GDEs.

Response

Section 5.3.5 of the BDAR (Niche, 2024a) has been revised to include additional information to inform the nature, extent and duration of short and long-term impacts to Groundwater Dependent Ecosystems (GDEs) and Threatened Ecological Communities (TECs) as a result of the Project.

Nature of Impacts

Large areas of the Project area are currently unsaturated, limiting the potential for impacts associated with changes in groundwater levels. Existing monitoring bores in areas previously unaffected by mining operations indicate variations in groundwater levels of around 5 m due to climatic variations (AGE, 2022).

The progressive open cut mining is predicted to result in limited drawdown beyond the mine footprint, particularly given the relatively shallow open cuts would be progressively backfilled, which would restore pre-mining hydraulic gradients and allow water levels to recover (AGE, 2024).

In addition, the Project proposes no residual final voids in the final landform. This is an improvement relative to the currently approved Moolarben Coal Complex (i.e. the Project would reduce the number of voids within the Moolarben Valley from 1 to 0 in the final landform).

Extent of Impacts

Generally, groundwater levels across the Project area are predicted to experience minor (i.e. <2 m) drawdown at the potential terrestrial GDEs, which would likely be indiscernible from natural variations.

Approximately 6 ha of potential terrestrial GDEs are predicted to experience greater than 2 m drawdown (i.e. 2 m to 6 m) for the amended Project (AGE, 2024). The drawdowns predicted at the potential terrestrial GDEs (i.e. a maximum of around 6 m) are similar to the natural variations observed at monitoring bores across the Project area.

The maximum predicted drawdown occurs in a single area along Moolarben Creek, where the groundwater level is approximately 10 m below the surface, and where the groundwater is simulated to occur below the quaternary alluvium in the Ulan Seam (AGE, 2024). Following recovery, groundwater levels return to pre-mining levels at this location.

In addition, the potential terrestrial GDEs located within the predicted maximum 2 m drawdown extent for the amended Project are located along the major surface water drainage lines, which are predicted to experience negligible change in baseflow and stream flows. This is considered to be due to the 200 m minimum setback on either side of these major drainage lines from open cut operations (AGE, 2024). Therefore, the terrestrial vegetation will continue to receive any surface flow contributions.

Duration of Impacts

The maximum predicted drawdown of 6 m at the single area of potential terrestrial GDE adjacent to Moolarben Creek is predicted to occur for approximately 30-40 years, based on the predictions of the groundwater model (AGE, 2024). It is noted the groundwater model considers only average rainfall recharge, indicating that recharge could occur more quickly following large rainfall/streamflow events. Following recovery, groundwater levels return to pre-mining levels at this location.

Short-term Impacts

Given the efficient backfilling of the relatively shallow open cuts during mining, limited extent of drawdown at potential terrestrial GDEs, that the groundwater level is simulated to occur below the quaternary alluvium in the Ulan Seam at the area of maximum drawdown at an area of potential terrestrial GDEs, and the natural variability in groundwater levels (AGE, 2024), no significant impacts to GDEs is predicted in short-term.

Long-term Impacts

In the long-term groundwater levels are predicted to recover to pre-mining levels (AGE, 2024), meaning no significant impacts to GDEs are predicted in the long-term.

Monitoring and Management

Groundwater and surface water monitoring is proposed for the Project, which would be described in an updated or new Water Management Plan. In addition, the majority of the approximately 6 ha of potential terrestrial GDEs where greater than 2 m drawdown is predicted is located within the Project Habitat Enhancement Area, which excludes open cut mining and would be subject to ongoing vegetation management and revegetation.

Recommendation 17.2

Offset any residual prescribed impacts in accordance with Section 6.1.2(b) of the Biodiversity Conservation Regulation 2017 and Section 8.6 of the BAM.

Response

The revised BDAR (Niche, 2024a) has calculated the offset requirement for the Project in accordance with the BAM (DPIE, 2020). As described in the response to Recommendation 17.1, it is considered that there would be no significant impacts to any GDEs or TECs as a result of prescribed impacts to waterbodies, water quality or hydrological processes as a result of the Project. For this reason, no offsets are required for prescribed impacts to GDEs.

Recommendation 18.1

Review and provide additional justification for PCT selection as per Table 1. [PCT 1655 and 1711]

Response

Niche has provided additional justification for selection of PCT 1655 and 1711 within Appendix E of the revised BDAR (Niche, 2024a). No changes to the vegetation were required.

Recommendation 19.1

Review vegetation zone stratification for PCT 281 within the subject site and provide justification on plot allocation.

Response

Niche has provided additional justification for the PCT 281 vegetation zone stratification within Appendix E of the revised BDAR (Niche, 2024a). No changes to the vegetation mapping were required.

Recommendation 20.1

Provide additional justification for use of plot data outside of the subject land.

Response

Niche has provided additional justification for the use of plot data outside of the subject land in Table 8, Section 3.3.4 of the revised BDAR (Niche, 2024a).

Recommendation 21.1

Provide additional justification for exclusion of threatened frog species from habitat within the project area.

Response

Table 12 of the revised BDAR (Niche, 2024a) states:

> *The only PCT recorded within the Study Area which provided potential habitat for Giant Burrowing Frog was PCT 1629. Breeding habitat for the Giant Burrowing Frog consists of soaks or pools within first or second order streams, as well as 'hanging swamp' seepage lines and where small pools form from the collected water. AMBS (2023) did not record any suitable breeding habitat within the Study Area, nor was any suitable habitat identified within the Aquatic Ecology Assessment (Bio-Analysis 2022). In addition, the species has never been recorded as far west as the Study Area with the closest record occurring 60km to the south east.*
>
> *The Booroolong Frog can be associated with PCT 281 elsewhere in NSW (DPE 2023a) and PCT 281 was mapped within the Study Area along the riparian zones of Moolarben Creek. The Booroolong Frog was not originally included as a candidate species in AMBS (2023) as it is not associated with the Kerrabee IBRA subregion and the Study Area occurs at the edge of the species predicted range. The closest record for the Booroolong Frog occurs 80 km to the south of the Study Area. The species was included as a candidate species in the BDAR due to the EPBC Act PMST (DCCEEW 2022) search indicating that it may occur in the search area. Targeted survey was not conducted for this species due to the Study Area occurring on the outer margins of the species known and predicted range, in addition to aquatic habitat within the Study Area not providing suitable habitat for the species. The Booroolong Frog requires permanent, or near permanent river environment with rocky structures (bedrock or cobble) (DPIE 2020d). The species is reliant on permanent running water and does not occupy ephemeral streams, or streams that have dried during severe drought (Hunter & Smith 2013). Whilst the Aquatic Ecology Assessment (Bio-Analysis 2022) describes Moolarben Creek (the largest creek within the Study Area) as providing good to very good aquatic habitat (in general), it also notes that this section of Moolarben Creek is characterised as "a non-permanently flowing (intermittent) creek with clearly defined bed and banks and semi-permanent to permanent waters in pools.". Therefore, this section of Moolarben Creek and any other ephemeral streams or creeks within the Study Area would not provide suitable habitat for the Booroolong Frog.*
>
> *As detailed in AMBS (2023), the Red-crowned Toadlet is found only on Triassic sandstones which are not present within the Study Area (Raymond et al. 2012). The microhabitats required by the species are absent from the Study area. Areas of potential habitat for the species include areas of heathland and woodland located on Triassic sandstones within 100 m of ephemeral streams or pools (DPIE 2020d). The Development Footprint contains two PCTs, PCT 1629 and PCT 1711, which are listed in the TBDC as PCT's associated with the species. Intact areas of PCT 1629 within 100 m of ephemeral streams or pools will be avoided. PCT 1711 occurs within the Development Footprint in the south, however, these areas have been subject to historic and ongoing disturbance and fragmentation as a result of land clearing for agriculture and are degraded. The closest record of the species is located about 35 km to the southeast of the Study Area.*

Recommendation 21.2

If impacts to threatened frog species has the potential to occur, undertake further survey, assume presence or prepare an expert report.

Response

No action needed. Refer to the response to Recommendation 21.1.

Recommendation 22.1

Provide additional information to justify the presence/absence of potential Large Bent-winged Bat breeding habitat.

Response

Section 3.5.3 of the revised BDAR (Niche, 2024a) states:

> *Further to this, and with regard to the Large Bent-winged Bat, the TBDC notes that this species is a dual credit because foraging habitat is broad ranging but breeding habitat is highly specific. AMBS (2023) notes that "No caves or crevices that would likely be suitable for a maternity/breeding roost were observed in the Study Area" and "The small number of calls, no animals captured in harp traps, and the lack of suitable habitat observed suggests it is unlikely for there to be breeding caves in the Study Area" (Section 3.4, Table 3.3).*
>
> *Of the records for the Large Bent-winged Bat that were detected during targeted survey, no individuals were captured in harp traps and only a small number of (probable) records were obtained from Anabats (AMBS 2023). Large Bent-winged Bats form discrete populations centred on a maternity cave that is used annually in spring and summer for the birth and rearing of young. At other times of the year, populations disperse within about a 300 km range of maternity caves. Breeding or roosting colonies can number from 100 to 150,000 individuals (DPE 2023e).*
>
> *AMBS (2023) conducted thorough surveys of all rocky habitat within the Study Area, as well as harp trapping in accordance with the 'Species credit' Threatened Bats and their Habitats (OEH 2018c), 'species credit' threatened bats and their habitats. It was determined that there was no suitable breeding habitat for Large Bent-winged Bat based on cave preference for maternity roosts which require very specific temperature and humidity regimes (DPE 2023e).*

Recommendation 22.2

If impact to Large Bent-winged Bat breeding habitat has the potential to occur, undertake further survey, assume presence or prepare an expert report.

Response

No action needed. Refer to the response to Recommendation 22.1.

Recommendation 23.1

Demonstrate adequate survey effort is compliant with the Department's guide Surveying threatened plants and their habitats (and Commonwealth survey guidelines where necessary) during optimal conditions for the species identified in Table 2. [Commersonia rosea, Dichanthium setosum, Euphrasia arguta and Kennedia retrorsa]

Response

Commersonia rosea and Kennedia retrorsa

Dr Stephen Bell prepared an Expert Report on the likely presence or otherwise for *Commersonia rosea* and *Kennedia retrorsa* in accordance with Section 5.2.4 of the BAM (DPIE, 2020), as an accredited expert under the NSW *Biodiversity Conservation Act 2016* (BC Act). The Expert Report is provided in Appendix L of the BDAR.

Dr Stephen Bell's conclusion supports the original BDAR finding that species credits are not required for *Commersonia rosea* or *Kennedia retrorsa*. The Expert Report (Appendix L of the BDAR) concludes:

> *For Commersonia rosea and Kennedia retrorsa, these too [in addition to Commersonia procumbens and Monotaxis macrophylla] are species restricted to Triassic Narrabeen landscapes, the first from scrubby heath on ridgelines and the second on sheltered slopes and gullies. While the Project area does support Triassic Narrabeen geology on the higher ridges, they sit atop older Permian sediments which elsewhere in areas supporting these species are considerably deeper and do not outcrop on the lower slopes. Hence, these species are unlikely to be present on the Project area.*

Dichanthium setosum and Euphrasia arguta

Neither *Dichanthium setosum* or *Euphrasia arguta* are candidate species identified by the BAM Credit Calculator. These species do not require further assessment because (among other factors) the distribution of the species does not include the IBRA subregion within which the subject land is mostly located. Section 2.1.3 of the revised BDAR (Niche, 2024a) states:

> *Dichanthium setosum and Euphrasia arguta were precautionarily included in this assessment for consideration due to their association with the Inland Slopes IBRA subregion, which is located less than 2 km west of the Development Footprint (ELA 2023). Neither of these species are associated with the Kerrabee IBRA subregion in which the Development Footprint is wholly located within. There are also no records for either species within 30 km of the Development Footprint (NSW DCCEEW 2024a). Under Section 5.2.1 of the BAM (DPIE 2020a), criteria 2a to 2f state the criteria by which threatened species must be considered under the BAM. Criteria 2 (a) specifies "the distribution of the species includes the IBRA subregion within which the subject land is mostly located". Section 5.2.1 states that "If any one of the criteria (2.a–2.f) relevant to the threatened species is not met, the subject land should be considered as unsuitable habitat for that species. No further assessment is required for that species".*
>
> *In considering the potential presence of both species, ELA (2023) reviewed vegetation condition, soils and geology to refine the potential survey areas and species habitat for Dichanthium setosum and Euphrasia arguta within their respective BioNet Vegetation Classification (DPE 2023b) PCT associations within the Study Area (ELA 2023). ELA (2023) describes in detail why areas of habitat within the Study Area were excluded as providing potential habitat for both species based on review of soil databases and land use.*
>
> *Given Dichanthium setosum and Euphrasia arguta are not associated with the Kerrabee IBRA subregion, there are no records within 30 km of the Development Footprint, and the species were further considered unlikely to occur due to lack of suitable habitat (as described in ELA 2023), the subject land (i.e. the Development Footprint) is considered as unsuitable habitat and no further assessment is required for these species.*

Commersonia procumbens and Monotaxis macrophylla

Upon further review, two candidate flora species, *Commersonia procumbens* and *Monotaxis macrophylla* which were previously assumed present in the Project EIS have since been excluded from further assessment following review of the species required microhabitats by the highly experienced botanist Dr Stephen Bell (Eastcoast Flora Survey and adjunct researcher at the University of Newcastle) (Bell 2024).

The BAM (DPIE, 2020) states:

> 2. *A candidate species credit species is considered unlikely to occur on the subject land (or specific vegetation zones) if one of the following applies:*
>   a. *After carrying out a field assessment:*
>   i. *the assessor determines that microhabitats required by a species are absent from the subject land (or specific vegetation zone). The assessor must include a description of the microhabitats assessed as being required by the species in the BAR. This must be based on* ***evidence*** *such as published literature, or*
>
> …
>
> 3. *A candidate species credit species that does not have suitable habitat as per (2.a.) or (2.b.) does not require further assessment.*

Whilst Dr Stephen Bell is not an accredited Expert for *Commersonia procumbens* or *Monotaxis macrophylla*, he has experience with both species so can provide a review of the species microhabitats in accordance with Section 5.2.3 of the BAM (DPIE 2020a). Bell (2024) found that neither species is likely to occur as the microhabitats required by the target species are absent within the indicative surface disturbance extent.

Dr Stephen Bell's report (Appendix L of the BDAR) states:

> *Based on reported habitat features from the seven meta-populations of Commersonia procumbens known in NSW, 24 PCTs can be considered the likely key vegetation types for this species (Table 2). One of these, PCT 3342 Kaputar White Box-Apple Sheltered Forest, has a direct link to known Commersonia procumbens habitat through component floristic plots in the ENSW PCT classification, but all others have been determined based on available habitat data linked to point records.*
>
> *The closest and most relevant populations to the Project area are at Ulan (15-25 km to the north) and at Goulburn River NP (40 km to the east). These populations occur on Triassic Narrabeen geology on ridges supporting either woodland or heath communities. The next closest population is at Dubbo-Gilgandra, c. 90 km to the north-west and on the older Jurassic Pilliga Sandstone.*
>
> *None of the PCTs shown to support or potentially support Commersonia procumbens in NSW match the six shown in Table 1 for the Project area.*
>
> *…*
>
> *Using habitat data for Monotaxis macrophylla records in NSW, the 11 defined meta-populations can be linked to 15 PCTs (Table 3). Four of these emanate directly from the ENSW PCT classification, and the remainder have been attributed with high confidence. Most PCTs comprise scrub or heath communities on rock plates or rocky outcrops, but key exceptions include western locations (Cobar, Boona Mount, Pilliga AA) where scrubby woodlands on sandstone ridges appear to be key habitat. There is some uncertainty about PCT 3045 South Coast Temperate Gully Rainforest from the South Coast, which contrasts strongly with all other habitats defined.*
>
> *The closest known population of Monotaxis macrophylla to the Project area lies c. 70 km to the southeast, in Wollemi NP. At this population, the species occurs in PCT 3784 Western Hunter Rocky Scrub and PCT 3866 Wollemi Rockplate Scrub. The next closest population is at Pilliga, 170 km to the north. Note that a May 2005 observational record of Monotaxis macrophylla, comprising a single individual from the upper Hunter Valley near Scone, was excluded from analysis as notes associated with it mention that insufficient fertile material was available at the time to confirm identification.*
>
> *None of the PCTs shown to support or potentially support Monotaxis macrophylla in NSW match the seven shown in Table 1 for the Project area.*
>
> *…*
>
> *Following a detailed review of existing database records for both Commersonia procumbens and Monotaxis macrophylla, I have identified 24 actual or potential PCTs for the former and 15 PCTs for the latter, based on available evidence from the literature, voucher collections, observational records and full floristic plot surveys. None of these PCTs (Table 2 and Table 3) have been mapped by Niche (2022) for the Project area (cf. Table 1 with Table 2 and 3), hence neither of these species are likely to occur because the habitats required by the species are absent.*

Recommendation 23.2

Alternatively undertake additional targeted survey in the correct survey period and survey conditions, assume presence, or obtain an expert report for these species.

Response

No action needed. Refer to the response to Recommendation 23.1.

Recommendation 24.1

Conduct further targeted survey to determine the presence or absence of the Eastern Pygmy Possum and Brush-tailed Rock Wallaby from previously unsurveyed areas within the project site, obtain an expert report or assume presence.

Response

Section 3.5.3 of the revised BDAR (Niche, 2024a) states:

> *Further targeted survey, an expert report and/or the assumption of presence within previously unsurveyed areas was determined to not be necessary to exclude presence of the Eastern Pygmy Possum (Cercartetus nanus) or Brush-tailed Rock Wallaby (Petrogale penicillata), based on the following:*

Eastern Pygmy Possum

- *There are no recent or old records of the Eastern Pygmy-possum within 80 km of the Project (DPE 2023c). The closest record of Eastern Pygmy Possum is located 80 km to the southeast in Goulburn River National Park*
- *Survey effort undertaken for the species included (ELA 2023):*
  - *Two remote (Spring/Summer) camera traps (one terrestrial and one arboreal) deployed for 14 nights at 14 sites in the Study Area*
  - *Six pitfall traps deployed over four nights at two sites*
  - *Twenty-five Elliot traps over four nights at two sites and*
  - *Spotlighting undertaken at four sites totalling seven person hours*
- *The survey effort was consistent with survey information provided in the TBDC (DPE 2023a) and also the Commonwealth Threatened Mammal Guidelines (DSEWPaC 2011a) and targeted key areas of likely preferred habitat for the species considering foraging and shelter resources required and present and connectivity of habitat*
- *The species has not been recorded opportunistically or otherwise during targeted nocturnal fauna surveys and/or small mammal surveys conducted in relation to development applications within the vicinity of the Project*
- *It is considered unlikely that Eastern Pygmy-possum would have remained undetected during the surveys.*

Based on the above justification, no further targeted surveys are required for the Eastern Pygmy Possum.

Brush-tailed Rock-wallaby

- *The closest record of Brush-tailed Rock-wallaby is located is 10 km to the Northeast in Wollemi National Park (DPE 2023c)*
- *Survey effort undertaken for the species included (ELA 2023):*
  - *One remote camera trap (terrestrial) deployed for 14 nights at 14 sites in the Study Area*
  - *Spotlighting undertaken at two sites totalling seven person hours and*
  - *Targeted scat searches at four locations within the Study area*
- *The survey effort was consistent with survey information provided in the TBDC (DPE 2023a) and also the Commonwealth Threatened Mammal Guidelines (DSEWPaC 2011a) and targeted key areas of likely preferred habitat for the species considering foraging and shelter resources required and present and connectivity of habitat*
- *The species has not been recorded opportunistically or otherwise during targeted nocturnal fauna surveys and/or small mammal surveys conducted in relation to development applications within the vicinity of the Project*
- *It is considered unlikely that Brush-tailed Rock Wallaby would have remained undetected.*

Based on the above justification, no further targeted surveys are required for the Brush-tailed Rock Wallaby.

Recommendation 25.1

Correct the specific spatial and BAM-C errors identified in this response.

Response

Niche (2024a) has addressed the spatial and BAM-C errors.

Recommendation 25.2

Audit all values of VI plot data, GIS shapefiles and data entered into the BAM-C and ensure these align with the BDAR.

Response

Niche (2024a) has audited all values of VI plot data, GIS shapefiles and data entered into the BAM-C and ensured these align with the BDAR.

NPWS Recommendations

Recommendation 26.1

Update mapping in the EIS to show that there will be no encroachment onto NPWS land.

Response

The Project would not encroach onto NPWS land. For additional clarity, Section 5.5 of the revised BDAR (Niche, 2024a) states:

> *There would be a minimum of 100 m from the edge of any open cut pit to the boundary of the Nature Reserve. The Development Footprint is at least 100 m from the boundary of the Nature Reserve (a buffer of which is vegetated) and ranges from 100 to 300 m from the Nature Reserve within the east and south of the Project (Stage 2 and 3). The buffer between Stage 1 area and the Nature Reserve is about 450 m.*

Recommendation 27.1

Establish appropriate setbacks within the development site boundary to ensure an appropriate buffer between NPWS lands and mining operations, such that impacts to NPWS estate are avoided.

Response

The amended Project includes additional setbacks to avoid all disturbance within 100 m of the Munghorn Gap Nature Reserve.

The BCS and NPWS submission recommended MCO consider additional strategies to minimise impacts to biodiversity values. In particular, BCS and NPWS recommended MCO apply a setback of 500 m to the boundary of the Munghorn Gap Nature Reserve. This setback would make the eastern and south-western pits uneconomic. MCO has considered the NPWS guideline *Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities* (NPWS, 2020) for the Project as presented in the EIS and including additional amendments.

Consideration of the Project with regard to the NPWS guideline *Developments adjacent to National Parks and Wildlife Service lands – Guidelines for consent and planning authorities* (NPWS, 2020) is provided in Table 4-1.

Recommendation 28.1

Amend the assessment to consider the extent of any direct or indirect adverse impacts on Munghorn Gap Nature Reserve. Including, but not limited to, vibration, noise and air quality.

Response

Refer to response to Recommendation 27.1.

Recommendation 29.1

Incorporate the impacts observed from the UG2 Modification into modelling scenarios to establish the likely impacts if both modifications are to be given approval.

Response

The approved underground mining areas (UG1, UG2 and UG4) at the Moolarben Coal Complex, including the optimised longwall layout and longwall extension areas for the UG2 Modification (recently approved in December 2023), were simulated in the OC3 Extension Project numerical groundwater modelling undertaken for the Groundwater Assessment as shown in Figure 4-8 (after Figure C 4.6 of the Groundwater Assessment prepared by Australasian Groundwater and Environment Consultants Pty Ltd [AGE] [2022]). Therefore, the potential cumulative effects associated with the approved UG2 Modification have been assessed for the Project (AGE, 2022; 2024).

Table 4-1
Consideration of Guidelines for Developments Adjacent to NPWS Lands for the Project

Issues to be Considered	Aim	Response
Erosion and sediment control	To prevent erosion and the movement of sediment onto NPWS land.	The Munghorn Gap Nature Reserve occurs upslope of the Project and therefore no surface water impacts will occur (no greater risk of erosion, movement of sediment or runoff into the Munghorn Gap Nature Reserve).
Stormwater runoff	Nutrient levels are minimised, and stormwater flow regimes and patterns mimic natural levels before reaching NPWS land, to ensure no detrimental change to hydrological regimes.	
Wastewater	There are no adverse impacts on NPWS land due to wastewater from nearby development.	
Pests, weeds and edge effects	Adjoining or nearby development does not: • Lead to increased impacts from invasive species (weeds and pests), domestic pets and stock. • Facilitate unmanaged visitation, including informal tracks, resulting in negative impacts on cultural or natural heritage values. • Lead to impacts associated with changes to the nature of the vegetation surrounding the park. • Impede NPWS access for management purposes, including inappropriate fencing (refer also to section 2.10).	There would be a minimum of 100 m from the edge of any open cut pit to the boundary of the Munghorn Gap Nature Reserve. The indicative surface disturbance extent is at least 100 m from the boundary of the Munghorn Gap Nature Reserve (a buffer of which is vegetated), and ranges from 100 m to 300 m from the Munghorn Gap Nature Reserve within the east and south of the Project (Stage 2 and 3). The buffer between the Stage 1 area and the Munghorn Gap Nature Reserve is about 450 m. Edge effects on the Munghorn Gap Nature Reserve are likely to be minimal given the indicative surface disturbance extent is at least 100 m from the boundary and control of invasive species (weeds and animal pests) would occur in areas adjacent to the indicative surface disturbance extent. Further, a Noisy Miner monitoring and management program would be implemented to manage Noisy Miners (an aggressive bird species). MCO would continue to participate in co-ordinating strategic pest management programs in consultation with NPWS.
Fire and the location of asset protection zones	All asset protection measures are within the development area, and there is no expectation for NPWS to change its fire management regime for the land it manages.	The Project is unlikely to increase fire risk. Bushfire risk would continue to be managed in accordance with the Moolarben Coal Complex Bushfire Management Plan. Mitigation measures that would be implemented by MCO to reduce bushfire risk would focus on education and training, reducing bushfire hazard, minimising and controlling ignition sources and developing appropriate responses and evacuation strategies.
Boundary encroachments and access through NPWS land	No pre-construction, construction or post-construction activity occurs on land managed by NPWS. Any access that does occur must be legally authorised and comply with park management objectives.	No construction activity would occur on land managed by NPWS. The risk of accidental damage to adjacent habitat or vegetation due to the Project operations would be managed through the minimum 100 m boundary from the indicative surface disturbance extent to the boundary of the Munghorn Gap Nature Reserve, and implementation of a Vegetation Clearance Protocol and a ground disturbance procedure to avoid accidental clearance of vegetation to be retained. Any adjacent fencing would be constructed and managed in accordance with the NPWS Boundary Fencing Policy (2021).

Table 4-1 (Continued)
Consideration of Guidelines for Developments Adjacent to NPWS Lands for the Project

Issues to be Considered	Aim	Response
Visual, odour, noise, vibration, air quality and amenity impacts	There is no reduction of amenity on NPWS land due to adjacent development.	There would be no disturbance within 100 m of the Munghorn Gap Nature Reserve as a result of the amended Project. The amended Project would also avoid any clearance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species and the Broad-headed Snake. In the absence of the Project, the Munghorn Gap Nature Reserve would continue to experience indirect impacts from the approved operations of the Moolarben Coal Complex (until 2038) and Wilpinjong Coal Mine (until 2034), as well as a range of other anthropogenic noise sources on land proximal to the Munghorn Gap Nature Reserve such as noise from traffic, farming machinery, dirt bikes and licensed hunting activities. To minimise the potential impacts from blasting and vibration, MCO would implement measures and reduce blasting criterion (i.e. vibration limit of 50 mm/s PPV at mapped rocky habitat features, unless further geotechnical investigation supports a higher value). Accordingly, sensitive geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve) would be expected to experience limited to no blast vibration as a result of the amended Project. Noise is an unavoidable short-term effect from open cut mining noting the Project life is only 10 years. Noise may temporarily disrupt individual animals near the mine during operations, however, there is unlikely to be any loss in biodiversity as a result of noise, as evidence by extensive records coincident with existing mining. These effects are unchanged for the Project, given approved operations at the Moolarben Coal Complex would continue beyond the Project life (i.e. beyond 2034). Additional indirect artificial lighting impacts on the Munghorn Gap Nature Reserve due to the Project would be minimal, localised and short-term (limited to the duration/direction of the artificial lighting). Similarly, potential impacts from dust are likely to be indistinguishable from background dust levels, and limited to the duration of construction and operations. MCO would implement all reasonable and feasible measures to minimise noise, dust, lighting, blast and vibration impacts from the Project as per existing environmental management plans for the Moolarben Coal Complex, which would be updated for the Project. In the medium to long-term, there would be no indirect impacts. In the absence of the Project, the existing agricultural land use would continue in the Moolarben Valley. With the Project, revegetation works proposed to be undertaken (i.e. progressive mine site rehabilitation and Habitat Enhancement Area) would result in a net increase in woodland habitat in the Moolarben Valley, including along the boundary of the Munghorn Gap Nature Reserve.

Table 4-1 (Continued)
Consideration of Guidelines for Developments Adjacent to NPWS Lands for the Project

Issues to be Considered	Aim	Response
Threats to ecological connectivity and groundwater-dependent ecosystems	Native vegetation and other flora and fauna habitats that provide a linkage, buffer, home range or refuge role on land that is adjacent to parks are maintained and enhanced, where possible. Groundwater-dependent ecosystems in NPWS land are protected.	Open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek (which have a riparian zone comprising Box-Gum Woodland CEEC) would be avoided for the Project. A Habitat Enhancement Area will be established within riparian zones along Moolarben Creek and Murdering Creek outside of the indicative surface disturbance extent, to facilitate the ecological restoration and ongoing maintenance of retained areas of native vegetation, threatened species, threatened ecological communities and their habitat. Revegetation of DNG/cleared land to woodland within the Habitat Enhancement Area would provide a net increase in woodland in the Moolarben Valley of approximately 22 ha during mining (i.e. not including rehabilitation). The revegetation proposed within the Habitat Enhancement Area can occur during Project operations and therefore, provide mitigation prior to rehabilitation within the indicative surface disturbance extent. Areas disturbed by mining would be progressively rehabilitated and revegetated following completion of active mining operations. As a component of the review of the Project design, MCO has also identified opportunities to improve the conceptual post-mining land uses by increasing the area rehabilitated to native vegetation from approximately 325 ha to 535 ha. With the Habitat Enhancement Area and rehabilitation, there is a long-term net increase in native woodland in the Moolarben Valley of approximately 557 ha. The Project is unlikely to impact on water-dependent assets in the Munghorn Gap Nature Reserve (including vegetation mapped as high-priority GDEs) given the localised impacts of the project, and given any water-dependent assets in the Munghorn Gap Nature Reserve are not connected to the regional groundwater system (AGE, 2022).
Cultural heritage	Areas and sites of heritage value on NPWS land, including Aboriginal cultural heritage, are protected.	The Project would not result in any direct or indirect impact on heritage resources within the Munghorn Gap Nature Reserve. Potential indirect impacts from blasting would be avoided by implementation of proposed blast vibration management measures.
Access to parks	Adjacent developments do not compromise public and NPWS access to parks.	There is no public access to the Munghorn Gap Nature Reserve from the Project area. MCO consults regularly with NPWS regarding the existing Moolarben Coal Complex and access to the Munghorn Gap Nature Reserve via Moolarben-owned lands. This would continue for the Project.

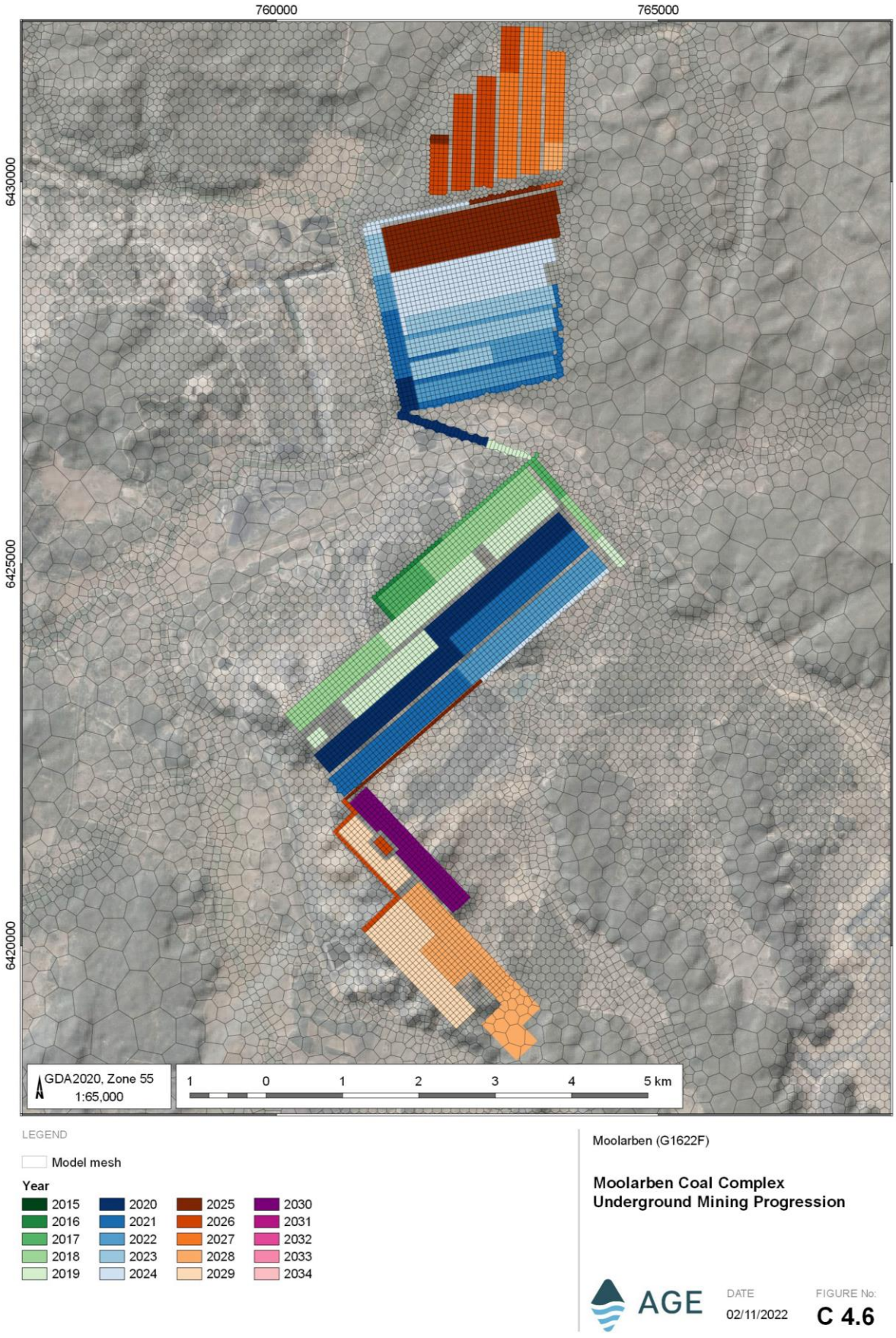


Figure 4-8: Underground Mining Progression Simulated in Numerical Groundwater Model for OC3 Extension (Source: AGE, 2022)

Recommendation 29.2

Provide clarification on any potential groundwater mounding and if this may have impacts on groundwater flow in Munghorn Gap Nature Reserve.

Response

Any predicted mounding in the Ulan Seam and spoil layer within the mine footprint would not impact on groundwater flow in the Triassic sandstone unit within the Munghorn Gap Nature Reserve and would not result in any adverse impacts to the Munghorn Gap Nature Reserve.

MCO has amended the Project to incorporate additional avoidance measures relative to the EIS. AGE (2024) has updated the groundwater modelling for the amended Project. The updated groundwater modelling predicts up to 2 m of mounding of groundwater within the backfilled spoil areas and Ulan Seam (e.g. target coal seam layer), the latter of which extends in part under the Munghorn Gap Nature Reserve (Figure 4-9).

The ridgelines within the Munghorn Gap Nature Reserve are associated with the Triassic sandstone unit and are not connected to the regional groundwater system, as they are in the order of 100 m above the regional groundwater table. AGE (2022) concluded there was no evidence to suggest that reductions in groundwater level or pressure in the Triassic sandstone unit due to the Project would impact perched groundwater features.

AGE (2022) also concluded water-dependent assets in the Munghorn Gap Nature Reserve are not connected to the regional groundwater system within the Permian coal measures. Further detail is provided in the response to IESC Item 1 (Section 4.1.7).

Recommendation 29.3

Provide clarification if any change in flow will facilitate contaminant transport pathways from mine spoil etc. that may impact Munghorn Gap Nature Reserve.

Response

The Munghorn Gap Nature Reserve is higher in elevation than the Project. It is not possible for the Project to result in transport pathways from the Project to the higher elevation Munghorn Gap Nature Reserve.

Recommendation 29.4

Install additional groundwater monitoring sites to include monitoring on:

- *Triassic sandstone on the Eastern side of the project area*
- *The various Illawarra Coal Measure layers around the project area. Including the southern side of the project for the Ulan Seam and the whole project area for the other Permian layers*
- *The cumulative impacts of the UG2 Extension modification.*

Response

MCO would adopt the proposed groundwater monitoring program recommendations from AGE (2024), including the installation of three additional vibrating wire piezometers within the Triassic sandstone unit, adjacent to local spring features, to monitor for potential impacts to perched groundwater, as shown on Figure 4-10. These additional monitoring bores would complement the existing extensive monitoring program and be used to monitor for potential impacts to key water features shown on Figure 4-11.

The existing groundwater monitoring program outlined in the approved Moolarben Coal Complex Water Management Plan (including the Groundwater Management Plan) provides for groundwater monitoring piezometers within the Moolarben Coal Complex monitoring network which covers all major hydrogeological units, including the Illawarra Coal Measures, and both standpipe bores and multi-level vibrating wire piezometers (VWPs). Additional monitoring sites targeting the Ulan Seam within the Illawarra Coal Measures are not considered necessary as the existing groundwater monitoring network is sufficient (Figure 4-11).

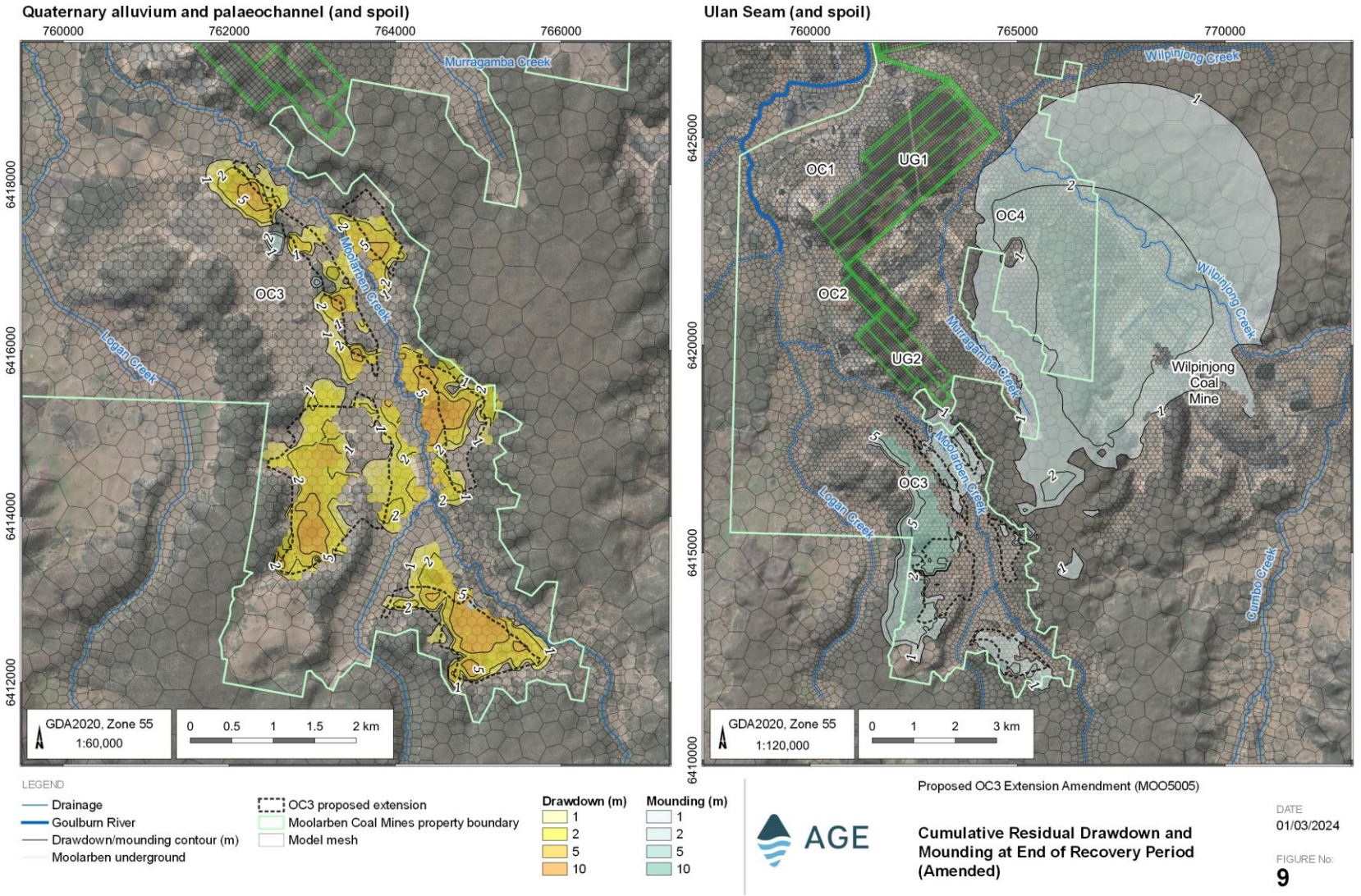


Figure 4-9: Residual Drawdown and Mounding at End of Recovery Period (Source: AGE, 2024)

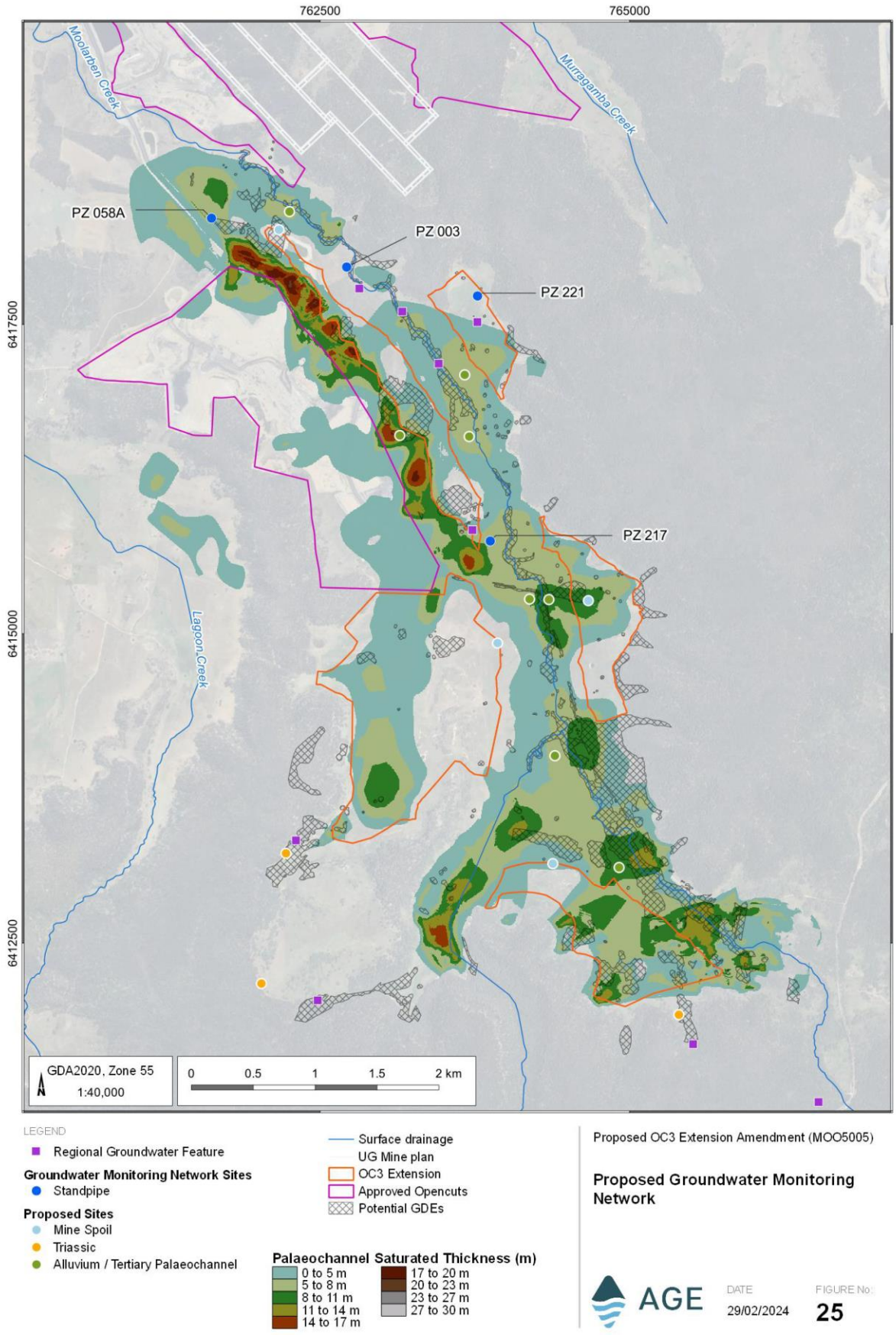
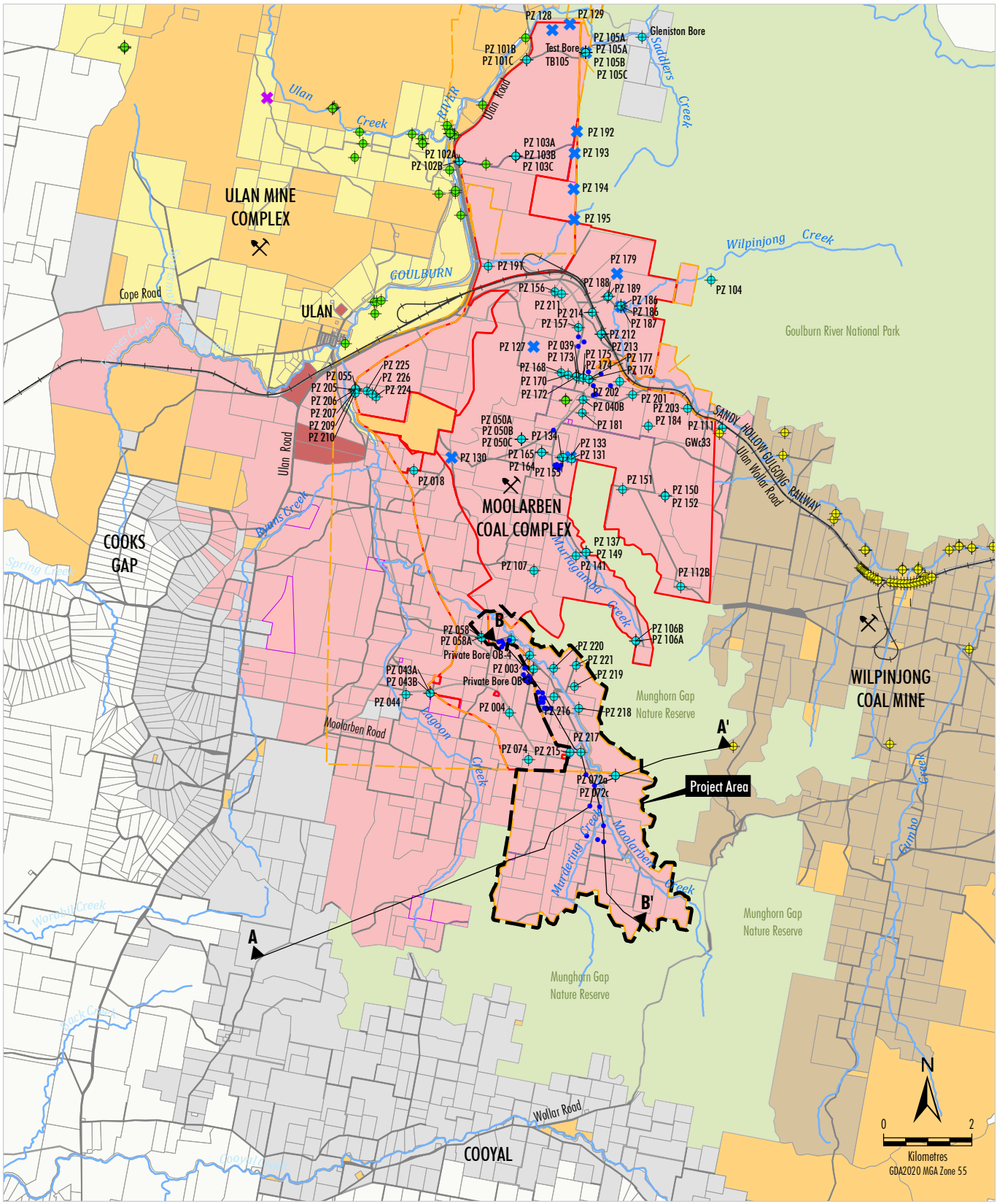


Figure 4-10: Proposed Groundwater Monitoring Program (Source: AGE, 2024)



MCM-20-18 OCG Ext AR SR_213A

LEGEND

- Railway
- Exploration Licence Boundary
- Mining Lease Boundary
- Project Study Area
- Cross-section Location

Groundwater Monitoring

- MCO Standpipe
- MCO VWP
- UCML Standpipe
- UCML VWP
- WCPL Standpipe
- Sonic Drilling Site

Relevant Landholder

- Moolarben Coal Operations Pty Ltd
- Yancoal Interest - Crown
- Ulan Coal Mines Limited
- Wilpinjong Coal Mine
- Privately Owned - Commercial/Community
- Crown Land
- Privately Owned
- Owner not Identified
- National Park/Nature Reserve

Note: Cross-section A-A' Refer Figure 6.3-3
Cross-section B-B' Refer Figure 6.3-4

Source: MCO (2022): NSW Spatial Services (2021)

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Regional Groundwater Monitoring Network

Figure 4-11

As outlined in response to Recommendation 29.1, the potential cumulative effects associated with the approved UG2 Modification have been assessed for the Project in the original Groundwater Assessment (AGE, 2022) and the amended Groundwater Assessment (AGE, 2024). Therefore, the recommendations for the groundwater monitoring program provided by AGE (2024) include consideration of the potential cumulative effects associated with the approved UG2 Modification.

Recommendation 29.5

Clarify if there is a risk of the perched aquifers within Munghorn Gap Nature Reserve cracking from far field earth movements as part of Moolarben Coal Complex activities.

Response

MCO notes the BCS and NPWS recommendation regarding the risk of perched aquifers cracking within the Munghorn Gap Nature Reserve due to far-field horizontal movements from the Moolarben Coal Complex. Far-field horizontal movements are associated with underground mining activities. The approved underground mining activities at the Moolarben Coal Complex would be unchanged by the Project (e.g. no extensions proposed to underground mining activities as part of the Project), and therefore this recommendation is not relevant to the scope of the Project or this Submissions Report.

Recommendation 29.6

Incorporate the storage of brine and mine water in the UG4 void into groundwater modelling.

Response

MCO notes the BCS and NPWS recommendation regarding brine storage modelling, however, brine and mine water storage in UG4 is approved as part of the Moolarben Coal Complex and would continue to be undertaken in accordance with the conditions of Moolarben Coal Complex Stage Project Approval (05_0117), which includes a requirement for brine storages to have a lining consistent with relevant standards and a suitable capacity, as detailed in the approved Brine Management Plan for the Moolarben Coal Complex.

Recommendation 29.7

Confirm if there are any impacts on Goulburn River National Park (and associated GDEs) due to potential changes in water quantity/quality in both surface water and groundwater.

Response

The Project is not predicted to materially change surface water and groundwater quality or availability (e.g. via drawdown) in the Goulburn River National Park. Therefore, the Project is not expected to result in cumulative impacts to aquatic habitat, flora and fauna associated with the Goulburn River National Park.

The Project would not result in any groundwater drawdown in the vicinity of the Goulburn River and potential impacts on baseflow in the Goulburn River and Moolarben Creek are predicted to be negligible (AGE, 2024).

An assessment of the potential impact on the receiving water quality due to sediment dam overflows was prepared for the amended Project (WRM, 2024) and concluded overflows from the proposed sediment dams would have a negligible impact on Moolarben Creek water quality and, therefore, a negligible impact on water quality in the downstream Goulburn River.

Furthermore, the IESC was satisfied with the assessment of the Goulburn River National Park and The Drip provided in the Groundwater Assessment (i.e. that the Project would not impact the Drip), stating:

> 6. *The IESC is satisfied that the Goulburn River National Park and The Drip are adequately considered by the groundwater assessment. The Drip is located 12 km north of the project site (Bio-Analysis 2022, p. 12) and is fed by a local shallow aquifer within the Triassic Sandstone on the far side of the Goulburn River (see recent work in ACARP 2022). Environmental tracers indicate The Drip seepage is distinctive from deeper aquifers, is a localised flow and is probably a perched aquifer.*

Recommendation 29.8

Ensure no impact on groundwater in Munghorn Gap Nature Reserve and Goulburn River National Park.

Response

As outlined in response to Recommendations 29.2, 29.3, 29.4 and 29.7, the Project is not predicted to impact groundwater quality or availability in the Munghorn Gap Nature Reserve and Goulburn River National Park as:

- predicted drawdown of the watertable is not expected to propagate beyond the tenements for the Moolarben Coal Complex; and
- perched aquifers in the Triassic sandstone unit within the Munghorn Gap Nature Reserve and Goulburn River National Park are not connected to the regional groundwater system, limiting the potential for impacts of the Project.

MCO would adopt the proposed groundwater monitoring program recommendations from AGE (2024) as shown on Figure 4-10, and would include:

- installation of three additional vibrating wire piezometers within the Triassic sandstone unit adjacent to local spring features to monitor for potential impacts to perched groundwater;
- installation of eight standpipes within the alluvium sediments and palaeochannel aquifer units to monitor groundwater level and quality in the vicinity of the proposed open cut pits, Moolarben Creek and water-dependent assets; and
- installation of four standpipes within the backfilled mine spoil to monitor groundwater recovery, hydraulic parameter estimation for any future re-calibration runs and comparison to historic groundwater level data.

These additional monitoring bores would complement the existing extensive monitoring program and be used to monitor for potential impacts to key water features, including the Munghorn Gap Nature Reserve and Goulburn River National Park.

Recommendation 30.1

Additional monitoring is required to confirm the presence of, or lack of, stygofauna in the area. Given that no sampling regime guidelines are currently in force for proposals in NSW, any sampling regime should be consistent with best practice from other state government agencies and technical bodies.

Response

In response to this comment from NPWS, additional stygofauna testing has been undertaken by Bio-Analysis (Attachment 2). The additional stygofauna testing comprised of:

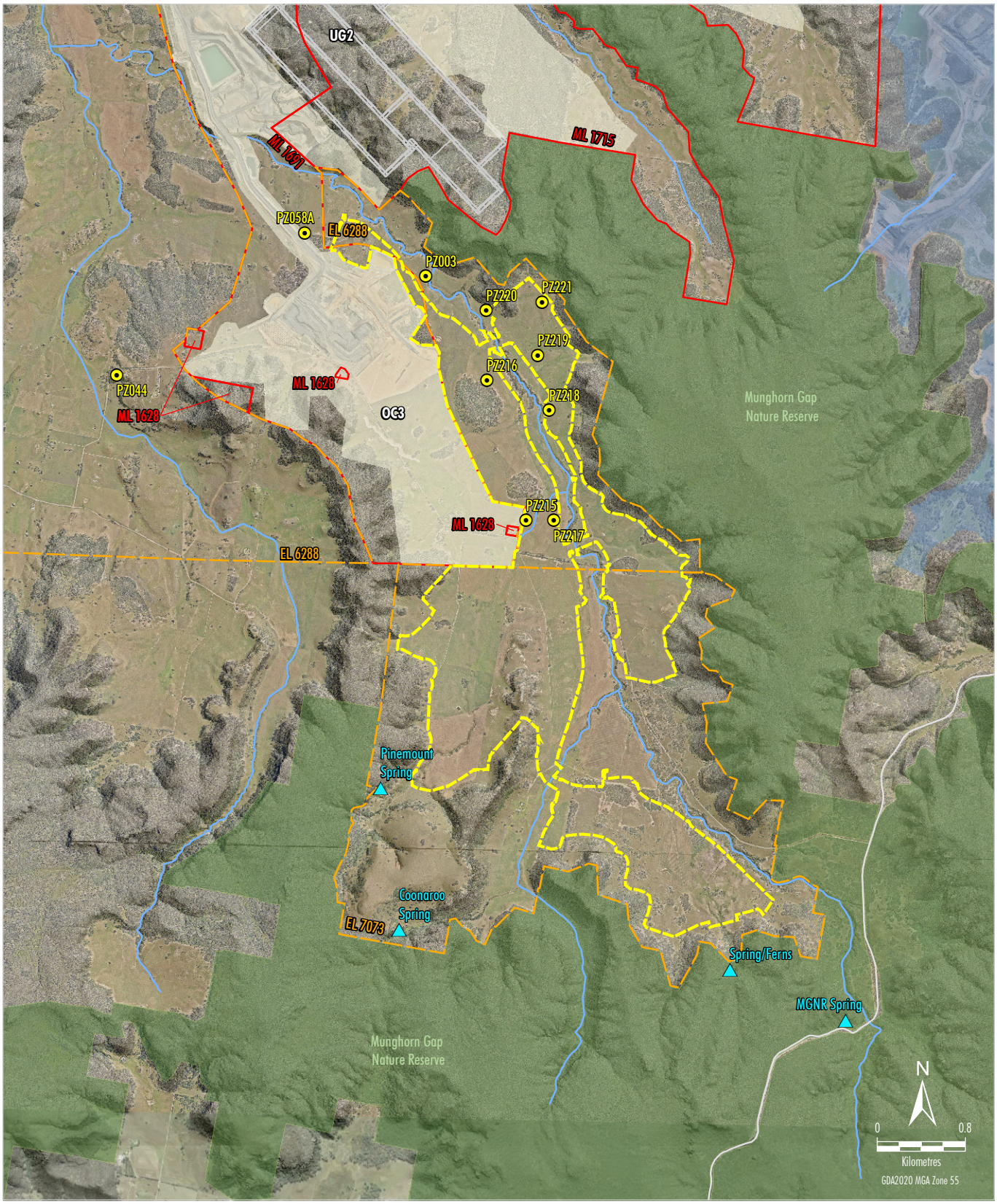
- Further testing of bores in the Project area sampled as part of the Aquatic Ecology Assessment for the Project EIS (Bio-Analysis, 2022).
- Testing of groundwater spring features located south of the Project area.

Stygofauna testing locations are shown on Figure 4-12. Further detail on the outcomes of these surveys is provided below.

Bore Testing

NPWS requested an additional round of stygofauna sampling be undertaken within the bores sampled in the Project Area for the EIS Aquatic Ecology Assessment, consistent with relevant guidelines. Additional monitoring of the bores sampled within and surrounding the indicative surface disturbance extent for the Project was undertaken by Bio-Analysis (2023) on 26–28 September 2023 (Figure 4-12).

Consistent with the findings from the previous stygofauna surveys undertaken for the EIS Aquatic Ecology Assessment (Bio-Analysis, 2022), no stygofauna were recorded from bores sampled in the Project Area during the additional surveys (Bio-Analysis, 2023).



MCM-20-18 OC3 Ext AR SR_214A

LEGEND

National Park/Nature Reserve
Exploration Licence Boundary
Mining Lease Boundary

Existing/Approved Development

Underground Longwall Layout
Moolarben Coal Complex Disturbance Footprint
Watercourse

OC3 Extension Project - Amended

Indicative Amended Project Surface Disturbance Extent

Aquatic Ecology Survey Sites

Stygofauna Survey Site
Spring

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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Aquatic Ecology Survey Sites

Figure 4-12

Spring Feature Testing

NPWS also recommended targeted stygofauna sampling within groundwater spring features identified to the south of the Project area, including the Pinemount Spring, Spring/Ferns, Coonaroo Springs and Munghorn Gap Nature Reserve Spring (Figure 4-12). Two rounds of sampling of the spring features was undertaken by Bio-Analysis (2023) in September and October 2023.

Additional samples from the springs in the vicinity of the Project identified at least five species of stygofauna, and invertebrate assemblages were mostly comprised of crustaceans (amphipods, ostracods, cyclopoid copepods) and oligochaete worms. None of the taxa collected within the springs are endemic to the Project area (Bio-Analysis, 2023). However, there is no drawdown predicted for Pinemount Spring, Spring/Ferns, Coonaroo Springs and Munghorn Gap Nature Reserve Spring as a result of the Project (AGE, 2024).

The Groundwater Assessment for the EIS (AGE, 2022) concluded that no impact is predicted for any of the identified local springs surrounding the Project (i.e. no groundwater drawdown). Freshwater samples from the springs are relatively recent (in terms of groundwater residence time), with no mixing with regional groundwaters (i.e. supporting the conceptualisation of perched aquifers within the Triassic ridgelines) (AGE, 2022). The Groundwater Assessment concludes that the Project is unlikely to impact on water dependent assets in the Munghorn Gap Nature Reserve as these are not connected to the regional groundwater system.

Conclusion

The outcomes of additional stygofauna sampling has not changed the conclusions in the Aquatic Ecology Assessment undertaken for the Project EIS (Bio-Analysis, 2022) that the Project is not likely to have a significant impact on aquatic ecology in the surrounding waterways or stygofauna. It is considered unlikely that the Project would have a measurable impact on subterranean GDEs (Bio-Analysis, 2023).

Monitoring adjacent to local springs features would be implemented as part of a groundwater monitoring network for the Project.

Recommendation 30.2

Include stygofauna sampling to the southern end of the proposed project area in, or on the boundary of, Munghorn Gap Nature Reserve.

Response

Refer to the response to Recommendation 30.1.

Recommendation 30.3

Confirmation is required of the location of the 23 hectares of GDEs within the 2 metres of drawdown area and the impacts that may occur on these GDEs over the period of mining operation (30 years).

Response

Since lodgement of the EIS, MCO has amended the Project to incorporate additional avoidance measures relative to the EIS in response to submissions received. AGE (2024) has updated the groundwater modelling for the amended Project, as well as the assessment of potential terrestrial GDEs.

AGE (2022) also concluded the predicted extent of drawdown due to the Project is limited due to the extensive unsaturated areas in the vicinity of the Project, the subcrop of the Ulan Seam west of the Project, and erosion of the Ulan Seam and overburden beneath Moolarben Creek. The areas of predicted drawdown are generally located along Moolarben Creek, where potential terrestrial GDEs could use stream flows rather than groundwater from the alluvial sediments and palaeochannel aquifer unit.

Patches of terrestrial vegetation along Moolarben Creek adjacent to Project disturbance areas and associated low-lying areas were considered as potential terrestrial GDEs. Potential impacts to these potential terrestrial GDEs were assessed in consideration of the drawdown predicted by AGE (2024) using the numerical groundwater model. With the implementation of the additional avoidance measures, AGE (2024) concluded approximately 6 ha of potential terrestrial GDEs are predicted to experience >2 m drawdown (i.e. 2 m to 6 m), these are shown in Figure 4-13 for the amended Project.

Further detail regarding assessment of potential terrestrial GDEs is provided in the response to Recommendation 17.1 of the BCS submission.

Recommendation 30.4

Clarification is required as to whether any GDEs within Munghorn Gap Nature Reserve are to be impacted, including areas with less than 2 metres of drawdown.

Response

The Groundwater Assessment (AGE, 2022) concludes that the Project is unlikely to impact on water dependent assets in the Munghorn Gap Nature Reserve as these are not connected to the regional groundwater system.

Recommendation 31.1

Amend the EIS to assess the extent of edge effect impacts on Munghorn Gap Nature Reserve, noting the natural values of the nature reserve, and provide an adequate setback to the nature reserve to mitigate such impacts.

Response

Refer to the response to Recommendation 27.1.

Recommendation 31.2

Ensure adequate protection from bushfire to the mine site and to adjacent lands such as Munghorn Gap Nature Reserve.

Response

The Project is unlikely to increase fire risk for the Munghorn Gap Nature Reserve.

Bushfire risk would continue to be managed in accordance with the Moolarben Coal Complex Bushfire Management Plan. Mitigation measures that would be implemented by MCO to reduce bushfire risk would focus on education and training, reducing bushfire hazard, minimising and controlling ignition sources and developing appropriate responses and evacuation strategies.

Recommendation 32.1

Amend the EIS to assess the extent of blasting and airblasting impacts on Munghorn Gap Nature Reserve, noting the recreational, cultural and natural values of the nature reserve, and provide an adequate setback to the nature reserve to mitigate such impacts.

Response

Refer to the response to Recommendation 27.1.

Recommendation 33.1

Consider sites of Aboriginal cultural heritage across the landscape and in proximity to the proposal area (including any sites in Munghorn Gap Nature Reserve) rather than just within the Subject Area and update assessment to consider potential impacts to those sites.

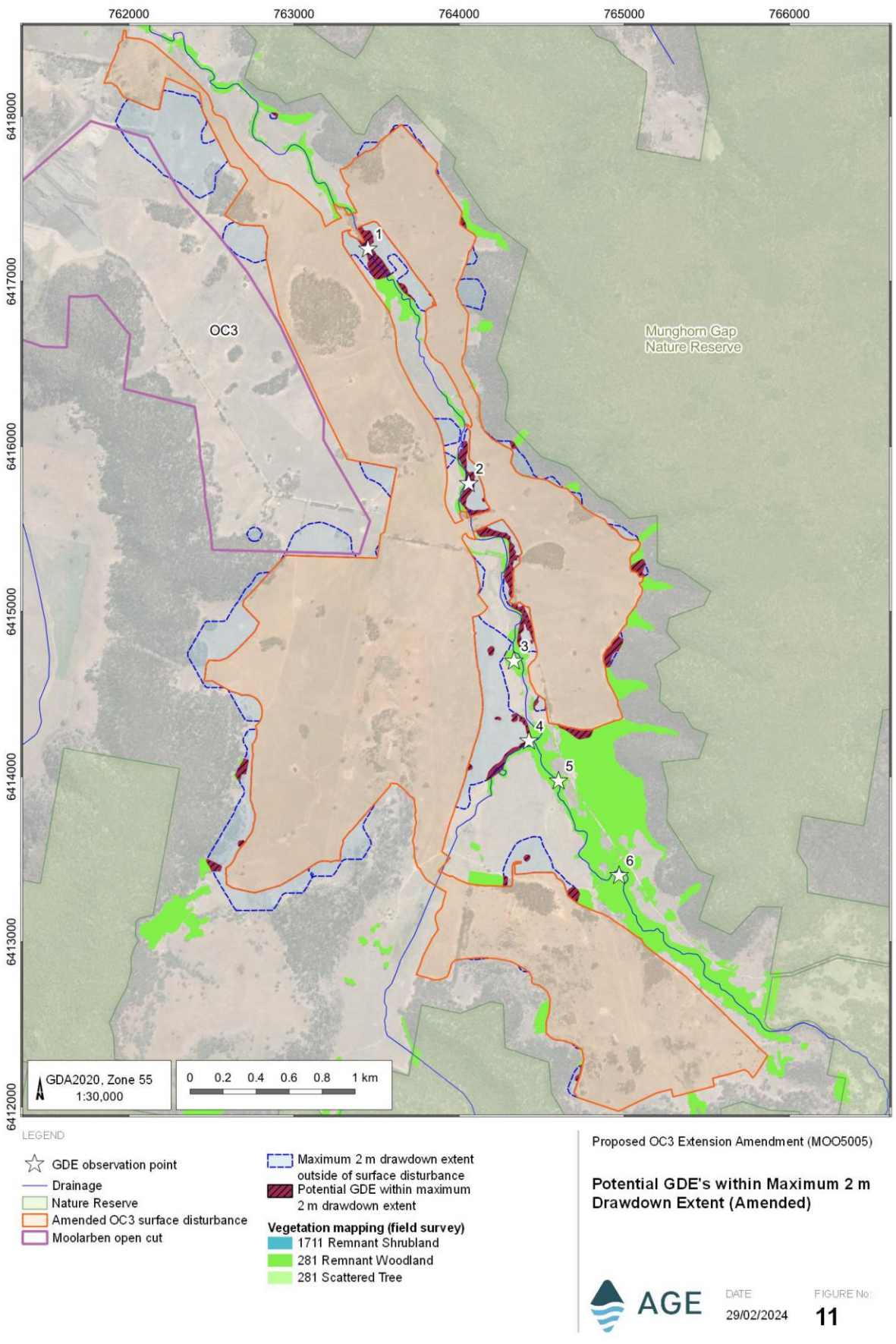


Figure 4-13: Potential Terrestrial GDEs within Predicted 2 m Drawdown Extent (Source: AGE, 2024)

Response

There would be no direct impacts to Aboriginal heritage sites outside of the indicative surface disturbance extent for the amended Project.

Potential indirect impacts are limited to rockshelter sites within 230 m of the Project indicative surface disturbance extent.

On this basis, there would be no direct or indirect impacts to any Aboriginal cultural heritage sites outside the Subject Area for the ACHA, including within the Munghorn Gap Nature Reserve

Recommendation 33.2

Consider the need for greater buffers to shelter sites (including any identified in Munghorn Gap Nature Reserve) as an avoidance measure to Aboriginal cultural heritage impacts.

Response

All Aboriginal cultural heritage sites outside the indicative surface disturbance extent, including rock shelter sites, would not be directly impacted by the Project. Aboriginal heritage sites located within proximity to the indicative surface disturbance extent boundary have the potential to be indirectly impacted by potential blast-related vibration associated with Project open cut mining activities.

In accordance with the existing Moolarben Coal Complex Blast Management Plan, MCO has committed to adjusting blast designs within 230 m of all shelter sites to ensure that ground vibration from blasting at shelter sites does not exceed the conservative 250 mm/s vibration damage criterion recommended by qualified blast experts (SLR, 2018).

These same controls would be adopted for the Project. Thus, while blasting is identified as a potential indirect impact to some Aboriginal heritage sites located within proximity to the indicative surface disturbance extent, existing blasting management measures for shelter sites would result in no impact.

In response to comments on the EIS regarding protection of geological features in the Munghorn Gap Nature Reserve, blast vibration would be limited to 50 mm/s PPV at sensitive geological features (including mapped rocky habitat) near the Project, unless further geotechnical investigation supports a higher value. Applying the blast vibration threshold at sensitive geological features would also limit the potential for vibration damage at shelter sites.

Blast vibration monitoring of shelter sites would be undertaken on a progressive basis to ensure that the relevant blast vibration limits are not exceeded.

Further detail is provided in the response to Heritage NSW Recommendation 6.3.

Recommendation 33.3

Amend the ACHA to accurately reflect the cumulative impacts of proposed damage to Aboriginal cultural heritage the locality (including to Munghorn Gap Nature Reserve) and provide updated avoidance and mitigation measures proportionate to those impacts.

Response

The Project as presented in the EIS would result in direct impacts to 79 known Aboriginal heritage sites. Since lodgement of the EIS, MCO has reduced the indicative surface disturbance extent for the Project to incorporate additional avoidance and minimisation measures to address comments received from BCS and NPWS. As a result, the amended Project would result in direct impacts to 55 known Aboriginal heritage sites.

There is a minimum of 100 m from the amended Project indicative surface disturbance extent and the Munghorn Gap Nature Reserve. Proposed blast management measures for mapped rocky habitat adjacent to the Project would have the benefit of protecting sensitive geological features in the Munghorn Gap Nature Reserve. Therefore there would be no impact to any Aboriginal heritage sites within the Munghorn Gap Nature Reserve.

The Aboriginal heritage sites within the amended Project indicative surface disturbance extent represent a well-documented and researched segment of Aboriginal archaeological resources in the area, including Artefact sites (with or without Potential Archaeological Deposit [PAD]) and Shelter sites (with or without Artefacts and/or PAD) (Niche, 2024b).

Niche (2024b) considers the Project is not expected to cause a loss of heritage resources that could be viewed as being very rare or unique or unlikely to exist elsewhere and, therefore, the Project would not result in any significant cumulative impact on Aboriginal heritage in the region.

Further detail is provided in the response to Heritage NSW Recommendations 5.1 and 5.2, as well as in Section 6.4 of the ACHA and Section 13.3 of the Archaeological Report.

Recommendation 34.1

NPWS is to be included in the notification and consultation requirements (i.e. TARPs) for any circumstances that occur in or under NPWS land or with potential to impact NPWS land.

Response

The amended Project would avoid all disturbance within 100 m of the Munghorn Gap Nature Reserve (i.e. no direct impact).

Indirect impacts to the Munghorn Gap Nature Reserve including noise, vibration and dust would be similar to cumulative impacts from the existing Moolarben Coal Complex and Wilpinjong Coal Mine. Potential impacts from lighting are expected to be localised and short-term (limited to the duration/direction of the artificial lighting).

MCO has considered the NPWS guideline *Developments adjacent to National Parks and Wildlife Service lands - Guidelines for consent and planning authorities* (NPWS, 2020) for the Project. Further detail is provided in the response to Recommendation 27.1.

The amended Project design and implementation of proposed mitigation and management measures would result in negligible impact to the Munghorn Gap Nature Reserve. MCO would continue ongoing consultation with NPWS in relation to existing mining activities at the Moolarben Coal Complex, including the Project.

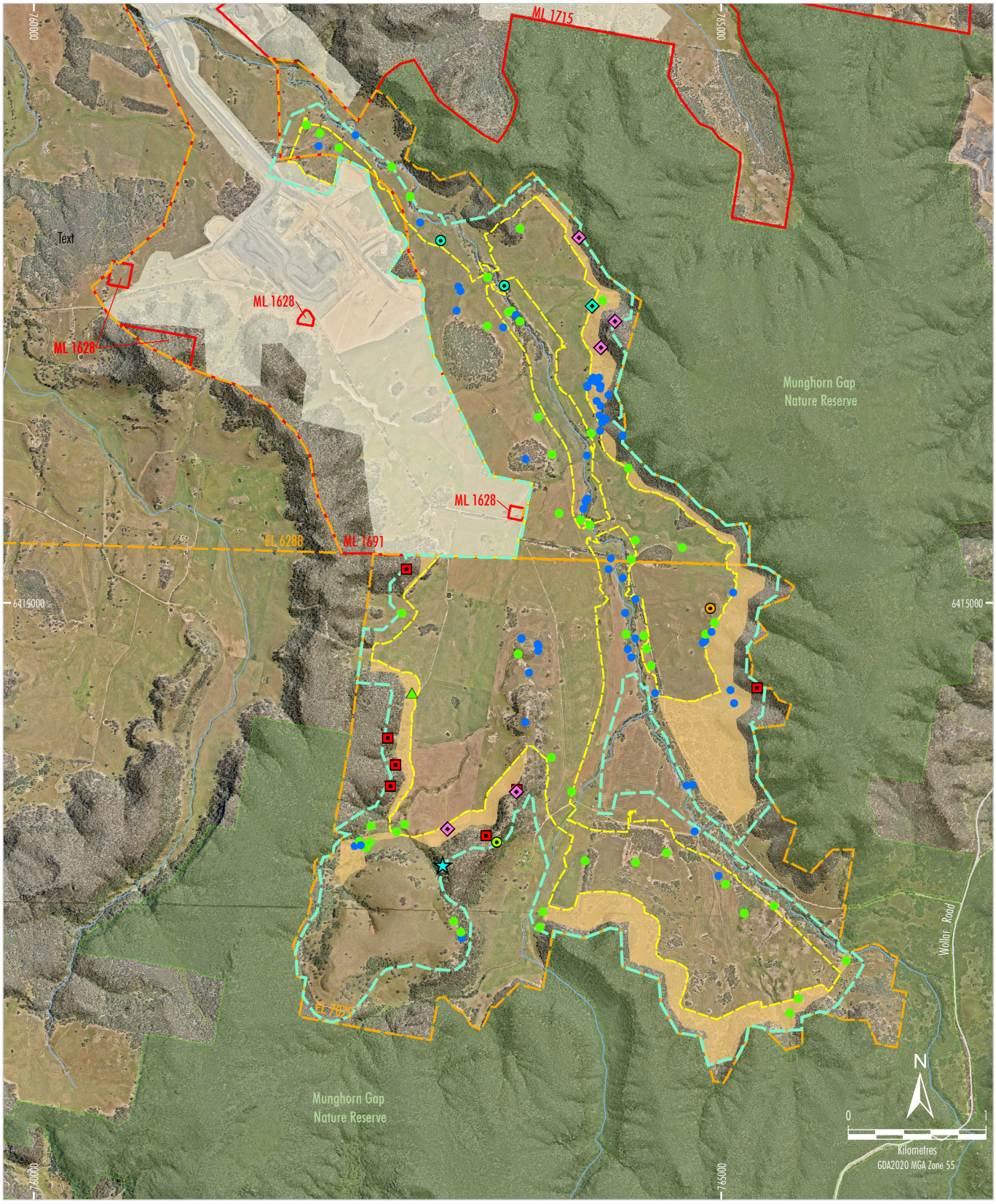
4.1.2 Heritage NSW

A submission was received from Heritage NSW which requested further information on the ACHA report prepared for the Project EIS. Responses to Heritage NSW's comments are provided below.

Since lodgement of the EIS, MCO has amended the Project, including reducing the indicative surface disturbance extent for the Project to incorporate additional avoidance and minimisation measures. This has resulted in a reduced number of Aboriginal cultural heritage sites subject to direct impacts as well as updated management measures for sites subject to indirect impacts.

The ACHA presented in the EIS has been updated by Niche (2024b) to reflect the amended Project, incorporate additional information in response to comments received from Heritage NSW, and incorporate outcomes of further fieldwork undertaken by Niche since lodgement of the EIS.

The Aboriginal cultural heritage sites within the Subject Area are shown on Figure 4-14 and a summary of the revised level of proposed impact for the amended Project is provided in Table 4-2. This includes eight Aboriginal heritage sites (all assessed as being of low scientific significance) identified during additional fieldwork since lodgement of the EIS, including four artefact scatters, one artefact scatter with PAD and three isolated finds.



MCN-20-18 OC3 Ext AR SR_219A

LEGEND

National Park/Nature Reserve
Exploration Licence Boundary
Mining Lease Boundary

OC3 Extension Project - Amended

Indicative Amended Project Surface Disturbance Extent
ACHA Subject Area
Additional Avoidance Minimisation for the Amended Project

Aboriginal Heritage Sites - High Scientific Significance

Shelter with Possible Burial (S1MC538)

Aboriginal Heritage Sites - Low to Moderate Scientific Significance

Artefact Scatter
Artefact Scatter with PAD
Grinding Grooves and Artefacts
Isolated find
PAD
Shelter with Artefacts
Shelter with Artefacts and Grinding Groove
Shelter with Artefacts and PAD
Shelter with PAD

Source: MCO (2023); Niche (2023); NSW Spatial Services (2021); Orthophoto Mosaic: MCO (2021)

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Aboriginal Cultural Heritage Sites Within the Subject Area

Figure 4-14

Table 4-2
Summary of Known Aboriginal Heritage Sites within the Subject Area

Site Type	Assessed Scientific Significance	Level of Proposed Impact*	Number of Sites
Artefacts (with or without PAD)			
Artefact Scatters	Low	Direct	26
		None	14
	Low-moderate	Direct	4
		None	4
	Moderate	Direct	3
		None	1
Artefacts and PAD	Low	Direct	1
		None	1
Isolated Finds	Low	Direct	19
		None	48
PAD	Low-moderate	None	1
Shelters (with or without Artefacts or PAD)			
Shelter with Artefacts	Low	Indirect	1
Shelter with Artefacts and PAD	Low	Indirect	4
	Moderate	Indirect	1
Shelter with Artefacts and Grinding Groove	Moderate	Direct	1
Shelter with PAD	Low	Indirect	2
		None	1
	Low-moderate	Indirect	4
Other Site Types			
Shelter with Possible Burial (S1MC538)	High	None	1
Grinding Grooves and Artefacts (S1MC437)	Moderate	Direct	1
Total			**138**

After: Niche (2024b)

Note: Site types have been updated where relevant to reflect outcomes of test excavation works undertaken since lodgement of the EIS.

** For the purpose of impact assessment, direct impact is defined as both total and partial impact to Aboriginal heritage sites located wholly or partially within the indicative surface disturbance extent for the amended Project.*

The broader Ulan and Moolarben region has been the subject of intensive archaeological and cultural heritage assessment over the last 20 years, driven by development of the Ulan Mine Complex, Moolarben Coal Complex and Wilpinjong Coal Mine. The archaeological record is therefore well understood, and the archaeological expectations of the Subject Area can be readily and confidently characterised based on the extensive previous findings and well-developed predictive model.

The sampling strategy for field survey for the ACHA was developed to target certain landforms in previously unsurveyed land within the Subject Area in consideration of the predictive model, with emphasis placed on landforms deemed to have archaeological potential. In particular, the survey work targeted ridgelines with potential for rockshelter sites, as well as creek lines and lower slopes.

An additional survey program was undertaken by Niche and representatives of the RAPs in March 2023, resulting in an additional 115 ha (9.5%) of survey of previously unsurveyed areas within the Subject Area. These surveys focused on lower slopes flat/plain landforms, areas of remnant vegetation and unsurveyed areas along Moolarben Creek. Therefore, a total of approximately 554 ha (45%) of the Subject Area has been surveyed to date.

A Geomorphological Assessment (Gippel, 2023) was undertaken to assess the landform types in the Subject Area and their sub-surface potential. Gippel (2023) concluded that there is a low likelihood of finding sub-surface late Pleistocene deposits in the Project area. The test excavation sampling strategy and locations of the testing areas were determined in consideration of the extent of landform types, surface geology, soil mapping and/or PAD associated with previously identified sites, as well as outcomes of the Geomorphological Assessment.

The results of the test excavation program confirm the predictive model as well as the conclusions of the Geomorphological Assessment (Gippel, 2023), particularly that there is low sub-surface potential in the Subject Area. No further excavation is required at the sites and landform areas prior to disturbance in consideration of the results of the test excavations (i.e. no further sub-surface potential). Niche (2024b) have not recommended any further test excavations within the Subject Area prior to disturbance.

The extensive archaeological survey, sub-surface test excavation program, and the assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within (Niche, 2024b).

Issue

Comments from the Aboriginal community need to be addressed

The Aboriginal Cultural Heritage Assessment Report (ACHAR) details consultation with the Aboriginal community that followed the Aboriginal Community Consultation Requirements for Proponents 2010. As part of the consultation, two RAPs provided feedback to the applicant. We are concerned that these comments have not been adequately addressed:

Recommendation 1.1

- *NEWCO requested that the project area be subject to a complete and thorough survey. In response, the applicant stated that additional surveys (i.e. of ancillary infrastructure outside of the proposed Project surface disturbance extent) would be conducted post-approval.*
    - *Heritage NSW supports conducting thorough survey pre-approval to inform the EIS.*

Response

During the consultation period for the Proposed Methodology for the Project ACHA, North East Wiradjuri Company (NEWCO) provided the following comment:

> *North East Wiradjuri company would like to see MCO do a detailed assessment of the whole of OC3 expansion area, in order to protect our heritage. It is indisputable that only surveying a representative sample of the area will not allow us to adequately place the relationship of the sites and the landscape into our Songlines.*

NEWCO's comment was considered during development of the proposed survey methodology and sampling strategy for the Project, which also considered the predictive model developed for the Project and the requirements of the *Code of Practice for Archaeological Investigation of Aboriginal Objects in New South Wales* (DECCW, 2010a) (the Code of Practice).

The Code of Practice provides that the purpose of archaeological survey is to "record all (or a representative sample of all) the material traces and evidence of Aboriginal land use" to inform the archaeological assessment.

Prior to the Project ACHA, approximately 16% (198 ha) of the Subject Area has been previously surveyed. Surveys undertaken to inform the ACHA presented in the EIS covered a further approximately 19.5% (241 ha) of the Subject Area. Additional surveys undertaken to inform the updated ACHA covered approximately an additional 9.5% (115 ha) of the Subject Area. Therefore, approximately a total of 45% (554 ha) of the Subject Area has been subject to systematic survey to date. Further detail regarding additional surveys undertaken since lodgement of the EIS is provided in the response to Recommendation 3.1.

Niche (2024b) recommended that, prior to surface disturbance, areas not previously subject to systematic survey should be surveyed by an appropriately qualified and experienced archaeologist in consultation with RAPs. This recommendation is consistent with the additional surveying commitments and Ground Disturbance Permit process described in the existing Moolarben Coal Complex Heritage Management Plan.

Representatives of NEWCO participated in all rounds of field survey undertaken to inform both the ACHA and updated ACHA.

Recommendation 1.2

- *Murong Gialinga Aboriginal and Torres Strait Islander Corporation raised concerns regarding the cumulative impact of the OC3 extension and other mining projects in the region on Aboriginal cultural heritage values. In response, the applicant stated that the sites within the project area have been assessed as having limited conservation value and there are representative sites conserved within the Moolarben Coal Complex (MCC), Ulan Coal Mine (UCM), and Wilpinjong Coal Mine conservation areas and there is no further requirement for avoidance or conservations of sites*
    - *Additional assessment of cumulative impact and the principles of Ecologically Sustainable Development (ESD) is recommended in the ACHAR to address this consultation comment.*

Response

The updated ACHA and Archaeological Report (Niche, 2024b) include additional information to clarify the cumulative assessment and consideration of the principles of Ecologically Sustainable Development (ESD) for the Project. Further detail is provided in Section 6.4 of the ACHA and Section 13.3 of the AR.

The Aboriginal heritage sites within the amended Project indicative surface disturbance extent represent a well-documented and researched segment of Aboriginal archaeological resources in the area, including Artefact sites (with or without PAD) and Shelter sites (with or without Artefacts and/or PAD) (Niche, 2024b).

Niche (2024b) considers the Project is not expected to cause a loss of heritage resources that could be viewed as being very rare, unique or unlikely to exist elsewhere and, therefore, the Project would not result in any significant cumulative impact on Aboriginal heritage in the region. Further detail on additional cumulative assessment undertaken in the updated ACHA and Archaeological Report is provided in the response to Recommendations 5.1 and 5.2.

Niche (2024b) has also assessed the Project against the ESD principles defined in the NSW Protection of the Environment Administration Act 1991 in consideration of the results of the literature review, Aboriginal heritage surveys and test excavation works as well as the significance assessment undertaken in the ACHA. A summary of the ESD assessment is provided in Table 4-3 extracted from Table 21 of Section 6.4 of the revised ACHA.

Issue

Amendments to the Aboriginal Cultural Heritage Assessment Report (ACHAR) and Archaeological Report (AR)

Recommendation 2.1

- *The ACHAR and AR identified that 130 ACH sites are located within the project area, with 98 previously identified and a further 32 newly identified. Both the ACHAR and AR focused on the 32 newly identified sites, rather than incorporating data (where available) from all 130 sites. Both reports need to include all sites to adequately characterise the nature of the known archaeological material across the project area.*

Response

The ACHA and Archaeological Report presented in the EIS (Niche, 2022b) assessed all 130 known Aboriginal cultural heritage sites within the Subject Area, including the 98 previously identified sites, as required by the Code of Practice (DECCW, 2010) and Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW (OEH, 2011).

The updated ACHA and Archaeological Report (Niche, 2024b) also assess all known Aboriginal cultural heritage sites in the Subject Area, including eight additional sites identified as a result of further survey and test excavation works undertaken since lodgement of the EIS (further detail is provided in the response to Recommendation 3.1 and 3.6).

Table 4-3
Assessment of Ecologically Sustainable Development

Principles of the ESD Guideline	ESD Assessment (Niche, 2024b)
A fundamental consideration for the conservation of biological diversity and ecological integrity	This assessment considers the conservation of cultural heritage. The majority of sites that may be directly impacted are of low scientific significance (i.e. not rare or unique). High archaeologically sensitive sites of moderate to high information potential in ridge contexts have been avoided by the indicative surface disturbance extent. Ongoing refinement of the indicative surface disturbance extent has resulted in the avoidance of 71 previously identified sites within the Subject Area.
Careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment	MCO has considered all options to avoid, where practical, harm to Aboriginal Objects in the design of the Project. Detailed ongoing mine planning and refinement of the indicative surface disturbance extent has resulted in the avoidance of direct and indirect impacts to seventy-one (71) Aboriginal heritage sites within the Subject Area. All Rock Shelters within 230 m of the indicative surface disturbance extent will experience ongoing blast monitoring to avoid impacts to these sites.
Consideration of intergenerational equity	Consistent with ESD, all Aboriginal heritage sites within the Subject Area are culturally significant to the Aboriginal community and are tangible links to their culture and Country. MCO has considered the potential cumulative impacts to Aboriginal heritage, and detailed refinement of the indicatives surface disturbance extent has resulted in the avoidance of additional Aboriginal heritage sites. Aboriginal heritage sites within the Subject Area represent a well-documented and researched segment of Aboriginal archaeological resources in the area. Conservation areas within the MCC contain representative sites and values protected from future impact. A keeping place has been designated and located on Country to maintain access to known archaeological resources for present and future generations. Therefore, the Project would not result in any significant cumulative impact on Aboriginal heritage in the region.
Where risk of serious or irreversible harm and lack of scientific knowledge of the nature of environmental harm combine, the precautionary principle applies. Where there is risk of serious or irreversible harm, it is necessary to establish whether there is adequate scientific knowledge of the subject to evaluate the perceived threat.	The majority of sites are of low scientific significance (i.e. not rare or unique), particularly due to their low integrity contexts, and inability to inform further knowledge of site patterning and occupation of the Moolarben landscape. Aboriginal heritage sites within the Subject Area represent a well-documented and researched segment of Aboriginal resources in the area. There is adequate scientific knowledge of the immediate Subject Area and local Moolarben region.
An assessment of the risk-weighted consequences of various options	A consideration of mitigating harm is provided in Section 7.4 of the ACHA. Avoidance is always preferred and 71 sites within the Subject Area will not experience any direct or indirect impacts. The latest archaeological works have provided clarity on sub-surface potential. This potential has been assessed as nil/low providing a much lower risk to archaeological sites.

After: Niche (2024b)

Specific sections of the ACHA and Archaeological Report (prepared for the EIS and for the amended Project) where all known Aboriginal cultural sites in the Subject Area are considered are detailed in Table 4-4.

Table 4-4
Reconciliation of ACHA and Archaeological Report Sections where all Sites in Subject Area are Assessed

Assessment Component	EIS Project (Niche, 2022b)		Amended Project (Niche, 2024b)	
	ACHA	Archaeological Report	ACHA	Archaeological Report
Significance Assessment	Section 5	Section 12	Section 5	Section 12
Impact Assessment	Section 6	Section 13	Section 6	Section 13
Recommended Mitigation and Management Measures	Section 7, 8	Section 14, 15	Section 7, 8	Section 14, 15
AHIMS Site Cards	–	Annex 2	–	Annex 2

Recommendation 2.2

- *The ACHAR and AR must separate the different types of artefact sites, including isolated artefacts, scatters, and those with PADs to accurately capture the nature of the archaeological sites present in the project area. The conflation of multiple site types may misrepresent the frequency of site types at the local and regional scales.*

Response

The updated ACHA and Archaeological Report (Niche, 2024b) has been revised to provide further separation of site types identified within the Subject Area, as follows (Table 4-2):

- Artefact Scatters.
- Artefacts and PAD.
- Isolated Finds.
- PAD.
- Shelter with Artefacts.
- Shelter with Artefacts and PAD.
- Shelter with Artefacts and Grinding Groove.
- Shelter with PAD.
- Shelter with Possible Burial.
- Grinding Grooves and Artefacts.

All figures, tables and discussion of site types throughout the updated ACHA and Archaeological Report (Niche, 2024b) have been revised accordingly.

Recommendation 2.3

- *The literature review in the ACHAR needs to be updated to consider the most recent reports from Ulan Mine Complex available on the Department of Planning and Environment Major Projects Portal.*

Response

Section 4 of the Project Archaeological Report provides a detailed summary and analysis of previous publicly available assessments conducted within the Subject Area and surrounds (including for the Moolarben Coal Complex, Ulan Mine Complex and Wilpinjong Coal Mine). Section 4 of the Archaeological Report has been updated by Niche (2024b) to incorporate a review of the ACHA for Modification 6 of the Ulan Mine Complex.

It is noted that the Ulan Modification 6 ACHA was not publicly available when the Project EIS (including the Project ACHA) were lodged with DPHI in November 2022.

Section 4 of the Archaeological Report has now been updated by Niche (2024b) to incorporate a review of the ACHA for Modification 6 of the Ulan Mine Complex.

The Ulan Modification 6 ACHA concluded that the "evidence from the surveyed area is typical of that from the Ulan locality. No specific aspects of the evidence appear to be rare or unusual or not replicated elsewhere within a local or regional context" (Kuskie, 2021). On this basis, the outcomes of the Ulan Modification 6 ACHA are consistent with the predictive model for the Project Subject Area.

Issue

Limitations in the archaeological survey coverage and areas of Potential Archaeological Deposit (PAD) need to be addressed

We have identified some areas of the archaeological assessment presented in the ACHAR that we recommend are addressed:

Recommendation 3.1

- *The survey coverage does not comply with Requirement 5a Code of Practice for Archaeological Investigation of Aboriginal Objects in NSW (DECCW 2010), nor does it provide adequate coverage based on the scale of proposed impacts. Requirement 5a states that "proportional emphasis [should be placed] on those landforms deem[ed] to have archaeological potential" and the survey must "include all landforms that will potentially be impacted. Where there is more than one instance of similar or the same landforms that have the potential to be impacted each individual landform must be sampled". From the information provided in the ACHAR and AR, 34% of the project area was subject to survey with lower slopes and valley flats not subject to survey and other areas selectively sampled.*

Response

Background

In accordance with the Code of Practice, the purpose of the field surveys for the Project ACHA were to assist in the identification of cultural heritage values and to record a representative sample of material traces and evidence of Aboriginal land use visible at ground surface, or exposed in sections or visible as features. In addition, the purpose of the field surveys were to identify those areas where it can be inferred that, although not visible, material traces or evidence of Aboriginal land use have a likelihood of being present under the ground surface (i.e. PADs) (Niche, 2024b).

The sampling strategy for field survey for the ACHA was developed to target certain landforms in previously unsurveyed land within the Subject Area in consideration of the predictive model, with emphasis placed on landforms deemed to have archaeological potential. In particular, the survey work targeted ridgelines with potential for rockshelter sites, as well as creek lines and lower slopes.

The Subject Area comprises a range of landform areas, including depressions, drainage lines, flats and lower slopes and ridges/crests, cliffs, upper slopes and mid-slopes. These landform elements have been allocated into two broad survey units based on grouping of associated landforms and their archaeological potential. Further detail regarding the sampling strategy for the Project field surveys is provided in the response to Recommendation 3.6.

Previous Survey Effort

Prior to this assessment, approximately 198 ha (16%) of the Subject Area had been previously surveyed.

An Aboriginal cultural heritage survey was completed in 2022 by Niche and representatives of the RAPs to inform the ACHA for the Project. The survey program completed for the Project in 2022 was undertaken on 2-4 February 2022 and 14-17 February 2022.

A total of approximately 241 ha[1] (19.5%) of previously unsurveyed areas within the Subject Area were subject to systematic archaeological survey during the 2022 program. Therefore, the ACHA as presented in the EIS was informed by a total survey coverage of approximately 440 ha (36%) of the Subject Area (Figure 4-15).

The survey sampled a range of landforms including depressions and open depressions, drainage lines, flats, lower slopes, mid-slopes, ridges, crests and upper slopes. Areas previously inspected were not surveyed as part of this program.

Additional Survey Effort

In response to comments from Heritage NSW on the ACHA presented in the EIS, an additional survey program was undertaken by Niche and representatives of the RAPs in March 2023, resulting in approximately an additional 115 ha (9.5%) of survey of previously unsurveyed areas within the Subject Area (Figure 4-15). These surveys focused on lower slopes flat/plain landforms, areas of remnant vegetation and unsurveyed areas along Moolarben Creek.

Therefore, a total of approximately 554 ha (45%) of the Subject Area has been surveyed to date.

The RAPs involved in the archaeological surveys expressed on-site that they consider the Subject Area has undergone thorough and extensive surveys.

Four new Aboriginal heritage sites (all assessed by Niche [2024b] as being of low scientific significance) were identified during the additional field survey in 2023, including one artefact scatter, one artefact scatter with PAD and two isolated finds. Site-specific management measures are included in the updated ACHA and AR.

Landform Survey Coverage

Since lodgement of the ACHA as presented in the EIS, Niche (2024b) have revised the ACHA and Archaeological Report to provide the breakdown of landform areas within the survey units. Figure 4-16 shows the landforms areas within the Subject Area and associated survey units. Table 4-5 provides the total area surveyed for each landform during the 2022 and 2023 survey programs.

All landforms were subject to survey prior to lodgement of the ACHA as presented in the EIS. In total, 27% of lower slopes and 29% of flat landforms were surveyed during both the 2022 and 2023 surveys programs (Table 4-5).

Table 4-5
2022 and 2023 Survey Coverage by Landform in the Subject Area

Survey Unit	Landform	Landform Area (m^2)	Percent of Subject Area	Area Surveyed 2022 (m^2)	Area Surveyed 2023 (m^2)	Total Area surveyed (m^2)	Total Percent of Landform Surveyed
1	**Drainage Line**	746,446	6.0%	104,999	87,321	192,320	26%
	Flat	2,944,733	23.8%	407,191	437,892	845,083	29%
	Lower slope	6,548,506	53.0%	1,174,591	577,738	1,752,329	27%
2	**Ridge**	266,035	2.0%	95,470	22,154	117,624	44%
	Crest	26,085	0.2%	1,342	0	1,342	5%
	Ridge/Crest	31,397	0.3%	16,363	0	16,363	52%
	Upper slope	711,837	5.9%	238,996	10,323	249,319	35%
	Mid slope	1,089,525	8.8%	370,109	14,566	384,675	35%
Total		**12,364,564**	**100%**	**2,409,063**	**1,149,994**	**3,559,055**	**29%**

m^2 = square metres

[1] Since lodgement of the EIS, the Niche (2024b) has revised the survey coverage areas following a review of previous survey coverage against topographic data, GIS calculations of tracklogs from Niche ArcGIS Enterprise data and aerial imagery. This has increased 2022 survey coverage from approximately 231 to 241 ha.

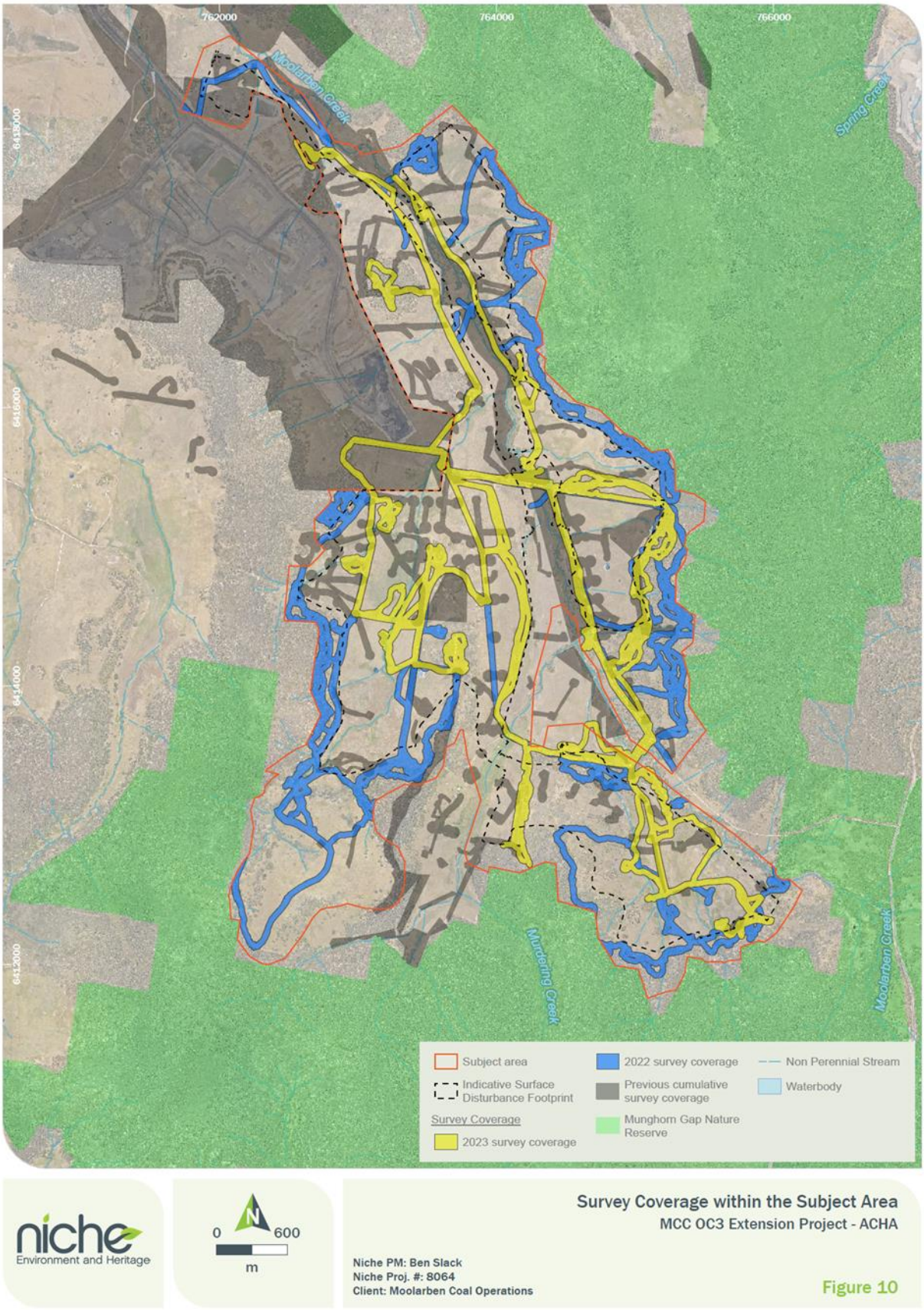


Figure 4-15: Survey Coverage within the Subject Area (Source: Niche, 2024b)

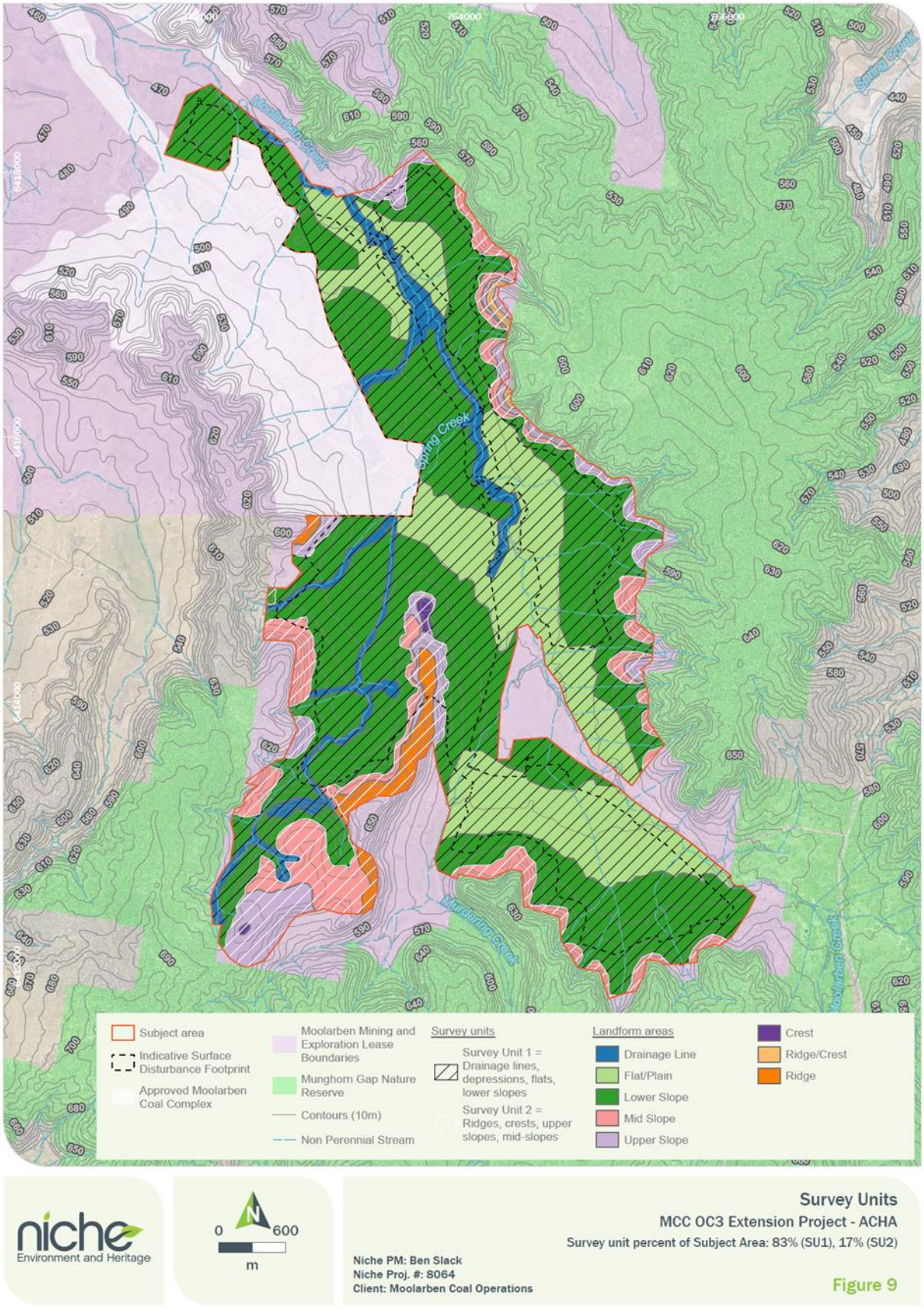


Figure 4-16: Survey Units and Landform Areas within the Subject Area (Source: Niche, 2024b)

Of the four new Aboriginal heritage sites identified during the additional field survey in 2023, two were identified within the lower scope landform, one within the drainage line landform and one within the flat landform.

Recommendation 3.2

- *The ACHAR and AR contain discrepancies between the Predictive Model and the objectives of the survey. The predictive model states that artefact assemblages are expected within lower slopes, however these areas were not subject to systematic survey. The ACHAR notes that these lower slopes have been subject to agricultural impacts, however evidence across the regions coalfields indicates that despite the level of disturbance there is still a high likelihood of artefactual material with the potential for subsurface finds.*

Response

Since lodgement of the ACHA as presented in the EIS, Niche (2024b) has revised the ACHA and AR to provide the breakdown of landform areas within the survey units developed for the survey program undertaken in 2022 (Table 4-5 and Figure 4-16). Further detail is provided in the response to Recommendation 3.1.

Extent of Surveys within the Lower Slopes Landform

Approximately 18% (1,174,591 m^2) of the total area of the lower slopes landform (6,548,506 m^2) was subject to systematic survey during the 2022 survey program (Table 4-5) and 10 of the 31 Aboriginal heritage sites identified during the 2022 survey program were recorded within the lower slopes landform area.

A further 9% (577,738 m^2) of the lower slopes landform area was subject to systematic survey during the additional survey program completed in 2023 (Table 4-5), and an additional two artefacts (an artefact scatter and an isolated find) were identified within this landform (out of a total of 4 identified during the 2023 survey program).

Overall, Niche (2024b) concludes the distribution of newly recorded Aboriginal heritage sites within the Subject Area is consistent with patterning outlined in the predictive model. In particular, that artefacts sites are more common in flat to gently inclined landforms such as lower slopes. The RAPs involved in the archaeological surveys expressed onsite that they consider the Subject Area has undergone thorough and extensive surveys.

Recommendation 3.3

- *The scale of the impacts proposed across the project area and the current level of survey across the area means that there is a risk that there are more than the 130 known sites in the project area. Heritage NSW recommends that those areas yet to be survey are subject to detailed and thorough assessment prior to any project approval.*

Response

In response to comments from Heritage NSW, additional field survey and a targeted test excavation program have been undertaken to further characterise the Subject Area, in consultation with RAPs and Heritage NSW. Niche (2024b) have updated the ACHA and Archaeological Report to incorporate the outcomes of this additional field work. As a result of the additional survey work, approximately a further 115 ha (9%) of previously unsurveyed areas within the Subject Area were subject to systematic survey. Therefore, a total of approximately 554 ha (45%) of the Subject Area has now been subject to systematic survey.

The results of the test excavation program confirm the predictive model as well as the conclusions of the Geomorphological Assessment (Gippel, 2023), particularly that there is low sub-surface potential in the Subject Area.

As a result of both the field survey and targeted test excavations, a further eight Aboriginal heritage sites have been identified within the Subject Area. All eight of these newly identified sites are assessed by Niche (2024b) as having low scientific significance and site-specific management measures are included in the updated ACHA and AR.

The updated ACHA and Archaeological Report provide that, prior to surface disturbance, Niche (2024b) recommend areas not previously subject to systematic survey should be surveyed by an appropriately qualified and experienced archaeologist in consultation with RAPs. This recommendation is consistent with the Ground Disturbance Permit process described in the existing Moolarben Coal Complex Heritage Management Plan.

Recommendation 3.4

- *Figure 8 of the ACHAR outlines that survey conducted within Survey Unit 1 focused on disturbed access tracks, rather than investigating areas along Moolarben Creek and areas of remnant vegetation. Further detail on the extent of surveys conducted in Survey Unit 1 is recommended.*

Response

The sampling strategy for field survey for the EIS ACHA was developed to target certain landforms in unsurveyed land within the Subject Area in consideration of the predictive model. In particular, the survey work targeted ridgelines with potential for rockshelter sites, as well as creek lines and lower slopes.

In response to this recommendation from Heritage NSW, an additional field survey program has been undertaken by Niche (2024b) in 2023 targeting previously unsurveyed areas along Moolarben Creek and areas of remnant vegetation which would be disturbed by the Project.

As a result, survey coverage of previously unsurveyed areas within Survey Unit 1 (which includes riparian areas and some remnant vegetation) has increased from 16% to a total of 27%. An additional four Aboriginal heritage sites were identified during these field surveys. Further detail regarding the outcomes of the additional surveys undertaken since lodgement of the EIS is provided in the response to Recommendation 3.1.

Recommendation 3.5

- *There are many sites and PADs associated with Moolarben Creek, however it is unclear if this area has been extensively surveyed. While the area will be excluded from open cut mining operations, the project will involve impacts to the creek through the construction of haul roads and associated creek crossings, internal access roads, water management infrastructure (e.g., clean water diversions, mine water dams and sediment dams) and temporary waste rock emplacement areas. Further information is required on the extent of surveys along the creek in relation to the proposed impacts.*

Response

The Project would avoid open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek.

The extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek has been minimised as far as practicable, however some infrastructure components (e.g. haul roads, haul road creek crossings, water management infrastructure, flood bunds) are required. This infrastructure is incorporated in the indicative surface disturbance extent for the Project and would not extend further than this boundary.

All Aboriginal cultural heritage sites outside the indicative surface disturbance extent but within the riparian zone of Moolarben Creek and Murdering Creek would not be impacted by the Project as they are avoided and would remain in situ. Notwithstanding, these sites would be described in an updated or new Heritage Management Plan for the Project, in consultation with RAPs.

In response to comments from Heritage NSW, additional field survey and a targeted test excavation program have been undertaken to further characterise the Subject Area, in consultation with RAPs and Heritage NSW. Niche (2024b) have updated the ACHA and Archaeological Report to incorporate the outcomes of this additional field work. Outcomes of this additional work specific to the Moolarben Creek area is provided below.

Extent of Surveys within the Drainage Line Landform

Approximately 14% (104,999 m^2) of previously unsurveyed areas within the drainage line landform located in the Subject Area has been subject to systematic survey during the 2022 survey program to inform the ACHA as presented in the EIS.

In response to comments from Heritage NSW, an additional field survey program has been undertaken by Niche (2024b) in 2023 targeting previously unsurveyed areas along Moolarben Creek and areas of remnant vegetation which would be disturbed by the Project.

A further 12% (87,321 m^2) of previously unsurveyed areas within the drainage line landform were subject to survey during the additional survey program completed in 2023 (Table 4-5) Further detail on the outcomes of the additional surveys is provided in the response to Recommendation 3.1, and further detail regarding the sampling strategy is provided in the response to Recommendation 3.6.

The 2023 survey identified one new site (S1MC545) within the drainage line landform (out of a total of 4 identified during the 2023 survey program), an artefact scatter with PAD, adjacent to the eastern bank of Moolarben Creek. S1MC545 was assessed by Niche (2024b) as having low scientific significance.

Test Excavation Program

In response to comments from Heritage NSW, a test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to determine the presence, extent and significance of sub-surface Aboriginal objects within the Subject Area. These investigations were informed by the outcomes of geomorphological review of the Subject Area and targeted Aboriginal heritage sites with PAD proposed to be disturbed as well as landform areas to fully assess the impact of the Project on any potential archaeological resources that may be present. Further detail regarding the test excavation program methodology and outcomes is provided in the response to Recommendation 3.7.

Of the five landform areas subject to test excavation, one (i.e. Test Area 1) was located on flat level plain in close proximity to Moolarben Creek (Figure 4-17). Of the three Aboriginal heritage sites with PAD subject to test excavation, one (S1MC422) was located within 50 m of Moolarben Creek (Figure 4-17).

Areas along Moolarben Creek (i.e. Test Area 1), have been shown to contain a lower density of artefacts than previously envisioned. Although excavations identified a deep A-horizon, the test pits were often excavated to a depth of 1 metre with no identified artefacts, particularly along the transects closest to Moolarben Creek. Niche (2024b) interpreted this as landscape subject to constant movement of soils through flooding events and not a landscape conducive to long term habitation, (i.e. indicates a more transient nature).

Niche (2024b) considers that no further excavation is required at Test Area 1 and site S1MC422 or elsewhere in the Subject Area prior to disturbance on the basis of the results of the test excavations (i.e. no further sub-surface potential).

Recommendation 3.6

- *Clarification is needed on why the project area has been divided into two survey units rather than adopting a landform approach. The AR states that this decision is based on previous research on land use, however further information on how site localities relate to slope and landform is needed to demonstrate the characterisation of the archaeological nature of the project area.*

Response

Consistent with Requirement 5a of the Code of Practice, a targeted sampling strategy was developed for the Project ACHA which considered landforms and their archaeological potential based on the current predictive model of land use for the Moolarben area and understanding of Aboriginal land use within the Moolarben landscape (Niche, 2024b). A review of previous survey coverage against topographic data, GIS calculations of tracklogs from Niche ArcGIS Enterprise data and aerial imagery as well as an assessment of past land use practices were additionally utilised to inform the sampling strategy.

The sampling strategy for both survey programs was developed to target certain landforms in unsurveyed land within the Subject Area in consideration of the predictive model, including:

- Raised ridgelines with potential impacts from the Project (i.e. including all ridges, cliffs, steep slopes [i.e. rockshelter and grinding groove potential]).
- Creek lines with exposed rock (i.e. grinding groove potential).
- Land within 200 m of watercourses.
- Lower slopes, depressions and flats.

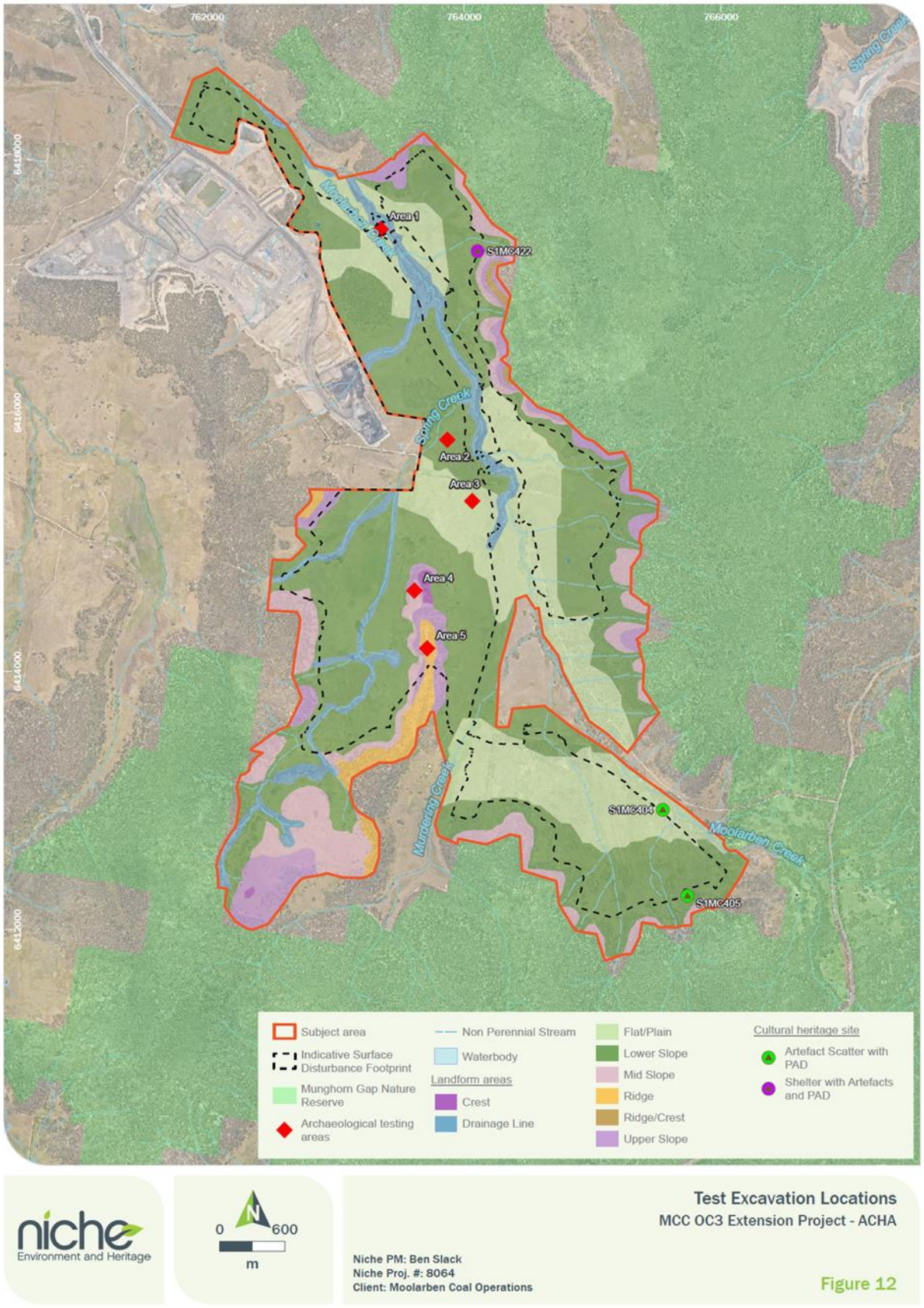


Figure 4-17: Location of Test Excavations (Source: Niche, 2024b)

Landform elements (based on morphology and following Speight [2009]) have been defined by Niche (2024b) for the Subject Area (Table 4-6 and Figure 4-17). These landform elements have been allocated into two broad survey units based on grouping of associated landforms, inferred resource zone type (after Kuskie, 2009) and archaeological potential. Lower elevation and relatively flat landform types associated with the secondary resource zone were grouped as Survey Unit 1. Higher elevation and generally steeper landform types outside of primary and secondary resource zones were grouped as Survey Unit 2.

Since lodgement of the ACHA as presented in the EIS, Niche (2024b) have revised the ACHA and Archaeological Report to provide the breakdown of landform areas within the survey units developed for the survey program. Further detail is provided in the response to Recommendation 3.1.

Table 4-6
Definition of Survey Units and Landform Areas within the Subject Area

Survey unit	Associated Resource Zone (after Kuskie, 2009)	Landform element (based on morphology)	Definition (after Speight, 2009)
1 (83% of Subject Area)	Secondary resource zone	Depression	Depressions form the lowest parts of the terrain. That stands below all, or almost all, points in the adjacent terrain. Many depressions are concave upwards.
		Drainage line	The channel of a creek/watercourse.
		Flat	A planar landform element that is neither a crest nor a depression and is level or very gently inclined (<3% tangent approximately).
		Lower slope	A waning slope, below a mid-slope and adjacent above a flat or depression.
2 (17% of Subject Area)	Outside primary and secondary resource zones	Mid-slope	A slope element that is not adjacent below a crest or flat and not adjacent above a flat or depression. Hence it is mid-way between the lowest point in the landscape and highest point in the landscape.
		Upper slope	A slope element adjacent below a crest or flat but not adjacent above a flat or depression.
		Ridge/Crest	A compound landform element that stands above all, or almost all, points in the adjacent terrain comprising a narrow crest and short adjoining slopes, the crest length being greater than the width of the landform element.

After: Niche (2024b)

Recommendation 3.7

- *As standard practice, Heritage NSW requires the identification of potential archaeological deposits and the subsurface testing of those deposits to establish their archaeological significance.*
  - *The ACHAR proposes that test excavations and, potentially, salvage excavations would be conducted post approval at five localities following the procedures in the existing MCC Heritage Management Plan (HMP).*
  - *As test excavations have not been undertaken as part of the EIS, the impacts to ACH values remain unknown.*
  - *Testing upfront informs the impact assessment, requirement for future salvage excavation and provides an opportunity to redesign the project to avoid any significant objects or sites.*
  - *Without the completion of test excavations and significance yet to be established, all parties, including the RAPs, have not had the opportunity to consider the full extent of impacts from the project.*
  - *Post approval excavation presents a risk that impact will be approved to a site while the significance is unknown. We note that there is limited potential to influence longwall design once approval is granted.*
  - *We recommend that test excavations occur before project approval*.

Response

Background

As an outcome of the ACHA for the EIS (Niche, 2022), test excavations were recommended for five Aboriginal cultural heritage sites with PAD within the Subject Area post-approval, but prior to any surface disturbance.

Heritage NSW's submission on the EIS requested that test excavation works at these sites be undertaken prior to determination of the Project to inform the significance and impact assessment. The submission also recommended further consideration of sub-surface potential of the Subject Area within relevant landforms types.

Since lodgement of the EIS, the indicative surface disturbance extent has been reduced and two of the five PAD sites recommended for test excavations in the ACHA are now avoided. The three Aboriginal cultural heritage sites with PAD within the amended Project indicative surface disturbance extent are as follows:

- S1MC422 – Shelter with Artefacts and PAD.
- S1MC404 – Artefact Scatter with PAD.
- S1MC405 – Artefact Scatter with PAD.

A Geomorphological Assessment (Gippel, 2023) was undertaken to assess the landform types in the Subject Area and their sub-surface potential. Gippel (2023) concluded that there is a low likelihood of finding sub-surface late Pleistocene deposits in the Project area.

The test excavation sampling strategy and locations of the testing areas were determined in consideration of the extent of landform types, surface geology, soil mapping and/or PAD associated with previously identified sites, as well as outcomes of the Geomorphological Assessment.

Targeted test excavation works were undertaken by Niche (2024b) in the Subject Area in September and October 2023, in consultation with RAPs and Heritage NSW, to investigate the sub surface potential of different landform types.

The location of the landform areas and the Aboriginal cultural heritage sites with PAD subject to test excavation are shown in Figure 4-17. Further detail regarding the Geomorphological Assessment and outcomes of the test excavations are provided below.

Further detail regarding the test excavations is provided in Section 4 of the ACHA and Section 8.2, Section 9.2 and Section 10.4 of the Archaeological Report (Niche, 2024b).

Geomorphological Assessment

A Geomorphological Assessment was undertaken by Dr Chris Gippel (2023) to assess the landform types in the Subject Area and the potential for late-Pleistocene sub-surface deposits.

Overall, Gippel (2023) concluded that:

> *…the likelihood of finding preserved sub-surface late-Pleistocene deposits in the Project area is low. This report found no basis for recommending locations for further investigation on the grounds that they have greater potential for sub-surface late-Pleistocene deposits.*

Other key conclusions from the assessment are as follows:

- There are no areas that could be regarded as having significant potential for sub-surface late- Pleistocene deposits.
- Most of the A-horizon sedimentary material on the slopes is less than 3,000 years old.
- No alluvial terraces were identified within the study area.
- Given the lack of alluvial terraces, the interface of transferral soils and alluvial soils has the most potential for presence of sub-surface late-Pleistocene deposits.

The outcomes of this assessment informed the location of sampling within landforms across the Subject Area.

Test Excavations

The test excavation program was undertaken over 19 days between 19-22 and 26-29 September 2023 and 10-13, 17-20 and 24-27 October 2023 and targeted three Aboriginal cultural heritage sites with PAD and five landform areas (Figure 4-17).

In total, 25 m^2 was excavated across 100 test pits and recovered 119 artefacts (i.e. average artefact density of 3.8 artefacts/m^2). The results of the test excavations determined that there is low sub-surface potential in the Subject Area, and no further test excavation is required for the sites investigated during the program (Niche, 2024b). A summary of the test excavation results is provided in Table 4-7.

Table 4-7
Summary of Test Excavation Results

Site Name	AHIMS Number	Sample (m^2)	Landform	Detailed soil landscape	Soil Landscape	Artefact Number	Artefacts/m^2
S1MC404	36-3-3299	5.25	Flat	Soil Map Unit 1: Tenosol/Kandosol	Ulan	15	2.9
S1MC405	36-6-3302	2.75	Lower slope	Soil Map Unit 1/ Rocky outcrop	Lees Pinch	15	5.5
S1MC422	36-3-3280	4.25	Lower slope	Soil Map Unit 1/ Rocky outcrop	Lees Pinch	54	12.7
Test Area 1 (S1MC552)	36-3-3964	3.75	Flat /plain	Soil Map Unit 2: Chromosol/Sodosol complex	Ulan	33	8.8
Test Area 2 (S1MC553)	36-3-3963	2.5	Lower slope	Soil Map Unit 2: Chromosol/Sodosol complex	Ulan	2	0.8
Test Area 3	-	2.5	Flat / plain	Soil Map Unit 1: Tenosol/Kandosol complex	Ulan	0	0
Test Area 4	-	2.0	Crest, Upper & Mid slopes	Soil Map Unit 2/4: Tenosol/Kandosol complex and Rudosol/Rocky outcrop	Ulan	0	0
Test Area 5	-	2.0	Ridge	Soil Map Unit 4 and Rocky outcrop: Rudosol/and Rocky outcrop	Ulan	0	0

After: Niche (2024b)

The three Aboriginal cultural heritage sites with PAD subject to test excavation revealed assemblages with low and moderate densities (Niche, 2024b).

Site S1MC422 (Shelter with Artefacts and PAD) revealed the highest density of artefacts (n=54) amongst the sites with PAD. S1MC422 is located on a mid-lower slope and comprises a shelter with surface artefacts and grinding grooves that were identified in proximity to this site during the excavation program. The extent of site S1MC422 has been expanded to encompass associated site features identified during the test excavation works, including a small grinding groove and surface artefacts.

S1MC404 and S1MC405 comprised lower density assemblages and are located approximately 50 m and 400 m from Moolarben Creek, respectively. The sites varied in soil type, with S1MC404 ceasing excavation at 90 cm and S1MC405 ceasing excavation at 20 cm. S1MC404 is located on a mound within the flat/plain landform while S1MC405 is located across an access track on a lower slope.

In consideration of results of test excavations of the known Aboriginal heritage sites, Niche (2024b) determined that no further excavation is required at S1MC422, S1MC404 and S1MC405 prior to disturbance as there is no further sub-surface potential.

Of the five landform types subject to test excavation, three (Test Area 3, Test Area 4, and Test Area 5) were determined to show no artefact bearing deposits and two (2) (Test Area 1 [S1MC552] and Test Area 2 [S1MC553]) revealed low density sub surface assemblages. Test Area 1 revealed the highest density of artefacts (n=33) amongst the landform samples.

All landform areas tested were within 1 km of known water sources (Moolarben Creek or Murdering Creek). Of the five landform areas, three (Test Area 3, Test Area 4 and Test Area 5), contained shallow soils with clay identified within 20 cm of the surface. No sub-surface artefacts were identified at these tested landform areas; however, these areas were within proximity to known Aboriginal cultural heritage sites associated with surface finds. Across all sites, the predominant raw material was quartz, which is common in the area and locally available.

Three known sites of low to moderate archaeological potential were assessed as accurate following test excavation of the sites. Landforms which were previously thought to have archaeological potential, are now known to have nil archaeological potential (Test Area 3 to Test Area 5). Drainage line contexts (Test Area 1 and Test Area 2) were also found to be of lower archaeological potential than previously thought. The test excavation of S1MC422 where a grinding groove was identified concluded that there was no further potential and therefore no further risk of impact from the Project. Table 4-8 showcases the archaeological potential prior to and following test excavation.

Table 4-8
Sub-surface Potential of Test Excavated Sites

Site Name	Archaeological Potential Prior to Test Excavation	Revised Archaeological Potential Following Test Excavation
S1MC404	Moderate	Moderate
S1MC405	Low-Moderate	Low-Moderate
S1MC422	Moderate	Moderate
Test Area 1	High	Low-Moderate
Test Area 2	High	Low
Test Area 3	Moderate to High	Nil
Test Area 4	Low-Moderate	Nil
Test Area 5	Low	Nil

A total of four new Aboriginal heritage sites were identified and recorded during the excavation program:

- S1MC550 (Artefact Scatter) adjacent to S1MC422.
- S1MC551 (Isolated Find) adjacent to Test Area 4.
- S1MC552 (Artefact Scatter) from Test Area 1.
- S1MC553 (Artefact Scatter) from Test Area 2.

All four sites have been assessed by Niche (2024b) as being of low scientific significance and would be directly impacted by the amended Project. Recommended management measures are included in the updated ACHA and Archaeological Report (Niche, 2024b).

Analysis

The results of the test excavation program confirm the predictive model, particularly that there is low sub-surface potential in the Subject Area (Niche, 2024b). Furthermore, areas originally identified as having higher sub-surface potential, such as along Moolarben Creek (Test Area 1), have been shown to contain a lower density of artefacts than previously envisioned. Although excavations identified a deep A horizon, the test pits were often excavated to a depth of up to one metre with no identified artefacts, particularly along the transects closest to Moolarben Creek. This can be interpreted as landscape subject to constant movement of soils through flooding events and not a landscape conducive to long term habitation (i.e. indicates a more transient nature) (Niche, 2024b).

Outside of the creek lines, heavy erosional factors have largely reduced A horizons to less than 20 cm and some areas often less than 5 cm. These erosional landscapes have been shown to contain very low to nil sub-surface potential, particularly crest, upper and mid slopes (Niche, 2024b).

No further excavation is required at the sites and landform areas prior to disturbance in consideration of the results of the test excavations (i.e. no further sub-surface potential). Niche (2024b) have not recommended any further test excavations within the Subject Area prior to disturbance.

Recommendation 3.8

- *The MCC HMP has no provisions for the avoidance and conservation of ACH sites within approved mining operations. Therefore, if significant sites are identified post-approval there is no requirement for their protection and conservation. This presents a risk to the protection of Aboriginal cultural heritage in the context of this SSD application.*

Response

The extensive archaeological survey, sub-surface test excavation program, and the assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within (Niche, 2024b).

The broader Ulan and Moolarben region has been the subject of intensive archaeological and cultural heritage assessment over the last 20 years, driven by development of the Ulan Mine Complex, Moolarben Coal Complex and Wilpinjong Coal Mine. The archaeological record is therefore well understood, and the archaeological expectations of the Subject Area can be readily and confidently characterised based on the extensive previous findings and well-developed predictive model.

As a result of the Project design and proposed avoidance and mitigation measures, highly sensitive landforms such as ridges, which are known to contain rockshelters with good depth of deposit, remain outside of the Project indicative surface disturbance extent, and will not be impacted by the works (Niche, 2024b). In addition, as an outcome of the targeted test excavation program, landforms which were previously thought to be highly sensitive and low to moderate scientific significance, are now known to have nil archaeological potential (Test Area 3 to Test Area 5). Sensitive archaeological contexts of drainage lines (Test Area 1 and Test Area 2) were found to be of lower archaeological sensitivity than previously thought (Niche, 2024b).

The existing Moolarben Coal Complex Heritage Management Plan details a protocol for the management of previously unrecorded Aboriginal archaeological sites. The nature, extent and scientific significance of the any previously unrecorded Aboriginal heritage sites would be determined by an archaeologist in consultation with RAPs prior to the implementation of any proposed management actions.

Recommendation 3.9

- *There has been limited consideration of PADs outside of artefact sites both along the creek and in lower slopes. For example, while the site description for S1MC525 notes that artefacts are present on an eroded and deflated surface, the site pictures indicate that there may be deposit upslope of the artefact scatter. Considerations of areas of PAD within relevant landforms should be included in the ACHAR.*

Response

In response to comments from Heritage NSW, a test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to determine the presence, extent and significance of sub-surface Aboriginal objects within the Subject Area. These investigations targeted Aboriginal heritage sites with PAD proposed to be disturbed as well as landform areas to fully assess the impact of the Project on any potential archaeological resources that may be present.

Landforms which were previously thought to have archaeological potential, are now known to have nil archaeological potential (Test Area 3 to Test Area 5). Drainage line contexts (Test Area 1 and Test Area 2) were also found to be of lower archaeological potential than previously thought (Niche, 2024b). Further detail regarding the test excavation program methodology and outcomes is provided in the response to Recommendation 3.7.

Niche (2024b) considers that no further excavation is required at these sites or elsewhere in the Subject Area prior to disturbance on the basis of the results of the test excavations (i.e., no further sub-surface potential). The extensive nature of the archaeological survey combined with sub-surface test excavation, assessment and the consultation process with RAPs substantially reduces the risk of a lack of scientific certainty for the Project.

S1MC525 is an artefact scatter located on an upper slope landform with extensive erosion and scalding. As a result of amendments to the Project indicative surface disturbance extent, S1MC525 is no longer proposed to be directly impacted.

A test excavation within an area representative of the upper slope landform was undertaken as part of the test excavation program (Test Area 4). No artefacts were identified during the test excavation within the landform, indicating nil sub-surface artefact potential (Niche, 2024b).

Issue

There are limitations in the significance assessment presented in the ACHAR

There is a risk that the scientific significance statements presented in the ACHAR have been underestimated. We recommend that this section of the ACHAR is revised and clarified.

Recommendation 4.1

- *The ACHAR has downgraded the significance of at least four sites from high to moderate significance (S1MC103, 401, 403, 404). Limited corroborating evidence has been provided for this change in significance assessment outside of additional disturbance and lack of art. Heritage NSW requires further justification on the adjustment to the significance assessment.*

Response

The significance assessment in the ACHA as presented in the EIS (Niche, 2022b) was undertaken in accordance with the criteria provided in the *Guide to investigating, assessing and reporting on Aboriginal cultural heritage in NSW* (OEH, 2011), and considered results of surveys and assessments undertaken for the Moolarben Coal Complex and surrounding operations, the archaeological context of the region and current site condition (as per surveys undertaken to support the ACHA).

In consideration of additional information available since the sites were originally recorded (Hamm, 2006; Niche, 2018), Niche have revised the scientific significance of the following sites in the Project ACHA (Table 4-9).

Table 4-9
Summary of Relevant Sites with Updated Significance Assessment

Site Name	AHIMS ID#	Type	Scientific Significance	Proposed Level of Impact for Amended Project
S1MC103	36-3-0912	Artefact Scatter.	Moderate	Partial – Direct
S1MC401	36-3-2999	Artefact Scatter.	Moderate	None
S1MC403	36-3-3001	Rock shelter with artefacts & PAD.	Moderate	Indirect Impact (30 m from disturbance)
S1MC404	36-3-3299	Artefact Scatter.	Moderate	Partial – Direct

After: Niche (2022b; 2024b)

Further information to support the updated significance assessment of these sites is provided below and in Section 5.2 of the updated ACHA (Niche, 2024b).

S1MC103 (Artefact Scatter)

S1MC103 is comprised of a relatively high number of surface artefacts (approximately 184), however they are dispersed across a large, disturbed area (approximately 750 m x 100 m) with an average artefact density of approximately 1 artefact per 400 m². S1MC103 is partially within the indicative surface disturbance extent for the Project.

Niche (2024b) does not consider it likely that S1MC103 is single knapping or tool producing site, as the high number of artefacts are more likely the result of consistent erosional factors from vegetation clearing, grazing, farming, and flooding of Moolarben Creek.

In consideration of the additional information available since the site was originally recorded in 2006, including further assessments in the region and a contemporary site inspection to evaluate site condition, Niche (2022b; 2024b) has assessed the scientific significance of site S1MC103 as 'moderate'. This is consistent with significance assessments for similar sites in the Moolarben area and the broader region.

S1MC401 (Artefact Scatter)

S1MC401 is a low-density artefact scatter comprising 12 artefacts (tuff and rhyolite) over a 60 m x 20 m area. The site characteristics indicate only transient use of this area. Niche (2024b) concluded the site type and characteristics of S1MC401 are extremely common in the Moolarben area as well as the broader region. S1MC401 would not be impacted by the amended Project.

In consideration of the additional information available since the site was originally recorded in 2013, including further assessments in the region and a contemporary site inspection to evaluate site condition, Niche (2024b) has assessed the scientific significance of site S1MC402 as 'moderate'. This is consistent with significance assessments for similar sites in the Moolarben area and the broader region.

S1MC403 (Rock Shelter with Artefacts & PAD)

S1MC403 consists of a rock shelter with two stone artefacts and PAD. The site is in poor condition with notable disturbances from erosion and animal burrowing. S1MC403 is located 30 m outside of the amended Project indicative surface disturbance extent and may be subject to potential indirect impacts.

Aside from the two identified artefacts within the site boundaries there is no more evidence of occupation at the site. Sandstone overhangs with or without artefacts and/or PAD are not uncommon at Moolarben or within the broader region. At the time of recording in 2013 similar site types were less common; however, subsequent surveys of lower and mid-slopes have revealed a much higher frequency of these sites (Niche, 2024b).

In consideration of the additional information available since the site was originally recorded in 2013, including further assessments in the region and a contemporary site inspection to evaluate site condition, Niche (2024b) has assessed the scientific significance of site S1MC403 as 'moderate'. This is consistent with significance assessments for similar sites in the Moolarben area and the broader region.

S1MC404 (Artefact Scatter)

S1MC404 consists of a low-density artefact scatter (approximately 39 artefacts) distributed over a 140 m x 120 m area. S1MC404 is partially within the indicative surface disturbance extent for the Project.

S1MC404 was also subject to targeted test excavation to investigate for PAD as part of the program undertaken since lodgement of the EIS. The results of the test excavation confirmed a low density artefact scatter and nil/low sub surface potential for the site (15 artefacts over 21 test pits). Based on the results of the test excavations, whilst the site is not considered to contain PAD, the site comprises of an artefact scatter (Niche, 2024b).

In consideration of the additional information available since the site was originally recorded in 2013, including further assessments in the region and a contemporary site inspection to evaluate site condition, Niche (2024b) has assessed the scientific significance of site S1MC404 as 'moderate'. This is consistent with significance assessments for similar sites in the Moolarben area and the broader region.

<u>Recommendation 4.2</u>

- *Further, we query the assessment of several other sites based on site type (i.e. grinding grooves), identified features (i.e. blade manufacture locality) and lack of testing of PADs as being of low and moderate significance. At a local, and potentially regional, scale these sites may hold greater significance. For example, site S1MC437 is one of only two grinding groove and artefact sites within MCC, however this uncommon site type has been assigned moderate significance.*

<u>Response</u>

The extensive archaeological survey, sub-surface test excavation program, and assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within.

Further information regarding the sub-surface archaeological potential of the Subject Area and significance assessment of S1MC437 are provided below.

Sub-surface Archaeological Potential

As described in Response 3.7, a test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to investigate the sub-surface archaeological potential of the Subject Area.

The test excavation program was informed by a Geomorphological Assessment (Gippel, 2023) to assess landform types in the Subject Area and their sub-surface potential. Gippel (2023) concluded that there is a low likelihood of finding sub-surface late-Pleistocene deposits in the Project area.

The results of the test excavation program confirm the predictive model as well as the conclusions of the Geomorphological Assessment (Gippel, 2023), particularly that is low sub-surface potential in the Subject Area. Areas originally identified as likely having higher sub-surface potential (e.g. along Moolarben Creek) have been shown to contain a lower density of artefacts than predicted.

S1MC437 (Grinding Groove)

S1MC437 comprises a single grinding groove and an isolated find on a sandstone outcrop. S1MC437 is one of six previously recorded grinding groove sites associated with the Moolarben Coal Complex.

Comparative site feature types are conserved elsewhere regionally, including an important cluster of open sites and grinding grooves (S2MC148-S2MC154) and approximately 206 stone artefacts and 30 grinding grooves associated with S2MC151 within the Powers Property Conservation Area (south-east of OC4), and a grinding groove with artefact site (S2MC261a) preserved within the Murragamba Creek Conservation Area. Therefore, the Powers Property Conservation Area and Murragamba Creek Conservation Area provide for conservation of a representative sample of grinding groove site types in the Moolarben area.

When S1MC437 was recorded by Niche in 2018, it was the only known grinding groove within the Subject Area. Since then, a further grinding groove has been identified during the test excavation program within a similar environmental context (considered to be an extension of site S1MC422 [Shelter with Artefacts, Grinding Groove and PAD]).

In consideration of the additional information available since the original significance assessment was undertaken in 2018, including further assessments in the region, contemporary site inspections to evaluate site condition and the decreasing rarity of grinding grooves, Niche (2024b) has assessed the scientific significance of site S1MC437 as ‘moderate’. This is consistent with significance assessments for similar sites in the Moolarben area and the broader region.

Issue

Consideration of Ecologically Sustainable Development (ESD) and cumulative impact

The ACHAR argues that ESD has been addressed because the sites most likely to be impacted are of low scientific significance. However, as explained above, we have concerns about the accuracy of some of the significance assessments and we have concerns about limitations in the consideration of ESD and cumulative impact that include:

Recommendation 5.1

- *The ACHAR argues that cumulative impact will be managed through conservation of representative samples in other areas of the coalfields and in comparison, the sites located within the project area have limited representative value. Little consideration was given to the additional loss of at least 79 known ACH sites resulting from the project. During consultation the RAPs raised this issue with the applicant.*

Response

The Project would occur within existing approved mining and exploration tenements areas and adjacent to already approved surface disturbance extents associated with the Moolarben Coal Complex.

The Project as presented in the EIS would result in direct impacts to 79 known Aboriginal heritage sites within 10 m of the Project EIS indicative surface disturbance extent. Of these sites, 82% (n=65) have been assessed as low scientific significance, 9% (n=7) have been assessed as low-moderate scientific significance and 9% (n=7) assessed as moderate scientific significance.

Since lodgement of the EIS, MCO has reduced the indicative surface disturbance extent for the Project to incorporate additional avoidance and minimisation measures to address comments received from BCS and NPWS. As a result, the amended Project would result in direct impacts to 55 known Aboriginal heritage sites, comprising:

- five sites (9%) assessed as being of moderate scientific significance;
- four sites (7%) assessed as being of low-moderate scientific significance; and
- 46 sites (84%) assessed as being of low scientific significance.

The Aboriginal heritage sites within the amended Project indicative surface disturbance extent represent a well-documented and researched segment of Aboriginal archaeological resources in the area, including Artefact sites (with or without PAD) and Shelter sites (with or without Artefacts and/or PAD) (Niche, 2024b).

Niche (2024b) considers the Aboriginal heritage sites within the amended Project indicative surface disturbance extent have limited conservation value, particularly as representative sites are preserved within conservation areas for the Moolarben Coal Complex, Ulan Coal Mine and Wilpinjong Coal and within salvaged assemblages in Keeping Places.

In addition, similar representative Aboriginal heritage sites (known and unknown) are protected from any future impact as they are within mine-owned offset and conservation areas, and larger conservation areas in the surrounding region, such as the Goulburn River National Park and the Munghorn Gap Nature Reserve.

Niche (2024b) considers the Project is not expected to cause a loss of heritage resources that could be viewed as being very rare or unique or unlikely to exist elsewhere and, therefore, the Project would not result in any significant cumulative impact on Aboriginal heritage in the region.

Further detail is provided in Section 6.4 of the ACHA and Section 13.3 of the AR.

Recommendation 5.2

- *If enough archaeological survey has not been conducted, there is a risk that the cumulative impact assessment may need to be revised. Without further survey of the project area and potentially subsurface test excavation, the presence and scientific values of the predicted sites are unknown and cannot be fully considered.*

Response

The extensive archaeological survey, sub-surface test excavation program, and assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within (Niche, 2024b).

In response to comments from Heritage NSW, additional survey work has been undertaken by Niche (2024b) since lodgement of the EIS to provide additional coverage in lower slopes and flat/plain landforms, areas of remnant vegetation and along Moolarben Creek (Response 3.7).

As a result of the additional survey work, approximately a further 115 ha (9%) of previously unsurveyed areas within the Subject Area were subject to systematic survey. Therefore, a total of approximately 554 ha (45%) of the Subject Area has now been subject to systematic survey.

A test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to investigate the sub-surface archaeological potential of the Subject Area (Response 3.7).

The test excavation program was informed by a Geomorphological Assessment (Gippel, 2023) to assess landform types in the Subject Area and their sub-surface potential. Gippel (2023) concluded that there is a low likelihood of finding sub-surface late-Pleistocene deposits in the Project area.

The results of the test excavation program confirm the predictive model as well as the conclusions of the Geomorphological Assessment (Gippel, 2023), particularly that there is low sub-surface potential in the Subject Area. No change to the assessment of cumulative impacts is required.

Recommendation 5.3

- *There is limited consideration for the avoidance and conservation of significant ACH sites. The ACHAR outlines that 40 sites will be avoided by the project, however, many of these are situated in conservation zones or at the boundary of the mining lease area. No sites within the surface Disturbance Footprint have been designated for conservation, even if sites have been identified as rare and of high significance (i.e. site S1MC437).*

Response

The Subject Area for the ACHA was developed as the potential maximum indicative surface disturbance extent for the Project during early stages of the assessment process. As the assessment process progressed, the indicative surface disturbance extent was refined to reflect outcomes of environmental studies, stakeholder comments and further conceptual design work.

As a result, the Project as presented in the EIS avoided direct impacts to a total of 40 known Aboriginal heritage sites within the Subject Area.

Since lodgement of the EIS, MCO has reduced the indicative surface disturbance extent for the Project to incorporate additional avoidance and minimisation measures to address comments received from BCS and NPWS. Key avoidance and minimisation measures for the amended Project include:

- avoidance of any mining-related disturbance within 100 m of the Munghorn Gap Nature Reserve;
- no open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek; and
- minimising the extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek as far as practicable.

Compared to the EIS, the amended Project indicative surface disturbance extent results in avoidance of direct disturbance of an additional 29 Aboriginal cultural heritage sites, including one site assessed as being of high scientific significance, one site assessed as being of moderate scientific significance, 3 sites assessed as being of low-moderate scientific significance and 24 sites assessed as being of low scientific significance (Figure 4-14).

As per the response to Recommendation 4.2, Niche (2024b) have assessed the scientific significance of site S1MC437 as ‘moderate’. Conservation is not possible without significant resource sterilisation.

In addition, during ongoing consultation with the RAPs on the ACHA, including participation in survey and test excavation works, no specific comments were provided relating to the significance assessment of S1MC437 or the proposed management measures.

Recommendation 5.4

- *It is unclear if sites within the Moolarben Creek exclusion zone will be impacted by ancillary or supporting infrastructure. Further details are required on those sites that may be impacted and the long-term conservation options for sites within this area. We support avoiding harm to Aboriginal cultural heritage and recommend appropriate mechanisms for long-term conservation and protection are included in the EIS.*

Response

The Project would avoid open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek.

The extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek has been minimised as far as practicable, however some infrastructure components (e.g. haul roads, haul road creek crossings, water management infrastructure, flood bunds) are required. This infrastructure is incorporated in the indicative surface disturbance extent for the Project and would not extend further than this boundary.

On this basis, for the purposes of impact assessment Niche (2024b) considers all Aboriginal cultural heritage sites wholly or partially within 10 m of the indicative surface disturbance extent would be directly impacted by the Project (Figure 4-14).

All Aboriginal cultural heritage sites outside the indicative surface disturbance extent but within the riparian zone of Moolarben Creek and Murdering Creek would not be impacted by the Project as they are avoided and would remain in situ. Notwithstanding, these sites would be described in an updated or new Heritage Management Plan for the Project, in consultation with the Registered Aboriginal Parties.

Issue

We recommend additional mitigation and management measures be included

We recommend additional management and mitigation measures are considered in the ACHAR. These should include:

Recommendation 6.1

- *Regular physical monitoring (e.g., annual, biannual) of site S1MC538.*

Response

Site S1MC538 (AHIMS ID# 36-3-3845), a Shelter with Possible Burial, was identified during the survey program undertaken for the EIS and assessed by Niche as being of high scientific significance. During the surveys, RAPs requested that the site not be disturbed and/or investigated further.

The site would not be subject to direct impacts, however is located within 230 m of the Project EIS indicative surface disturbance extent and would be subject to potential indirect impacts from blasting. On this basis, the ACHA prepared for the EIS recommended that blast vibration monitoring be undertaken at a location adjacent to the site to ensure blast vibration limits are not exceeded (Niche, 2022b).

As a result of the amended Project, site S1MC538 is now located 250 m outside the amended Project indicative surface disturbance extent (i.e. greater than 230 m). Therefore, no impacts are predicted for site S1MC538 for the amended Project and no ongoing monitoring is proposed, consistent with the request of RAPs for there to be no further investigation.

Recommendation 6.2

- *Consideration secondary impacts (e.g., road grading, road widening, public road upgrades, compaction, erosion, haul roads, water management infrastructure) and long-term conservation options to areas of PAD and artefact sites within and adjacent to the project area.*

Response

All ancillary infrastructure (e.g. haul roads, haul road creek crossings, water management infrastructure, flood bunds) required for the Project is incorporated in the indicative surface disturbance extent for the Project and would not extend further than this boundary.

For the purposes of impact assessment Niche (2024b) considers that all Aboriginal cultural heritage sites wholly or partially within 10 m of the indicative surface disturbance extent would be directly impacted by the Project (Figure 4-14).

The potential for indirect impacts to rockshelter sites from Project blasting activities has been considered in the ACHA. Implementation of existing blasting management measures (including monitoring) for shelter sites would result in no impact to these sites (Niche, 2024b).

All other Aboriginal cultural heritage sites outside the indicative surface disturbance extent would not be directly impacted by the Project. Aboriginal heritage sites outside of the indicative surface disturbance extent would be managed in accordance with existing measures detailed in the Moolarben Coal Complex Heritage Management Plan, including implementation of a Ground Disturbance Permit process.

A test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to determine the presence, extent and significance of sub-surface Aboriginal objects within the Subject Area. These investigations targeted Aboriginal heritage sites with PAD and landform areas to fully assess the impact of the Project on any potential archaeological resources that may be present.

The test excavation program was informed by a Geomorphological Assessment (Gippel, 2023) to assess landform types in the Subject Area and their sub-surface potential. Gippel (2023) concluded that there is a low likelihood of finding sub-surface late-Pleistocene deposits in the Project area.

The results of the test excavation program confirm the predictive model as well as the conclusions of the Geomorphological Assessment (Gippel, 2023), particularly that there is low sub-surface potential in the Subject Area. Further detail is provided in the response to Recommendation 3.7.

Recommendation 6.3

- *Secondary impacts from open cut mining and blasting (e.g., dust) should be considered for all rockshelter sites adjoining the project area. Within the coalfields area several rockshelter and art sites have potentially been impacted through such secondary impacts.*

Response

All Aboriginal cultural heritage sites outside the indicative surface disturbance extent, including rock shelter sites, would not be directly impacted by the Project.

Aboriginal heritage sites located within proximity to the indicative surface disturbance extent boundary have the potential to be indirectly impacted by the Project. Indirect impacts to Aboriginal heritage are defined here as impacts resulting from potential blast-related vibration associated with open cut mining activities.

For the purpose of impact assessment, and consistent with the existing Moolarben Coal Complex Blast Management Plan, all rockshelter sites located within 230 m of the indicative surface disturbance extent have the potential to be indirectly impacted by the Project. It is noted blasting would not occur in all areas of the indicative surface disturbance extent, however it has been conservatively assumed blasting could potentially occur across the full extent of proposed disturbance.

In accordance with the existing Moolarben Coal Complex Blast Management Plan, MCO has committed to adjusting blast designs such that ground vibration from blasting at shelter sites would not exceed the conservative 250 mm/s vibration damage criterion recommended by qualified blast experts (SLR, 2018).

MCO would therefore adjust blast designs for any blasts proposed within 230 m of all shelter sites in order to achieve this criterion and prevent damage from blasting. Thus, while blasting is identified as a potential indirect impact to some Aboriginal heritage sites located within proximity to the indicative surface disturbance extent, existing blasting management measures for shelter sites would result in no impact.

In response to comments on the EIS regarding protection of geological features in the Munghorn Gap Nature Reserve, blast vibration would be limited to 50 mm/s at sensitive geological features (including mapped rocky habitat) near the Project, unless further geotechnical investigation supports a higher value. Applying the blast vibration threshold at sensitive geological features would also limit the potential for vibration damage of shelter sites.

Site-specific vibration limits may be considered for shelter sites (determined by a suitably qualified expert). Blast vibration monitoring of shelter sites would be undertaken on a progressive basis to ensure that the relevant blast vibration limits are not exceeded.

Recommendation 6.4

- *Provisions should include regular (e.g., annual, bi-annual) monitoring of all sites along Moolarben Creek and if secondary impacts are present (e.g., erosion) then PADs should be subject to test excavations so that areas of conservation value and moderate to high significance are adequately avoided and protected.*

Response

All Aboriginal cultural heritage sites outside the indicative surface disturbance extent would not be directly impacted by the Project. Aboriginal heritage sites outside of the indicative surface disturbance extent would be managed in accordance with existing measures detailed in the Moolarben Coal Complex Heritage Management Plan, including implementation of a Ground Disturbance Permit process.

In response to comments from Heritage NSW, a test excavation program has been undertaken by Niche (2024b) since lodgement of the EIS to determine the presence, extent and significance of sub-surface Aboriginal objects within the Subject Area. These investigations targeted Aboriginal heritage sites with PAD proposed to be disturbed as well as landform areas to fully assess the impact of the Project on any potential archaeological resources that may be present. Further detail regarding the test excavation program methodology and outcomes is provided in the response to Recommendation 3.7.

Of the five landform areas subject to test excavation, one (i.e. Test Area 1) was located on flat level plain in close proximity to Moolarben Creek (Figure 4-17). Of the three Aboriginal heritage sites with PAD subject to test excavation, one (S1MC422) was located within 50 m of Moolarben Creek (Figure 4-17).

Areas originally identified as having higher sub-surface potential, such as areas along Moolarben Creek (i.e. Test Area 1), have been shown to contain a lower density of artefacts than previously envisioned.

Niche (2024b) considers that no further excavation is required at these sites or elsewhere in the Subject Area prior to disturbance on the basis of the results of the test excavations (i.e., no further sub-surface potential).

4.1.3 DPE – Science, Economics and Insights Net Zero Emissions Modelling Team

A submission was received from NZEM which requested further clarification on the GHG calculations and assessment conducted for the Project EIS. Detailed responses to these comments are provided below.

It is noted that since lodgement of the EIS, MCO has amended the Project to incorporate additional avoidance measures relative to the EIS in response to submissions received. This has resulted in a reduction in total resource extracted (i.e. from approximately 40 Mt to 30 Mt over the life of the Project) and a revised mine schedule which in turn affects the GHG calculations for the Project.

The annual average Scope 1 emissions intensity for the amended Project is 0.016 tonnes of carbon dioxide equivalent per tonne ROM (t CO_2-e/t ROM), which is well below the Safeguard Mechanism industry average of 0.0653 t CO_2-e/t ROM for coal mining facilities. This reaffirms the Moolarben Coal Complex, including the Project, would remain one of the lowest emission intensive coal mining operations in Australia (on a Scope 1 basis).

Revised GHG emissions calculations for the amended project are provided in Table 4-10 and Table 4-11 below and presented in the Air Quality and Greenhouse Gas Amendment Report (Todoroski Air Sciences [TAS], 2023).

The responses to comments from NZEM include additional detail on the GHG calculations for the Project as presented in the EIS, as well as updated calculations for the amended Project.

Table 4-10
Summary of GHG Emissions Estimates for the Amended Project

Component	Estimated GHG Emissions (Mt CO2-e)		
	Scope 1	Scope 2	Scope 3
Annual Average	**0.047**	**0.005**	**6.406**
Maximum Annual Value	**0.110**	**0.019**	**18.291**
Total	**0.485**	**0.053**	**64.063**

After: TAS (2023)

Mt CO_2-e = Million tonnes of carbon dioxide equivalent.

* *The annual values are for the operational phase only (i.e. between 2025-2034), however the total values include the decommissioning phase.*

Table 4-11
Summary of GHG Emissions for the Amended Project (kt CO_2-e)

Year	Fugitive[1]	Diesel[2]		Oil[3]		Grease[3]		Explosives (ANFO)[3]	Explosives (Emulsion)[3]	Processing ROM at CHPP[4]		Land (vegetation) clearance[5]	Decommiss-ioning phase[5]		Product coal transport (rail)[5]	Product coal transport (ship)[5]	End use of product coal[5]
	Scope																
	1	1	3	1	3	1	3	1	1	2	3	1	1	3	3	3	3
2025	2.6	33.1	1.7	0.08	0.02	0.003	0.003	0.5	0.5	9.5	0.8	9.6	-	-	22.6	213.6	6,036.1
2026	4.5	54.2	2.8	0.13	0.03	0.006	0.006	0.9	0.9	13.0	1.0	9.6	-	-	38.7	366.1	10,342.4
2027	7.6	89.7	4.6	0.22	0.06	0.010	0.010	1.4	1.5	19.3	1.1	9.6	-	-	65.9	622.8	17,596.0
2028	1.4	19.2	1.0	0.04	0.01	0.002	0.002	0.3	0.3	2.5	0.1	9.6	-	-	11.9	112.7	3,185.1
2029	1.7	23.1	1.2	0.05	0.01	0.002	0.002	0.3	0.3	2.6	0.3	9.6	-	-	15.0	141.3	3,993.1
2030	1.6	21.7	1.1	0.05	0.01	0.002	0.002	0.3	0.3	1.4	0.1	9.6	-	-	13.8	130.8	3,695.9
2031	1.9	25.4	1.3	0.06	0.01	0.003	0.003	0.4	0.4	1.6	0.1	9.6	-	-	16.7	158.2	4,469.8
2032	2.0	25.7	1.3	0.06	0.01	0.003	0.003	0.4	0.4	1.6	0.0	9.6	-	-	16.9	160.1	4,523.8
2033	2.0	25.9	1.3	0.06	0.01	0.003	0.003	0.4	0.4	1.8	0.1	9.6	-	-	17.1	161.1	4,552.7
2034	1.4	19.4	1.0	0.04	0.01	0.002	0.002	0.3	0.3	0.2	0.0	9.6	-	-	12.1	114.5	3,233.9
2035*	-	-	-	-	-	-	-	-	-	-	-	-	3.4	0.2	-	-	-
2036*	-	-	-	-	-	-	-	-	-	-	-	-	3.4	0.2	-	-	-
2037*	-	-	-	-	-	-	-	-	-	-	-	-	3.4	0.2	-	-	-
2038*	-	-	-	-	-	-	-	-	-	-	-	-	3.4	0.2	-	-	-

After: *TAS (2023)*

Note: *NGA Factors used in the EIS GHG Assessment (TAS, 2022) were adopted for other calculations unless stated below.*

* *Decommissioning phase*

[1] *The site-specific Scope 1 fugitive emissions factor of 0.0009 t CO2-e/t ROM has been adopted for the amended Project.*

[2] *The Scope 1 emissions from diesel consumption incorporates an additional 1,314 kL/year associated with use of a generator within the mine infrastructure area. A revised diesel usage factor has been adopted for the amended Project consistent with the most recent (FY22 and FY23) NGER data for the Moolarben Coal Complex (3,743 kL/Mtpa) (TAS, 2023). This is a function of increased haulage distance as mining moves further from the CHPP.*

[3] *A revised material usage factor has been adopted for the oil, grease, ammonium nitrate-fuel oil (ANFO) and emulsion emission calculations for the amended Project consistent with the most recent (FY22 and FY23) NGER data for the Moolarben Coal Complex.*

[4] *Scope 2 and 3 electricity emission calculations for the amended Project adopted Cth DCCEEW (2022a) factors. A comparison with NGA Factors (2021) is provided below. Note some values appear as zero due to rounding.*

[5] *No change to intensity compared to EIS. Emissions decreased due to the reduced ROM coal extraction for the amended Project.*

Issue

Activity Data

Recommendation

Table 2-1 in Attachment 1 of the GHG assessment gives the annual fuels, oils, greases, explosives and electricity requirements for the Project as a function of ROM coal production. Table 2-2 gives the quantities for each year covering 2025 to 2036 based on the anticipated volume of ROM coal. The years 2035-38 are considered the years for decommissioning, where diesel is consumed by plant and equipment for rehabilitation of the site.

A check was performed on the data in Table 2-2 covering years 2025-2036 using the factors in Table 2-1. Apart from diesel, the quantities were in reasonable agreement with those reported (apart from errors presumably due to round-off).

For diesel consumption, the consumption figures calculated by NZEM using 3,388 kL/Mtpa were between 4% and 24% lower than reported in Table 2-2. The Proponent should provide more details around the diesel consumption calculations given that it is the largest source of emissions for the Project.

The overall approach is reasonable but more information on e.g., the equipment and specific activities that consume the diesel would have been helpful. This would enable a more in-depth review of the abatement measures to be made.

Response

Consistent with the existing Moolarben Coal Complex, diesel consuming activities for the Project would include operation of mining fleet (e.g. dozers, water trucks, excavators, front-end loaders and haul trucks) and associated equipment (e.g. pumps, mobile crushers and work lighting).

The material usage factor adopted for the Project GHG calculations (i.e. kilolitre (kL) consumed per ROM tonne coal produced) had been estimated through a review of the previous four years (FY18 to FY21) of National Greenhouse and Energy Reporting (NGER) documents and corresponding ROM coal production at the existing Moolarben Coal Complex (TAS, 2022).

Since lodgement of the Project EIS, the material usage factor has been updated to incorporate an additional two years (FY22 and FY23) of NGER data on diesel usage, resulting in an increase from 3,388 to 3,743 kilolitre per million tonnes per annum (kL/Mtpa) (TAS, 2023). This is a function of increased haulage distance as mining moves further from the Coal Handling and Preparation Plant (CHPP), which is also a better representation of haul distances for the Project.

Diesel consumption for the Project was then calculated by applying the usage factor to the ROM coal production profile. The calculation of diesel consumption also included an addition of 1,314 kL per year to account for potential usage of a generator in the mine infrastructure area (as detailed in the Project Description [Section 3 of the EIS]).

Table 4-12 below provides a breakdown of the diesel consumption calculations for the Project as presented in the EIS (TAS, 2022) as well as updated for the amended Project ROM coal production schedule and updated material usage factor (TAS, 2023), including diesel consumption for a generator to power the Project mine infrastructure area and diesel consumed post-mining for rehabilitation activities.

MCO would continue to implement existing measures to minimise GHG emissions through the efficient use of diesel, including:

- optimising mine plans and schedules to minimise haul distances and re-handle;
- maximising equipment utilisation/productivity and mining yields;
- maintaining or improving equipment to maximise fuel efficiency and consideration of fuel efficiency when:
    - procuring new or replacement equipment; and
    - undertaking monthly monitoring of fuel consumption.

Table 4-12
Project Diesel Consumption Breakdown (EIS and Amended Project)

Year	EIS ROM Coal Production (Mt)	Diesel Consumption (kL)				Amended Project ROM Coal Production (Mt)	Diesel Consumption (kL)			
		Mining Activities	Generator Operation	Post-mining Rehabilitation Activities	Total		Mining Activities	Generator Operation	Post-mining Rehabilitation Activities	Total
2025	1.6	5,517	1,314	0	6,831	2.9	10,908	1,314	0	12,222
2026	1.2	4,012	1,314	0	5,326	5.0	18,691	1,314	0	20,005
2027	3.1	10,504	1,314	0	11,818	8.5	31,799	1,314	0	33,113
2028	9.0	30,496	1,314	0	31,810	1.5	5,756	1,314	0	7,070
2029	4.6	15,644	1,314	0	16,958	1.9	7,216	1,314	0	8,530
2030	4.1	13,818	1,314	0	15,132	1.8	6,679	1,314	0	7,993
2031	4.9	16,480	1,314	0	17,794	2.2	8,078	1,314	0	9,392
2032	5.5	18,773	1,314	0	20,087	2.2	8,175	1,314	0	9,489
2033	3.9	13,218	1,314	0	14,532	2.2	8,228	1,314	0	9,542
2034	1.6	5,543	1,314	0	6,857	1.6	5,844	1,314	0	7,158
2035	0.0	0	0	1,471	1,471	0.0	0	0	1,245	1,245
2036	0.0	0	0	1,471	1,471	0.0	0	0	1,245	1,245
2037	0.0	0	0	1,471	1,471	0.0	0	0	1,245	1,245
2038	0.0	0	0	1,471	1,471	0.0	0	0	1,245	1,245

After: TAS (2022, 2023)

Recommendation

Approximately 82 ha of land-clearing is required for the Project – the types of vegetation to be cleared was not specified.

Response

Annual land clearing for the Project was estimated to be a total of approximately 82 ha in the EIS, of which approximately 18.5 ha comprised of woodland/scattered tree areas and approximately 63.5 ha comprised of grassland/previously cleared areas. A description of land clearing and breakdown by vegetation type is provided below.

Issue

GHG Emissions Factors and Calculations

Recommendation

Section 1.3 of the GHG assessment indicates that the key gases assessed were methane (CH_4), nitrous oxide (N_2O) and carbon dioxide (CO_2). The global warming potentials (GWPs) were consistent with those in the National Greenhouse Accounts Factors (NGAF) 2021. The methane GWP is 28 and the nitrous oxide GWP is 265, consistent with the International Panel on Climate Change (IPCC) Fifth Assessment Report (AR5).

Section 2.2 in Attachment 1 indicates the source of the emission factors. The scope 1 and 3 fuels, oils and greases emission factors in Table 2-3 were checked against NGAF 2021 and all were identical.

The explosives emission factors were identical to those in the 2004 AGO Factors and Methods workbook.

The scope 2 and 3 electricity emission factors were also identical to those in NGAF 2021. As discussed in the Peer review report, electricity consumption emissions were forecast using the current NSW grid emissions factor of 0.79 kg CO2-e/kWh.

The Proponent should revise the forecast scope 2 and 3 electricity emissions from 2025 to 2036 using forecasts based on e.g. projections published by the Department of Climate Change, Energy, Environment and Water (DCCEEW). Table 38 in ref. 4 gives the projected scope 2 electricity grid emission factor in 2035 as 0.02 kg CO_2-e/kWh. The scope 2 and 3 factor in 2030 (ref. 4, Table 39) is 0.02 kg CO_2-e/kWh.

Response

The following emissions factors were used in the Project EIS to calculate Scope 2 and 3 emissions due to electricity, consistent with the National Greenhouse Accounts Factors (NGA Factors) (Department of Industry, Science, Energy and Resources, 2021):

- Scope 2 – 0.79 kilograms carbon dioxide equivalent per kilowatt hour (kg CO_2-e/kWh).
- Scope 3 – 0.07 kg CO_2-e/kWh.

NZEM has instead recommended use of *Australia's emissions projections 2022* prepared by the Cth DCCEEW as it provides forecasted annual electricity emissions factors in consideration of proposed GHG reduction targets (Table 4-13). These factors reduce each year as a result of declining emissions intensity of electricity generation in accordance with a baseline scenario (Cth DCCEEW, 2022b).

Table 4-13
Cth DCCEEW Scope 2 and 3 Electricity Emission Factors

Year	2025	2026	2027	2028	2029	2030	2031	2032	2033	2034	2035
Emission Factor (kg CO_2-e/kWh)	0.53	0.42	0.36	0.25	0.22	0.13	0.12	0.11	0.13	0.02	0.02

After: Cth DCCEEW (2022b)

Table 4-14 provides electricity emissions for the Project as presented in the EIS, as well as results of updated calculations using the Cth DCCEEW electricity emissions factors. Application of the Cth DCCEEW factors results in a reduction in GHG emissions from electricity use of 0.16 Mt CO_2-e (76%) for Scope 2 and 3 over the life of the Project (i.e. between 2025 and 2034). The significant reduction is a result of the declining emissions intensities compared to the NGA Factors applied in the EIS.

The Cth DCCEEW electricity emission factors have also been applied for the amended Project (Table 4-14) (TAS, 2023). Scope 2 and 3 emissions from electricity usage increase slightly compared to the Project EIS ROM schedule (by 0.08 Mt CO_2-e [i.e. 16%]). This is a result of the amended Project mining ROM at a higher rate in earlier years, when there is less decline in the Cth DCCEEW emissions factors.

Table 4-14
Project Scope 2 and 3 Emissions from Electricity Usage (EIS and Amended Project)

Year	NGA Emissions Factors[1] (Mt CO2-e)		Cth DCCEEW Emissions Factors[2] (Mt CO2-e)	
	EIS	Amended Project	EIS	Amended Project
2025	0.0086	0.0166	0.0053	0.0103
2026	0.0063	0.0285	0.0031	0.0140
2027	0.0164	0.0485	0.0069	0.0204
2028	0.0476	0.0088	0.0138	0.0026
2029	0.0244	0.0110	0.0062	0.0028
2030	0.0216	0.0102	0.0033	0.0016
2031	0.0257	0.0123	0.0036	0.0017
2032	0.0293	0.0125	0.0037	0.0016
2033	0.0206	0.0126	0.0031	0.0019
2034	0.0087	0.0089	0.0002	0.0002
2035	0.0000	0.0000	0.0000	0.0000
Total	**0.2092**	**0.1699**	**0.0492**	**0.0572**

After: TAS (2022, 2023)

1. DISER (2021)

2 Cth DCCEEW (2022)

Recommendation

The scope 3 emission factors for rail and ship transport of the product coal are as per the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. The GHG assessment states that the approximate rail distance is 560 km return and the shipping distance is 16,000 km return.

The scope 3 emission factor for combustion of product coal (assumed bituminous) was also identical to the factors in NGAF 2021.

The scope 1 emission factors for land clearing are consistent with those in the Greenhouse Gas Assessment Workbook for Road Projects.

The scope 1 emission factor for fugitive emissions is a site-specific factor. The maximum fugitive emissions factor was 0.0009 t CO_2-e/t ROM based on gas sampling, coal quality and geological logging. The factor for the Moolarben Coal Complex, based on Method 2 under the NGER Act,7 was 0.0012 t CO_2-e/t ROM. The latter value was adopted in the EIS providing more conservative figures for the fugitive emissions. However, the Proponent should use the pit specific emission factor to provide more a more accurate assessment of fugitive emissions for the Project.

The Proponent should provide indicative values for the gas content of the seam and the methane and carbon dioxide content of the gas. This would provide more transparency in relation to the quoted fugitive emissions factor.

Response

Fugitive emissions for the Project in the EIS were estimated using emissions data reported for the Moolarben Coal Complex open cut operations in accordance with Method 2 under section 3.21 of the NGER Measurement Determination. Method 2 estimates fugitive emissions from the open cut extraction of coal using site-specific gas modelling on site drilling and in-situ gas sampling and testing.

Since lodgement of the Project EIS, NGER reporting for the Moolarben Coal Complex (FY22 and FY23) has applied the site-specific Scope 1 fugitive emissions factor of 0.0009 t CO_2-e/t ROM coal. Calculation of Scope 1 fugitive GHG emissions for the Project as presented in the EIS using the updated fugitive factor results in a reduction of 0.011 Mt CO_2-e (i.e. from 0.047 to 0.036 Mt CO_2-e).

Application of the site-specific fugitive emissions factor to the amended Project ROM coal mining schedule results in a further reduction in predicted Scope 1 fugitive GHG emissions of 0.009 Mt CO_2-e (i.e. from 0.036 Mt CO_2-e to 0.027 Mt CO_2-e).

It is noted that the Moolarben Coal Complex and surrounding Wilpinjong Coal Mine and Ulan Mine Complex all have relatively low Scope 1 emissions intensities compared to other coal mining operations in NSW. This is largely due to the low gas content of the target seam/s in the Western Coalfield.

Further details on gas content for the target seam are provided below.

Issue

GHG Emissions for the Project and Verification of Calculations

Recommendation

As discussed above, the emissions due to diesel consumption could not be verified due to discrepancies in the activity data. The Proponent should provide a more detailed calculation of diesel consumption (e.g. by specific equipment types) to allow verification and identification of the key diesel consuming activities to better inform abatement measures.

Response

As described above, calculation of diesel consumption for the Project included addition of 1,314 kL per year to account for potential usage of a generator in the mine infrastructure area. A breakdown of diesel usage calculations is provided in Table 4-12.

Recommendation

The land clearing emissions could not be verified – two emission factors are provided for clearance of forests and grassland but only a single figure for land clearing (82 hectares). The Proponent should specify the areas of each type of vegetation that are to be cleared annually.

Response

Annual land clearing for the Project was assumed to be a total of approximately 82 ha in the EIS, of which approximately 18.5 ha comprised of woodland/scattered tree areas and approximately 63.5 ha comprised of grassland/previously cleared areas (Table 4-15). Application of the two relevant emissions factors determines that total annual GHG emissions for the Project as presented in the EIS due to land clearing are 12,639 t CO_2-e/year (Table 4-15) (TAS, 2022).

Due to the proposed amendments to the Project, the total surface disturbance area has been reduced, which results in a reduction in estimated annual land clearing from approximately 82 ha to 67.5 ha, comprised of approximately 11.2 ha of woodland/scattered tree areas and approximately 56.3 ha of grassland/previously cleared areas (Table 4-15). Total annual GHG emission for the amended Project due to land clearing have therefore reduced to 9,637 t CO_2-e/year (TAS, 2023).

Table 4-15
Project Land Clearing Emissions (EIS and Amended Project)

Vegetation Type	Project as Presented in the EIS		Amended Project	
	Area (ha/year)	Land Clearing Emissions (t CO2-e/year)	Area (ha/year)	Land Clearing Emissions (t CO2-e/year)
Woodland/ Scattered Trees	**18.5**	**5,692**	**11.2**	**3,445**
Grasslands/ Previously Cleared Areas	**63.5**	**6,947**	**56.3**	**6,192**
Total	**82.0**	**12,639**	**67.5**	**9,637**

After: TAS (2022, 2023)

Recommendation

A verification of the scope 3 emissions using the various emission factors shows a discrepancy of about 10-15% in the reported emissions. This may be due to round-off in the reported emission factors and/or ROM coal volumes.

Response

The discrepancy identified by NZEM is likely due to application of ROM coal rates to calculate Scope 3 emissions associated with transport and end use of product coal, rather than product coal rates. ROM coal contains a small portion of non-coal material (including shales, clays, interbedded rock strata and other non-coal minerals), which require processing to remove.

ROM coal from the Project would be hauled to the Stage 1 CHPP (along with ROM coal from the rest of the Moolarben Coal Complex) for processing. A small amount of non-coal material is lost during processing as coal rejects, which results in a smaller volume of product coal.

For the Project as presented in the EIS, while 39.5 Mt of ROM coal would be mined through the life of the Project, following processing at the CHPP this would result in approximately 34 Mt of product coal requiring transport offsite and end use to generate electricity. For the amended Project, the 30 Mt ROM coal mined would result in approximately 25 Mt of product coal following processing at the CHPP.

Application of ROM coal volumes to calculate product coal Scope 3 emissions results in an increase in approximately 15% of total Scope 3 emissions. On this basis, no updates to Scope 3 emissions calculations are required as they have applied product coal rates for the Project.

Recommendation

The figures in Table 2-5 in Attachment 1 have been verified. That is, the annual average scope 1 and 2 emissions of 0.06 and 0.02 Mt CO_2-e and the total scope 1 and 2 emissions of 0.60 and 0.19 Mt CO_2-e. However, the scope 2 emissions need to be reviewed in light of the declining NSW electricity grid GHG emissions intensity.

Response

The GHG calculations of emissions associated with electricity use for the Project (which applied the NGA Factors) are considered to be a conservative forecast of Scope 2 and 3 electricity emissions for the Project.

Notwithstanding, the Cth DCCEEW electricity emissions factors have been applied for the Project as presented in the EIS as well as for the amended Project and are presented in Table 4-14.

Recommendation

The Proponent claims that the estimated annual average and maximum annual Scope 1 greenhouse gas emissions of the Project combined with the emissions for the existing Moolarben Coal Complex would remain below the current Safeguard Mechanism baseline of 0.36 Mt CO_2-e. This is likely to be the case in NZEM's view.

The Proponent acknowledges that they would be required to purchase ACCUs, or fund other appropriate offsets, for any exceedance of the Safeguard Mechanism baseline emissions value.

Response

Noted. MCO remains of the view that, even following the recent reforms to the Safeguard Mechanism, Scope 1 emissions from Moolarben Coal Complex should continue to remain below the declining baseline.

Issue

GHG Abatement Measures

Recommendation

Section 4.2.2 of the main assessment report and Section 3 of Attachment 1 address GHG management. Fugitive emissions for the Project are "small due to the shallow open cut mining depth and low gas content of the target seam (particularly low methane content)."

The statement above may be true in the early years of the Project. But in the years beyond 2030, what depth will the open cut pit reach? Will the pit in these years remain shallow? As the pit expands towards the east and away from the basin margins could deeper seams with higher gas contents (and higher methane content) be accessed?

Were the gas properties of over- and underlying coal seams, and their subsequent contribution to fugitive emissions, considered particularly as mining deepens?

Is it possible that as the pit deepens the methane could be drained and used beneficially?

Response

There is no possibility of beneficial drainage of methane during Project operations.

Target Coal Seam

As per the existing Moolarben Coal Complex, the Project targets the Ulan Seam of the Illawarra Coal Measures. Other shallower coal seams may also be recovered, if present. The Ulan Seam has inherently low gas content. It is relatively shallow and is not confined by thick overlying sediments. It has historically had available pathways for in-situ gas and associated fugitive emissions to release naturally over time.

Coal Seam Depth

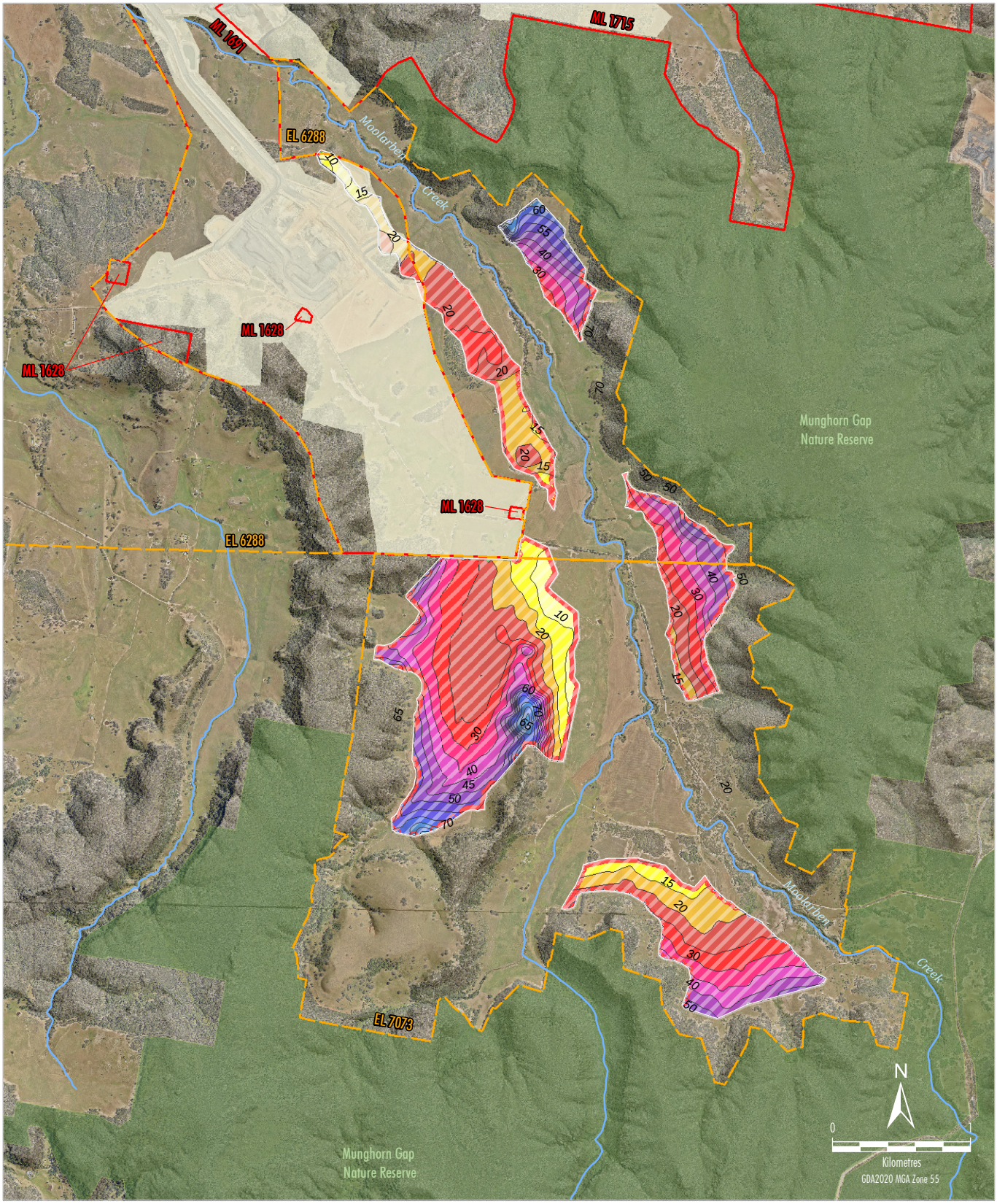
Figure 4-18 of the Project EIS shows the depth to the base of the coal seam within the open cut mining extent (average depth of 34 m). The thickness of overburden over the Project area typically ranges from less than 5 m thick (along eroded sections of Moolarben Creek and where the Ulan seam subcrops) up to approximately 120 m along the valley edges at the boundary of the Munghorn Gap Nature Reserve (i.e. depth is due to changes in topography rather than seam dip).

Coal Seam Gas Properties

Analysis of gas properties considered both overlying and underlying gas bearing strata in addition to the target seam that would be extracted or exposed during mining. These results show that the gas content is relatively low and the gas composition is largely CO_2.

Unlike the deeper multi-seam operations in the Hunter Valley, where there can be material changes in gas properties over time as mining deepens, the gas properties for the Ulan seam are relatively uniform.

Due to the low gas and minimal methane content of the target seam, measures to minimise fugitive emissions, including pre-drainage, have not been pursued.



MCM-20-18 OC3 Ext AR SR_216A

LEGEND

- National Park/Nature Reserve
- Exploration Licence Boundary
- Mining Lease Boundary
- Moolarben Coal Complex Disturbance Footprint
- Proposed OC3 Extension
- Indicative Amended Open Cut Pit Extent

Depth to Base of Ulan Coal Seam (metres)

100 m
75 m
50 m
25 m
0 m

Source: MCO (2023); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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Depth to Base of Ulan Coal Seam

Figure 4-18

Recommendation

The most significant source of emissions for the Project is from diesel consumption. The reported mitigation measures include minimising haul distances, maximising equipment utilisation, regular equipment maintenance, and monitoring fuel consumption. The use of biodiesel is being considered.

As discussed in the Peer review report,[3] the option for electrification of the mine fleet within the project lifetime is not likely feasible due to the lack of battery electric mobile equipment currently available at the required scale. However, there may be significant advancements in this technology over the next 5-10 years.

Therefore, the Proponent should commit to regular reviews of best practice technologies in relation to low emissions alternatives to diesel-powered equipment.

As discussed above, more details are needed on the diesel consuming activities to allow better identification of mitigation opportunities.

As discussed in the GHG assessment, the option for purchasing renewable electricity should be reviewed if the existing contractual arrangements allow.

Response

MCO would continue to implement measures to minimise GHG emissions through the efficient use of diesel, including optimising mine plans and schedules, minimising haul distances, maximising equipment utilisation/productivity, regular equipment maintenance to maximise fuel efficiency, selection of new fleet and monitoring of fuel consumption as far as practicable and where reasonable and feasible.

MCO would investigate the potential to replace standard diesel fuel with biodiesel as B10 or B20, subject to ensuring that engine warranties, efficiencies or maintenance requirements are not compromised.

The NZEM submission also provides that:

> *NZEM agrees with the peer reviewer that the option for electrification of the mine fleet within the project lifetime is not likely feasible due to the lack of battery electric mobile equipment currently available at the required scale.*

MCO would continue to investigate other low-emissions alternatives to diesel-power equipment over the life of the Project, noting the peer review (GHD, 2022) and NZEM comments regarding feasibility due to the short Project timeframe (i.e. mining ceases in 2034). Further detail on diesel consumption and calculation of associated emissions is provided above.

MCO would continue to investigate whether it is reasonable and feasible to reduce Scope 2 GHG emissions associated with on-site electricity use at the approved Moolarben Coal Complex (e.g. evaluation of sourcing a proportion of site electricity from renewable sources). A number of constraints apply to potential reduction of Scope 2 emissions, including the terms of commercial agreements with electricity providers.

4.1.4 DPE – Water

Recommendation

DPE – Water stated in its submission:

> *All the SEARs relevant to groundwater impact have been satisfactorily addressed in the Groundwater Assessment report. The impact of the project on groundwater and its receptors was estimated using Modflow-USG groundwater model that was independently peer reviewed as fit for the purpose. Nevertheless, DPE Water assessed the groundwater model as acceptable with 66% rating. DPE Water agrees with the selection of proposed monitoring sites and the proposal to update the approved WMP for MCC once baseline information of the proposed monitoring sites are analysed.*

Response

MCO notes DPE – Water's comments that:

- SEARs relevant to groundwater impacts have been satisfactorily addressed;
- DPE – Water has assessed as the groundwater model as acceptable; and
- DPE – Water agrees with the selection of proposed monitoring sites for the Project, which would be described in an updated or new Water Management Plan for the Project.

Recommendation

DPE – Water requested that, prior to determination:

> *That the proponent:*
>
> - *confirm total water requirements from each water source for the project. This should include groundwater inflows, indirect surface water take, harvestable rights and any water take to meet site water demands, and*
> - *demonstrate sufficient entitlements available to account for all water take for each water source and note which take is sourced from a third party.*

Response

Table 4-16 presents the peak licensable take for both the approved Moolarben Coal Complex, and the amended Project. This includes licensing requirements associated with groundwater inflows and indirect surface water take from the relevant water sources. MCO does not rely on harvestable rights to meet its licencing requirements.

As seen by Table 4-16, there is limited change in peak licensable take due to the amended Project.

MCO has, and will continue to, hold sufficient licences for its annual water take, as is required under the NSW *Water Management Act 2000*.

MCO plans for its future licensable take via:

- Review of groundwater modelling predictions.
- Updates to the groundwater model, when required, with associated licence re-forecasting.
- Annual reporting, via Annual Reviews, for calendar year predicted water take for the periods 1 January to 30 June, and 1 July to 31 December. The annual reporting on a calendar year basis enables a 6-month period to plan for expected water take for the next 'water year', which is based on financial years.

If Water Access Licences (WALs) held by MCO (including when considering carry-over entitlements) are not predicted to be sufficient to account for licensable take, in the first instance, MCO would seek to trade licence entitlements with other Yancoal operations, where relevant.

Yancoal operates a number of mines in the Sydney Basin-North Coast Groundwater Source, which provides opportunities to trade licences between Yancoal-owned assets to meet the specific licensing requirements for each site, which fluctuate from year-to-year. The trading of WAL entitlements is a recognised and legally approved mechanism under the NSW *Water Management Act 2000* to maximise the efficient use of the state's water resources.

Temporary trades or other WAL purchases would also be considered if required.

Table 4-16 demonstrates available licences in each relevant water source are well in excess of peak licensing requirements.

Table 4-16
WAL Entitlements Currently Held by MCO

Groundwater Source	WALs	Total Share Component	Maximum Predicted Take – Approved Operations (ML/y)[1]	Maximum Predicted Take – Inclusive of Amended Project (ML/y)[1]	Total Licences Available in Source[2]
Sydney Basin – North Coast Groundwater Source	39799	2,950	3,910	3,937	68,283.5
Upper Goulburn River Water Source	37582, 19052, 41888	208	250	299	1,882
Wollar Creek Water Source	36340, 37583	218	282	282	860

[1] *Typically occurs for one water year only.*

[2] *As per NSW Water Register.*

Recommendation

DPE – Water recommended that, post-approval:

> *The proponent must ensure sufficient water entitlement is held in a water access licence/s to account for the maximum predicted take for each water source prior to take occurring.*

Response

Please refer to the response above, which outlines the process MCO undertakes to hold sufficient licences for its annual water take, as is required under the NSW *Water Management Act 2000*, as well as demonstrating sufficient licences are available to account for peak licencing requirements.

Recommendation

In addition, DPE – Water stated:

> *The report does not clearly, or consistently, detail the expected volumes of take from natural water sources, nor does it identify the Water Access Licences (WALs) held to account for that take, as follows:*
>
> - *The total groundwater inflows are not clearly identified throughout the document and are not represented in the water balance schematic.*
> - *Predicted groundwater inflows are inconsistently reported, as follows:*
> - *Appendix A – Figure 7.1 shows 181ML/yr – 2029*
> - *Appendix A – Figure 7.10 shows inflows 200ML/yr – 2029*
> - *Appendix B – Figure 7.1 which shows net groundwater inflows 0ML/yr for all stages*
> - *There is no clear separation between the volumes of water taken from natural water sources (eg: groundwater and clean water) from that which is recirculated or captured as dirty water.*
> - *It should be noted that total volumes are required to be identified in the Water Balance. All volumes of take should be itemised by water source and, where required, the WAL which would account for that take be identified.*
> - *The proposal to construct an in-river clean water dam on Spring Creek, a third order watercourse, is not consistent with clause 42 of the Water Sharing Plan for the Hunter Unregulated and Alluvial Water Sources 2022.*

Response

Water licensing requirements were addressed in Appendix A of the EIS (Groundwater Assessment), rather than the Surface Water Assessment (Appendix B of the EIS). This is because the three-dimensional groundwater model is the only tool that can be used to calculate direct and indirect take from the relevant water sources for the Project (and the remainder of the approved Moolarben Coal Complex).

Appendix B of the EIS (Surface Water Assessment) includes a site water balance for the Project. 'Net groundwater inflows' (i.e. net of evaporation on the face of the open cut walls) to the open cut in the site water balance are assumed to be 0 megalitres per year (ML/year), consistent with existing site water balances for the approved Moolarben Coal Complex, which are calibrated and updated annually, and presented in Annual Review. This assumption would continue to be verified over the life of the Project via ongoing review and updates to the site water balance. Notwithstanding, 'gross' groundwater inflows (e.g. prior to evaporation) are calculated by the groundwater model and included in licensable take.

It is noted that Chart 7.1 of the Groundwater Assessment (Appendix A of the EIS) presents predicted groundwater inflows for the Project, and Chart 7.10 presents a range of groundwater inflows as a result of sensitivity analysis, including the base case as well and six sensitivity scenarios. Chart 7.1 and Chart 7.10 report consistent groundwater inflows for the base case scenario.

The Project includes clean water diversion systems to divert runoff from undisturbed areas around the Project. For the amended Project, the clean water diversion system associated with Spring Creek has been redesigned such that there is no longer an in-river storage on the hydroline (Figure 3-1).

Recommendation

DPE – Water recommended that, post-approval:

> *That the proponent develop a water management plan (WMP) including the construction & placement of new monitoring sites, frequency of monitoring, water quality analyte suites and trigger action response plan. Performance against this plan should be reported annually.*

Response

MCO accepts this recommendation.

Recommendation

DPE – Water recommended that, prior to determination:

> *That the proponent confirm adherence to the Guidelines for Controlled Activities on Waterfront Land and Minimum Construction Requirements for Water Bores in Australia for the construction and decommissioning of the monitoring bores.*

Response

MCO confirms that the construction and decommissioning of monitoring bores will be undertaken in accordance with the *Guidelines for Controlled Activities on Waterfront Land and Minimum Construction Requirements for Water Bores in Australia*.

4.1.5 DPE – Crown Lands

Recommendation

The DPE – Crown Lands submission advised MCO that Crown Land subject to Mining Leases and Exploration Licences require agreements and/or licences under the NSW *Mining Act 1992*.

Response

Any requirements for Crown Lands would be complied with in relation to the approval of any necessary mining tenements for the Project under the NSW *Mining Act 1992*, prior to commencement of mining activities.

4.1.6 Mid-Western Regional Council

Recommendation

As per the Environmental Impact Assessment (EIS), one option for Biodiversity Offset would be Funding a Biodiversity Conservation Action. Council asks MCO to consider future conservation projects within the Mid-Western LGA and how they may co-contribute towards funding these projects. As such, a Koala Conservation Management Plan will be devised and implemented in 2023 following current Koala Mapping within the LGA which will identify suitable areas of land which would benefit from restoration, with the aim of reconnecting fragmented Koala habitat by restoring corridors. Further, future conservation plans within the LGA include retrofitting microbat habitat to existing council structures such as bridges are underway.

Council would also like to promote aquatic ecology further through community engagement/awareness programs such as regular carp musters and offer greater incentives for participants than has been provided in the past. MCO's consideration of local Biodiversity Conservation Actions/Projects and further consultation would be welcome by Council.

Response

A Biodiversity Offset Strategy has been developed for the Project in accordance with the offset rules under the NSW Biodiversity Offsets Scheme. Residual potential impacts on biodiversity would be offset in accordance with the BC Act, including retirement of credits, funding of a biodiversity conservation action and/or payment into the Biodiversity Conservation Fund.

MCO is expecting land based offset options to be available to secure the Project's total offset liability for the Regent Honeyeater and Koala (and potential for other threatened species following targeted surveys), including options to establish land-based offsets using Moolarben-owned land in the region.

MCO will continue to consult with MWRC Council and consider other biodiversity conservation actions/projects in the Mid-Western Local Government Area as the Project Biodiversity Offset Strategy is finalised and implemented.

Since lodgement of the EIS, a planning agreement between MCO and MWRC has been executed for the Project (Section 3.1.1).

4.1.7 Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development

The IESC provided advice to the decision maker in relation to the Project. The below provides MCO's consideration of the IESC's advice to assist DPHI with its assessment of the Project.

Item 1

1. *The surface water modelling is generally sufficient to provide some confidence in the proponent's predicted impacts on surface water resources; however, additional consideration is needed of how the available historic streamflow gauging data could improve confidence in the estimates of the potential impacts on surface water yields and floods (Paragraph 5). Improvements to the surface water impact methodology would increase confidence in model predictions; additionally, further discussion and justification of some results is required (see Paragraphs 3 and 4). The contribution of groundwater to surface water as base flow also requires further consideration (see Paragraph 9).*

Response

Incorporation of the available historic streamflow gauging data in the modelling to assess the potential impacts to surface water resources was considered by WRM, but not included in surface water modelling as it would not result in an improvement in the accuracy of the model predictions as:

- the daily stream flow data from UCML SW01 and UCML SW02 is influenced by licensed releases from Moolarben Creek Dam, and the Moolarben Coal Complex and Ulan Coal Mine, which are not representative of the area of interest for the hydrologic model; and
- the site water balance model validation identified the runoff model provided an appropriate representation of the rainfall runoff.

The local drainage network in the vicinity of the Moolarben Coal Complex is shown in Figure 4-19, as well as the existing regional and local surface water monitoring sites and sampling locations used for the assessment. Review of the recorded stream flow data at local gauges was undertaken for UCML SW01 on Moolarben Creek and UCML SW02 on Goulburn River, maintained by the Ulan Mine Complex (Figure 4-19), and was presented in Section 3.4.2 of the Surface Water and Flood Impact Assessment (WRM, 2022).

UCML SW01 and SW02 are located downstream of Moolarben Creek Dam, which is operated in accordance with the conditions under Works Approval 20WA209953 requiring environmental flows to be released from the dam, as follows:

> *Flow of not less than 7 L/sec pass out of the Moolarben Dam into Moolarben Creek downstream of the dam at all times, provided that when the flow into the stored water is less than 7 L/sec, the flow to be passed out of the dam wall shall be that flowing into the stored water for the time being.*

As such, Moolarben Creek Dam regulates flows downstream in a manner that is not related to rainfall, meaning there is less relevance in using data from stream gauges downstream of Moolarben Creek Dam (i.e. both UCML SW01 and UCML SW02) to calibrate modelled flows upstream of Moolarben Creek Dam.

As a result, use of the daily stream flow data from UCML SW01 and UCML SW02 was considered not to be suitable for the calibration of the hydrologic model. Therefore, the hydrologic model was validated against the Regional Flood Frequency Estimation model and Rational Method estimates.

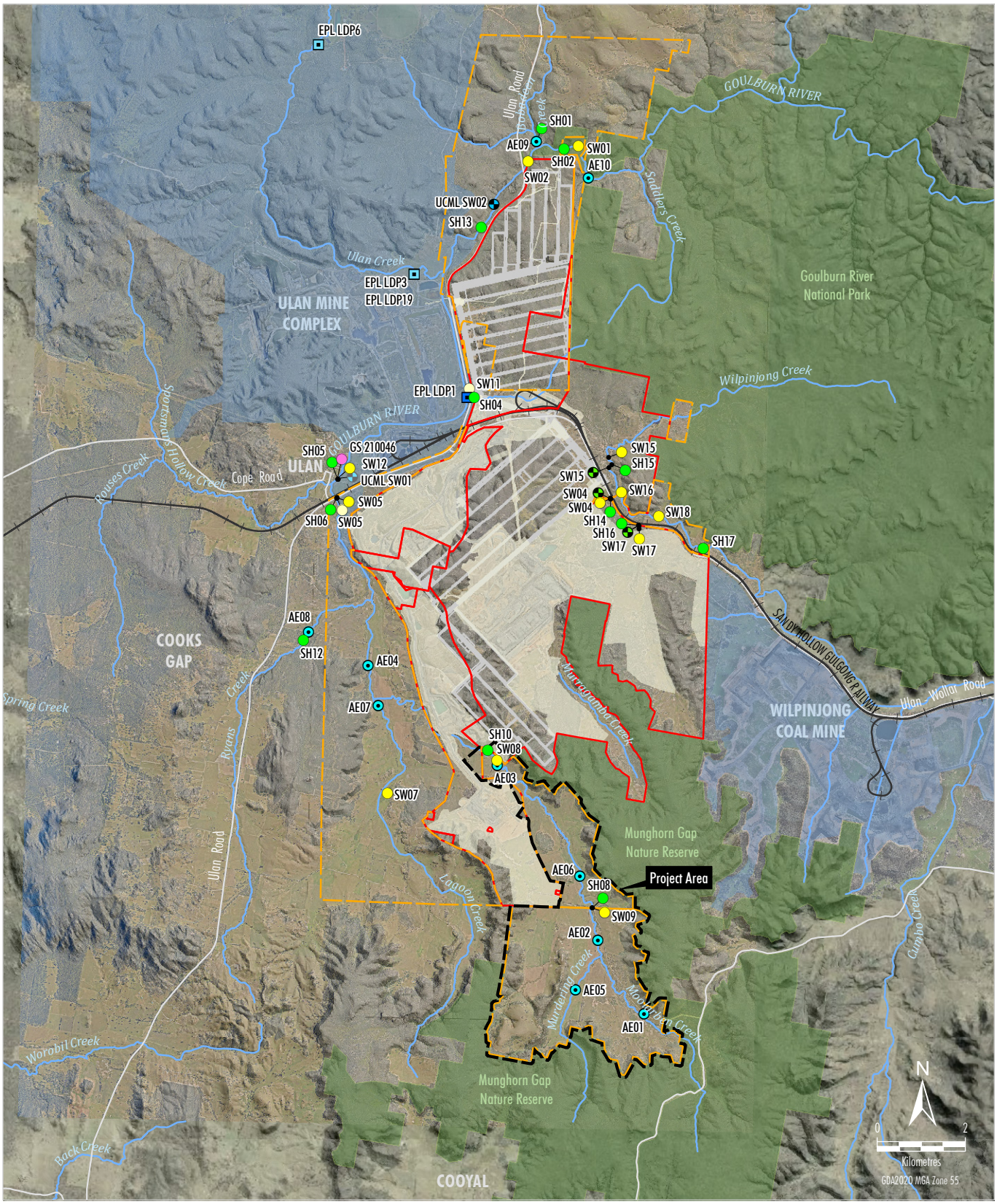
Item 2

2. *Modelling should ideally have included an ecohydrological conceptual model (ECM) to support identification of potential impact pathways from proposed activities to water-dependent assets. Two large-scale hydrogeological cross-sections have been supplied, but these do not adequately capture the complexity of ecohydrological relationships nor potential impacts to water-dependent biota, particularly those using surface water. An ECM should be developed and used to derive an appropriate geo-referenced impact pathway diagram that indicates the probable extent and magnitude of the project's impacts. The conceptual models should be sufficiently detailed to identify impacts to specific resources (e.g., individual groundwater-fed pools), and should be used to guide risk assessment and focus mitigation and monitoring strategies.*

Response

The IESC recommends that an ecohydrological conceptual model would be ideally used to identify potential impacts on water-dependent assets, however it is noted:

- The water-dependent assets relevant to the Project were identified and assessed in the *Integrated Assessment of Potential Impacts on Groundwater Dependent Ecosystems* (MCO, 2022), which incorporated information from the following studies that were prepared in accordance with the relevant guidelines (at the time of preparation):
  - Groundwater Assessment (AGE, 2022), that was peer reviewed by Brian Barnett (Co-author of the *Australian Groundwater Modelling Guidelines* [Barnett *et al*., 2012]);
  - Surface Water and Flood Impact Assessment (WRM, 2022);
  - BDAR (Niche, 2022a); and
  - Aquatic Ecology Assessment (Bio-Analysis, 2022).
- The Groundwater Assessment (AGE, 2022) and Surface Water and Flood Impact Assessment (WRM, 2022) pre-date the recently released consultation draft *Information Guidelines Explanatory Note: Using impact pathway diagrams based on ecohydrological conceptualisation in environmental impact assessment* (IESC, 2023), that introduced ecohydrological conceptual models and impact pathway diagrams to support the assessment of water dependent ecosystems (note, the consultation draft is 'not for official use').
- IESC (2023) outlines development of an ecohydrological conceptual model would generally be undertaken at the start of the assessment process. As the assessment of the water-dependent assets was completed (including the modelling) in the EIS, the predicted impacts to water-dependent assets are well understood, and additional ecohydrological conceptual models and impact pathway diagrams at this stage of the process would not change the outcomes of the assessments.



MCM-20-18 OC3 Ext AR SR_217A

LEGEND

National Park/Nature Reserve
Other Mining Operation
Exploration Licence Boundary
Mining Lease Boundary

Existing/Approved Development

Underground Longwall Layout
Moolarben Coal Complex Disturbance Footprint

Proposed OC3 Extension

Project Study Area

Relevant Licensed Discharge Points

Moolarben Coal Complex
Ulan Mine Complex

Existing Monitoring Sites

Historical Streamflow Gauging Station
Streamflow Gauging Station
Historical UCML Streamflow Gauging Station
UCML Streamflow Gauging Station
Stream Health Monitoring Site
Surface Water Monitoring Site
Government Monitoring Site GS 210046
Aquatic Ecology Assessment Survey Site

Source: MCO (2022); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

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Surface Water Monitoring Program

Figure 4-19

Figure 4-20 provides a conceptual ecohydrological model for water-dependent assets near the Project.

Items 3, 15 and 18

3. *Loss of streamflow due to reduced catchment size (up to 16% of the Moolarben Creek catchment) was described by the proponent as indiscernible and likely to cause only negligible impacts to watercourses (WRM 2022, p. 97). Currently, insufficient data are presented to justify this conclusion, particularly as the spatial arrangement of the excised area may exacerbate impacts to run-off and infiltration. Excision of up to 16% of the catchment area, including the removal of at least 16 km of ephemeral drainage channels (Bio-Analysis 2022, Figure 4, p. 7) and associated infiltration patterns are likely to reduce the extent and quality of aquatic habitats over the life of the project. The IESC notes that Moolarben Creek is already moderately stressed but recommends that project-related impacts from altered flow regimes should be evaluated and include an assessment of the contribution to cumulative impacts from this project.*
15. *The EIS provides minimal assessment of cumulative impacts to surface water resources. The proponent has stated that as potential impacts to surface water flow and quality are negligible, cumulative impacts would likewise be negligible. As discussed in Paragraph 3, impacts of an up to 16% reduction in catchment area for Moolarben Creek are unlikely to be negligible. The proponent should therefore reassess potential cumulative impacts with reference to the recommendations outlined in Paragraphs 3, 4 and 5.*
18. *The documentation provided does not differentiate impacts due to the project, historical mining and currently approved operations.*

Response

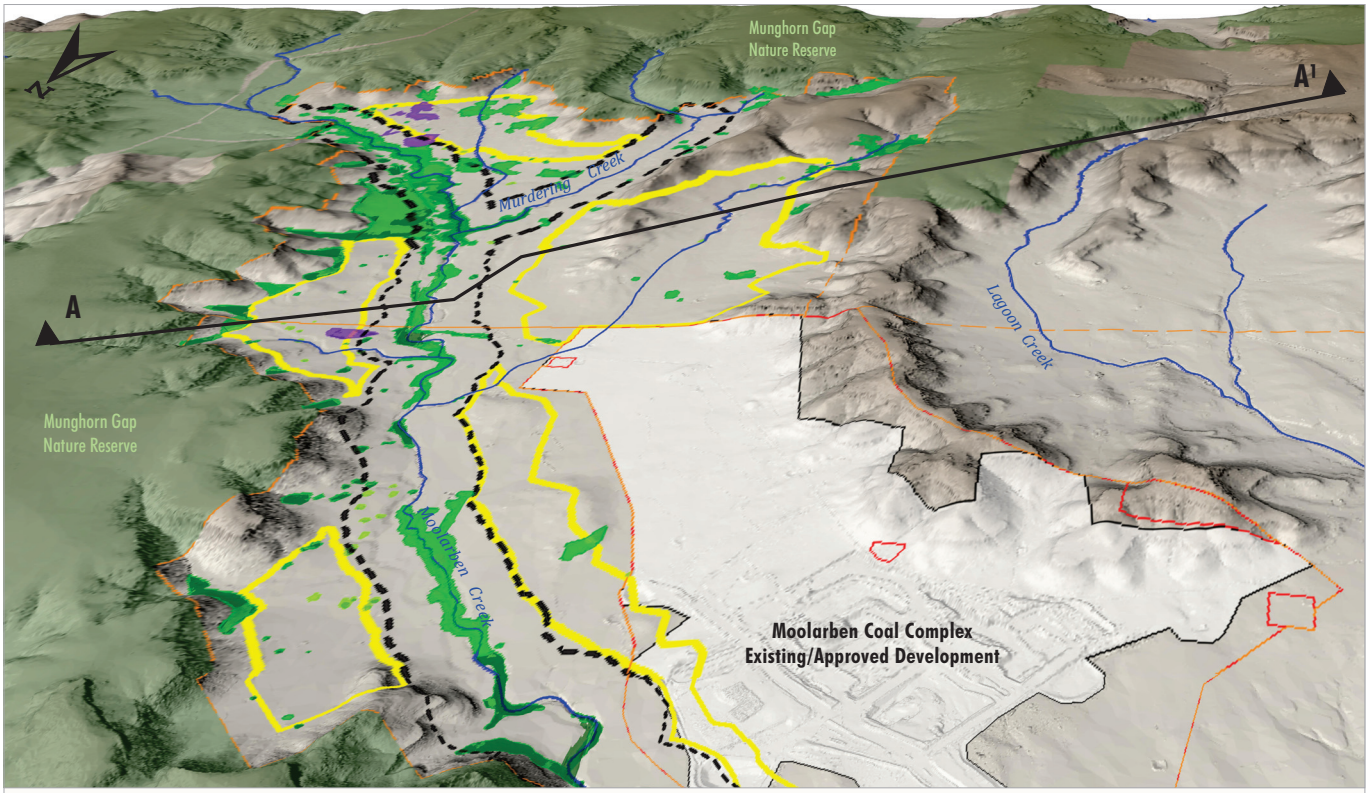
Modelling by WRM (2024) of the impact of catchment excision due to the Project during operations and post-mining to flows in Moolarben Creek and Goulburn River demonstrates impacts would be negligible as:

- The Project has been designed to maintain flows in 4th order and above streams, with open cut mining set back 200 m from the high bank of Moolarben Creek and Murdering Creek, and the water management system would divert clean runoff in 3rd order streams around the Project.
- Catchment excision of the amended Project indicative surface disturbance extent is shown in Figure 4-21 and represents:
  - a maximum of approximately 11% of the Moolarben Creek catchment (downstream of the Project) at the confluence with the Goulburn River;
  - a maximum of approximately 4% of the Goulburn River catchment (downstream of Moolarben Coal Complex) to the north of UG4; and
  - a maximum of approximately 0.4% of the Goulburn River catchment (at Coggan gauge).
- The frequency of occurrence of flow events in Moolarben Creek and Goulburn River would not be significantly altered as demonstrated by flow-duration curves with and without the Project (e.g. no change to zero flow or low flow days) (Figure 4-22).
- Minor catchment excision due to the Project only occurs for a period of approximately 10 years, with the maximum catchment excision only occurring for a period of 3 years. After this time period, the full catchment area would be restored as the final rehabilitated landform for the Project would be free-draining, allowing time for runoff to be of suitable quality to report to the environment.
- Moolarben Creek Dam regulates downstream flows, in accordance with the conditions requiring environmental flows, in a manner that is not related to rainfall.

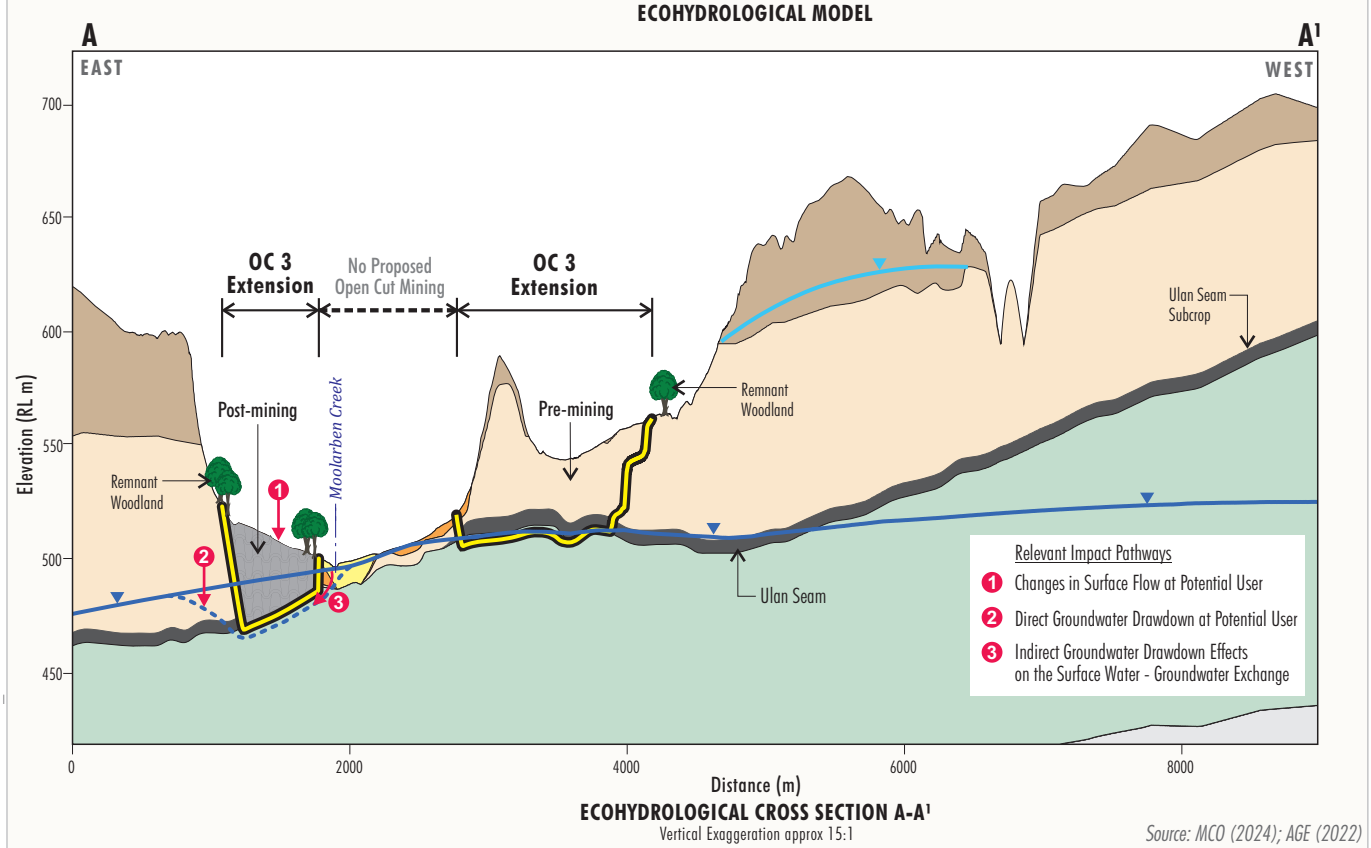
As Project-only impacts to downstream flow are considered negligible (WRM, 2024), the change in cumulative impacts due to the Project would also be negligible.

Figure 4-22 demonstrates the change in downstream flow durations due to the cumulative impacts from approved mining operations and the Project are effectively indistinguishable on the flow duration curve.

Following the completion of mining, there would be no catchment excision due to the Project, noting the Project would backfill the approved OC3 void and leave a free-draining final landform (i.e. a net reduction in catchment excision would occur post-mining as a consequence of the Project).



ECOHYDROLOGICAL MODEL



ECOHYDROLOGICAL CROSS SECTION A-A¹

Vertical Exaggeration approx 15:1

Source: MCO (2024); AGE (2022)

MCM-20-18 OC3 Ext AR SR_001A

MODEL LEGEND

- OC3 Extension Project Indicative Pit Extents
- No Proposed Open Cut Mining (Avoidance Measures)
- Moolarben Coal Complex Disturbance Footprint
- Exploration Licence Boundary
- Mining Lease Boundary
- National Park/Nature Reserve
- Strahler Stream Order (≥ 3rd Order)

Potential Terrestrial GDEs

- Rough-barked Apple - Red Gum - Yellow Box Woodland
- Rough-barked Apple - Red Gum - Yellow Box Woodland - Scattered Tree
- Tantoon - *Leyrodia Leptocaulis* Shrubland

CROSS SECTION LEGEND

- OC3 Extension Project Indicative Pit Extents
- No Proposed Open Cut Mining (Avoidance Measures)
- Potential Groundwater Perching
- Regional Water Table
- Indicative Predicted Water Table with Project Drawdown

Geology

- Alluvium
- Paleochannel
- Triassic
- Permian Overburden
- Ulan Seam
- Permian Underburden

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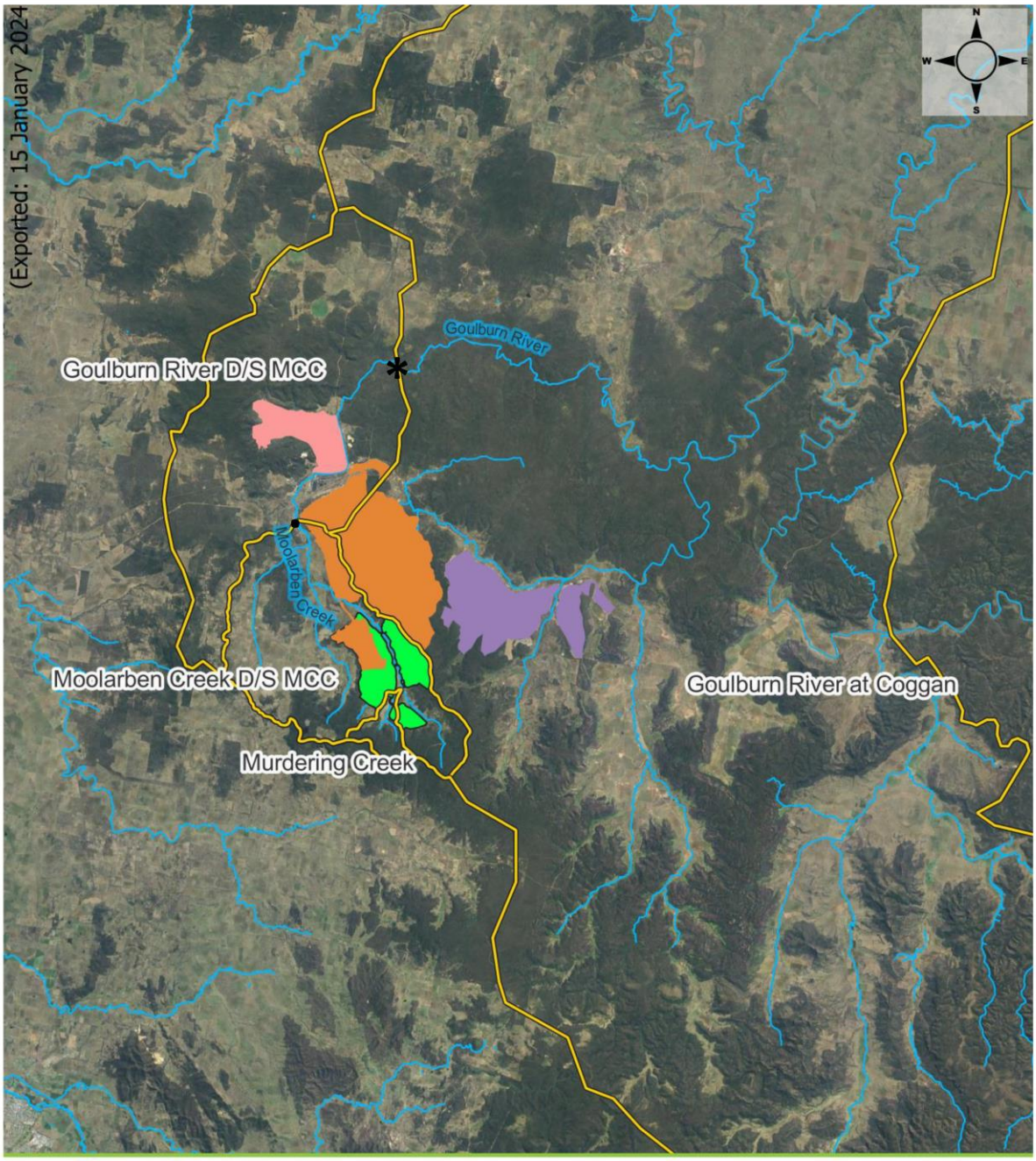
Conceptual Ecohydrological Model
for Water-dependent Assets

Figure 4-20



* Moolarben Creek catchment downstream of the Project.

• Goulburn River catchment downstream of Moolarben Creek Catchment.

Figure 4-21: Moolarben Creek and Goulburn River Catchments and Project-only and Cumulative Catchment Excision (Source: WRM, 2024).

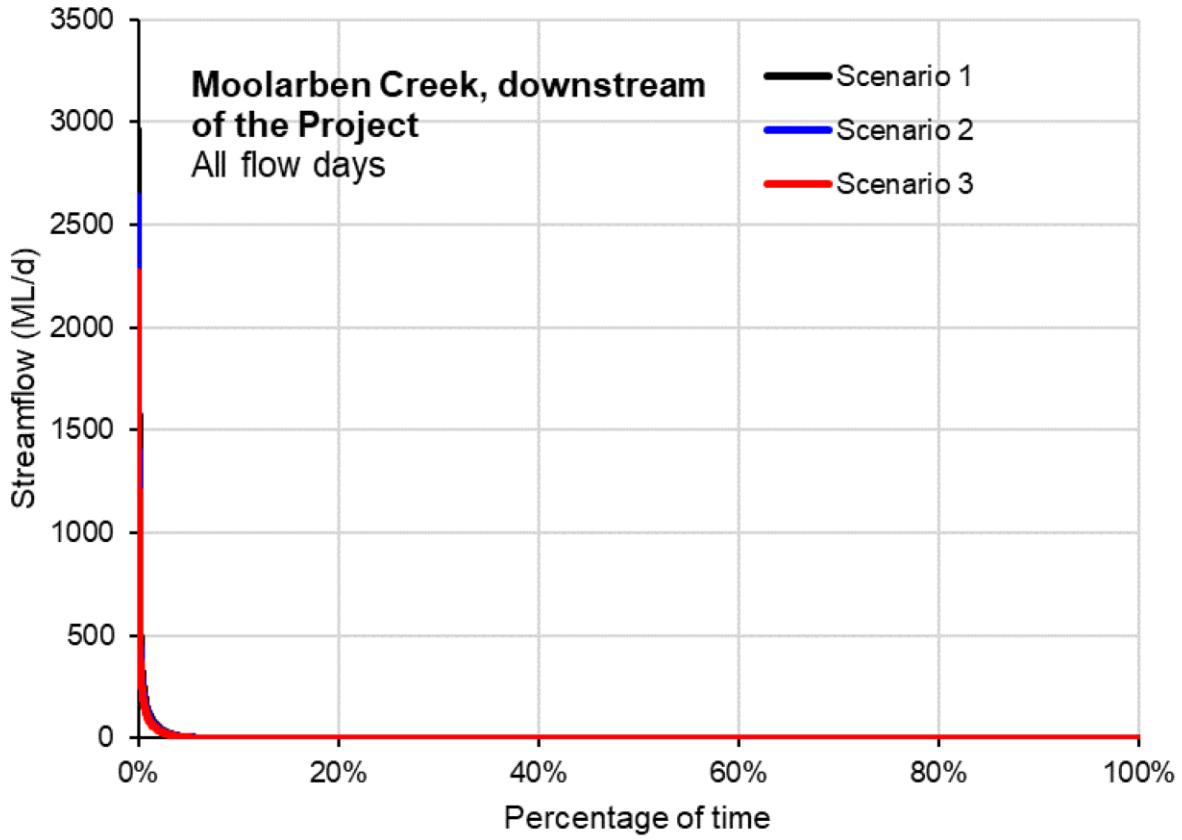


Figure 4-22: Flow-duration Curve in Moolarben Creek Downstream of the Project for Scenario 1 (Baseline), Scenario 2 (Project-only) and Scenario 3 (Cumulative) (Source: WRM, 2024).

Item 4

4. *The proponent has predicted that there will be minimal impacts associated with overtopping of dams based on the outcomes of the water balance modelling (WRM 2022, p. 102). However, due to inadequacies in this model (see below), the IESC has concerns regarding this assessment.*

    a. *The following are required to provide greater confidence in the water balance model.*

        i. *The results of the water balance model are based on a statistical analysis of 121 unique climatic sequences used in simulations from monthly data spanning from 1889 to 2021. This analysis assumes that the past climate is representative of conditions over the next 20 years, which is not consistent with current understanding. An appropriately conservative emission scenario should be adopted (e.g., SSP8.5) by factoring or censoring the historic data used in the simulations, or by some other rainfall-based approach.*

        ii. *It is not clear from the provided information that model validation results are within reasonable bounds. Further justification is required, with a numerical basis for this assertion. Consideration should be given to transposing information from the (now closed) gauging station for the Goulburn River at Ulan (station number 210046) to help inform the parameterisation of the Australian Water Balance Model.*

        iii. *A sensitivity analysis is needed to provide greater confidence in model results*

    b. *The results of the revised water balance model must be considered to provide confidence that the following concerns have been addressed.*

        i. *Design volumes for Dam 316, used for surge storage, have not been defined. As the inventory for the remainder of the water management system will be unable to hold the predicted excess (see WRM 2022, Figure 7.1, p. 75), more detailed information on Dam 316 and referencing the revised model is required.*

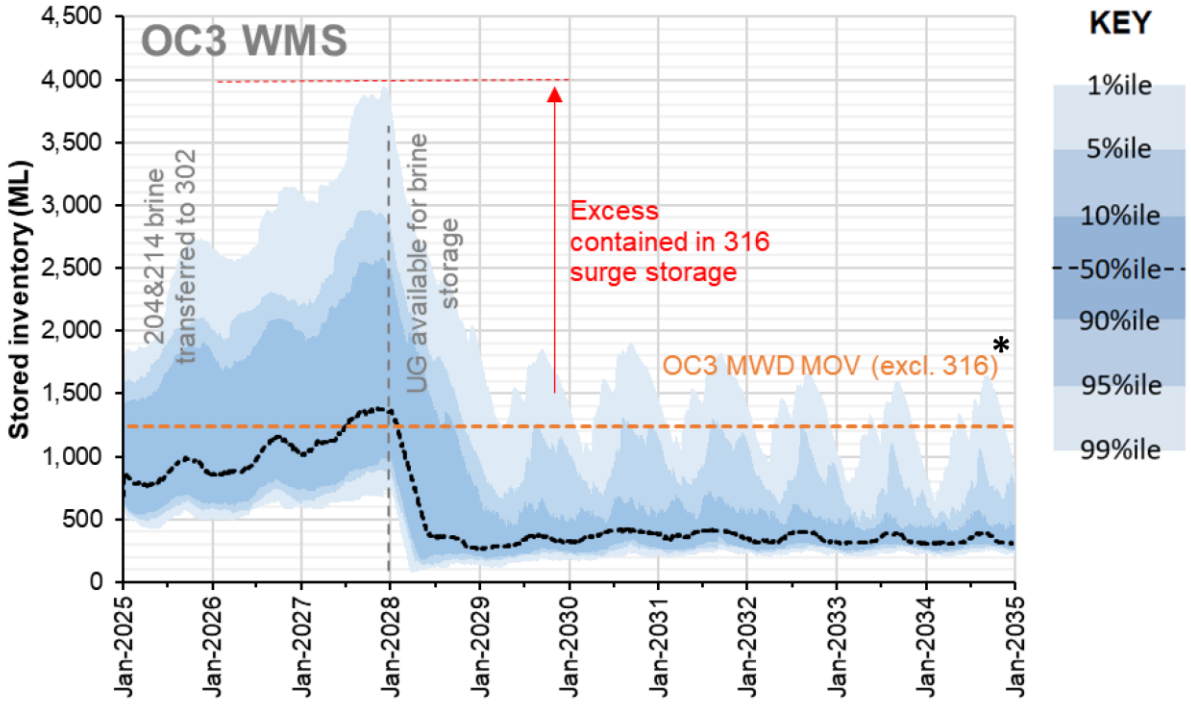
ii. Limited freeboard is modelled to be available in wet conditions for in-pit water storages and mine-affected water dams (WRM 2022, Figure 7.2 and 7.6, pp. 75, 79). Further information is required on how contaminated water in dams within the 200-m buffer zone will be managed under extreme weather events.

iii. Overflow from sediment dams is expected to occur in conditions exceeding design specifications (WRM 2022, p. 102). The IESC suggests that water quality monitoring of sediment dams and mine-affected water dams be expanded to include additional parameters (e.g., metals) to ensure that potential impacts from overflows are fully understood.

Response

The base case scenario site water balance for the Project water management system considers a broad range of climatic conditions. The validation process identified the site water balance model was able to suitably simulate components of the water management system with an acceptable degree of accuracy and well within the reasonable bounds (WRM, 2022).

The base case site water balance for the Project water management system performs under all modelled climatic conditions with no uncontrolled spills of mine water dams and limited requirement for in-pit storage under wetter climatic conditions. Dam 316 is a contingency mine water dam, which would be constructed within the indicative surface disturbance extent of the Project operations to avoid additional disturbance, and would be used if wetter climatic conditions were experienced during the life of the Project (Figure 4-23).



* OC3 Mine Water Dam Maximum Operating Volume (excluding contingency Dam 316)

Figure 4-23: OC3 Water Management System Inventory (Source: WRM, 2024).

In consideration of the Project duration of 10 years (rather than 20 years referred to in the IESC advice), calibrated runoff model, sensitivity analysis for climate change and runoff sensitivity analysis, the Project water management system can operate to protect the environment from mine water dam overflows under a broad range of climatic conditions (WRM, 2024). This conclusion remains true and is supported by the climate change and AWBM parameter sensitivity analyses undertaken, which is provided below.

MCO also accepts the IESC recommendations regarding the expansion of water quality monitoring of mine water dams and sediments dams (which is conducted in accordance with MCO's existing Environment Protection Licence and Water Management Plan) for storages required for the Project.

Climate Change Sensitivity Analysis for Project Water Management System

The sensitivity analysis used climate change projections and methodologies outlined in *Climate Change in Australia Technical Report* (Commonwealth Scientific and Industrial Research Organisation [CSIRO] and the Australian Bureau of Meteorology [BOM], 2015) which provides guidance on the possible projections of future climate for Australia based on the current climate system, historical trends, and model simulations of the climate response to changing greenhouse gas and decreasing aerosol emissions.

Climate change projections are provided for a range of climatic variables including temperature, rainfall, wind speed and potential evapotranspiration. CSIRO and BOM (2015) presents a number of possible approaches to quantify risks associated with climate change impacts.

The performance of the Project water management system has been undertaken using the Representative Concentration Pathway 8.5 (RCP 8.5) for Year 2035 (representative of conservative climate change conditions over the life of the Project). Potential changes in climate were obtained using the projection builder tool provided in the *Climate Change in Australia* website (CSIRO, 2023). Climate variable inputs for the 'best-case' (Scenario 1) and 'worst-case' (Scenario 2) as defined by CSIRO (2015) for the RCP 8.5 climate change scenarios are provided in Table 4-17.

A summary of the results from the assessment of the Project water management system performance under climate change sensitivity analysis scenarios is provided in Table 4-18 and further detail is provided in WRM (2024).

AWBM Parameter Sensitivity Analysis for Project Water Management System

A sensitivity analysis has been undertaken to assess the potential impact of variations in the rainfall runoff parameters on the performance of the Project water management system. The scenarios adopted for the sensitivity analysis of the AWBM parameters included a global increase in AWBM soil capacity by 20% (Scenario 3) and a global decrease in AWBM soil capacity by 20% (Scenario 4).

A summary of the results from the assessment of the Project water management system performance under the AWBM parameter sensitivity analysis scenarios is provided in Table 4-19 and further detail is provided in Appendix G of the Amendment Report.

Table 4-17
Adopted Projections for Climate Change Assessment

Scenario	Climate Projection	Climate Model	Annual Change in Rainfall	Annual Change in Evapotranspiration
Scenario 1	'Best Case'	HadGEM2-CC	-17.9%	4.5%
Scenario 2	'Worst Case'	CESM1-CAM5	2.0%	6.2%

After: CSIRO (2015)

Table 4-18
Assessment of the Project Water Management System Performance under the Climate Change Sensitivity Analysis Scenarios

Scenario	Climate Projection	Mine Water Containment	Mine Water Dams Outflows
Scenario 1	'Best Case'	The Project water management system inventory would be decreased in comparison to the base case. No demand for external water sources.	Controlled releases from the approved water treatment plant at the Moolarben Coal Complex would be reduced in comparison to the base case. No uncontrolled releases are projected to occur for any of the modelled simulations.
Scenario 2	'Worst Case'	The Project water management system inventory would be slightly decreased in comparison to the base case. No demand for external water sources.	Controlled releases from the approved water treatment plant at the Moolarben Coal Complex would be reduced in comparison to the base case. No uncontrolled releases are projected to occur for any of the modelled simulations.

After: WRM (2024)

Table 4-19
Assessment of the Project Water Management System Performance under the AWBM Parameter Sensitivity Analysis Scenarios

Scenario	Description	Mine Water Containment	Mine Water Dams Outflows
Scenario 3	Increase in AWBM soil capacity by 20%	The water management system inventory would be decreased in comparison to the base case. No demand for external water sources.	Controlled releases from the approved water treatment plant at the Moolarben Coal Complex would be reduced in comparison to the base case. No uncontrolled releases are projected to occur for any of the modelled simulations.
Scenario 4	Decrease in AWBM soil capacity by 20%	The water management system inventory would be decreased in comparison to the base case. No demand for external water sources.	Controlled releases from the approved water treatment plant at the Moolarben Coal Complex would be increased in comparison to the base case. No uncontrolled releases are projected to occur for any of the modelled simulations.

After: WRM (2024)

Item 5

5. *The proponent has adopted a "rain-on-grid" methodology to estimating floods, a modelling approach that is not fully endorsed by the national flood guidelines (Ball et al., 2019, Book 5, Section 6.5.3). The comparisons undertaken with regional estimates provide some additional confidence, but use should be made of the flow data collected at the (now closed) gauging station located just downstream of the mining site (site number 210046). The uncertainties associated with accounting for differences in upstream area when transposing the flow information to the mine site are probably less than those associated with the adopted approaches.*

Response

Overview

WRM (2022; 2024) considered the available historic streamflow gauging data in the flood modelling to assess the potential impacts to flooding regime and concluded that incorporation of this data would not result in a noticeable improvement in the accuracy of the model predictions.

As the Project is not predicted to have any material flooding impacts on Moolarben Creek, and in consideration of the limited infrastructure downstream of Moolarben Creek Dam (e.g. no privately-owned receptors, no high-value infrastructure, etc.) and regulation of flows downstream by Moolarben Creek Dam, flooding is not a key risk for the Project.

Items 6 and 7

6. *The IESC is satisfied that the Goulburn River National Park and The Drip are adequately considered by the groundwater assessment. The Drip is located 12 km north of the project site (Bio-Analysis 2022, p. 12) and is fed by a local shallow aquifer within the Triassic Sandstone on the far side of the Goulburn River (see recent work in ACARP 2022). Environmental tracers indicate The Drip seepage is distinctive from deeper aquifers, is a localised flow and is probably a perched aquifer.*
7. *The proponent has acknowledged that high-probability terrestrial GDEs occur along Moolarben Creek (MCO 2022, p. 19). Groundwater use by potential GDEs has not been proven or quantified. The proponent should quantify groundwater use in these potential GDEs using methods outlined in Doody et al. (2019).*

Response

MCO notes the IESC is satisfied with the assessment of the Goulburn River National Park and The Drip provided in the Groundwater Assessment (i.e. the Project would not impact the Drip).

AGE (2024) has considered potential impacts to GDEs for the amended Project, and GDEs are assessed in response to the recommendation in 17.1 of the BCS submission.

In summary:

- Large areas of the Project area are currently unsaturated, limiting the potential for impacts associated with changes in groundwater levels. Existing monitoring bores in areas previously unaffected by mining operations indicate variations in groundwater levels of around 5 m due to climatic variations.
- The progressive open cut mining is predicted to result in limited drawdown beyond the Project indicative surface disturbance extent, particularly given the relatively shallow open cuts would be backfilled, which would restore pre-mining hydraulic gradients and allow water levels to recover.
- Approximately 6 ha of mapped potential terrestrial GDEs are predicted by AGE (2024) to experience greater than 2 m drawdown for the amended Project.
- The drawdowns predicted at the potential terrestrial GDEs (i.e. a maximum of around 6 m) are similar to the natural variations observed at monitoring bores across the Project area.
- Generally, groundwater levels across the Project area are predicted to experience minor (i.e. less than 2 m) drawdown at the potential terrestrial GDEs, which would likely be indiscernible from natural variations.
- The maximum predicted drawdown occurs in a single area along Moolarben Creek, where the groundwater level is approximately 10 m below the surface, and where the groundwater is simulated to occur below the quaternary alluvium in the Ulan Seam. Following recovery, groundwater levels return to pre-mining levels at this location.
- Groundwater and surface water monitoring is proposed for the Project, which would be described in an updated or new Water Management Plan. In addition, the majority of the approximately 6 ha of potential terrestrial GDEs where greater than 2 m drawdown is predicted is located within the Project Habitat Enhancement Area, which excludes open cut mining and would be subject to ongoing vegetation management and revegetation.

Items 8 and 9

8. *The potential impacts to the groundwater resources occur at two scales: regional and local. The groundwater model selected is appropriate for understanding impacts at the regional scale, and cumulative impacts of multiple mine operations. At this scale, the assumptions adopted are reasonable and commensurate with the likely severity of potential impacts, and the model is capable of assessing the potential impact pathway of depressurisation through the coal seams.*
9. *The groundwater model is not sufficient to make predictions at the local scale due to inadequate hydrogeological characterisation and deficiencies in the regional groundwater model. Due in part to a lack of reporting on the modelling calibration within the project area, confidence is limited in the model's ability to make meaningful predictions, including worst-case impacts on groundwater resources along the alluvium beneath Moolarben Creek. The following paragraphs identify additional work that would increase confidence in these predictions.*

    A. *The proponent states that interpretation of geophysical survey data indicates that the maximum thickness of the Tertiary palaeochannel sediments is approximately 30 metres (AGE 2022, p. 82); however, this is not clearly supported by the information provided. The proponent should clarify how the Tertiary palaeochannel sediments have been delineated as their representation in the groundwater model may affect predictions of drawdown in overlying unconsolidated sediments that could support GDEs. Similarly, the extent, thickness and degree of saturation of the alluvium present along Moolarben Creek and its geometry in relation to the proposed mine extension require clarification.*

    b. *There is a discrepancy of three orders of magnitude between field-tested and modelled hydraulic conductivity of the alluvium. Tested hydraulic conductivities of the alluvium are quoted as being between 0.05 and 3 m/d with a median of 0.4 m/d, (AGE 2022, Table 5.4, p. 37 and Figure 5.2, p. 38), while the range in the calibrated model is from approximately 14 to 50 m/d, with 44.8 m/d highlighted (AGE 2022, Att. C, Figure C 5.20, p. 38 and Table C 5.1, p. 36). The reasons for, and influence of, this discrepancy have not been explored. The alluvium within the model may be acting as a surrogate parameter, and appears to have been poorly constrained by the calibration process. The proponent presents summary results for two sets of hydraulic conductivity testing, but the location of these tests and their proximity to the mine extension area are not presented.*

    c. *Local-scale groundwater impacts need to be quantified, including drawdown in the alluvium and impacts on baseflow.*

Response

Regional Model and Local Model

MCO notes the IESC is satisfied with the regional groundwater modelling and impact assessment undertaken for the Project.

Although the IESC requested clarification regarding the local scale performance of the groundwater model, the three-dimensional (3D) calibrated numerical groundwater model is the only suitable model to simulate the potential impacts of the Project at the local scale.

The groundwater model has undergone extensive regulatory review, including by DPE – Water, whose submission states:

> *All the SEARs relevant to groundwater impact have been satisfactorily addressed in the Groundwater Assessment report. The impact of the project on groundwater and its receptors was estimated using Modflow-USG groundwater model that was independently peer reviewed as fit for the purpose. Nevertheless, DPE Water assessed the groundwater model as acceptable with 66% rating. DPE Water agrees with the selection of proposed monitoring sites and the proposal to update the approved WMP for MCC once baseline information of the proposed monitoring sites are analysed.*

The model was also peer reviewed by Brian Barnett (Co-author of the *Australian Groundwater Modelling Guidelines* [Barnett *et al*., 2012]) who concluded:

> *The Report provides a summary of the groundwater modelling work described in the Appendix. Important groundwater modelling outcomes are clearly described and illustrated through a series of easily digested maps, charts and tables. The level of reporting is of a high standard and meets all requirements of the Australian Groundwater Modelling Guidelines (Barnett et al., 2012).*
>
> *…*
>
> *The groundwater assessment and supporting groundwater modelling work described in the Report and Appendix have been carried out in a professional and rigorous manner and meet current industry standards. The modelling work has been completed in line with the Guiding Principles included in the Australian Groundwater Modelling Guidelines and I have not identified any fundamental flaws in the work, both in terms of the approaches and assumptions that have been adopted and the interpretation of the outcomes.*
>
> *I have concluded that the model is fit for the purpose of impact quantification and assessment and, in particular, it is able to meet the modelling objectives as defined in the Report and Appendix.*

The potential impacts of the Project to groundwater are limited due to the extensive unsaturated areas in the vicinity of the Project, due to the subcrop of the Ulan Seam west of the Project and erosion of the Ulan Seam and overburden beneath Moolarben Creek (AGE, 2024). The Project also avoids open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek, further minimising the potential for impacts to these key features and associated groundwater resources.

The shallow depth of the target Ulan Seam (average depth of 34 m within the Project mining areas) facilitates the timely extraction and subsequent backfilling of the Project open cut mining areas, which reduces the length of time the Project open cut pits remain open and act as localised groundwater sinks (AGE, 2024).

At the local scale, the calibrated numerical groundwater model predicts no impacts at private groundwater bore users (e.g. no drawdown greater than 2 m), no impacts at natural springs and negligible reductions in Moolarben Creek baseflow in consideration of both estimated and modelled baseflow and measured stream flow in Moolarben Creek.

It is considered there is a very low risk of impacts to groundwater resources at the local scale greater than those predicted by the regional groundwater model.

Numerical Groundwater Model Calibration and Validation

The scaled root mean squared error (SRMS) is a statistical measure recommended by the *Australian Groundwater Modelling Guidelines* (Barnett et al., 2012) to determine if a groundwater model is sufficiently calibrated. The SRMS of the recalibrated model is 4.6%, which included simulation of groundwater levels measured by groundwater bores and vibrating wire piezometers at the local scale and regional scale. This is well within the target SRMS of less than 10% recommended by Barnett et al. (2012) and therefore satisfactorily matched historical measured water levels.

Figure 4-24 provides a local scale plot (e.g. within the Project area) of the observed groundwater levels against the modelled groundwater levels at groundwater monitoring bores within the alluvial sediments and paleochannel at the local scale only. The groundwater model has an SRMS of 6.8% at groundwater monitoring bores within the local scale for the Project, which is also within the target SRMS of less than 10%.

Definition of Tertiary Sediment

The groundwater model in the Moolarben Coal Complex area was informed by the site geological model, which is based on extensive exploration data including within the Project area.

Accordingly, the delineation and thickness of the paleochannel and other tertiary sediments are based on a combination of extensive hydrogeological testwork and exploration drilling.

Calibrated Hydraulic Conductivity Parameters

Hydraulic property investigations were previously undertaken at the Moolarben Coal Complex and reported by RPS Aquaterra (2011), including short duration constant pump test and a falling head slug test to estimate hydraulic conductivity aquifer properties. AGE (2022) reviewed RPS Aquaterra (2011) results and summarised these in AGE (2022).

The review noted some uncertainty in the hydraulic parameters reported in RPS Aquaterra (2011) and therefore the range of hydraulic properties considered for calibration was not constrained to the data available from the hydraulic investigations.

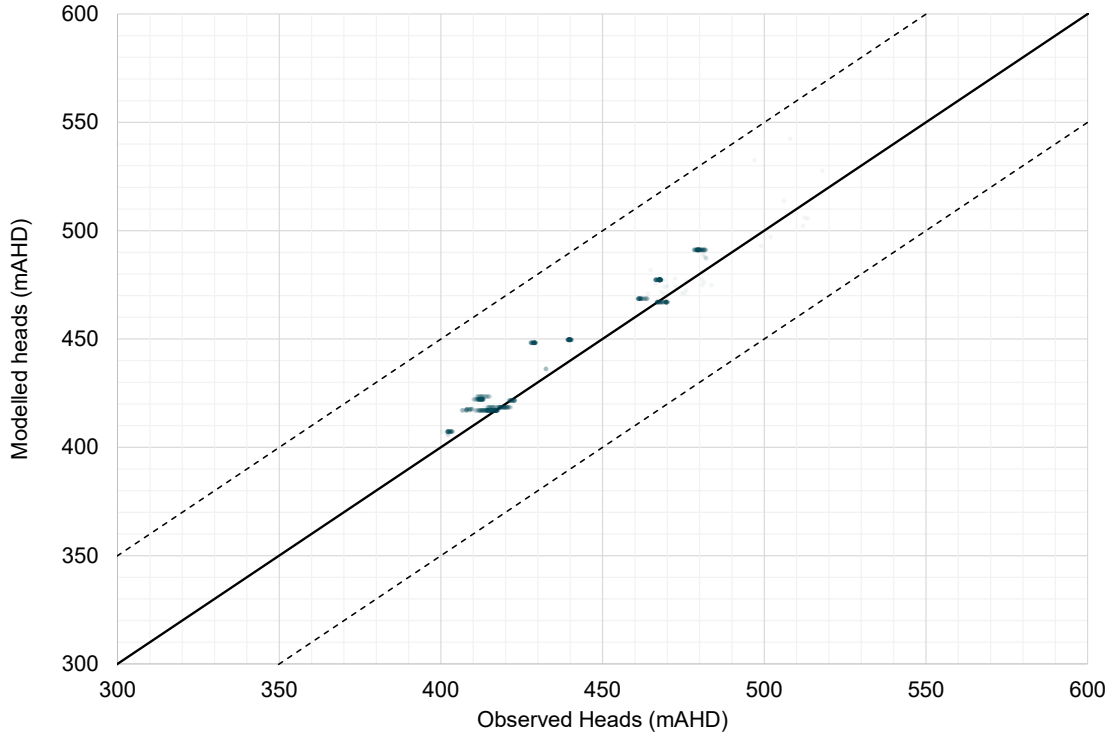


Figure 4-24: Plot of Observed Groundwater Levels against the Modelled Groundwater Levels for Monitoring Bores within the Alluvial Sediments and Paleochannel Unit at the Local Scale of the Project (Source: AGE, 2024)

Hydraulic properties were varied during the calibration of the numerical groundwater model, and the calibrated hydraulic properties were presented in Table C 5.1 of AGE (2022). Given the spatial variability over the groundwater model domain, AGE (2022) presented the average value per layer for each hydraulic conductivity parameter in Table C 5.1 of the Groundwater Assessment (AGE, 2022).

The numerical groundwater model adopted a wide range of hydraulic conductivities as part of the calibration, based on literature reviews and field-tested data, any discrepancy with field-tested data was to provide a more conservative assessment of groundwater impacts. The sensitivity analysis tested the effect of varying the hydraulic conductivities on the numerical groundwater model predictions and the same overall trends were observed as modelled runs for the adopted parameters.

The model has been peer reviewed by Brian Barnett and reviewed by DPE – Water, and concluded to be satisfactory.

Item 10

10. *The proponent's approach to assess the sensitivity and uncertainty of the model is limited. As the model was calibrated using PEST (2021) and a detailed sensitivity matrix (Jacobian) has already been calculated, then a more detailed sensitivity analysis could easily have been undertaken. Regarding the uncertainty analysis, the IESC considers that additional scenarios are needed. For each quantity of interest, a combination of parameters should be selected within reasonable ranges that would maximise the potential impact. Riverbed conductance should also be included in the varied parameters. Climate-variability scenarios (e.g., extended high-rainfall periods and how that would change the mine dewatering requirements and groundwater level predictions) should be considered in future iterations of the model.*

Response

The uncertainty analysis undertaken by AGE (2024) was run to assess the sensitivity of drawdown, pit inflows and baseflow estimates to a range of different hydraulic properties and stresses. This approach was peer reviewed by Brian Barnett for AGE (2022) and it was concluded the uncertainty analysis for the numerical groundwater model was considered suitable:

> *The method is considered to be the simplest approach to predictive uncertainty analysis and is usually considered appropriate for those modelling studies in which the predicted impacts are relatively modest or where the consequences of having poorly defined predictive uncertainty are not severe. In my opinion the approach is suitable for the current study.*

The predicted impacts due to drawdown, pit inflows and baseflow from the uncertainty analysis are generally consistent with the base case predictions for the Project and are not significant in comparison to the predicted and observed impacts as a result of approved mining operations in the region. This conclusion is supported by the conclusions of the peer review by Brian Barnett (2022) which states:

> *Uncertainty analysis is presented in Section 7.4. Six model realisations were run to assess the sensitivity of drawdown, pit inflows and baseflow estimates to a range of different hydraulic properties and stresses. In these models, all predicted impacts associated with the proposed OC3 extension are not significant compared to impacts that have already been observed and that are expected to occur as a result of approved mining operations at Moolarben and neighbouring mines.*
>
> *The Report provides a summary of the groundwater modelling work described in the Appendix. Important groundwater modelling outcomes are clearly described and illustrated through a series of easily digested maps, charts and tables. The level of reporting is of a high standard and meets all requirements of the Australian Groundwater Modelling Guidelines (Barnett et al., 2012).*

Further detailed information on the uncertainty analysis is provided in AGE (2022) and AGE (2024).

Item 11

11. *The recovery phase comprises 14 stress periods which represent 576 years (AGE 2022, Att. C, p. 11). The rationale behind this timeframe selection, which is an order of magnitude longer than the calibration period and likely to increase uncertainty, should be presented. Additionally, the proponent should provide model outcomes identifying when equilibrium has been reached (refer to AGE 2022, Figure 5.6, p. 99).*

Response

AGE (2022) adopted the selected timeframe for the groundwater recovery phase as any significant impacts beyond the predictive phase of the groundwater model are adequately captured in the 576-year timeframe.

The shallow depth of the target Ulan Seam (average depth of 34 m within the Project mining areas) facilitates the relatively efficient extraction and subsequent backfilling of the Project open cut mining areas, which reduces the length of time that the Project open cut pits remain open and act as localised groundwater sinks (AGE, 2024).

The Project also avoids open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek, further minimising the potential for impacts to these key features and associated groundwater resources.

A 576-year timeframe for the modelled recovery phase was adopted by AGE (2022) for the groundwater model as it allowed sufficient time for a pseudo-equilibrium to be reached as shown in Figure 4-25, which provides a long-term hydrograph for a Quaternary alluvium observation Point 1 in the Project area (shown in Figure 4-13). Figure 4-25 also shows that after approximately 30 years, the groundwater level is predicted to recover to pre-mining levels within the range of natural variation.

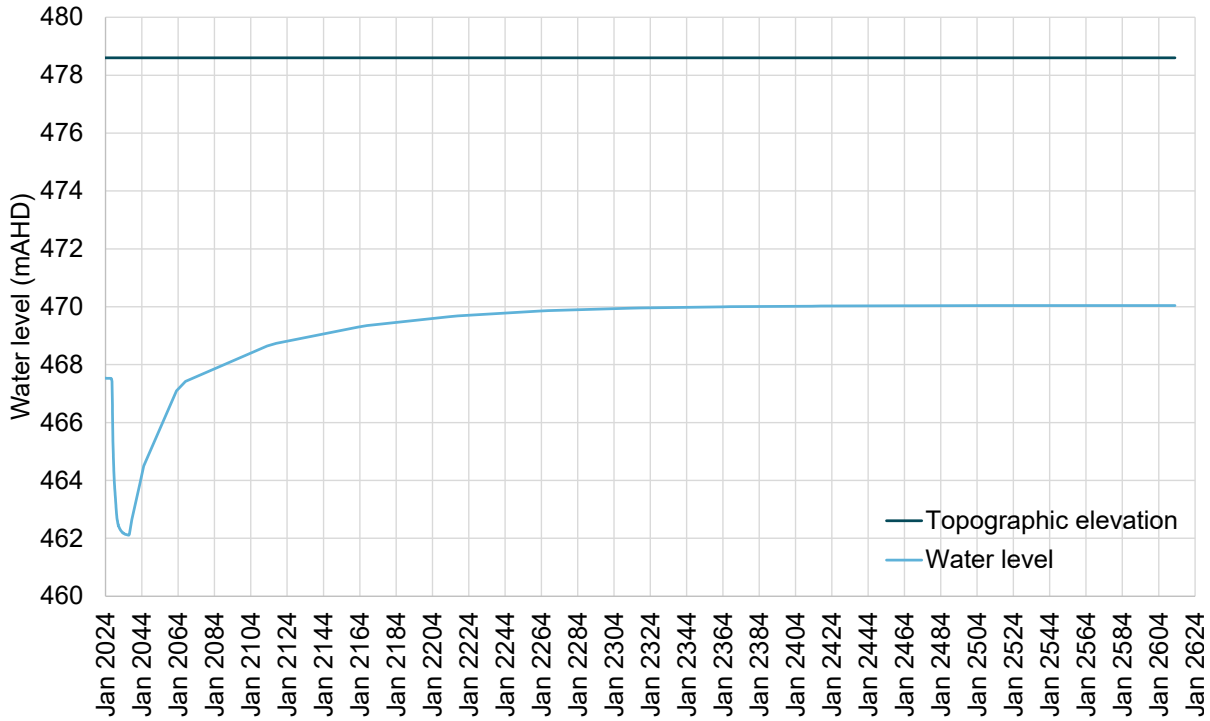


Figure 4-25: Long-term Hydrograph at Quaternary Alluvium Observation Point 1 over the Recovery Phase (Source: AGE, 2022)

Figure 4-26 shows the model budget outputs for the boundary conditions over the recovery phase, which demonstrates the Rivers-Out budget (i.e. baseflow) stabilises within the 576-year timeframe and other boundary condition budgets generally remain stable for the duration of the recovery phase.

Item 12

12. *It is predicted that mounding would start approximately 30 years after operations have ceased and will stabilise around 470 m AHD somewhere in the middle of the predictive period (refer to AGE 2022, Figure 5.6, p. 99). The proponent should discuss potential adverse impacts (e.g., waterlogging) of the predicted mounding to the health and persistence of GDEs and riparian vegetation.*

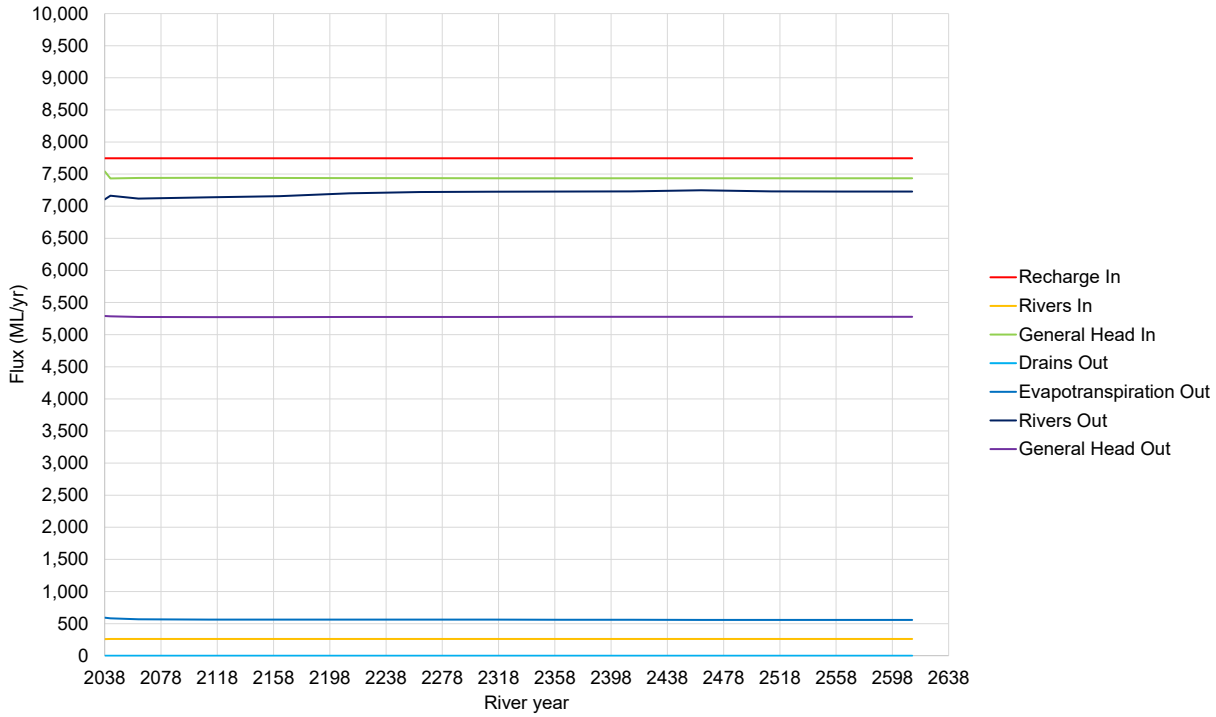


Figure 4-26: Mass Balance for Groundwater Model over Recovery Phase (Source: AGE, 2022)

Response

AGE (2024) has updated the groundwater modelling undertaken for the amended Project, and there is limited overlap between areas of predicted mounding of the groundwater table and GDEs and riparian vegetation (outside of the surface development for the Project), with a maximum of 2 m of mounding predicted within the Quaternary alluvium and paleochannel aquifers at the potential terrestrial GDEs and riparian vegetation (Figure 4-9).

The predicted mounding at the potential terrestrial GDEs is similar to the natural variations observed at monitoring bores across the Project area and, therefore, is not expected to significantly impact on the potential terrestrial GDEs.

Item 13

13. *Based on the analysis of cation-anion ratios, the proponent assumes that water samples from springs are relatively recent (in terms of groundwater residence time), with no mixing with regional groundwaters (AGE 2022, p. 58). This conclusion should be further supported with additional data (e.g., residence times) to confirm that these GDEs are perched.*

Response

The intent of the analysis of cation-anion ratios was not to quantify physical groundwater residence or movement times in absolute terms, but to highlight the significant difference in groundwater geochemistry between the samples from the spring and samples from regional groundwater below the water table (e.g. Permian aquifers).

Average chloride concentrations were reported as follows:

- samples from springs generally ranging between 68 milligrams per litre (mg/L) to 93 mg/L;
- samples from bores screening the Triassic sandstone (from all available groundwater quality samples) generally ranging between 50 mg/L to 776 mg/L; and
- samples from bores screening the Permian aquifers (from all available groundwater quality samples) at an average of approximately 1200 mg/L.

Based on the above and information presented in the Groundwater Assessment (AGE, 2022), there is sufficient information to characterise the springs as locally perched features.

AGE (2022) concluded perched aquifers within the Triassic ridgelines are not connected to the regional groundwater system, as they are in the order of 100 m above the regional groundwater table. There was no evidence to suggest that reductions in groundwater level or pressure in the Triassic sandstone unit (which the perched aquifers and potential terrestrial GDEs are associated with) due to the Project would impact these perched groundwater features.

Item 14

14. Potential impacts to stygofauna (including hyporheic invertebrates) due to drawdown in Moolarben Creek have not been adequately assessed. The proponent should conduct additional stygofauna surveys in saturated alluvial sediments where drawdown is predicted near Moolarben Creek, including the hyporheic zone. The proponent should continue macroinvertebrate and stygofauna biomonitoring throughout the operational period and use this information to infer and report on any alterations to ecosystem health.

Response

In consideration of the recommendations from the IESC (and BCS and NPWS), Dr Sharon Cummins and Dr Dan Roberts (Bio-Analysis) undertook further stygofauna surveys. Additional monitoring of the bores and springs for stygofauna and groundwater quality within and surrounding the amended Project was undertaken between 26 to 28 September 2023 (Bio-Analysis, 2023).

Similar to the findings from previous stygofauna surveys undertaken in December 2021 and February 2022 of bores within the vicinity of the Moolarben Coal Complex, no stygofauna were recorded from the bore sampling during the additional surveys in September 2023 (Bio-Analysis, 2023).

Additional samples from the springs in the vicinity of the Project identified at least five species of stygofauna, and invertebrate assemblages were mostly comprised of crustaceans (amphipods, ostracods, cyclopoid copepods) and oligochaete worms. None of the taxa collected within the springs are endemic to the Project area (Bio-Analysis, 2023). However, there is no drawdown predicted for Pinemount Spring, Spring/Ferns, Coonaroo Springs and Munghorn Gap Nature Reserve Spring as a result of the Project (AGE, 2024).

As a result, the additional stygofauna sampling recommended by the IESC did not change the conclusions of Aquatic Ecology Assessment (Bio-Analysis Pty Ltd, 2022) and it is considered unlikely that the Project would have a measurable impact on subterranean GDEs (Bio-Analysis, 2023).

Notwithstanding the above, MCO would adopt the recommendation from AGE (2022) to install three additional vibrating wire piezometers adjacent to local spring features to monitor for potential impacts to perched groundwater within the Triassic sandstone. Ongoing monitoring will allow for the assessment of natural groundwater level fluctuations (such as response to rainfall) and the quantification of potential groundwater level impacts due to depressurisation (and dewatering) resulting from the approved and proposed mining activities. In the event that groundwater monitoring identifies an exceedance of an appropriate trigger value, MCO would implement a response plan in accordance with the approved Water Management Plan to mitigate impacts on aquatic ecosystems.

Item 16

16. Cumulative impacts to groundwater levels have been adequately assessed, assuming the local impacts are as predicted. The regional groundwater model captures impacts from the whole MCC and the surrounding Ulan Mine Complex and Wilpinjong Coal Mine.

Response

MCO notes the IESC is satisfied with the cumulative groundwater modelling and impact assessment undertaken for the Project, which included consideration of the approved Moolarben Coal Complex, Ulan Coal Complex and Wilpinjong Coal Mine.

Item 17

17. *The proponent should assess the potential cumulative impacts of impairment and loss of GDEs (some of which will be removed during open-cut mining whereas others will experience drawdown and potentially altered water quality) and aquatic habitats throughout the surrounding landscape. Moolarben Creek and its surrounding mosaic of GDEs and watercourses complement the contiguous woodland habitat provided by the Munghorn Gap Nature Reserve. Although historic land uses have degraded aquatic and riparian habitats in the area, some high-quality habitats remain (Bio-Analysis 2022, p. 27) and their persistence is important for maintaining landscape-scale ecosystem health and diversity.*

Response

The Project is not predicted to significantly impact GDEs and aquatic habitat as a result of changes to surface water and groundwater quality or availability (e.g. via drawdown), therefore, the Project is not expected to result in significant cumulative impacts to aquatic habitat, flora and fauna due to indirect impacts outside the indicative surface disturbance extent.

Direct impacts associated with surface disturbance for the Project and associated cumulative impacts are assessed in the BDAR, which considers avoidance, minimisation and offsetting of the impacts.

Further detail regarding assessment of potential terrestrial GDEs is provided in response to Items 6 and 7 of the IESC advice.

Items 19, 20 and 21

19. *The proposed mitigation strategies are largely focussed on maintaining the 200-m buffer for open-cut mining around creek lines and post-closure landscape rehabilitation, which are likely to be generally successful. However, few strategies to mitigate impacts that may occur during the operation period have been described in sufficient detail. The proponent should propose additional mitigation measures to ensure that ecosystem health and biodiversity associated with Moolarben Creek are likely to persist during operations or recover post-closure. This should include TARPs for water dependent assets associated with Moolarben Creek within the project area, which should describe the remediation of riparian vegetation, potential groundwater-dependent vegetation and stream health.*
20. *The Surface Water Management Program (SWMP) and associated TARPs were not provided for assessment. The SWMP should be updated with TARPs to assist in adaptive management and to prevent repeated impacts. This is of particular importance as key mitigation strategies regarding impacts to surface water quality include appropriate monitoring strategies and water quality trigger values.*
21. *Trigger values for metals (e.g., ANZG 2018) should be applied to Moolarben Creek, in line with the suggested additional monitoring (Paragraph 4).*

Response

As described above in response to Item 3 of the IESC advice, there would be negligible impacts associated with the Project to the surface water resources and water-dependent assets downstream of the Project along Moolarben Creek, given the following measures adopted by the MCO:

- The Project avoids open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek, the major drainage lines in the Moolarben Valley, such that flows are unaffected.
- Clean runoff, particularly from ephemeral third order streams, would be directed around the Project to mitigate impacts on downstream flows.
- The effective capture of runoff from disturbed areas in the mine water management system will have a limited effect on flows in Moolarben Creek (Figure 4-22).

The existing surface water monitoring program, which is included in the approved Surface Water Management Plan, would be retained for operations of the Project. MCO currently undertakes quarterly monitoring of open cut pits (i.e. mine voids), sediment dams and mine water dams across the Moolarben Coal Complex for a comprehensive range of parameters, including metals at water storages outlined in the Surface Water Management Plan.

A range of surface water quality investigation trigger levels, stream health monitoring site investigation trigger levels and associated Trigger Action Response Plans (TARPs) have been previously developed for the receiving environment (including for SW05 along Moolarben Creek) and are outlined in the approved Surface Water Management Plan. If required, a new or updated Surface Water Management Plan would be prepared by MCO (i.e. with respect to monitoring parameters, frequency and/or TARPs) to incorporate the Project, subject to the conditions of any Development Consent for the Project.

Item 22

22. *The IESC notes that alluvial and streamflow monitoring on Moolarben Creek is extremely limited and provides little indication of flow regimes upstream of the present OC3 operations. Additional alluvial monitoring bores and flow monitoring sites should be placed upstream of the confluence with Lagoon Creek and within the project area downstream of the Murdering Creek confluence. Two years of continuous baseline monitoring data should be obtained to develop a comprehensive understanding of the alluvial system and flow patterns such that impacts to Moolarben Creek can be identified and assessed at the local scale, and suitable management plans developed to remediate impacts.*

Response

MCO accepts the IESC recommendations regarding the establishment of additional Moolarben Creek alluvial monitoring bores upstream of the confluence with Lagoon Creek and within the Project area downstream of the Murdering Creek confluence. This is consistent with the additional monitoring recommendations of AGE (2022) for the Project.

Items 23, 24 and 25

23. *The existing water quality monitoring site SW09 will be relocated further upstream of Moolarben Creek as mining progresses (WRM 2022, p. 100). Relocating the monitoring site will prevent the proponent from assessing changes to water quality resulting from the project as there will likely be insufficient pre-impact baseline data available at the new location. To address this, additional water quality monitoring sites should be established further upstream on Moolarben Creek instead of the proposed relocation.*
24. *Water quality monitoring frequency for dissolved metals and other parameters (dissolved organic carbon, total phosphorus, total nitrogen and total dissolved solids) has not been specified by the proponent. Results indicate that monitoring of various parameters has been inconsistent over time, ranging from 4 to 104 samples analysed between 2005 and 2021 (WRM 2022, Tables 3.7 – 3.9, pp. 38 – 39). Monitoring for these analytes should be completed at least six-monthly during operations (including event-based sampling).*
25. *The IESC recommends monitoring of sediment dams and mine-affected water dams should be expanded to include sampling metals and metalloids, dissolved organic carbon and nutrients.*

Response

MCO accepts these IESC recommendations regarding the establishment of additional monitoring locations and other management measures.

Item 26

26. *During the backfilling and rehabilitation of final voids, annual rehabilitation monitoring does not appear to include environmental monitoring. Monitoring of surface water flows and water quality is integral for assessing the success of rehabilitation measures and should be incorporated into the rehabilitation monitoring strategy and associated TARPs.*

Response

MCO would continue to implement the Surface Water Management Plan during the closure phase of the Project, until it can be demonstrated ongoing monitoring is no longer required. The results would continue to be reported in Annual Reviews during rehabilitation (i.e. until any Development Consent for the Project can be surrendered).

Item 27

27. The proponent intends to store waste brine in a mine-affected water dam for the first two stages of the project, then in the UG4 void (WRM 2022, p. 56). Further information and discussion are required concerning the design of brine storage facilities and long-term storage solutions, with particular consideration given to potential for leakage and seepage of contaminants into groundwater. The proponent should monitor groundwater quality in the vicinity of the proposed brine storages, to identify potential leaks and seepage.

Response

These activities are approved as part of the Moolarben Coal Complex and would be unchanged by the Project. The management and storage of brine would continue to be undertaken in accordance with the conditions of Moolarben Coal Complex Stage 1 Project Approval (05_0117), which includes a requirement for brine storages to have a dam lining consistent with relevant standards and a suitable capacity, as detailed in the approved Brine Management Plan.

Item 28

28. The IESC previously recommended the development of a TARP by the operators of Moolarben, Ulan and Wilpinjong mines to provide an adaptive management approach to address water quality in the Goulburn River (IESC 2017). This included the installation of a flow and water quality monitoring point on the Goulburn River downstream of Wollar Creek to assess cumulative water quality impacts. This TARP was not provided nor discussed in the documentation but should be updated to accommodate the potential impacts associated with the project.

Response

MCO notes this recommendation regarding the development and implementation of additional TARPs relevant to the approved Moolarben Coal Complex, Ulan Mine Complex and Wilpinjong Coal Mine is not relevant to the Project. Each operation currently implements TARPs in accordance with the respective approved Surface Water Management Plans.

4.2 PUBLIC AND ORGANISATION SUBMISSIONS

Response to comments from organisations and the public are provided below. Two public submissions supported the Project on the basis of continued employment, and potential benefits for the local community and the state of NSW. These submissions have not been responded to below.

4.2.1 Project Design

Comments made in public and organisation submissions relevant to the Project design include clarification of:

1. Proposed ROM coal mining rate and total extraction for the Project.
2. Project and Moolarben Coal Complex mine life.
3. Project location.

Responses to these comments are provided below.

1. Proposed ROM Coal Mining Rate and Total Extraction for the Project

The Project as presented in the EIS proposed extraction of up to 9 Mt of ROM coal (average of approximately 4 Mtpa over the life of the Project) in any calendar year providing a total of approximately 40 Mt of ROM coal in addition to approved Moolarben Coal Complex operations.

As a result of the proposed additional avoidance and minimisation for the amended Project, the indicative surface disturbance extent and extent of the proposed open cut mining area has reduced. A revised indicative mine schedule and mining progression have been developed for the amended Project.

The amended Project would mine up to 8.5 Mtpa of ROM coal (average of approximately 3 Mtpa over the life of the Project) and would provide approximately 30 Mt of ROM coal over the life of the Project (i.e. a reduction in 10 Mt compared to the Project EIS).

Consistent with the Project EIS, the amended Project would not result in any change to the cumulative ROM coal extraction limit for open cut operations at the Moolarben Coal Complex (i.e. 16 Mtpa) or production and transport limits from the existing CHPP (Figure 4-27).

It is noted that the amended Project design and associated reduction in the total resource extracted over the life of the amended Project has resulted in a reduction in GHG emission estimates. Further detail is provided in the Amendment Report.

2. Project and Moolarben Coal Complex Mine Life

The Project would not result in any changes to the approved life of the Moolarben Coal Complex (Figure 4-28).

Mining operations at the Moolarben Coal Complex are currently approved until 31 December 2038. MCO currently operates across multiple open cut mining areas and, at current production rates, mining within the approved OC3 mining areas is forecast to be completed in 2025.

The Project would follow completion of mining in the approved OC3 mining area, providing approximately 10 years of mining (from 2025 to 2034, within the approved life of the Moolarben Coal Complex), which would occur in parallel with the remaining approved mining at the Moolarben Coal Complex.

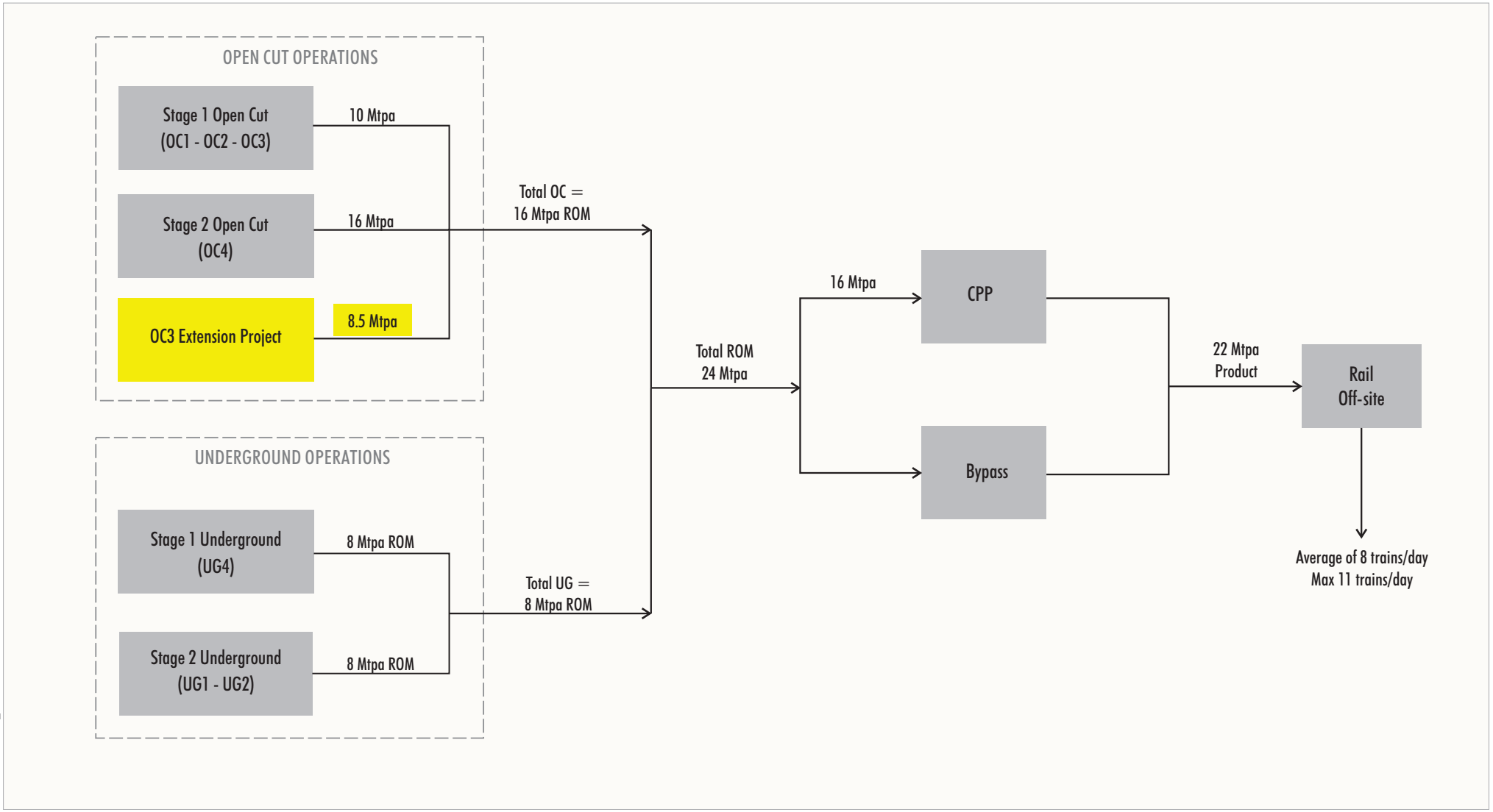
The Project would maximise use of the existing mining infrastructure and equipment and maintain steady production of ROM coal.

3. Project Location

Some submissions requested further justification of the Project's location within the Central West Orana Renewable Energy Zone (REZ). The Project is located on the eastern border of the Central West Orana REZ, accounting for approximately 0.0004% of the entire REZ area.

The Project would be located largely within land that has been previously cleared for low intensity agriculture (i.e. grazing and dryland cropping).

The Project is an extension of the existing Moolarben Coal Complex and is located within an existing mining precinct including the Wilpinjong Coal Mine and Ulan Mine Complex. Freehold land in the immediate vicinity of the Project area is largely owned by Moolarben.



MCM-20-18 OC3 Ext AR SR_002A

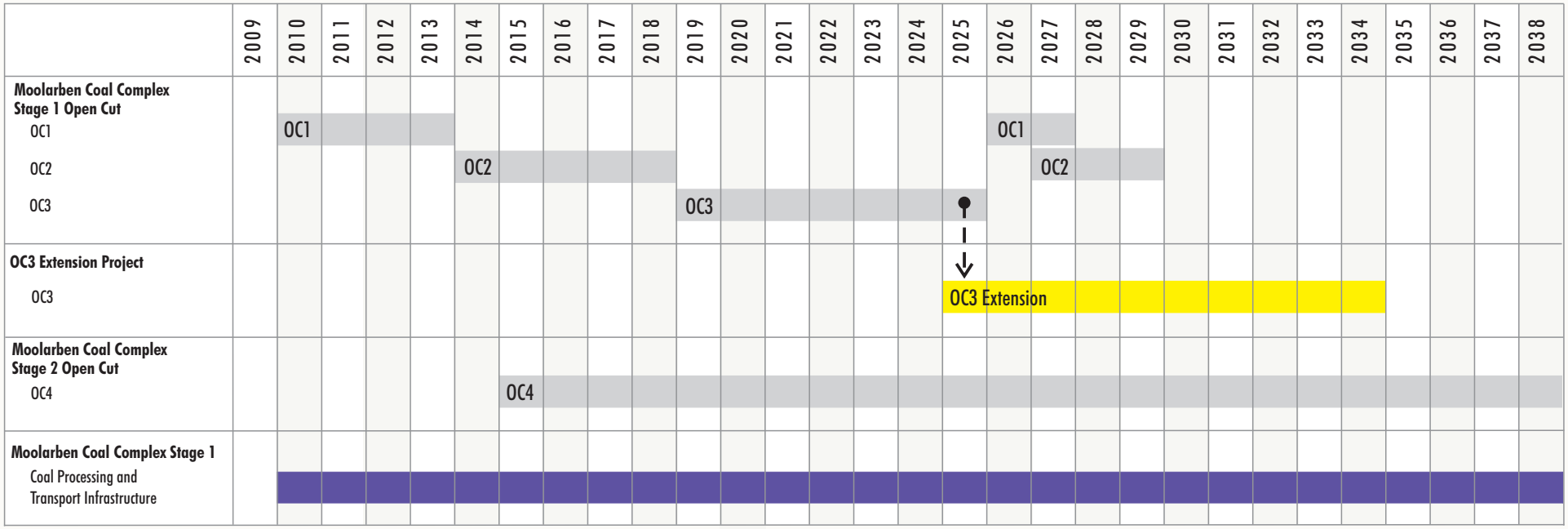
LEGEND
Project Components
Approved Moolarben Coal Complex Components

YANCOAL 兖煤澳大利亚有限公司
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Moolarben Coal Complex
and OC3 Extension Project -
Coal Production Limits

Figure 4-27



Note: Indicative timing only includes mining operations and does not take into consideration decommissioning, closure and rehabilitation activities.

MCM-20-18 OC3 Ext AR SR_0003A

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MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Moolarben Coal Complex
and OC3 Extension Project -
Indicative Open Cut Operations Timing

Figure 4-28

4.2.2 Groundwater

Comments made in public and organisation submissions relevant to groundwater and GDEs include:

1. Baseline data and monitoring.
2. Predicted groundwater drawdown for the Project and cumulatively with the Moolarben Coal Complex.
3. Potential indirect impacts to surrounding groundwater systems, including Munghorn Gap Nature Reserve and Goulburn River National Park.
4. Potential impacts to seep and spring features.
5. Groundwater Dependent Ecosystems.
    A. Potential indirect impacts from groundwater drawdown.
    B. Proposed mitigation and monitoring.
6. Impacts to groundwater quality as a result of recharge from backfilled pits.
7. Justification of stygofauna sampling and assessment for the Project.

Responses to these comments are provided below.

1. Baseline Data and Monitoring

The Moolarben Coal Complex currently operates in accordance with an approved Water Management Plan (including a Groundwater Management Plan) which addresses the requirements of the Stage 1 (05_0117) and Stage 2 (08_0135) Project Approvals, Commonwealth approvals, and relevant licences and permits, as well as commitments outlined in environmental assessments undertaken to date.

Since groundwater investigations commenced in 2005, a broad network of monitoring bores has been installed at the Moolarben Coal Complex (Figure 4-11). Currently, a total of 64 groundwater monitoring observation points are monitored on a monthly or continuous basis. Additional piezometers have also been installed for other operational and project purposes. All available groundwater data from MCO was provided and incorporated into the Groundwater Assessment for the EIS (AGE, 2022).

MCO would add the monitoring bores recommended by AGE (2022) to the groundwater monitoring network for the Project. These additional monitoring bores would complement the existing monitoring program and be used to monitor for potential impacts to key water features, including Moolarben Creek and potential terrestrial GDEs. Monitoring bores established in the backfilled waste rock would monitor groundwater recovery and associated flow directions and gradients.

2. Predicted Groundwater Drawdown for the Project and Cumulatively with the Moolarben Coal Complex

The Groundwater Assessment for the Project as presented in the EIS (AGE, 2022) evaluated the potential impacts on groundwater resources using a numerical regional groundwater model. The numerical regional groundwater model incorporates the approved Moolarben Coal Complex, Ulan Mine Complex and Wilpinjong Coal Mine.

Brian Barnett in the peer review of the Project Groundwater Assessment concluded the calibration of the groundwater model is acceptable. Further, that the numerical groundwater model was considered suitable to simulate the potential impacts of the Project as well as the cumulative impacts with the approved Moolarben Coal Complex, Ulan Mine Complex and Wilpinjong Coal Mine (Barnett, 2022).

As a result of the proposed additional avoidance and minimisation measures for the amended Project, the indicative surface disturbance extent and extent of the proposed open cut mining areas has reduced. The changes in groundwater predictions as a result of the amended open cut mining pit extents and revised mine progression have been modelled by AGE (2024) for the amended Project.

It is noted the predicted extent of groundwater drawdown due to the Project is limited due to the extensive unsaturated areas in the vicinity of the Project, the subcrop of the Ulan Seam west of the Project, and erosion of the Ulan Seam and the overburden beneath Moolarben Creek. As a result, the contribution of the Project to cumulative drawdowns from the approved Moolarben Coal Complex and surrounding mines is negligible (AGE, 2024).

Consistent with the assessment undertaken for the EIS, updated groundwater modelling for the amended Project predicted the following (AGE, 2024):

- a predicted peak in groundwater inflows to the open cut mining pits of approximately 156 ML per annum in 2027, which has reduced compared to the predictions presented in the EIS at a peak of approximately 181 ML per annum in 2029;
- an overall reduction in the extent of groundwater drawdown (during operations) and mounding (post-mining) compared to the predictions presented in the EIS;
- a predicted reduction in baseflow to Moolarben Creek of 2.3 ML per annum, compared to 2.8 ML per annum presented in the EIS, which is considered negligible in consideration of the modelled baseflow to and observed streamflow in Moolarben Creek;
- no privately-owned bores predicted to experience drawdown greater than 2 m in accordance with the "minimal impact" criteria of the NSW *Aquifer Interference Policy*, consistent with the EIS; and
- no predicted drawdown or impacts at local spring features within and adjacent to the Munghorn Gap Nature Reserve and no predicted impacts at the Drip, consistent with the EIS.

3. Potential Indirect Impacts to Surrounding Groundwater Systems, Including Munghorn Gap Nature Reserve and Goulburn River National Park

The Project would not result in any groundwater drawdown in the vicinity of the Goulburn River under the amended mine plan and predicted drawdown of the watertable is not expected to propagate beyond the MCO mining lease (AGE, 2024). In addition, the amended Project would result in negligible changes to baseflow in Moolarben Creek.

Groundwater modelling completed for the Project indicates (AGE, 2024):

- minimal drawdown in the Moolarben Creek alluvium or downstream Goulburn River alluvium; and
- negligible changes to baseflow in Moolarben Creek or the Goulburn River.

Accordingly, it is unlikely that the Project would result directly or indirectly in a substantial change in the hydrology of groundwater resources within the Goulburn River National Park or Munghorn Gap Nature Reserve. Given the location of the Project and limited associated extent of drawdown predicted, the Project would not impact the Drip (AGE, 2024).

4. Potential Impacts to Seep and Spring Features

There are four spring features (Pinemount Spring, Spring/Ferns, Coonaroo Springs and MGNR Spring) located south of the Project area along the boundary of the Munghorn Gap Nature Reserve or within the Nature Reserve (Figure 4-12).

Analysis of water samples from the springs has identified that the water sources are relatively recent in age (i.e. terms of groundwater residence time), with no mixing with regional groundwaters (i.e. supporting the conceptualisation of perched aquifers within the Triassic ridgelines) (AGE, 2022).

No drawdown has been predicted at these spring features, and therefore no impact to the spring features has been predicted (AGE, 2024). The Groundwater Assessment concludes that the Project is unlikely to impact on water dependent assets in the Munghorn Gap Nature Reserve as these are not connected to the regional groundwater system (AGE, 2022).

5. Groundwater Dependent Ecosystems

A. Potential indirect impacts from groundwater drawdown

Patches of terrestrial vegetation along Moolarben Creek adjacent to Project disturbance areas and associated low-lying areas are conservatively considered as potential terrestrial GDEs (Figure 4-13). AGE (2024) has updated the groundwater modelling for the amended Project, including the assessment of potential terrestrial GDEs.

With the implementation of additional avoidance measures, AGE (2024) concluded approximately 6 ha of potential terrestrial GDEs are located within the maximum predicted 2 m of groundwater drawdown for the amended Project extent (Figure 4-13).

The Project would not result in a long-term reduction in water availability for terrestrial vegetation along Moolarben Creek and associated low-lying areas, as open cut mining areas would be progressively backfilled to restore pre-mining hydraulic gradients and allow water levels to recover.

Monitoring indicates groundwater levels naturally vary in the alluvial sediments and paleochannel aquifer unit by up to 3 m and in the Ulan Seam unit by up to 5 m near the potential terrestrial GDEs predicted to experience some drawdowns.

Drawdowns predicted at the potential terrestrial GDEs by AGE (2024) are similar to the natural variations observed at monitoring bores across the Project area. As such, the predicted drawdown of the Project is not expected to significantly impact on the potential terrestrial GDEs in consideration of the natural climatic variation of the groundwater levels near these areas, the surface water availability and efficient backfilling of the Project open cut pits.

In addition, the potential terrestrial GDEs located within the predicted maximum 2 m drawdown extent for the amended Project are located along the major surface water drainage lines, which are predicted to experience negligible change in baseflow and stream flows. Therefore, the terrestrial vegetation will continue to receive any surface flow contributions and would not be significantly impacted by the Project.

B. Proposed mitigation and monitoring

In their submission on the EIS, DPE – Water stated that they agree with the selection of proposed monitoring sites for the Project.

AGE (2022) recommended a number of additional groundwater monitoring locations be installed for the Project, including within areas of potential terrestrial GDEs to monitor drawdown. AGE (2024) consider that these recommendations are sufficient for the amended Project. The Moolarben Coal Complex Water Management Plan (including the Groundwater Management Plan) would be reviewed in an updated or new Water Management Plan to reflect the Project, including any additional monitoring of GDEs.

6. Impacts to Groundwater Quality as a Result of Recharge from Backfilled Pits

Project open cut pits would be progressively backfilled as mining progresses. The shallow depth of the target Ulan Seam (average depth of 34 m within the Project mining areas) facilitates the efficient extraction and subsequent backfilling of the open cut mining areas, which reduces the length of time the open cut pits would potentially act as localised groundwater sinks (AGE, 2024).

There would be a change in hydraulic properties where the waste rock is subsequently used to backfill the open cut pits. The backfilled waste rock would have a higher permeability than the pre-mined natural rock due to its higher porosity and also has enhanced groundwater recharge, which were adopted in the groundwater model. The differences in these parameters can result in a ‘reversal’ from mining-induced groundwater drawdown, into groundwater mounding in the longer term, once groundwater levels recover from mining, and receive higher than antecedent groundwater recharge (AGE, 2024).

Groundwater mounding may locally cause groundwater levels to rise higher than pre-mining levels and induce a potentiometric gradient away from backfilled pit areas. Not including a long-term evaporative sink such as a residual void in the final landform may also exacerbate localised groundwater mounding. Since the approved OC3 mining operations and Project area do not propose to include a residual void, watertable mounding is predicted in some localised areas.

An assessment of the geochemical characteristics of the waste rock material and reject materials associated with the development of the Project was provided in the EIS. It is noted that the waste rock materials generated from the Project have a very low sulfur content, excess acid neutralising capacity and would be classified as non-acid forming (NAF) (RGS, 2022).

The flow of water through the backfilled open cuts to the palaeochannel and Moolarben Creek is not anticipated to result in a detrimental impact to downstream water quality on the basis that:

- Open cut pits will be backfilled with natural rock material excavated in the process of accessing the coal.
- Groundwater flow from the backfilled open cuts would represent a small proportion of the total flows in Moolarben Creek.
- Groundwater in the backfilled waste rock would be generally fresh due to the relatively high recharge rate (as is evident in existing groundwater monitoring within waste rock emplacement areas at the Moolarben Coal Complex).
- The expected salinity of groundwater in the backfilled waste rock (based on average TDS for existing waste rock bores) is less saline than the baseline water quality in Moolarben Creek.
- Waste rock material would be NAF and contain low levels of dissolved trace metals/metalloids.
- CHPP rejects would be managed in accordance with approved procedures at the Moolarben Coal Complex to avoid oxidisation and the potential mobilisation of metals/metalloids.
- The amended Project significantly reduces, in the extent and magnitude, the predicted residual groundwater drawdown and mounding at the end of the recovery period within the water table hosting sediments, and also reduces the radius of influence of mounding within the deeper Ulan Seam.

Notwithstanding, MCO would add the monitoring bores recommended by AGE (2022) to the groundwater monitoring network for the Project. These additional monitoring bores would complement the existing monitoring program and be used to monitor for potential impacts to key water features, including Moolarben Creek and potential terrestrial GDEs. Monitoring bores established in the backfilled waste rock would monitor groundwater recovery and associated flow directions and gradients.

MCO would continue to monitor groundwater level and quality in accordance with the approved Water Management Plan (including the Groundwater Management Plan) for the Project (subject to conditions of any Development Consent).

7. Justification of Stygofauna Sampling and Assessment for the Project

Additional stygofauna survey of bores within the Project area and springs to the south of the Project were undertaken by Bio-Analysis in response to comment from NPWS (Section 4.1.1).

Similar to the findings from previous stygofauna surveys undertaken for the EIS, bores within the vicinity of the Moolarben Coal Complex undertaken, no stygofauna were recorded from the bore sampling during the additional surveys (Bio-Analysis, 2023).

Additional samples from the springs in the vicinity of the Project identified at least five species of stygofauna, and invertebrate assemblages were mostly comprised of crustaceans (amphipods, ostracods, cyclopoid copepods) and oligochaete worms (Bio-Analysis, 2023).

There is no drawdown predicted for the springs as a result of the Project (AGE, 2024), as a result, the additional stygofauna sampling recommended by the IESC did not change the conclusions of Aquatic Ecology Assessment (Bio-Analysis, 2022).

MCO would adopt the recommendation from AGE (2022) (which is unchanged for the amended Project [AGE, 2024]) to install three additional vibrating wire piezometers adjacent to local spring features to monitor for potential impacts.

4.2.3 Surface Water

Comments made in public and organisation submissions relevant to surface water include:

1. Site Water Balance.
    A. Forecast water consumption at the Moolarben Coal Complex CHPP including the Project.
    B. Modelling of climate scenarios.
2. Loss of catchment and baseflows to Moolarben Creek and downstream Goulburn River, including cumulatively since commencement of mining in the region.
3. Additional release of water to the Goulburn River.
4. Impacts to downstream surface water quality from overflows of sediment dams.

Responses to these comments are provided below.

1. Site Water Balance

A. Forecast water consumption at the Moolarben Coal Complex CHPP including the Project

ROM coal washing and processing at the Moolarben Coal Complex occurs at the CHPP, which is approved under the Stage 1 Project Approval (05_0117). ROM coal from the Project would be hauled to the CHPP to be processed along with ROM coal from the rest of the Moolarben Coal Complex.

The CHPP is the major water user at the Moolarben Coal Complex. The forecast net water consumption at the CHPP over the life of the Project was determined in the Surface Water Assessment prepared for the EIS (WRM, 2022). As a result of the amended Project, WRM (2024) has revised the forecast CHPP consumption (Table 4-20).

ROM coal from the Project only makes up a portion of the total coal processed at the Moolarben Coal Complex CHPP. In addition, the Moolarben Coal Complex is approved to process up to 16 Mtpa of ROM coal from its existing open cut mining areas (i.e. without the Project).

A significant proportion of mine site water requirements for the existing Moolarben Coal Complex are sourced from water collected on site, including rainfall runoff and groundwater inflows to open cut pits and underground mining areas. This water is stored in the mine water storages for recycling and reuse, including at the CHPP. MCO would comply with water licensing requirements under the NSW *Water Management Act 2000* over the life of the Project.

Table 4-20
Forecast CHPP Consumption

Stage	Year	Project only		Wider Moolarben Coal Complex		Total	
		Feed (Mt)	Net consumption (ML/a)	Feed (Mt)	Net consumption (ML/a)	Feed (Mt)	Net consumption (ML/a)
1	2025	2.9	233	13.1	1,047	16.0	1,280
	2026	5.0	400	11.0	880	16.0	1,280
	2027	8.5	680	7.5	600	16.0	1,280
2	2028	1.5	123	14.5	1,157	16.0	1,280
	2029	1.9	154	14.1	1,126	16.0	1,280
3	2030	1.8	143	14.2	1,137	16.0	1,280
	2031	2.2	173	13.8	1,107	16.0	1,280
4	2032	2.2	175	13.8	1,105	16.0	1,280
	2033	2.2	176	13.8	1,104	16.0	1,280
	2034	1.6	125	14.4	1,155	16.0	1,280

After: WRM (2024)

B. Modelling of Climate Scenarios

The potential implications of climate change (e.g. prolonged dry periods and storm surges) on local surface water resources were considered in the Project Surface Water Assessment (WRM, 2022) and have been reviewed for the amended Project in the amended Surface Water Report (WRM, 2024).

The sensitivity analysis used climate change projections and methodologies outlined in *Climate Change in Australia Technical Report* ([CSIRO and BOM, 2015) for a range of climatic variables including temperature, rainfall, wind speed and potential evapotranspiration.

For the sensitivity analysis, the performance of the Project water management system has been undertaken using the Representative Concentration Pathway 8.5 (RCP 8.5) for Year 2035 (representative of conservative climate changes conditions over the life of the Project). Potential changes in climate were obtained using the projection builder tool provided in the *Climate Change in Australia* website (CSIRO, 2023). Climate variable inputs for the 'best-case' (Scenario 1) and 'worst-case' (Scenario 2) as defined by CSIRO (2015) for the RCP 8.5 climate change scenarios are provided in Table 4-17.

A summary of the results from the assessment of the Project water management system performance under climate change sensitivity analysis scenarios is provided in Table 4-18 and further detail is provided in the response to the IESC advice (Section 4.1.5).

MCO would also implement an adaptive management approach to climate change impacts throughout the life of the Project, consistent with Yancoal's broader Environmental, Social and Governance Strategy (Yancoal, 2022b).

2. Loss of Catchment and Baseflows to Moolarben Creek and Downstream Goulburn River

The impact of catchment excision due to the Project during operations and post-mining to flows in Moolarben Creek and Goulburn River was assessed as negligible, as:

- The frequency of occurrence of flow events in Moolarben Creek and Goulburn River would not be significantly altered as demonstrated by flow-duration curves with and without the Project (e.g. no change to zero flow or low flow days).
- Catchment excision due to the Project only occurs for a period of approximately 10 years, with the maximum catchment excision only occurring for a period of 3 years. After this time period, the full catchment area is restored as the final rehabilitated landform for the Project is designed to be free-draining.
- Moolarben Creek Dam regulates downstream flows, in accordance with the conditions requiring environmental flows, in a manner that is not related to rainfall.

In addition, no impact is predicted for any of the identified local springs surrounding the Project (i.e. no groundwater drawdown). Freshwater samples from the springs are relatively recent (in terms of groundwater residence time), with no mixing with regional groundwaters (i.e. supporting the conceptualisation of perched aquifers within the Triassic ridgelines) (AGE, 2022). The Groundwater Assessment concludes that the Project is unlikely to impact on water dependent assets in the Munghorn Gap Nature Reserve as these are not connected to the regional groundwater system.

As such, there would be negligible impacts associated with the Project to the surface water resources and water-dependent assets downstream of the Project along Moolarben Creek and Goulburn River. Further information regarding changes in flow regimes is provided in response to the IESC advice (Section 4.1.5).

3. Additional Release of Water to the Goulburn River

Controlled releases of water to the Goulburn River do not form part of the Project, and would continue to be undertaken in accordance with the Moolarben Coal Complex Stage 1 and Stage 2 Project Approvals and relevant EPL conditions (including discharge limits).

4. Impacts to Downstream Surface Water Quality from Overflows of Sediment and Uncontrolled Spills

The base case site water balance for the Project water management system performs under all climatic conditions with no uncontrolled spills of mine water dams and limited requirement for in-pit storage under wetter climatic conditions.

During operations, progressive rehabilitation of the waste rock emplacements will minimise the potential generation of sediment. The existing Moolarben Coal Complex Water Management Plan would be reviewed in an updated or new Water Management Plan to include the Project. The following broad principles of erosion and sediment control apply at the existing Moolarben Coal Complex:

- minimise the area of disturbance;
- where possible, apply local temporary erosion control measures;
- intercept runoff from undisturbed areas and divert around disturbed areas; and
- where temporary measures are likely to be ineffective, divert runoff from disturbed areas to sedimentation basins prior to release from the site.

Environmental risks from sediment water are expected to be low (WRM, 2024). In rainfall events below the design standard, runoff from disturbed areas would be intercepted and treated by sediment dams. In larger events that exceed the design standards, these dams would overflow following a period of settlement.

4.2.4 Biodiversity

Comments made in public and organisation submissions relevant to biodiversity include:

1. Loss of native vegetation and associated species habitat in Moolarben Valley.
2. Potential impacts to riparian vegetation and habitat along Moolarben Creek and Murdering Creek.
3. Potential impacts to Habitat for Serious and Irreversible Impact Entities.
4. Potential impacts to the Munghorn Gap Nature Reserve and associated species habitat.
   A. Proximity of Project operations to the boundary of the Nature Reserve.
   B. Loss of habitat connectivity and conservation value.
   C. Potential indirect impacts due to Project operations.
5. Assessment of quality of aquatic ecology habitat.
6. Cumulative Biodiversity Impacts.
7. Proposed Biodiversity Offset Strategy for the Project.

Responses to these comments are provided below.

1. Loss of Native Vegetation and Associated Species Habitat in Moolarben Valley

Proposed Avoidance and Minimisation Measures and Residual Biodiversity Impacts

The Project is an extension of approved open cut operations within existing mining and exploration tenements. The new mining areas associated with the Project are largely contiguous with the approved and operating OC3 mining area.

The Project as presented in the EIS would result in the clearance of approximately 825 ha (out of a total Study Area of 1,680 ha), including approximately 625 ha of native vegetation and approximately 200 ha of non-native vegetation, and incorporated a number of measures to avoid and minimise impacts to environmental features, native vegetation and threatened species habitat within the study area, including:

- Avoiding disturbance of mapped rocky habitat associated with threatened bat species and the Broad-headed Snake.
- Minimising disturbance of vegetation/habitat associated with steeper terrain adjacent to Munghorn Gap Nature Reserve, as far as practicable.
- No open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek or within 50 m of the Munghorn Gap Nature Reserve.
- Minimising the extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek as far as practicable.
- Locating haul road creek crossings within previously cleared areas, where practicable and feasible.
- Maximising use of existing infrastructure at the Moolarben Coal Complex (i.e. coal handling and transport infrastructure) to minimise construction of additional infrastructure areas for the Project.
- Preferentially locating disturbance in Category 1 – exempt land or where vegetation/habitat is in the poorest condition (e.g. low quality DNG).
- Reducing the number of voids in the Moolarben Valley from one to zero, therefore increasing the area available for rehabilitation and post-mining land uses.

MCO has reviewed the Project design and reduced the indicative surface disturbance extent to further avoid and/or minimise impacts to threatened species habitat.

As a result of the proposed additional avoidance and minimisation measures for the amended Project, the indicative surface disturbance extent has reduced by approximately 150 ha compared to the Project EIS (i.e. from approximately 825 ha to 675 ha total disturbance area). The amended Project indicative surface disturbance extent of approximately 675 ha is comprised of approximately 480 ha of native vegetation and approximately 195 ha of non-native vegetation.

Additional avoidance and minimisation measures for the amended Project include:

- Avoidance of any mining-related disturbance within 100 m of the Munghorn Gap Nature Reserve (noting the EIS proposed no open cut mining within 50 m of the Munghorn Gap Nature Reserve).
- Avoidance of any clearance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species (i.e. Large-eared Pied Bat and Eastern Cave Bat) and the Broad-headed Snake (noting the EIS proposed avoidance of any clearance of mapped rocky habitat).
- Approximately 59% (i.e. 50 ha) less disturbance of the woodland component of Box-Gum Woodland CEEC compared to the Project EIS.
- Approximately 56% (i.e. 103 ha) less disturbance of Regent Honeyeater Important Habitat Mapping compared to the Project EIS.
- Reduced disturbance of potential habitat for other threatened fauna species habitat including Pink-tailed Legless Lizard, Koala, Swift Parrot and Squirrel Glider.

Residual biodiversity impacts would be offset in accordance with the BC Act.

Mitigation, Enhancement and Rehabilitation Measures

A number of additional mitigation, enhancement and rehabilitation measures are proposed for the amended Project compared to the EIS.

To limit potential indirect impacts, MCO has amended the Project design to avoid all mining-related disturbance within 100 m of the Munghorn Gap Natures Reserve. In addition, a specific vibration limit of 50 mm/s PPV has been developed for mapped rocky habitat to mitigate potential impacts to associated threatened species (i.e. threatened bats and Broad-headed Snake) during mining (unless further geotechnical investigation supports a higher value).

The Project as presented in the EIS proposed to establish a Habitat Enhancement Area within approximately 160 ha of the riparian zones along Moolarben and Murdering Creek to improve the condition of remnant vegetation, enhance habitat connectivity with the Munghorn Gap Nature Reserve and provide a net increase in native vegetation and associated species habitat in the Moolarben Valley during the life of the Project. To further mitigate potential impacts to threatened species habitat, the amended Project would extend the Habitat Enhancement Area by approximately an additional 28 ha (to a total of 188 ha).

In consideration of the extent of native woodland clearance proposed for the amended Project (i.e. approximately 113 ha), revegetation within the extended Habitat Enhancement Area would provide a net increase in woodland in the Moolarben Valley of approximately 22 ha during mining (i.e. not including rehabilitation) (Table 4-21).

As a component of the review of the Project design, MCO has identified an opportunity to increase the area rehabilitated to native vegetation from approximately 325 ha to 535 ha. Considering the extended Habitat Enhancement Area and rehabilitation cumulatively, there is a long-term net increase in native woodland in the Moolarben Valley of approximately 557 ha (Table 4-21).

Table 4-21
Net Increase in Native Woodland as a Result of the Project

Native Woodland Area	Project EIS	Amended Project
Native Woodland Vegetation Clearance	(230 ha)	(113 ha)
Total Revegetation during Mining (within Habitat Enhancement Area)	90 ha	135 ha
Net Increase in Woodland in Study Area during Mining	**- 140 ha**	**+ 22 ha**
Native Woodland Rehabilitation	325 ha	535 ha
Net Increase in Woodland in Study Area Following Completion of Mining and Rehabilitation	**+ 185 ha**	**+ 557 ha**

2. Potential Impacts to Riparian Vegetation and Habitat along Moolarben Creek and Murdering Creek

The Project would minimise potential impacts to biodiversity values within the riparian corridor along Moolarben and Murdering Creek through:

- avoiding open cut mining within 200 m of the high bank of Moolarben Creek and Murdering Creek;
- minimising the extent of infrastructure within the riparian zone of Moolarben Creek and Murdering Creek where practicable and feasible;
- condensing the indicative surface disturbance extent as far as practicable by locating infrastructure areas immediately adjacent to open cut mining areas; and
- locating haul road creek crossings within previously cleared areas, where practicable and feasible.

In addition, the proposed Habitat Enhancement Area would be established within riparian zones along Moolarben and Murdering Creeks outside the indicative surface disturbance extent. The revegetation proposed within the Habitat Enhancement Area can occur during Project operations and, therefore, provide mitigation prior to rehabilitation within the indicative surface disturbance extent.

3. Potential Impacts to Habitat for Serious and Irreversible Impact Entities

Five species were identified as potential SAII entities for the Project, namely the Large-eared Pied Bat, Eastern Cave Bat, Broad-headed Snake, Regent Honeyeater and Box-Gum Woodland CEEC.

The indicative surface disturbance extent for the Project has been reduced to incorporate additional avoidance and minimisation measures. The areas proposed for further avoidance and minimisation have targeted key threatened species habitat for potential SAII entities, largely contiguous remnant woodland vegetation, as well as further setback from the Munghorn Gap Nature Reserve and rocky habitat features.

Further detail regarding additional avoidance and minimisation measures for each of the species is provided below and summarised in Table 4-22.

Large-eared Pied Bat, Eastern Cave Bat and Broad-headed Snake

The amended Project includes additional setbacks such that there would be no direct disturbance of mapped rocky habitat (as proposed in the EIS) and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with the Large-eared Pied Bat, Eastern Cave Bat and the Broad-headed Snake (Table 4-22). On this basis, the Project would completely avoid areas that require consideration of SAII for these entities.

In addition, a blast vibration limit of 50 mm/s would be applied to mapped rocky habitat associated with the Large-eared Pied Bat, Eastern Cave Bat and Broad-headed Snake (unless further geotechnical investigation supports a higher value).

Suitably qualified experts (Andrew Lothian and Glenn Hoye) have undertaken a review of the potential residual impacts of the amended Project (after implementation of proposed avoidance and minimisation measures) to the Large-eared Pied Bat, Eastern Cave Bat and Broad-headed Snake and concluded the amended Project would not contribute significantly to the risk of the species becoming extinct (Biodiversity Monitoring Services, 2024a; 2024b).

Regent Honeyeater

The amended Project indicative surface disturbance extent would reduce disturbance of Regent Honeyeater Important Habitat Mapping (prepared by NSW DCCEEW) by approximately 56% (an additional 103 ha) compared to the Project EIS (Table 4-22).

Dr Stephen Debus (a suitably qualified expert) has undertaken a review of the potential for SAII of Regent Honeyeater as a result of the amended Project, which concluded the residual impact of the Project would not contribute significantly to the risk of the Regent Honeyeater becoming extinct (Debus, 2023).

Box-Gum Woodland CEEC

The amended Project indicative surface disturbance extent would reduce disturbance of the woodland component of Box-Gum Woodland CEEC by approximately 59% (an additional 50 ha) and the DNG component by approximately 7% (an additional 28 ha) compared to the Project EIS (Table 4-22).

The Project would result in a long-term increase in native woodland in the Moolarben Valley by approximately 557 ha due to proposed revegetation and rehabilitation, including species consistent with Box-Gum Woodland CEEC.

Dr Colin Driscoll (a suitably qualified expert) has undertaken a review of the potential for SAII of Box-Gum Woodland CEEC as a result of the amended Project, which concluded the Project would not contribute significantly to the risk of Box-Gum Woodland CEEC becoming extinct (Hunter Eco, 2024).

4. Potential Impacts to the Munghorn Gap Nature Reserve and Associated Species Habitat

A. Proximity of Project operations to the Boundary of the Nature Reserve

The Project EIS proposed to avoid open cut mining within 50 m of the Munghorn Gap Nature Reserve, consistent with the approved Moolarben Coal Complex.

MCO has amended the Project to include additional setbacks to avoid all mining-related disturbance within at least 100 m of the Munghorn Gap Nature Reserve. In some areas the amended Project indicative surface disturbance extent is greater than 100 m from the boundary of the Munghorn Gap Nature Reserve due to other proposed avoidance and minimisation measures.

Table 4-22
Summary of Habitat Avoidance

Common Name	Scientific Name	Habitat Component	Project Study Area	Project EIS Footprint	Amended Project Footprint		
					Total Habitat	Habitat Avoidance	
			Total Habitat	Total Habitat		Compared to Study Area	Compared to EIS Footprint
Box-Gum Woodland CEEC	*White Box - Yellow Box - Blakely's Red Gum Grassy Woodland and Derived Native Grassland*	Woodland	213 ha	84 ha	34 ha	84%	59%
		Derived Native Grassland (DNG)	648 ha	394 ha	366 ha	43%	7%
Large-eared Pied Bat and Eastern Cave Bat	*Chalinolobus dwyeri and Vespadelus troughtoni*	Mapped rocky habitat	137 ha	**Complete avoidance**			
		Breeding habitat	376 ha	39 ha	**Complete avoidance**		
Broad-headed Snake	*Hoplocephalus bungaroides*	Mapped rocky habitat	137 ha	**Complete avoidance**			
		Breeding habitat	239 ha	38 ha	**Complete avoidance**		
Regent Honeyeater	*Anthochaera phrygia*	Mapped 'Important' Habitat	683 ha	184 ha	81 ha	88%	56%

B. Loss of habitat connectivity and conservation value

The riparian vegetation along Moolarben and Murdering Creeks provides connectivity and flora and fauna habitat in a roughly north-south direction across the Moolarben Valley. Habitat within the Project indicative surface disturbance extent is largely fragmented and isolated patches of native woodland.

While there would be creek crossings, most of this vegetation would not be impacted by the Project and would be retained and revegetated during mining as part of the proposed Habitat Enhancement Area. The retention of this vegetation throughout the life of the Project would allow for the continued use of this habitat for fauna species.

Rehabilitation would be undertaken progressively throughout the life of the Project as mining advances through the open cut pits. Rehabilitated areas of native vegetation and species habitat would therefore be available within the Project indicative surface disturbance extent prior to completion of mining (as early as 2029), reducing the overall period that habitat is unavailable.

The proposed Habitat Enhancement Area and rehabilitation for the Project would result in a net increase in native woodland in the Moolarben Valley of approximately 557 ha and associated improvement in habitat connectivity in the long-term.

C. Potential Indirect Impacts due to Project Operations

As described above, there would be no mining-related disturbance within 100 m of the Munghorn Gap Nature Reserve as a result of the amended Project. The amended Project would also avoid any clearance of mapped rocky habitat and breeding habitat (defined as relevant vegetation within 100 m of mapped rocky habitat) associated with threatened bat species and the Broad-headed Snake.

MCO would implement all reasonable and feasible measures to minimise noise, dust, lighting, blast and vibration impacts from the Project as per existing environmental management plans for the Moolarben Coal Complex, which would be updated for the Project or a new management plan prepared for the Project. In the medium to long-term (i.e. following completion of mining for the Project), there would be no indirect impacts.

MCO would implement a blast vibration limit of 50 mm/s PPV at mapped rocky habitat features, which would also limit vibration at sensitive geological features located further from blasting than the mapped rocky habitat (e.g. deeper into the Munghorn Gap Nature Reserve), unless further geotechnical investigation supports a higher value.

Noise may temporarily disrupt individual animals near the mine during operations (noting the Project life is only 10 years), however, there is unlikely to be any loss in biodiversity as a result of noise, as evidence by extensive records coincident with existing mining.

Additional indirect artificial lighting impacts on the Munghorn Gap Nature Reserve due to the Project would be minimal, localised and short-term (limited to the duration/direction of the artificial lighting). Similarly, potential impacts from dust are likely to be indistinguishable from background dust levels, and limited to the duration of construction and operations.

In the absence of the Project, the Munghorn Gap Nature Reserve would continue to experience indirect impacts from the approved operations of the Moolarben Coal Complex (until 2038) and Wilpinjong Coal Mine (until 2034), as well as other anthropogenic noise sources including public roads running through and adjacent to the Munghorn Gap Nature Reserve, and farming machinery, dirt bikes and licensed hunting activities.

The amended Project design and implementation of proposed mitigation and management measures would result in negligible impact to the Munghorn Gap Nature Reserve. MCO would continue ongoing consultation with NPWS in relation to existing mining activities at the Moolarben Coal Complex, including the Project.

5. Assessment of Quality of Aquatic Ecology Habitat

There would be no open cut mining for the Project within 200 m of the high bank of Moolarben and Murdering Creeks and disturbance of riparian vegetation would be limited to the three proposed haul road creek crossings.

A number of small ephemeral drainage lines would be disturbed for the Project, including Spring Creek and minor tributaries of Moolarben Creek. There would be a reduction in habitat available to aquatic flora and fauna as a result of the removal of these ephemeral drainage lines. However, these habitats do not provide sufficient permanent habitat for aquatic biota as flow only occurs during heavy or prolonged rainfall events.

To ensure potential impacts to aquatic ecology are mitigated, the Project would design creek crossings to maintain aquatic habitat connectivity (i.e. the Project would incorporate water management features designed to avoid and minimise environmental impacts) and monitor potential impacts on stream health, surface water quality, groundwater quality and water levels as outlined in the existing Water Management Plan.

It is noted that surface water quality measurements undertaken for the Aquatic Ecology Assessment (Bio-Analysis, 2022) were assessed against the default trigger values recommended by ANZECC & ARMCANZ (2000). Surface water quality monitoring data in the Surface Water Assessment (WRM, 2022) was assessed against the site-specific trigger levels developed using statistical analysis of background data. The ANZECC & ARMCANZ (2000) guidelines recommend that wherever possible, site-specific data is used to define investigation trigger values for physical and chemical factors which can adversely impact the environment.

6. Cumulative Biodiversity Impacts

Cumulative impacts are considered to be the total impact on the environment that would result from the incremental impacts of the Project in addition to past, present and reasonably foreseeable planned developments that may interact with Project impacts.

Relevant to the Project, other major developments in the locality include the approved Moolarben Coal Complex, Wilpinjong Coal Mine, Ulan Mine Complex, other mining operations and renewable projects associated with the Central West Orana Renewable Energy Zone.

The approved Moolarben Coal Complex includes approximately 2,940 ha of approved disturbance and more than approximately 7,000 ha of biodiversity offset areas to maintain long-term environmental benefit.

Although the Project would add to the cumulative impacts from other major developments in the locality, including the Moolarben Coal Complex, it would also add to the cumulative area of land conserved for biodiversity in the form of offset areas. MCO currently manages land within a number of biodiversity offset areas established to offset impacts related to the approved Moolarben Coal Complex.

The Project life is only 10 years, and the proposed Habitat Enhancement Area and rehabilitation in the final landform would provide a net increase in native woodland and habitat in the Moolarben Valley. In addition, the Project would facilitate backfilling of an approved final void in the existing OC3 mining area, increasing the total area available for rehabilitation by approximately 24 ha.

7. Proposed Biodiversity Offset Strategy for the Project

As a result of the additional avoidance and minimisation measures for the amended Project, as well as further assessment and survey undertaken since lodgement of the EIS, the offset liability for the Project has reduced. The revised BDAR (Niche, 2024a) has calculated the offset requirement for the amended Project in accordance with the BAM (DPIE, 2020). Further detail on the revised offset liability is provided in the Amendment Report.

Development of the amended Project would still occur in three key stages; however, the extent of each stage has been updated to reflect the revised mine progression. Consistent with the EIS, MCO would address the ecosystem and species credit requirement associated with each of the updated stages for the amended Project prior to commencement of relevant disturbance.

Residual potential impacts from the amended Project on biodiversity would be offset in accordance with the BC Act, including the retirement of credits, funding of a biodiversity conservation action and/or payment into the Biodiversity Conservation Fund. MCO would address the Commonwealth offset requirement consistent with the NSW Biodiversity Offsets Scheme under the Bilateral Agreement.

MCO is expecting land based offset options to be available to secure the Project's total offset liability for the Regent Honeyeater and Koala (and potential for other threatened species following targeted surveys), including options to establish land-based offsets using Moolarben-owned land in the region.

MCO is also investigating two potential "on-site" offset areas within the Project Study Area, associated with Regent Honeyeater Important Habitat Mapping, Box-Gum Woodland CEEC and other recorded threatened species and their habitat (including Large-eared Pied Bat, Eastern Cave Bat, Pink-tailed Legless Lizard, Squirrel Glider and Koala).

4.2.5 Social

Comments made in public and organisation submissions relevant to social aspects included:

1. Employment opportunities associated with the Project.
2. Potential impacts to sense of community and wellbeing.
3. Adequacy of community consultation.

Responses to these comments are provided below.

1. Employment Opportunities Associated with the Project

Mining in the approved OC3 mining area is forecast to be completed in 2025. Mining of the Project area would follow the completion of the approved OC3 operations and therefore this workforce (and mining fleet) would be employed in the Project area.

Up to approximately 400 personnel from the existing Moolarben Coal Complex workforce would be employed for the Project. The Project would provide continuity and security of employment by extending the duration of employment for the existing open cut workforce.

The existing Moolarben Coal Complex has a peak workforce of up to approximately 1,000 personnel. This would not change as a result of the Project (i.e. the cumulative peak workforce of the Moolarben Coal Complex including the Project would also be up to approximately 1,000 personnel). However, the Project would result in an extension of peak cumulative employment for a longer period.

In addition to the extension of employment of the open cut workforce at the Moolarben Coal Complex, the Project would generate other expenditure-induced indirect jobs and provide support for local and regional businesses.

2. Potential Impacts to Sense of Community and Wellbeing

The Project has been designed so that no additional residences require acquisition or mitigation compared to the existing Moolarben Coal Complex.

Mining operations for the Project would be a greater distance from Cooks Gap than the existing Moolarben Coal Complex, and would progressively move further south and southeast. The nearest private residence to the Project area is 2.5 km to the south in Cooyal. The second closest residence, after Cooyal is situated in Cooks Gap (approximately 5 km from the indicative surface disturbance extent).

No views of the Project are available as the surrounding elevated topography provides a natural barrier between the Project and nearby private residences at Cooyal to the south and Cooks Gap to the west, also limiting potential amenity impacts. Compliance with the relevant noise, air, and blast criteria is predicted at all private residences.

Project operations would occur within the approved mine life of the Moolarben Coal Complex to 2038 (i.e. from 2025 to 2034). Therefore, the Project would not result in any extension in duration of potential amenity impacts beyond those previously approved. It is noted the Wilpinjong Coal Mine is also approved for operation until 2034.

MCO would continue to provide funding contributions throughout the life of the Moolarben Coal Complex to local community programs and groups via the Community Support Program, as well as to the MWRC via existing and ongoing contributions under the Stage 1 and Stage 2 Project Approvals.

3. Adequacy of Community Consultation

Community engagement to support the Project was undertaken throughout preparation of the EIS in accordance with *Undertaking Engagement Guidelines for State Significant Projects* (DPE, 2021a), including targeted engagement to inform the Social Impact Assessment (SIA) in accordance with the *Social Impact Assessment Guideline for State Significant Projects* (DPE, 2021b).

MCO has consulted with a range of stakeholders including Federal, State and local government agencies, infrastructure and service providers, surrounding mines and the local community to obtain feedback on the proposed assessment approach, potential impacts and proposed mitigation and management measures for the Project.

Public consultation undertaken by MCO for the Project included:

- provision of Project updates to the Moolarben Community Consultative Committee at regular quarterly meetings;
- distribution of community newsletters in June 2021, February, August and November 2022 and March 2024 to provide updates to the local community about the Project and contact details for MCO to request further information or provide feedback;
- community information sessions in August and December 2022 to provide opportunity for members of the public to discuss the Project with MCO and provide feedback;
- maintenance of a Project-specific page on the Moolarben website to provide contact information (dedicated email and phone number) as well as newsletters and details of community information sessions;
- Aboriginal community consultation to support the ACHA; and
- notification of MCO staff and contractors.

Targeted engagement was also undertaken by a specialist (CDM Smith) to inform the SIA for the Project, which included:

- private landholders from Cooks Gap, Cooyal, Stoney Creek and Ulan;
- members of the Moolarben CCC members,
- representatives of organisations and agencies, including Mudgee Local Aboriginal Land Council, MWRC, NPWS, NSW Police Mudgee, NSW Rural Fire Service, State of Emergency Services, NSW Department of Education and Mudgee District Environment Group; and
- local businesses and service providers.

Stakeholders consulted for the SIA were either contacted directly to gauge their interest in participating, or identified via self-registration through the dedicated Project contact details.

4.2.6 Aboriginal Cultural Heritage

Comments made in public and organisation submissions relevant to Aboriginal cultural heritage include:

1. Potential impacts to Aboriginal cultural heritage sites.
    A. Further Detail regarding Aboriginal Cultural Heritage Sites Identified in the Subject Area.
    B. Potential Indirect Impacts to Aboriginal cultural Heritage Sites due to Blasting Activities.
    C. Proposed Monitoring and Management Measures.
2. Aboriginal Cultural Heritage Assessment.
    A. Justification of Survey Coverage.
    B. Clarification regarding Assessment of Potential for Scarred Trees within the Subject Area.
    C. Cultural Values Assessment.
    D. Further clarification of Cumulative Aboriginal Cultural Heritage Impacts.
3. Further Clarification of Native Title.

Responses to these comments are provided below.

1. Potential Impacts to Aboriginal Cultural Heritage Sites

A. Further Detail regarding Aboriginal Cultural Heritage Sites Identified in the Subject Area

The ACHA as presented in the EIS (Niche, 2022b) identified 130 known Aboriginal cultural heritage sites within the Subject Area and assessed it would result in the direct impact to 79 known Aboriginal heritages sites in or within 10 m of the Project EIS indicative surface disturbance extent.

Since lodgement of the EIS, MCO has amended the Project, including reducing the indicative surface disturbance extent to incorporate additional avoidance and minimisation measures. This has resulted in a reduced number of Aboriginal cultural heritage sites subject to direct impacts as well as updated management measures for sites subject to indirect impacts.

A total of eight new Aboriginal heritage sites (all assessed by Niche [2024b] as being of low scientific significance) were identified during the additional field surveys in 2023, therefore a total of 138 Aboriginal heritage sites have now been identified within the Subject Area.

The Aboriginal cultural heritage sites within the Subject Area are shown on Figure 4-14 and a summary of the revised level of proposed impact for the amended Project is provided in Table 4-2

Due to the reduced indicative surface disturbance extent, the amended Project would directly impact a total of 55 sites, comprising:

- five sites (9%) assessed as being of moderate scientific significance;
- four sites (7%) assessed as being of low-moderate scientific significance; and
- 46 sites (84%) assessed as being of low scientific significance.

A total of 71 known Aboriginal heritage sites within the Subject Area would not be directly impacted by the Project. A total of 12 Aboriginal rockshelter sites would be subject to potential indirect impacts from the Project.

Further detail is provided in Section 6.3 of the Amendment Report.

B. Potential Indirect Impacts to Aboriginal Cultural Heritage Sites due to Blasting Activities

For the purpose of impact assessment, and consistent with the existing Moolarben Coal Complex Blast Management Plan, all rockshelter sites located within 230 m of the indicative surface disturbance extent have the potential to be indirectly impacted by the Project. It is noted blasting would not occur in all areas of the indicative surface disturbance extent, however it has been conservatively assumed blasting could potentially occur across the full extent of proposed disturbance.

In accordance with the existing Moolarben Coal Complex Blast Management Plan, MCO has committed to adjusting blast designs such that ground vibration from blasting at shelter sites would not exceed the conservative 250 mm/s vibration damage criterion recommended by qualified blast experts (SLR, 2018).

MCO would therefore adjust blast designs for any blasts proposed within 230 m of all shelter sites in order to achieve this criterion and prevent damage from blasting. Thus, while blasting is identified as a potential indirect impact to some Aboriginal heritage sites located within proximity to the indicative surface disturbance extent, existing blasting management measures for shelter sites would result in no impact.

In response to comments on the EIS regarding protection of geological features in the Munghorn Gap Nature Reserve, blast vibration would be limited to 50 mm/s at mapped rocky habitat near the Project, unless further geotechnical investigation supports a higher value. Applying the blast vibration threshold at mapped rocky habitat would also limit the potential for vibration damage of shelter sites.

Blast vibration monitoring of shelter sites would be undertaken on a progressive basis to ensure that the relevant blast vibration limits are not exceeded.

Further detail is provided in the response to Recommendations 6.2 and 6.3 in the Heritage NSW submissions (section 4.1.2).

C. Proposed Monitoring and Management Measures

Mitigation, management and monitoring measures are detailed in the ACHA (Niche, 2024b) and have been developed in consultation with RAPs, in consideration of the approved management detailed in the existing Moolarben Coal Complex Heritage Management Plan and cultural and archaeological significance of the Aboriginal heritage sites predicted to be impacted.

Specific management recommendations for each Aboriginal heritage site in the Subject Area are detailed in the ACHA and summarised in Table 4-23, and include (Niche, 2024b):

- avoidance of Aboriginal sites and objects;
- surface collection (i.e. salvage) of the original objects;
- detailed recording of sites subject to salvage; and
- blast vibration monitoring for rockshelter sites located within 230 m of blasting.

In response to comments on the EIS, blast vibration would be limited to 50 mm/s at mapped rocky habitat near the Project, unless further geotechnical investigation supports a higher value. Applying the blast vibration threshold at mapped rocky habitat would also limit the potential for vibration damage of shelter sites.

Table 4-23
Summary of Site-Specific Management Recommendations for Sites within the Subject Area

Proposed management strategy	Sites	Total
Surface collection	S1MC104, S1MC110, S1MC118, S1MC119, S1MC145, S1MC146, S1MC147, S1MC148, S1MC149, S1MC150, S1MC151, S1MC216, S1MC217, S1MC218, S1MC220, S1MC397, S1MC400, S1MC416, S1MC417, S1MC418, S1MC419, S1MC420, S1MC421, S1MC422, S1MC423, S1MC437, S1MC439, S1MC440, S1MC441, S1MC450, S1MC454, S1MC455, S1MC489, S1MC497, S1MC498, S1MC499, S1MC500, S1MC501, S1MC502, S1MC503, S1MC504, S1MC505, S1MC526, S1MC542, S1MC543, S1MC545, S1MC550, S1MC551, S1MC552, S1MC553	50
Partial Surface Collection and partial Avoidance / Conservation *in-situ*	S1MC103, S1MC405, S1MC404, S1MC524, S1MC528	5
Avoidance/ Conservation *in-situ* and Blast vibration monitoring	S1MC403, S1MC508, S1MC509, S1MC510, S1MC511, S1MC512, S1MC513, S1MC514, S1MC516, S1MC517, S1MC518, S1MC540	12
Avoidance / Conservation *in-situ*	PAD 14 Moolarben Coal, S1MC105, S1MC106, S1MC107, S1MC108, S1MC109, S1MC111, S1MC112, S1MC113, S1MC114, S1MC116, S1MC128, S1MC130, S1MC132, S1MC133, S1MC134, S1MC135, S1MC136, S1MC137, S1MC153, S1MC154, S1MC155, S1MC156, S1MC196, S1MC197, S1MC208, S1MC209, S1MC210, S1MC211, S1MC212, S1MC213, S1MC214, S1MC215, S1MC402, S1MC415, S1MC453, S1MC456, S1MC115, S1MC117, S1MC120, S1MC121, S1MC122, S1MC123, S1MC124, S1MC125, S1MC126, S1MC127, S1MC129, S1MC219, S1MC224, S1MC401, S1MC452, S1MC515, S1MC519, S1MC520, S1MC521, S1MC522, S1MC523, S1MC525, S1MC529, S1MC530, S1MC531, S1MC532, S1MC533, S1MC534, S1MC535, S1MC536, S1MC538, S1MC539, S1M544, S1MC546	71
TOTAL		**138**

After: Niche (2024b)

Aboriginal cultural heritage sites would be managed in accordance with the principles outlined in the Moolarben Coal Complex Heritage Management Plan developed in consultation with RAPs, including:

- Survey of areas not subject to previously systematic survey.
- Management of sites outside of major surface development areas.
- Determining the likely impact of blasting and subsidence.
- Blast vibration monitoring of Aboriginal rockshelter sites.
- Following the protocol for recording and surface collection of Aboriginal cultural heritage sites.
- Following the protocol for controlled test excavation and/or salvage excavation where warranted.
- Management of previously unrecorded Aboriginal archaeological sites.
- Following the protocol for the discovery of human remains.
- Management of the Aboriginal archaeological sites database.
- Management of the keeping place.
- Following the protocol for damage to a known Aboriginal archaeological site.

An updated or new Heritage Management Plan would be prepared for the Project, including the Aboriginal heritage sites and values of the Project area as well as associated management measures.

2. Aboriginal Cultural Heritage Assessment

A. Justification of Survey Coverage

Prior to assessments for the Project, approximately 198 ha (16%) of the Subject Area had been previously surveyed.

An Aboriginal cultural heritage survey was completed in 2022 by Niche and representatives of the RAPs to inform the ACHA for the Project EIS. A total of approximately 241 ha (19.5%) of previously unsurveyed areas within the Subject Area were subject to archaeological survey during the 2022 program. Therefore, a total of approximately 440 ha (36%) of the Subject Area was subject to systematic survey for the ACHA undertaken for the Project EIS. The extent of survey coverage prior to the ACHA and undertaken in 2022 to inform the ACHA is shown on Figure 4-15.

In response to comments received on the ACHA presented in the EIS, an additional survey program was undertaken by Niche and representatives of the RAPs in 2023, resulting in approximately an additional 115 ha (9.5%) of survey of previously unsurveyed areas within the Subject Area (Figure 4-15).

Therefore, a total of approximately 554 ha (45%) of the Subject Area has been surveyed to date. The RAPs involved in the archaeological surveys expressed on-site that they consider the Subject Area has undergone thorough and extensive surveys.

The extensive archaeological survey, sub-surface test excavation program, and assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within (Niche, 2024b).

B. Clarification regarding Assessment of Potential for Scarred Trees within the Subject Area

As described above, a total of 554 ha (approximately 45%) of the Subject Area has been subject to systematic survey to date. The extensive archaeological survey, sub-surface test excavation program, and assessment and consultation process with RAPs undertaken to inform the Project ACHA substantially reduces the risk of a lack of scientific certainty for the Subject Area and Aboriginal cultural heritages sites identified within.

Prior to surface disturbance, areas not previously subject to systematic survey would be surveyed by an appropriately qualified and experienced archaeologist in consultation with RAPs

C. Cultural Values Assessment

An assessment of cultural values was undertaken for the Subject Area, as well as for each individual Aboriginal heritage sites, to inform the ACHA. Feedback from RAPs on cultural values was requested during all stages of the consultation process.

All Aboriginal heritage sites, known or otherwise are considered to have high cultural and social value by the RAPs. The cultural values of the Subject Area are informed by (Niche, 2024b):

- Physical archaeological evidence of past occupation and use of the area as represented by the presence of Aboriginal heritage sites.
- Values and meanings of environmental and landscape features of the area such as creeks and rivers which, for instance, were used for travel, navigation, food resources and to establish boundaries between different groups as well as elevated ridge systems which may have been used for ceremonial practices.
- Long history of traditional occupation and land use as documented in the archaeological, ethnographic, historical and oral records associated with the local region.
- More recent history of maintaining ongoing connection to Country and cultural heritage (e.g. time and investment of RAPs in the management of Aboriginal cultural heritage at the Moolarben Coal Complex).

D. Further Clarification of Cumulative Aboriginal Cultural Heritage Impacts

The Project would occur within existing approved mining and exploration tenements areas and adjacent to already approved surface disturbance extents associated with the Moolarben Coal Complex.

Since lodgement of the EIS, MCO has reduced the indicative surface disturbance extent for the Project to incorporate additional avoidance and minimisation measures to address comments received. As a result, the amended Project would result in direct impacts to 55 known Aboriginal heritage sites (compared to 79 known Aboriginal heritage sites to be directly impacted for the Project as presented in the EIS).

As the Aboriginal heritage sites within the amended Project indicative surface disturbance extent represent a well-documented and researched segment of Aboriginal archaeological resources in the area, Niche (2024b) considers they have limited conservation value. Particularly as representative sites are preserved within conservation areas for the Moolarben Coal Complex, Ulan Mine Complex and Wilpinjong Coal Mine within salvaged assemblages in Keeping Places, and also protected from any future impact within mine-owned offset and conservation areas, and larger conservation areas in the surrounding region, such as the Goulburn River National Park and the Munghorn Gap Nature Reserve.

Niche (2024b) considers the Project is not expected to cause a loss of heritage resources that could be viewed as being very rare or unique or unlikely to exist elsewhere and, therefore, the Project would not result in any significant cumulative impact on Aboriginal heritage in the region.

3. Further Clarification of Native Title

The Commonwealth *Native Title Act 1993*, where applicable, would be complied with in relation to the approval of any necessary mining tenements for the Project under the NSW *Mining Act 1992*.

4.2.7 Agriculture

Comments made in public and organisation submissions relevant to agriculture include:

1. Loss of agricultural land within the Project area.
2. Assessment of the Project area as non-Biophysical Strategic Agricultural Land.

Responses to these comments are provided below.

1. Loss of Agricultural Land within the Project Area

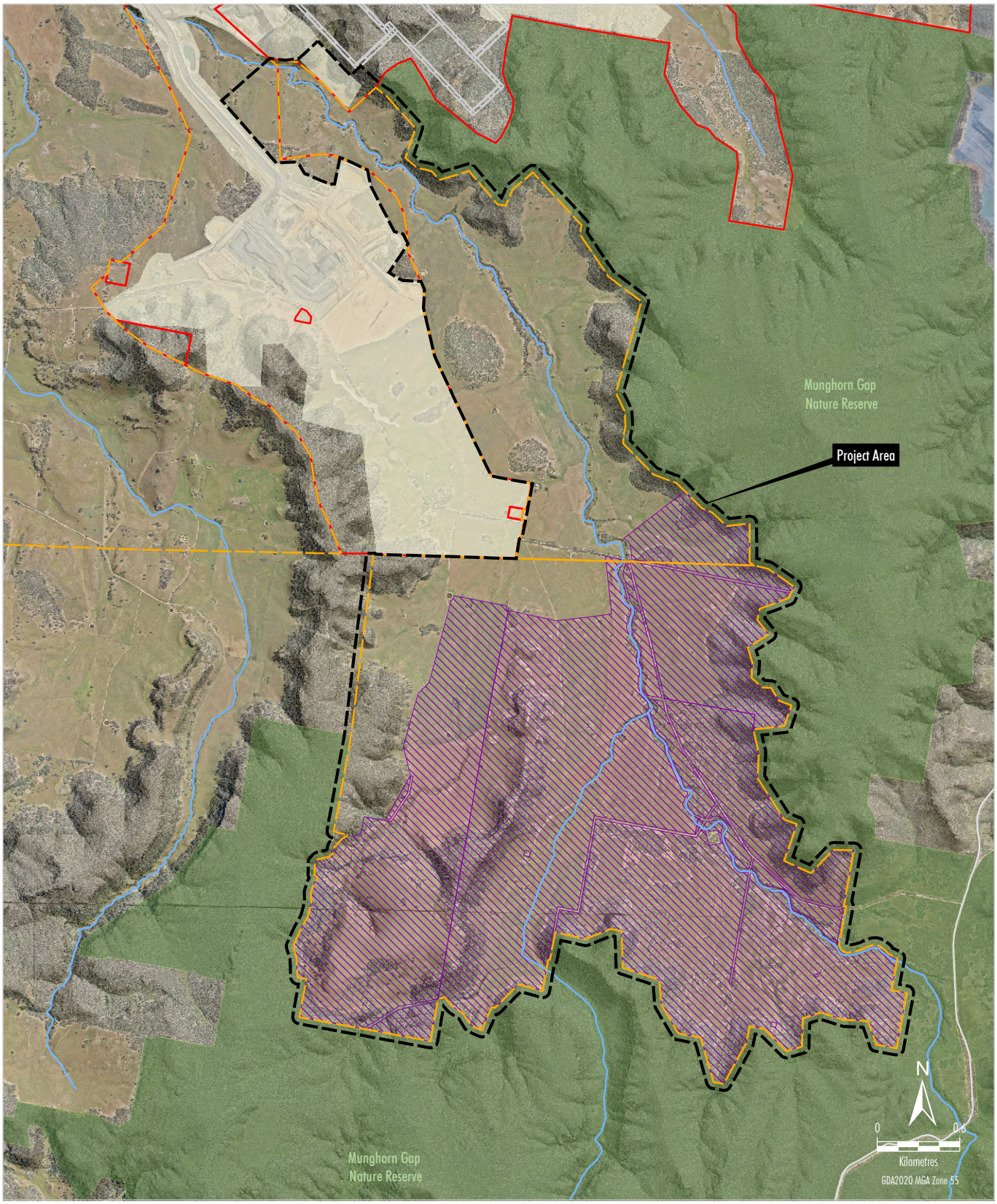
MCO has licensed approximately 975 ha of land for low intensity agriculture use within the Moolarben Valley (Figure 4-29). This land will be unavailable for agricultural use during the Project mine life (i.e. 2025 to 2038) while mining, decommissioning and rehabilitation activities are completed. Note that due to the existing Moolarben Coal Complex, agricultural land use has already ceased in portions of the Moolarben Valley immediately adjacent and within the approved OC3 mining area.

An Agricultural Impact Assessment was undertaken by 2rog (Appendix L of the Project EIS), which estimated the forgone agricultural gross margin due to the Project is approximately 0.12% and approximately 0.62% of gross value generated annually by the same agricultural industries from the Central Tablelands LLS Region and the Mid-Western Local Government Area, respectively.

On this basis, there is likely to be insignificant impacts to regional agricultural resources and agricultural production as a result of the Project (2rog, 2022).

The proposed rehabilitation strategy for the Project would reinstate approximately 140 ha of agricultural land within the indicative surface disturbance extent. Areas of rehabilitated agricultural land in the Project area and in the adjacent OC3 mining area would be available for agricultural use following completion of mining and rehabilitation.

It is noted the conceptual post-mining land uses for the Project, including 535 ha of native woodland, enable improved biodiversity outcomes by reinstating species habitat and increasing connectivity within the Moolarben Valley.



MCM-20-18 OCG Ext AR SR_218A

LEGEND

National Park/Nature Reserve
Exploration Licence Boundary
Mining Lease Boundary
Project Study Area

Existing/Approved Development
Underground Longwall Layout
Moolarben Coal Complex Disturbance Footprint
Moolarben-owned Land Licensed for Agricultural Use

Source: MCO (2022); NSW Spatial Services (2021)
Orthophoto: MCO (2021)

YANCOAL 克煤澳大利亚有限公司
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Land Licensed for Agricultural Use within the Project Area

Figure 4-29

No additional residences or properties would be subject to acquisition for the Project compared to the existing Moolarben Coal Complex.

2. Assessment of the Project area as Non-biophysical Strategic Agricultural Land

There is no NSW Government-mapped Biophysical Strategic Agricultural Land (BSAL) or Critical Industry Cluster land within the Project area.

A BSAL Site Assessment was undertaken by Minesoils (2022) in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (Interim Protocol) (Office of Environment & Heritage [OEH] and Department of Primary Industries - Office of Agricultural Sustainability and Food Security, 2013), including soil testing and laboratory testing (where required) across 103 individual sites to determine soil type and characteristics.

The BSAL Site Assessment determined that the Project area is verified non-BSAL, consistent with the NSW Government BSAL mapping.

A Site Verification Certificate (SVC) was issued by the Planning Secretary in October 2022 verifying the Project area is not located on BSAL, in accordance with the relevant criteria of the Interim Protocol. A summary of the determination is provided in Table 4-24 below.

Table 4-24
Determination of SVC Based on Relevant Criteria

Relevant criteria	Consideration
Soil fertility (type)	The limitations associated of soil within the SVC Project Application area are poor drainage, soil depth to a physical barrier, soil fertility, pH < 5.0 and ESP > 15%. As such it does not meet the necessary criteria to be mapped as BSAL
Slope and rocky outcrops	The SVC Project Application Area includes areas with slopes > 10%, rock outcrops >30% and unattached fragments > 20%
Contiguous areas of BSAL soils	Areas of soils that meet the criteria for BSAL are < 20 contiguous hectares

4.2.8 Greenhouse Gas Emissions

Comments made in public and organisation submissions relevant to greenhouse gas (GHG) emissions include:

1. Forecast direct and indirect GHG emissions associated with the Project.
2. Demand for Project coal.
3. Proposed GHG mitigation measures.

Responses to these comments are provided below.

1. Forecast Direct and Indirect Greenhouse Gas Emissions Associated with the Project

Since lodgement of the EIS, MCO has amended the Project to incorporate additional avoidance measures relative to the EIS in response to submissions received. This has resulted in a reduction in total resource extracted (i.e. from approximately 40 Mt to 30 Mt over the life of the Project) and a revised mine schedule which in turn affects the GHG emissions estimates for the Project.

The revised Project GHG emissions estimates for the amended Project are provided in Table 4-10.

2. Demand for Project Coal

Demand for the Project's product coal is expected to continue over the Project life (2025 to 2034) as the NSW Government estimates that global demand for seaborne thermal coal would increase to over 950 Mt leading up to 2030, at which point demand would begin to decline (NSW Government, 2020). By comparison, total NSW exports in 2021 was 164 Mt of coal, and the average ROM coal from the Amended Project is 3 Mtpa (NSW Mining, 2022).

This demand increase is partly attributed to developing countries seeking to provide their communities with access to electricity to support economic growth and improve their quality of life (NSW Government, 2020).

Under the scenario of a reduced export regime from NSW, most coal consumers would be likely to source their coal from elsewhere, and much of this coal would be lower quality compared to NSW coal (NSW Government, 2020). Lower quality coal requires the consumption of more fuel to produce equivalent energy, increasing overall environmental impacts.

The Project presents an opportunity to provide thermal coal to existing customers and meet energy demands while alternative energy sources become more available globally.

3. Proposed Greenhouse Gas Mitigation Measures

The Project's GHG emissions are subject to be managed under the Safeguard Mechanism. The predicted annual average Scope 1 emissions intensity for the Project is considerably below the legislated Safeguard Mechanism industry baseline.

MCO currently, implements reasonable and feasible GHG mitigation and management measures at the Moolarben Coal Complex, which would continue for the Project operations.

Diesel consumption is a major contributor to GHG emissions for the Project. MCO would continue to implement existing measures to minimise GHG emissions through the efficient use of diesel, including optimising mine plans and schedules, minimising haul distances, maximising equipment utilisation/productivity, regular equipment maintenance to maximise fuel efficiency, selection of new fleet and monitoring of fuel consumption.

MCO would investigate the potential to replace standard diesel fuel with biodiesel as B10 or B20, subject to ensuring that engine warranties, efficiencies or maintenance requirements are not compromised.

MCO would continue to investigate other low-emissions alternatives to diesel-power equipment over the life of the Project, noting the peer review (GHD, 2022) and NZEM comments regarding the lack of feasible alternatives due to the short Project timeframe (as mining ceases in 2034).

MCO would continue to investigate whether it is reasonable and feasible to reduce Scope 2 GHG emissions associated with on-site electricity use at the approved Moolarben Coal Complex (e.g. evaluation of sourcing a proportion of site electricity from renewable sources). A number of constraints apply to potential reduction of Scope 2 emissions, including the terms of commercial agreements with electricity providers.

4.2.9 Economic

Comments made in public and organisation submissions relevant to Project economics requested further clarification of the Economic Assessment, including:

1. Calculation of company tax payments.
2. Calculation of external effects, including mitigation costs for biodiversity offsets and GHG emissions.

Responses to these comments are provided below.

1. Calculation of company tax payments

The Economic Assessment for the EIS (Analytecon, 2022) was undertaken in accordance with the *Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (DPE, 2015) (EA Guidelines).

The EA Guidelines outline the requirements of a cost benefit analysis for a project, and provide that net benefits to the NSW community that are attributable to a mining project include royalties, company income tax, net producer surplus, economic benefit to existing landholders, workers and suppliers, net environmental, social and transport-related costs and net public infrastructure costs.

The method to determine company income tax payments described in the EA Guidelines (which was applied in the Economic Assessment for the EIS) requires proponents to determine the share of benefits that would accrue to the NSW community on the basis of population.

A sensitivity analysis was undertaken in the Economic Assessment for the EIS for variation in company income tax payments in accordance with the EA Guidelines. Two sensitivity scenarios were assessed (i.e. +/- 50% variation in company income tax payments) compared to the central case to determine potential impact on incremental net benefit to NSW. The Project would continue to provide a net benefit to NSW under both sensitivity scenarios.

The method for calculation of company income tax payments and associated sensitivity analysis in accordance with the EA Guidelines has been applied in an addendum Economic Assessment for the amended Project (Analytecon, 2024). The amended Project would also continue to provide a net benefit to NSW under both sensitivity scenarios.

2. Calculation of external effects, including mitigation costs for biodiversity offsets and GHG emissions

The *Technical Notes Supporting the Guidelines for the Economic Assessment of Mining and Coal Seam Gas Proposals* (DPE, 2018) (EA Technical Notes) support the EA Guidelines and outline methods for completing a robust and comprehensive economic assessment for a range of potential environmental and social impacts of a project (i.e. indirect costs or externalities).

The EA Technical Notes provide that potential environmental and social impacts must be assessed by specialist experts, consistent with relevant legislation, policy and guidelines. In the event that residual impacts are found to be material, the EA Technical Notes sets out methods for determining costs of these externalities.

For the majority of potential environmental and social impacts for the Project, specialist assessment determined residual impacts to be minimal or negligible and therefore costs associated with implementation of management and monitoring were internalised. Targeted management to address residual impacts to biodiversity, groundwater and GHG emissions were included as indirect costs of the Project and calculated in the Economic Assessment for the EIS.

Biodiversity

The EA Technical Notes acknowledges that NSW has an established framework to avoid, minimise and offset impacts on biodiversity under the *Biodiversity Conservation Act 2016* and *Biodiversity Conservation Regulation 2017*. The EA Technical Notes provides that costs to implement biodiversity offsets for a project under the NSW Biodiversity Offsets Scheme should be assessed as an indirect cost.

Consistent with the EA Technical Notes, the Project's biodiversity impacts were valued on the basis of the costs of implementing a Biodiversity Offset Strategy for the Project (e.g. via establishment of land-based offsets and/or the purchase of credits). It is noted that biodiversity offset liabilities are prescribed in Project Approval conditions established by the NSW Government at determination, and must be satisfied in accordance with these conditions to allow Project commencement.

Costs associated with biodiversity mitigation, monitoring and management during Project operations have been internalised and factored into capital and operating costs, in accordance with the requirements of the EA Technical Notes.

GHG Emissions

Submissions requested further clarification of the calculation of GHG emissions attributable to the Project, in particular:

- the use of the price of Australian Carbon Credit Units (ACCUs) to value GHG emissions;
- the approach used to attribute the value (cost) of GHG emissions to NSW; and
- valuation of Scope 3 emissions.

Use of Australian Carbon Credit Units

Technical Note 9 of the EA Technical Notes state that:

> *Market prices should be used as a basis for valuing the costs of carbon emissions, where reliable evidence can demonstrate that those market prices are not significantly biased as a direct consequence of scheme design.*

Given the above, the application of the forecast price of European emission allowances, as reflected in futures prices published by the European Energy Exchange was adopted by Analytecon.

ACCUs are considered to represent a reliable market price for the cost of abating carbon emissions in Australia and a reasonable indication of future demand and supply trends. The ACCU price used to value the Project's predicted Scope 1 and Scope 2 emissions represents a market price for GHG emissions abatement in Australia.

The ACCU scheme has recently been put to an independent review (Chubb et. al, 2022). The review panel concluded "the scheme was fundamentally well-designed when introduced". The panel's recommendations focused on matters of governance and transparency, measures to facilitate positive project outcomes, and measures to enhance confidence in the integrity and effectiveness of the scheme.

A sensitivity analysis of carbon prices and method of allocation of costs to NSW was undertaken in the Economic Assessment for the EIS (Analytecon, 2022) and considered methods of apportionment where:

- All externality costs are allocated to the Project.
- Externality costs are allocated on the basis of NSW share of Australian population.
- Externality costs are allocated on the basis of NSW share of global population.

The method for calculation of carbon price and associated sensitivity analysis in accordance with the EA Guidelines has been applied in an addendum Economic Assessment for the amended Project (Analytecon, 2023). An additional method of apportionment is considered where externality costs is allocated on the basis of NSW share of global GDP. The amended Project would continue to provide a net benefit to NSW under all sensitivity scenarios (Table 4-25).

Attribution of GHG Emissions Costs to NSW

Consistent with the EA Guidelines and EA Technical Notes, a cost benefit analysis is only required to determine the net present value of the project to the NSW community, and therefore value of any externalities is also limited to potential impact to the NSW community.

The EA Guidelines and EA Technical Notes do not provide a method for determining the share of GHG emissions costs attributable to NSW. The Economic Assessment for the EIS (Analytecon, 2022) applied the NSW share of global population.

It is noted that the approach adopted for apportioning the net externality cost of the GHG emissions from the Project on the basis of the NSW population share has been deemed appropriate and reasonable by the relevant NSW authorities, for instance the Tahmoor South Coal Project, Wongawilli Colliery Modification, Mount Pleasant Optimisation Project and Narrabri Stage 3 Extension Project.

A sensitivity analysis of carbon prices and method of allocation of costs to NSW was undertaken in the Economic Assessment for the EIS (Analytecon, 2022), and considered a 'low' (ACCUs), 'medium' (carbon prices derived from the Australian Treasury Clean Energy Future Policy) and 'high' (EU A futures) carbon price for different methods of apportionment. The Project would continue to provide a net benefit to NSW under all sensitivity scenarios.

The method for calculation of carbon price and associated sensitivity analysis in accordance with the EA Guidelines has been applied in an addendum Economic Assessment for the amended Project (Analytecon, 2024). The amended Project would also continue to provide a net benefit to NSW under all sensitivity scenarios (Table 4-25).

Table 4-25
Updated Carbon Price Sensitivity ($AU2022)

	Low price forecast: ACCUs (NPV $2022 millions)	Medium price forecast: CEFP scenario (NPV $2022 millions)	High price forecast: EUA futures (NPV $2022 millions)
All externality costs allocated to the Project			
Project	$7	$22	$52
NSW net benefits	$183	$168	$139
Externality costs allocated on the basis of NSW share of Australian population			
Project	$2	$7	$16
NSW net benefits	$188	$183	$174
Externality costs allocated on the basis of NSW share of global population			
Project	$0.01	$0.02	$0.05
NSW net benefits	$190	$190	$190
Externality costs allocated on the basis of NSW share of global GDP			
Project	$0.02	$0.07	$0.16
NSW net benefits	$190	$190	$190

After: Analytecon (2024)

Notes: As of December 2021, the NSW share of the Australian population was 31.4 %. As of 2021, the NSW share of the world population was 0.1 %. The €/AU$ exchange rate was assumed at 1.5. As of June 2021, NSW GSP was about 0.31 per cent of world GDP (ABS 2021, World Bank 2022b).

Scope 3 Emissions

The EA Technical Notes provide that only Scope 1 and Scope 2 GHG emissions should be valued for a project, as they are under the direct control of a proponent.

Therefore the value of externalities from indirect (Scope 3) GHG emissions are not considered in the cost benefit analysis for the Project, consistent with the EA Technical Notes.

4.2.10 Amenity

Comments made in public and organisation submissions relevant to amenity impacts include potential additional dust, noise, vibration, and light pollution impacts to nearby residences.

The Project has been designed so that no additional residences require acquisition or mitigation compared to the existing Moolarben Coal Complex.

No views of the Project are available as the surrounding elevated topography provides a natural barrier between the Project and nearby private residences at Cooyal to the south and Cooks Gap to the west, also limiting potential amenity impacts. Compliance with the relevant noise, air, and blast criteria is predicted at all private residences.

The nearest private residence to the Project area is 2.5 km to the south in Cooyal. The second closest residence, after Cooyal is situated in Cooks Gap (approximately 5 km from the indicative surface disturbance extent). Mining operations for the Project would be a greater distance from Cooks Gap than the existing Moolarben Coal Complex, and would progressively move further south and southeast.

The Project would be integrated into the existing Moolarben Coal Complex operations, resulting in no change to the overall mine life or peak production rate and, therefore, no extension in duration of potential amenity impacts beyond those previously approved.

4.2.11 Road Transport

Comments made in public and organisation submissions relevant to road impacts include the potential for increased mine-related traffic.
A Road Transport Assessment was undertaken by The Transport Planning Partnership (2022) for the Project to assess potential impacts of the Project on traffic generation, roadway capacity and safety. Potential impacts were considered and assessed cumulatively, in the context of anticipated future background traffic growth.

The Project does not include any direct interaction with the public road network, as it does not involve any new site access points or road closures when compared to the existing Moolarben Coal Complex. In addition, the Project would not cumulatively increase the peak workforce numbers at the Moolarben Coal Complex.

The Road Transport Assessment concluded the existing road network can satisfactorily accommodate the forecasted traffic demands of the Moolarben Coal Complex (including the Project), with no significant impact identified on the performance, capacity, efficiency, and safety of the road network.

As a result, no specific management or mitigation measures are warranted by the future operations of the Moolarben Coal Complex (including the Project) and other mining operations in the region.

5 PROJECT EVALUATION

A total of 90 submissions on the Project were received from government agencies, local councils, organisations and members of the public during the exhibition period for the EIS. These comprised of 15 submissions (17%) from government agencies and local councils, 18 submissions (20%) from organisations, and 57 submissions (63%) from members of the public.

This Submissions Report provides responses to issues raised by government agencies, local councils, organisations and members of the public during the exhibition period for the EIS and has been prepared in consideration of the *State significant development guidelines – preparing a submissions report* (DPE, 2022).

Since lodgement of the Project EIS, MCO has continued to consult with community members, MWRC, DPHI and other NSW and Commonwealth government agencies regarding the Project.

In response to submissions received, MCO has amended the Project to reduce the indicative surface disturbance extent and incorporate additional avoidance and minimisation measures relative to the EIS. The areas proposed for reduction have been targeted to key threatened species habitat for potential SAII entities, largely contiguous remnant woodland vegetation, as well as further setback from the Munghorn Gap Nature Reserve and mapped rocky habitat features. These areas are on the outer edge of the Project mining area such that the extent of open cut mining areas have been reduced while maintaining a feasible and economically viable mine plan.

In summary, when compared to the EIS, the proposed amendments to the Project include:

- A reduction in the extent of proposed open cut mining (from approximately 825 ha to 675 ha).
- A reduction in the extent of proposed open cut mining.
- A reduction in total resource extracted from 40 Mt to approximately 30 Mt over the life of the Project.
- A reduction in the peak annual ROM mining rate from 9 Mt to 8.5 Mt over the life of the Project.
- No change to the duration of the mine life (i.e. between approximately 2025 to 2034), peak workforce, or hours of operation of the mine.
- No change to the proposed integrated final landform with the approved OC3 mining area (including no final voids in the rehabilitated final landform).
- A revised conceptual post-mining land use which incorporates additional areas of native woodland (i.e. from approximately 325 ha to 535 ha).
- An increase to the proposed Habitat Enhancement Area extent (from approximately 160 ha to 188 ha) which would be revegetated during mining.

Separate to this Submissions Report, MCO has prepared an Amendment Report for the Project to document revised potential environmental impacts as a result of the amended Project.

The revised revegetation and rehabilitation strategy means the amended Project, if approved, would result in:

- A net gain in native woodland in the Moolarben Valley of approximately 22 ha during mining due to revegetation within the Habitat Enhancement Area (i.e. approximately 113 ha of woodland to be cleared for the amended Project vs 135 ha of revegetation within the revised Habitat Enhancement Area extent).
- An overall net gain in native woodland in the Moolarben Valley of approximately 557 ha post-mining when considering revegetation during mining and rehabilitation of the final landform.
- A reduction in the number of voids in the Moolarben Valley from one to zero, as the Project proposes to backfill the currently approved OC3 final void, and provide a free-draining final landform (i.e. no residual voids).

Residual potential impacts on biodiversity would be offset in accordance with the BC Act (in addition to proposed revegetation with the Habitat Enhancement Area and rehabilitation of the final landform). MCO is expecting land based offset options to be available to secure the Project's total offset liability for the Regent Honeyeater and Koala (and potential for other threatened species following targeted surveys), including options to establish land-based offsets using Moolarben-owned land in the region. MCO is also investigating two potential "onsite" offset areas within the Project Study Area.

As a result of the proposed amendments, in particular the reduced indicative surface disturbance extent, the environmental impacts of the Project would largely be reduced compared to that presented in the EIS. Accordingly, the conclusion in the EIS that, on balance, the Project is a logical extension of an existing mining operation that would develop internationally in-demand resources, while minimising environmental impacts, and is in the public interest, remains unchanged.

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ATTACHMENT 1

REGISTER OF SUBMITTERS

Table A1-1
Register of Submitters

Category	Submitter	Suburb	Where Comments are Addressed
Agency	DPE - Biodiversity, Conservation and Science Directorate and NSW National Parks and Wildlife Service	Dubbo	Section 4.1.1
	DPE - Science, Economics and Insights Net Zero Emissions Modelling	Lidcombe	Section 4.1.3
	DPE - Crown Lands	Dangar	-
	DPE - Hazards	-	-
	DPI Fisheries	Calala	-
	Environmental Protection Authority	Parramatta	-
	Fire and Rescue NSW	Greenacre	-
	DPE - Heritage NSW	Parramatta	Section 4.1.2
	Department of Regional NSW - Mining, Exploration and Geoscience and Resources Regulator	Maitland	-
	Mid-Western Regional Council	Mudgee	Section 4.1.6
	Transport for NSW	Parkes	-
	DPI Agriculture	Orange	-
	DPE - Water	Parramatta	Section 4.1.4
	Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development	-	Section 4.1.5
	Australian Rail Track Corporation	Parramatta	-
Organisation	Water for Rivers	Chippendale	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Nature Conservation Council of NSW	Chippendale	Section 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Mudgee District Environment Group	Budgee Budge	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6 and 4.2.8
	Correct Planning and Consultation for Mayfield (CPCFM)	Mayfield	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	The Australia Institute	Griffith	Section 4.2.9
	Lock the Gate Alliance	Sydney	Section 4.2.8
	Bathurst Community Climate Action Network	Llanarth	Section 4.2.4 and 4.2.8
	Warrabinga Native Title Claimants Aboriginal Corporation	Lurnea	Section 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6 and 4.2.10
	BirdLife Southern NSW	Blacktown	Section 4.2.4, 4.2.8 and 4.2.9
	Environmentally Concerned Citizens of Orange (ECCO)	Orange	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Lithgow Environment Group	Lithgow	Section 4.2.2, 4.2.4, 4.2.6 and 4.2.8

Table A1-1 (Continued)
Register of Submitters

Category	Submitter	Suburb	Where Comments are Addressed
Organisation (Continued)	Hunter Environment Lobby INC	East Maitland	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Wollar Progress Association	Wollar	Section 4.2.1, 4.2.3, 4.2.5 and 4.2.8
	Central West Environment Council	Summer Hill Creek	Section 4.2.1, 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.2.7, 4.2.8 and 4.2.9
	Healthy Rivers Dubbo	Dubbo	Section 4.2.2 and 4.2.8
	Denman Aberdeen Muswellbrook Scone Healthy Environment Group Inc	Kayuga	Section 4.2.2, 4.2.4, 4.2.7 and 4.2.8
	North Coast Environment Council	Elands	Section 4.2.2, 4.2.4, 4.2.6, 4.2.8 and 4.2.9
	Rylstone District Environment Society	Rylstone	Section 4.2.2, 4.2.4, 4.2.8 and 4.2.10
Public	Name withheld	Cooks Gap	Section 4.2.4
	Rosemary Hadaway	Mudgee	Section 4.2.2, 4.2.4, 4.2.5, 4.2.6, 4.2.7 and 4.2.8
	Anne Reeves	Glebe	Section 4.2.4 and 4.2.8
	Name withheld	Mogo	Section 4.2.3 and 4.2.8
	Max Smiles-Schmidt	Wollar	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Margaret Cameron	Lue	Section 4.2.8
	Margaret May	Five Dock	Section 4.2.2, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Name withheld	Olinda	Section 4.2.2, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Colin Imrie	Ulan	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Julia Imrie	Ulan	Section 4.2.1, 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Phillip Enderby	Speers Point	Section 4.2.5 and 4.2.9
	Name withheld	Breakfast Creek	Section 4.2.2 and 4.2.4
	Name withheld	Olinda	Section 4.2.2, 4.2.4, 4.2.5, 4.2.6, 4.2.7, 4.2.8, 4.2.10 and 4.2.11
	Name withheld	Olinda	Section 4.2.3 and 4.2.5
	John Clarke	St Fillans	Section 4.2.2, 4.2.3,4.2.4, 4.2.6 and 4.2.8
	Heather Mclean	Singleton	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.8
	Name withheld	Lilyfield	Section 4.2.4
	Name withheld	Newport	Section 4.2.2, 4.2.4, 4.2.6 and 4.2.8
	Simon Clough	Iluka	Section 4.2.1, 4.2.2, 4.2.4, 4.2.7 and 4.2.8

Table A1-1 (Continued)
Register of Submitters

Category	Submitter	Suburb	Where Comments are Addressed
Public (Continued)	Name withheld	Mudgee	Section 4.2.5 and 4.2.9
	Margot White	Manobalai	Section 4.2.3, 4.2.4, 4.2.5 and 4.2.8
	Paul Kelly	Orange	Section 4.2.2, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Beverley Smiles	Wollar	Section 4.2.3, 4.2.4, 4.2.6, 4.2.8 and 4.2.9
	Name withheld	Farrer	Section 4.2.3,4.2.5, 4.2.8 and 4.2.9
	Name withheld	Mudgee	Section 4.2.4, 4.2.8 and 4.2.10
	Julie Hunter	Rylstone	Section 4.2.4 and 4.2.6
	Name withheld	The Hill	Section 4.2.2, 4.2.4, 4.2.5, 4.2.7 and 4.2.8
	Janet Fenwick	Bulga	Section 4.2.2, 4.2.7 and 4.2.8
	Name withheld	Lilyfield	Section 4.2.2 and 4.2.4
	Katherine Allan	Stuart Town	Section 4.2.8
	Tane Schmidt	Wollar	Section 4.2.3 and 4.2.8
	Elisabeth Brasseur	Sydney	Section 4.2.3, 4.2.4, 4.2.6 and 4.2.8
	Beverley Atkinson	Scone	Section 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Michaela Primmer	Grattai	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.7
	Susan Barling	Rylstone	Section 4.2.4, 4.2.6 and 4.2.8
	Claudia Koller	Carrington	Section 4.2.8
	Janet Walk	Camboon	Section 4.2.8
	Name withheld	Cooks Gap	Section 4.2.5 and 4.2.10
	Name withheld	Lue	Section 4.2.3, 4.2.4 and 4.2.8
	Lorraine Davies	Toormina	Section 4.2.2, 4.2.4, 4.2.6, and 4.2.8
	Name withheld	Olinda	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Linda Bowden	Munni	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Anthony Lonergan	Kayuga	Section 4.2.2, 4.2.4, 4.2.6 and 4.2.8
	Rod Pryor	Mudgee	Section 4.2.3, 4.2.4, 4.2.7 and 4.2.8
	Name withheld	Stuart Town	Section 4.2.4 and 4.2.8
	Don White	Laguna	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6 and 4.2.8

Table A1-1 (Continued)
Register of Submitters

Category	Submitter	Suburb	Where Comments are Addressed
Public (Continued)	Peter Bryant	Mudgee	Section 4.2.4, 4.2.5, 4.2.6, 4.2.8 and 4.2.9
	Dianne Thompson	Fisher	Section 4.2.2, 4.2.3, 4.2.4 and 4.2.9
	John L Hayes	Mayfield	Section 4.2.2, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Sharyn Munro	Dunbogan	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Megan Benson	Gloucester	Section 4.2.2, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Name withheld	Petersham	Section 4.2.4 and 4.2.8
	Lyn Coombe	Lue	Section 4.2.4 and 4.2.6
	Michael Mangold	Cremorne Point	Section 4.2.2, 4.2.3, 4.2.4, 4.2.5, 4.2.6, 4.2.7 and 4.2.8
	Name withheld	Maitland Bar	Section 4.2.2, 4.2.3, 4.2.4, 4.2.6, 4.2.7 and 4.2.8
	Ralf Steines	Cooks Gap	Section 4.2.10
	Derek Finter	Mudgee	-

ATTACHMENT 2

MOOLARBEN COAL COMPLEX OC3 EXTENSIONS PROJECT – SUPPLEMENTARY STYGOFAUNA TESTING (BIO-ANALYSIS, 2023)

BIO-ANALYSIS Pty Ltd

Marine & Freshwater Ecology

2/1 Botham Close, Charmhaven, NSW 2263

(Mobile) 0414 477 066; (Email) info@bioanalysis.com.au

Mike Moore

Manager – Approvals

Yancoal Australia Ltd

20 December 2023

Re: Moolarben Coal Complex OC3 Extension Project – Supplementary Stygofauna Testing

1.0 Background

The Moolarben Coal Complex (MCC) is located approximately 40 kilometres (km) north of Mudgee in the Western Coalfields of New South Wales (NSW) and comprises four approved open cut mining areas (OC1 to OC4), three approved underground mining areas (UG1, UG2 and UG4) and other mining related infrastructure (including coal processing and transport facilities).

Mining operations at the MCC are approved until 31 December 2038 in accordance with Project Approval (05_0117) (Moolarben Coal Project Stage 1) and Project Approval (08_0135) (Moolarben Coal Project Stage 2). Moolarben Coal Operations (MCO) is investigating options to extend the current open cut mining operations at the MCC within the study area identified on the enclosed figure (i.e. OC3 Extension Study Area). The Project Environmental Impact Statement (EIS) was submitted in November 2022 and the public exhibition period ended in December 2022.

A submission received from the NSW Biodiversity, Conservation and Science Directorate (BCS) and NSW National Parks and Wildlife Service (NPWS) provided recommendations for additional stygofauna survey and assessment:

- *30.1. Additional monitoring is required to confirm the presence of, or lack of, stygofauna in the area. Given that no sampling regime guidelines are currently in force for proposals in NSW, any sampling regime should be consistent with best practice from other state government agencies and technical bodies;*
- *30.2. Include stygofauna sampling to the southern end of the proposed project area in, or on the boundary of, Munghorn Gap Nature Reserve.*

Dr Sharon Cummins and Dr Dan Roberts (BIO-ANALYSIS Pty Ltd [BA]) were commissioned by MCO to undertake further stygofauna testing to address the relevant recommendations of the BCS and NPWS submission.

2.0 Scope of Works

The scope of works included:

- Review of the stygofauna testing program undertaken for the EIS against the referenced guidelines in the BCS and NPWS submission:
    - Hose, G. C., & Lategan, M. J. (2012). *Sampling strategies for biological assessment of groundwater ecosystems - Technical Report 21. CRC Care.*
    - Western Australian Environmental Protection Authority (WA EPA) (2016). *Sampling methods for Subterranean fauna - Technical Guidance. Western Australia Environmental Protection Authority.*
    - Hose, G. C., Sreekanth, J., Barron, O., & Pollino, C. (2015). *Stygofauna in Australian Groundwater Systems: Extent of Knowledge.*
- Provision of recommendations for any additional survey work to address the guideline requirements.
- Additional stygofauna testing of previously sampled bores to address the referenced guidelines.
- Stygofauna (or aquatic ecology) testing in groundwater springs identified in the southern extent of the Project area.
- Preparation of a report (or similar) which provides the outcomes of the guideline review and additional stygofauna testing.

3.0 Stygofauna Sampling Review

3.1 Stygofauna

Stygofauna are generally small aquatic invertebrates that live in groundwater systems. Assemblages of stygofauna are typically dominated by crustaceans, but also include mites, worms, snails, insects and fish. Attributes include lack of eyes and body pigments, hardened body parts, and long, thin body shapes as an adaption to the groundwater environment.

Stygofauna have special adaptations to survive in the relatively resource-poor aquifers, where there is no light, space is limited, and food is scarce (Humphreys, 2008). Adaptations include blindness, slow metabolism, reduced body size, elongation, and low reproduction rates (Coineau, 2000; Humphreys, 2008). As there is no photosynthesis below ground, subterranean environments rely on inputs of organic matter from the surface to provide the basis of the food web (Schneider et al., 2011). Tree roots are also important sources of organic matter for groundwater food webs, and where they intersect the water table can support diverse communities (Hancock and Boulton, 2009; Jasinska et al., 1996).

Under the NSW Groundwater Dependent Ecosystem (GDE) Guidelines, the aquifer ecosystems that accommodate stygofauna, are classified as either Karst and Cave Ecosystems or Subsurface Phreatic Aquifer Ecosystems (Serov et al., 2012). Aquifers are relatively stable compared to surface aquatic environments with little or no daily fluctuations in water quality variables such as temperature, water level, and electrical conductivity (EC).

Many stygofauna taxa are sensitive to rapidly changing conditions (Hancock et al., 2005), such as water table draw-down, the removal of aquifer material for mining or quarrying, or rapid changes to water quality (Humphreys, 2008). Concerns over the impact of mining and other large development projects prompted the Western Australian and Queensland Governments to require stygofauna sampling as part of Environmental Impact Assessments (WA EPA, 2003; 2007). In NSW, the Department of Primary Industries Office of Water developed the *Risk assessment guidelines for groundwater dependent ecosystems* (Serov et al., 2012).

As NSW has no designated or preferred stygofauna sampling protocol/guideline, sampling protocols for NSW assessments have largely been designed to comply the WA EPA Guidance Statements for Sampling Subterranean Fauna (WA EPA, 2003; 2007).

3.2 Review of Current Sampling Methods for Stygofauna

The WA EPA (2007) guidelines suggested 12 samples were necessary to collect 95% of taxa within the Pilbara region. This could be done as 12 repeat samples from a single bore, six from two bores etc (WA EPA, 2007).

Following the WA EPA (2007) guidelines, a minimum of six net hauls were collected from a bore with a fine mesh net (50 – 63 micrometre [µm] mesh). Netting was followed by use of a mechanical pneumatic or inertia (e.g. Waterra) type pump (i.e. rather than an impeller driven pump which has the potential to damage the animals collected) to collect three bore volumes or 300 litres (L) (whichever is greater) from a bore hole for sampling (WA EPA, 2007). Samples were collected in buckets and then filtered through 50 – 63 µm mesh sieves to concentrate the invertebrates and facilitate storage and sample processing (WA EPA, 2007). Bores were not purged before sample collection. Samples were preserved in 100% ethanol.

Based on the review of referenced guidelines in the BCS and NPWS submission (i.e., Hose & Lategan, 2012; Hose et. Al., 2015; WA EPA, 2016), a survey plan was prepared as follows:

- Sampling of stygofauna within and close to the Project boundary in September 2023.
- Sampling of stygofauna at four GDEs identified within the southern end of the proposed Project area in, or on the boundary of, Munghorn Gap Nature Reserve (MGNR).
- Sampling of stygofauna through a combination of net and pump samples.

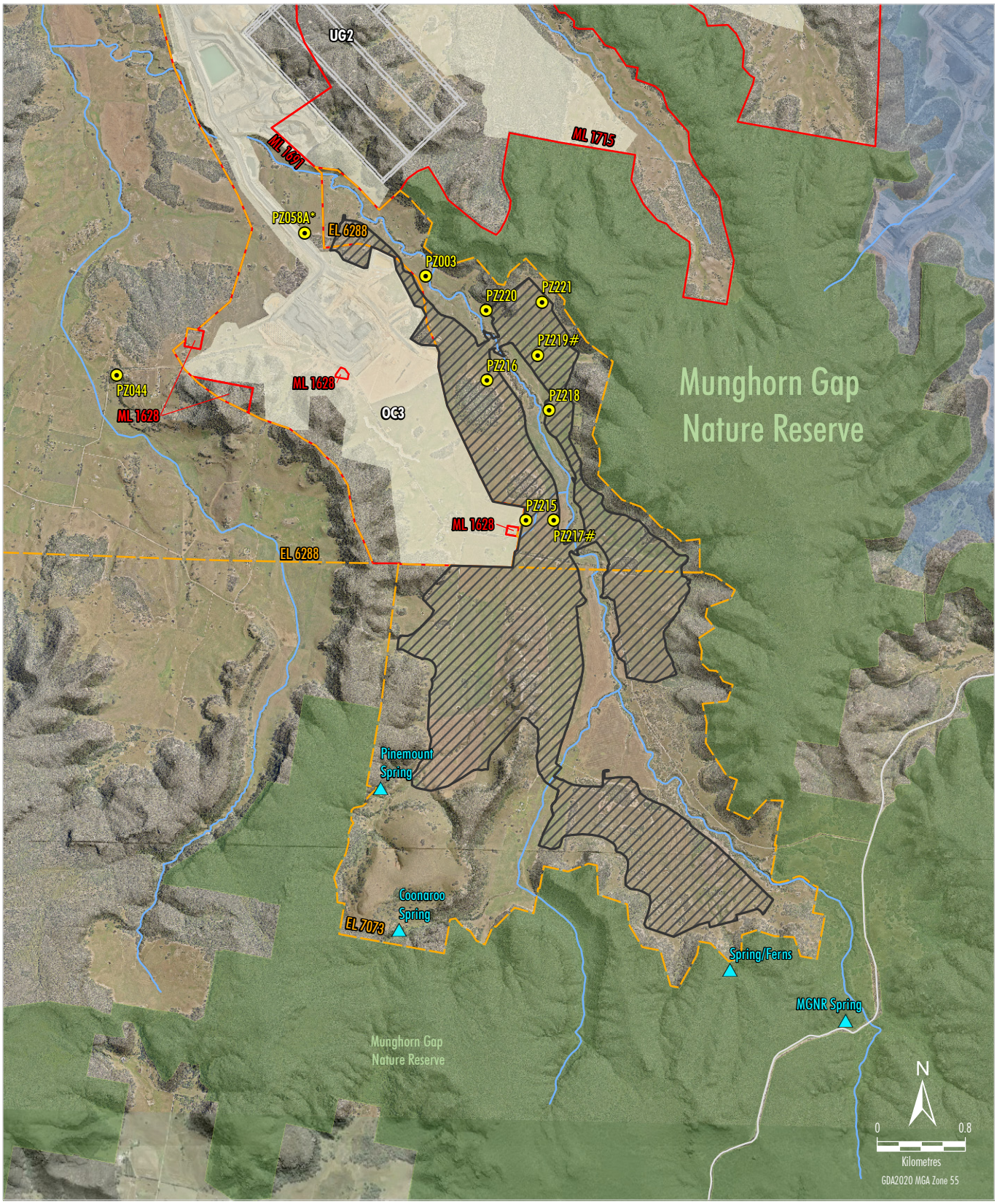
4.0 Stygofauna Survey

4.1 Survey Dates

Additional monitoring of the bores sampled for groundwater and stygofauna within and surrounding the disturbance footprint for the Project was undertaken on 26–28 September 2023 (Table 1, Figure 1).

Stygofauna sampling was also to be carried out at four identified local springs (Pinemount Spring, Spring/Ferns, Coonaroo Spring and MGNR Spring), situated to the south of the proposed Project area, near the boundary of MGNR (Table 2, Figure 1). Sampling was carried out on 25 and 26 September and 5 October 2023.

Collections of stygofauna and aquatic macroinvertebrates were completed in accordance with section 37 of the NSW *Fisheries Management Act 1994* using Scientific Collection Permit Number P03/0032(B) and NSW Agriculture, Animal Research Authority Care and Ethics Certificate of Approval Number 03/2445.



MCIA-20-18 OC3 Ext AR UPD ARR_201A

LEGEND

National Park/Nature Reserve
Exploration Licence Boundary
Mining Lease Boundary

Existing/Approved Development

Underground Longwall Layout
Moolarben Coal Complex Disturbance Footprint
Watercourse

OC3 Extension Project

Indicative Surface Disturbance Extent

Aquatic Ecology Survey Sites

Stygofauna Survey Site
Spring

Source: MCO (2022); NSW Spatial Services (2021)
Orthophoto: MCO (Jan 2021)

YANCOAL 克煤澳大利亚有限公司
MOOLARBEN COAL

MOOLARBEN COAL COMPLEX

Aquatic Ecology Survey Sites

Figure 1

4.2 Sampling of Bores

The ten bores sampled for stygofauna in spring 2021/summer 2022 were re-sampled between 26 – 28 September 2023 (Table 1, Figure 1).

A weighted stygofauna net (50 µm mesh with a 40 mm diameter opening) was lowered to the bottom of each bore, bounced four times to dislodge resting invertebrate fauna and slowly (to avoid a bow-wave) retrieved to the surface. Once at the surface, net contents were emptied into a 50 µm mesh sieve. In total, six net hauls were collected. The cumulative contents of the sieve were then transferred to a labelled plastic container and preserved with 100% ethanol.

After each sampling, nets were rinsed in deionized water and air-dried to prevent the transfer of specimens between bores during the survey.

Pump samples were collected immediately after netting. A Watterra groundwater pump was used to extract up to 300 L of water from each bore. A sampling hose was fed into the bore until it reached the bottom of the bore casing, then lifted approximately 1-2 m above the bottom of the bore. Prior to pumping, three rows of ten x 10 L buckets were set out. Buckets were carefully (to avoid splashing and overflows) filled sequentially.

Once the buckets were filled, a Yeo-Kal 618 probe was used to measure temperature (degrees Celsius [^{o}C]), electrical conductivity (microsiemens [µS/cm]), dissolved oxygen (% saturation and milligrams per litre [mg/L]) and pH [pH units]) in the first bucket and then every five buckets.

Subsequently, water from the first ten buckets were passed through a 50 µm mesh sieve, the sieve contents transferred to a labelled plastic container and preserved with 100 % ethanol. The second and third rows of buckets were then sieved separately, to give three x 100 L samples per bore site (not including the net sample).

Table 1. Bores sampled for stygofauna.

Bore	Easting	Northing	Depth (m)	Date Established	Aquifer	Date Sampled Previously (BA, 2022)
PZ003	762714	6417964	21	23/11/04	Ulan Seam	16/12/21
PZ216	763268	6417021	30	21/01/18	Ulan Seam	16/12/21
PZ217	763875	6415750	18	19/01/18	Ulan Seam	22/02/22
PZ219	763732	6417249	35	22/11/17	Ulan Seam	16/12/21
PZ221	763771	6417731	66	25/11/17	Ulan Seam	22/02/22
PZ044	759906	6417069	23	29/07/05	Ulan Granite	15/12/21
PZ215	763627	6415750	18	19/01/18	Sandstone Conglomerate	22/02/22
PZ218	763835	6416751	36	12/12/17	Sandstone Conglomerate	22/02/22
PZ220	763263	6417655	35	24/11/17	Sandstone Conglomerate	22/02/22
PZ058A	761616	6418360	12	1/09/05	Tertiary Aged Sediment	16/12/21

4.3 Sampling of Springs

Pinemount, Spring/Ferns, Coonaroo and the MGNR springs were to be sampled for stygofauna on two occasions, on 25 and 26 September and 5 October 2023. Prior to sampling, a Yeo-Kal 618 probe was used to measure temperature (ºC), electrical conductivity (µS/cm), dissolved oxygen (% saturation and mg/L) and pH (pH units).

Samples were collected from the edge of standing pools (where present) using a 50 µm mesh net with a 150 mm diameter opening. The sediments and vegetation at the edge of pools were gently disturbed with the edge of the net to dislodge resting invertebrate fauna, after which the net was swept through the resulting 'plume' four times. Net contents were emptied into the sample bottle (Plate 1). The net and sinkers were then rinsed into the sample bottle with 100 % ethanol. In total, six net hauls were collected. After each sampling, nets were rinsed in deionized water and air-dried to prevent the transfer of samples between springs/seeps during the survey.

Where possible, a pump sample was also collected from each spring/seep immediately after netting. A sample of 20 L was extracted from pools using a hand-operated bilge-pump and run through the 50 µm mesh net (Plate 2). The filter contents were then transferred to a labelled sample jar and preserved in 100 % ethanol.

Plate 1: Net samples were emptied into a labelled sample bottle.

Plate 2: Samples collected using a hand-operated bilge pump were filtered through the stygofauna net and then emptied into a labelled sample bottle.

Table 2. Spring features sampled for stygofauna.

Spring	Site Code	Easting	Northing	Description[1]
Pinemount Spring	PS	762304	6413329	Groundwater has been observed upwelling from sand at base of pool. Flows to Spring Creek.
Spring/Ferns	SF-S	765512	6411682	Not conclusively confirmed as a groundwater feature.
Coonaroo Spring	C-S	762480	6412036	Groundwater discharge has been observed from the collection point.
MGNR Spring	MGNR-S	766526	6411214	Seepage has been observed on moss/rock above concrete weir and water in retention structure is present.

[1] Environment & Natural Resource Solutions [ENRS], (2022)

4.4 Laboratory

Net and pump samples were later transported to the laboratory to be processed in a sorting dish under a ISSCO ML400 series Stereo Microscope and identified as far as possible using taxonomic keys. A stygofauna voucher collection was compiled for the Project, and maintained so that it is available on request for further analysis (if needed).

Field and laboratory data and other records were incorporated into appropriate excel data sheets and databases. Once the data had been entered, the Project Manager validated the data set by checking it against relevant guidelines and past surveys done within the Study Area.

4.5 Limitations

This assessment was based on the condition of the Study Area at the time of the field investigation and information provided on the Project at the date of publication of this document.

5.0 Results

5.1 Bores

Of the ten groundwater bores proposed to be sampled, one bore (PZ058A) was unable to be sampled for water quality as it is blocked by a tree root (Table 3). Two bores (PZ217 and PZ219) were unable to be pumped because they had no casing to which the groundwater pump could be attached (Table 3). Up to approximately 300 L of water was able to be pumped from each of the seven remaining boreholes to a depth of up to 50 m below ground level (Table 3).

At the time of sampling, groundwater temperature ranged between 19.3 and 20.6 °C and pH ranged from 6.1 to 6.4 (Table 3). The dissolved oxygen concentrations were low at all bores sampled (range = 3.6 to 12.6 % saturation) (Table 3). The EC ranged from 1,272 µS/cm at PZ221 to 5,048 µS/cm at PZ016 (Table 2).

Stygofauna were not found to be present in the net or pump samples collected from the seven bores.

Table 3. Mean (± SE) values of ground water quality recorded in the first and fifth bucket and then every five buckets collected from each bore in September 2023 (*n* = 7 buckets).

Bore	Aquifer	Volume Pumped (L)	Temp (°C)	pH	Electrical Conductivity (µS/cm)	Dissolved Oxygen (% Sat)
PZ003	Ulan seam	300	19.3 (0.3)	6.2 (0.0)	2,568 (846)	10.7 (1.3)
PZ016	Ulan Seam	300	20.6 (0.3)	6.4 (0.0)	5,048 (19.5)	10.8 (3.2)
#PZ217	Ulan Seam	0	-	-	-	-
#PZ219	Ulan Seam	0	-	-	-	-
PZ221	Ulan Seam	300	20.4 (0.2)	6.1 (0.0)	1,272 (5.7)	6.6 (1.0)
PZ044	Ulan Granite	80	19.9 (0.3)	6.2 (0.0)	3,020 (126.5)	12.6 (3.7)
PZ215	Sandstone Conglomerate	300	19.3 (0.4)	6.2 (0.0)	2,374 (19.0)	3.8 (1.0)
PZ218	Sandstone Conglomerate	300	19.6 (0.1)	6.1 (0.0)	2,451 (19.6)	3.6 (0.5)
PZ220	Sandstone Conglomerate	300	19.3 (0.1)	6.2 (0.0)	2,670 (2.3)	4.8 (0.6)
^PZ058A	Tertiary Aged Sediment	0	-	-	-	-

#Net sample collected for stygofauna but the bore was unable to be pumped because there was no casing to attach the Waterra Backpack pump too; ^Net sample collected for stygofauna but the bore was unable to be pumped due to insufficient water; * NB Historical values in brackets are median values

5.2 Springs

5.2.1 Aquatic Habitat Characteristics

Pinemount Spring

When Environment & Natural Resource Solutions (ENRS) (2022) surveyed groundwater features for the Moolarben Coal Complex OC3 Extension Project EIS and surrounding area, they observed Pinemount Spring to have visible groundwater discharge (in May 2022) and conclusively determined the spring to be a feature with surface expression of groundwater.

At the time of sampling, a stone/concrete forming was observed around the groundwater feature, which was covered by corrugated iron attached to a wooden frame. Water was upwelling from the sandy base of the pool. Tadpoles and frogs were observed.

The spring fed a narrow (generally less than 0.5 m) channel bordered by a dense growth of ferns and trees (Plates 3 and 4).

Plate 3: Pinemount Spring (PS) (25/09/2023).

Plate 4: Pinemount Spring (PS) (25/09/2023), view downstream.

Spring/Ferns

At the time of their inspection (May 2022), ENRS (2022) did not observe visible groundwater discharge at Spring/Ferns. For this reason, the feature was not conclusively determined to be a feature with surface expression of groundwater (ENRS, 2022).

At the time of surveys undertaken by BA, water was observed flowing across a rockface (~50 – 80 m in length) mostly covered by ferns (Plate 5). Flowing water mostly fed a narrow, incised channel downstream of the feature (Plate 5). No visible upwelling or pools were observed along the bottom of the rock face (Plate 6). A water sample was collected from the feature using a large tub (Plate 6).

Plate 5: Spring/Ferns (SF) (25/09/2023), view along the rockface covered by ferns.

Plate 6: Spring/Ferns (SF) (25/09/2023), a large tub was used to collect water near the base of the rockface.

Coonaroo Spring

At the time of sampling, a stainless-steel drum appeared to have been dug into a soak below large boulders to form a collection point for a plastic polyline (Plates 7 and 8). Tadpoles and frogs were observed. Water was observed to be upwelling from the base of the pool. Water had also pooled in areas immediately below the collection point.

Coonaroo Spring has been conclusively determined to be a feature with surface expression of groundwater ENRS (2022).

Plate 7: Coonaroo Spring (CS) (26/09/2023).

Plate 8: Coonaroo Spring (CS) (26/09/2023).

MGNR Spring

The MGNR Spring is located near the Moolarben picnic area. At the time of the survey, the feature was observed to comprise a constructed concrete retention structure, which was not holding pooled water.

When ENRS (2022) inspected the MGNR Spring, they considered that the ground conditions and vegetation indicated a common source of groundwater interaction, and that the spring is a potential feature with a surface expression of groundwater.

Plate 9: MGNR Spring (5/10/2023).

Plate 10: MGNR Spring (5/10/2023).

5.2.2 Water Quality

Mean physico-chemical water quality measurements from the spring surveys are summarised in Table 4. Values highlighted in bold type indicate where results were outside the appropriate default trigger values recommended by the Australian and New Zealand Environment Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand (ANZECC/ARMCANZ) (2000) for the protection of slightly disturbed aquatic ecosystem in upland rivers (i.e. systems at > 150 m altitude) in southeast Australia.

The main findings for the water quality survey are summarised as follows:

- at the time of sampling, water temperature measured at the springs ranged between 13.9 and 16.2 °C;
- pH ranged from 4.2 to 7.0;
- in general, the dissolved oxygen concentrations were low (range = 11.7 to 90.5 % saturation); and
- the electrical conductivity ranged from < 48 µS/cm at Spring/Ferns to 223 µS/cm at Coonaroo Spring (Table 4).

Table 4. Mean (± SE) values of ground water quality recorded (*n* = 3).

	Survey 1 (September 2023)			
Spring	**PS**	**SF**	**CS**	**MGNR**
Temperature °C (*n* =3)	16.2 (0.0)	16.2 (0.0)	16.1 (0.0)	
pH (*n* =3)	**4.2** (0.0)	**4.9** (0.1)	**5.6** (0.0)	
Conductivity (µS/cm) (*n* = 3)	77 (0.6)	41.7 (0.3)	222.7 (0.3)	
Dissolved Oxygen (%) (*n* = 3)	**51.8** (0.1)	90.5 (0.2)	**11.7** (0.2)	
Turbidity (NTU) (*n* = 3)	1.2 (0.1)	1.9 (0.1)	18.6 (1.1)	
	Survey 2 (October 2023)			
Spring	**PS**	**SF**	**CS**	**MGNR**
Temperature °C (*n* =3)	16.1 (0.0)	13.9 (0.0)	16.2 (0.0)	I/S
pH (*n* =3)	**4.5** (0.0)	7.0 (0.0)	**5.6** (0.10)	I/S
Conductivity (µS/cm) (*n* = 3)	75.3 (0.3)	47.3 (0.7)	215 (0.0)	I/S
Dissolved Oxygen (%) (*n* = 3)	**49.5** (0.1)	**52.0** (0.0)	**12.4** (0.4)	I/S
Turbidity (NTU) (*n* = 3)	1.0 (0.0)	1.0 (0.1)	2.0 (0.2)	I/S

I/S: Insufficient aquatic habitat

5.2.3 Stygofauna Testing

Over 150 invertebrates were collected during the two surveys at the spring features (Table 5). Samples were collected from Pinemount, Spring/Ferns and Coonaroo springs on two occasions. At the time of sampling, aquatic habitat was not able to be sampled at the MGNR spring due to lack of water present.

Invertebrate assemblages were mostly comprised by crustaceans (Table 5). Fauna collected included Amphipoda (cf Neoniphargidae and Paramelitidae), Ostracoda, Cyclopoida, and Oligochaeta (Table 5). The amphipods and cyclopoids all showed traits (blindness, lack of body pigments) that are typical of groundwater adapted invertebrates and were therefore considered as stygofauna. Oligochaetes and a large proportion of the ostracods lacked body pigments and were considered as possible stygofauna.

Small numbers (three individuals) of Acarina were collected but were pigmented and not considered to be stygofauna. A number of surface water insects, including Chironomidae larvae (Diptera), Scirtidae larvae (Coleoptera) and Dugesiidae (Tricladida) were also collected. Small numbers (< ten individuals) of frogs and tadpoles were observed at each of Pinemount and Coonaroo springs.

Table 5. Stygofauna identified by the Spring surveys.

Taxa	Spring/Seep						
	PS		SF	CS		MGNR	
Survey 1	**Net**	**Pump**	**Tub**	**Net**	**Pump**	**Net**	**Pump**
Oligochaeta	1		1	1	2		
cf Paramelitidae							
cf Neoniphargidae	3				1		
Ostracoda					7		
Cyclopoida - Cyclopidae					1		
Survey 2	**Net**	**Pump**	**Tub**	**Net**	**Pump**	**Net**	**Pump**
Oligochaeta	1	1		5	3		
cf Paramelitidae				5			
cf Neoniphargidae	1			7	22		
Ostracoda	1			20+	20+		
Cyclopoida - Cyclopidae	3+			1	2		

6.0 Conclusions & Recommendations

Similar to the findings from previous surveys of bores within the vicinity of the MCC (i.e. in December 2021 and February 2022), no stygofauna were collected during the September 2023 survey.

The spring features adjacent to the southern end of the proposed Project area, near the boundary of MGNR, contain at least five species of stygofauna. Invertebrate assemblages were mostly comprised of crustaceans (amphipods, ostracods, cyclopoid copepods) and oligochaete worms.

None of the taxa collected to date from within the springs are endemic to the Project area. At least 26 groups of stygofauna have been identified within the Hunter Valley alluvial aquifer system (Eco Logical Australia, 2019), some of which have been collected from within the Goulburn River alluvial aquifer, near Sandy Hollow (approximately 70 km east of the Project) (Hancock, 2004; 2006). These taxa are known to be widespread throughout the Hunter River alluvial aquifer, and aquifers of tributary streams (Eco Logical Australia, 2019).

Freshwater samples from the springs are relatively recent (in terms of groundwater residence time), with no mixing with regional groundwaters (i.e. supporting the conceptualisation of perched aquifers within the Triassic ridgelines) (Australasian Groundwater and Environmental Consultants [AGE], 2022).

No drawdown has been predicted at these spring features (Pinemount Spring, Spring/Ferns, Coonaroo Springs and MGNR Spring), and therefore no impact to the spring features has been predicted (AGE, 2022). The Groundwater Assessment concludes that the Project is unlikely to impact on water dependent assets in the MGNR as these are not connected to the regional groundwater system (AGE, 2022).

As a precaution, AGE (2022) recommended that three additional vibrating wire piezometers be installed adjacent to local spring features to monitor for potential impacts to perched groundwater within the Triassic sandstone. Ongoing monitoring will allow for the assessment of natural groundwater level fluctuations (such as response to rainfall) and the quantification of potential groundwater level impacts due to depressurisation (and dewatering) resulting from the approved and proposed mining activities (see AGE, 2022).

This additional stygofauna sampling has not changed the conclusions in the Moolarben Coal Complex OC3 Extension Project Aquatic Ecology Assessment (BA, 2022) and it is considered unlikely that the Project would have a measurable impact on subterranean GDEs.

If you have any concerns or wish any clarification please feel free to call or email Dr Sharon Cummins (Mobile: 043 8112 962; Email: cumminssharon@bigpond.com)

Yours sincerely

Dr S. P. Cummins
Senior Aquatic Ecologist

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