Centurion Coal Mining Pty Ltd
t/a Centurion Coal Mine

ABN: 50 010 879 526

Level 14, 31 Duncan Street,
Fortitude Valley QLD 4006

PO Box 41
Glenden Qld 4743
Australia

Tel + 61 (0) 7 4949 2880
au_info@peabodyenergy.com

7 November 2024

Department of Environment, Science and Innovation
Delegate of the administering authority
Environmental Protection Act 1994
Business Centre Coal
PO Box 3028, Emerald QLD 4720

Attention: Forough Ghasemi

Dear Forough

Information Request Response
P-EA-100658735 and P-PRCP-100669070_V1

Centurion Coal Mining Pty Ltd (a subsidiary of Peabody Energy Australia PTY LTD) is seeking authorisation to undertake exploration activities which consist of a pilot coal seam gas (CSG) exploration and extraction programme on Mining Lease (ML) 1790. To obtain authorisation for these activities, an amendment to the Environmental Authority (EA) P-EA-100658735 and Progressive Rehabilitation and Closure Plan (PRCP) P - PRCP - 100669070_V1 is required.

An Environmental Authority Amendment Application Supporting Report for the Project was submitted to the Department of Environment, Science and Innovation (DESI) on 13 September 2024. Subsequently the following actions have been executed:

- an Assessment Level Decision was received from DESI on 1 October 2024 stating that the assessment level decision for this application is that the proposed amendment to the environmental authority and PRCP schedule is a major amendment.
- an Information Request (IR) was received from DESI on 1 November 2024.
- meetings were held between Peabody and DESI to discuss the ALD and Information Request on 20 September 2024 and 24 October 2024 respectively.
- public notification for the major amendment is scheduled for 11 November – 6 December 2024.

A revised Environmental Authority Amendment Application Supporting Report has been prepared to respond to the IR and be publicised during the public notification period. The below table identifies in which section of the revised report the IR raised have been addressed.

If you have any further clarifications, please do not hesitate to contact us.

Regards,

Mike Carter
Vice President, **Australia Underground Operations**

Item #	Matter of Interest	Information Sought	Requested Action	Response
1.	Greenhouse Gas Abatement Plan – Appendix C Table 2.1	Table 2.1 presents a summary of Peabody's Greenhouse Gas Abatement Plan (GHG Abatement Plan). This Table indicates that the reference point for emissions for this project is the Centurion Coal Mine. The following statement is made *'Emission reduction will be measured based on the site- specific emission intensity approved by the Clean Energy Regulator for the Centurion Coal Mine.'* The current EA amendment relates to activities proposed to occur at the Centurion North project. The Centurion Coal Mine reference above, and in Table 2.1 is a distinctly different operation, occurring in a different location and authorised under a different Environmental Authority. The GHG Abatement plan does not explain why a neighbouring project has been used as the emissions reference point for the project or justify the appropriateness of this approach.	1. Provide an explanation as to why the neighbouring project Centurion Coal Mine has been used as the emissions reference point for the Centurion North Project. 2. Justify the use of the Centurion Coal Mine as the emissions reference point for the Centurion North project with consideration of the fact that the current EA amendment being assessed for the Centurion North project, occurs on an unrelated tenement under an unrelated environmental authority to that the Centurion Coal Mine. 3. If part of the explanation relies on the two projects being operated as a singular Safeguard Facility under the Commonwealths Safeguard Mechanism, provide details of the appropriateness of this approach.	1. Refer to Section 3.0 and 4.2 of the GHG Abatement Plan for an explanation as to why CCM has been used as the emissions reference point for the Project. 2. Refer to Section 3.0 and 4.2 of the GHG Abatement Plan for an explanation as to why CCM has been used as the emissions reference point for the Project. 3. Refer to Section 3.0 and 4.2 of the GHG Abatement Plan for an explanation as to why two projects being operated as a singular Safeguard Facility under the Commonwealths Safeguard Mechanism.
2.	Greenhouse Gas Abatement Plan – Appendix C Table 2.2 Environmental Authority Amendment Application Supporting Report – Section 3.7 Equipment	Table 2.2 of the GHG abatement plan states 'operation of flares at >95% availability and the response time are generally 20 minutes to restart flaring.' Table 3.2 in Section 3.7 'Equipment' indicates that venting systems will also be installed, presumably to facilitate direct venting when flaring is not in operation. Given the large volume of methane to be extracted over the life of the proposed project, the resulting GHG emissions from direct venting into the atmosphere when	1. Provide a detailed discussion in the GHG Abatement Plan of any direct venting that is proposed as part of the project. This must include more specific information about any venting systems required, the expected frequency of venting and any safety or technical considerations that have been contemplated in the development of the project. Any further regulatory requirements that have been considered must also be	1. Refer to Section 4.1 of the GHG Abatement Plan for an estimate of venting emissions and explanation on how to manage them. 2. Refer to Section 4.1 of the GHG Abatement Plan for an estimate of the Scope 1 emissions. 3. Refer to Section 4.1 of the GHG Abatement Plan for an estimate of leakage

Item #	Matter of Interest	Information Sought	Requested Action	Response
		flaring is not available, during re-start of flaring, and/or leaking could be significant. The GHG emissions produced in these instances must be estimated.	detailed. 2. Provide an estimate of the Scope 1 emissions that is inclusive of GHG emitted during direct venting and during restart of flaring. 3. Consider the impact that any leakage could have of the GHG emissions estimates, and if required includes the estimated emissions from any leakages in the Scope 1 estimate. Identify and discuss the implementation of mitigation measures in order to reduce the leakage of GHG emissions as a result of direct venting and during restart of flaring.	emissions and explanation on how to manage them.
3	Environmental Authority Amendment Application Supporting Report – Section 6.2 Greenhouse Gas Greenhouse Gas Abatement Plan – Appendix C	Table 6.7 of the supporting report 'Environmental Authority Amendment Application Supporting Report' outlines the emissions factors that have been considered in the Greenhouse Gas Assessment, based on the National Greenhouse Account Factors. It is noted that one of the emissions factors referred to is for 'coal seam methane that is captured for combustion'. The National Greenhouse Account Factors Table also provide a factor for 'coal mine waste gas', which has not been considered in Table 6.7. It is not clear whether using the coal mine waste gas factor has been considered in preparing the GHG assessment or the justification for ultimately using the coal seam methane factor. It may be appropriate to use the coal mine waste gas factor given one of the objectives of the project is to inform	1. Confirm whether the National Greenhouse Account Factor for 'coal seam waste gas' was considered in developing the GHG assessment. 2. If the 'coal seam waste gas' factor was considered, provide details on how each of the National Greenhouse Account Factors for 'coal seam methane' and 'coal seam waste gas' were considered and why the 'coal seam methane' factor was used in the development of the assessment. 3. Alternatively, if the 'coal seam waste gas' factor was not considered, provide an assessment on it's applicability to the project and revise the GHG assessment as required.	1. Refer to Section 4.1 of the GHG Abatement Plan for an explanation as to which National Greenhouse Account Factor was selected. 2. Refer to Section 4.1 of the GHG Abatement Plan for an explanation as to which National Greenhouse Account Factor was selected. 3. Refer to Section 4.1 of the GHG Abatement Plan for an explanation as to which National Greenhouse Account Factor was selected.

Item #	Matter of Interest	Information Sought	Requested Action	Response
		environmentally conscious management plans for eventual extraction of coal from ML1790.		
4	Environmental Authority Amendment Application Supporting Report – Section 6.2 Greenhouse Gas Greenhouse Gas Abatement Plan – Appendix C	Sections 6.2.2.3 and 6.2.2.4 discuss the operation of the vertical and lateral wells, and the summary of GHG emissions estimates. From these sections, it appears that the operation of 13 vertical wells has been included in estimating the scope 1 emissions, however it is not clear that the operation of 10 lateral wells has been accounted for. Further information is requested to explain how the operation of the 10 lateral wells contributes to the emissions profile of the project.	1. Provide further details on how the 10 lateral wells will operate in conjunction with the vertical wells, and whether any emissions will be produced through their operations. 2. If the operation of the 10 lateral wells will contribute to the scope 1 emissions for the project, revise the GHG assessment to make clear what these emissions are estimated to be and how they have been incorporated.	1. Refer to Section 2.2.4 of the GHG Abatement Plan for an explanation on how the lateral wells operate in conjunction with the vertical wells. 2. Refer to Section 4.1 of the GHG Abatement Plan for an estimate of the Scope 1 emissions.
5.	Greenhouse Gas Abatement Plan – Appendix C	The GHG abatement plan presented in Table 2.2 'Project Specific Greenhouse Gas Abatement Plan' generally lacks the detail required as specified in Appendix A of the GHG Guideline. Matters that are required to be addressed in accordance with Appendix A, which are currently considered absent from the GHG abatement plan include the following: • Emission Reduction Targets • A GHG emissions reduction • program • A discussion of advancing • technologies and opportunities • Details on monitoring and • auditing. It must also be noted that the GHG emissions reduction program is required to provide detailed information as outlined	1. Revise and update the GHG abatement plan to address sections (d), (e), (f) and (g) in accordance with Appendix A of the GHG guideline. Note that part (e) must be addressed in accordance with Appendix B of the GHG Guideline. 2. Revise and update the GHG abatement plan to provide further details on parts (b), (c) and (h). 3. It must be noted that the requirements outlined in Appendix A are a majority of the content requirements needed for the GHG abatement plan. The current approach to address these requirements in table and dot point formation does not meet the level of detail expected.	1. Refer to the following sections of the GHG Abatement Plan for details on: • Section 4.3 for (d) Emission reduction target. • Section 4.4 for (e) GHG emission reduction program. • Section 4.5 for (f) Advancing technologies and opportunities. • Section 4.6 for (g) Monitoring and auditing. 2. Refer to the following sections of the GHG Abatement Plan for details on: • Section 4.1 for (b) Emissions projections

Item #	Matter of Interest	Information Sought	Requested Action	Response
		in Appendix B of the GHG Guideline. Further, the information that has been supplied in Table 2.2 to meet the Appendix A requirements lacks the detail and specificity required to allow the department to understand the effectiveness of the proposed mitigation measures, emissions reduction measures and abatement opportunities.		and commencing abatement measures. • Section 4.2 for (c) GHG emissions reference point. • Section 4.7 for (h) Reporting 3. Refer to the revised GHG Abatement Plan.
6.	Environmental Authority Amendment Application Supporting Report – Section 6.5 Terrestrial Ecology	Section 6.5.2.1 of the supporting document identifies that the project will intercept an area of regulated vegetation that is classified as 'Of Concern' RE 11.8.11. However, the application indicates that the RE is not classified as MSES in accordance with the definition of prescribed regional ecosystem given in the *Environmental Offset Regulation 2014*, which refers to section 8(b) of the *Vegetation Management Act 1999*. The VM REDD referred to in the v*egetation Management Act 1999* classifies 'grassland' and woody grassland' separately and section 8b refers only to the grassland structural category. RE 11.8.11 has a structural category of woody grassland. Thus the exclusion provided in the prescribed regional ecosystem	1. Revise the supporting document to identify RE 11.8.11 as MSES regulated vegetation and address any significant residual impact to this regulated vegetation.	1. Refer to Section 6.5.2.1 of the Environmental Authority Amendment Application Supporting Report which has been updated to include RE 11.8.11 as MSES regulated vegetation.

Environmental Authority Amendment Application Supporting Report

P-EA-100658735 and P-PRCP-100669070_V1

Centurion Coal Mining Pty Ltd.

Moranbah, Queensland 4744

Prepared by:

SLR Consulting Australia

SLR Project No.: 620.040594

7 November 2024

Revision: 3.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	11 September 2024	Eliza Blandthorn, Mavisha Nariansamy	Reine Byrne	Peter Smith
2.0	13 September 2024	Eliza Blandthorn, Mavisha Nariansamy	Reine Byrne	Peter Smith
3.0	7 November 2024	Reine Byrne	Reine Byrne	Peter Smith

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Centurion Coal Mining Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Executive Summary

Centurion Coal Mining Pty Ltd has recently secured the rights to further explore resources under a portion of Mining Lease (ML) 1790 and ML 70495 located immediately adjacent to and directly north of the Centurion Coal Mine, an existing underground longwall mine located on ML 6949.

As a result, Centurion Coal Mining Pty Ltd proposes to undertake exploration activities which consist of a pilot coal seam gas (CSG) exploration and extraction programme (the Project) within ML 1790. Exploration and evaluation of CSG requires the implementation of a network of 13 vertical and 10 lateral wells, extending from the ground surface down to the Goonyella Middle coal seam. These wells will be connected to flare kits and be supported by other surface infrastructure for CSG processing, monitoring, and control.

To obtain authorisation for the Project activities, an amendment to the Environmental Authority (EA) P-EA-100658735 and Progressive Rehabilitation and Closure Plan (PRCP) P-PRCP-100669070_V1 is required. The proposed changes include:

- EA P-EA-100658735:
  - Condition 15 Schedule A.
  - Condition 7 Schedule F.
  - Condition 9 Schedule F.
  - Condition 22 Schedule F.
- PRCP P-PRCP-100669070_V1:
  - Section B - Figure 1.
  - Section C – (RA1) Rehabilitation area 1.

Assessments for air quality, greenhouse gas, noise and vibration, terrestrial ecology, aquatic ecology, groundwater, surface water, and waste management were undertaken to determine impacts. The impacts resulting from Project activities along with mitigation measures are presented in this Supporting Report.

Risk assessments have determined that the proposed Project activities pose a low risk of causing environmental harm/ nuisance beyond that authorised by the EA. This is attributed to the scale and location of the Project activities, and that these activities can be managed under the monitoring and compliance requirements of the existing EA and Centurion Coal Mine management practices that will be applied to the Project to minimise and/or prevent unauthorised harm to Environmental Values from the Project.

An Assessment Level Decision (ALD) was received from the Department of Environment, Science and Innovation (DESI) on 1 October 2024. The ALD for this application considered that the proposed amendment to the environmental authority and PRCP schedule is a major amendment.

Subsequently, this environmental authority amendment application supporting report has been revised to address the issues raised in the Information Request receive from DESI on 1 November 2024.

Table of Contents

Tables in Text

Figures in Text

Appendices

Acronyms and Abbreviations

ALD	Assessment level decision
AUSRIVAS	Australian River Assessment System
BAR	Bioacoustic records
CCM	Centurion Coal Mine
CEC	Cation exchange capacity
CH4	Methane
CONCAWE	The Conservation of Clean Air and Water Europe
CSG	Coal seam gas
dBA	Decibels A
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DEHP	Department of the Environment and Heritage Protection
DES	Department of Environment and Science
DESI	Department of Environment, Science and Innovation
DEWHA	Department of the Environment, Water, Heritage and the Arts
DNRM	Department of Natural Resource Management
DNRME	Department of Natural Resources, Mines and Energy
DoR	Department of Resources
DotE	Department of the Environment
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities
DSITI	Department of Science, Information Technology and Innovation
EA	Environmental authority
EIS	Environmental Impact Statement
EO Act	*Environmental Offsets Act 2014*
EO Regulation	Environmental Offsets Regulation 2014
EP Act	*Environmental Protection Act 1994*
EP Regulation	Environment Protection Regulation 2019
EPBC Act	*Environmental Protection and Biodiversity Conservation Act 1999*
EPP	Environmental Protection Policy
ERA	Environmentally Relevant Activities
ERC	Estimated Rehabilitation Cost
E2M	E2M Consulting Pty Ltd
GDE	Groundwater-dependent ecosystem
GHG	Greenhouse gas
GHG Act	*Greenhouse Gas Storage Act 2009*
GM	Goonyella Middle
ha	Hectares
HDPE	High density poly ethylene
Hydrobiology	Hydrobiology Pty Ltd
Hz	Hertz
ID	Identification
IESC	Independent Expert Scientific Committee
ISO	International Organisation for Standardisation
kL	kilolitre

km	kilometers
kpa	kilopascals
kV	kilovolt
L	litre
LIKT	Locally important koala tree
m	meters
mm	millimeters
mbGL	meters below ground level
MMC	Model Mining Conditions Guideline
MDL	Mineral development lease
ML	Mega litres
ML	Mining lease
MNES	Matters of national environmental significance
MR Act	*Mineral Resources Act 1989*
MSES	Matters of state environmental significance
NA	Not applicable
NC Act	*Nature Conservation Act 1992*
NEPM	National Environment Protection Measures
PET	Plecoptera, Ephemeroptera, and Trichoptera macroinvertebrates
PM	Particulate matter
PNC	EcoAccess Planning for Noise Control guideline
PPV	Peak particle velocity
PRCP	Progressive Rehabilitation and Closure Plan
RBL	Rating background levels
RE	Regional Ecosystem
RIDA	Regional Interests Development Approval
RPI Act	*Regional Planning Interests Act 2014*
SCADA	Supervisory Control and Data Acquisition
SEVT	Semi-evergreen vine thicket
SIGNAL	Stream Invertebrate Grade Number - Average Level
SIS	Surface-to-inseam
SLR	SLR Consulting Australia
SO	Stream order
SRI	Significant Residual Impact
SWL	Sound power level
SWL	Standing water level
t	tonnes
TEC	Threatened ecological communities
TEP	Transitional Environment Programs
TSP	Total suspended particulates
TSSC	Threatened Species Scientific Committee
VM Act	*Vegetation Management Act 1999*
W	Watts

1.0 Introduction

This section presents the background, objectives, and structure of this supporting report.

1.1 Objective of this Environmental Authority Amendment

Centurion Coal Mining Pty Ltd (a subsidiary of Peabody Energy Australia Pty Ltd) is seeking authorisation to undertake exploration activities which consist of a pilot coal seam gas (CSG) exploration and extraction programme on Mining Lease (ML) 1790.

To obtain authorisation for these activities, an amendment to the Environmental Authority (EA) P-EA-100658735 and Progressive Rehabilitation and Closure Plan (PRCP) P - PRCP - 100669070_V1 is required.

This report has been prepared to support an amendment to P-EA-100658735 and P- PRCP - 100669070_V1 under Section 226A of the *Environmental Protection Act 1994* (EP Act).

1.2 Project Background

Centurion Coal Mining Pty Ltd has recently secured the rights to further explore resources within ML 1790 and ML 70495 located immediately adjacent to and directly north of the Centurion Coal Mine (CCM), an existing underground longwall mine located on ML 6949.

As a result, Centurion Coal Mining Pty Ltd proposes to undertake the Project exploration activities on ML 1790. The activities and infrastructure associated with the pilot CSG exploration and extraction programme are the subject of this EA and PRCP Amendment and are henceforth referred to as ‘the Project’.

1.3 Project Objectives

The objectives of the Project are:

- **Resource identification and characterisation**: Determine the presence, quantity, and quality of CSG within the Goonyella Middle (GM) coal seam and further assess the geological and petrophysical properties of the coal seam (i.e. permeability, porosity). As the exploration wells are brought online, the water and gas production are monitored and measured to determine the drawdown characteristics of the water and CSG within the GM coal seam.
- **Feasibility assessment**: There had been no historical testing on ML1790 to measure CSG drainage performance. This Project is required to understand more about the characteristics of the GM coal seam and the contained gas. This is required to develop management plans for the safe, environmentally conscience and economic extraction of CSG and coal from the ML1790. The drilling and sampling of the resource, and data gathering from the exploration works enables resource and groundwater models to be built and verified. From this the technical and economic analysis can be based on more reliable information to assess the feasibility of extracting the resource.
- **Impact and risk assessment**: Monitor and evaluate potential impacts associated with CSG exploration and extraction on environmental values (EVs); and refine mitigation measures to ensure the safety and success of the Project.
- **Regulatory compliance**: Ensure that exploration activities comply with, or exceed, local, state, and commonwealth regulations.

1.4 Report Structure

This report is structured as shown in **Table 1.1.**

Table 1.1 Report structure

Chapter	Content
Chapter 1: Introduction (this chapter)	Objectives of the EA Amendment Application Supporting Report, project background, project objectives, and report structure.
Chapter 2: Legislation Context	Key legislation, policies and guidelines to this project.
Chapter 3: Activities Subject to this EA Amendment	Design information on each phase of the Project to inform the impact assessment process. Includes the project justification and alternatives assessment.
Chapter 4: Proposed EA Amendments	Conditions of EA P-EA-100658735 and PRCP P-PRCP-100669070_V1 that require amendment.
Chapter 5: Assessment Methodology	A description of the environmental assessment process and approach taken to determining the significance of impacts and appropriate mitigation.
Chapters 6: Environmental Assessment	An assessment of the Project's environmental impacts on air quality, greenhouse gases (GHG), noise and vibration, land resources, terrestrial ecology, aquatic ecology, surface water and groundwater resources, and waste management. Includes a description of relevant legislation, policies and guidelines adopted for this assessment, a description of baseline characteristics, identified mitigation measures to reduce or avoid significant impacts, and a summary of the residual (post-mitigation) effects.
Chapter 7: Conclusion	A summary of the EA Amendment Application Supporting Report findings.
Chapter 8: Reference	-

2.0 Legislative Context

This section summarises the key State and Commonwealth legislation, policies, and guidelines applicable to the Project.

2.1 Mineral Resources Act 1989

The Mineral Resources Act 1989 (MR Act) is administered by the Department of Resources (DoR) and provides for "*the assessment, development and utilisation of mineral resources to the maximum extent practicable consistent with sound economic and land use management'*.

The principal objectives of the MR Act are to:

- Encourage and facilitate prospecting and exploring for and mining of minerals.
- Enhance knowledge of the mineral resources of the State.
- Minimise land use conflict with respect to prospecting, exploring and mining.
- Encourage environmental responsibility in prospecting, exploring and mining.
- Ensure an appropriate financial return to the State from mining.
- Provide an administrative framework to expedite and regulate prospecting and exploring for and mining of minerals.
- Encourage responsible land care management in prospecting, exploring and mining.

The MR Act provides for the granting, conditioning and management of mining tenements, prospecting permits, exploration permits, mineral development licences, mining leases and mining claims.

A ML (with surface rights) under the MR Act is required to permit the conduct of mining and associated activities within the ML. The Project footprint is located within ML 1790, which authorise surface rights to access minerals and gaseous hydrocarbons in the Project Area.

2.2 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) was established "to protect Queensland's environment, while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends".

Resource activities carried out on mining tenure are approved via the grant of an EA under Chapter 5 of the EP Act. When deciding whether to grant or refuse an application for an EA or an amendment to an EA or deciding on the conditions of the EA, the Department of Environment, Science and Innovation (DESI), the administering authority, must consider certain matters set out in the EP Act.

The EP Act utilises several mechanisms to achieve its objectives. These include:

- EA assessment processes, including where applicable, an Environmental Impact Statement (EIS) process for resource projects.
- Licensing or approving all Environmentally Relevant Activities (ERAs).
- Major and minor EA Amendment provisions to EAs.
- Allowing for improvement through Transitional Environment Programs (TEPs).
- Issuing Environmental Protection Policies (EPPs).

- Regulating contaminated land.
- Creating a general environmental duty.

An EA Amendment is required where there is a proposed change to the nature and extent of authorised activities on an associated ML(s) and/or the conditions of the EA need to be amended. For the Project to proceed, an amendment to the existing EA Conditions is required.

2.2.1 Amendment Threshold

An assessment of the proposed EA Amendment for the Project against the minor amendment (threshold) criteria (as outlined in Section 223 of the EP Act) is presented in **Table 2.1**. As per the EP Act Major and Minor Amendment Guideline, a major amendment for an EA or PRCP schedule is an amendment that is not a minor amendment.

Table 2.1 Summary of minor EA amendment threshold criteria (Section 223)

Minor EA Amendment Threshold Criteria	This EA Amendment Application
The proposed amendment:	
a) is not a change to a condition identified in the authority as a standard condition, other than – i. a change that is a condition conversion. ii. a change that is not a condition conversion but that replaces a standard condition of the authority with a standard condition for the environmentally relevant activity to which the authority relates. iii. a change that will not result in a change to the impact of the relevant activity on an EV.	The Project is not a change to a standard condition.
b) does not significantly increase the level of environmental harm caused by the relevant activity	The Project does not significantly increase the level of environmental harm, as demonstrated under **Section 6.0.**
c) does not change any rehabilitation objectives stated in the authority in a way likely to result in significantly different impacts on EVs than the impacts previously permitted under the authority	The Project does not result in any changes to the current rehabilitation objectives that would result in a significant impact on EV, as demonstrated under **Section 6.0**.
d) does not significantly increase the scale or intensity of the relevant activity	The Project does not significantly increase the intensity of the relevant activities, as demonstrated under **Section 6.0**.
e) does not relate to a new relevant resource tenure for the authority that is— i. a new mining lease ii. a new petroleum lease iii. new geothermal lease under the Geothermal Energy Act iv. a new GHG injection and storage lease under the GHG storage Act	The Project does not relate to a new resource tenure for the EA.

Minor EA Amendment Threshold Criteria	This EA Amendment Application
f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area	The Project will not change the existing surface area for the relevant activities by more than 10%, as demonstrated under **Section 3.0** and **Section 6.0**.
g) for an environmental authority for a petroleum activity— i. involves constructing a new pipeline that does not exceed 150km ii. involves extending an existing pipeline so that the extension does not exceed 10% of the existing length of the pipeline	Not Applicable.
h) if the amendment relates to a new relevant resource tenure for the authority that is an exploration permit or GHG permit—seeks, in the amendment application under section 224, an amended environmental authority that is subject to the standard conditions for the relevant activity or authority, to the extent it relates to the permit.	The Project will adhere to the standard conditions for the relevant authority.

2.2.1.1 Assessment Level Decision

An ALD was received from the DESI on 1 October 2024. The ALD for this application considered that the proposed amendment to the environmental authority and PRCP schedule is a major amendment.

2.2.1.2 Public Interest and Notification

After receiving the ALD and Information Request, public notification for this major EA and PRCP amendment will occur for 20 business days from 11 November 2024 to 6 December 2024.

Relevant materials will be available for viewing on the Peabody Energy website and advertised in the local Mercury News.

2.2.2 Standard Criteria

The Standard Criteria, as defined in Schedule 4 of the EP Act, has been considered to assist in assessing the significance of the proposed amendment in accordance with Section 241 of the EP Act. Centurion Coal Mining Pty Ltd assessment against the Standard Criteria is outlined in Table 2.2.

Table 2.2 Assessment of standard criteria

EP Act Reference	Legislation Requirement	How Requirement is Addressed
Standard criteria (a)	The following principles of environmental policy as set out in the	(i) Peabody has evaluated the risk of potential environmental impact in line with the precautionary principle. These evaluations have formed the

EP Act Reference	Legislation Requirement	How Requirement is Addressed
	Intergovernmental Agreement on the Environment— (i) the precautionary principle; (ii) intergenerational equity; (iii) conservation of biological diversity and ecological integrity	development of suitable environmental avoidance and mitigation measures, detailed in each Environmental Assessment provided in **Section 6.0** for the technical disciplines. Peabody possesses the necessary technical expertise, financial backing, and resources to implement and sustain the suggested environmental mitigation measures for the Project. (ii) The Project will balance economic benefit with minimal environmental disturbance, beneficial infrastructure construction, and post-mining land use planning. It emphasises maintaining environmental value, reducing impact, and using existing infrastructure where possible. Intergenerational equity is addressed through long-term land use planning, community impact consideration, and environmental monitoring and mitigation measures. (iii) The Project will retain remnant vegetation, use existing infrastructure to limit clearing, and plan progressive rehabilitation. Mitigation measures include preserving riparian zones, minimising clearing, managing weeds, and rehabilitating with native species.
Standard criteria (b)	Any Commonwealth or State government plans, standards, agreements or requirements about environmental protection or ecologically sustainable development.	It is expected that the Project will be consistent with the Isaac Regional Planning Scheme Version 1.1, July 2024. Relevant standards include those set out under the *National Environment Protection Council* (*Queensland) Act 1994*. National Environment Protection Measures (NEPMs) outline national objectives for protecting and managing aspects of the environment. These NEPMs have been considered during the environmental assessment stage for the Project. The following EPPs are relevant to the Project and discussed in **Section 2.2.4, 2.2.5, and 2.2.6.**
Standard criteria (d)	Any relevant environmental impact study, assessment or report.	Peabody has conducted environmental assessments commensurate with a minor EA Amendment Application under the EP Act. These assessments have prioritised key factors such as air quality, GHG, noise and vibration, surface water and groundwater resources, terrestrial and aquatic ecology, GDEs, and waste management i.e., critical matters. They comprehensively address

EP Act Reference	Legislation Requirement	How Requirement is Addressed
		current environmental values, potential impacts, and strategies for avoiding, managing, mitigating, and rehabilitating these impacts.
Standard criteria (e)	The character, resilience and values of the receiving environment.	The ML 1790 and ML 70495 are situated amongst a coal mining region in the Bowen Basin where resource extraction, agriculture and livestock grazing are the predominant, co-existent land uses. The Project is located on an area that has been subject to previous drilling and exploration activities. As a result, the landscape has been highly modified. An assessment of environmental characteristics was conducted (**Section 6.0**) as part of this amendment application.
Standard criteria (f)	All submissions made by the applicant and submitters.	The Project and associated environmental studies will constitute Peabody's submission in support of the EA Amendment Application. Peabody will undertake an appropriate level of formal and non-formal key stakeholder consultation during the EA Amendment process in line with Peabody's existing stakeholder engagement principles and process. Peabody will respond to complaints and concerns from the public during the Project should they arise.
Standard criteria (g)	The best practice environmental management for activities under any relevant instrument, or proposed instrument, as follows— (i) an environmental authority (ii) a transitional environmental program (iii) an environmental protection order (iv) a disposal permit (v) a development approval	P-EA-100658735 sets out suitable environmental management practice for the proposed activities and is not the subject of: (ii) a transitional environmental program (iii) an environmental protection order (iv) a disposal permit, or (v) a development approval.
Standard criteria (h)	The financial implications of the requirements under an instrument, or proposed instrument, mentioned in paragraph (g) as they would relate to the type of activity or industry carried out, or proposed to be carried out, under the instrument	Approval of this EA Amendment will require an amendment to the current estimated rehabilitation cost (ERC) decision. This will be addressed following approval of the amendment application.
Standard criteria (i)	The public interest	Issues of community interest and concern will be addressed during the EA Amendment process. Peabody will continue to engage with the relevant key stakeholders in relation to the Project as an extension of its existing stakeholder engagement program. In addition, the Project does not represent a significant impact to EVs that is currently

EP Act Reference	Legislation Requirement	How Requirement is Addressed
		approved under the EA P-EA-100658735. It is therefore reasonably considered unlikely that the Project (and accompanying EA amendment) would trigger minimal, if any, public interest.
Standard criteria (j)	Any relevant site management plan	The existing CCM environmental management plans will be updated accordingly, stating the management strategies to prevent or minimise the potential for environmental harm from the Project. They will also set out a framework to manage environmental obligations set out in the EA.
Standard criteria (k)	Any relevant integrated environmental management system or proposed integrated environmental management system	The Project will operate in accordance with the existing CCM Environmental Management Framework and other related documentation.

2.2.3 Environmentally Relevant Activities

ERAs described under the *Environment Protection Regulation 2019* (Qld) (EP Regulation) and authorised to take place on ML 1790 and ML 70495 will continue to be undertaken under EA (P-EA-100658735).

The Project will not require the authorisation of any additional ERAs.

2.2.4 Environmental Protection (Air) Policy 2019

The purpose of the *Environmental Protection (Air) Policy 2019* (EPP(Air)) is to achieve the relevant objectives of the EP Act by:

- Identifying EVs to be enhanced or protected.
- Stating indicators and air quality objectives for enhancing or protecting the EVs.
- Providing a framework for making consistent, equitable and informed decisions about the air environment.

This EA Amendment outlines an air quality assessment in **Section 6.1**, inclusive of a summary of management and mitigation measures and risk assessment of impacts to the air shed and sensitive receptors.

2.2.5 Environmental Protection (Noise) Policy 2019

The purpose of the *Environmental Protection (Noise) Policy 2019* (EPP(Noise)) is to achieve the relevant objectives of the EP Act by:

- Identifying EVs to be enhanced or protected.
- Stating acoustic quality objectives for enhancing or protecting the EVs.
- Providing a framework for making consistent, equitable and informed decisions about the acoustic environment.

This EA Amendment outlines the noise and vibration assessment in **Section 6.3**, inclusive of a summary of management and mitigation measures and risk assessment of potential impacts to sensitive receptors.

2.2.6 Environmental Protection (Water and Wetland Biodiversity) Act 2019

The purpose of the *Environmental Protection (Water and Wetland Biodiversity) Act 2019* (EPP(WWB)) is to achieve the relevant objectives of the EP Act by:

- Identifying EVs for waters and wetlands.
- Identifying management goals for waters.
- Stating water quality guidelines and water quality objectives to enhance or protect the environment.
- Providing a framework for making consistent, equitable and informed decisions about waters.
- Monitoring and reporting on the condition of water.

This EA Amendment outlines the surface and groundwater assessment in **Section 6.7** and **Section 6.8**, inclusive of a summary of management practices and risk assessment of impacts to the relevant EVs.

2.3 Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) prescribes the Commonwealth's role in environmental assessment, biodiversity conservation and the management of protected areas. The EPBC Act identifies nine Matters of National Environmental Significance (MNES) categories:

- World heritage properties.
- National heritage places.
- Wetlands of international importance (listed under the Ramsar Convention).
- Listed threatened species and ecological communities.
- Migratory species protected under international agreements.
- Commonwealth marine areas.
- The Great Barrier Reef Marine Park.
- Nuclear actions (including uranium mines).
- A water resource, in relation to coal seam gas development and large coal mining development.

An assessment and approval under the EPBC Act is required for any activity that has, or is likely to have, a significant impact on an MNES. Such an activity is deemed to be a 'controlled action'. It is an offence to undertake a 'controlled action' without the approval of the Commonwealth Environment Minister.

The Project is not anticipated to require approval under EPBC Act; refer to **Section 6.5** and **Appendix B** for further details. However, Centurion Coal Mining Pty Ltd is currently preparing a self-assessment to determine whether there are potential impacts to MNES. Should the self-assessment determine there is a significant impact on MNES, Centurion

Coal Mining Pty Ltd will submit a referral to the Department of Climate Change, Energy, the Environment and Water (DCCEEW) accordingly.

2.4 Water Act 2000

The *Water Act 2000* (Water Act) provides for the management of waters and watercourses and the construction, control and management of works that affect watercourses. The purpose of the Water Act is to advance sustainable management and efficient use of water resources by establishing a system for planning, allocation and use of water.

Centurion Coal Mining Pty Ltd exercises underground water rights on ML 1790 and ML 70495 in accordance with the requirements of the Water Act.

Section 227AA of the EP Act describes the circumstances in which additional information on the exercise of underground water rights must be provided for an EA amendment application. Additional information must be provided where:

- The application relates to a site-specific EA for a resource project or activity that includes a resource tenure that is a mineral development licence, mining lease or petroleum lease.
- The proposed amendment involves changes to the exercise of underground water rights.

Section 227AA requires that an applicant must provide the information required by section 126A of the EP Act. Section 1.1.4 of the DESI Guideline ESR/2016/3275 '*Requirements for site-specific and amendment applications – underground water rights*' provides guidance on when information on the exercise of underground water rights is required. Amendment applications only need to include information relating to the changes to the proposed exercise of underground water rights which will occur, or are predicted to occur as a result of the proposed amendment to the EA.

The activities proposed as part of this EA amendment are partially located within the Highland Groundwater Underground Water Area. The Water Regulation 2016 outlines that the Highland Groundwater Underground Water Area does not require water entitlement, water permit or seasonal water assignment notice for stock or domestic purposes or a prescribed activity.

2.5 Regional Planning Interests Act 2014

The *Regional Planning Interests Act 2014* (RPI Act) regulates impacts from resource and other regulated activities on identified areas of regional interest. The RPI Act restricts the carrying out of resource activities in 'areas of regional interest' where the activity is not exempt from the provisions of the RPI Act, or a regional interests development approval (RIDA) has not been granted. The 'areas of regional interest' managed under the RPI Act are Priority Living Areas, Priority Agricultural Areas, Strategic Environmental Areas and Strategic Cropping Areas.

Under the RPI Act, approximately 153 ha of Strategic Cropping Land has been mapped within the Project Area. A compliance certificate (No. SCLRD2013/000151) has been issued for ML1790, ML4752, MLA70443, MLA70495 on 6 November 2013.

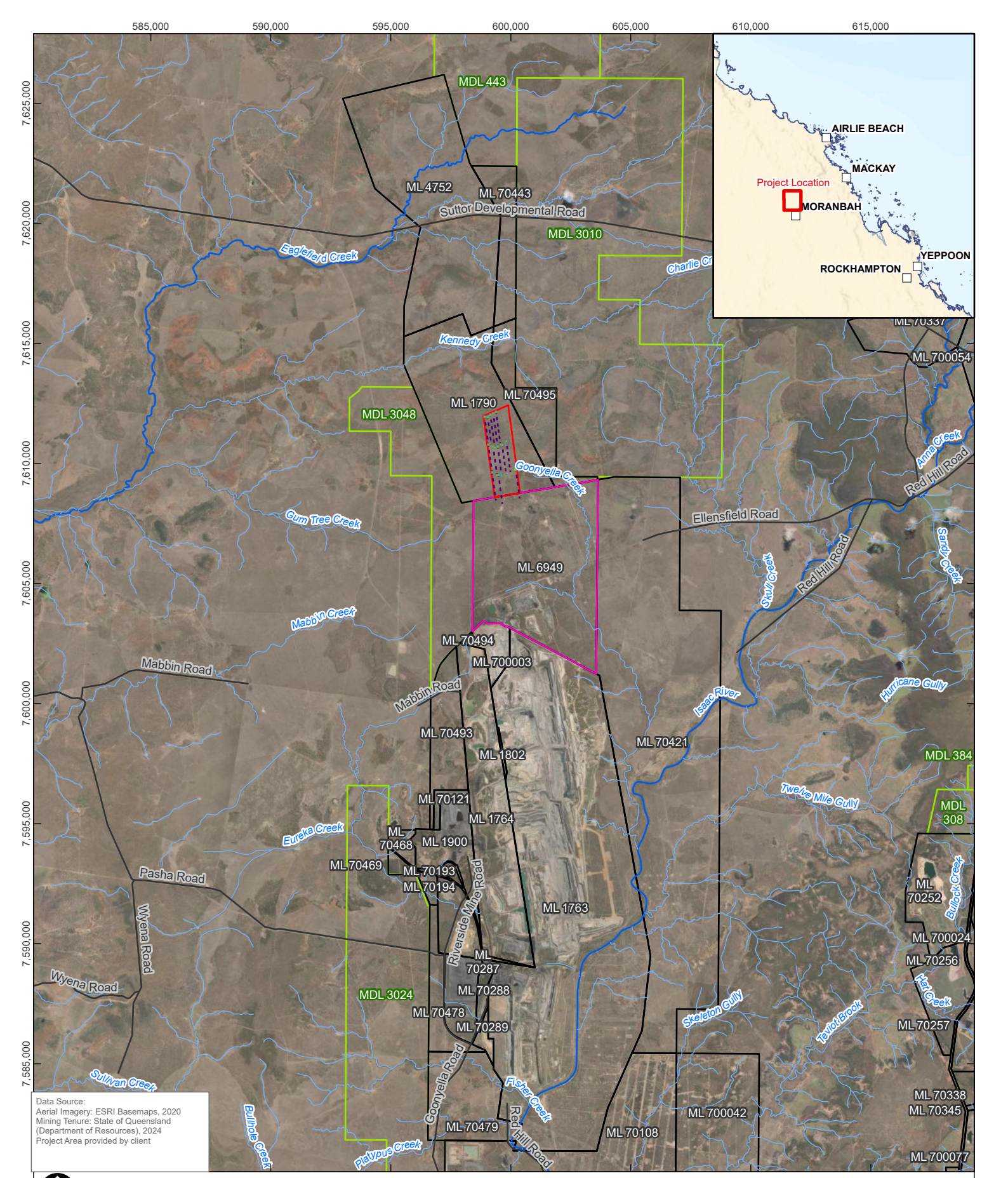
3.0 Activities Subject of this EA Amendment

This section provides a description of the activities subject of this EA Amendment. **Section 4.0** provides details on the necessary amendments to the EA.

3.1 Location of the Project

The Project is located approximately 40 km north of Moranbah and is accessed from Moranbah via the Goonyella Road, the Red Hill Road and the North Goonyella Mine Access Road. Mackay is located approximately 140 km (and approximately 188 km by road), to the east and is accessed via the Peak Downs Highway, the Suttor Developmental Road, the Red Hill Road and the North Goonyella Mine Access Road.

The Project is located immediately adjacent to, and north of, the CCM (**Figure 3.1**).



SLR

FIGURE 3.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_F03-01_Project Location

3.2 Access Tracks

A network of access tracks for light and heavy vehicles is present across ML 1790 and connects to the existing road network (i.e. North Goonyella Mine Access Road) (**Figure 3.1**) due to existing and historical activities within ML 1790. The existing access tracks will be used as much as possible to connect the proposed drill pads and minimise requirements for additional surface disturbance.

Where new access tracks are required due to the location of the drill pads, these will be constructed to allow for light and heavy vehicles. The new access tracks will be 5 m wide and will extend a cumulative 0.31 km, typically in an East-West direction (**Figure 3.2**).

The access tracks will be constructed as follows:

- Survey and demarcation of access track alignment and clearing boundaries.
- Removal of vegetation.
- Removal and stockpile of topsoil and unsuitable sub-soils.
- Preparation of access track base with sub-base material.
- Installation of traffic control infrastructure such as signage.

A 30 kL water cart will operate for dust suppression across working and trafficable areas. The access tracks will be maintained to ensure the safety of site personnel and to facilitate the effective transportation of equipment and personnel.

3.3 Coal Seam Gas Exploration

The program for exploration and evaluation of CSG has been designed as a network of gas extraction wells, extending from the ground surface down to the GM coal seam with lateral in-seam drainage to maximise the coverage of data acquisition from the exploration program. These wells will be supported by surface infrastructure for CSG processing, monitoring, and control.

Vertical wells are drilled from the surface directly downwards. The lateral wells are drilled near vertically from the surface and are then deviated through a tight radius bend to intercept the target coal seam parallel to the bedding planes (**Image 3.1**). The lateral wells are then directionally drilled through the GM coal seam to incept its corresponding vertical well. The vertical wells are used for collecting and conveying the CSG and associated water to the surface from within the lateral well that passes through the GM coal seam.

3.3.1 Drill Pad

Each CSG well will be constructed and operated from within the boundaries of a drill pad. A total of nineteen (19) drill pads are proposed for the vertical and lateral wells. **Table 3.1** presents details of the drill pad disturbance area and **Figure 3.2** illustrates their locations.

Table 3.1 Drill pad disturbance area

Drill pads	No	Dimensions (m)	Disturbance area (ha)
Drill pad	19	80 X 80 m	12.65
Less existing approved disturbance			(0.85)
Total new disturbance			**11.80**

Drill pad construction methodology will be as follows:

- Permit to Disturb is required prior to any vegetation or groundcover removal.
- Survey and demarcation of access track alignment and clearing boundaries.
- Removal of vegetation.
- Removal and stockpile of topsoil and unsuitable sub-soils.
- Construction and installation of water management infrastructure, such as sumps, bunds and water tanks.
- Delivery and spread of gravel to ensure drill pad allows for all-weather access.

Figure 3.2 illustrates the proposed layout of vertical and lateral wells across the drill pads. Some drill pads will be dual propose and accommodate both vertical and lateral wells within them.

3.3.2 Vertical Wells

A total of thirteen (13) vertical wells will be drilled (**Figure 3.2**). Following development of the drill pads, construction methodology for the vertical wells is as follows:

- The initial step involves drilling a pilot hole (known as spudding). A larger diameter hole (12 ¼" diameter) is then drilled to a shallow depth (24 m) and a steel casing is installed to prevent the well from collapsing. The hole is then drilled to the target GM coal seam depth (290 - 570 m). Drilling fluid (mud) is used to lubricate the bit, control pressure, and carry cuttings to the surface. The cuttings will then be collected at the surface, where they will be disposed of in line with the CCM waste management procedure.
- Casing (such as steel, fibre glass or high-density polyethylene (HDPE)) is run into the hole to the total depth and cemented in place to prevent groundwater and gas from moving outside of the well and between geological layers. Perforations are made in the casing at the coal seam level to allow gas to flow into the well.
- The well is completed with necessary equipment for gas extraction. Initial production tests are conducted to evaluate the well's performance.
- During the extraction evaluation operation, the CSG from the vertical well will be connected via a low-pressure pipeline to a candle stick flare kit located within the disturbance footprint of the drill pad. The flare will enable combustion of all extracted methane gas to minimise the emission intensity of the evaluation operation.

3.3.3 Lateral Wells

Ten (10) lateral wells will be drilled into the GM coal seam (**Figure 3.2**) from pads located within ML1790. A further three (3) lateral wells will be drilled from pads located within ML6949 and will intercept vertical wells that are within ML1790 such that a total of thirteen (13) paired lateral and vertical wells are completed to enable gas extraction from the GM seam. Following development of the drill pads, construction methodology for the lateral wells follows the same methodology as for vertical wells:

- A vertical section is drilled to a depth above the target GM coal seam (290 - 570m). Then, using directional drilling techniques, the wellbore is gradually deviated from the vertical to horizontal, forming a curve. This requires specialized downhole motors and tools.

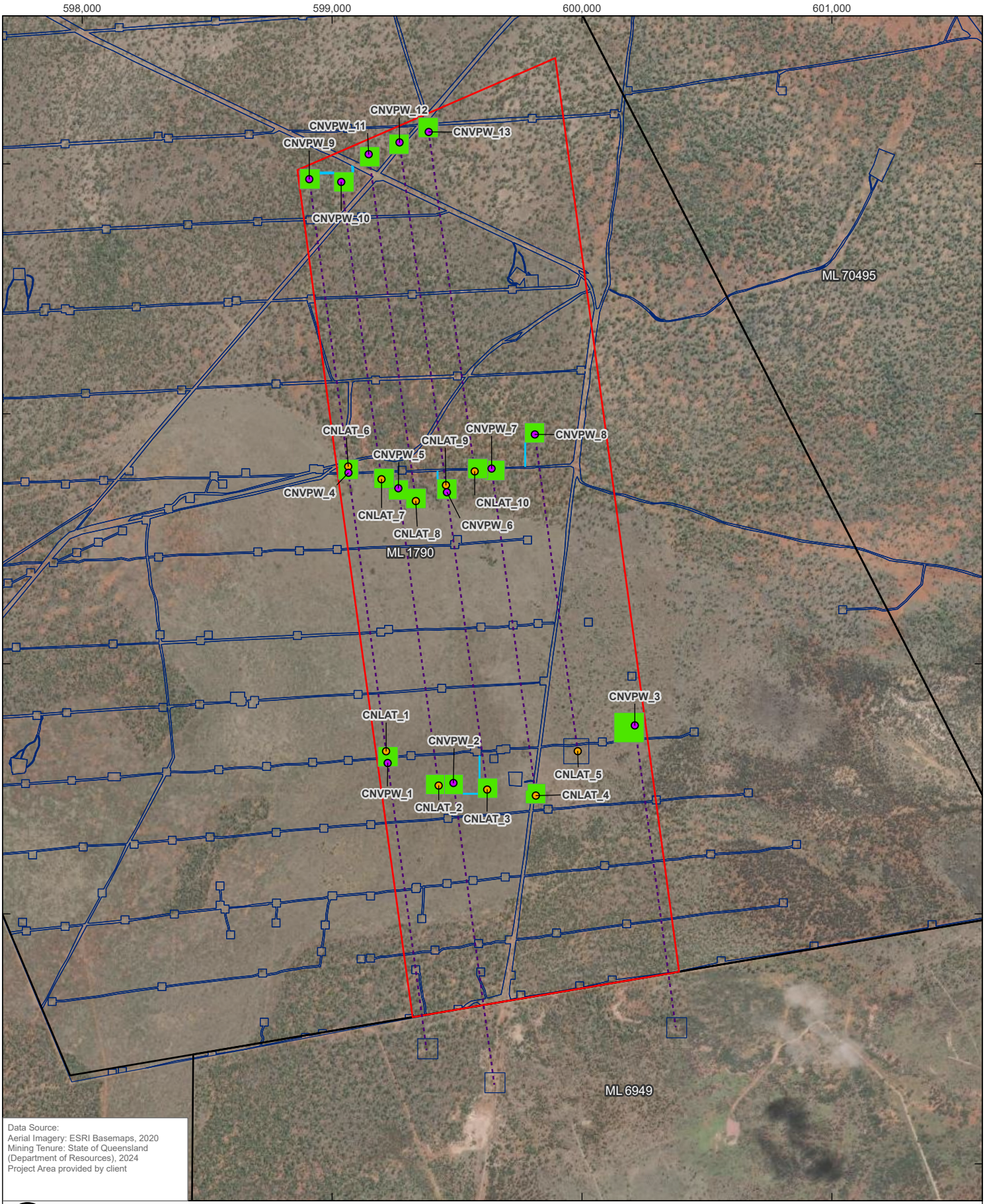
- Once the curve is horizontal, it is drilled along the coal seam (1000-1900 m) for a specified distance to connect with the vertical well. The horizontal well maximizes exposure to the coal seam, enhancing gas recovery and the spatial extent of data acquisition.
- Casing (such as steel, fibre glass or HDPE) (7 7/8” diameter) is run into the well and cemented to isolate the gas-producing zones. Perforations are made in the casing at the coal seam level to allow gas to flow into the well.
- The horizontal well is completed with equipment designed for gas production, including perforating the casing along the horizontal section.

3.3.4 Exploration Method

Following drilling of the vertical and lateral wells and installation of the necessary extraction and monitoring equipment, CSG will be extracted as follows:

- Water in the GM coal seam (formation water) will be removed through the vertical well, reducing the pressure in the coal seam (by ~40 kpa/day) throughout the lateral well that each vertical well is paired with. Pumps located at the base of the vertical wells, are operated to bring water to the surface.
- It is anticipated that depressurising of the coal seam will take up to 90 days. The water will pass through the well head to storage tanks and be carted off and added to the CCM mine water management system.
- The reduction in pressure within the coal seam allows CSG to be desorbed from the coal. The CSG will migrate through the coal's natural fractures (cleats) through the perforations made in the casing and into the well.
- The desorbed CSG will flow along the lateral well and up into the connected vertical well to the surface, where it will be separated from any remaining water.
- The CSG will pass through a steel pipe before being flared. It is anticipated that the CSG will comprise >99% methane (CH_4) and will be flared 24 hours per day. Data logging will take place to record the amount of CSG produced from the wells. It is anticipated that CSG will be produced at a rate of 500 l/sec from each vertical well.
- Water and gas monitoring data collected during the evaluation will enable the development of decline curves which will better inform the gas-in-place, geological and hydrogeological models for the resource.

Image 3.1 and **Image 3.2** present examples of CSG well schematics.



EA AMENDMENT P-EA-100658735

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

PROPOSED PROJECT LAYOUT

SLR

FIGURE 3.2

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_F03-02_Proposed Project Layout

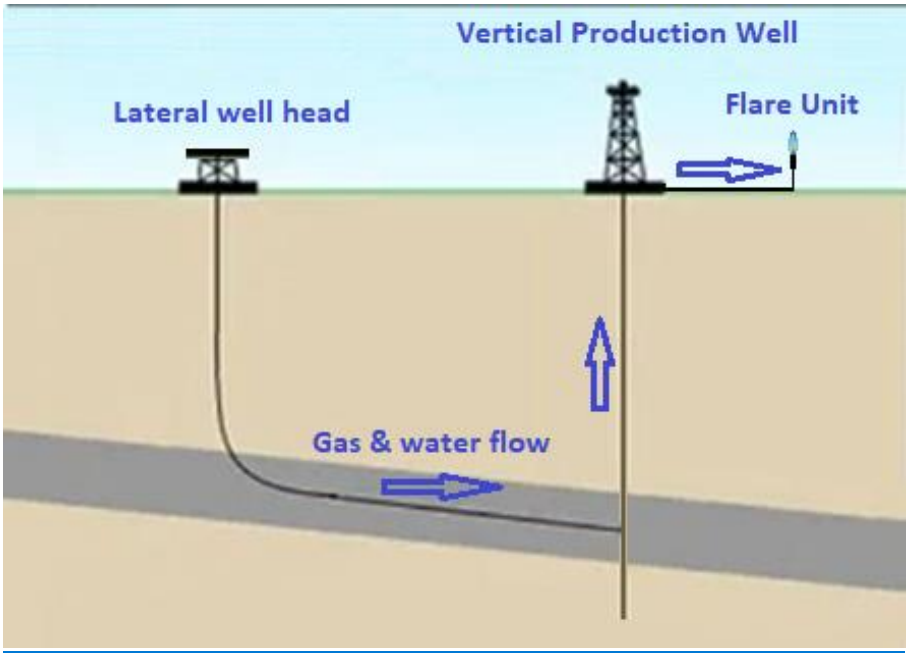


Image 3.1 Schematic of vertical and lateral wells

Image 3.2 Example of drill pad arrangement

3.4 Water

Construction water requirements will be supplied via water truck to the drill pad and well locations. Approximately 5,000 kL of water sourced from the CCM raw water dam is anticipated to be required for construction of the 19 drill pads and drilling of the 23 wells.

Water collected from the wells during operations will be pumped to holding tanks located on the relevant drill pads. Each holding tank is designed to hold a capacity of 20 kL of water / sufficient for one day of pumping during initial depressurising of the target coal seam. It is expected that water collected from the wells following depressurisation will reduce. From the holding tank, the water will be collected by a water truck and taken to CCM where it will be treated and integrated into the CCM mine water management system.

3.5 Power

The Project electricity requirements are for the drill pumps and well pumps. It is proposed that on-site generators are used to provide electricity for vertical drill pads. One 60 kV diesel generator is required per vertical drill pad, a total of thirteen (13) generators are required.

High-voltage connection to the electricity network will not be required.

3.6 Amenities

Typical drill pad site layouts are shown in **Image 3.3** and **Image 3.4.** The drill pad sites will include a mobile office and workshop which will be relocated as drilling progresses.

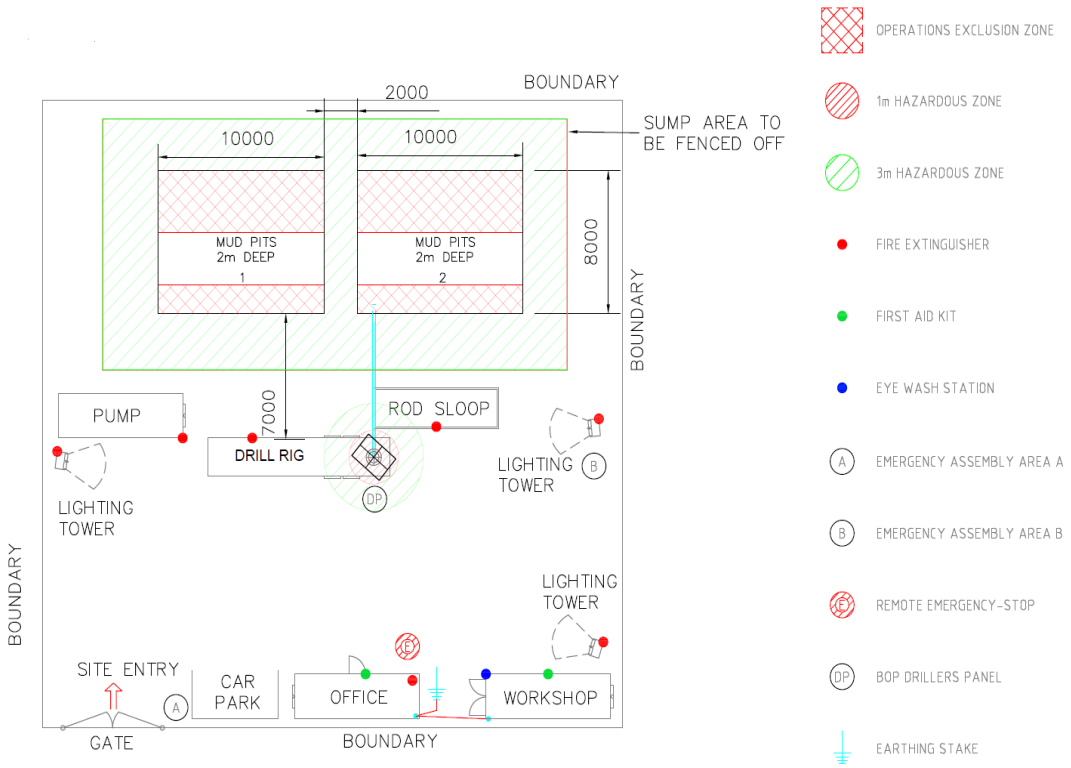


Image 3.3 Example of vertical well drill pad layout and amenities

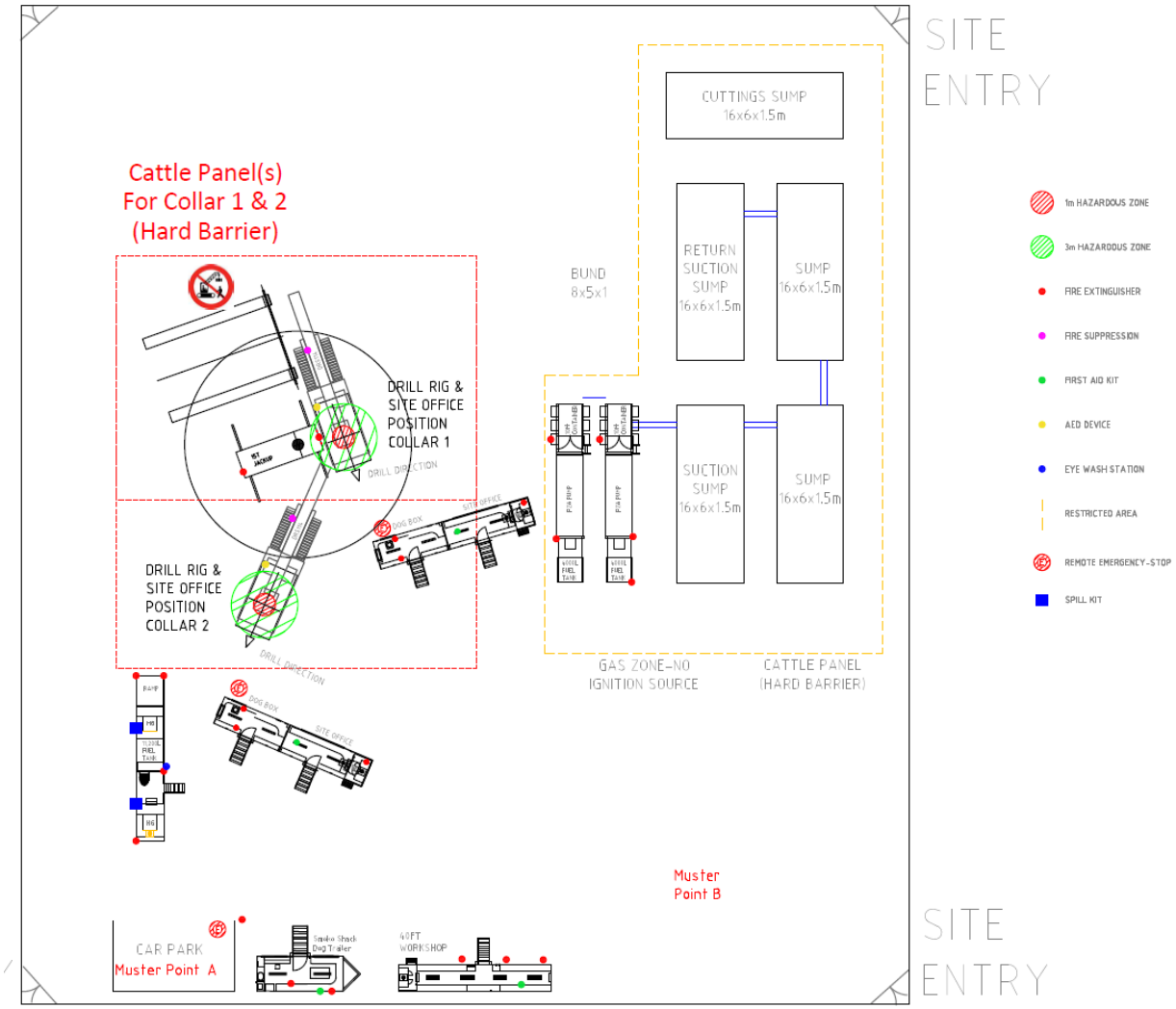


Image 3.4 Example of lateral well drill pad layout and amenities

3.7 Equipment

Table 3.2 outlines the earth moving and drilling equipment (currently being utilised at the CCM) that will be used in the construction, maintenance and operation of the access tracks, drill pads and wells.

Table 3.2 Equipment requirements

Equipment Description
Earth moving
Dozer such as the Caterpillar D8T for primary excavation surface of drill pads and access tracks
Grader, such as Caterpillar Grader 150
Truck, such as Caterpillar 745 Articulated Truck
Vibratory soil compactor, such as Caterpillar Roller 256B
Vegetation slasher
Water
30kL water truck to provide construction water requirements and collect extracted well water
Power
60kV diesel generator to provide power to well and pump infrastructure
Drill rigs
1 SIS drill rig and 1 vertical drill rig
Wellhead equipment
Wellhead assemblies to control the pressure and flow of CSG to the surface
Valves and fittings to control and direct the flow of CSG to the surface
Flares and venting systems for controlled burning of CSG
Pumps
Water pumps to remove water from the coal seam
Gas pumps for extracting CSG from the well
Mud pumps and systems for drilling fluid circulation
Gas Separation and processing equipment
Separators to separate CSG from water and other impurities
Measurement and monitoring devices
Flow meters to measure the amount of CSG being extracted
Pressure gauges to monitor pressure levels in the well
Gas analysers to analyse the composition and quality of the CSG
Safety and environmental control equipment
Blowout preventers (BOPs) to prevent uncontrolled release of CSG
Monitoring systems for detecting gas leaks and monitoring environmental compliance
Control and automation systems
SCADA systems for remote monitoring and control of gas production
Automation software for optimising gas extraction and processing

3.8 Workforce and Working Hours

Staffing has been estimated at 14 personnel during the construction of the Project. Construction staff will work a 12 -hour day / night shift 7 days / 7 nights roster.

During operation, the CSG drainage will be flared 24 hours per day. Staffing has been estimated at 2 personnel working 12-hour day / night shift 7 days / 7 nights roster (commencing 6:00am or 6:00pm).

Staff will transfer from CCM to the Project, and it is not envisaged that additional staff will be required.

The existing Centurion Village will provide accommodation for the Project workforce during the construction and operation phase. No additional worker accommodation will be required.

3.9 Hours of Operation

It is anticipated that the Project will operate 24 hours per day.

3.10 Rehabilitation and Closure

In accordance with the P-PRCP-100669070_V1, land will be rehabilitated to a stable condition which is defined as land that is:

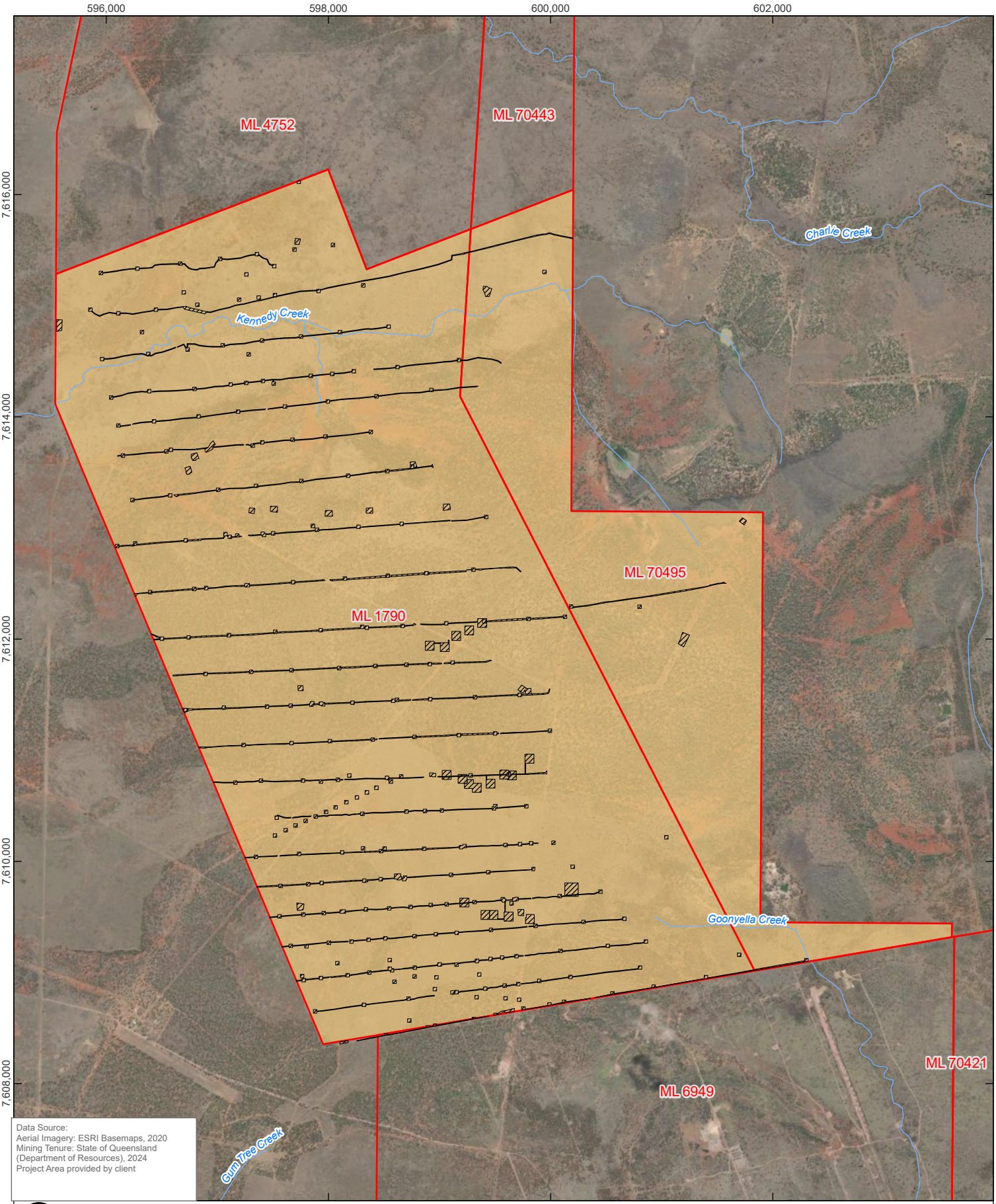
- Safe and structurally stable.
- No environmental harm being caused by anything on or in the land.
- Can sustain a post-mining land use.

The access tracks and drill pads will be rehabilitated through the following methodologies:

- Windrows and drains will be pushed and deep ripped.
- Topsoil placement, amelioration and seeding with pasture grasses and trees.
- Where the access tracks and drill pads cross a watercourse, or there is an increased risk of sedimentation, rock armour will be applied.

The extent of rehabilitation activities will be subject to agreement with landholders who may choose to retain infrastructure deemed beneficial.

Figure 3.3 presents the proposed final site design to be included in the amended PRCP.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:45,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

LEGEND

- Watercourse
- Mining Lease
- Maximum Disturbance Footprint
- PMLU - Grazing

EA AMENDMENT P-EA-100658735

PROPOSED FINAL SITE DESIGN

SLR

FIGURE 3.3

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_F03-03_Proposed Final Site Design

3.11 Project Schedule

One Surface-to-Inseam (SIS) drill rig will be used to drill the vertical and lateral wells. Vertical wells will be drilled first (approximately 10 days per well) followed by the connecting lateral wells (approximately 20 days per well). Once the wells have been drilled, the surface infrastructure will be installed (approximately 15 days per vertical well). It is anticipated that it may take up to 90 days to depressurise the wells followed by up to 18 months of gas flow.

To summarise, Project activities are:

- Clearing 12 ha of vegetation for drill pads (11.80 ha) and access tracks (0.20 ha).
- Developing 0.31 km of 5 m wide access track.
- Drilling, installing and operating thirteen (13) vertical wells and ten (10) lateral wells across 19 drill pads.
- Extracting the groundwater and CSG from the target GM coal seam.
- Closure and rehabilitation of the wells.

4.0 Proposed EA and PRCP Amendments

The following section details the conditions of EA P-EA-100658735 and PRCP P-PRCP-100669070_V1 that require amendment.

4.1 Environmental Authority

This section presents the proposed amendments to the following conditions:

- Condition 15 Schedule A
- Condition 7 Schedule F
- Condition 9 Schedule F, and
- Condition 22 Schedule F.

4.1.1 Condition 15 Schedule A

Table 4.1 details the existing conditions of A15 and the proposed changes subject of this EA amendment.

Table 4.1 EA P-EA-100658735 Condition A15

<table>
<tr><th colspan="5">Existing Condition</th></tr>
<tr><td colspan="5">The only mining activities to be carried out under this EA are the mining activities defined within the parameters of Table 1 (Mining Activities) and identified in Figure 1 attached to this EA.</td></tr>
<tr><td colspan="5">Proposed Condition</td></tr>
<tr><td colspan="5">No change to wording of condition. Table 1 and Figure 1 referenced in the condition is to be amended.</td></tr>
<tr><td colspan="5">Change</td></tr>
<tr><td colspan="5">Table 1 will be updated and replaced by
<table>
<tr><th>Mine Domain</th><th>Mine Feature Domain</th><th>Location (GDA94)</th><th>Maximum Disturbance Area</th><th>Constraints</th></tr>
<tr><td rowspan="3">Exploration activities</td><td rowspan="2">Drill holes and pads</td><td rowspan="2">As per Figure 3.2</td><td>1400 metres squared per drill pad</td><td>Total disturbed area must not exceed 1.4 ha</td></tr>
<tr><td>6400 metres squared per drill pad</td><td>Total disturbed area must not exceed 11.80 ha</td></tr>
<tr><td>Historic holes and pads</td><td>As per Figure 3.2</td><td>3000 metres squared
per drill pad</td><td>Quantity: 310 drill holes</td></tr>
<tr><td>Ancillary infrastructure</td><td>Roads and tracks</td><td>As per Figure 3.2</td><td></td><td>Scale and intensity</td></tr>
</table>
Figure 1 in EA P-EA-100658735 will be updated and replaced by Figure 3.2 of this report.</td></tr>
</table>

Existing Condition
Figure 3.2 reflects the following changes to the location and extent of activities for the Project outlined in Section 3 of this report. • Clearing 12 ha of vegetation for drill pads (11.80 ha) and 0.31 km of access tracks (0.20 ha). • Drilling, installing and operating thirteen (13) vertical wells and ten (10) lateral wells across 19 drill pads. • Closure and rehabilitation of the wells.
Justification
The proposed amendment ensures that the variation in activities aligns with the approved disturbance and activities outlined in Table 1 (Mining Activities) and Figure 1. The amendment incorporates the Project activities to determine the presence, quantity, and quality of CSG within the GM coal seam and further assess the geological and petrophysical properties of the coal seam (i.e. permeability, porosity).

4.1.2 Condition 7 Schedule F

Table 4.2 details the existing conditions of F7 and the proposed changes subject of this EA amendment.

Table 4.2 EA P-EA-100658735 Condition F7

Existing Condition
Exploration activities undertaken must be consistent with **Figures 1 to 4** attached to this environmental authority.
Proposed Condition
No change to wording of condition. Figure 1 to 4 referenced in the condition is to be amended.
Change
Figure 1 to **Figure 4** in EA P-EA-100658735 will be updated and replaced by **Figure 3.1**, **Figure 3.2, Figure 6.10** through **Figure 6.19** of this report. These figures illustrate the location of exploration and mineral development activities, mining leases, and proposed extent of impacts to Matters of State Environmental Significant (MSES) regulated vegetation and protected wildlife habitat.
Justification
The proposed amendment ensures that any necessary expansions or modifications to the exploration activities, as depicted in the updated figures, are within the scope of the EA.

4.1.3 Condition 9 Schedule F

Table 4.3 details the existing conditions of F9 and the proposed changes subject of this EA amendment.

Table 4.3 EA P-EA-100658735 Condition F9

Existing Condition
The operational area of individual drill sites must not exceed 1,400 square metres.
Proposed Condition
The operational area of individual drill sites must not exceed 6,400 square metres.
Change

Existing Condition
Condition F9 would be updated to refer to the drill pads in which the Project activities can be performed. **Figure 1** in EA P-EA-100658735 will be updated and replaced by **Figure 3.2** of this report. This figure illustrates the location of exploration and mineral development activities.
Justification
The proposed amendment ensures that the variation in activities aligns with the approved disturbance and activities outlined in Table 1 (Mining Activities) and **Figures 1** to **4**. The amendment incorporates the Project activities to determine the presence, quantity, and quality of CSG within the GM coal seam and further assess the geological and petrophysical properties of the coal seam (i.e. permeability, porosity).

4.1.4 Condition 22 Schedule F

Table 4.4 details the existing conditions of F22 and the proposed changes subject of this EA amendment.

Table 4.4 EA P-EA-100658735 Condition F22

Existing Condition
Impacts to matters of State environmental significant (MSES) as a result of carrying out exploration activities must only occur to the maximum extent stated in Table F1 – Authorised residual impacts to MSES' and consistent with general exploration activities depicted in **Figure 3** 'Authorised impacts to MSES Regulated Vegetation' and **Figure 4** 'Authorised impacts to MSES Protected Wildlife Habitat'.
Proposed Condition
No change to wording of condition. Table F1, **Figure 3** and **Figure 4** referenced in the condition is to be amended.
Change
Table F1 in EA P-EA-100658735 will be updated and replaced by:

Prescribed Environmental Matters – Matter Of State Environmental Significance (MSES)	Location Of Impact	Offset Requirements Under Environmental Offsets Act 2014	Maximum Extent Of Impact (Ha)
Regulated vegetation – Endangered or Of Concern Regional Ecosystem			
Grassland Regional Ecosystem (11.8.11)	In accordance with Figure 6.10**.**	No	1.81
Sparse Regional Ecosystem (11.3.4, 11.4.2)	N/A	No	0
Dense / Mid Dense Regional Ecosystem (11.3.1, 11.9.5)	N/A	No	0
Regulated Vegetation – Located in the defined distance from the defining banks of a watercourse			

Existing Condition			
Grassland Regional Ecosystem (11.8.11)	N/A	No	0
Sparse Regional Ecosystem (11.3.4, 11.4.2)	N/A	No	0
Dense / Mid Dense Regional Ecosystem (11.3.1, 11.9.5)	N/A	No	0
Protected Wildlife Habitat – Essential habitat for an endangered or vulnerable animal or plant			
Dichanthium queenslandicum (King Blue Grass)	In accordance with Figure 6.10**.**	No	1.81
Protected Wildlife Habitat – A habitat for endangered or vulnerable wildlife or Special Least Concern animal			
Squatter Pigeon	In accordance with Figure 6.16	No	7.41
Grey Falcon	N/A	No	1.50
Fork Tailed Swift	In accordance with Figure 6.18	No	1.50
Koala	In accordance with Figure 6.14	No	7.15
Greater Glider	N/A	No	0.88
Short Beaked Echidna	In accordance with Figure 6.15	No	7.95
Ornamental Snake	N/A	No	6.54

Figure 3 and **Figure 4** in EA P-EA-100658735 will be updated and replaced by **Figure 6.10** through **Figure 6.19** of this report. These figures illustrate the proposed extent of impacts to MSES regulated vegetation and protected wildlife habitat.

Justification

The completion of terrestrial and aquatic ecology field surveys across the Study Area have allowed for a more refined understanding of the categorisation of vegetation communities, presence of flora and fauna, and extent of habitat for these flora and fauna species. As such, the assessment of impacts to MSES from the Project are based on contemporary, ground-truthed ecological data.

During the design stages of the Project, terrestrial and aquatic ecological values were considered and avoided where feasible and practical. This included the use of previously disturbed areas where possible, prioritised location of disturbance in non-remnant areas of vegetation affording limited habitat value, avoidance of TECs where possible, and where remnant vegetation was required for

Existing Condition
clearing those area classified as No concern at present under the VM Act were prioritised over Of concern and Endangered REs. Though the Project will result in the direct clearing of habitat for MSES flora and fauna species, this amount comprises less than 1% of habitat for each species as mapped within the broader Study Area. In addition, the implementation of mitigation measures will further minimise potential impacts to the species. As such, an assessment against the SRI Guideline determined the Project is unlikely to result in a significant residual impact on any MSES (Refer to **Appendix B**).

4.2 Progressive Rehabilitation and Closure Plan

This section presents the proposed amendments to the following conditions:

- Section B – Figure 1.
- Section C – (RA1) Rehabilitation area 1.

4.2.1 Section B – Final site design and reference maps

Table 4.5 details the existing conditions of Section B – Final site design and reference maps and the proposed changes subject of this PRCP amendment.

Table 4.5 PRCP P-PRCP-100669070_V1 Section B – Figure 1

Existing Condition
Section B of the PRCP contains the final site design plans in **Figure 1**.
Proposed Condition
No change to wording of condition. **Figure 1** referenced in the PRCP is to be amended.
Change
Figure 1 in PRCP P-PRCP-100669070_V1 will be updated and replaced by **Figure 3.3** of this report. **Figure 3.3** reflects the following changes to the location and extent of activities for the Project activities. • Clearing 12 ha of vegetation for drill pads (11.80 ha) and access tracks (0.20 ha) • Developing 0.31 km of 5 m wide access tracks • Drilling, installing and operating thirteen (13) vertical wells and ten (10) lateral wells across 19 drill pads, and • Closure and rehabilitation of the wells.
Justification
The amendment incorporates the Project activities to determine the presence, quantity, and quality of CSG within the GM coal seam and further assess the geological and petrophysical properties of the coal seam (i.e. permeability, porosity).

4.2.2 Section C – Post-mining land uses

Table 4.6 details the existing conditions of Section C – (RA1) Rehabilitation area 1 and the proposed changes subject of this PRCP amendment.

Table 4.6 PRCP P-PRCP-100669070_V1 Section C – (RA1) Rehabilitation area 1

Existing Condition

Rehabilitation of the site must be undertaken as per Section C of PRCP P-PRCP-100669070_V1. Currently, 133 ha of the site is to be rehabilitated, with rehabilitation milestones to be reached within the timeframes indicated in the schedule below.

Proposed Condition

No change to wording of condition. Section C – Post-mining land use, (RA1) Rehabilitation area 1 referenced in the PRCP is to be amended.

Change

Post-mining land uses (PMLU)						
Rehabilitation area				RA1		
Relevant activities				Exploration - drilling and associated tracks		
Total rehabilitation area size (ha)				145		
Commencement of fire milestone : RM1				10/12/2021		
PMLU				Cattle grazing		
Date area is available	10/12/2021	10/12/2028				
Cumulative area available	19	145				
Milestone completed by	10/12/2026	10/12/2031	10/12/2036	10/12/2041	10/12/2046	
Milestone Reference	**Cumulative area achieved (ha)**					
RM1	19	145				
RM2	19	145				
RM3	19	145				
RM4	19	145				
RM5	19	145				
RM6			19	145		
RM7				19	145	

Justification

Total rehabilitation area size in (RA1) Rehabilitation area 1 of PRCP P-PRCP-100669070_V1 is proposed to increase from 133 ha to 145 ha. The 145 ha reflects the additional 12 ha of disturbance involved with the aforementioned clearing of vegetation for drill pads (11.80 ha) and access tracks (0.20 ha) associated with the Project activities.

5.0 Assessment Methodology

This section outlines the methodology used to assess the potential impacts the Project has on relevant EVs.

The following methodology was taken when assessing the impacts to the EVs:

- Characterisation of EVs.
- Identification of any potential relevant environmental impacts.
- Outline existing management practices.
- Risk assessment of potential impacts.

5.1 Terminology

In the context of this Report, the following terminology are used to define the spatial and operational parameters of the Project:

- **Project**: Refers to the planned development which is the subject if this Report. A project usually involves construction, operation, or changes to land use, that requires regulatory approval and has the potential to cause environmental impacts. A project includes all stages of its lifecycle, from design to construction, operation, and rehabilitation and closure.
- **Project Area**: The Project Area refers to the physical boundaries of the land, water resources, or other resources that will be directly affected by the proposed Project. This includes the location where construction, operations, and any other project-related activities will take place.
- **Study Area**: The Study Area is the broader geographic region that is considered through the impact assessment process. It includes the Project Area and surrounding areas that may be indirectly affected by the Project. The boundaries of the Study Area are often determined by the nature of the Project's potential impacts on EVs.
- **Project Activities**: Project activities encompass all actions or operations associated with the Project during construction, operation and rehabilitation that may have a direct or indirect impact on the environment. These activities are assessed to determine the impacts on EVs.
- **Disturbance Area**: The disturbance area refers to the specific portion of the Project or Study Area where physical or ecological disturbance will occur as a result of the Project Activities. It is usually a subset of the Project Area but might extend beyond it due to indirect impacts.

5.2 Methodology to Identify Environmental Impacts

To identify the potential impacts to the EVs desktop assessments were conducted. The nature of the Project Activities and the location of the Project resulted in further investigation into the potential impacts associated with ecology and groundwater. The specific methodology for the assessments of these EVs are detailed in the following sections. **Section 6.0** provides the results of such assessments.

5.2.1 Terrestrial and Aquatic Ecology

Refer to **Appendix A** for details of the terrestrial and aquatic ecology methodology, respectively.

5.2.2 Groundwater Assessment

Refer to **Section 6.7** of the groundwater methodology.

5.3 Risk Assessment Methodology

The EVs were assessed using an adapted version of the Risk Assessment Education Resource (Mining Safety and Health Advisory Committee 2023). This guideline was developed for conducting effective risk assessments and was designed in accordance with *ISO 31000:2018 – Risk Management*.

A likelihood and consequence rating were assigned to each potential impact, which resulted in an overall, risk rating. **Table 5.1** details the likelihood descriptors and **Table 5.2** outlines the level of consequence. The combination of likelihood and consequence resulted in a risk matrix (**Table 5.3**). A description of each risk rating is provided in **Table 5.4**.

Table 5.1 Likelihood level

Likelihood Level	Description
Almost certain (5)	Could occur several times a year Could be expected to occur during a project >80% likely to occur
Likely (4)	Could occur within one year Could easily occur during a project 60% - 80% likely to occur
Possible (3)	Could occur in a one to two-year period Occurred in a small number of projects 30% - 60% likely to occur
Unlikely (2)	Could occur in a two to five-year timeframe Known to have happened within the industry 5% - 30% likely to occur
Rare (1)	Could occur in more than five years' time Has not occurred but could Less than 5% likely to occur

Table 5.2 Consequence rating

Consequence	Description
Major (5)	Destruction of important habitat, species, or natural environment Significant impact to sensitive receptors Regulatory significant
High (4)	Extensive and measurable medium-term impact on habitat, species, or natural environment Extensive impact to sensitive receptors

Consequence	Description
Medium (3)	Localised medium-term impact on habitat, species, or natural environment Localised medium-term impact to sensitive receptors
Low (2)	Localised short-term impact on habitat, species, or natural environment Localised short-term impact on sensitive receptors
Minor (1)	Little to no discernible impact on habitat, species, or natural environment Little to no impact on sensitive receptors

Table 5.3 Risk matrix

	Consequence				
Likelihood	**Minor (1)**	**Low (2)**	**Medium (3)**	**High (4)**	**Major (5)**
Almost certain (5)	Medium	Significant	Significant	High	High
Likely (4)	Medium	Medium	Significant	High	High
Possible (3)	Low	Medium	Significant	Significant	High
Unlikely (2)	Low	Low	Medium	Significant	Significant
Rare (1)	Low	Low	Medium	Medium	Significant

Table 5.4 Descriptions of risk rating

Risk Level	Risk Measures
High	Immediate action required Identify and implement controls to manage risks Highest level of management needs to be involved
Significant	Immediate action required Identify and implement controls to manage risks Senior site management should be involved
Medium	Implement controls to manage risks Responsibility must be defined
Low	Implement controls as required Manage by routine processes

6.0 Environmental Assessments

The following sections provide the environmental assessments for:

- Section 6.1: Air quality.
- Section 6.2: Greenhouse gas.
- Section 6.3: Noise and vibration.
- Section 6.4: Land resources.
- Section 6.5: Terrestrial ecology.
- Section 6.6: Aquatic ecology.
- Section 6.7: Groundwater.
- Section 6.8: Surface water.
- Section 6.9: Waste.

The EVs for which no new or varied impacts are anticipated as a function of the Project activities are summarised in **Table 6.1**.

Table 6.1 Environmental values not subject to potential impacts

EV	Risk to EV	Details
Social	Not subject to potential impacts. No changes are predicted.	The Project activities will not change existing potential impacts. Any potential, relevant impacts to EVs will continue to be managed via current protocols and management plans.
Geochemistry	Not subject to potential impacts. No changes are predicted.	The Project activities will not change existing potential impacts. Any potential, relevant impacts to EVs will continue to be managed via current protocols and management plans.

6.1 Air Quality

This section presents the assessment of Project related air quality impacts to sensitive receptors.

6.1.1 Existing Environmental Values

6.1.1.1 Sensitive Receptor Locations

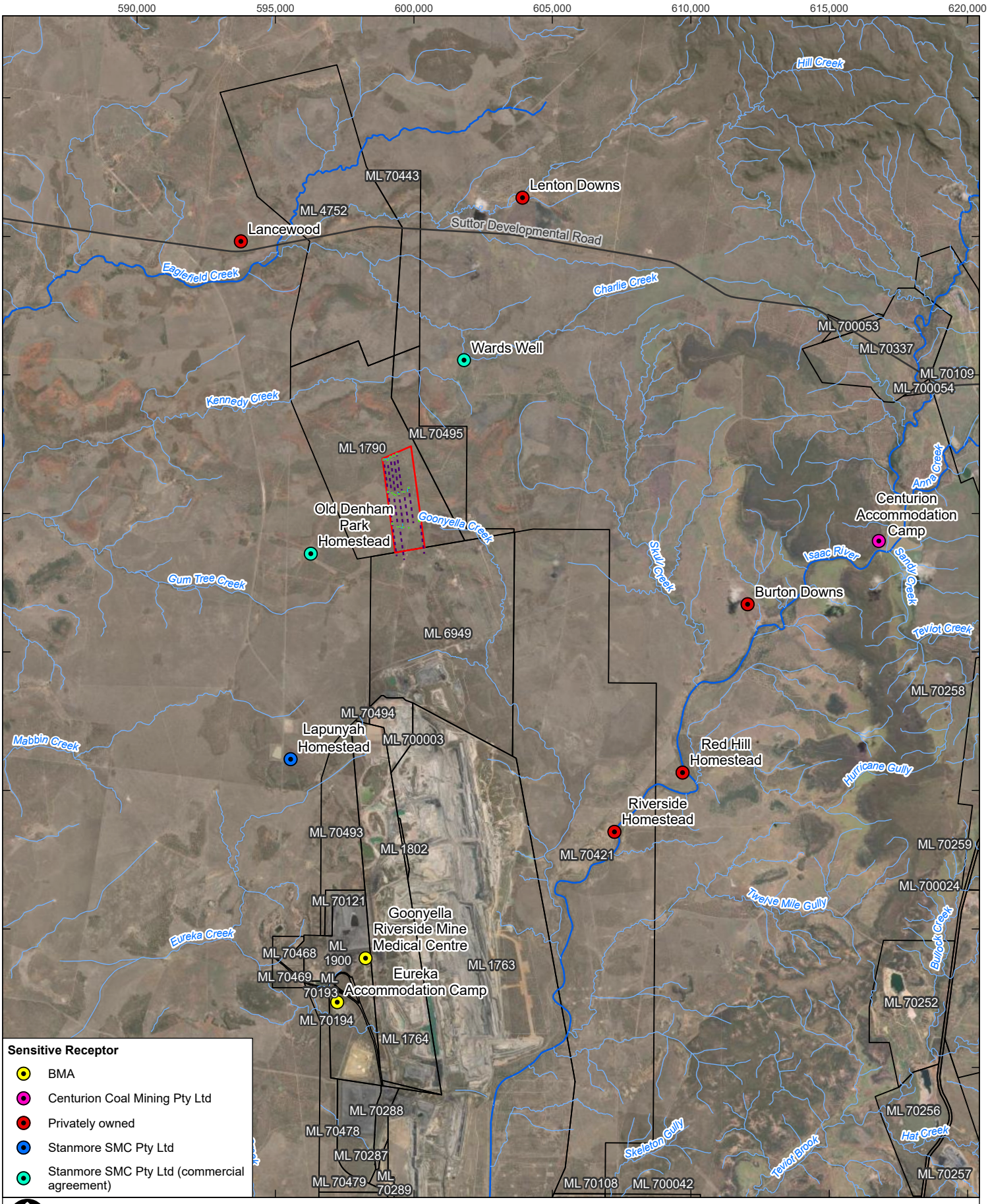
Potential sensitive receptors surrounding the Project Area are presented in **Table 6.2** and **Figure 6.1**. Sensitive receptors have been identified through desktop review of historical information (e.g. EIS, EA amendments etc) and an analysis of available aerial photographic images.

It is noted that the nearest privately owned receptor is Lancewood which is located approximately 9.4 km to the nearest drill pad. The closest receptor is Old Denham Park Homestead (3.1 km) which is owned by Stanmore SMC Pty Ltd and with which there is an agreement in place.

Table 6.2 Receptors Surrounding the Project

ID	Receptor Name	Easting (m)	Northing (m)	Approximate Distance to Closest Drill Pad (km)	Ownership/Agreement Status
1	Old Denham Park Homestead	596275	7608546	3.1	Stanmore SMC Pty Ltd (commercial agreement)
2	Wards Well	601809	7615534	4.1	Stanmore SMC Pty Ltd (commercial agreement)
3	Lancewood	593750	7619821	9.4	Privately owned
4	Lenton Downs	603922	7621398	10.2	Privately owned
5	Centurion Accommodation Camp	616790	7609005	16.5	Centurion Coal Mining Pty Ltd
6	Burton Downs	612051	7606721	12.2	Privately owned
7	Red Hill Homestead	609702	7600644	13.0	Privately owned
8	Riverside Homestead	607241	7598505	13.2	Privately owned
9	Goonyella Riverside Mine Medical Centre	598253	7593944	15.5	BMA
10	Eureka Accommodation Camp	597230	7592356	17.2	BMA
11	Lapunyah Homestead	595547	7601128	9.2	Stanmore SMC Pty Ltd

Note 1: GDA 2020 MGA Zone 55 projection.



EA AMENDMENT P-EA-100658735

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:180,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LOCATION OF SENSITIVE RECEPTORS

SLR

FIGURE 6.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_AQ_F06-01_Location of Sensitive Receptors

6.1.1.2 Air Quality Objectives

A summary of the Queensland EPP (Air) ambient air quality objectives that are relevant to the Project is provided in **Table 6.3.**

The pollutants are associated with the mechanical generation of dust (i.e. total suspended particulates (TSP), particulate matter with an aerodynamic diameter less than 10 microns (PM_{10}), and dust deposition) and the combustion of diesel fuels (particulate matter with an aerodynamic diameter less than 2.5 microns ($PM_{2.5}$), carbon monoxide, and nitrogen dioxide).

Table 6.3 Ambient Air Quality Objectives

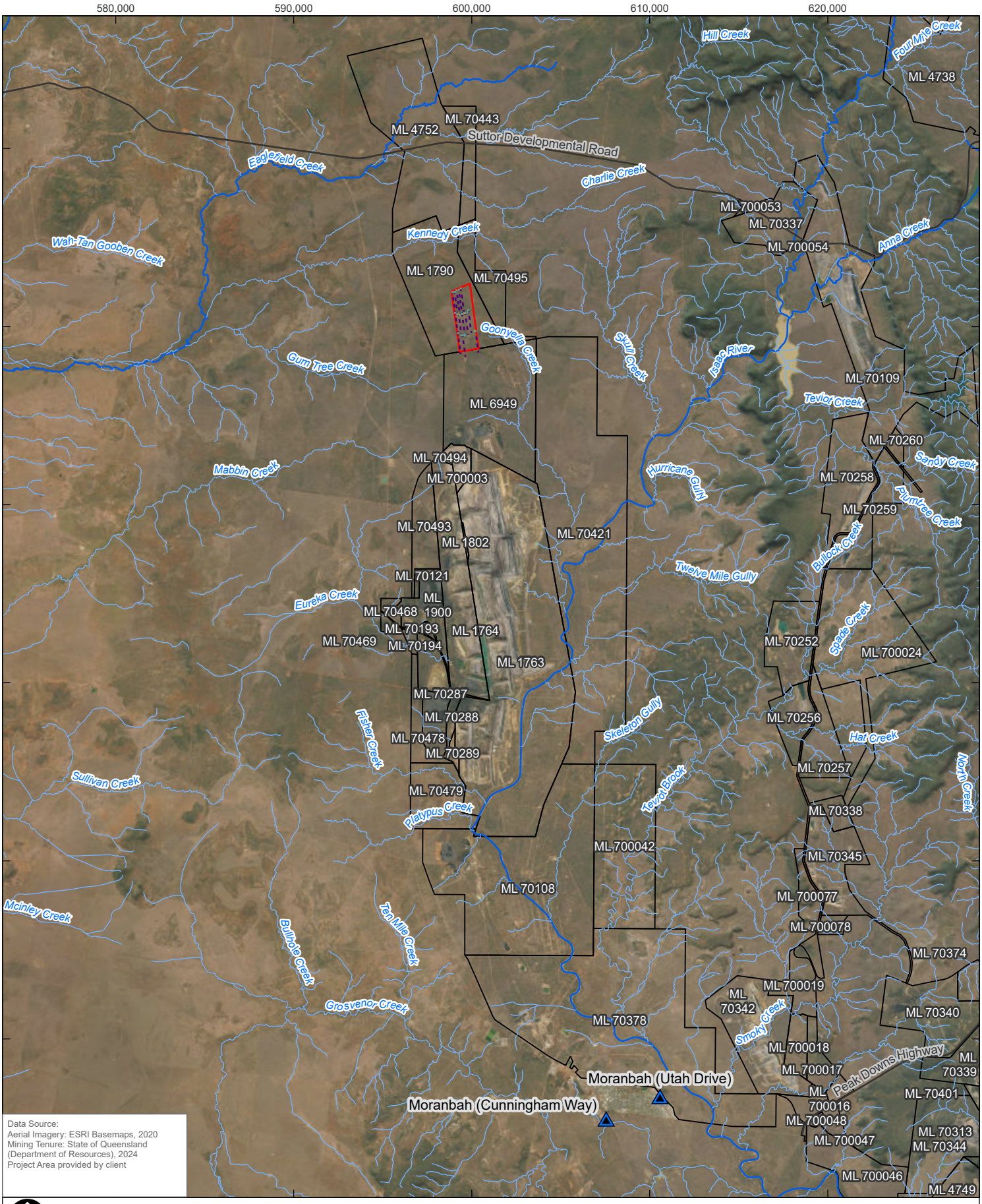
Pollutant	Environmental Value	Averaging Period	Objectives	Allowable exceedances	Source
Carbon monoxide	Health and wellbeing	8 hours	11,000 µg/m^3	1 day each year	QLD EPP(Air)
Nitrogen dioxide	Health and wellbeing	1 hour	250 µg/m^3	1 day each year	QLD EPP(Air)
		1 year	62 µg/m^3	None	QLD EPP(Air)
	Health and diversity of ecosystems	1 year	33 µg/m^3	None	QLD EPP(Air)
PM_{10}	Health and wellbeing	24 hour	50 µg/m^3	None	QLD EPP(Air)
		Annual	25 µg/m^3	None	QLD EPP(Air)
$PM_{2.5}$	Health and wellbeing	24 hour	25 µg/m^3	None	QLD EPP(Air)
		Annual	8 µg/m^3	None	QLD EPP(Air)
TSP	Health and wellbeing	Annual	90 µg/m^3	None	QLD EPP(Air)
Dust deposition	Nuisance	30 day	120 mg/m^2/day	None	QLD DESI

6.1.1.3 Air Quality Environment

The nearest ambient air monitoring stations operated by the DESI are the DESI Moranbah (Utah Drive) and DESI Moranbah (Cunningham Way) located approximately 40 km to the south-southeast of the Project (**Figure 6.2**).

The DESI monitoring station on Utah Drive has been in operation since 2011 with the Cunningham Way station operational since 2020. Both of the DESI stations record levels of PM_{10} and $PM_{2.5}$ as well as meteorological parameters such as wind speed and wind direction.

The DESI Moranbah monitoring stations are potentially influenced by a number of open cut mining operations within the airshed. When developing estimates of background levels of dust, it has been assumed that air quality recorded at the DESI Moranbah (Utah Drive) monitoring station is sufficiently representative of those in the vicinity of the Project.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:280,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

EA AMENDMENT P-EA-100658735

LOCATION OF AMBIENT AIR QUALITY MONITORING

SLR

FIGURE 6.2

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_AQ_F06-02_Location of Ambient Air Quality Monitoring

Pollutant gases included in the Queensland EPP (Air) such as carbon monoxide or nitrogen dioxide, that are associated with the combustion of diesel fuel, are not recorded at either of the two DESI Moranbah ambient air monitoring stations.

Thus estimates of background levels of these pollutants were based on data sets from other DESI operated monitoring stations.

Carbon monoxide and nitrogen dioxide are recorded at locations that are more representative of the urban and/or industrialised airshed as opposed to an airshed dominated by the influence of mining or mine-related operations and thus estimates developed from these data sets may over-estimate background pollutant levels in the vicinity of the Project.

A summary of estimates of background levels of pollutants is provided in **Table 6.4** with additional notes in relation to the data sets, included in the table.

Background estimates suggest that in general background ambient air quality is well below the relevant objective with the exception of the annual averages of PM_{10} (96% of objective) and $PM_{2.5}$ (85% of objective).

These high levels of dust as well as the frequently recorded exceedances of the 24 hour average concentration of PM_{10} and $PM_{2.5}$ at the DESI Moranbah monitoring stations, highlights the dusty background environment within the airshed that includes the Project.

Table 6.4 Estimates of background levels of pollutants

Pollutant	Environmental Value	Averaging Period	Objectives	Background Estimate	Percentage of Objective	Source
Carbon monoxide	Health and wellbeing	8 hours	11,000 µg/m^3	370 µg/m^3	3%	QLD(4)
Nitrogen dioxide	Health and wellbeing	1 hour	250 µg/m^3	60.4 µg/m^3	24%	QLD(5)
		1 year	62 µg/m^3	14.5 µg/m^3	23%	QLD(5)
	Health and diversity of ecosystems	I year	33 µg/m^3	14.5 µg/m^3	44%	QLD(5)
PM_{10}	Health and wellbeing	24 hour	50 µg/m^3	24.4 µg/m^3	49%	DESI(2)
		Annual	25 µg/m^3	23.8 µg/m^3	96%	DESI(2)
$PM_{2.5}$	Health and wellbeing	24 hour	25 µg/m^3	7.6 µg/m^3	30%	DESI(2)
		Annual	8 µg/m^3	6.8 µg/m^3	85%	DESI(2)
TSP	Health and wellbeing	Annual	90 µg/m^3	47.6 µg/m^3	53%	DESI(2,3)
Dust deposition	Nuisance	30 day	120 mg/m^2/day	47 mg/m^2/day	39%	AQMP(1) (CMJV)

Notes:

(1) AQMP (CMJV) – Air Quality Management Plan: Coppabella-Moorvale Joint Venture – Draft, dated 13 March 2023

(2) DESI – Based on 2023 data from the DESI Moranbah (Utah Drive) monitoring station. Estimates for the 24 hour averages are conservatively based on the 90th percentile of the data set. A total of five days exceeded the EPP(Air) objective of 50 for the 24 hour average concentration of PM_{10}. Four $PM_{2.5}$ EPP(Air) exceedances days were recorded.

(3) TSP is not collected at the DESI Moranbah monitoring stations. The estimate for the annual average is based on the assumption that 50% of TSP is in the form of PM_{10}.

Pollutant	Environmental Value	Averaging Period	Objectives	Background Estimate	Percentage of Objective	Source
(4) QLD – Queensland Government's Queensland air monitoring 2023 National Environment Protection (Ambient Air Quality) Measure. Estimate based on the maximum 90th percentile 8 hour average concentration from the Boyne Island monitoring station over the period 2010 through 2023. Note that concentrations of carbon monoxide are only reported for the Boyne Island and Woolloongabba monitoring stations in 2023. Carbon monoxide ceased to be measured at the North Toowoomba monitoring station in 2010.						
(5) QLD – Queensland Government's Queensland air monitoring 2023 National Environment Protection (Ambient Air Quality) Measure. Estimate based on the maximum 90th percentile 1 hour average or annual average concentration of nitrogen dioxide from the South Gladstone monitoring station over the period 2010 through 2023.						

6.1.2 Potential Impacts

The following subsections detail the potential air quality impacts as a result of the Project activities described in **Section 3.0**.

A risk-based assessment of these potential impacts is detailed in **Table 6.5.**

6.1.2.1 Construction of Access Tracks

Based on information provided in **Section 3.2**, the establishment of new access tracks to will involve the clearing of vegetation and the stockpiling of topsoil and sub-soils for the access track. Compacting of the access track will be undertaken using a roller. Gravel will be delivered by truck to the access track and spread using a grader to ensure all-weather access.

As a series of access tracks already exist across ML 1790, the construction of new access tracks will be limited to a disturbance footprint of approximately 0.20 ha.

The construction of the access tracks has the potential to create emissions of mechanically generated dust as well as emissions of particulates and gases through the combustion of diesel fuel by the dozer, grader, roller and trucks.

The construction of the access track is anticipated to be associated with a minimal risk of air quality impacts at receptor locations due to the significant distance to the nearest receptor.

6.1.2.2 Construction of Drill Pads

Based on information provided in **Section 3.3**, a total of 19 drill pads will be developed as part of the Project. The total combined footprint of all pads in areas that are not covered by existing disturbance approvals is 11.8 ha.

A dozer will be used to remove and stockpile topsoil and sub-soils from each of the pads. Compacting of the pad will be undertaken using a roller. Gravel will be delivered by truck to the drill pad and spread using a grader to ensure all-weather access. It is estimated that each drill pad will take 2-3 days to construct.

The construction of the drill pads has the potential to create emissions of mechanically generated dust as well as emissions of particulates and gases through the combustion of diesel fuel by the dozer, grader, roller and trucks.

The construction of the drill pads is anticipated to be associated with a minimal risk of air quality impacts at receptor locations due to the significant distance to the nearest receptor.

6.1.2.3 Drilling of Vertical and Lateral Wells

Based on information provided in **Section 3.3**, the 13 vertical wells will require approximately 10 days of drilling time. Lateral wells will each take approximately 20 days. One well will be

drilled at a time, thus cumulatively approximately 330 days of drilling will be required to complete the network.

Although the drilling of the wells is unlikely to generate significant levels of larger scale dust (i.e. TSP or PM_{10}) emissions of particulate ($PM_{2.5}$) and gases (e.g. carbon monoxide and oxides of nitrogen) will be associated with the combustion of diesel fuel by the drill rig.

As a single drill rig will be used at any one time, the risk of impacts due to emissions of particulate and gases associated with the combustion of diesel fuel are anticipated to be minimal at receptor locations due to the significant distance to the nearest receptor.

6.1.2.4 Vertical and Lateral Well Operation

Flaring

Based on information provided in **Section 3.3**, CSG will be extracted at a rate of approximately 500 l/sec per well or approximately 1,800 cubic metres per hour of CSG per well. It is anticipated that the operational efficiency of the candlestick flare will be in excess of 95%.

The risk of adverse impacts associated with emission of pollutant gases included in the EPP (Air) due to the flaring of the CSG is anticipated to be minimal at receptor locations due to the significant distance to the nearest receptor.

Generators

As noted in **Section 3.5**, electricity will be required to operate the drill pumps and the well pumps.

A total of thirteen 60 kV diesel generators will be co-located with the vertical wells.

The risk of adverse impacts associated with emission of pollutant gases included in the EPP(Air) due to the combustion of diesel fuel is anticipated to be minimal at receptor locations due to the significant distance to the nearest receptor.

6.1.2.5 Closure and Rehabilitation

The risk of air quality impacts will reduce as the need for diesel fuel decreases.

The reduction in the disturbance footprint associated with rehabilitation will lead to a reduction in the risk of air quality impacts associated with the generation of dust either by the movement of equipment and/or wind generated dust during adverse conditions.

6.1.3 Management Practices

will be managed. Mitigation and management practices to reduce the potential impacts to the sensitive receptors as a result of the Project Activities include:

- Watering of unsealed areas whenever visible dust is being generated.
- Reducing speed limits.
- Minimising clearing of vegetation.
- Seeding of stockpiled material where appropriate.
- Utilising cleaner burning generators.
- Optimising engine performance based on emissions outcomes.
- Operating plant and equipment (including flares) in an emission’s optimal manner.

- Monitoring meteorological conditions and pro-actively watering unsealed areas and stockpiles prior to and during, adverse meteorological conditions.

6.1.4 Risk Assessment

The potential air quality impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6.5**.

The risk of air quality impacts is Low.

Table 6.5 Air quality risk assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Impact of emissions of dust and/or pollutants due to combustion of diesel at sensitive receptor locations during construction of access track and drill pads	Unlikely (2)	Low (2)	Low	Short duration of drill pad construction activities (i.e. 2-3 days each). Watering of disturbance areas will provide effective mitigation of dust. Significant distance to nearest receptor (i.e. greater than 3 km)
Impact of emissions of pollutants due to combustion of diesel at sensitive receptor locations during drilling	Unlikely (2)	Low (2)	Low	Drilling activities at each drill pad ranges from 10 to 30 days per pad. Significant distance to nearest receptor (i.e. greater than 3 km)
Impact of emissions of pollutants due to combustion of CSG at sensitive receptor locations during flaring	Unlikely (2)	Low (2)	Low	Flares distributed over a number of drill pads. High destruction efficiency of flares. Significant distance to nearest receptor (i.e. greater than 3 km)
Impact of emissions of pollutants due to combustion of diesel in generators during dewatering and CSG extraction	Unlikely (2)	Low (2)	Low	Individual generators distributed over a number of drill pads. Significant distance to nearest receptor (i.e. greater than 3 km)

6.2 Greenhouse Gas

This section presents the assessment of Project related GHG emissions.

6.2.1 Existing Environmental Values

6.2.1.1 Climate and Meteorology

The Project is located in the sub-tropical region of Central Queensland and is characterised by hot, moist summers and dry winters.

The nearest monitoring station is located at the Moranbah Water Treatment Plant (MWTP), approximately 38 km south of the Project. The MWTP was operated by the Bureau of Meteorology for the period of 1972 to 2012.

Table 6.6 presents a summary of the long term monthly averaged data for:

- Daily maximum temperature
- Daily minimum temperate, and
- Rainfall, of particular note is the seasonal variability in rainfall totals with the majority of the rain occurring during the summer months of December, January and February.

Table 6.6 Rainfall and temperature climate statistics based on data obtained from the BoM MWTP monitoring station (1972-2012)

Statistics	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Mean maximum temperature (°C)	33.9	33.1	32.2	29.6	26.5	23.7	23.6	25.5	29.3	32.3	33.1	33.9	29.7
Mean minimum temperature (°C)	21.9	21.8	20.2	17.6	14.2	11.1	9.8	11.1	14.1	17.6	19.4	21.1	16.7
Mean rainfall (mm)	103.8	100.7	55.4	36.4	34.5	22.1	18	25	9.1	35.7	69.3	103.9	613

Long term wind roses for 09:00 and 15:00 provide in **Image 6.1** and **Image 6.2** respectively, highlight the general light to moderate winds and predominately easterly and south-easterly winds experienced at this location.

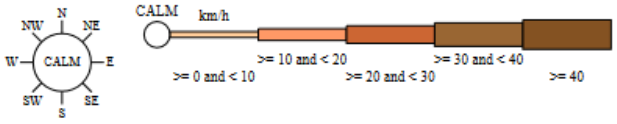
Rose of Wind direction versus Wind speed in km/h (10 Jan 1986 to 26 Mar 2012)

Custom times selected, refer to attached note for details

MORANBAH WATER TREATMENT PLANT

Site No: 034038 • Opened Jan 1972 • Closed Apr 2012 • Latitude: -21.9947° • Longitude: 148.0308° • Elevation 260m

An asterisk (*) indicates that calm is less than 0.5%.
Other important info about this analysis is available in the accompanying notes.



9 am
9141 Total Observations

Calm 22%

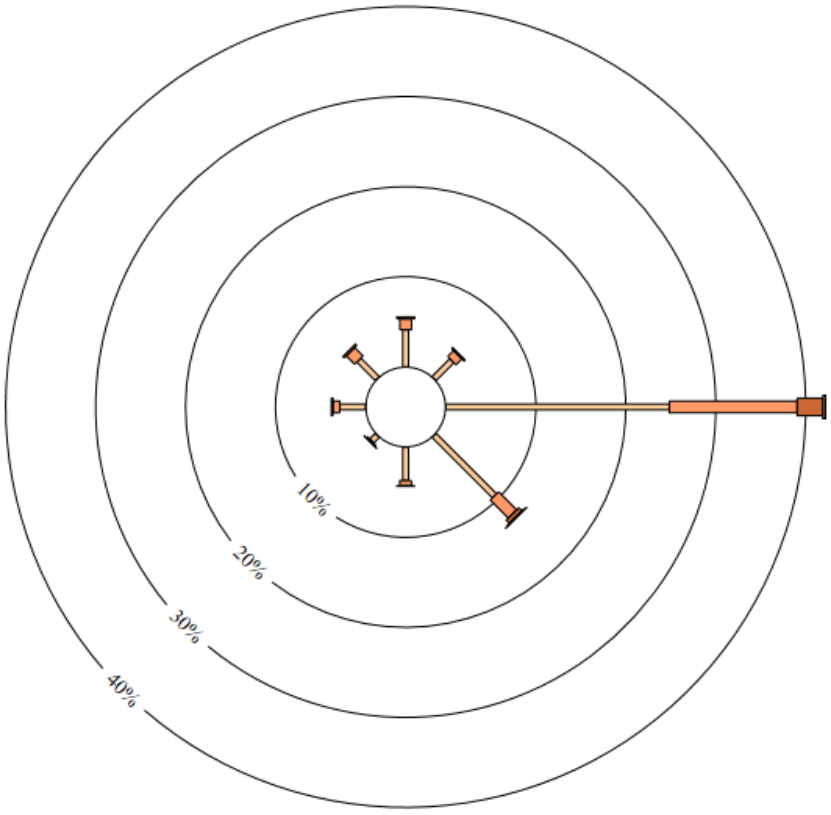


Image 6.1: Wind Rose based on data obtained at 09:00 at the MWTP (1986-2012) (Source: BoM website http://www.bom.gov.au/climate/averages/tables/cw_034038.shtml)

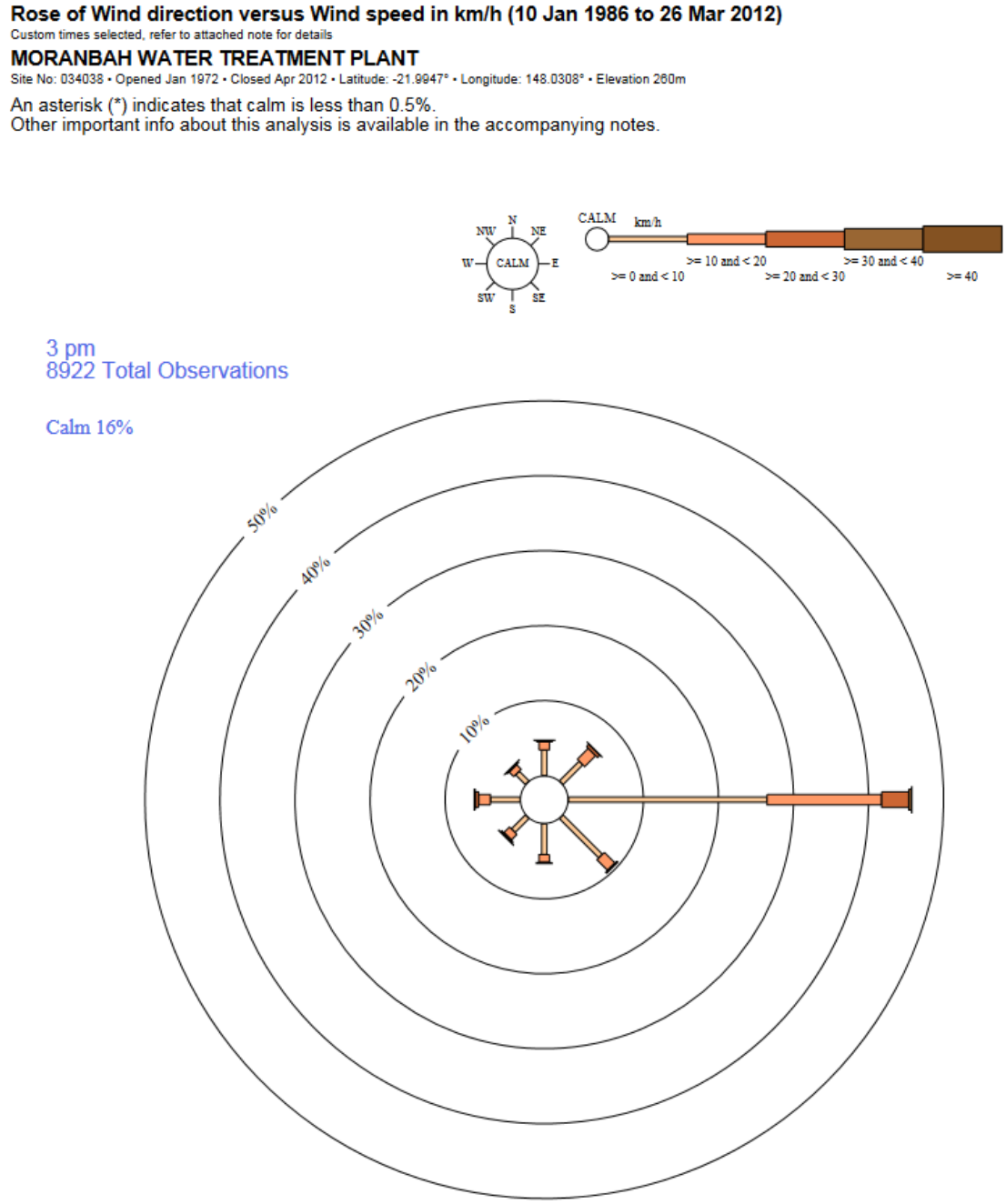


Image 6.2: Wind Rose based on data obtained at 15:00 at the MWTP (1986-2012) (Source: BoM website http://www.bom.gov.au/climate/averages/tables/cw_034038.shtml)

6.2.1.2 Greenhouse Gas Inventory

The *'National Greenhouse and Energy Reporting Act 2007*' (NGER Act) provides a framework for the annual reporting of corporate greenhouse gas (GHG) emissions, energy consumption and production.

DCCEEWs *'Australian National Greenhouse Accounts Factors'* (NGA Factors 2023) provides a methodology by which corporations estimate GHG emissions associated with their activities, including:

- GHG emissions are reported in units of carbon dioxide equivalent or CO2-e
- GHG sources are classified as being either 'direct" or 'indirect'.
    - Direct emission sources (or Scope 1) are produced from sources within the boundary of an organisation and as a result of that organisation's activities.
    - Indirect emissions are generated as a consequence of an organisation's activity, but which are physically produced by the activities of another organisation. There are two classes of indirect emissions: electricity (Scope 2) and other sources (Scope 3).
- It is noted that the NGER Act requires the reporting of Scope 1 and Scope 2 emissions, however the reporting of Scope 3 emissions is voluntary.

The focus of this GHG assessment is Scope 1 emissions. Scope 2 emissions are not applicable as the Project electricity requirements will be locally generated using diesel generators and not consumed from the national grid. Furthermore, the Project will not produce a product, therefore there are no downstream Scope 3 emissions. Upstream Scope 3 emissions have not been considered.

In relation to the NGA Factors used in the assessment (**Table 6.7**) it is noted that options for the combustion of the extracted gas within the NGA Factors include:

- Coal seam methane that is captured for combustion.
- Coal mine waste gas that is captured for combustion.

Chapter 3, Part 3.2, Division 3.2.1 of the NGER (Measurement) Determination 2008 (the Determination), refers to available methods for estimating emissions with a differentiation between the release of fugitive emissions during mining operations and those that are release *before* the extraction of coal. Method 4 under Part 1.3 of the Determination has been used to estimate fugitive emissions associated with venting.

Estimates of emissions associated with flaring have been based on the NGA factor for *coal seam methane that is captured for combustion* with the methane component of the CSG associated with the Project, estimated at greater than 99%.

Table 6.7 presents a summary of the scope 1 NGA Factors used in this assessment.

Table 6.7 National Greenhouse Accounts Emission Factors (Scope 1)

Emission Source	Energy Content[3]	Emission Factor	Units[2]	Source
Coal seam methane that is captured for combustion	0.0377 GJ/m^3	51.63	kg CO2-e/GJ	NGA[1]
Combustion of diesel fuel	38.6 GJ/kL	70.20	kg CO2-e/GJ	NGA[1]

Emission Source	Energy Content[3]	Emission Factor	Units[2]	Source
Note: (1) NGA – Australian Government's Department of Climate Change, Energy, the Environment and Water's National Greenhouse Accounts Factors (2023) (2) kg CO2-e/GJ – kilograms (KG) of carbon dioxide equivalent (CO2-e) per gigajoule (GJ) (3) (a) GJ/m^3 – gigajoule (GJ) per cubic metre (m^3) (3) (b) GJ/kL – gigajoule (GJ) per kilolitre (kL)				

6.2.2 Potential Impacts

The following subsections detail the potential GHG impacts as a result of the activities described in **Section 3**. A risk-based assessment of these potential impacts is detailed in **Table 6.5** and a GHG Abatement Plan is presented in **Appendix C**.

6.2.2.1 Construction of Drill Pads and Access Tracks

Based on information provided in **Section 3.2**, a total of 19 drill pads (11.80 ha) and 0.2 ha of access tracks will be developed as part of the Project. Combustion of diesel fuel will be associated with activities undertaken by the dozer, articulated truck, roller and grader during the construction of the drill pads and access tracks.

Based on the NGA Factors provided in **Table 6.7** and estimates of diesel fuel usage, between 170 and 260 tonnes of CO2-e emissions are estimated to be associated with the combustion of diesel fuel during the construction of the drill pads and access tracks.

For the purposes of this assessment, an average value of 215 tonnes of CO2-e has been used as an estimate of GHG emissions during the construction of the drill pads and access track. These emissions are assumed to emitted during FY2025.

6.2.2.2 Establishment of Vertical and Lateral Wells

Based on information provided in **Section 3.3**, the 13 vertical well will require approximately 10 days of drilling time. Lateral wells will each taking approximately 20 days. Thus in total, approximately 330 days of drilling will be undertaken to complete drilling of the network of vertical and lateral wells.

Based on the NGA Factors provided in **Table 6.7** and a drill rig diesel fuel consumption range of 75 and 110 litres per hour, approximately 1,600 to 2,400 tonnes of CO2-e emissions are estimated to be associated with the drilling of the network of vertical and lateral wells.

For the purposes of this assessment, an average value of 2,000 tonnes of CO2-e is used as an estimate of GHG emissions during the establishment of the wells. These emissions are assumed to be distributed between FY2025 and FY2026.

6.2.2.3 Vertical and Lateral Wells Operation

Flaring

Based on information provided in **Section 3.3**, each of the 13 vertical wells will produce CSG at a rate of approximately 500 l/sec per well.

The combustion of methane by the flaring of CSG, as opposed the release of CSG directly to the atmosphere, has the benefit of significantly reducing the global warming potential (GWP)

of the released gases into the atmosphere due to the conversion through combustion of methane with a GWP of 28 into carbon dioxide with a GWP of 1.

Estimates of GHG emissions associated with the flaring of CSG have been based on:

- The NGA Factor provided in **Table 6.7**
- An assumed 95% flare up-time
- Due to the staggering of wells coming online during the first half of FY2026, an equivalent of 9.58 wells will be operating for the 12 month period
- Due to the staggered shutdown of wells during the second half of FY2027, an equivalent of 9.92 wells will be operating for the 12 month period, and
- The wells will produce CSG at an average rate of 500 l/s per well.

Thus, the flaring of CSG is estimated to produce:

- 279,420 tonnes of CO2-e during FY2026, and
- 289,140 tonnes of CO2-e during FY2027

Venting

The venting of CSG may occur when the flare is unavailable which is estimated to occur less than 5% of the time.

Method 4 of Part 1.3 of the NGER (Measurement) Determination 2008 has been used to estimate fugitive emissions during venting of CSG.

Based on the assumptions as per those applied in the estimation of GHG emissions associated with flaring with an assumed 5% flare down-time, fugitive emissions due to the venting of CSG is estimated to result in:

- 45,900 tonnes of CO2-e during FY2026, and
- 47,500 tonnes of CO2-e during FY2027.

Generators

As noted in **Section 3.5**, electricity will be required to operate the drill pumps and the well pumps. A total of thirteen 60 kV diesel generators will be co-located with the vertical wells.

Based on the NGA Factors provided in **Table 6.7** and conservatively assuming that all diesel generators will operate for a period of c. 27 months at a diesel fuel consumption rate of between 8 to 14 litres per hour, between 5,500 to 9,700 tonnes of CO2-e emissions are estimated to be associated with the operation of the generators.

For the purposes of this assessment, an average value of 3,400 tonnes of CO2-e per 12 months is used as an estimate of GHG emissions. Thus it is estimated that:

- 850 tonnes of CO2-e are emitted during FY2025
- 3,400 tonnes of CO2-e are emitted during FY2026, and
- 3,400 tonnes of CO2-e are emitted during FY2027.

6.2.2.4 Summary of GHG Emission Estimates

Table 6.8 provides a summary of estimated Scope 1 GHG emissions over the life of the Project, highlighting the flaring of CSG as the primary source of emissions.

Table 6.8 Summary of GHG Emissions

Scope	Project Phase	Source	FY2025 Tonnes of CO2-e	FY2026 Tonnes of CO2-e	FY2027 Tonnes of CO2-e	Percentage of Total
1	Construction	Combustion of diesel in equipment during drill pad and access track construction	215	n/a	n/a	0.03%
1	Construction	Combustion of diesel in drill rig during construction of vertical and lateral wells	1,000	1,000	n/a	0.30%
1	Operation	Combustion of diesel in generators during operation of vertical and lateral wells	850	3,400	3,400	1.14%
1	Operation	Flaring of CSG	n/a	279,420	289,140	84.63%
1	Operation	Venting of CSG	n/a	45,900	47,500	13.90%
2	n/a	Electricity consumption	0	0	0	0%
Total GHG Emissions (tonnes CO2-e)			**2,065**	**329,720**	**340,040**	**100%**

6.2.2.5 Comparison with Australian Emissions

The latest Australian GHG emissions inventory (2021-2022) provided in the DCCEEW '*National Inventory Report 2022'* (DCCEEW, 2024) indicates Australia's total GHG emissions (including land use, land use change and forestry activities) was 432.6 million tonnes (Mt) of CO2-e.

More than 99.6% of the Project's CO2-e emissions occur over the 2-year period FY2026 and FY2027 and are primarily associated with the flaring of CSG (84.6%).

The summary of emissions provided in **Table 6.8** suggests an annual Project-related contribution to GHG emissions in the range of approximately 0.33 Mt and 0.34 Mt of CO2-e per year. This represents between 0.076% and 0.079% of Australia's 2022 GHG emissions.

Queensland's contribution to the 2022 national inventory was estimated to be 124.1 Mt of CO2-e. The Project's contribution represents 0.266% to 0.274% of Queensland's 2022 emissions.

6.2.3 Management Practices

The potential impacts will be managed through current practices. These methods are used to mitigate impacts of GHG emission, and include:

- Monitoring of diesel use
- Operating plant and equipment so as to minimise fuel usage
- Minimising the risk of fugitive emissions of CSG, and
- Ensuring flares are operating optimally.

6.2.4 Risk Assessment

The potential GHG impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6.9**. The risk of greenhouse gas impacts is considered low.

Table 6.9 Greenhouse gas risk assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Fugitive emissions of GHG associated with the Project will contribute to climate change	Possible (3)	Minor (1)	Low	Although any contribution to GHG emissions may contribute to climate change in theory, it is unlikely that the scale of the contribution of fugitive emissions of GHG from the Project would result in a material change in climate outcomes. Nonetheless, all practicable strategies to reduce the risk of fugitive emissions of CSG throughout the life of the Project should be implemented.

6.3 Noise and Vibration

This section presents the assessment of Project related noise and vibration impacts to sensitive receptors.

6.3.1 Existing Environment

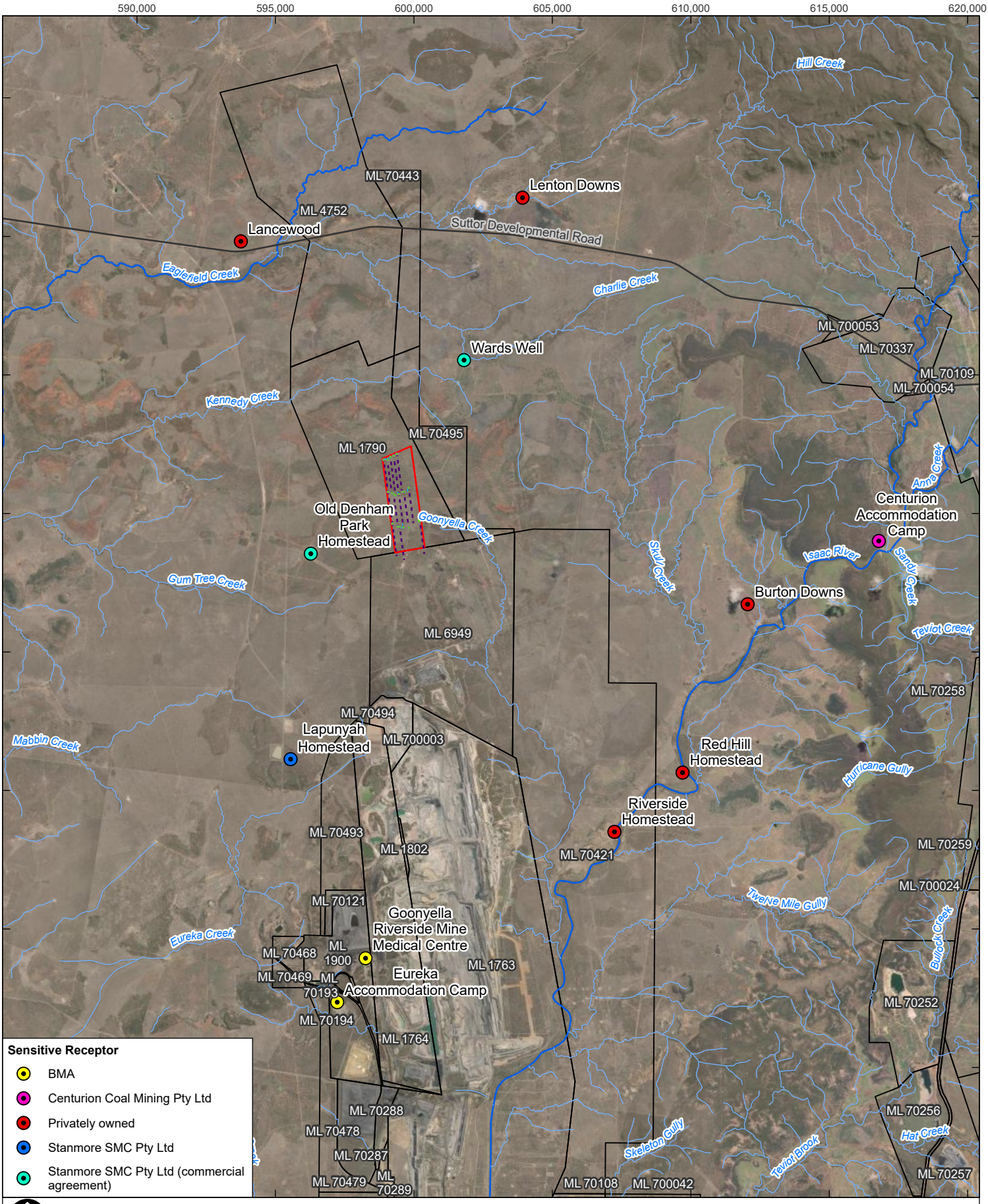
6.3.1.1 Sensitive Receptors

Potential sensitive receptors surrounding the Project Area, are presented in **Table 6.10** and **Figure 6.3**. Sensitive receptors have been identified through a desktop review of historical information (e.g. EIS, EA amendments, etc) and an analysis of available aerial photographic images.

Table 6.10 Receptors Surrounding the Project

ID	Receptor Name	Easting (m) [1]	Northing (m) [1]	Approximate Distance to Closest Drill Pad (km)	Ownership/Agreement Status
1	Old Denham Park Homestead	596275	7608546	3.1	Stanmore SMC Pty Ltd (commercial agreement)
2	Wards Well	601809	7615534	4.1	Stanmore SMC Pty Ltd (commercial agreement)
3	Lancewood	593750	7619821	9.4	Privately owned
4	Lenton Downs	603922	7621398	10.2	Privately owned
5	Centurion Accommodation Camp	616790	7609005	16.5	Centurion Coal Mining Pty Ltd
6	Burton Downs	612051	7606721	12.2	Privately owned
7	Red Hill Homestead	609702	7600644	13.0	Privately owned
8	Riverside Homestead	607241	7598505	13.2	Privately owned
9	Goonyella Riverside Mine Medical Centre	598253	7593944	15.5	BMA
10	Eureka Accommodation Camp	597230	7592356	17.2	BMA
11	Lapunyah Homestead	595547	7601128	9.2	Stanmore SMC Pty Ltd

Note 1: GDA 2020 MGA Zone 55 projection.



EA AMENDMENT P-EA-100658735

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:180,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LOCATION OF SENSITIVE RECEPTORS

SLR

FIGURE 6.3

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_ANV_F06-03_Location of Sensitive Receptors

6.3.1.2 Acoustic Environment

Historical noise monitoring results obtained from measurements completed by SLR have been used to inform the assessment criteria for the Project. The baseline noise levels are summarised in **Table 6.11** and have been conservatively applied to the assessment.

All items of acoustic instrumentation employed during the noise monitoring were set to A-weighted and 'Fast' response in accordance with the relevant Australian Standards and DESI's *Noise Measurement Manual* (EPA 2020). All items of acoustic instrumentation employed during the noise measurement surveys were designed to comply with AS/NZS IEC 61672.1-2019 *Electroacoustics-Sound level meters–Specifications* and carried current manufacturer calibration certificates.

Table 6.11 Baseline noise monitoring results summary

Monitoring Location	Description	Rating Background Level (dBA)		
		Day (7 am – 6 pm)	Evening (6 pm – 10 pm)	Night (10 pm – 7 am)
(ID 1) Old Denham Park Homestead	Noise logger located in south-eastern corner of front yard, approximately 15 m from the homestead	28	25	25
(ID 6) Burton Downs Homestead	Noise logger located in centre of front yard, approximately 100 m from the homestead (between homestead and working shed, next to fruit garden)	25	24	24
(ID 8) Riverside Homestead	Noise logger located in north-eastern corner of tennis court, approximately 40 m from the homestead	30	23	23
(ID 10) Eureka Accommodation Camp	Noise logger located ~200 m from Eureka Creek & ~500 m from Riverside Mine Road	36	39	36
(ID 11) Lapunyah Homestead	Noise logger located in south-eastern corner of front yard, approximately 20 m from the homestead	26	30	28

The following is noted from the existing baseline noise monitoring data:

- Excluding the Eureka Camp, Rating Background Levels (RBL) ranged from 25 dBA to 30 dBA during the daytime, and 23 dBA to 30 dBA during both the evening and night-time.
- The observed noise levels were typical of a rural environment with natural noise sources, such as birds, light wind in trees, insects, as well as mining noise contributions associated with the Goonyella Riverside Mine complex and CCM.
- RBLs at the Eureka Village ranged between 36 dBA to 39 dBA during the daytime, evening and night-time. The ambient noise environment at this location was largely controlled by local (i.e. camp-related) vehicle movements, mechanical plant noise from within the camp and noise from Goonyella Riverside Mine.

Of the above, the observation most relevant to this study is that background noise levels (in the context of the existing EA) were shown to be 30 dBA or lower during the day, evening and night-time assessment periods. This is expected to also be the case at other sensitive receptor locations listed in **Table 6.17**.

6.3.2 Potential Impacts

The following subsections detail the noise and vibration assessment methodology and potential impacts resulting from the activities described in **Section 3.0**.

6.3.2.1 Assessment Methodology

Modelling Parameters and Assumptions

A SoundPLAN (Version 8.2) computer noise model was developed to predict project noise levels at potentially impacted receptors. SoundPLAN is a computer model software package enabling calculation of environmental noise by combining a digitised ground map (topography), the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The Conservation of Clean Air and Water Europe (CONCAWE[1]) industrial prediction algorithm has been used to model predicted noise levels from the Project. The statistical accuracy of environmental noise predictions using CONCAWE was investigated by Marsh (Applied Acoustics 15 – 1982). Marsh concluded that CONCAWE was accurate to ±2 dBA in any one octave band between 63 hertz (Hz) and 4 kHz and ± 1 dBA overall.

In relation to the modelling of atmospheric conditions, DESI's *EcoAccess Planning for Noise Control* (PNC) guideline (retracted and currently undergoing review by DESI), provides guidance with respect to applying default atmospheric conditions for the assessment of mining operations. The default weather parameters recommended by the PNC guideline are summarised in **Table 6.12** and have been applied to the assessment of noise impacts from the Project.

Table 6.12 Modelled meteorological conditions

Parameter	Neutral Weather	Adverse Weather
Temperature	10oC	10oC
Humidity	70%	90%
Pasqual stability class	D	F (representative of temperature inversion)
Wind speed	0 m/s	2 m/s

Noise and Vibration Modelling Scenarios

The following provides an overview of the noise and vibration modelling completed to inform the assessment of the potential for noise and vibration impacts from the Project:

- New access track and drill pad construction:
  - The pre-drilling stage involving the development of the new access tracks and drill pads has been modelled based on the combined fleet of construction equipment listed in **Table 6.13** operating simultaneously. Noise from the new access tracks and drill pad construction activities have been modelled individually at every proposed access track and drill pad site with the highest (i.e. worst-case) noise level predicted at each receptor assessed against the noise criteria.

[1] Report no. 4/81 the propagation of noise from petroleum and petrochemical complexes to neighbouring communities

- Vibration modelling and assessment has been carried out for the 12t vibratory roller required for soil compaction as part of the earthmoving fleet.

- Drilling of vertical and lateral wells:
  - The modelling of well drilling noise has been conservatively based on the lateral well rig setup (spread) for all Project wells (i.e. both vertical and lateral wells), noting noise emission from the drilling of vertical wells will potentially be lower, given the smaller rig spread. Noise from the SIS drill rig have been modelled individually at every proposed drill site with the highest (i.e. worst-case) noise level predicted at each receptor assessed against the noise criteria. The modelled sound power level (SWL) data is summarised in **Table 6.13**.
  - No discernible sources of vibration are anticipated during this stage of the Project.
- Vertical and lateral well operation:
  - Modelling of worst-case operational noise from the Project has been based on the plant listed in **Table 6.13** all operating simultaneously at all proposed well sites. As can be seen by the significant difference in source SWLs, noise emission levels associated with this stage of the Project will be dominated by the vertical flare.
  - No discernible sources of vibration are anticipated during this stage of the Project.

Table 6.13 Modelled scenarios and equipment SWL data – A-weighted

Plant Item	Octave Band Centre Frequency (Hz)								Total SWL	Source Height
	63	125	250	500	1k	2k	4k	8k		
New access track and drill pad construction (note: fleet consists of one (1) of each item)										
Slasher	83	103	105	110	112	104	102	92	115	2.0 m
Dozer D8T	84	93	97	105	101	100	98	90	108	2.5 m
Vibratory roller (12t)	97	102	95	100	102	101	98	93	108	2.0 m
Water truck (30 kL)	84	90	95	100	100	99	95	85	106	2.5 m
Grader CAT 150	94	100	106	103	109	106	102	90	113	3.0 m
Well drilling (note: only one (1) rig proposed for well drilling)										
SIS drill rig	105	109	111	117	122	119	111	102	125	3.0 m
Well operation (note: well operational plant modelled at each well pad; other plant will also be required however the below represents the acoustically significant plant items required for the Project)										
Flare (500 L/sec)	95	106	113	118	116	115	111	108	123	6.0 m

Plant Item	Octave Band Centre Frequency (Hz)								Total SWL	Source Height
	63	125	250	500	1k	2k	4k	8k		
Well pumps	89	84	88	91	96	98	92	81	102	2.0 m
Generator 60kV diesel	78	85	86	83	85	85	79	65	92	1.5 m

6.3.2.2 New Access Tracks and Well Pad Development

Construction Noise

The predicted new access track and drill pad construction noise levels, under neutral and adverse weather conditions, are summarised in **Table 6.14**.

Construction of the new access tracks and drill pads is anticipated to occur during the hours of 6:00 am to 6:00 pm daily. As such, the EA noise limits for both the daytime period (i.e. 7:00 am to 6:00 pm) and night-time period (i.e. 6:00 am to 7:00 am) have been included for reference in **Table 6.14**.

Table 6.14 Predicted worst-case new access track and drill pad construction noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)		Predicted Construction Noise Level $L_{A10,adj,10min}$ (dBA)	
	6:00 am to 7:00 am	7:00 am to 6:00 pm	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	31	26
2 - Wards Well [1]	N/A	N/A	27	21
3 - Lancewood	33	35	14	<10
4 - Lenton Downs	33	35	13	<10
5 - Centurion Accommodation Camp	N/A	N/A	<10	<10
6 - Burton Downs	33	35	11	<10
7 - Red Hill Homestead	33	35	10	<10
8 - Riverside Homestead	33	35	10	<10
9 - Goonyella Riverside Mine Medical Centre [2]	33	35	<10	<10
10 - Eureka Accommodation Camp [2]	33	35	<10	<10
11 - Lapunyah Homestead [1]	33	35	15	<10

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

From the noise modelling results presented in **Table 6.14**, the following is noted:

- Worst-case new access track and drill pad construction noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level was 31 dBA $L_{A10,adj,10mins}$ at the Old Denham Park Homestead, which is noted to be owned by Stanmore SMC Pty Ltd with a commercial agreement in place between CCM and Stanmore.
- The highest predicted noise level at a privately-owned sensitive receptor was 14 dBA $L_{A10,adj,10mins}$ at Lancewood.

Construction Vibration

The current EA does not prescribe vibration limits, nor does it provide guidance in relation to the prevention of vibration impacts from activities occurring on ML 1790. Consequently, the potential for vibration impacts associated with the operation of the 12t vibratory roller (required as part of the earthworks fleet) has been assessed against the following criterion:

- Human comfort peak particle velocity (PPV) vibration limit of 5 mm/s, based on guidance from DESI's *Model Mining Conditions* Guideline (MMC).

It is noted the above criterion specifically refers to ground vibration from blasting, however it is considered that the vibration limits are relevant to the assessment of vibration from the Project vibratory compaction works, particularly given the temporary and short-term nature of these works. Notwithstanding this, vibration offset buffer distances to comply with the threshold of human perception (i.e. <0.15 mm/s[2]) have also been calculated and assessed for the Project.

Prediction of PPV vibration levels from the 12t roller has been based on the following methodology:

- Vibratory compaction – BS 5228-2:2009 Evaluation and measurement for vibration in buildings - Part 2 (plus 2014 Amendment), specifically Table E.1 '*Empirical predictors for groundborne vibration arising from mechanized construction works*'.

Vibratory compaction PPV vibration levels were calculated using the empirical formulae shown in **Image 6.3.**

Operation	Prediction question	Scaling factors (and probability of predicted value being exceeded)	Parameter range
Vibratory compaction (steady state)	$v_{res} = k_s\sqrt{n_d}\left[\frac{A}{x+L_d}\right]^{1.5}$	$k_s = 75$ (50%) $k_s = 143$ (33.3%) $k_s = 276$ (5%)	$1 \leqslant n_d \leqslant 2$ $0.4 \leqslant A \leqslant 1.72$ mm $2 \leqslant x \leqslant 110$ m
Vibratory compaction (start up and run down)	$v_{res} = k_t\sqrt{n_d}\left[\frac{A^{1.5}}{(x+L_d)^{1.3}}\right]$	$k_t = 65$ (50%) $k_t = 106$ (33.3%) $k_t = 177$ (5%)	$0.75 \leqslant L_d \leqslant 2.2$ m

Image 6.3 Empirical predictors for groundborne vibration from construction works

Source: Table E.1, Vibratory rolling – BS 5228-2:2009 Evaluation and measurement for vibration in buildings - Part 2 (plus 2014 Amendment)

[2] British Standard BS 5228-2:2009, *Code of practice for noise and vibration control on construction and open sites – Part 2: Vibration*, states "*Human beings are known to be very sensitive to vibration, the threshold of perception being typically in the PPV range of 0.14 mm/s to 0.3 mm/s".*

Based on the formulae presented in **Image 6.3**, vibration offset buffer distances for the 12t roller have been calculated to inform the assessment:

- Approximately 30 m to comply with the 5 mm/s human comfort vibration limit.
- Approximately 480 m to be below the threshold of human perception (i.e. <0.15 mm/s).

Based on the above vibration offset buffer distances and the receptor to drill pad distances in Table 6.10 (i.e. 9.4 km to 13.2 km for privately-owned sensitive receptors), the risk of vibration-related impacts is negligible for any sensitive receptor during the vibratory compaction works.

6.3.2.3 Vertical and Lateral Well Drilling

The predicted vertical and lateral well drilling noise levels, under neutral and adverse weather conditions, are summarised in **Table 6.15** and are assessed against the daytime and night-time period noise limits.

Table 6.15 Predicted worst-case CSG exploration drilling noise levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)		Predicted Drilling Noise Level $L_{A10,adj,10min}$ (dBA)	
	6:00 am to 7:00 am	7:00 am to 6:00 pm	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead [1]	N/A	N/A	37	31
2 - Wards Well [1]	N/A	N/A	32	26
3 - Lancewood	33	35	17	10
4 - Lenton Downs	33	35	16	<10
5 - Centurion Accommodation Camp	N/A	N/A	<10	<10
6 - Burton Downs	33	35	13	<10
7 - Red Hill Homestead	33	35	12	<10
8 - Riverside Homestead	33	35	12	<10
9 - Goonyella Riverside Mine Medical Centre [2]	33	35	11	<10
10 - Eureka Accommodation Camp [2]	33	35	<10	<10
11 - Lapunyah Homestead [1]	33	35	17	10

Note: Greyed cells indicate the receptor is either owned by CCM or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

The noise prediction modelling results shown in **Table 6.14** and **Table 6.15** indicate the following:

- Worst-case drilling noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level at a privately-owned sensitive receptor was 17 dBA $L_{A10,adj,10mins}$ at Lancewood.

6.3.2.4 Vertical and Lateral Well Operation

The predicted vertical and lateral well operational noise levels under neutral and adverse weather conditions, are summarised in **Table 6.16** and are assessed against the daytime and night-time period noise limits.

Table 6.16 Predicted worst-case CSG well operational noise levels

Receptor	EA Noise Limit LA10,adj,10mins (dBA)		Predicted CSG Well Noise Level LA10,adj,10min (dBA)	
	6:00 am to 7:00 am	7:00 am to 6:00 pm	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead 1	N/A	N/A	46	40
2 - Wards Well 1	N/A	N/A	41	34
3 - Lancewood	33	35	28	20
4 - Lenton Downs	33	35	26	19
5 - Centurion Accommodation Camp	N/A	N/A	<10	<10
6 - Burton Downs	33	35	24	17
7 - Red Hill Homestead	33	35	23	16
8 - Riverside Homestead	33	35	23	15
9 - Goonyella Riverside Mine Medical Centre 2	33	35	22	14
10 - Eureka Accommodation Camp 2	33	35	19	12
11 - Lapunyah Homestead 1	33	35	29	21

Note: Greyed cells indicate the receptor is either owned by Centurion Mine or a commercial agreement exists (i.e. non-sensitive receptors).

Note 1: Receptor owned and operated by Stanmore SMC Pty Ltd.

Note 2: Receptor owned and operated by BMA.

The noise prediction modelling results shown in **Table 6.16** the following is noted:

- Worst-case CSG well operational noise levels are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted noise level at a privately-owned sensitive receptor was 28 dBA $L_{A10,adj,10mins}$ at Lancewood. The 6 m high vertical flares are the dominant source of noise during this stage of the Project.

6.3.3 Management Practices

The assessment of the potential for noise and vibration impacts to sensitive receptors has indicated that impacts would likely be avoided without the need for specific mitigation and management measures. Nonetheless, it is recommended that the following good practice measures are applied during the Project to assist with the control of noise and vibration levels:

- Use of the quietest available equipment to complete the earthworks, drilling and CSG flaring works.
- All plant and equipment should be operated in accordance with the manufacturer's instruction and regularly maintained in order to minimise noise emission levels.
- Lining pipe racks with rubber to dampen the metal-on-metal impact.
- Equipment should be shut down when not in use.
- Broadband "buzzer", not tonal "beeper", reversing alarms should be utilised on all mobile plant.

6.3.4 Risk Assessment

The potential noise and vibration impacts were assessed to provide an overall risk rating, which are presented in **Table 6.17**. The risk-based assessment has determined that noise and vibration impact to sensitive receptors surrounding the Project are low due to the scale and location of the Project activities.

Table 6.17 Noise and vibration risk assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Noise disturbance at sensitive receptors during new access track and drill pad construction works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Vibration disturbance at sensitive receptors during vibratory compaction associated with new access track and drill pad construction works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Noise disturbance at sensitive receptors during CSG exploration drilling works	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm
Noise disturbance at sensitive receptors during CSG flaring operations	Unlikely (2)	Low (2)	Low	Due to the minor scale and size of the Project activities, and the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm

6.4 Land Resources

This section presents the assessment of Project related land resource impacts to environmental values.

6.4.1 Existing Environmental Values

6.4.1.1 Surface Geology

The Project is located within the Nogoa-Belyando region, which comprises of gently undulating Tertiary land surface that was depositional over extensive lowland areas (SKM 2012). **Table 6.18** translates lithologies (Department of Resources 2023) within the Project area, as illustrated in **Figure 6.4.**

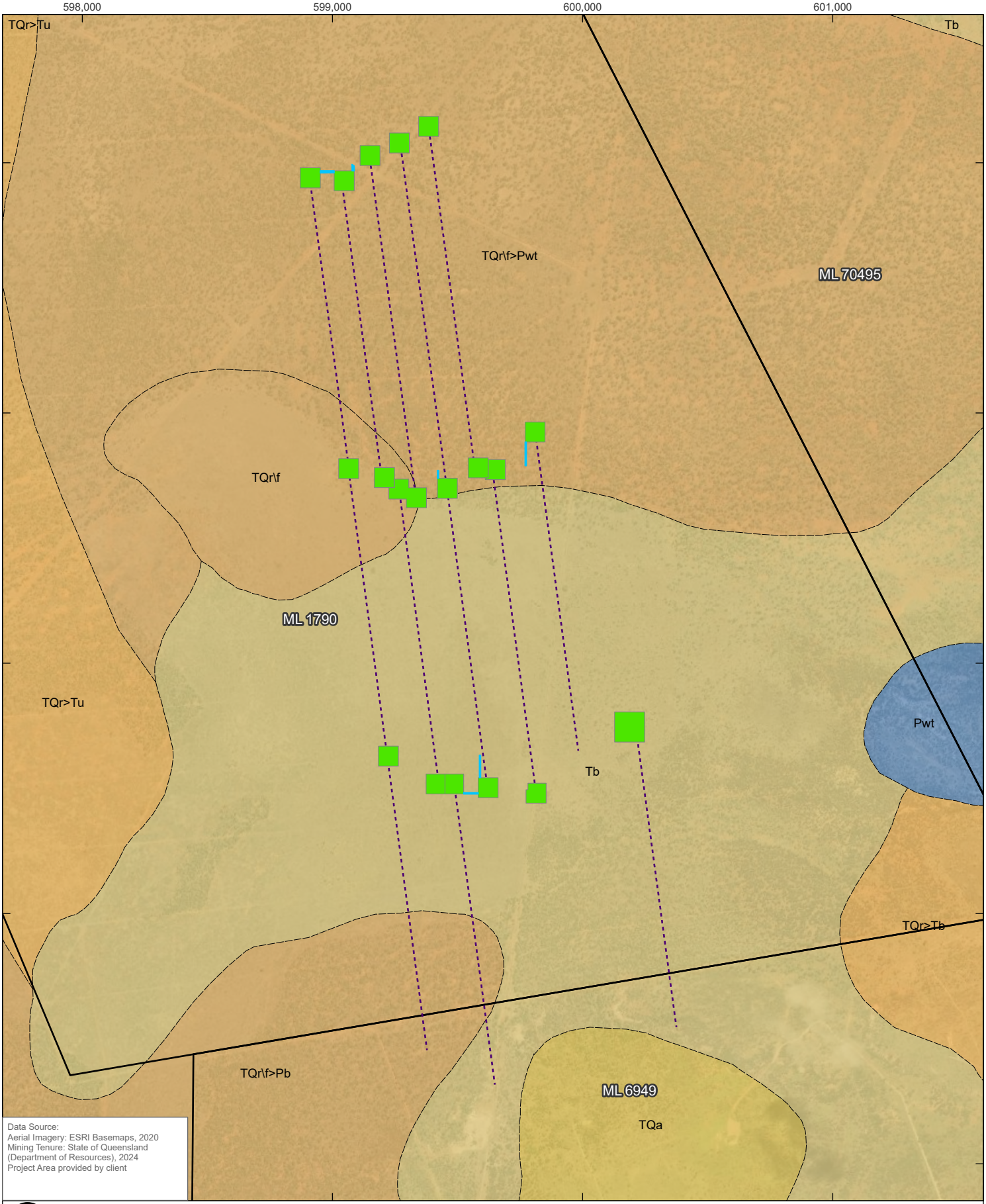
Table 6.18 Surface geology lithological summary

Map Symbol	Legend	Lithological Summary	Age
TQr\f>Pwt	TQr\f-QLD>Fort Cooper Coal Measures (TQr\f>Pwt)	Older residual soils, colluvium (ferruginous soils)	Late Tertiary - Quaternary
Pwt	Fort Cooper Coal Measures (Pwt)	Lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff, tuffaceous (cherty) mudstone	Late Permian
TQr\f>Pb	TQr\f-QLD>Back Creek Group (TQr\f>Pb)	Older residual soils, colluvium (ferruginous)	Late Tertiary - Quaternary
TQa	TQa-(TQa)	Locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits (generally related to present stream valleys but commonly dissected)	Late Tertiary - Quaternary
TQr>Tu	TQr-QLD>Suttor Formation (TQr>Tu)	Clay, silt, sand, gravel and soil; colluvial and residual deposits (generally on older land surfaces)	Late Tertiary - Quaternary
TQr>Tb	TQr-QLD>Tb-(TQr>Tb)	Clay, silt, sand, gravel and soil; colluvial and residual deposits (generally on older land surfaces)	Late Tertiary - Quaternary
TQr\f	TQr\f-(TQr\f)	Older residual soils, colluvium (ferruginous)	Late Tertiary - Quaternary
Tb	Tb-(Tb)	Mostly olivine basalt flows and some plugs; some areas of nephelinite, basanite etc	Tertiary

6.4.1.2 Soil Mapping Units

Within the disturbances areas of the Project, only one soil mapping unit (**Figure 6.4**) is identified utilising the Queensland Government Department of Resources (2018) database. It uses The Atlas of Australian Soils compiled by during the 1960's period to create a standardised Australian national description of soils.

The disturbance area is dominated by the unit My28 (**Figure 6.5**) and is described as gently undulating lands with broad ridge crests and low rises. Dominant soils are loamy or occasionally sandy red earths.



0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Surface Geology

- Geological boundary approximate
- Fort Cooper Coal Measures (Pwt)
- TQa-QLD (TQa)
- TQr-QLD>Suttor Formation (TQr>Tu)
- TQr-QLD>Tb-QLD (TQr>Tb)
- TQr\f-QLD (TQr\f)
- TQr\f-QLD>Back Creek Group (TQr\f>Pb)
- TQr\f-QLD>Fort Cooper Coal Measures (TQr\f>Pwt)
- Tb-QLD (Tb)

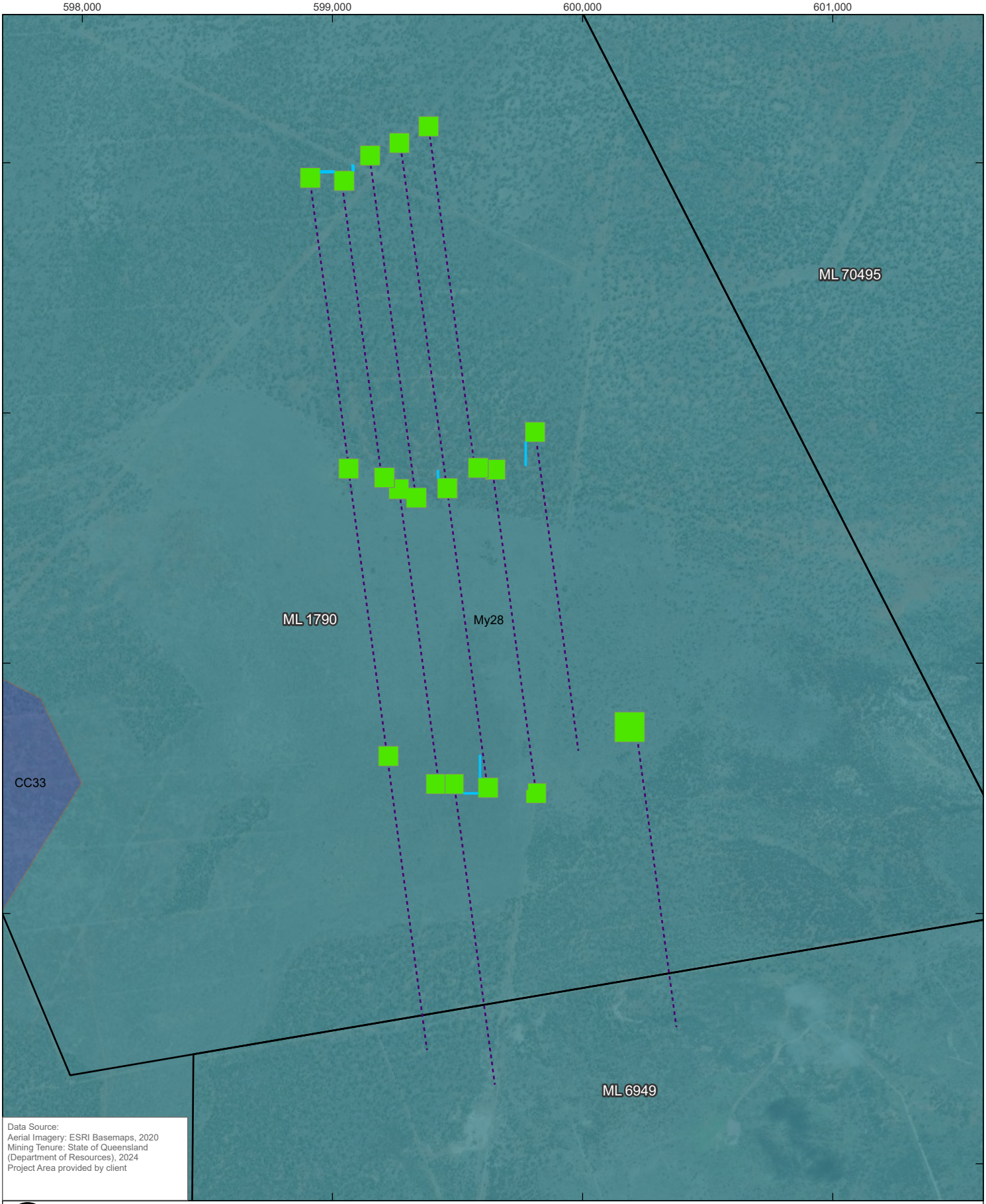
EA AMENDMENT P-EA-100658735

SURFACE GEOLOGY

SLR

FIGURE 6.4

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-04_Surface Geology



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Atlas of Australian Soils

Map Unit

- CC33
- My28

EA AMENDMENT P-EA-100658735

ATLAS OF AUSTRALIAN SOILS

SLR

FIGURE 6.5

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-05_Atlas of Australian Soils

6.4.1.3 Soil Orders

Soil units for most of the Project Area was mapped by (2012) as part of the *Wards Well: Soil Survey.* completed detailed soil descriptions at 98 locations and 384 observation sites. A section of the disturbance area to the south of the Project Area was not classified by SKM (**Figure 6.6**). The broad scale regional soil mapping (DNRME and DES 2024) was accessed to determine the soil order (**Figure 6.7**). The major soil orders present on site are Vertosol, Dermosol and Kandosol. The dominant properties of each soil order are provided below.

Vertosol

The soil profile is predominantly clayey, with the surface soil typically consisting of light clay containing over 35% clay content. The subsoil varies from light to medium or heavy clay. Due to the characteristics of the clay minerals, these soils undergo significant shrinkage and swelling during wetting and drying cycles. When dry, they develop noticeable cracks that usually extend to the soil surface (VRO 2021).

On-site (SKM 2012), the observed Vertosols have a well-developed structure and high clay content, with most being utilized for grazing in the region. These cracking clays typically range from very dark brown to dark greyish black, consisting of medium to heavy clays. They are moderately to well-drained, generally alkaline, and become increasingly alkaline with depth.

Further observations include:

- Overall good fertility.
- Sodicity and salinity increase below 300 mm, restricting plant rooting depth and plant-available water capacity (PAWC) with probability of soils becoming epihypersodic[3].
- Desirable pH levels.
- High levels of nitrates, phosphorus and metals.
- Well-structured surface soil (high organic matter and calcium relative to magnesium), though it may become dispersive below 300 mm.

Dermosol

Dermosols are characterized by a strong texture transition between the A and B horizons and are not uniformly calcareous. They feature moderately to strongly structured B2 horizons, which are typically clayey and contain less than 5% free iron oxides. In arid regions, Dermosols are commonly found on low-angle pediments with sparse shrublands.

Within the mining lease (SKM, 2012), Dermosols have been observed to have the following properties:

- Overall low fertility (low levels of phosphorus and nitrogen).
- Sodicity and dispersiveness increase below 200 mm.
- pH at desirable levels.

[3] Extremely high levels of exchangeable sodium within the upper part of the soil profile. Soil with very high exchangeable sodium percentage (ESP), typically in the range of 15% or more, which is considered detrimental to soil health.

- Poor surface soil structure (low organic matter and apedal) with dispersiveness below 200 mm; other tested Dermosols showed dispersiveness below 700 mm.

Kandosol

Kandosols are non-texture contrast soils (with little or gradual increase in clay content with depth) that have massive (i.e. weakly to non-structured) subsoils (B horizons). They are found mainly in the upland areas, often in association with Dermosols, Chromosols and Kurosols. These soils can vary from stony hardsetting soils to deeper friable soils. Some may almost be texture contrast and have a bleached subsurface (A2) horizon (VRO 2021).

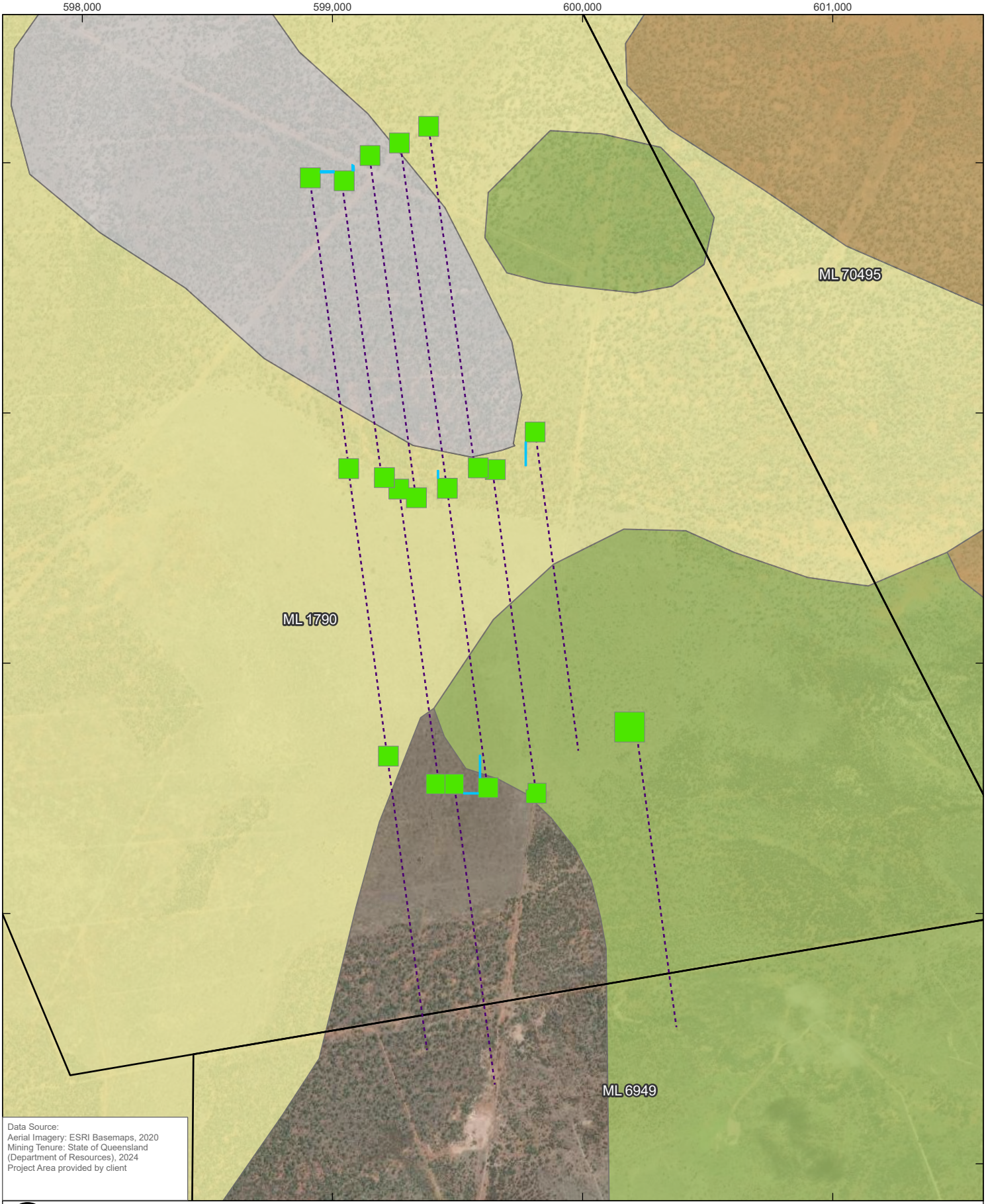
Kandosols are often found in conjunction with ferricrete deposits, within level to gently undulating plains. Their parent material usually consists of quartz-rich sedimentary rock. They are often greater than 3m deep and clay rich. The Kandosols within the Project area have been observed with the following (SKM 2012):

- pH is within desirable range.
- Good soil structure.
- Moderate overall fertility (high levels of nitrogen, adequate phosphorus and metals, low sulphate at surface and low to moderate cation exchange capacity (CEC)).

A summary of chemical properties (**Table 6.19**) of these soil orders have been extracted from Wards Well Mine (BHP, 2021). Further details of each soil order are presented in the following sections.

Table 6.19 Soil order chemical properties summary

Parameter	Unit	Vertosol	Dermosol	Kandosol
pH1:5 water	N/A	7.8 - 8.6	7.2 - 7.8	6.7 – 7.5
Electrical conductivity (1:5 water)	dS/m	0.1 - 0.66	0.025 - 0.15	0.014 – 0.034
Plant available water content	mm	125 - 450	100 - >125	>125
Organic carbon	%	5.1	1.4	3.6
Cation exchange capacity	cmol/kg	57 - 72.4	8.1 - 20.3	17.4 – 31
Exchangeable sodium percentage	%	0 - 12	5 – 11	0 – 5
Calcium to magnesium ratio	N/A	1.1 - 2.1	0.8 – 1.2	1.2 – 1.7
Productivity	-	Predominate soil type in the region. Soil properties sufficient to support grasses and native trees	Suitable for rehabilitation for cattle grazing on flat to gentle slopes	Suitable for rehabilitation of steeper slopes due to good soil structure



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Australian Soil Classification (SKM, 2012)

- Dermosol
- Kandasols
- Sodosol
- Vertosol

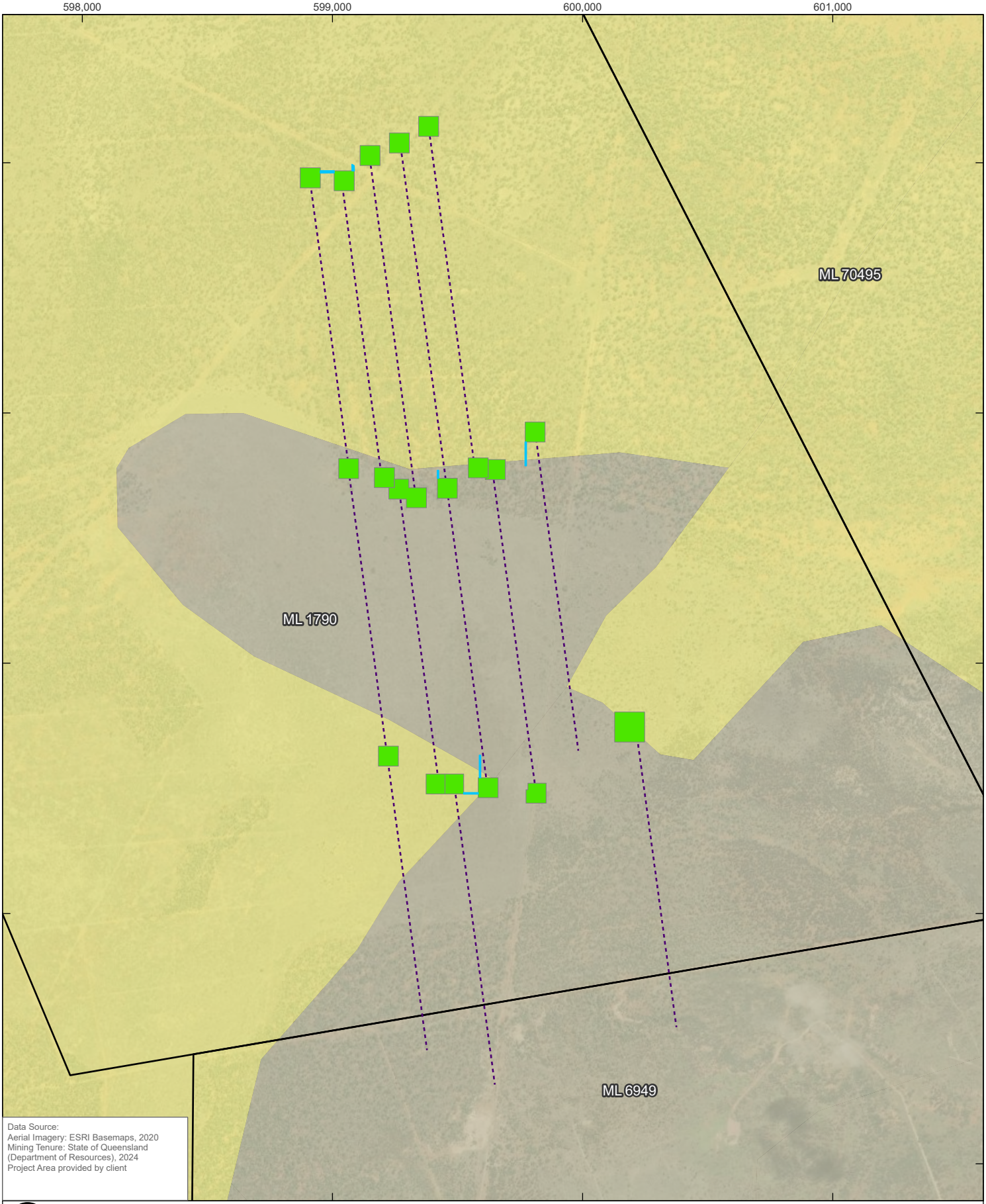
EA AMENDMENT P-EA-100658735

AUSTRALIAN SOIL CLASSIFICATION OF PROJECT AREAS (SKM, 2012)

SLR

FIGURE 6.6

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-06_Australian Soil Classification - SKM 2012



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Australian Soil Classification (DNRME and DES, 2024)

- Kandosol
- Vertosol

EA AMENDMENT P-EA-100658735

AUSTRALIAN SOIL CLASSIFICATION OF PROJECT AREAS (DNRME AND DES, 2024)

SLR

FIGURE 6.7

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-07_Australian Soil Classification - DNRME and DES

6.4.1.4 Land Use

Most of the Project Area is currently utilised for cattle grazing on buffel and native grasses, which were in good condition during the survey completed by (2012). The vegetation in the area includes natural bush consisting of Poplar Box, Bloodwood, Ironbark, Acacia, Wattle and Brigalow species. The environmental values of terrestrial ecology and vegetation are described in further detail in **Section 6.5** and **Section 6.6**.

6.4.1.5 Land Suitability

Five land suitability classes are defined for use in Queensland, with land suitability decreasing progressively from Class 1 to Class 5 (**Table 6.24**). These classes are used to describe an area of land in terms of suitability for a particular land use which allows optimum, sustainable production with current technology while minimising degradation to the land resource in the short, medium or long-term (Queensland Government 2013). Land suitability deals with land specific uses, which in this case are grazing and cropping.

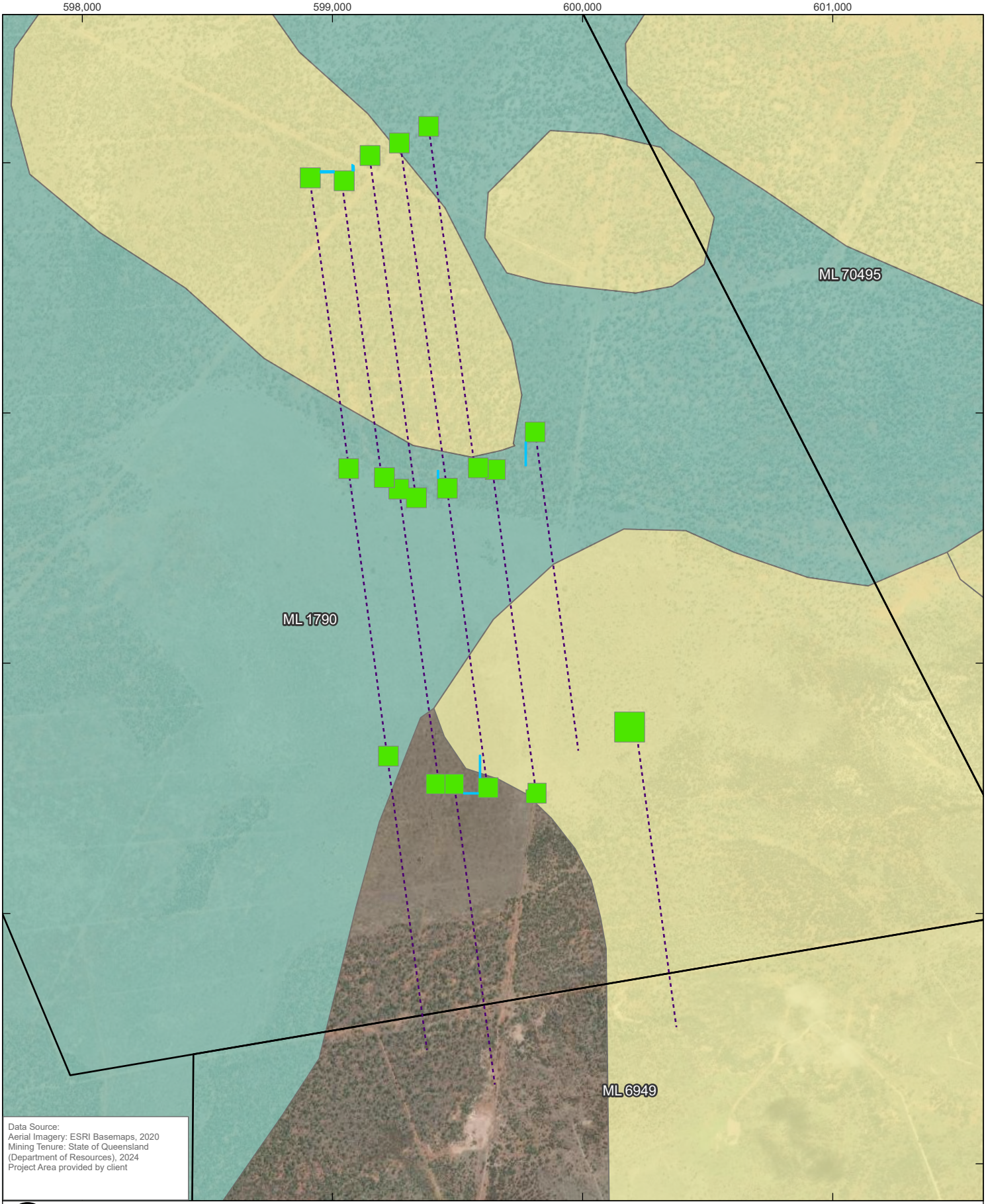
An overall suitability class for each land use is then determined for each mapping unit on a scale of 1 to 5. This is usually determined by the most severe suitability subclass that applies in that particular mapping unit.

Land suitability for the Project Area was classified by (2012) using the Department of Minerals and Energy (1995) *Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland* (1995) and the grazing and cropping guidelines in Shields and Williams (1991) *Land Resource Survey and Evaluation of the Kilcummin Area, Queensland.*

Vertosol and Dermosol were Class 3 for grazing and Class 4 for cropping and Kandosol Class 2 for grazing and Class 3 for cropping (**Figure 6.8** and **Figure 6.9**). The soil survey did not evaluate the full Project Area. The area between the Kandosols and Dermosols in the southern extend of the Project Area was not evaluated. Following a conservative approach, it is assumed that this area is classified as the higher of the two land suitability classes between which it is located.

Table 6.20 Queensland suitability classes

Class	Description
1	Highly productive land requiring only simple management practices to maintain economic production.
2	Land with limitations that either constrain production or require more than the simple management practices of class 1 land to maintain economic production.
3	Land with limitations that either further constrain production or require more than those management practices of class 2 land to maintain economic production.
4	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology.
5	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Land Suitable for Grazing

- 2 - Suitable grazing land with minor limitations (Kandasols)
- 3 - Suitable grazing land with moderate limitations (Dermosols, Sodosols, Vertosols

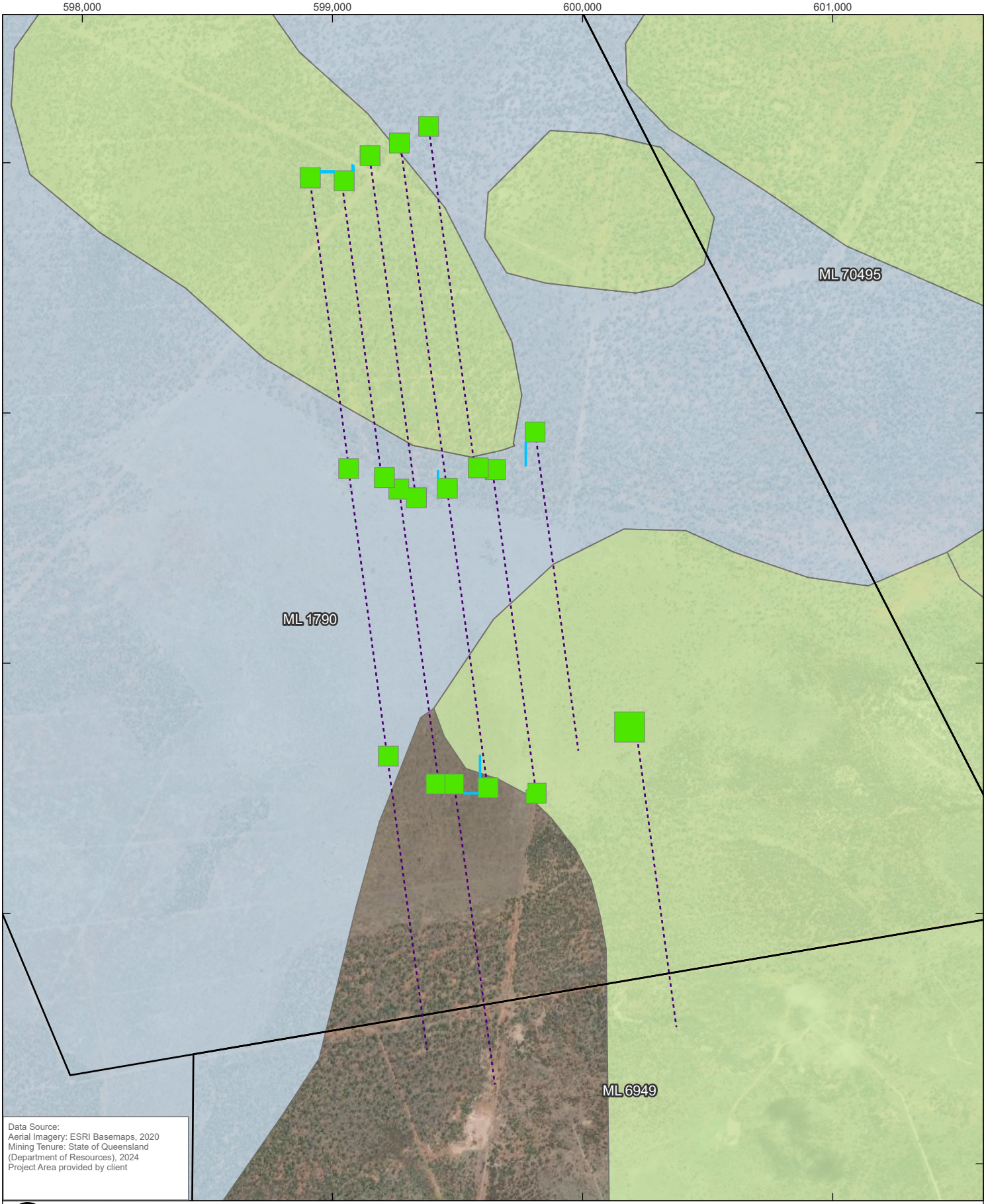
EA AMENDMENT P-EA-100658735

GRAZING LAND CLASS SUITABILITY

SLR

FIGURE 6.8

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-08_Grazing Land Class Suitability



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.3 0.5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Lateral Well Length
- Drill Pad
- Access Track
- Mining Lease

Land Suitable for Cropping

- 3 - Cropping land with moderate limitations (Kandasols)
- 4 - Marginal cropping land (Dermosols, Sodosols, Vertosols

EA AMENDMENT P-EA-100658735

CROPPING LAND CLASS SUITABILITY

SLR

FIGURE 6.9

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_LandResource_F06-09_Cropping Land Class Suitability

6.4.1.6 Regional Interest Areas

This desktop strategic cropping land (SCL) assessment has been prepared generally in accordance with the requirements of the following relevant strategic land use planning documents:

- Regional Planning Interests Act 2014 (Act) (DSDMIP 2014).
- Regional Planning Interests Regulation 2014 (Regulation) (DSDMIP 2014).
- Act Guideline 08/14: How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land (State of Queensland, 2014) (Guideline) (State of Queensland 2014).

The Act commenced in 2014 and replaced the repealed Act. The Act is designed to manage the impact of resource activities and other regulated activities on areas of the State that contribute, or are likely to contribute, to Queensland's economic, social and environmental prosperity. The relevant aspects of the Act, as with regard to this report, are as follows:

- The Act incorporates the current zonal criteria and on-ground guideline for assessing whether a property (or part of a property) is SCL.
- The Act does not allow the mapping of an Area of Regional Interest (ARI) to be challenged by proponents or third parties. However, through the process of a Regional Impact Development Approval (RIDA) application this will in essence determine if land is or not according to the Assessment Criteria contained in the Guideline. These criteria detailed are generally equivalent to those in the repealed Act.

The Project is located within the Western Cropping Zone. Four of the proposed drill pads and wells are located on trigger mapped SCL.

Resource activities that were the subject of a Protection Decision or Compliance Certificate do not need to obtain another approval in relation to for the approved activities.
The Strategic Cropping Land Standard conditions code for resource activities contains the standard conditions that were applied to certain resource activities that were triggered for assessment under the *Strategic Cropping Land Act 2011*. A compliance certificate was issued in November 2013 for ML1790 (Application Reference SCLRD2013/000151).

6.4.2 Potential Impacts

The following subsections detail the potential land and soil impacts as a result of the Project activities described in **Section 3.0**.

A risk-based assessment of these potential impacts are detailed in **Table 6.21** and determined that land resource and soil impacts are low due to the scale and location of the Project activities.

The Project consists of activities relevant to Condition 15 Schedule A, Condition 7 Schedule F, and Condition 22 Schedule F in P-EA-100658735. Key activities which may have an impact on the land resource and soil include:

- New access tracks (5 metres wide) totalling 0.31 km in length will be slashed to allow vehicle access. This will result in approximately 0.20 ha of ground disturbance.
- Construction of 19 drill pads, each 80 x 80 metres in size, will disturb a total of 12.65 ha. This includes 11.8 ha of new disturbance and 0.82 ha of previously approved disturbance.

- Construction of water management features such as holding ponds and bunds on the drill pads.
- The development of 13 vertical wells and 10 lateral wells requires clearing and preparing the drill pad areas.
- Placement of mobile offices, workshops, and other temporary facilities at the drill pad sites will involve localised ground preparation and disturbance.

These areas will involve vegetation removal, topsoil stockpiling and surface preparation for construction and operation activities.

6.4.2.1 Construction

The construction phase involves land disturbance, including site preparation, access track and drill pad clearance and the installation of infrastructure such as vertical and lateral wells. During this phase, soil compaction, erosion and loss of topsoil are primary concerns. Impacts associated with the construction phase include:

- Increased erosion resulting from ground disturbance, vegetation clearance, alteration of natural drainage and flow concentration due to construction activities that disturbs the ground.
- Exposure of sodic and saline subsoils from soil profile inversion during ground disturbance.
- Deposition of eroded material downslope or downstream.
- Soil compaction from spoil placement or access tracks and laydown areas, potentially affecting long term cropping and grazing productivity.

6.4.2.2 Operation

During the operational phase, the risk to land resource and soil includes:

- Soil contamination from chemical spills, leaks from gas wells and improper management of wastewater.
- Increased erosion and deposition of eroded material downslope/downstream resulting from alteration of natural runoff regimes.
- Presence of heavy machinery can also result in soil compaction, reducing soil porosity and water infiltration, which may affect both the soil's biological activity and agricultural potential.

6.4.2.3 Closure and Rehabilitation

The closure and rehabilitation phase are focused on restoring the soil and ecosystem after Project activities cease. During this phase, the main goal is to address any damage caused by de-compacting soils, re-establishing vegetation and ensuring proper drainage systems are in place to prevent erosion. Risks associated with this phase include:

- Increased erosion resulting from ground disturbance and vegetation clearance.
- Soil not meeting requirements for post development land use.
- Insufficient topsoil to reinstate vegetation.

6.4.3 Management Practices

The potential impacts will be managed through current practices. The following general mitigation measures are to be implemented by the Project to minimise the extent and severity of land disturbance and constraints on rehabilitation, thus minimising risks that could result in environmental impacts:

- Clearing will occur within the area approved via the Permit to Disturb process.
- Minimise land disturbance with the smallest practical area of land being disturbed in the shortest practicable time.
- Erosion and sediment control measures will be implemented prior to any clearing activities where required.
- Establish clear delineation of disturbance boundary limits of works prior to commencement of clearing and soil stripping.
- Disturbance to be undertaken in consideration of water flows that could affect land resources during early construction activities.
- Topsoil will be stripped prior to construction and direct re-spread is the preferred method to minimise topsoil handling and reduce damage to soil structure and propagules.
- Strip soil according to designated profile depths, subject to further field investigations during stripping.
- Stripped and salvaged soil will be re-used within a short period of time in areas where rehabilitation immediately follows installation of infrastructure.
- Topsoil that is not directly re-spread will be stockpiled for re-use in rehabilitation.
- Surface of soil stockpiles to be left in as coarsely structured condition as possible to promote infiltration and minimise erosion until vegetation is established or suitable erosion controls have been applied.
- Appropriate surface water management measures will be implemented.
- Monitoring and maintenance of rehabilitation until post-mining land use criteria and relinquishment have been achieved.
- Appropriate storage and management of hydrocarbons and hazardous materials to prevent contamination of land e.g. bunding.

6.4.4 Risk Assessment

The potential land and soil impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6.21.**

The risk of land resource impacts is low. Any realised impacts will be low in comparison to the existing operations undertaken on ML1790.

.

Table 6.21 Land resources risk assessment

Stage	Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Construction	Increased erosion resulting from ground disturbance, vegetation clearance, alteration of natural drainage and flow concentration	Unlikely	Minor	Low	Erosion control measures such as drainage and sediment control will be implemented where required. Minimizing land disturbance and controlling water flow will reduce the risk of erosion.
Construction	Exposure of sodic and saline subsoils from soil profile inversion	Unlikely	Minor	Low	Topsoil stripping and controlled soil stockpiling will reduce the likelihood of exposure to sodic and saline subsoils.
Construction	Deposition of eroded material downslope or downstream	Unlikely	Minor	Low	Erosion control measures will be implemented where required to mitigate the deposition of eroded materials downslope.
Construction	Soil compaction from spoil placement or access tracks and laydown areas, potentially affecting long-term cropping and grazing productivity	Possible	Minor	Low	Limiting vehicle access and using designated tracks will reduce soil compaction. Compacted areas will be rehabilitated post-construction to restore productivity.
Operation	Soil contamination from chemical spills, leaks from gas wells, and improper management of wastewater	Unlikely	Minor	Low	Proper storage, bunding, and management of hydrocarbons and chemicals will minimize the risk of contamination.
Operation	Increased erosion and deposition of eroded material downslope/downstream resulting from alteration of natural runoff regime	Unlikely	Minor	Low	During operations, water from wells will be collected in water tanks located on drill pads to prevent erosion during operations.
Operation	Presence of heavy machinery can result in soil compaction, reducing soil porosity and water infiltration, affecting biological activity and agricultural potential	Possible	Minor	Low	Regular visual monitoring of compacted areas and decompaction during rehabilitation will help mitigate the impacts of machinery.
Closure and Rehabilitation	Increased erosion resulting from ground disturbance and vegetation clearance	Unlikely	Minor	Low	The re-establishment of vegetation and implementation of erosion control measures during closure will reduce erosion risks.

Stage	Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Closure and Rehabilitation	Soil not meeting requirements for post-development land use	Unlikely	Minor	Low	Rehabilitation will focus on restoring soil structure and quality to meet post-development land use requirements.
Closure and Rehabilitation	Insufficient topsoil to reinstate vegetation	Unlikely	Medium	Medium	Topsoil will be carefully stockpiled and re-used in rehabilitation, ensuring adequate supply for vegetation regrowth.

6.5 Terrestrial Ecology

This section presents the assessment of Project related terrestrial ecology impacts to environmental values.

6.5.1 Existing Environmental Values

The following subsections detail the existing EVs within the Project Area (see **Figure 3.2**) based on terrestrial ecological surveys undertaken to date. It also details the MSES impacted by the Project based on these findings.

6.5.1.1 Regional Ecosystems

A total of approximately 7.74 ha of remnant vegetation and 0.23 ha of mature regrowth were ground-truthed within the Project Area. A summary of REs and their associated vegetation condition and area is provided in **Table 6.22** and depicted in **Figure 6.10**.

REs recorded within the Project Area comprised:

- 7.74 ha of remnant vegetation.
- 0.23 ha of mature regrowth vegetation.
- 4.89 ha of non-remnant vegetation comprising non-remnant young woody regrowth vegetation.

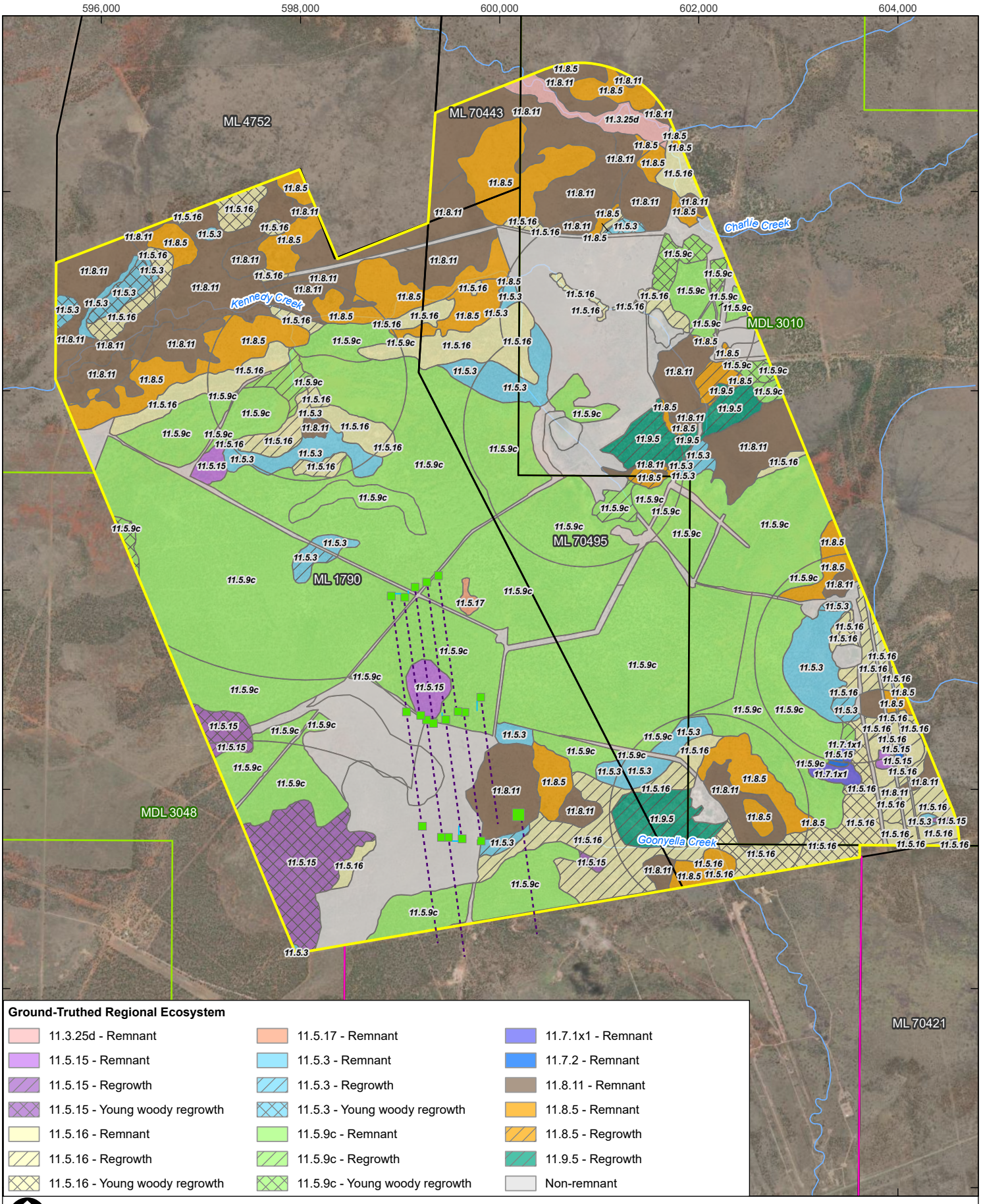
Table 6.22 Ground-truthed REs within the Project Area

RE	RE description	RE type	Biodiversity status	VM Act class	Broad Vegetation Group	Area within Project Area (ha)
11.5.3	*Eucalyptus brownii* woodland on Cainozoic sand plains and/or remnant surfaces	Mature regrowth	No concern at present	Least concern	17a	0.23
11.5.9c	*Eucalyptus crebra +/- Corymbia intermedia +/- E. moluccana +/- C. dallachiana woodland.* Occurs on Cainozoic sandplains formed on plateaus and broad crests of hills and ranges. Soils are generally deep red earths.	Remnant	No concern at present	Least concern	18b	5.75
		Non-remnant: young woody regrowth	NA	NA	NA	4.89
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains and/or remnant surfaces	Remnant	Endangered	Least concern	7a	0.46
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks.	Remnant	Of concern	Of concern	30b	1.53

6.5.1.2 Threatened Ecological Communities

The Project Area intersects with 0.46 ha of the SEVT TEC. This TEC is mapped in association with a patch of remnant RE 11.5.15 which showed characteristic floristic and minimum structure requirements to be considered as the RE (**Figure 6.10**).

The Brigalow TEC and Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin TEC were identified as present within the Study Area, however neither are located within the Project Area.



Ground-Truthed Regional Ecosystem

11.3.25d - Remnant	11.5.17 - Remnant	11.7.1x1 - Remnant
11.5.15 - Remnant	11.5.3 - Remnant	11.7.2 - Remnant
11.5.15 - Regrowth	11.5.3 - Regrowth	11.8.11 - Remnant
11.5.15 - Young woody regrowth	11.5.3 - Young woody regrowth	11.8.5 - Remnant
11.5.16 - Remnant	11.5.9c - Remnant	11.8.5 - Regrowth
11.5.16 - Regrowth	11.5.9c - Regrowth	11.9.5 - Regrowth
11.5.16 - Young woody regrowth	11.5.9c - Young woody regrowth	Non-remnant

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

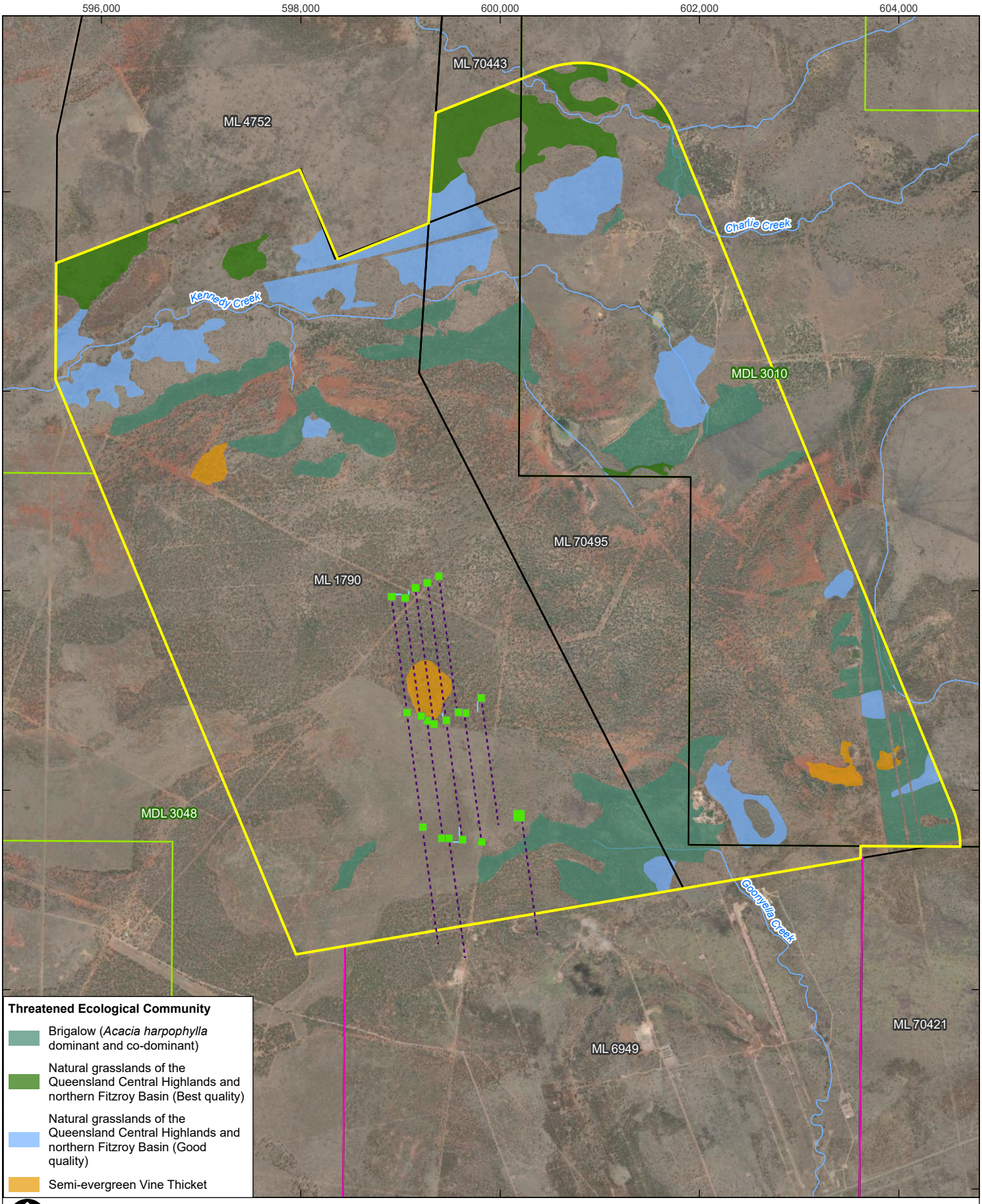
EA AMENDMENT P-EA-100658735

GROUND-TRUTHED REGIONAL ECOSYSTEMS

SLR

FIGURE 6.10

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-10_Ground-Truthed REs



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

EA AMENDMENT P-EA-100658735

THREATENED ECOLOGICAL COMMUNITIES

SLR

FIGURE 6.11

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-11_Threatened Ecological Communities

6.5.1.3 Threatened Flora

The likelihood of occurrence assessment identified two threatened flora species that are known to occur within the Study Area. Given the presence of mapped habitat within the Project Area, these species are also considered known to occur within the Project Area. The species include:

- *Dichanthium queenslandicum* – Endangered under the EPBC Act and *Nature Conservation Act 1992* (NC Act).
- *Digitaria porrecta* – Near Threatened under the NC Act.

Dichanthium Queenslandicum

There are no records for *D. queenslandicum* within the Project Area, however, 1,800 tussocks of this species were identified within the northern part of the Study Area in association with areas of remnant bluegrass grasslands and open woodlands on basalt plains with low weed abundance.

Preferred habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas of remnant bluegrass grasslands and open woodlands on basalt plains with low weed abundance (RE 11.8.11 and 11.8.5) where records of *D. queenslandicum* were present within the Study Area.

The Project Area intercepts with 1.53 ha of preferred habitat for the species in RE 11.8.11 as shown in **Figure 6.12**.

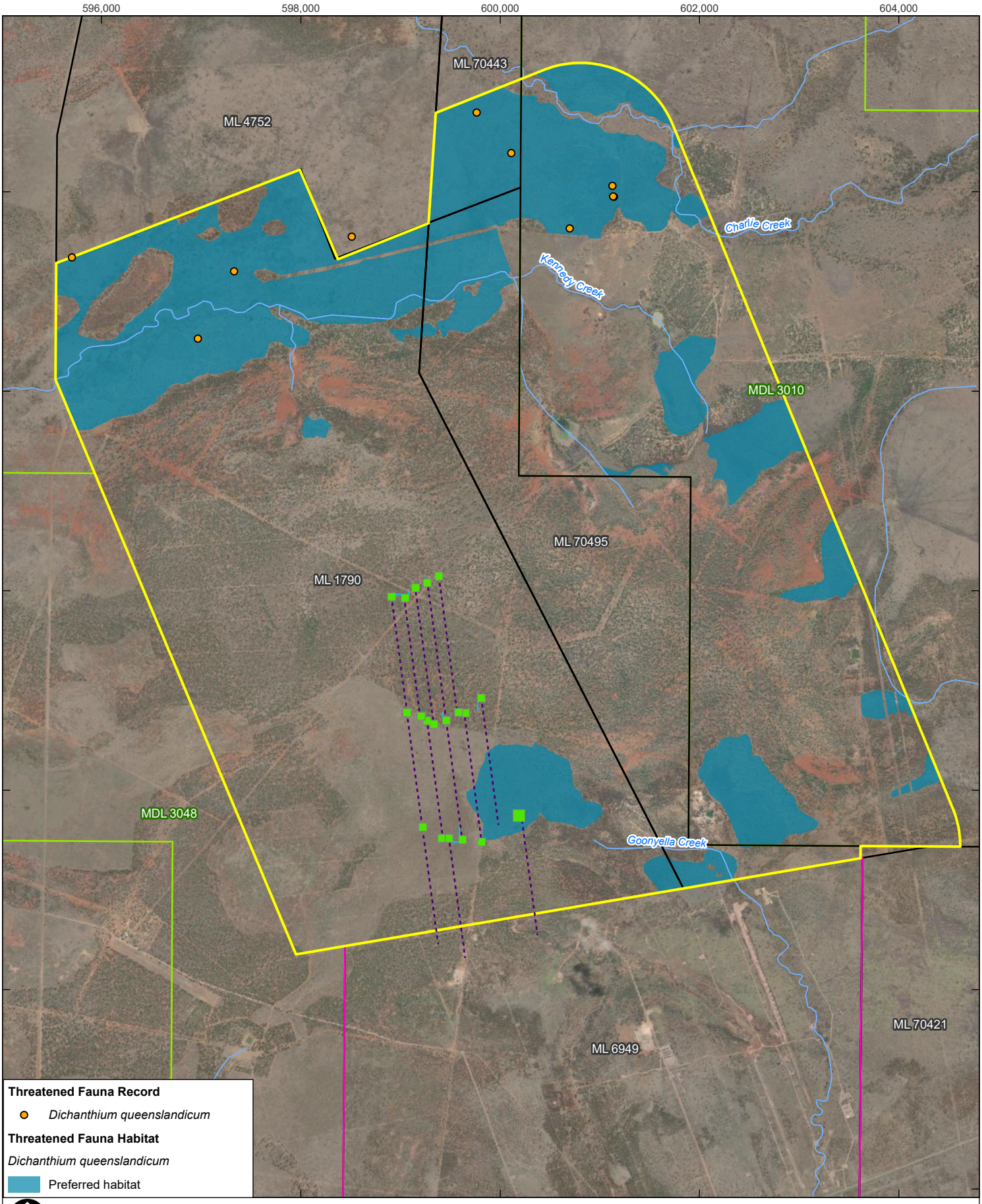
Digitaria Porrecta

There are no records for *D. porrecta* within the Project Area, however, 71 tussocks were identified within the northern and central eastern part of the Study Area in associations with areas of remnant bluegrass grasslands and open woodlands on basalt plains with low weed abundance.

Preferred habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas of remnant bluegrass grasslands and open woodlands on basalt plains with low weed abundance (RE 11.8.11 and 11.8.5) where records of *D. porrecta* were present within the Study Area.

The Project Area intercepts with 1.53 ha of preferred habitat for the species in RE 11.8.11 as shown in **Figure 6.13.**



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

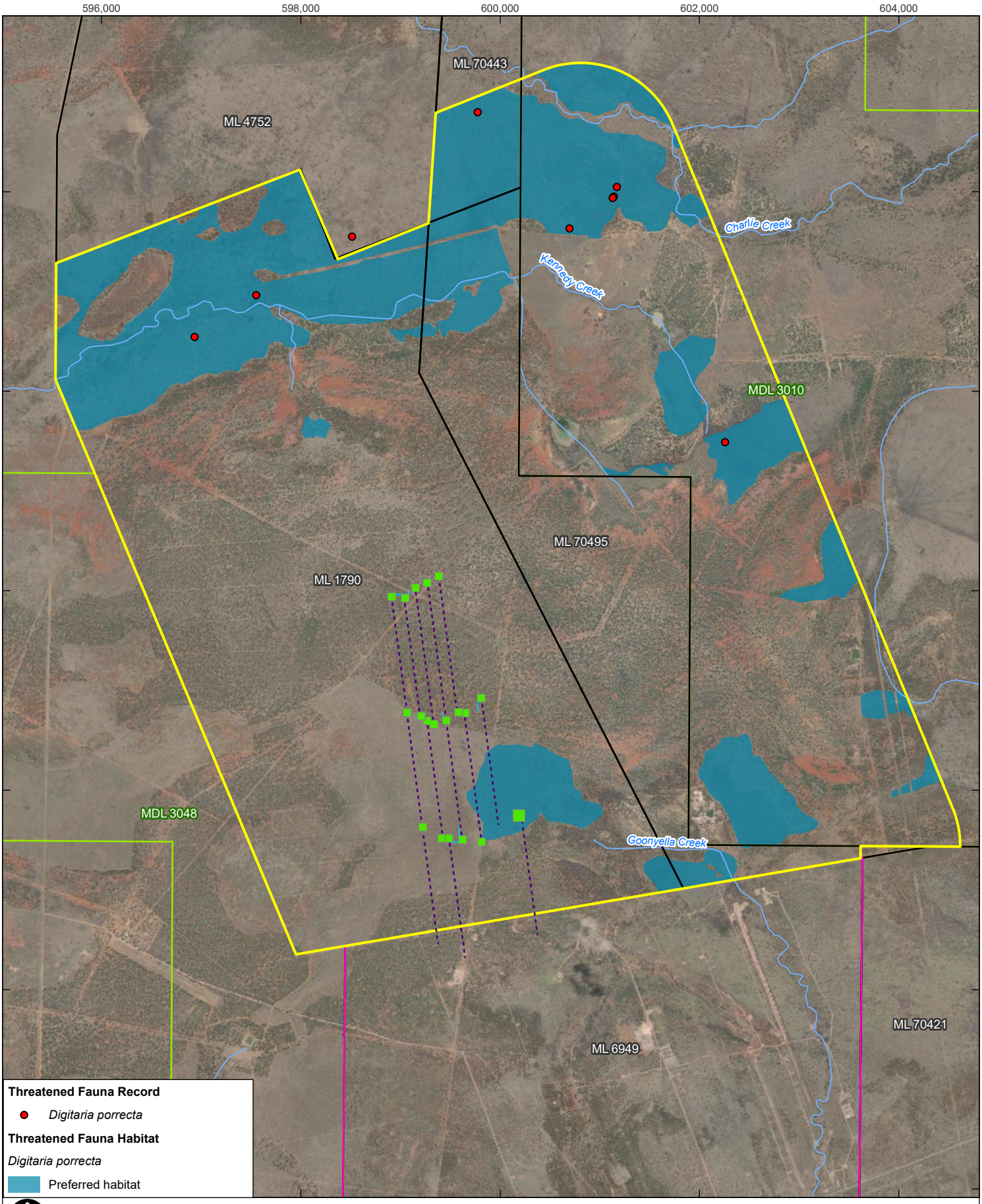
EA AMENDMENT P-EA-100658735

***DICHANTHIUM QUEENSLANDICUM* RECORDS AND HABITAT**

SLR

FIGURE 6.12

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-12_Dichanthium Queenslandicum



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

EA AMENDMENT P-EA-100658735

***DIGITARIA PORRECTA* RECORDS AND HABITAT**

SLR

FIGURE 6.13

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-13_Digitaria Porrecta

6.5.1.4 Pest Flora

Three weed species listed as Weeds of National Environmental Significance (WoNS) or restricted matters under the Queensland *Biosecurity Act 2014* (Biosecurity Act) were recorded within the Study Area and are therefore considered likely to also be present within the Project Area. These weed species include:

- *Harrisia martinii* (harrisia cactus) – Category 3 under the Biosecurity Act and WoNS.
- *Opuntia tomentosa* (velvet tree pear) – Category 3 under the Biosecurity Act and WoNS.
- *Parthenium hysterophorus* (parthenium) – Category 3 under the Biosecurity Act and WoNS.

The cactus-like species (*Harrisia martinii* and *Opuntia tomentosa*) were scattered across remnant and regrowth woodland vegetation types. Parthenium was in high abundance in wet areas.

6.5.1.5 Threatened Fauna

The likelihood of occurrence assessment identified two threatened fauna species and one conservation significant species that are known to occur within the Study Area. Given the presence of mapped habitat within the Project Area, these species are also considered known to occur within the Project Area. The species include:

- Koala (*Phascolarctos cinereus*) – Endangered under the EPBC Act and NC Act.
- Short-beaked echidna (*Tachyglossus aculeatus*) – Special least concern under the NC Act.
- Squatter pigeon (southern) (*Geophaps scripta scripta*) – Vulnerable under the EPBC Act and the NC Act.

An additional threatened fauna species was assessed as likely to occur within the Study Area and Project Area, including:

- White-throated needletail (*Hirundapus caudacutus*) – Vulnerable under the EPBC Act and the NC Act.

The Australian painted snipe (*Rostratula australis*) (Endangered under the EPBC Act and NC Act) was assessed as likely to occur within the Study Area, however, given that the Project Area does not contain mapped habitat for the species it is considered unlikely to occur within the Project Area and is not detailed further here.

Koala

There are no records for koala within the Project Area, however, individuals were identified from two BAR locations within the central western and central parts of the Study Area. The closest of these records is within 330 m of the Project Area. All records were in areas of *Eucalyptus crebra* woodland and *Eucalyptus brownii* woodland (RE 11.5.9c).

Koala habitat within the Study Area has been mapped as either preferred, suitable or marginal habitat, with guidance from *A review of koala habitat assessment criteria and methods* (Youngentob et al., 2021).

- Preferred habitat mapped for the species within the Study Area includes:

- Areas of remnant riparian eucalypt woodland RE 11.3.25d with locally important koala trees (LIKTs) present with high moisture content (*E. tereticornis* and *E. camaldulensis*) and connectivity to other areas of preferred habitat.

Suitable habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas of remnant and mature regrowth eucalypt woodland REs 11.5.3, 11.5.9c, 11.8.5 and 11.5.17 providing abundant LIKTs (*E. brownii, E. crebra* and *E. tereticornis*) where koalas were recorded within the Study Area.
- Marginal habitat mapped for the species within the Study Area includes:
- Areas of remnant and regrowth brigalow dominated communities RE 11.5.16 and 11.9.5 providing few LIKTs (*E. cambageana*) and ancillary habitat trees (*A. harpophylla*) that provide limited feeding resources but may facilitate dispersal to other areas of suitable and preferred habitat.

The Project Area intercepts with 5.98 ha of suitable habitat for the species in remnant RE 11.5.9c and mature regrowth RE 11.5.3 as shown in **Figure 6.10**.

Short-beaked Echidna

There are no records for short-beaked echidna within the Project Area, however, one individual was identified with the central part of the Study Area. This record is within 490 m of the Project Area. This record was recorded in remnant *Eucalyptus crebra* woodland (RE 11.5.9c). Scats attributable to the species were also recorded in multiple locations in remnant vegetation within the Study Area.

Short-beaked echidna habitat within the Study Area has been mapped as either suitable or marginal habitat.

Suitable habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas of remnant and mature regrowth woodland REs providing habitat features such as large woody debris, shrubby areas and logs suitable for short-beaked echidna.

Marginal habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas of grasslands and young woody regrowth vegetation providing limited habitat features such as large woody debris, shrubby areas and logs suitable for short-beaked echidna and provides dispersal habitat between areas of preferred habitat.

The Project Area intercepts with:

- 6.45 ha of suitable habitat for the species in remnant REs 11.5.9c and 11.5.15 and mature regrowth RE 11.5.3.
- 1.53 ha of marginal habitat for the species in remnant RE 11.8.11 as shown in **Figure 6.15.**

There are no records of the squatter pigeon (southern) within the Project Area, however, a total of 65 squatter pigeon (southern) individuals were recorded across the Study Area. The closest of these records (comprising 2 individuals) is within 170 m of the Project Area. Records were in proximity to dams where there were trees nearby to disperse into when startled. Wooded areas with tree cover had lower levels of grass productivity with mid-dense

to sparse ground cover. These areas are likely to be more suitable for squatter pigeon (southern) foraging habitat.

Squatter pigeon (southern) habitat within the Study Area has been mapped as either preferred, suitable or marginal habitat with guidance from the DCCEEW species profile (DotE, 2022).

Preferred habitat mapped for the species within the Study Area includes:

- Areas within 1 km of permanent water source suitable for breeding, that are areas of remnant and mature regrowth eucalypt woodland REs suitable for foraging.

Suitable habitat mapped for the species within the Project Area and greater Study Area includes:

- Areas within 3 km of permanent water source that are areas of remnant and mature regrowth eucalypt woodland REs suitable for foraging.

Marginal habitat mapped for the species within the Study Area includes:

- Dispersal habitat which includes non-remnant areas within 3km of a permanent water source.
- The Project Area intercepts with 5.98 ha of suitable habitat for the species in remnant RE 11.5.9c and mature regrowth RE 11.5.3 as shown in **Figure 6.16**.

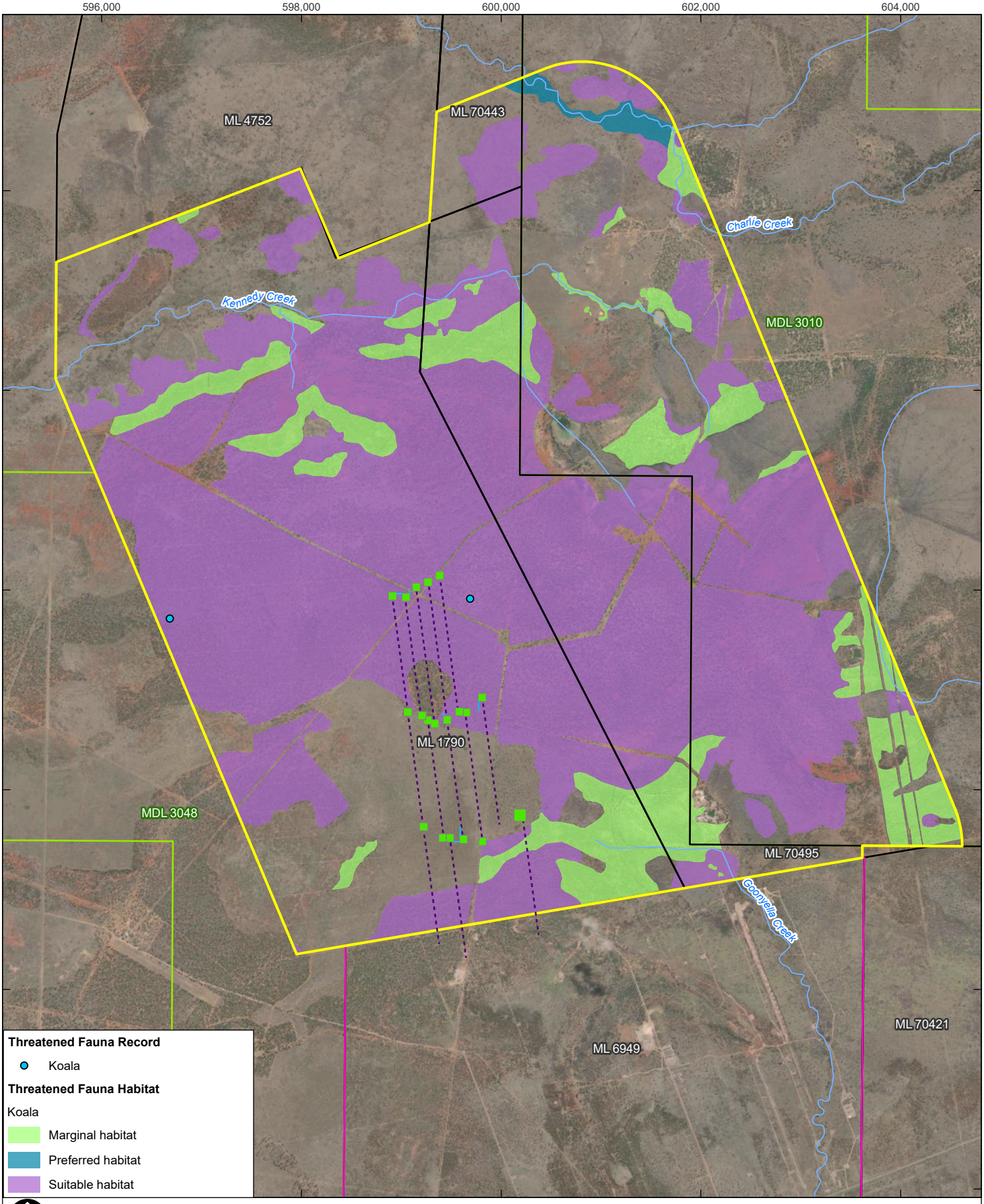
White-throated Needletail

White-throated needletail was not detected during the field surveys, however, has been previously recorded nearby (approximately 20 km) the Study Area (ALA, 2024) and is considered likely to occur. Suitable habitat for the species includes a broad range of vegetation communities that support feeding resources in which they fly in the airspace above. No areas of emergent trees with hollows in woodlands or tall trees at the edges of clearing were observed within the Study Area.

Marginal habitat mapped for the species within the Project Area and greater Study Area includes:

- All areas that provide aerial space above suitable for foraging.

The Project Area intercepts with 12.86 ha of marginal habitat for the species comprising all aerial space above the Project Area as shown in **Figure 6.17**.



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

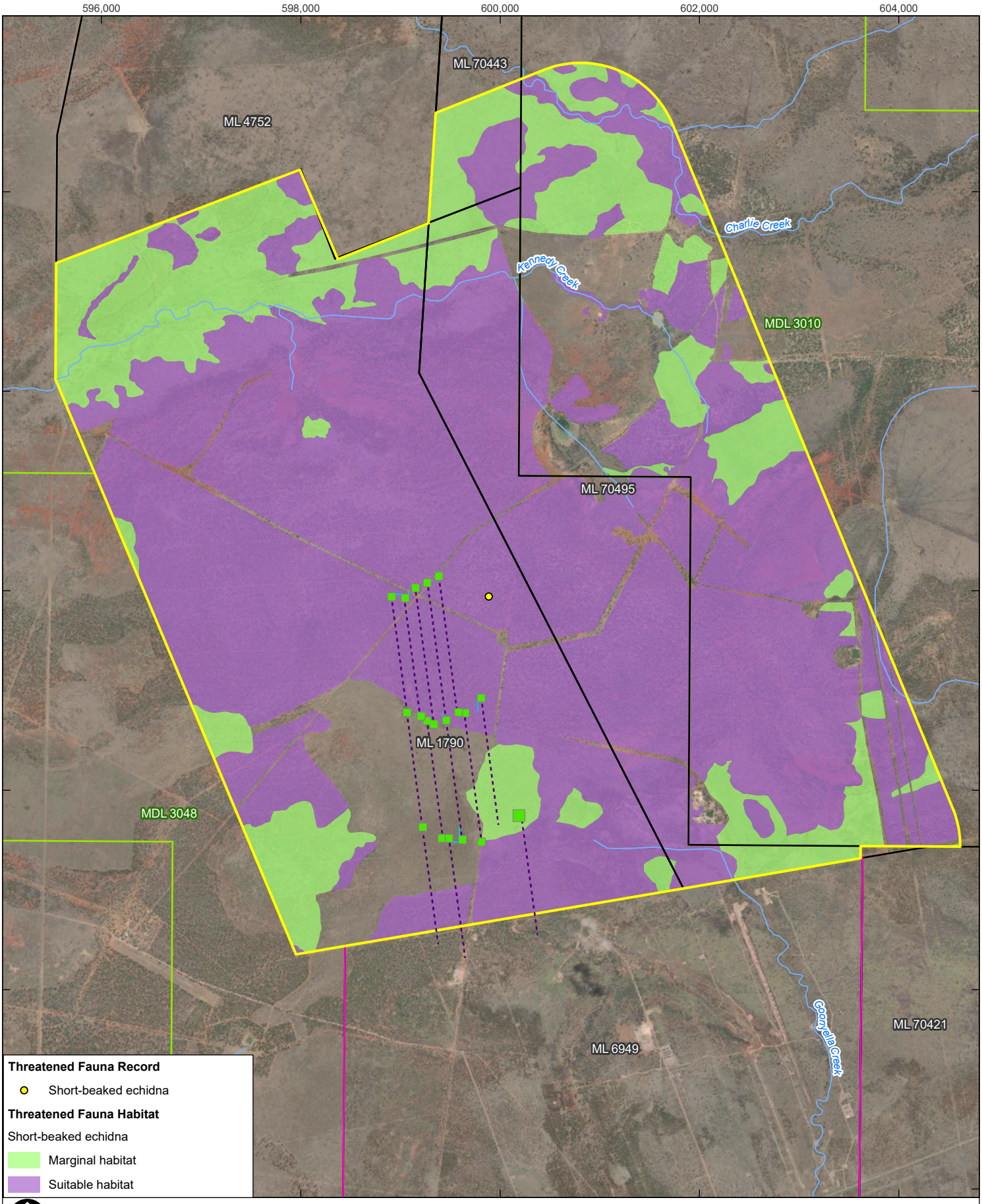
EA AMENDMENT P-EA-100658735

KOALA RECORDS AND HABITAT

SLR

FIGURE 6.14

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-14_Koala



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

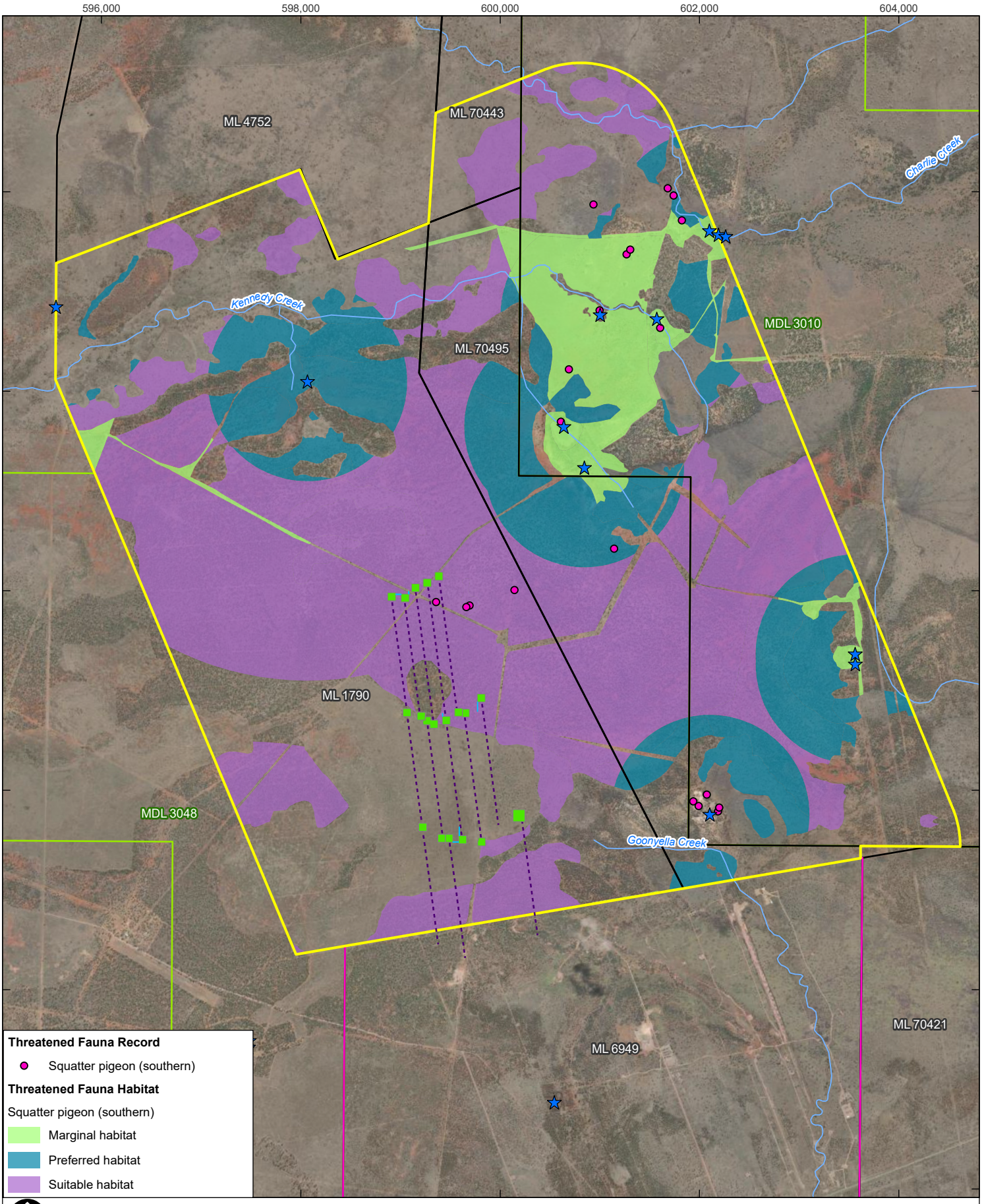
EA AMENDMENT P-EA-100658735

SHORT-BEAKED ECHIDNA RECORDS AND HABITAT

SLR

FIGURE 6.15

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-15_Short-beaked Echidna



Threatened Fauna Record

- Squatter pigeon (southern)

Threatened Fauna Habitat

Squatter pigeon (southern)

- Marginal habitat
- Preferred habitat
- Suitable habitat

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

- Permanent Watersource
- Watercourse
- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

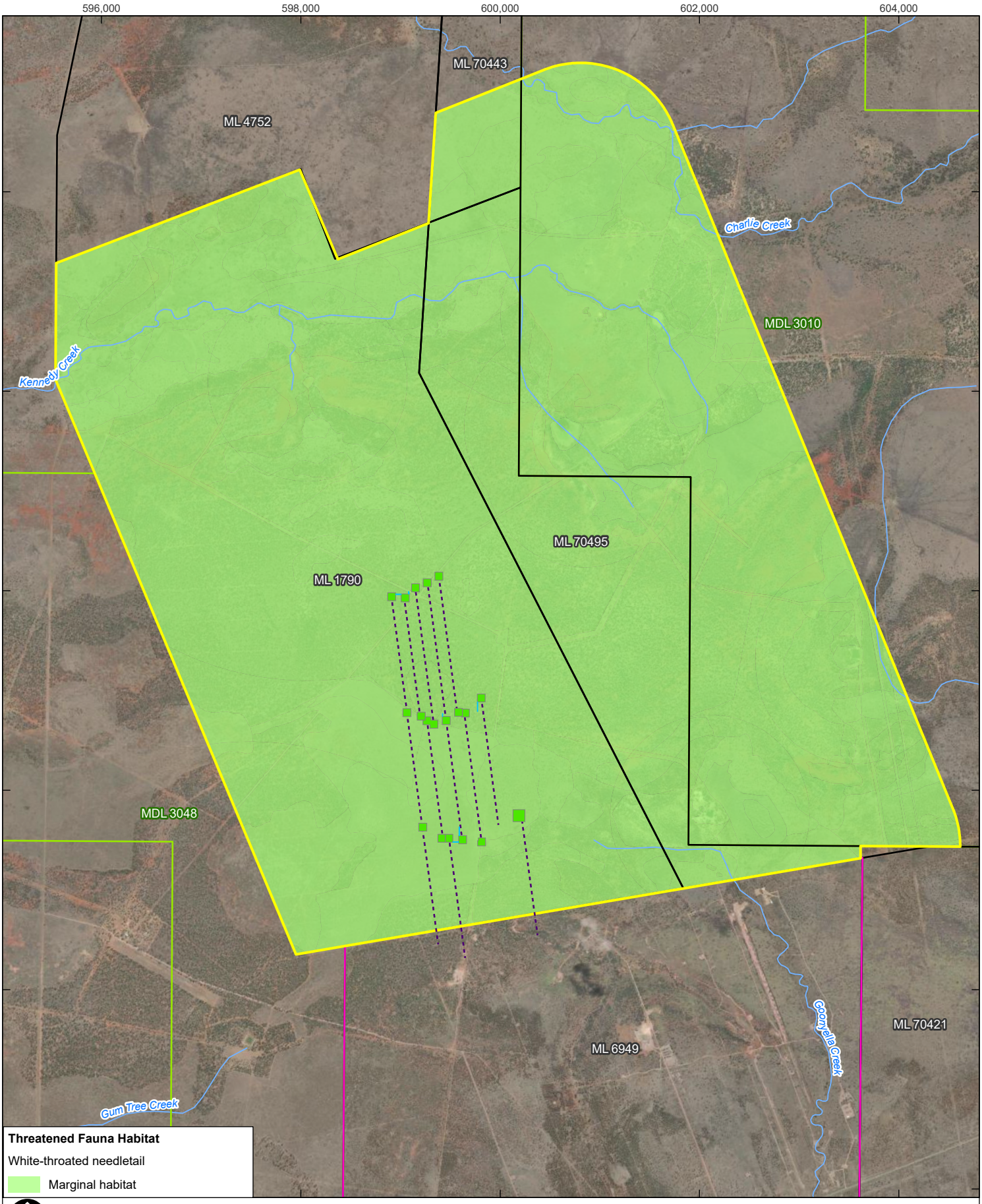
EA AMENDMENT P-EA-100658735

SQUATTER PIGEON (SOUTHERN) RECORDS AND HABITAT

SLR

FIGURE 6.16

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-16_Squatter Pigeon (Southern)



Threatened Fauna Habitat

White-throated needletail

Marginal habitat

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

EA AMENDMENT P-EA-100658735

WHITE-THROATED NEEDLETAIL HABITAT

SLR

FIGURE 6.17

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-17_White-throated Needletail

6.5.1.6 Migratory Fauna

The likelihood of occurrence assessment identified two migratory fauna species that are likely to occur within the Study Area and Project Area, including:

- Fork-tailed swift (*Apus pacificus*) – Migratory under the EPBC Act and Special least concern under the NC Act.
- Oriental cuckoo (*Cuculus optatus*) - Migratory under the EPBC Act and Special least concern under the NC Act.

An additional two migratory fauna species were assessed as likely to occur within the Study Area, however, given that the Project Area does not contain mapped habitat for these species they are considered unlikely to occur within the Project Area and are not detailed further here. These species include glossy ibis (*Plegadis falcinellus*) and Latham's snipe (*Gallinago hardwickii*) (Migratory under the EPBC Act and Special least concern under the NC Act).

Fork-tailed Swift

Fork-tailed swift was not detected during the field surveys, however, has been previously recorded nearby (approximately 20 km) the Study Area (ALA, 2024) and is considered likely to occur. Suitable habitat for the species include a broad range of vegetation communities that support feeding resources in which they fly in the airspace above.

Marginal habitat mapped for the species within the Project Area and greater Study Area includes:

- All areas that provide aerial space above suitable for foraging.

The Project Area intercepts with 12.86 ha of marginal habitat for the species comprising all aerial space above the Project Area as shown in **Figure 6.18**.

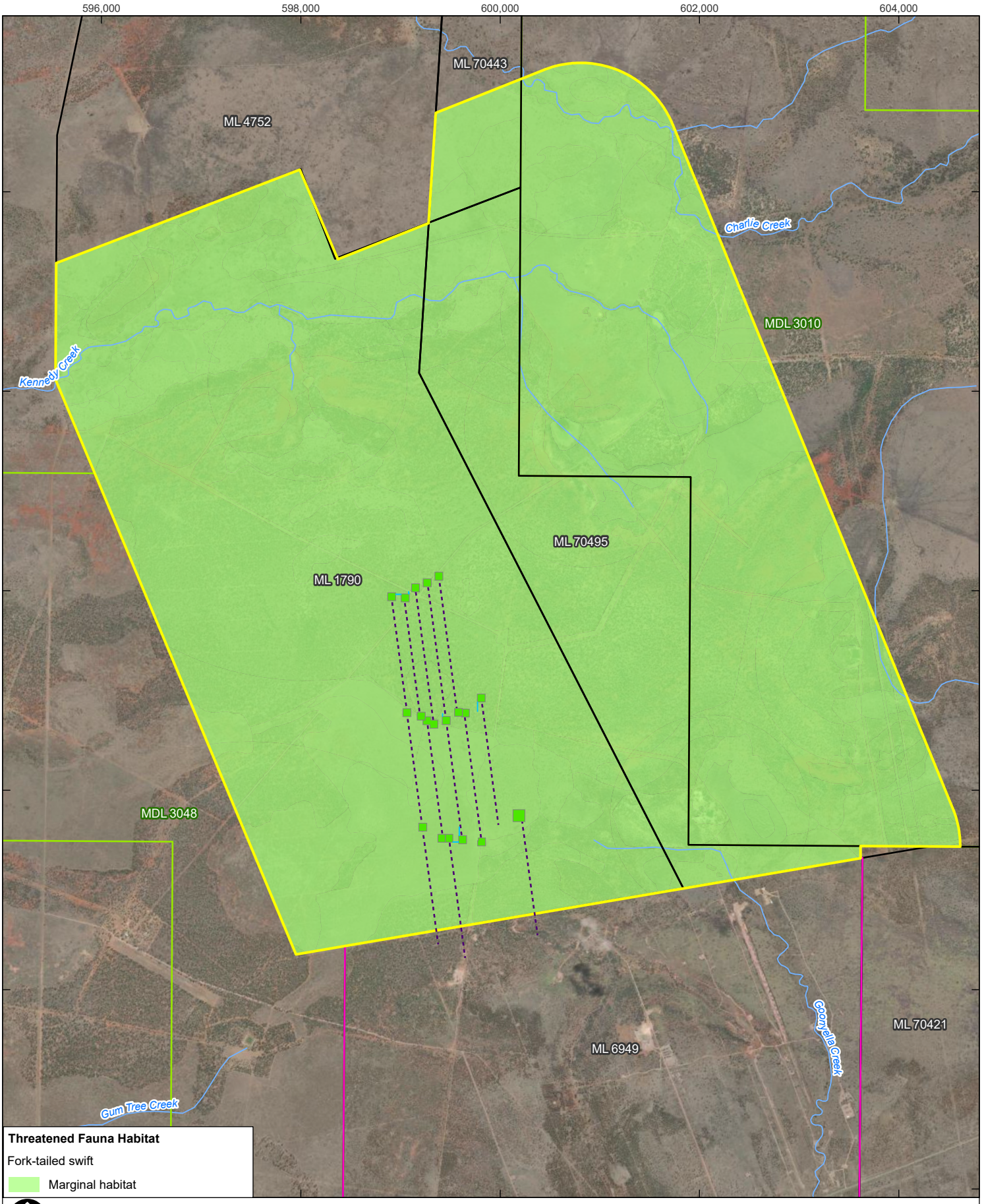
Oriental Cuckoo

Oriental cuckoo was not detected during the field surveys, however, has been previously recorded approximately 17 to 25 km from the Study Area (BMA, 2014; ALA, 2024) and is considered likely to occur. The species does not breed in Australia. Suitable habitat for the species' only includes intermittent roosting and foraging habitat (DotE, 2015). Suitable habitat for the species includes a broad range of vegetation communities that support feeding and dispersal of the species. Therefore, oriental cuckoo habitat within the Study Area has been mapped as marginal habitat with guidance from the *Referral guideline for 14 birds listed as migratory species under the EPBC Act* (DotE, 2015).

Marginal habitat mapped for the species within the Project Area and greater Study Area includes:

- All areas of remnant and regrowth woodland communities that intermittently provide roosting, feeding and dispersal opportunities.

The Project Area intercepts with 6.45 ha of marginal habitat for the species in remnant RE 11.5.9c and 11.5.15 and mature regrowth RE 11.5.3 as shown in **Figure 6.18**.



Threatened Fauna Habitat

Fork-tailed swift

Marginal habitat

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

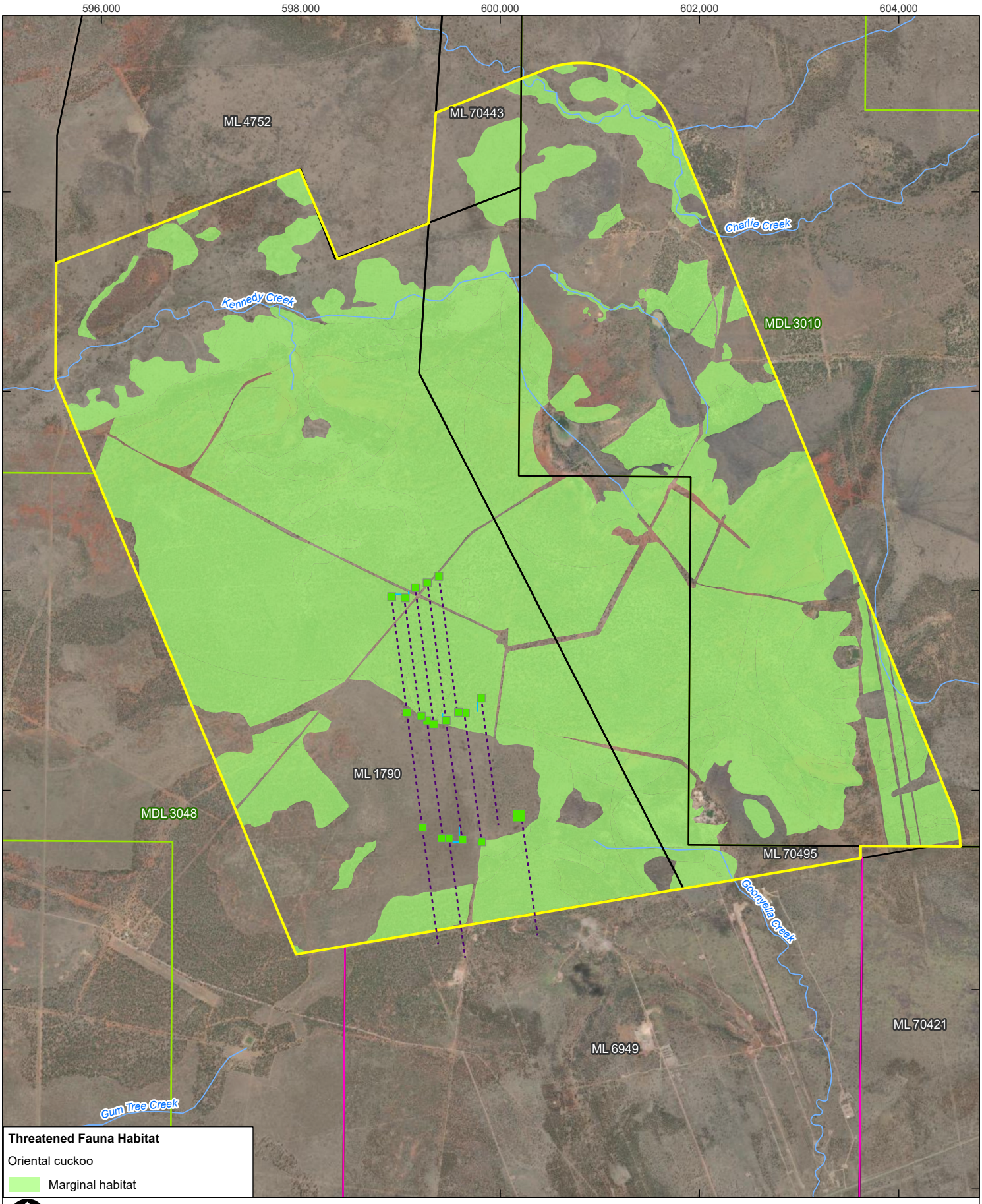
EA AMENDMENT P-EA-100658735

FORK-TAILED SWIFT HABITAT

SLR

FIGURE 6.18

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-18_Fork-tailed Swift



Threatened Fauna Habitat

Oriental cuckoo

Marginal habitat

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

Watercourse
Study Area
Mining Lease
Centurion Coal Mine
Mineral Development Licence
Lateral Well Length
Drill Pad
Access Track

EA AMENDMENT P-EA-100658735

ORIENTAL CUCKOO HABITAT

SLR

FIGURE 6.19

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_F06-19_Oriental Cuckoo

6.5.1.7 Pest Fauna

Five pest fauna species were recorded within the Study Area. Four of these species were listed as restricted matters under the Biosecurity Act, including:

- Cane toad (Rhinella marina).
- Cat (*Felis catus*) – Category 3, 4 and 6 restricted matter.
- Wild dogs (*Canis lupus*) – Category 3, 4 and 6 restricted matter.
- European rabbit (*Oryctolagus cuniculus*) – Category 3, 4, 5, and 6 restricted matter.
- Feral pig (*Sus scrofa*) – Category 3, 4, and 6 restricted matter.

Pest fauna species have varying adverse impacts on the environment. Pigs are known to contribute to habitat degradation by damaging the banks of wetlands, creek lines and gilgai, uprooting vegetation, causing soil erosion, spreading weeds and browsing/grazing native flora. Evidence of habitat degradation caused by pig rooting was observed within the Study Area including damage around gilgai as well as within SEVT vegetation.

Carnivorous pest fauna such as feral cats and dingos and opportunistic carnivores such as feral pigs, are known to directly predate native fauna. In addition, cane toads outcompete native amphibians and are toxic to animals such as ornamental snake that predate upon them.

6.5.1.8 Ecological Function

Watercourses and Wetlands

The Project Area does not intercept with any watercourses or wetland values.

Corridors and Connectivity

The Project Area does not intercept with any mapped terrestrial corridors.

Groundwater Dependent Ecosystems

The Project Area does not intercept with any ground-truthed potential terrestrial GDEs (refined during field surveys from BoM supplied mapping).

Environmentally Sensitive Areas

The Project Area does not intercept with any Category A or Category B ESAs as described in the Queensland *Environmental Protection Regulation 2019*.

Note: This was assessed utilising an RE amendment that has been submitted and approved by the Queensland Herbarium (MAR 3577) to refine vegetation mapping within the Study Area.

6.5.2 Summary of MSES

Three MSES as defined in the *Queensland Environmental Offset Regulation 2014* (EO Regulation) were identified within the Project Area, including:

- Regulated vegetation.
- Protected wildlife habitat.
- Connectivity areas.

No protected areas or legally secured offset areas are located within the Project Area.

6.5.2.1 Regulated Vegetation

MSES regulated vegetation includes *prescribed regional ecosystems* (remnant), as defined under the EO Regulation. In accordance with the EO Regulation, a prescribed regional ecosystem does not include:

- Regional Ecosystem comprising vegetation defined under Section 8 of the VM Act (i.e. grass or non-woody herbage, a grassland RE with a grassland structure, a mangrove).
- Regrowth or non-remnant vegetation.

MSES regulated vegetation includes prescribed REs that:

- Are 'endangered' (VM Act class) Res.
- Are 'of concern' (VM Act class) Res.
- Intersect with an area shown as a wetland on the vegetation management wetlands map (Wetland REs).
- Are an area of essential habitat on the essential habitat map for an animal that is critically endangered wildlife, endangered wildlife or vulnerable wildlife or a plant that is critically endangered wildlife, endangered wildlife or vulnerable wildlife.
- For a prescribed activity mentioned in Schedule 1, Item 7(e), if the ecosystem is an area of essential habitat on the essential habitat map for an animal that is near threatened wildlife or a plant that is near threatened wildlife.
- The extent the ecosystem is located within a defined distance from the defining banks of a relevant watercourse or relevant drainage feature. In accordance with the Queensland Environmental Offset Policy (DES, 2021b), distances from the defining bank of the watercourse stream order (SO) (non-coastal Bioregion) comprised:
  - 25 m for SO 1 and 2,
  - 50 m for SO 3 and 4, and
  - 100 m for SO 5 or greater.

Within the Project Area, MSES regulated vegetation was assessed utilising data from an RE amendment that has been submitted and approved by the Queensland Herbarium (MAR 3577) to refine vegetation mapping within the Study Area. A summary of MSES regulated vegetation within the Project Area is provided in **Table 6.23**.

REs located within the defined distance from the defining banks of a Vegetation Management watercourse were mapped by buffering all DoR mapped VM Act watercourses and drainage features (DoR, 2024) by a 2 m buffer to estimate the defining banks of the watercourse. The banks were then buffered by the defined distance[4] and any E2M ground-truthed remnant REs within these defined distances were included as MSES regulated vegetation. The Project Area does not intercept regulated vegetation within the defined distance of a VM Act watercourse.

The Project Area does intercept regulated vegetation comprising 'endangered' or 'of concern' REs. Specifically, 1.53 ha of remnant Of concern RE 11.8.11, which has a structure category / structure code of woody grassland / tussock grassland respectively (**Table 6.23**).

[4] *defined distance*, for a RE, means a distance identified in the *Queensland Environmental Offsets Policy* as the relevant distance from the defining banks of a relevant watercourse or relevant drainage feature.

In accordance with the *Queensland Environmental Offsets Policy: Significant Residual Impact Guideline* (DEHP 2014) (SRI Guideline), essential habitat included in **Table 6.23** will be assessed as part of MSES protected wildlife habitat.

Table 6.23 MSES regulated vegetation within the Project Area

MSES	Area within Project Area (ha)
Category B regulated vegetation comprising Endangered or Of Concern REs	
RE 11.8.11 (Of Concern)	1.53
Essential habitat	
Ornamental snake (*Denisonia maculata*)	6.45

6.5.2.2 Protected Wildlife Habitat

Protected wildlife habitat is defined in the EO Regulation as:

- A high-risk area on the flora survey trigger map that contains plants that are Critically endangered wildlife, Endangered wildlife or Vulnerable wildlife.
- An area that contains plants that are Critically endangered wildlife, Endangered wildlife or Vulnerable wildlife.
- A mapped koala habitat area.
- Habitat for an animal that is Critically endangered wildlife, Endangered wildlife or Vulnerable wildlife or a Special least concern animal (non-migratory).

The SRI Guideline defines habitat as '*the area occupied, or periodically or occasionally occupied, by any species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their life cycles'*.

The MSES protected wildlife habitat summarised in **Table 6.24** comprises those species that were identified as known or likely to occur within the Project Area. In addition, essential habitat for ornamental snake has been mapped as present by the DoR (see **Section 6.5.2.1** and **Table 6.23**) and will therefore be assessed further even though it was identified as unlikely to occur based on ecological field surveys. The following three threatened species identified as known and likely to occur within the Project Area are not considered as MSES protected wildlife habitat, for the following reasons:

- *Digitaria porrecta* – habitat mapped within the Project Area (see **Section 6.5.1.3**) but the species is listed as Near threatened under the NC Act.
- Fork-tailed swift (*Apus pacificus*) – habitat mapped within the Project Area (see **Section 6.5.1.6**) but the species is listed as Special least concern under the NC Act due to migratory status.
- Oriental cuckoo (*Cuculus optatus*) – habitat mapped within the Project Area (see **Section 6.5.1.6)** but the species is listed as Special least concern under the NC Act due to migratory status.

Table 6.24 MSES protected wildlife habitat within the Project Area

Species	NC Act status	Area within Project Area (ha)
Dichanthium queenslandicum	Endangered	1.53
Koala	Endangered	5.98
Short-beaked echidna	Special least concern (non-migratory)	6.45*
Squatter pigeon (southern)	Vulnerable	5.98
White-throated needletail	Vulnerable	12.86

* Dispersal habitat mapped as marginal habitat has been removed from this table due to this habitat type not being regarded as offsetable.

6.5.2.3 Connectivity Areas

Connectivity areas are defined under the EO Regulation as prescribed REs that contain remnant vegetation and an area of land that is required for ecosystem functioning. *Prescribed regional ecosystems* (remnant) as defined under the EO Regulation does not include:

- RE comprising vegetation defined under Section 8 of the VM Act (i.e. grass or non-woody herbage, a grassland RE with a grassland structure, a mangrove), or
- Regrowth or non-remnant vegetation.

MSES connectivity areas was assessed utilising an RE amendment that has been submitted and approved by the Queensland Herbarium (MAR 3577) to refine vegetation mapping within the Study Area. Within the Project Area, all ground-truthed remnant vegetation containing a prescribed RE is considered to comprise connectivity values. The Project Area contains approximately 6.51 ha of connectivity areas.

6.5.3 Potential Impacts

The following subsections detail the potential terrestrial ecology impacts as a result of the activities described in **Section 3.0**. Where multiple activities contribute to a potential impact, all relevant activities have been listed in the subsection heading.

6.5.3.1 Access Tracks and Coal Seam Gas Exploration

Native Vegetation Clearing

The Project activities will result in native vegetation clearing of approximately 12.00 ha comprising non-remnant, remnant and mature regrowth vegetation. **Table 6.25** details the remnant and mature regrowth vegetation that will be cleared and shows that this is a small portion of what will be retained in surrounding areas within the Study Area. In addition, the majority of this vegetation is listed as Least concern under the VM Act with only one small area (1.53 ha) listed as Of concern. The Project Area intersects with 0.46 ha of the SEVT TEC with other areas of TEC avoided where feasible and possible.

Table 6.25 Direct impacts to remnant and mature regrowth REs within the Project Area

RE	VM Act class	Area within Study Area (ha)	Area within Project Area (ha)	Percentage impacted (%)
Remnant				
11.5.9c	Least concern	2,119.64	5.75	0.27
11.5.15	Least concern	32.02	0.46	1.44
11.8.11	Of concern	741.57	1.53	0.21
Mature regrowth				
11.5.3	Least concern	29.64	0.23	0.78

Fauna and Flora Habitat Removal

The Project activities will also result in loss of habitat for MSES threatened flora and fauna species. The extent of habitat removal is detailed in **Table 6.26**. As shown, this is a small portion of what will be retained in surrounding areas within the Study Area.

Table 6.26 Direct impacts to threatened flora and fauna habitat within the Project Area

Species	NC Act status	Area within Study Area (ha)	Area within Project Area (ha)	Percentage impacted (%)
Dichanthium queenslandicum	Endangered	1,163.36	1.53	0.13
Koala	Endangered	2,831.40*	5.98	0.21
Short-beaked echidna	Special least concern (non-migratory)	3,398.89*	6.45*	0.19
Squatter pigeon (southern)	Vulnerable	2,759.26*	5.98	0.22
White-throated needletail	Vulnerable	5,191.48	12.00	0.25

* Dispersal habitat mapped as marginal habitat has been removed from this table due to this habitat type not being regarded as offsetable.

Habitat Degradation and Edge Effects

Project activities and native vegetation clearing have the potential to result in indirect degradation of adjacent (edge effects) and downstream habitats. Edge effects occur where vegetation communities are subject to distinct ecotones, as may occur due to vegetation clearing, resulting in changes in vegetation/habitat composition, and quality (Laurance & Yensen, 1991). Indirect influences associated with edge effects can include exposure to weeds, noise, light, dust, reduced foraging resources and species assemblages (Laurance & Yensen, 1991). Prolonged exposure to edge effects can degrade or reduce the quality of habitat.

While the Project activities are likely to result in edge effects to some degree, it is unlikely to contribute significantly at a landscape scale given the surrounding land use of the area being largely fragmented with agricultural and mining activities.

Fauna Injury and/or Mortality

Project activities, during construction and operation, have the potential to lead to fauna injury or mortality. Vehicles and machinery can cause injury or mortality to fauna if individuals are struck. Similarly, fauna that are unable to disperse away from areas under active clearing are also particularly susceptible to injury or mortality. Other causes of injury or mortality include animals becoming trapped in excavations/trenches.

6.5.3.2 Access Tracks, Coal Seam Gas Exploration, Amenities and Hours of Operation

Noise, Light and Dust

Project activities, during construction and operation, can disrupt local fauna roosting, breeding and foraging activities as a result of increased exposure to artificial lighting, noise and vibration. Artificial lighting poses risks to fauna, as increased light allows predators to locate prey more easily. Additionally, noise and vibration can also lead to increased predation of some species, as it makes it harder for prey to detect approaching predators.

Excessive dust deposition on foliage can cause impacts to vegetation, including reducing photosynthetic processes, respiration, transpiration, health and growth rates. Potential dust impacts on vegetation are concentrated near dust sources such access tracks, drilling locations and stockpiles as a result of construction/operation activities.

Areas of remnant vegetation adjacent to the Project may be subject to degradation from dust deposition on foliage.

6.5.3.3 Amenities

Introduction and Spread of Pests

The Project may result in an increase in the presence and abundance of feral animals through improper waste disposal and increased permanency of water sources associated with the amenities located on drill pads. These pests can result in adverse impacts to native fauna through increased habitat degradation, predation pressure and competition for resources. They can also be identified as a particular risk to the recovery of threatened fauna species. Five pest fauna species were recorded within the Study Area, including:

- Cane toad (Rhinella marina).
- Cat (Felis catus).
- Wild dogs (*Canis lupus*).
- European rabbit (*Oryctolagus cuniculus*).
- Feral pig (*Sus scrofa*).

6.5.3.4 Equipment

Introduction and Spread of Weeds

Introduced flora species disrupt ecosystems by outcompeting and replacing native species, resulting in altered ecosystem diversity and function. They can also be identified as a particular risk to the recovery of threatened fauna and flora species. Proliferation and spread of environmental weeds and pests may occur as a result of the increased movement and use of heavy machinery and vehicles as required for vegetation clearing and soil

disturbance/movement. Three weed species listed as WoNS and/or restricted matters under the Biosecurity Act were recorded within the Study Area, including:

- *Harrisia martini.*
- *Opuntia tomentosa.*
- *Parthenium hysterophorus.*

Weed seeds can be transported in contaminated landfill, and as seed and material on machinery, vehicles or personnel. Construction activities have the potential to spread or introduce weeds throughout adjacent areas, resulting in a degradation of vegetation/habitat quality and native species assemblages.

6.5.4 Management Practices

The potential impacts will be managed through current practices. The methods used to mitigate impacts to terrestrial ecology are detailed in the following subsections.

6.5.4.1 Avoidance

During the design stages of the Project, terrestrial ecological values were considered and avoided where feasible and practical. These included the following.

- The total number of drill pads and wells has been optimised to align with Project objectives while also reducing the extent of disturbance to ecological values.
- Previously disturbed access tracks and areas used in exploration have been utilised were possible. Drill pads have been positioned closer to previously disturbed areas so that limited new access tracks would need to be cleared.
- Non-remnant areas of vegetation that provide limited habitat value in the south-western areas of the Study Area were prioritised over areas of mature regrowth and remnant vegetation. Nine of the proposed wells are situated in pastureland that has previously been cleared for agricultural purposes.
- Where remnant vegetation was required to be cleared, vegetation classified as No concern at present under the VM Act was utilised in preference of Of concern and Endangered REs.
- Areas of TEC were avoided where possible.

6.5.4.2 Mitigation

Native Vegetation Clearing and Habitat Removal

To mitigate and minimise the potential impacts from native vegetation clearing and fauna habitat removal (including habitat for MNES and MSES fauna) during the construction and operational stage of the Project, the following measures should be implemented.

- Vegetation clearing extents will be kept to the minimum area necessary for access road and drill pad construction.
- Boundaries of areas to be cleared, and those not to be cleared, are to be clearly defined during clearing activities and clearly communicated to all necessary construction personnel. Where necessary, signage, flagging and/or barricade fencing may be used to demarcate areas not to be cleared.

- Pre-clearance fauna surveys are to be undertaken by a suitably experienced and qualified person to identify fauna and habitat features at direct risk from clearing activities.
- Habitat features such as large logs will be moved out of disturbance areas into adjacent areas as habitat.
- A suitably experienced and qualified person will be present during the clearing of any structures that may serve as habitat or refugia for animals.
- Directional clearing towards retained vegetation would be undertaken where practical to enable the movement of fauna into retained vegetation.
- Hollow-bearing trees providing shelter for native fauna should be felled slowly (in sections), so as to minimise the risk of injury to fauna.
- In the event a MSES fauna (such as koala) is identified within areas to be cleared, the individual is to be left to vacate the area in accordance with the legislation.
- During construction works, work areas and excavations (trenches) are to be checked regularly for fauna that may have become trapped.
- Fauna exclusion fencing will be erected around open trenches and pits >1 m depth to minimise the risk of injury to fauna.
- If trenches remain open after daily site works have been completed, fauna ramps would be put in place.

Fauna Injury and/or Mortality

To mitigate and minimise the potential for fauna injury and/or mortality during Project activities, the following measures should be implemented.

- Vehicles are to remain on designated access tracks and adhere to site rules relating to speed limits.
- Speed limits are to be clearly signposted to minimise potential fauna strike.
- Removal of roadkill should be undertaken to minimise the risk of attracting other fauna to the road corridor.
- Contingencies and procedures for the treatment of injured fauna will be implemented.
- Where installation of wire fencing is required to exclude personnel or vehicular traffic, consideration should be given to movement of fauna around and/or through such fencing. Barbed wire should not be used on the top strand of wire fences unless necessary for security.

Noise, Light and Dust

To mitigate and minimise the potential impacts from noise, light and dust during the construction and operational stage of the Project, the following measures will be implemented:

- Where artificial lighting is required, directional lighting and glare guards should be implemented to focus on work areas and minimise lighting of adjacent remnant vegetation.
- Active roads are to be regularly watered (or applied with dust suppressants) to minimise dust generation potential.

- Regular maintenance of machinery and mobile plants should be undertaken to minimise unnecessary noise.

Introduction and Spread of Pests and Weeds

To mitigate and minimise the potential for the introduction and spread of pests and weeds during Project activities, the following measures should be implemented:

- Weeds or soil removed as a result of construction activities are to be appropriately disposed of or stored separately to minimise potential spread and proliferation of weed species.
- Prior to vegetation clearing activities, a pre-clearance survey should be undertaken to identify and map infestations of WoNs and restricted matters under the Biosecurity Act to minimise spread during clearing works and the operational phase.
- Waste management measures should be identified and enacted to minimise occurrences of pest fauna.
- All vehicles, equipment and materials (e.g. landfill, soil etc.) brought to site are to be certified free of biosecurity matter and carry weed hygiene certification.
- Biosecurity monitoring will be undertaken during construction, operational and rehabilitation phases to identify and assess the risk of weed and pest occurrences within the Project.
- Pest fauna will be monitored and control actions will be undertaken to limit the abundance and spread of pest fauna in the Project Area and adjacent land.
- Biosecurity measures will be undertaken to ensure no diseases will be spread during construction and operational phases of the Project.

Rehabilitation and Closure

Rehabilitation will be undertaken to ensure land be progressively rehabilitated to achieve completion criteria for a safe, stable and non-polluting landform able to sustain an agreed post-mining land use. This will include:

- Top-soil to be stockpiled to be utilised during rehabilitation.
- Rehabilitated areas will be of similar floristic diversity and structure to pre-disturbance.
- Any habitat features in adjacent habitat that are unoccupied may be returned to pre-disturbance locations.

6.5.5 Risk Assessment

The field surveys identified that the Project Area contains three MSES identified under the EO Act (see **Section 6.5.2**). The Queensland Government has produced the *Queensland Environmental Offsets Policy – Significant Residual Impact Guideline* (DEHP 2014) (SRI Guideline) to assist in determining if significant residual impacts associated with a Project will require offsetting. Self-assessments against the SRI Guideline are provided in Appendix A.

An assessment against the SRI Guideline determined the Project is unlikely to result in a significant residual impact on any of the three MSES. This is summarised below for each MSES.

Regulated Vegetation

Endangered and Of Concern REs

Regulated vegetation comprising of 'endangered' or 'of concern' REs was assessed in accordance with the SRI Guideline. The Project will result in removal of 1.53 ha of remnant 'of concern' RE 11.8.11, which has a structure category / structure code of woody grassland / tussock grassland respectively. Therefore, given the Project will impact less than the prescribed 5 ha limit specified for grassland communities within the SRI Guideline, the Project is considered unlikely to have a significant residual impact.

Essential Habitat

In accordance with the SRI Guideline, essential habitat has been assessed as part of MSES protected wildlife habitat.

Protected Wildlife Habitat

Protected wildlife habitat was assessed in accordance with the SRI Guideline for the following five threatened species and essential habitat for one species:

- ***Dichanthium queenslandicum*** – The Project will result in the direct clearing of 1.53 ha of preferred habitat for *D. queenslandicum*. This amount comprises less than 1% of preferred habitat for the species mapped within the broader Study Area. Any individuals removed will be a small portion of the population within the habitat patch that is being disturbed and therefore, it is considered unlikely that the Project will have a significant residual impact on the species. The implementation of mitigation measures will further minimise potential impacts to the species.
- **Koala** – The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala. This comprises less than 1% of suitable habitat for the species mapped within the broader Study Area. The Project is located outside of areas of preferred habitat for the species and given survey effort across the Study Area it is considered that koala is present at low densities in this area. Therefore, it is considered unlikely that the Project will have a significant residual impact on the species. The implementation of mitigation measures will further minimise potential impacts to the species.
- **Ornamental snake (comprising Essential Habitat)** – The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake. Seasonal targeted surveys for the species (comprising pitfall trapping and spotlighting) within the Study Area failed to detect the species, and no suitable habitat was identified. Therefore, the species is assessed as unlikely to occur within the Study Area and Project Area and it is considered unlikely that the Project will have a significant residual impact on the species.
- **Short-beaked echidna** – The Project will result in the direct clearing of 6.45 ha of suitable habitat for short-beaked echidna. This comprises less than 1% of suitable habitat for the species mapped within the broader Study Area. The species has a relatively widespread distribution across its range (Van Dyck & Strahan, 2008) and given the small portion of habitat being cleared and retained connectivity of avoided habitat within the Study Area, it is considered unlikely that the Project will have a significant residual impact on the species. The implementation of mitigation measures will further minimise potential impacts to the species.
- **Squatter pigeon (southern)** – The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern). This comprises less than 1% of suitable habitat for the species within the broader Study Area. The species is locally

abundant within its range (DCCEEW, 2024) and given the small portion of habitat being cleared and retained presence of important habitat features (i.e. permanent and seasonal waterbodies) (Squatter Pigeon Workshop, 2011), it is considered unlikely that the Project will have a significant residual impact on the species. The implementation of mitigation measures will further minimise potential impacts to the species.

- **White-throated needletail** – The species is a wide-ranging nomadic species that is almost exclusively aerial in Australia (DCCEEW, 2024). As such, the clearing of vegetation is considered largely inconsequential to the species. Therefore, it is considered unlikely that the Project will lead to a long-term decrease in the species population, extent of occurrence, quality of habitat or result in an invasive species or disease that may cause the species to decline. Furthermore, the Project is unlikely to interfere substantially with the recovery of the species.

Connectivity Areas

In accordance with the SRI Guideline, the Landscape Fragmentation and Connectivity Tool was used to assess the associated impacts to connectivity areas resulting from the Project. Based on the Landscape Fragmentation and Connectivity Tool, the Project will not result in a significant residual impact on MSES connectivity areas. The two tests identified:

- **Test 1:** The regional extent of core remnant areas is approximately 41.61%, resulting in a local impact threshold of 10.00%. The core remnant extent at the local scale pre-impact was calculated as 5,700.58 ha with a 0.36% change post impact. As such, Test 1 did not exceed the 10.00% threshold for change in core remnant ecosystem extent at the local scale.
- **Test 2:** One core remnant area was identified within the site pre-impact and this was retained post impact. As such the loss or fragmentation of core remnant ecosystem at the site does not result.

6.6 Aquatic Ecology

This section presents the assessment of Project related aquatic ecology impacts to environmental values.

6.6.1 Existing Environmental Values

The following subsections detail the existing EVs within the Project Area (see **Figure 3.2**) based on aquatic ecological surveys undertaken to date. It also details the MSES impacted by the Project based on these findings.

6.6.1.1 Subterranean GDEs and Stygofauna

According to state mapping, high potential GDEs are present along two of the creeks that are located within the Study Area; Kennedy Creek and Goonyella Creek. However, field surveys of these creeks identified that they were dry and did not exhibit characteristics of an ecosystem likely to be dependent on the surface expression of groundwater. Additionally, neither of these creeks intersect with the Project Area.

There are no mapped subterranean GDEs within or near (within 100 km) the Study Area. Additionally, no stygofauna were collected from bores within or immediately surrounding the Study Area, suggesting the absence of subterranean GDEs within these aquifers.

6.6.1.2 Habitat

The creeks of the Study Area are ephemeral in nature, where flow and pool habitat only occur following sufficient rainfall. Habitat condition of the creeks within the Study Area ranged from poor to fair, given that they were impacted by grazing, heavily eroded, dominated by fine sediment and affected by scouring and channelisation. The Project Area does not intercept with these creeks.

Two constructed dams in the Study Area were surveyed and likely provide a perennial source of water, though do not appear to supply water or be directly connected to surrounding creeks. The Project Area does not intercept with constructed dams.

6.6.1.3 Water Quality

Water quality was only measured in the two dams present in the Study Area and one creek when it held water in the early-wet survey. Water quality was typical for constructed dams, though some extremes were noted in pH and dissolved oxygen, owing to the high macrophyte density. High turbidity was noted in the only creek to hold water, though this is typical for an ephemeral creek. The Project Area does not intercept creeks or constructed dams.

6.6.1.4 Macroinvertebrates

Macroinvertebrate diversity indices (taxonomic richness, PET richness and SIGNAL score) were generally low, largely due to the lack of macro and microhabitat diversity within the creeks or constructed dams. The Project Area does not intercept creeks or constructed dams.

6.6.1.5 Fish and Macrocrustaceans

Fish were only caught in one dam and were typical species for the area, potentially being stocked in the past. Red claw crayfish (*Cherax quadricarinatus*) was also caught in the same dam and though native to northern Queensland, are considered non-native in the area. Freshwater inland crabs were also caught in the only creek site to hold water and provide an indication of ephemerality. The Project Area does not intercept with creeks or constructed dams.

6.6.1.6 Threatened Species

No threatened flora or fauna species were identified during the field survey. The critically endangered white-throated snapping turtle (Critically endangered under the EPBC Act and NC Act) and Fitzroy River turtle (Vulnerable under the EPBC Act and NC Act) have not been recorded in or near (within 100 km) the Study Area and suitable habitat was not identified mostly due to the lack of perennial, flowing water. The platypus (Special least concern under the NC Act) was also not caught and suitable habitat was not identified, again largely due to the lack of suitable habitat in the Study Area.

6.6.2 Summary of MSES

No MSES as defined in the EO Regulation were identified within the Project Area. More specifically, the Project Area does not intercept with the following MSES:

- Wetlands and watercourses (including High Ecological Significance wetlands and wetlands or waterways in High Ecological Value waters).
- Protected wildlife habitat (for aquatic species).

- Declared fish habitat areas under the Fisheries Act 1994.
- Protected areas.
- Legally secured offset areas.
- Watercourses as defined in the *Water Act 2000*:
  - Waterways providing for fish passage.
  - Threatened aquatic species.

6.6.3 Potential Impacts

There are no direct Project impacts to aquatic ecology considered likely to occur. As such, the following subsections detail the potential indirect aquatic ecology impacts as a result of the activities described in **Section 3.0.** Where multiple activities contribute to a potential impact, all relevant activities have been listed in the subsection heading.

6.6.3.1 Access Tracks, Coal Seam Gas Exploration and Water

Surface Water Quality

Changes in the surface water quality and quantity may impact terrestrial ecosystems downstream of the Project Area. Sedimentation and chemicals can enter downstream environments resulting from overland flow patterns (Evans, 2000). While no uncontrolled spills of water will be impacted by Project activities, some overflow may occur when rainfall exceeds the design standard (e.g. flood events).

Groundwater Drawdown

Changes to groundwater quality and quantity can have an indirect impact on ecosystems surrounding the Project Area, including ecosystems that are dependant or partially dependant on groundwater (terrestrial GDEs). The process of CSG drainage may reduce water levels in the surrounding groundwater units. The extent of the zone affected is dependent on the properties of the aquifers/aquitards and is referred to as the zone of drawdown.

6.6.4 Management Practices

6.6.4.1 Avoidance

During the design stages of the Project, aquatic ecological values were considered and avoided where feasible and practical. This included the complete avoidance of MSES associated with aquatic ecology (see **Section 6.6.2**).

6.6.4.2 Mitigation

To mitigate and minimise the potential indirect impacts to surface water and groundwater during the Project activities, the following measures should be implemented.

- Erosion and sediment control monitoring should be implemented to reduce the amount of sediment laden run-off entering downstream waterways. The following general principles should apply to the erosion and sediment controls:
  - Minimise the surface disturbance areas
  - Where possible, apply local temporary erosion control measures, and

- Intercept run-off from undisturbed areas and divert around surface disturbance areas, where required.

- Active access tracks are to be regularly watered (or applied with dust suppressants) to minimise dust generation potential.
- Bunding and appropriate storage of fuels and other hazardous and flammable materials will be undertaken in accordance with AS1940:2004, and where practical, will be located away from any waterbodies.
- Oil spill recovery equipment will be available and located with construction crews conducting activities with the potential for significant spills.
- As soon as practical, disturbed areas will be rehabilitated to reduce the extent of exposed soils.

6.6.5 Risk Assessment

As detailed in **Section 6.6.2**, no MSES are located within the Project Area. As such, no SRIs in accordance with the SRI Guideline are considered likely to result from the Project.

6.7 Groundwater

The following section describes the hydrogeological environment, and analytical modelling undertaken to assess potential impacts on groundwater receptors resulting from the Project. The proposed location of vertical and lateral wells is presented in **Figure 6.20**.

Table 6.27 sets out where in this groundwater assessment the exercise of underground water rights for site-specific application as per Section 126A of the EP Act are considered.

Table 6.27 Groundwater Section 126A

Section 126A of the EP Act	Reference
2 (a) any proposed exercise of underground water rights during the period in which resource activities will be carried out under the relevant tenure	Refer to **Section 6.7.2** for a description of the proposed activities.
(b) the areas in which underground water rights are proposed to be exercised	Refer to **Section 6.7.2** for the underground water rights area.
(c) for each aquifer affected, or likely to be affected, by the exercise of underground water rights — I. a description of the aquifer; and II. an analysis of the movement of underground water to and from the aquifer, including how the aquifer interacts with other aquifers and surface water; and III. a description of the area of the aquifer where the water level is predicted to decline because of the exercise of underground water rights; and IV. the predicted quantities of water to be taken or interfered with because of the exercise of underground water rights	I. Refer to **Section 6.7.1.1** for a description of the aquifers. II. Refer to **Section 6.7.1.1** and **Section 6.7.1.2** for a description of the movement and interactions of groundwater. III. Refer to **Section 6.7.3** for a description of predicted water level decline. IV. Refer to **Section 6.7.2** for anticipated water take.

Section 126A of the EP Act	Reference
during the period in which resource activities are carried out;	
(d) the environmental values that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the environmental values;	Refer to **Section 6.7.1** and **Section 6.7.4** for a description of EV impacts.
(e) any impacts on the quality of groundwater that will, or may, happen because of the exercise of underground water rights during or after the period in which resource activities are carried out;	Refer to **Section 6.7.1** and **Section 6.7.4** for a description of EV impacts.
(f) strategies for avoiding, mitigating or managing the predicted impacts on the environmental values stated for paragraph (d) or the impacts on the quality of groundwater mentioned in paragraph (e).	Refer to **Section 6.7.4** for a risk assessment of predicted impacts.

6.7.1 Existing Environmental Values

6.7.1.1 Aquifers

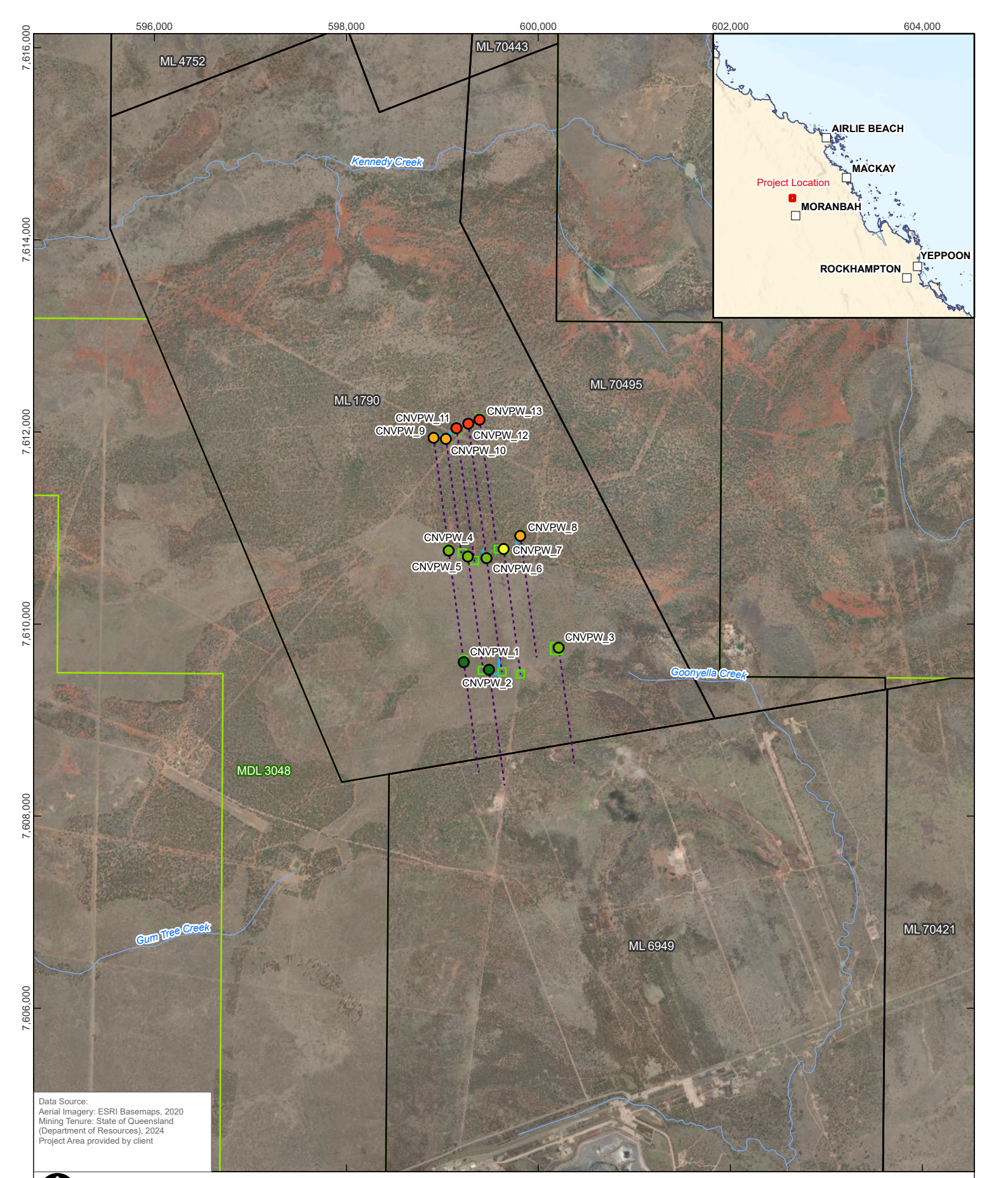
Hydrostratigraphy

The hydrostratigraphy relevant to the Project comprises the Quaternary alluvium, Tertiary strata (basalt and sediments) and Permian strata. A conceptual cross section of the hydrogeological setting is provided in **Image 6.4** and the surface geology of the Project Area is shown in **Figure 6.21.** Solid geology (excluding Tertiary and Quaternary cover sequences) used for the representation of dip angles and formation contacts is per geology model provided by Peabody.

Quaternary Alluvium

The Quaternary alluvium forms an unconfined aquifer and includes alluvial deposits associated with local creeks. Where present, the thickness of the alluvium is likely to be highly irregular, with estimates of maximum thicknesses in the range of 15 to 25m (Golder, 2020). Groundwater flow within the alluvium (if/where saturated) will follow topographic gradients but it is considered unlikely that, where present, the alluvium forms a continuous saturated aquifer. Relative to the vertical and lateral wells, the Quaternary Alluvium is located along Kennedy Creek, approximately 7.5 kilometres (km) northwest of the Project Area.

Recharge to the Quaternary alluvium will occur via direct infiltration of rainfall and occasional creek flow/flooding during the wet season (Golder, 2020, BMC, 2021). Discharge mechanisms from the alluvium include evapotranspiration, leakage to underlying/adjacent aquifers and groundwater extraction (BMC, 2021). Previous conceptualisations have noted all creeks in the area are ephemeral. No water level data for this unit is available in the monitoring network.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.041540.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Watercourse
- Lateral Well Length
- Mining Lease
- Mineral Development Licence
- Drill Pad
- Access Track

Planned Vertical Well

Approximate Depth

- 290 - 305
- 306 - 425
- 426 - 460
- 461 - 505
- 506 - 565

EA AMENDMENT P-EA-100658735

VERTICAL WELL DEPTH

SLR

FIGURE 6.20

Path: H:\Projects-SLR\620-BNE\620-BNE\620.041540.00001 Centurion Early Works CSG extr\06 SLR Data\01 GIS\GIS\ArcPro\Centurion Early Works CSG\Centurion Early Works CSG.aprx\620041540_F06-20_Vertical Well Depth

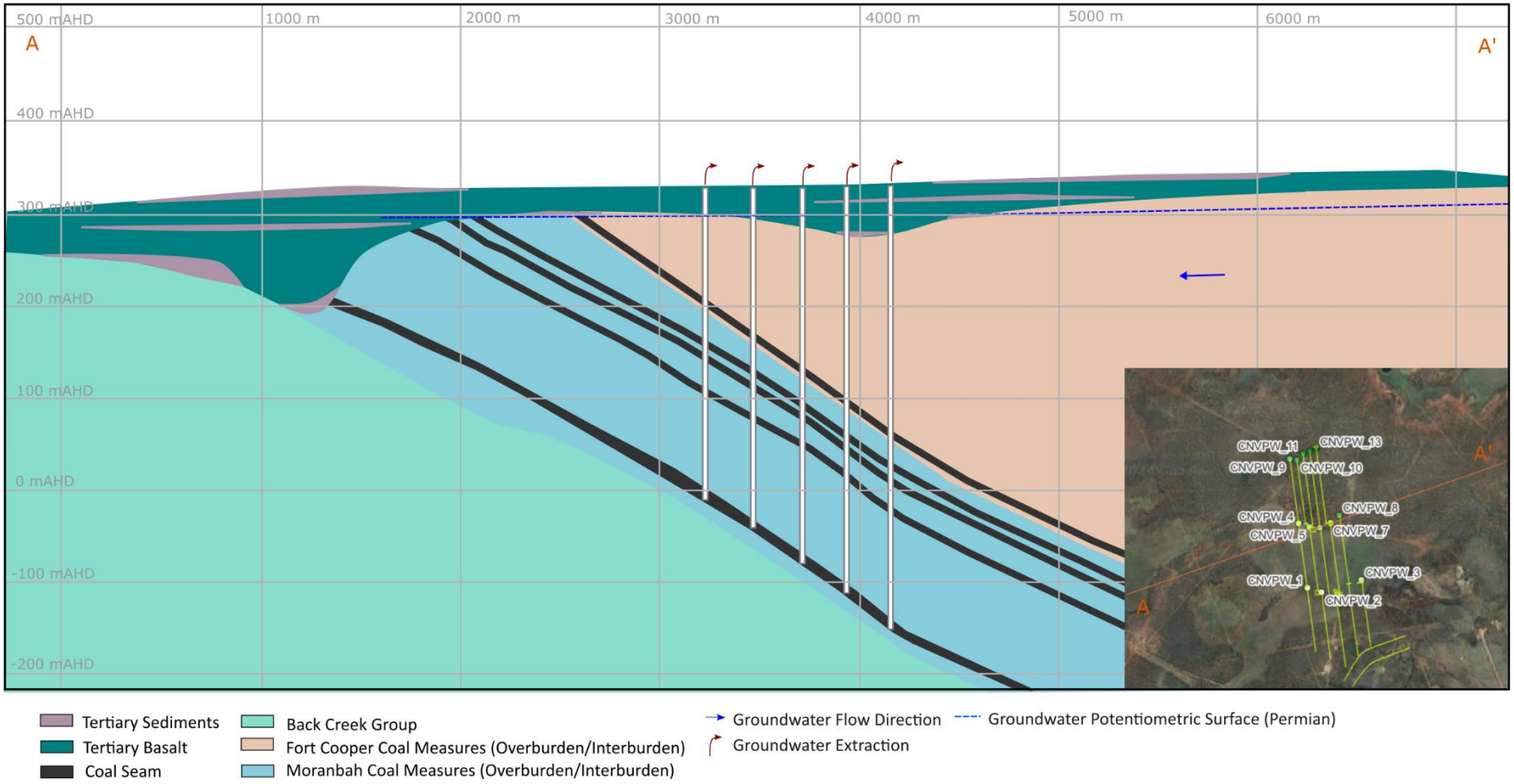


Image 6.4 Conceptual hydrogeological cross section

Tertiary

The Tertiary Strata includes thick basalt flows interbedded with sediments. The flows and sediments occupy Tertiary paleochannels in the Permian coal measures basement. These strata represent the most significant groundwater resource in the region.

Groundwater within the basalt is stored and transmitted through fractures, joints, and discontinuities within the rock mass. The aquifer is layered due to the presence of sediments and weathering horizons which develop between individual flows. Additionally, low permeability associated with massive basalt in the centre of the flows typically separate the higher permeability vesicular basalts, which develop at the top and bottom individual flows (Golder, 2017). In most areas the basalt is underlain by sediments of variable thickness, however, in some areas the basalt is directly in contact with the underlying Permian strata. These underlying sediments occasionally express as lenses of sand that may be hydrogeologically significant due to high primary porosity and hydraulic conductivity.

Golder, 2017 presents geological model data including mapping for the base of the Tertiary, basalt thickness, and the inferred thickness of Tertiary sediments underlying the basalt across ML1790 and the immediate surroundings. The basalts are thickest along the western, north-western and northern edge of ML 1790 reaching thicknesses of up to 150m, including one data point at the south-western corner of ML 1790, proximal to the proposed well field.

Permian

The Permian strata comprise siltstone, sandstone, calcareous and carbonaceous shale and coal seams. The coal seams and jointed sandstone units are generally the most transmissive units within in the coal measures with water moving through the coal seams via joints and fractures. The lower permeability interburden/overburden units (siltstones and mudstones / shales) may have some fracture permeability but typically confine groundwater within the coal seams.

Recharge to the Permian will occur via downwards seepage from overlying aquifers, though faults or discontinuities and where the unit outcrops through direct rainfall infiltration or overland flow (Golder, 2020, BMC, 2021). Discharge from the Permian is expected to occur through downgradient flow, downwards seepage through structural discontinuities and groundwater extraction (including dewatering) (Golder, 2020, BMC, 2021)

Hydraulic Properties

Site specific hydraulic conductivity estimates from field testing are presented in **Table 6.28**.

Hydraulic conductivity estimates for the Quaternary alluvium indicate a range from 2 to 20 metres per day (m/day). However, this is based on testing of the Suttor Creek alluvium and regional studies and no site-specific testing has been conducted.

Hydraulic conductivity estimates from one bore in the Tertiary sediments (sandy sediments of the Suttor Formation), shows a range from 0.3 to 0.8 m/day. The silt and clay layers of this formation would be expected to have permeabilities several orders of magnitude lower. The Tertiary sediments distribution model (Silwa, 2011) indicates a varied composition and distribution of sand, clay and mixed material for these sediments.

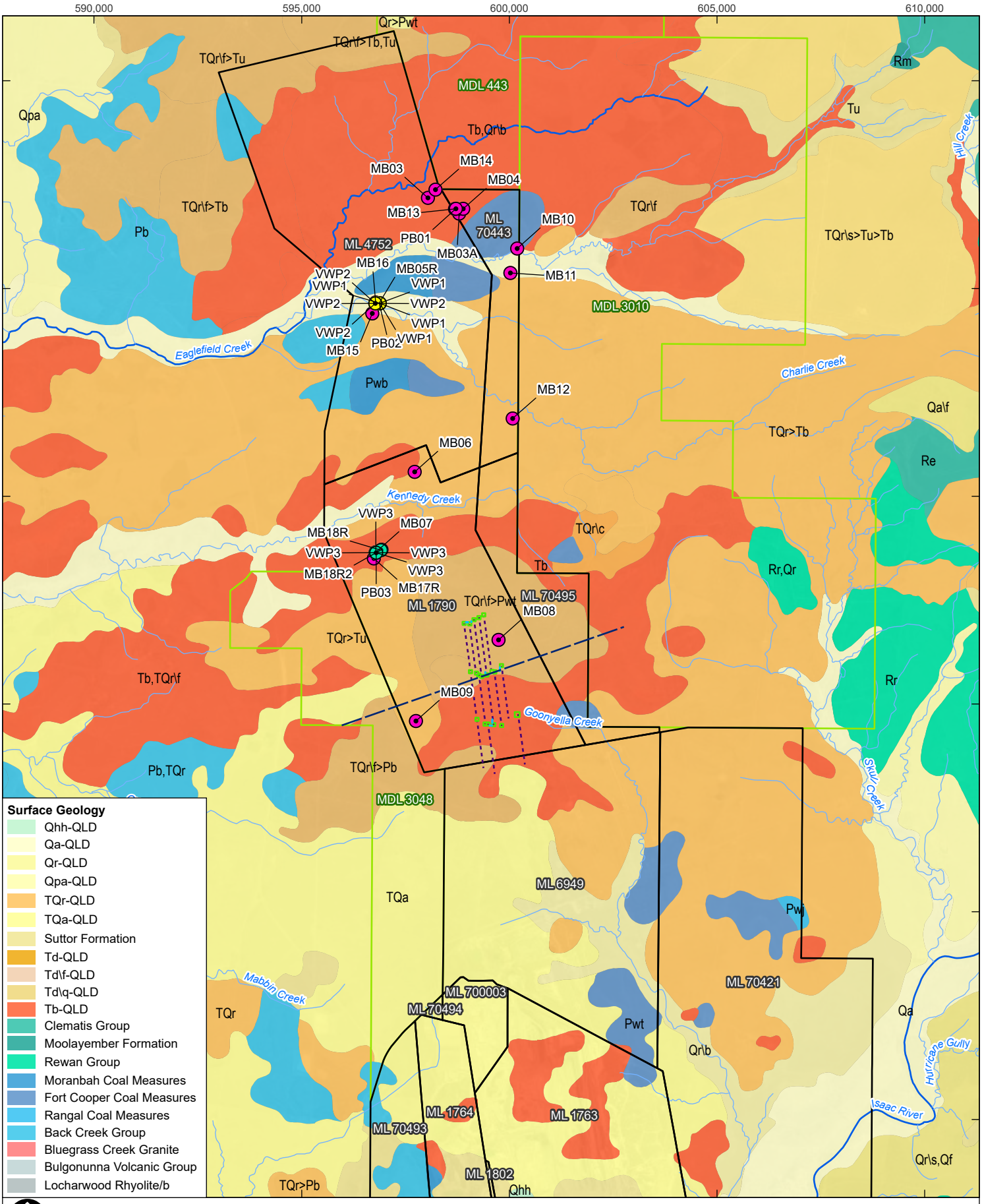
Two long term pumping tests in the basalt (Streamline Hydro, 2012) were conducted at the northern end of ML 1790 some 8-10 km north of the proposed production well area. The hydraulic conductivity, transmissivity and storage of the Tertiary basalt is likely to vary significantly across the area.

Hydraulic conductivity estimates for the Permian interburden/overburden range from 2 x 10-6 to 0.33 m/day. Hydraulic conductivity estimates for the Permian coal seams ranged from 2 x 10-6 to 0.47 m/day, with estimates for the Goonyella seams in the range 0.003 to 0.47 m/day.

Table 6.28 Hydraulic conductivity estimates from field testing

Aquifer	K (m/day)	Test bore/area	Type	Source1
Alluvium	2 to 20	Regional study		Arrow (2012)
	3	Suttor Creek	-	Golder, 2005
Tertiary sediments	0.3 to 0.8	PB03	CRT	Streamline Hydro (2012)
Tertiary Basalt	0.5 to 2.4	PB01	CRT	Streamline Hydro (2012)
	0.01 to 0.4	PB02	CRT	Streamline Hydro (2012)
Permian GM Seam	0.003 to 0.034	GBMC	-	URS, 2013
	0.01	GBMC	-	Golder, 2016
Permian GL Seam	0.06 to 0.47	GBMC	-	URS, 2013
	0.01 to 0.1	GBMC	-	URS, 2013
	0.01	GBMC	-	Golder, 2016
Permian GU Seam	0.01	GBMC	-	Golder, 2016
Permian coal seams (undifferentiated)	1×10^{-6} to 0.001	Wards Well ML	packer	AGE, 2012
Permian Interburden	2×10^{-5} to 0.33	GBMC	-	URS, 2013
	2×10^{-6} to 3×10^{-5}	Red Hill	-	URS, 2013
Permian Overburden/Interburden	8×10^{-4}	GBMC	-	Golder, 2016

1 as reported by Golder (2020)
- test type not reported
CRT = Constant Rate Test
GBMC = Goonyella Broad Meadow Complex



EA AMENDMENT P-EA-100658735

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:120,000 at A4
Project Number:	620.041540.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

SURFACE GEOLOGY AND MONITORING NETWORK

SLR

FIGURE 6.21

Path: H:\Projects-SLR\620-BNE\620-BNE\620.041540.00001 Centurion Early Works CSG extr\06 SLR Data\01 GIS\GIS\ArcPro\Centurion Early Works CSG\Centurion Early Works CSG.aprx\620041540_F06-21_Surface Geology and Monitoring Network

6.7.1.2 Groundwater Conditions

This section outlines the baseline understanding of hydrogeological conditions that informs the analytical model design and impact assessment.

Water Level

Located in between CNVPW_13 and CNVPW_8, MB08 is screened in the basalt aquifer and gives the best indication of groundwater conditions in this aquifer at the production well field. **Image 6.5** shows a hydrograph MB08 with Cumulative Rainfall Departure included to assess the impact of monthly rainfall variations in the groundwater hydrographs.

Groundwater levels at MB08 very broadly reflect the long-term rainfall trend with a clear recession from the significant recharge associated with very high rainfall during the 2010-11 wet season. Based on groundwater levels at MB08, Tertiary basalt groundwater levels in the immediate footprint of the Project Area are considered likely to range between approximately ~296 and 297m AHD.

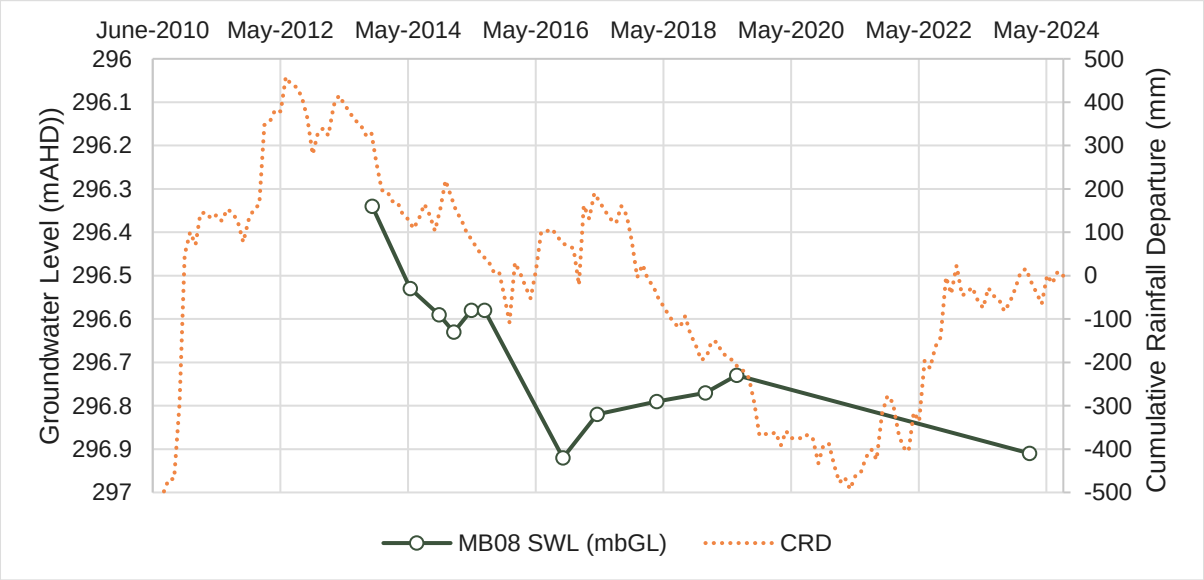


Image 6.5 Groundwater level monitoring bore MB08 hydrograph

The nearest groundwater level monitoring in the Permian coal seams is VWP03, approximately 2.7 km northwest of the proposed Project Area. Hydrograph of this data is provided in **Image 6.6**. Sensor lithology corresponds to:

- Sensor 4: Interburden
- Sensor 3: Goonyella Middle 0
- Sensor 2: Goonyella Lower 3, and
- Sensor 1: Goonyella Lower 8.

Groundwater level and flow direction in the Permian was additionally investigated by developing groundwater level contours from exploration drilling bores that were cased to below 150 metres below ground level (mbGL) i.e. reflecting groundwater conditions in the Permian (**Image 6.6**). These are considered to be low reliability water level estimates as they are likely to present as averaged piezometric level Permian strata that are exposed in the borehole (including coal and overburden). Based on these localised contours for data collected in 2011, the interpreted groundwater flow direction is to the south and west.

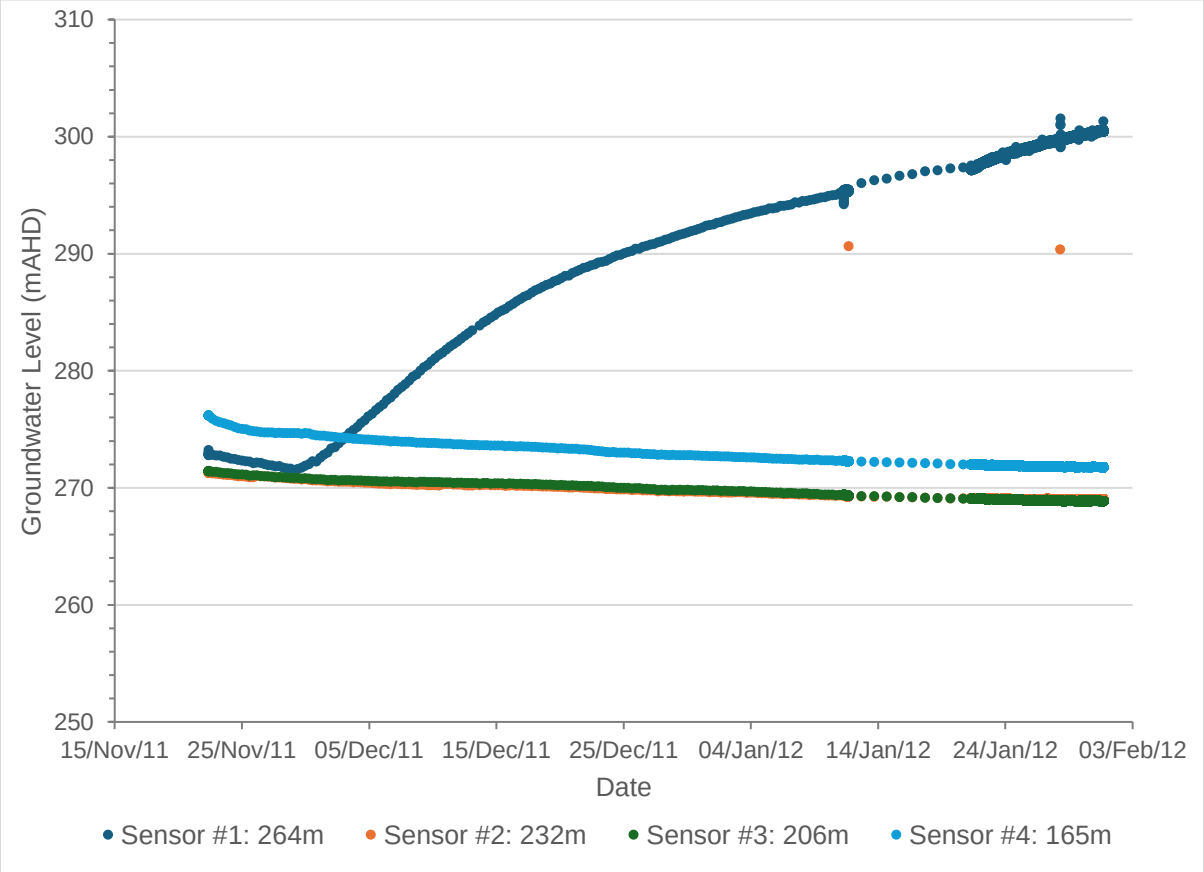
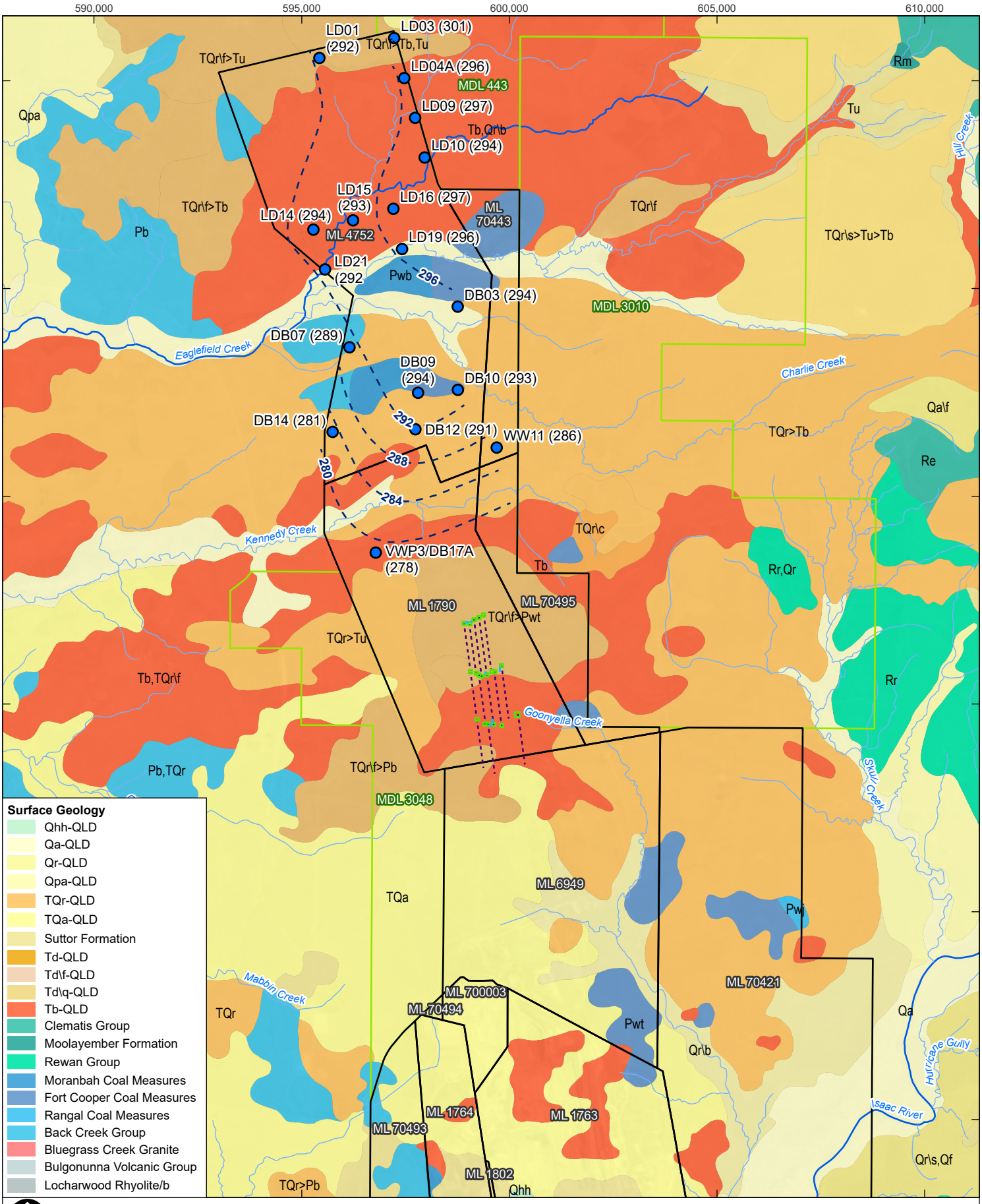


Image 6.6 VWP03 hydrograph

Water Chemistry

Groundwater quality data collected for the Project Area indicates the following:

- **Alluvium**: Variable salinity, but generally brackish to saline (up to 6,600 µS/cm, with an average of ~3,700 µS/cm), slightly alkaline pH (7.32 to 7.61) and sodium chloride dominated.
- **Basalt**: Moderate salinity, ranging from slightly brackish to saline (893 µS/cm to 4,670 µS/cm), very slightly alkaline to moderately alkaline pH (7.16 to 8.97), and sodium chloride dominated.
- **Permian Coal Measures**: Limited data exists for monitoring bores screened within the coal measures outside of two rounds of grab samples in late 2011. Chemistry results from these sampling rounds indicated that groundwater in the coal measures is of significantly higher in salinity, and more alkaline compared to samples from the basalt and alluvium.



Surface Geology

- Qhh-QLD
- Qa-QLD
- Qr-QLD
- Qpa-QLD
- TQr-QLD
- TQa-QLD
- Suttor Formation
- Td-QLD
- Td\f-QLD
- Td\q-QLD
- Tb-QLD
- Clematis Group
- Moolayember Formation
- Rewan Group
- Moranbah Coal Measures
- Fort Cooper Coal Measures
- Rangal Coal Measures
- Back Creek Group
- Bluegrass Creek Granite
- Bulgonunna Volcanic Group
- Locharwood Rhyolite/b

0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:120,000 at A4
Project Number:	620.041540.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

- Exploration and Monitoring Bore Water levels (2011)
- Major Watercourse
- Minor Watercourse
- Permian Contour
- Mining Lease
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

PERMIAN COAL MEASURES GROUNDWATER CONTOURS (2011)

SLR

FIGURE 6.22

Path: H:\Projects-SLR\620-BNE\620-BNE\620.041540.00001 Centurion Early Works CSG extr\06 SLR Data\01 GIS\GIS\ArcPro\Centurion Early Works CSG\Centurion Early Works CSG.aprx\620041540_F06-22_Permian Coal Measures Groundwater Contours (2011)

6.7.1.3 Environmental Values

Groundwater Management Areas

The south-eastern corner of ML 1790 and the southern half of the adjoining ML 70495 lie within the Isaac-Conners Rivers catchment of the Fitzroy Basin and the Isaac Connors GMA. The rest of ML 1790 to the north-west lies within the Suttor River catchment of the Burdekin Basin. The south-western area of ML 1790 which lies within the Suttor River catchment also lies within the Highlands Underground Water Area.

Groundwaters in the portion of the Project intersecting the Isaac Connors GMA are scheduled under the Queensland Environmental Protection Policy (Water and Wetland Biodiversity) 2019 (under the *Environmental Protection Act 1994*) as Isaac Groundwaters of the Isaac River Sub-basin of the Fitzroy Basin water plan (WQ1310). The legislated Environmental Values (EVs) for these groundwaters are:

- Biological integrity of aquatic ecosystems – these occur where groundwater baseflow supports streams and water holes to some extent (e.g. seasonally or permanently).
- Human use EVs:
    - Suitability of water supply for irrigation – where groundwater is used to grow crops and pastures for commercial purposes.
    - Farm water supply/use – where groundwater is used to provide domestic supply and support growing domestic produce.
    - Stock watering – where groundwater is used to provide stock water.
    - Drinking water supply – where groundwater is used for potable water supply.
    - Primary recreation – where groundwater supports recreational use that involves direct contact ad a high probability of being swallowed, e.g. diving, swimming, water skiing.
    - Cultural and spiritual values – where groundwater supports both indigenous and non-indigenous values, e.g. recreational fishing, heritage, ecology.

The majority of ML 1790 is located within the Suttor River Catchment which is not a defined water management zone within the Burdekin Basin and no legislated EVs for groundwaters are currently defined. However, within this catchment the southwestern portion of ML 1790 lies within the Highlands Underground Water Area. The Water Act states that declared underground water areas may be subject to the following regulations:

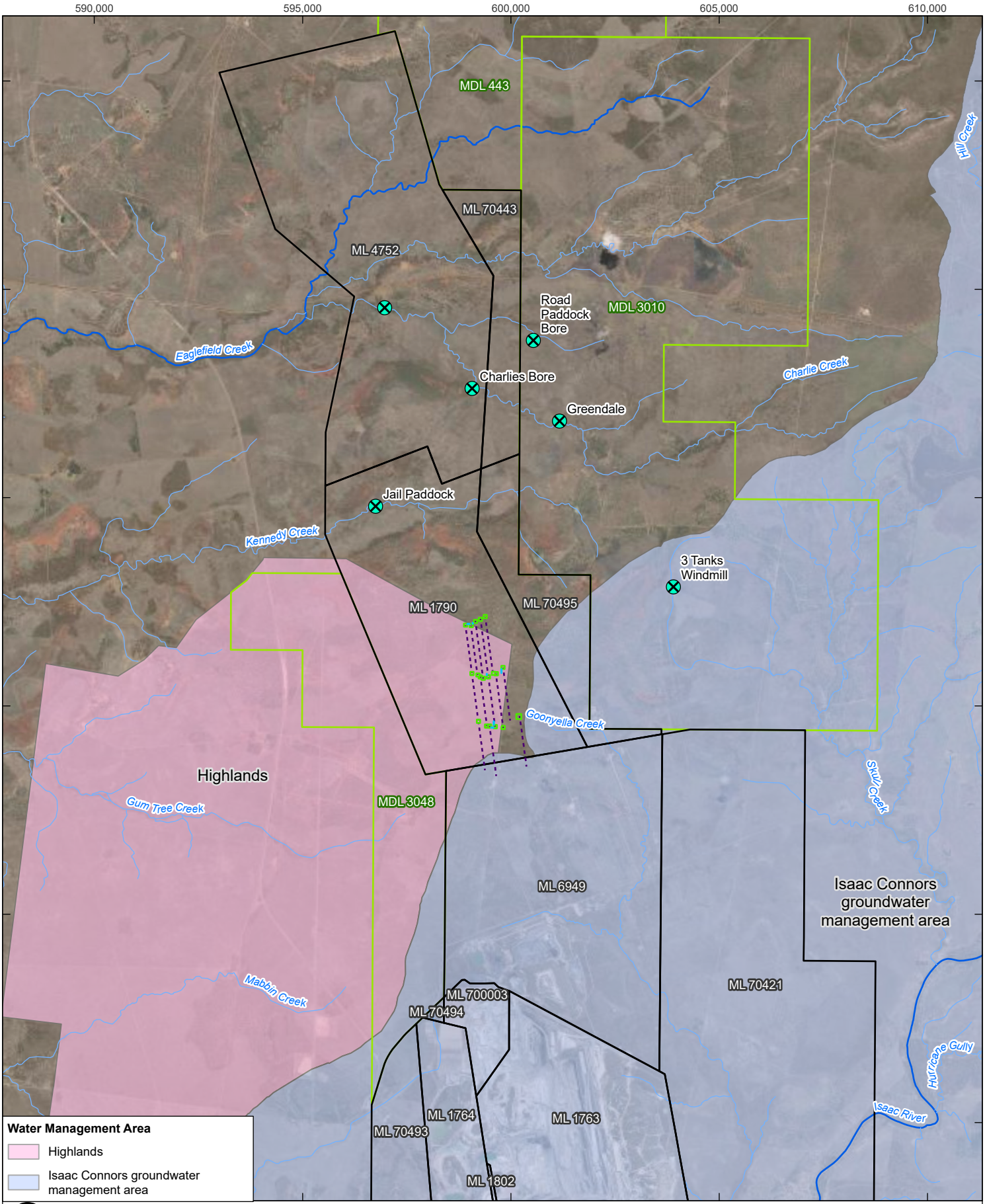
- The taking of, or interfering with, underground water.
- The types of works for taking or interfering with underground water that are assessable development or accepted development of the Planning Act.

The Water Regulation 2016, which describes the relevant legislation surrounding declared underground water areas, states that the Highlands Underground Water Area does not require water entitlement, water permit or seasonal water assignment notice for stock or domestic purposes or a prescribed activity. Prescribed activities in the context of mining operations include:

- Washing down equipment plant or vehicles.
- Supplying water for temporary camps or living quarters for staff, for example, for operating toilets, showers, kitchens, or laundries.

- Construction works, infrastructure or plant that are temporary and reasonably necessary for, or incidental to, carrying on mining under a mining lease granted under the Mineral Resources Act.
- Constructing, but not maintaining, roads with the area of a mineral development licence, or mining lease, granted under the Mineral Resources Act.
- Rehabilitation of riparian land.
- The following activities in relation to pumps, wells, or bores:
    - Constructing or drilling.
    - Proving supply.
    - Testing water quality.
    - Flushing out.

Any dewatering requirements occurring within the bounds of the Highlands Underground Water Area will be subject to obtainment of a water entitlement, water permit or seasonal water assignment notice.



Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:120,000 at A4
Project Number:	620.041540.00001
Date Drawn:	11-Sep-2024
Drawn by:	RB

LEGEND

- Bore Census Water Supply Bore (AGE 2012)
- Major Watercourse
- Minor Watercourse
- Mining Lease
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

WATER MANAGEMENT AREAS AND PRIVATE BORES

SLR

FIGURE 6.23

Path: H:\Projects-SLR\620-BNE\620-BNE\620.041540.00001 Centurion Early Works CSG extr\06 SLR Data\01 GIS\GIS\ArcPro\Centurion Early Works CSG\Centurion Early Works CSG.aprx\620041540_F06-23_Water Management Areas and Private Bores

Water Supply Bores

A search of the Queensland Government's Registered Groundwater Bore Database (GWDB) (DRDMW, 2024) was undertaken to identify registered bores within the 10 km of the Project Area. The search returned 45 bores with the following uses:

- Mine monitoring (28 bores).
- Petroleum exploration (1 bores).
- Water supply (7 bores).
- Sub-artesian monitoring (5 bores).
- Unknown use (10 bores).
- Decommissioned (1 bores).

Monitoring bores, exploration, and decommissioned or abandoned bores were excluded, which left no existing registered water supply bores within the search area. A landholder bore census was conducted for the Wards Well EIS by AGE (2012). The census included a total of 21 bores and identified six unregistered bores. The results of the survey indicated that these bores are used for stock watering. The locations of the six unregistered bores identified are included on **Figure 6.23**.

Groundwater Dependent Ecosystems

A groundwater dependant ecosystem (GDE) is a natural ecosystem that requires "access to groundwater to meet all or some of their water requirements on a permanent or intermittent basis, so as to maintain their communities of plants and animals, ecosystem processes and ecosystem services" (Richardson, S., et al., 2011).

The BoM's National Atlas of Groundwater Dependent Ecosystems (GDE Atlas) (BoM, 2017) classifies ecosystems based on the potential for dependence on groundwater through multiple lines of scientific evidence. Ecosystems have been mapped as either:

- High potential for groundwater dependence (indicating a strong possibility the ecosystem is interacting with groundwater).
- Moderate potential for groundwater dependence.
- Low potential for groundwater dependence (indicating it is relatively unlikely the ecosystem will be interacting with groundwater and will include ecosystems that are not interacting with groundwater).

BoM GDE Atlas regional study mapping indicates that areas with possible high, moderate, and low potential for groundwater interaction occur in the vicinity of the Project Area (**Figure 6.23**). This includes "high potential" terrestrial GDEs associated with regional ecosystems on basalt within the immediate mining footprint and the riparian corridor of Kennedy Creek across the northern end of ML 1790.

Ecological field surveys (refer to **Section 6.6**) have identified that there are no aquatic or terrestrial GDEs present within the Study Area. There are no mapped subterranean GDEs within or near (within 100 km) the Study Area. Additionally, no stygofauna were collected from bores within or immediately surrounding the Study Area, suggesting the absence of subterranean GDEs within these aquifers.

6.7.2 Proposed Activities

Groundwater extraction will occur at the vertical and lateral wells that may have impact on groundwater levels in the area. The extraction of groundwater from the wells, located on ML 1790, is the primary activity to be assessed for potential hydrogeological impacts.

Proposed activities will include drilling of vertical and lateral wells to target the GM seam between 290 - 570 mbGL. These activities are detailed in **Section 3.0**. The summary presented below focuses on the relevant information for prediction of potential groundwater impacts.

Groundwater in the coal seam will be pumped from the wells, reducing the hydrostatic pressure in the production seam by a planned 40 kilopascals (kPa) per day, or 4 metres water head (mH_2O). Based on information provided by Peabody, it is anticipated that depressurisation of the coal seam will take up to 90 days. From the well head, the water will pass through the well head to storage tanks and ultimately be added to the CCM mine water management system.

- The reduction in hydrostatic pressure within the coal seam allows CSG to desorb from the coal matrix. The CSG will migrate through the coal's natural fractures (cleats) through the perforations made in the casing and into the well.
- The desorbed CSG will flow up the well to the surface, where it will be separated from any co-produced water. The CSG will pass through a steel pipe before being flared. Data logging will take place to record the amount of CSG produced from the wells. It is anticipated that CSG will be produced at 500 l/sec rate.
- Currently, Peabody estimates water production rates of 20 kilolitres (kL) per day over the operational life of the well.
- Report on Surface to Inseam (SIS) well performance at North Goonyella (Weisstech, 2023) demonstrates that production effectively ceased at four production locations before the 800th day online, indicating that CSG production per bore will likely be less than 800 days. As a conservative assumption, the following prediction of impact is based on well life of 800 days. Analytical model runs extended to t = 1200 days.

6.7.3 Prediction of Impacts

The following subsections detail the potential groundwater impacts as a result of the activities described in **Section 3.0**. Impacts may result from the propagation of drawdown that results from the depressurisation of the target coal seam to groundwater receptors (**Section 6.7.1.3)**. The prediction of drawdown impacts has been investigated through analytical modelling of the hydrogeological environment outlined above, with conservative estimates of input parameters selected to inform the assessment of risk.

The analytical assessment of the Project activities has aimed to adopt an overly conservative approach to offset some of the limitations of the simple representation of the hydrogeological setting.

A risk-based assessment of these potential impacts is detailed in **Section 6.7.4**.

6.7.3.1 Analytical Modelling

The proposed well field was represented using MLU (Multi Layer Unsteady) (Hemker and Post, 2012), an aquifer testing software that computes drawdown within layered aquifer systems. Analytical model represented the proposed activities discussed above as:

- 13 vertical wells, and 10 lateral wells, distributed across the Project Area targeting the GM seam near the base of the Moranbah Coal Measures.
- Initial pumping period involving depressurising the coal seam by approximately 4 mH_2O per day for 90 days, followed by CSG extraction. Model results are presented below for up to 1200 days to include some recovery period representation. A conservative assumption is included that all production bores are operating simultaneously, which will increase the predicted drawdown.
- Estimated water production rate of 20 kilolitres per day (kL/day) for the life of the bores.

The detail of these inputs is discussed in subsequent sections.

Model Inputs

Model Layers

Model aquifer/aquitard layers were based on geological logs of monitoring in the Project Area (MB08 and MB09 bore logs) as well as the geological model and a conceptual understanding of the surrounding area. A thin unit representing surficial Tertiary/weathered basalt regolith was represented at the surface, comprising tertiary sediments although not a regionally significant aquifer. Below this is a basalt layer which is between 30 and 150 metres thick near the production well field. This unit is underlain by Permian overburden between 300 and 150 m thick in this area, comprising interbedded siltstone, claystone and coal seams.

The model development process included evaluating different scenarios where the thicknesses of Basalt Aquifer and Overburden Aquitard was varied between 50 and 200 metres to gauge the sensitivity of predicted impacts in the basalt to the thickness of intervening overburden. The results of this basic sensitivity analysis are outlined below. A consolidated thickness of 7 metres was used for the target coal seam.

The basal unit of the model is taken to be the Back Creek Group contact underneath target coal seams. For the purposes of simplifying the model, and as a conservative assumption, there is no vertical flow component upwards from the basal unit to the target coal seam. This is considered appropriate as the back Creek Group at this depth is not likely to be a significant groundwater contributor, and this has the effect of focusing groundwater flow within the target aquifer (and the overlying aquifer/aquitards).

Hydraulic Parameters

Hydraulic conductivities were based on test data summarised in **Section 6.7.1.1**. Permeability values provided by the client in millidarcies for nearby CSG projects were not used as this is a pressure dependant quantification of material flow capacity that is incompatible with this analytical modelling method. As displayed in **Table 6.30**, a range of vertical hydraulic conductivities between 0.001 and 0.00001 were tested, with variable aquifer thickness to assess the sensitivity interaction between the basalt aquifer and target coal seam. Horizontal conductivity for the Basalt was taken to be 2 m/day as a conservatively high point within the range of site-specific hydraulic testing for this unit. Coal seam horizontal conductivity and storativity was refined to produce the anticipated production well drawdown curve, under the pumping regime that is outlined above. This is considered an appropriately conservative value in the higher range of hydraulic testing data for this unit.

Storage values for the shallow basalt and Tertiary layers were selected based on mid-point values from pumping tests carried out at PB01, PB02 and PB03, as presented in Golder (2021). No storage values were available in the previous studies for the Permian overburden

or coal seams. Coal seam storage was selected based on re-producing planned drawdown rate with anticipated pumping volumes discussed below. Overburden storage values were aligned with the coal seam estimate as a conservative assumption, with values in the mid-point of typical range (Fitts, 2012).

Pumping Stress Periods

The pumping arrangement was modified from the design locations due to the need to represent groundwater extraction along the length of the horizontal coal seam wells. Hence, the collar positions of some vertical production wells were moved to a mid-point along the trace of the lateral well connecting to them. These new locations, (termed image bores) were used along the path of lateral wells to simulate the distributed extraction and avoid over-localisation of drawdown at the clustered vertical production well points. Note that two locations (indicated as Approved VPB in **Image 6.5**) are vertical production wells that will be drilled within existing approved disturbance area. These are included in modelling due to likely interaction between the drawdown induced at these locations and the proposed disturbance for approval.

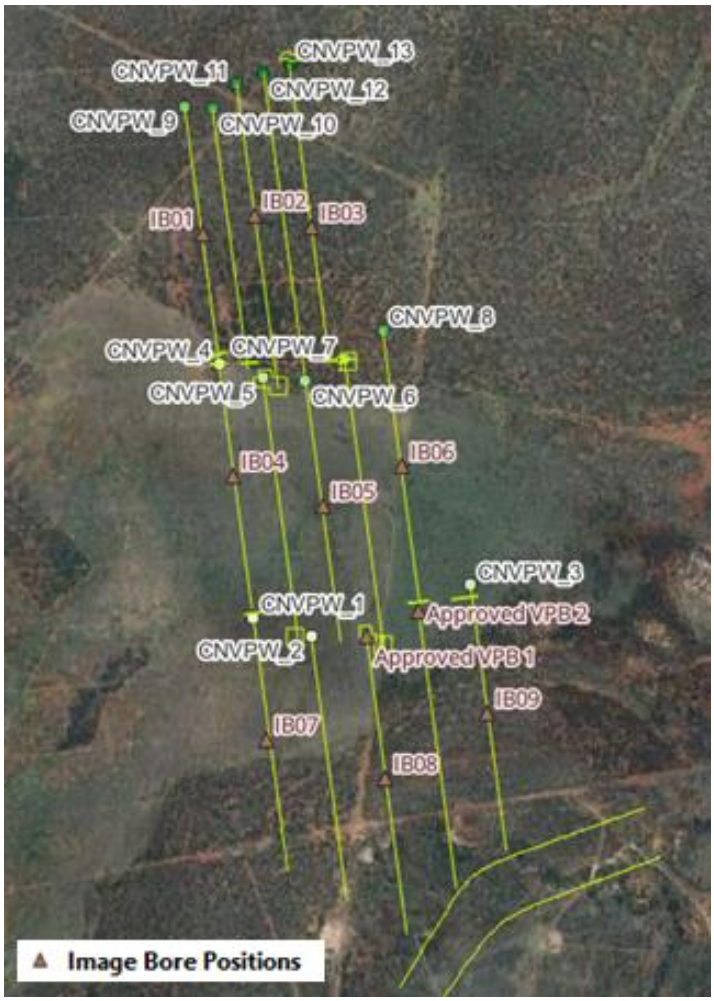


Image 6.7 Bore locations with designed vertical production well collar locations

Pumping stress periods were defined based on:

- Communication from Peabody is that hydrostatic pressure within the bores will be reduced at 40 kilopascals per day (kPa/day), approximately 4 mH2O (metres of water head), for 90 days.
- Estimated water make for the production well field, provided by Peabody is approximately 20 kilolitres per day (kL/day), averaged over the production life of the wells.

Observation bores positioned within 10 metres of the active vertical production wells were used to approximate an initial high water production period, as groundwater levels are lowered to the CSG production pressure. Extraction rates between 20 L/sec (1753 kL/day) and 0.2 L/sec (20 kL/day) were tested for this period, with the best re-production of planned drawdown occurring at approximately 0.58 L/sec (50 kL/day) In practice, the well then transitions to CSG production, with lower water production as piezometric pressure is maintained constant and gas flow is primary discharge from the wells. This was represented conservatively by using the average water production estimate of 20 kL per day.

Table 6.29 Pumping stress periods used in model

Stress Period	Starting Time (days)	Pumping Rate (kL/day)
1	0	50
2	90	20
3	800	0

Base Case

For the base case scenario, model layers were aligned with general geological information as described above. Hydraulic conductivity data selected, aquifer model layout and parameterisation are shown in **Table 6.30** and **Image 6.6**.

Table 6.30 Model aquifer layering and hydraulic parameters

Layer	Thickness (m)	Vertical Conductivity (m/day)	Horizontal Conductivity (m/day)	Storativity (-)	Justification Assumptions
Regolith	5	0.01	-	0.001	• Little to no regolith influence on pumping arrangement or groundwater utilisation • Hydraulic parameters per Golder (2021)
Basalt Aquifer	**Range**: 50 to 200 **Base Case**: 50	-	2.0	0.0001	• Thickness varied to test sensitivity. Thick and thin areas present on site. • Relatively high hydraulic conductivity used as conservative assumption (Golder 2021) • Middle order-of-magnitude storage value used from pumping test data (Golder 2021)
Claystone/Siltstone/Sandstone Overburden	**Range**: 50 to 275 **Base Case:** 250	**Range**: $1x10^{-4}$ to $1x10^{-6}$ **Base Case**: 1 $x10^{-4}$	-	0.0001	• Thickness varied to test sensitivity. Thick and thin areas present on site. • Hydraulic conductivity range from Golder (2021). Sensitivity analysis applied to K_v. Base case uses upper range as conservative assumption • No storativity data from previous studies, estimate derived from literature values (Fitts, 2002)
Permian Coal Measures	7	-	**Range**: $3x10^{-1}$ to $1x10^{-6}$ **Base Case**: $1x10^{-2}$	0.0005	• Hydraulic conductivity data presented per Golder (2021) • Hydraulic conductivity and storativity values refined to produce anticipated drawdown response in production wells. Correspond to upper range of reported conductivity in this unit, therefore appropriately conservative • No storativity data from previous studies
Siltstone Underburden	30	0.0		0.0	• Basal unit, assumed impermeable

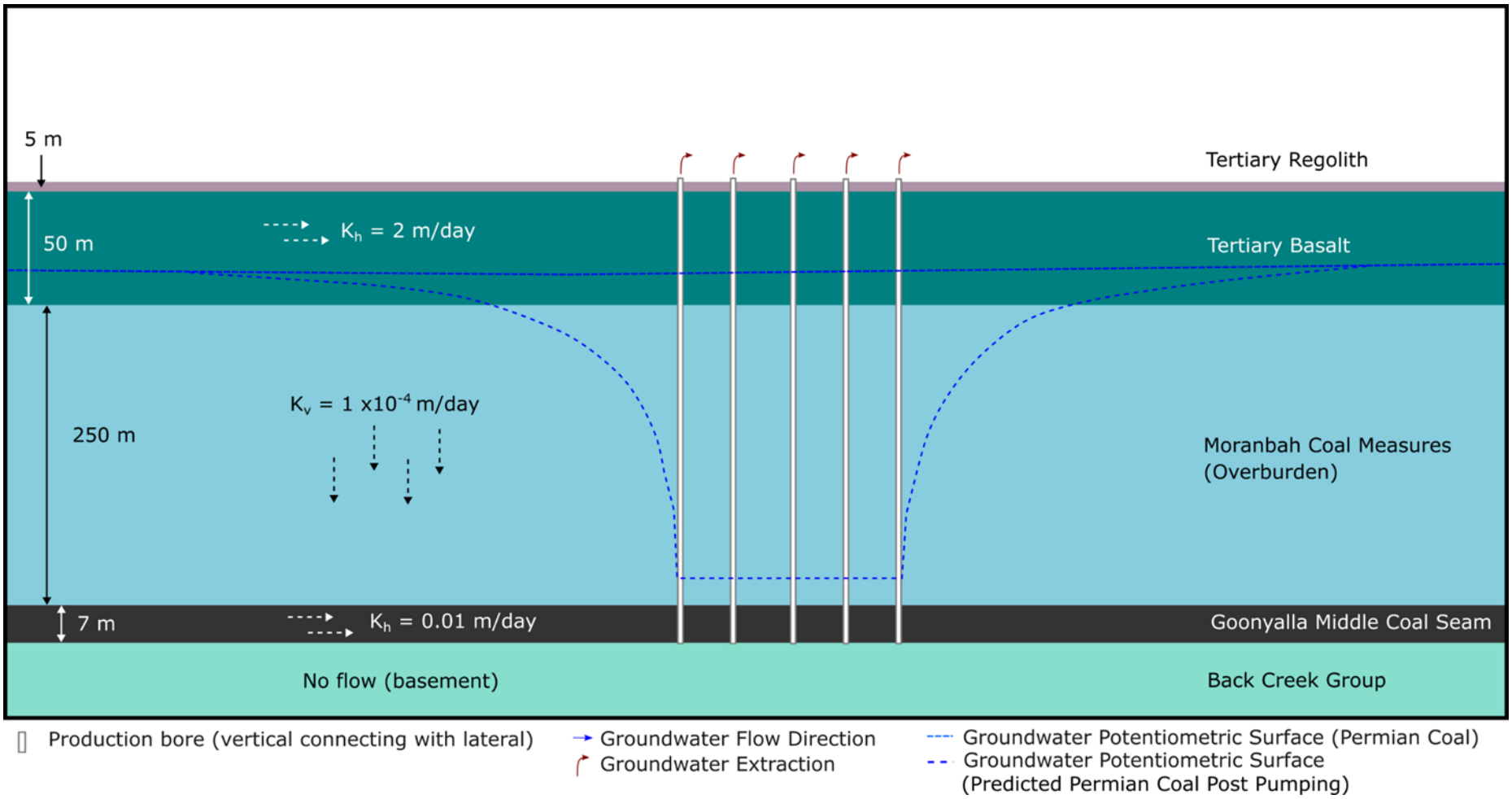


Image 6.8 Analytical model layout and base case diagram

6.7.3.2 Results

Drawdown predictions from the analytical model are presented as hydrographs in **Image 6.7** and **Image 6.8**. **Image 6.7** shows drawdown observations at CNVPW6, a centrally located vertical production well. High drawdown in initial pumping period stabilises once target drawdown has been attained. **Image 6.8** depicts water level response in the basalt adjacent to CNVPW_6, together with predicted impacts at the location of landholder bores in the overlying basalt aquifer. Predicted coal seam drawdown contours for t = 800 days are presented in **Figure 6.24**.

Observed drawdown in the shallow aquifer, is negligible i.e. <0.02 m. No drawdown is observed in the basalt aquifer at three of the closest potential water supply receptors. Coal seam drawdown is pronounced in the immediate area of the production bores, however horizontal drawdown propagation (**Figure 6.24**), is relatively limited, within 1 kilometre of the production well field.

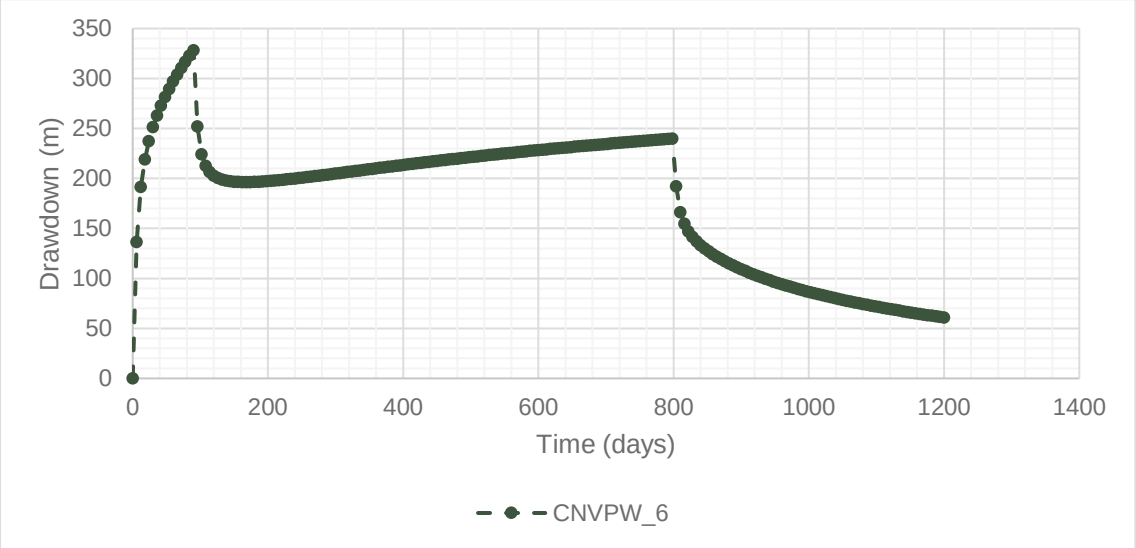


Image 6.9 Predicted drawdown in the target coal seam at the production well field

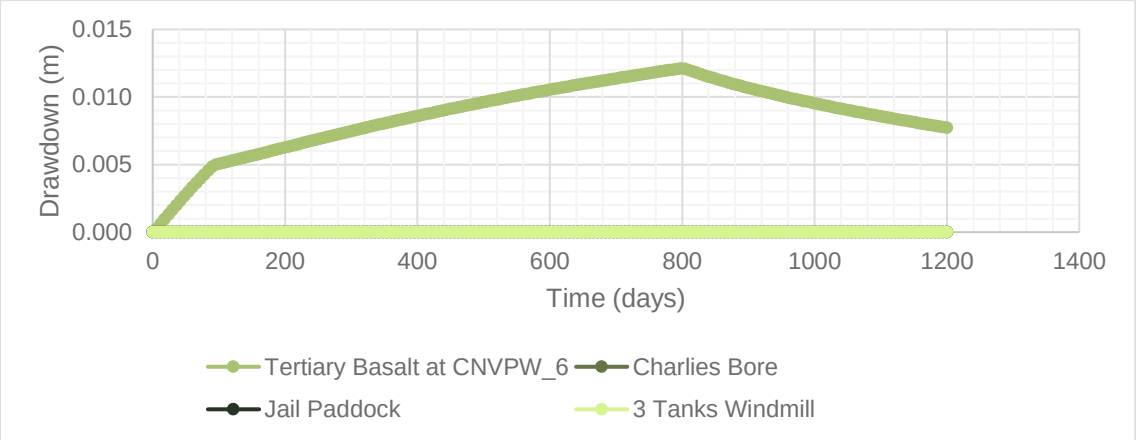
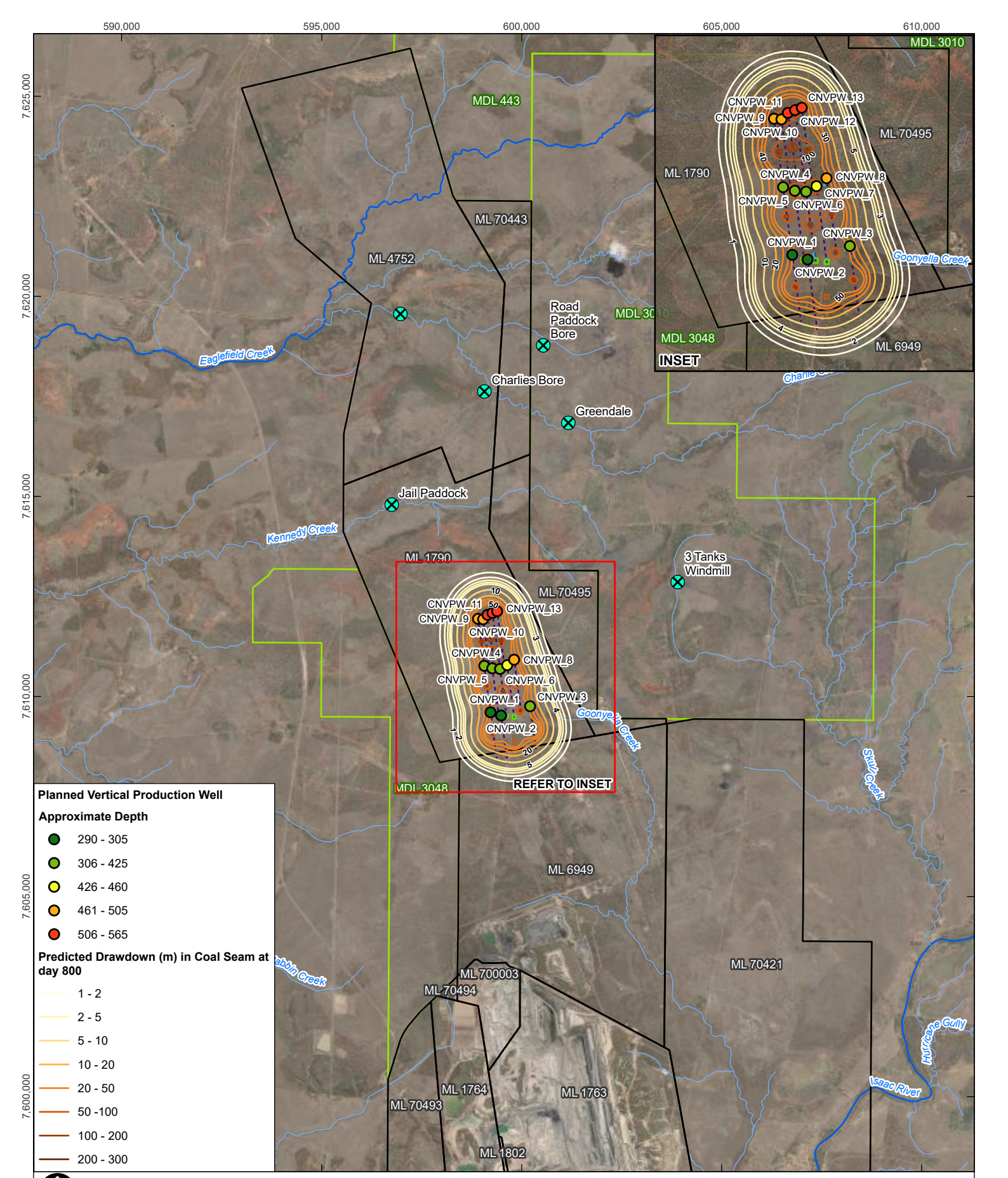


Image 6.10 Predicted drawdown in the shallow aquifer observation bores, basalt aquifer at the production well field, and nearby landholder bores


590,000
595,000
600,000
605,000
610,000
7,625,000
7,620,000
7,615,000
7,610,000
7,605,000
7,600,000
MDL 3010
MDL 443
ML 70495
ML 1790
ML 70443
ML 4752
MDL 3048
INSET
ML 6949
Road Paddock Bore
Charlies Bore
Greendale
Jail Paddock
3 Tanks Windmill
Eaglefield Creek
Kennedy Creek
Goonyella Creek
Skuy Creek
Hurricane Gully
Isaac River
ML 70421
ML 700003
ML 70494
ML 1764
ML 1763
ML 70493
ML 1802
CNVPW_11
CNVPW_13
CNVPW_9
CNVPW_12
CNVPW_10
CNVPW_4
CNVPW_8
CNVPW_7
CNVPW_5
CNVPW_6
CNVPW_3
CNVPW_1
CNVPW_2
REFER TO INSET
Planned Vertical Production Well
Approximate Depth
290 - 305
306 - 425
426 - 460
461 - 505
506 - 565
Predicted Drawdown (m) in Coal Seam at day 800
1 - 2
2 - 5
5 - 10
10 - 20
20 - 50
50 -100
100 - 200
200 - 300
0 1 2 km
Coordinate System: GDA2020 MGA Zone 55
Scale: 1:120,000 at A4
Project Number: 620.041540.00001
Date Drawn: 10-Sep-2024
Drawn by: RB
LEGEND
Bore Census Water Supply Bore (AGE 2012)
Major Watercourse
Minor Watercourse
Mining Lease
Mineral Development Licence
Lateral Production Well Trace
Drill Pad
Access Track
EA AMENDMENT P-EA-100658735
PREDICTED DRAWDOWN IN COAL SEAM
SLR
DISCLAIMER: All information within this document may be based on external sources. SLR Consulting Pty Ltd makes no warranty regarding the data's accuracy or reliability for any purpose.
FIGURE 6.24
Path: H:\Projects-SLR\620-BNE\620-BNE\620.041540.00001 Centurion Early Works CSG extr\06 SLR Data\01 GIS\GIS\ArcPro\Centurion Early Works CSG\Centurion Early Works CSG.aprx\620041540_F06-24_Predicted Drawdown in Coal Seam

Sensitivity Analysis

The key impact of groundwater extraction for the purposes of this assessment is the propagation of depressurisation in the target coal seam propagating into the overlaying strata, specifically the basalt aquifer. Therefore, the sensitivity analysis focuses on interaction / connection between the basalt aquifer and the target coal seam. A range model inputs for the thickness and vertical hydraulic conductivity of the Permian overburden between the target coal seam and the basalt aquifer, and the thickness of the basalt aquifer, were tested. Parameter combinations and predicted drawdowns in the basalt aquifer are presented in **Table 6.31**. An observation point located at CNVPW_6, which is positioned at a central point in the Project Area, and observing the basalt aquifer was used to measure the predicted maximum drawdown after 1200 days of pumping. This location was selected as this is expected to be the point of maximum potential interaction, with the lowest coal seam pressures inducing leakage from the overlying layers.

Table 6.31 Sensitivity analysis of interburden vertical conductivity

	Vertical Hydraulic Conductivity of Overburden (m/day)	Basalt & Overburden Thickness (m)		
		200 / 50	150 / 100	50 / 250
Predicted Drawdown In Basalt at Production Bore Field (m)	Minimum: $1x10^{-6}$	0.0009	0.0005	0.0003
	Median: $1x10^{-5}$	0.008	0.004	0.002
	Maximum: $1x10^{-4}$	0.026	0.023	0.017

Predicted drawdown in the overlying basalt aquifer is negligible for all scenarios. A high overburden vertical hydraulic conductivity ($1x10^{-4}$ m/day) was selected to bring forward in the modelling process, reflecting a conservatively high value, on the upper estimates of potential vertical conductivity for the region. Basalt thickness of 50 m and overburden thickness of 250 m was selected as these represent values more in line with the geological information for the production well field, and these combine for a reasonably conservative representation of the aquifer layout based on sensitivity analysis.

6.7.4 Risk Assessment

A risk assessment has been used to summarise the potential impacts on groundwater receptors arising from the Project activities based on a consideration of likelihood and consequence of potential risks being realised. The following were considered as part of the risk assessment:

- Brief description of the potential issue in terms of source > pathway > receptor.
- Description of the potential impact.
- Potential likelihood of the risk being realised.
- Potential consequence of the impact.
- Risk rating derived from likelihood vs consequence.

Descriptions of the categories that were used to rank the likelihood and consequence of potential risks being realised are provided in **Table 6.32** and **Table 6.33** respectively.

Table 6.32 Likelihood Categories

Likelihood	Basis of Rating
Highly Likely	Expected to occur
Likely	More likely to occur than not to occur
Possible	As likely to occur as not to occur
Unlikely	More likely to not occur than to occur
Highly Unlikely	Very unlikely to occur even in the long term

Table 6.33 Consequence Categories

Rating		Environmental	Reputational / Legal & Compliance
5	Severe	Widespread environmental damage or effect (permanent; >10 years)	Formal expression of significant dissatisfaction by government Sustained campaign by one or more international NGOs resulting in physical impact on the assets or loss of ability to operate Major litigation / prosecution at Glencore corporate level
4	High	Long term impact (2 to 10 years)	Broad societal concern and criticism Negative media coverage at international level resulting in a Corporate statement within 24 hours Investigation from government and/ or international (or high-profile) NGOs Negative impact on share price Major litigation / prosecution at Department level
3	Moderate	Medium term impact (<2 years impact)	Negative media coverage at national level over more than one day Local Stakeholder action resulting in national societal scrutiny Major litigation / prosecution at Operation level
2	Low	Short term impact (<1 year)	Negative local/ regional media coverage Complaint received from an internal or external stakeholder Regulation breaches resulting in fine or litigation
1	Negligible	No lasting environmental damage or effect	Negligible media interest Regulation breaches without fine or litigation

The risk rating for each potential impact was determined by combining the likelihood and consequence of a risk being realised. The modelling predictions allow quantification of the likelihood of drawdown impacts occurring. The likelihood vs consequence risk assessment matrix is presented in **Table 6.34**.

Table 6.34 Risk Ranking Matrix

		Likelihood				
		Highly Unlikely	**Unlikely**	**Possible**	**Likely**	**Highly Likely**
Consequence	**5**	Moderate	Moderate	High	High	High
	4	Low	Moderate	Moderate	High	High
	3	Low	Low	Moderate	Moderate	High
	2	Insignificant	Low	Low	Moderate	Moderate
	1	Insignificant	Insignificant	Low	Low	Low

The risk assessment summary is presented in **Table 6.35**.

The risk of significant impacts to groundwater receptors from the proposed limited CSG development are considered to be low to negligible. Note that the conclusions discussed here are subject to the assumptions and exclusions outlined in **Section 6.7.5**.

Table 6.35 Risk assessment summary

Source	Pathway	Receptor	Potential Impact	Consequence	Likelihood	Risk
Depressurisation of the target coal seam at depth below the basalt aquifer for the purpose of CSG production	Upward propagation of drawdown from the depressurised coal seam through the overburden into the basalt aquifer	Landholder bores	Drawdown impacts at landholder bores – loss of yield	**Moderate**: loss of water source for landholder, reputational risk for operator.	**Highly unlikely**: modelling predicts no significant drawdown in the basalt at landholder bore locations.	**Low**
		Aquatic and terrestrial GDEs	Drawdown reaches potential terrestrial GDEs which are dependent on the saturated water table rather than shallow perched water tables. Decline in health or loss GDE	Ecological field surveys (**Section 6.6**) identified that terrestrial GDE are not present within the Study Area. Therefore, assessment of risk is not required.		**N/A**
		Watercourses	Drawdown impacts reach creek locations and reduce baseflow.	**Negligible**: The creeks are ephemeral and not supported by baseflow and so a reduction in basalt groundwater levels could not affect creek flows.	**Highly unlikely**: The local watercourses are ephemeral, flowing only in response to heavy rainfall and runoff events. There is no baseflow to the creeks and so a reduction in groundwater levels beneath isolated creek reaches can have no effect on creek flow. In addition, drawdown impacts in the basalt are considered negligible.	**Negligible**
Contaminant release through drilling or water storage activities	Hydraulic gradient away from disturbance activities, either in deep aquifer through production bores,	Landholder bores	Unable to use water for domestic or stock purposes	**Moderate**: loss of water source for landholder, reputational risk for operator.	**Highly unlikely**: No fracking to be conducted, therefore hydraulic gradient will be towards production well. Appropriate post-production rehabilitation and decommissioning to be taken to mitigate long-term risk.	**Low**

Source	Pathway	Receptor	Potential Impact	Consequence	Likelihood	Risk
	or shallow aquifers through surficial infiltration				Additionally, surface water controls are to mitigate contaminant release potential at surface.	
		Aquatic and terrestrial GDEs	Harm to water reliant ecosystems	Ecological field surveys (**Section 6.6**) identified that terrestrial GDE are not present within the Study Area. Therefore, assessment of risk is not required.		**N/A**
		Watercourses	Harm to water reliant ecosystems	**Negligible:** The creeks are ephemeral and not supported by baseflow and so a reduction in basalt groundwater levels could not affect creek flows	**Highly unlikely:** The local watercourses are ephemeral, flowing only in response to heavy rainfall and runoff events. There is no baseflow to the creeks and so a reduction in groundwater levels beneath isolated creek reaches can have no effect on creek flow. In addition, surface water controls are to mitigate contaminant release potential	**Negligible**

6.7.5 Limitations

The analytical modelling has adopted a conservative approach and included a sensitivity analysis to assess the outcome of high vertical conductivity in the overburden and reduced thickness of overburden in order to compensate for potential limitations.

As with an analytical model, this method is subject to simplifying assumptions (outlined in Carlson and Randall, 2012) including:

- All layers are of infinite horizontal extent.
- All aquifer layers are homogeneous and isotropic with respect to transmissivity and storativity.
- All aquitard layers are homogeneous with respect to vertical resistance and storativity.
- Darcy's law is valid, except for turbulent flow near well screen.

6.8 Surface Water

This section presents the assessment of Project related surface water impacts to environmental values.

6.8.1 Existing Environmental Values

The environmental values associated with surface water for this Project are downstream aquatic ecosystems, farm water supply, stock watering, drinking water supply, industrial use and cultural values.

Aquatic environmental values are not present in the Study Area or immediate surrounds and accordingly, there are unlikely to be any aquatic ecosystem environmental values associated the Study Area. Refer to **Section 6.5** for further details on aquatic ecology.

6.8.1.1 Land Use

The predominant land use in the Study Area comprises relatively natural environments, including grazing, native vegetation (99%) and localised areas of residential homesteads and farm infrastructure.

6.8.1.2 Protected Areas

The nearest protected area is Homevale National Park which is located approximately 60 km to the east of the Project Area. This Park is not hydrologically connected to the Project Area.

6.8.1.3 Regional Drainage

The Project Area is located within the Burdekin Basin water management area with the Fitzroy Basin immediately adjacent to the southeast.

There are no mapped creek systems within the Project Area. The mapped head of Goonyella Creek, a stream order 1 watercourse, is approximately 1 km to the east of the Project Area and runs east before heading south before joining into Isaac River in the Fitzroy Basin water management area. Kennedy Creek, a stream order 2 watercourse, is approximately 2.3 km to the north of the Project Area and runs east and discharges towards the Suttor River, which is situated to the west of the Project Area in the Burdekin Basin water management area. The mapped head of Gum Tree Creek is approximately 2 km southwest of the Project Area and drains westward, again discharging towards the Suttor River, shown in **Figure 6.25.** The mapped head of Goonyella Creek, a stream order 1 watercourse, is approximately 1 km to the east of the Project Area and runs east before heading south before joining into Isaac River in the Fitzroy Basin water management area. Kennedy Creek, a stream order 2 watercourse, is approximately 2.3 km to the north of the Project Area and runs east and discharges towards the Suttor River, which is situated to the west of the Project Area in the Burdekin Basin water management area. The mapped head of Gum Tree Creek is approximately 2 km southwest of the Project Area and drains westward, again discharging towards the Suttor River, shown in **Figure 6.25**.

These creeks are ephemeral waterways, meaning that there is extreme variability in both water quality and volume as a natural part of the water system. A ‘typical’ year could see local waterways dry from March through to November, intermittently flowing or flooding following high intensity rainfall events between November - March, with this flow slowing and developing into pools of stagnant water that slowly dry out until the more typical dry conditions return.

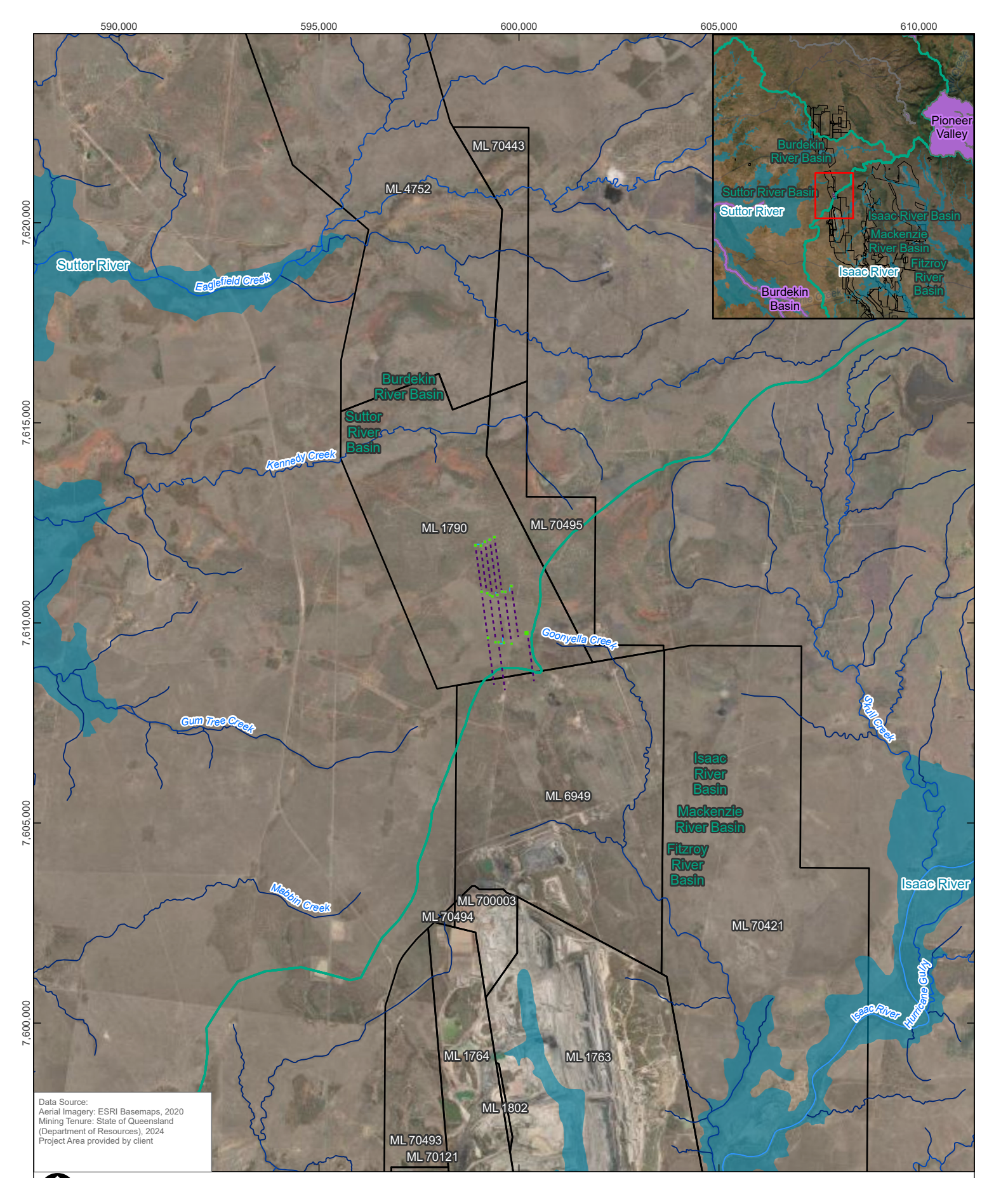
Streamflow gauging stations are sparsely distributed in the region, and none are located near the Project Area. The nearest gauging station is on the Suttor River at Eaglefield (# 120304A) approximately 30 km to the northwest. Details of flow volumes at this gauging station are provided in **Table 6.36**. This data demonstrates the ephemeral nature of this river and by proxy, the nearby creek systems. The catchment area for this gauging station is approximately 1,915 km^2. In comparison the total drill pad area is approximately 0.12 km^2.

For ungauged catchments in the region, peak streamflow discharges can be estimated using empirical techniques, as recommended in Australian Rainfall and Runoff 2019.

Table 6.36 Suttor River at Eaglefield: flow volume summary (ML)

	Daily				Monthly
	Max	Min	Mean	Median	Mean
Jan	70,286	0	669	4	20,748
Feb	110,991	0	1,054	13	29,802
Mar	110,328	0	554	5	17,178
Apr	34,107	0	116	0	3,423
May	59,461	0	110	0	3,412
Jun	6,600	0	20	0	614
Jul	5,978	0	17	0	519
Aug	13,300	0	9	0	276
Sep	2,085	0	3	0	85
Oct	5,314	0	11	0	336
Nov	22,768	0	114	0	3,413
Dec	48,444	0	502	0	15,547
All months	110,991	0	263	0	7,974

https://water-monitoring.information.qld.gov.au/



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 1 2 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:120,000 at A4
Project Number:	620.040594.00001
Date Drawn:	10-Sep-2024
Drawn by:	RB

LEGEND

Stream Order

- 1
- 2
- 3
- 4
- 6

- Lateral Well Length
- Drill Pad
- Access Track
- Potential Flood Hazard Area
- River Basin
- Surface Water Management Area

EA AMENDMENT P-EA-100658735

REGIONAL DRAINAGE

SLR

FIGURE 6.25

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_SW_F06-25_Regional Drainage

6.8.2 Potential Impacts

Potential surface water impacts as a result of the activities described in Section 3 include:

- Clearing for access track and drill pads will affect runoff regimes locally.
- Surface water contamination from chemical spills, leaks from gas wells and improper management of wastewater.

A risk-based assessment of these potential impacts is detailed in **Table 6.37** and determined that surface water impacts are low due to the scale and location of the proposed activities described in **Section 3.0**.

6.8.3 Management Practices

The potential impacts to the surface water resulting from Project activities outlined in **Section 3.0** will be managed through practices currently employed at CCM. The following management and mitigation measures will be implemented to minimise and/or prevent unauthorised harm to environmental values from the Project:

- Operation water management and control measures associated with potential pollutant and contaminant sources will be maintained to prevent uncontrolled discharge to surface waters. This includes:
    - Bunding and appropriate storage of fuels and other hazardous and flammable materials will be undertaken in accordance with AS1940:2004, and where practical, will be located away from any waterbodies.
    - Provision of spill recovery equipment will be available and located with construction crews conducting activities with the potential for significant spills.
- Water extracted during operations will be contained in water tanks located on drill pads and will be trucked to CCM for treatment and integration into the mine water system.
- Erosion and sediment control monitoring should be implemented to reduce the amount of sediment laden run-off entering downstream waterways. The following general principles apply:
    - Minimise the surface disturbance areas.
    - Where possible, apply local temporary erosion control measures.
    - As soon as practical, disturbed areas will be rehabilitated to reduce the extent of exposed soils.

6.8.4 Risk Assessment

The potential surface water impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6.37**.

The risk of surface water impacts is low. Any realised impacts will be low in comparison to the existing operations undertaken on ML1790.

Table 6.37 Surface water risk assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Sedimentation of surface waters result from erosion and surface water runoff from Project area	Possible	Minor	Low	Due to the minor scale and size of the Project activities, and the distance to the nearest creeks, this impact poses a low risk of environmental harm
Water and drilling muds contaminate surface waters	Unlikely	Low	Low	Due to the minor scale and size of the Project activities, and the distance to the nearest creeks this impact poses a low risk of environmental harm
Impact to EVs caused by contaminates	Unlikely	Low	Low	Due to the minor scale and size of the proposed activities, and the distance to the nearest creeks this impact poses a low risk of environmental harm

6.9 Waste

This section presents the assessment of Project related waste management impacts to environmental values.

6.9.1 Existing Environmental Values

EVs relevant to waste management refer to the qualities or physical characteristics of the environment that support ecological health, public amenity, safety, or are otherwise defined under a declared environmental protection policy or regulation. The identified waste management EVs for the Project include:

- Air (refer to **Section 6.1**)
- Land resources (refer to **Section 6.4**)
- Terrestrial and aquatic ecological values (refer to **Section 6.5** and **Section 6.6** respectively)
- Groundwater (refer to **Section 6.7**)
- Surface water (refer to **Section 6.8**).

6.9.2 Potential Impacts

The following subsections detail the potential waste impacts resulting from Project activities as described in **Section 3.0**. The sections below outline the Project activities that are relevant to waste generation management. **Table 6.38** outlines the waste types which are likely to be generated by Project activities.

Table 6.38 Waste types anticipated from Project activities

Type of waste	Type	Nature
General: Waste that is not classified as regulated waste, as set out in schedule 9 of the *Environmental Protection Regulation 2019* and must be managed according to local council regulations and can be disposed of in designated landfills or through other authorized waste management services.	Putrescible – administrative and maintenance buildings	Solid
	General waste (non-regulated) generated from Project-related activities	Solid
	Green waste (vegetation)	Solid
	Soil (uncontaminated from topsoil removal)	Solid
Recyclable: Waste that can demonstrate a higher level of use in the waste management hierarchy such as reuse, reprocessing or recycling	Paper and cardboard – administrative and maintenance buildings	Solid
	Drink containers (such as aluminium cans and plastic bottles)	Solid
	Scrap steel	Solid
Regulated: Waste listed in Schedule 9 of the *Environmental Protection Regulation 2019,* requiring specific handling and disposal control defined by legislation to manage associated risks to the environment (may also be recyclable)	Hydrocarbon waste – waste oils, solvents and greases, water emulsions, oil filters, oily rags, oil interceptor sludges, and oil and grease drums	Liquid/ Solid
	Light and heavy vehicle tyres	Solid
	Batteries	Solid
	Other regulated waste (such as paint tins and aerosol cans)	Solid
	Sewage and sewage sludge	Liquid/solid
	Water from dewatering activities (produced/ formation water)	Liquid with fine particulates
	Drill cuttings and drill fluid additives	Solid

6.9.2.1 Access Tracks

Site clearance activities for the establishment of new access tracks will comprise the removal of existing minor surface structures or material (such as boulders or fencing if present). Following removal, there will be vegetation clearing (tress, bushes, and grasses) and stripping and removal of topsoil.

Potential waste impacts associated with site clearance in the construction and rehabilitation and closure phase will include:

- Generation of organic waste which if not properly managed, may decompose on-site attracting pests or impact local ecology.
- Improper waste disposal of organic material, example by burning, can result in air pollution and increase in particulate matter emissions (refer to **Section 6.1**).
- Removal of vegetation will result in increased erosion and dust (refer to **Section 6.1** and **Section 6.4**).
- During the operation phase, minimal impacts are anticipated because clearance will occur for maintenance purposes. Potential generation of organic waste which is not properly managed may decompose on-site attracting pests or impacts local ecology.

6.9.2.2 Vertical and Lateral Well Operation

The construction and operation of the vertical and lateral wells comprise vegetation clearance, stripping and removal of topsoil (for the drill pads and wells), installation of casing, pipelines, and wellheads, which can generate waste. In addition to this, the drilling activities involve creating both vertical and lateral wells, which generate various forms of waste which may impact soil and water quality.

Potential waste impacts associated with Project activities in the **construction phase** includes:

- Generation of organic waste, if not properly managed, may decompose on-site, attracting pests and negatively impacting local ecology. Additionally, improper disposal methods, such as burning, can contribute to air pollution through the release of particulate matter and other harmful emissions (refer to **Section 6.1** and **Section 6.4**).
- Potential for contamination of identified EVs due to improper disposal or management of generated waste, such as:
    - Sedimentation in surface waters from improper handling and management of topsoil.
    - Overflow or improper disposal of sewage from portable toilets.
    - Contamination from improper disposal drilling mud and rock cuttings or spills from cement, lubricants, and other chemicals used during well construction.
- Potential for contamination of identified EVs due to accidental spillages or improper management of equipment, such as:
    - Accidental spillages or leakages due to improper storage of chemicals or transfer of waste products.
    - Hydrocarbon leakages from unmaintained equipment.

- Increased generation of gaseous waste from vehicular movement and operation (refer to **Section 6.1**).

Potential waste impacts associated with CSG extraction activities in the **operation phase** includes:

- Potential for contamination of identified EVs due to improper disposal or management of generated waste, such as:
  - Putrescible & organic (food waste) leading to the introduction of nuisance pests and vermin.
  - Accidental overflow of sewage from administration buildings.
  - Accidental spillages or leakages due to improper storage of chemicals used for maintenance of equipment.
  - Hydrocarbon spillages or accidental leaks from equipment.

Potential contamination of water resources due to improper management of wastewater, including the risk of overflow of produced water from dewatering activities and spillage during the transfer of produced water by truck to CCM facilities.

Potential contamination of identified EVs due to improper disposal of produced water, such as uncontrolled releases.

Potential waste impacts associated with CSG extraction activities in the rehabilitation and closure phase includes:

- Dismantling of infrastructure (where required) will generate large amounts of solid wastes.
- Potential contamination of soil and water resources due to improper disposal or handling of materials, including:
  - Improper sealing of wells.
  - Residual contamination from inadequate cleaning of wells or pipelines.
  - Improper disposal of wastewater from dewatering activities.
  - Improper disposal of hazardous materials, such as fuel, oil, and cleaning chemicals used in equipment maintenance.

6.9.2.3 Power and Water

On-site diesel generators will be used for power generation. Water will be supplied via truck to drill pad locations, and water collection from the dewatering activities (from the wells) will be contained in holding tanks. Impacts related to produced water storage is provided as part of the Project activities (**Section 3.0**), other impacts are outlined below.

- The use of the diesel generator during the Project will result in waste in the form of particulate emissions affecting air quality (see **Section 6.1**).
- Operation of the generators may increase the risk of accidental spillages, or leaks of hydrocarbons (diesel), potentially contaminating identified EVs.
- There is a risk of contamination to land or surface water resources due to accidental spillages of hydrocarbon (fuels and oils) from water transportation by trucks.

6.9.2.4 Amenities

On-site amenities for workers will be located on the drill pads and will include a mobile office and workshop. Waste generation from the mobile office will include domestic solid waste, and sewage and greywater. The workshop is likely to generate hazardous waste (such as hydrocarbon materials from fuel, oils). Potential impacts associated with amenities include the following:

- Potential contamination of land and water due and increased risk of occurrence of pests and diseases due to improper handling, treatment or disposal of sewage and greywater.
- Potential contamination of identified EVs because of improper management of litter, causing windblown litter which may affect surface water quality or cause an increase pests which affect the local ecology.
- Potential contamination of surface water and land resources, and increased risk of pests due to improper storage and disposal of organic waste.
- Potential contamination due to accidental spillages, leakage of hazardous materials such as hydrocarbons fuels, oils, chemicals, detergents from the workshop operation.

A risk-based assessment of these potential impacts is detailed in **Table 6.39** and determined that waste impacts are low due to the scale and location of the Project activities.

6.9.3 Management Practices

The following principles, in preferential order, may be applied to management of waste for the Project:

- *Waste avoidance and minimisation* – includes practices that prevent or reduce the generation of waste. This can be achieved either by using products/processes that do not generate waste or products/processes, thus reducing the total volume of waste generated.
- *Waste reus*e – includes practices to re-use wastes without first substantially changing its form. Examples include recovering solvents, metals, oil and re-using them for a secondary purpose or substituting a waste for a virgin material in a production process.
- *Waste recycling* – includes treatment practices for waste that is no longer useable in its present form and using it to produce new products. This can be achieved by using products that can be recycled and then collected for storage and removal by a recycling company.
- *Waste disposal* – all waste generated as part of the Project activities must be disposed of ensuring compliance with Queensland's environmental legislation, particularly the *Environmental Protection Act 1994* and *Environmental Protection Regulation 2019* and should employ best practice approaches.

The potential impacts will be managed through current practices. These methods are used to mitigate impacts to waste, and include:

- Ensure personnel are trained and competent in waste identification, segregation, storage, and disposal activities.
- Segregate and classify all construction and operational waste for appropriate disposal according to Queensland's regulated waste guidelines.

- Implement containment measures and rapid response protocols to manage spills, preventing soil and water contamination.
- Use low-emission diesel generators and manage fuel waste, such as spent oils and filters, to minimize air and soil contamination.
- Minimize vegetation clearing to reduce green waste, overburden, and emissions from equipment use and decomposition.
- Maintain a procurement policy which encourages goods and services that reduce waste generation, substituting for more sustainable alternatives where feasible.
- Conduct routine preventative maintenance and inspections of plant equipment, wastewater containment structures, waste disposal locations, and workplaces.
- Store liquid waste (excluding CSG water and sewage) and periodically remove for disposal or recycling.
- Contained waste drilling fluids from drilling activities in properly lined storage tanks before re-use, recycling, treatment, or disposal.
- Store putrescible solid waste in covered containers to prevent odours, public health hazards, and access by fauna.

6.9.4 Risk Assessment

The potential waste impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6.39.**

The risk of waste impacts is low. Any realised impacts will be low in comparison to the existing operations undertaken at CCM.

Table 6.39 Waste risk assessment

Impact	Likelihood	Consequence	Risk Rating	Justification
Contamination of surface water or land resources	Unlikely	Low	Low	Due to the small scale of the project activities and the distance away for surface water resources, this impact poses a low risk of environmental harm. Proper storage and management of regulated wastes such as hydrocarbons and chemicals will minimise the risk of contamination and result in a low risk of environmental harm.
Generation of wastes from infrastructure and maintenance	Unlikely	Low	Low	Due to the small scale and size of Project activities, in the context of proper waste management and disposal, this impact poses a low risk of environmental harm.
Generation of litter and windblown waste	Unlikely	Low	Low	Given the small scale of the Project activities and the fact that there will be a minimal staff complement the generation of litter and windblown

Impact	Likelihood	Consequence	Risk Rating	Justification
				waste poses a low risk of environmental harm.
Increased prevalence of pests and vermin due to improper management of organic waste	Rare	Low	Low	Proper handling and disposal of waste material, and routine removal of organic waste will mitigate against the occurrence of pests and vermin. Additionally, waste generated by the small staff complement will be on a smaller scale, posing low environmental risk.

7.0 Conclusion

To obtain authorisation for the proposed Project activities, an amendment to:

- EA P-EA-100658735:
  - Condition 15 Schedule A
  - Condition 7 Schedule F
  - Condition 9 Schedule F, and
  - Condition 22 Schedule F.
- PRCP P-PRCP-100669070_V1:
  - Section B - Figure 1, and
  - Section C – (RA1) Rehabilitation area 1.

Assessment of air quality, GHG, noise and vibration, terrestrial ecology, aquatic ecology, groundwater, surface water, and waste management impacts resulting from Project activities are presented in the supporting report.

Risk assessments have determined that the changes proposed pose a low risk of causing environmental harm/ nuisance beyond that authorised by the EA. This is attributed to the scale and location of the Project activities, and that these activities can be managed under the monitoring and compliance requirements of the existing EA and CCM management practices that will be applied to Project to minimise and/or prevent unauthorised harm to EVs from the Project.

An Assessment Level Decision (ALD) was received from the Department of Environment, Science and Innovation (DESI) on 1 October 2024. The ALD for this application considered that the proposed amendment to the environmental authority and PRCP schedule is a major amendment.

Subsequently, this environmental authority amendment application supporting report has been revised to address the issues raised in the Information Request receive from DESI on 1 November 2024.

8.0 References

AECOM Australia Pty Ltd (AECOM). (2015, June 26). Wards Well 1 and Lancewood 1 Wet Season Ecological Surveys—Memorandum.

AGE (2012). Wards Well Bore Census Data. Prepared for BHP Billiton. G1521A

Atlas of Living Australia. (2024). Atlas of Living Australia Occurrence Records (ALA). https://www.ala.org.au/

BHP Billiton Mitsubishi Alliance (BMA). (2014). Red Hill Mining Lease Environmental Impact Statement—Section 09 Terrestrial Ecology. https://eisdocs.dsdip.qld.gov.au/Red%20Hill%20Mining%20Lease/EIS/Section%2009_Terrestrial%20Ecology.pdf

BHP Billiton Mitsui Coal Pty Ltd (BMC), (2021). Progressive Rehabilitation and Closure Plan Wards Well Mine Environmental Authority: EPPR00668513. Report reference WW_PRCP_v1.0.

BHP. (2021). Progressive Rehabilitation and Closure Plan.

BHP. (2021). Progressive Rehabilitation and Closure Plan.

Bureau of Meteorology. (2019). The Groundwater Dependent Ecosystem Atlas (GDE Atlas) (Version 2.1) [Computer software]. Bureau of Meteorology.

Butler, D. W. (2007). Recovery plan for the “Brigalow (Acacia harpophylla dominant and co-dominant” endangered ecological community. Queensland National Parks and Wildlife Service.

Carlson, F. and Randall, J. (2012), MLU: A Windows Application for the Analysis of Aquifer Tests and the Design of Well Fields in Layered Systems. Groundwater, 50: 504-510. https://doi.org/10.1111/j.1745-6584.2012.00945.x

Cropper, S. (1993). Management of Endangered Plants. CSIRO Publishing.

CSIRO. (2024). Australian Soil Resource Information. Accessed 9/09/2024. https://data.csiro.au/collection/csiro:62790

Department of Agriculture, Water and the Environment (DAWE). (2022). National Recovery Plan for the Koala Phascolarctos cinereus (combined populations of Queensland, New South Wales and the Australian Capital Territory).

Department of Agriculture, Water and the Environment. (2022). Conservation Advice for Phascolarctos cinereus (Koala) combined populations of Queensland, New South Wales and the Australian Capital Territory. Department of Agriculture, Water and Environment. https://www.environment.gov.au/biodiversity/threatened/species/pubs/85104-conservation-advice-12022022.pdf

Department of Climate Change, Energy, the Environment and Water (DCCEEW). (2024). Species Profile and Threats Database. https://www.environment.gov.au/sprat

Department of Environment (DoTE). (2013). Draft Guidelines for Australia’s Threatened Orchids. Commonwealth of Australia.

Department of Environment and Heritage Protection (DEHP). (2014). Queensland Environmental Offsets Policy Significant Residual Impact Guideline. State of Queensland.

Department of Environment and Science (DES). (2018a). Monitoring and Sampling Manual: Environmental Protection (Water) Policy. Department of Environment and Science.

Department of Environment and Science (DES). (2018b). Regional Ecosystem Technical Descriptions for the Brigalow Belt Bioregion. Queensland Government. https://www.publications.qld.gov.au/dataset/re-technical-descriptions

Department of Environment and Science (DES). (2020). Flora Survey Guidelines—Protected Plants v.2.01. State of Queensland. https://www.des.qld.gov.au/policies?a=272936:policy_registry/gl-wl-pp-flora-survey.pdf

Department of Environment and Science (DES). (2021). Environmental Authority EPPR00668513.

Department of Environment and Science (DES). (2024). Australian Soil Resource Information System.

Department of Environment and Science. (2020). Flora Survey Guidelines—Protected Plants. State of Queensland.

Department of Environment, Science and Innovation (DESI). (2024). WildNet wildlife records [Dataset]. Department of Environment, Science and Innovation.

Department of Minerals and Energy (DME). (1995). Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland. Department of Minerals and Energy.

Department of Natural Resources and Mines (DNRM). (2001). Queensland Australian River Assessment System (AUSRIVAS) Sampling and Processing Manual. Department of Natural Resources and Mines.

Department of Natural Resources and Mines (DNRM). (2011). Strategic Cropping Land Standard consitions code for resource activities. Department of Natural Resources and Mines.

Department of Primary Indystries (DPI). (1993). Guidelines for the Identification of Good Quality Agricultural Land. Department of Primary Industries.

Department of Resources (DoR). (2018). Soils- Land Resource Assessment.

Department of Resources (DoR). (2023). Queensland geology regional web map service. Department of Resources.

Department of Resources (DoR). (2024). Vegetation management watercourse and drainage feature map (1:25000) – South East Queensland Version 6.00 [Map]. Department of Resources.

Department of Science, Information Technology and Innovation (DSITI). (2015). Guideline for the Environmental Assessment of Subterranean Aquatic Fauna. Queensland Government. https://www.publications.qld.gov.au/dataset/subterranean-aquatic-fauna/resource/ba880910-5117-433a-b90d-2c131874a8e6

Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC). (2011). Survey guidelines for Australia's threatened fish.

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). (2011a). Draft Referral guidelines for the nationally listed Brigalow Belt reptiles. Australian Government. https://www.agriculture.gov.au/sites/default/files/documents/draft-referral-guidelines-comment-brigalow-reptiles.pdf

Department of Sustainability, Environment, Water, Population and Communities (DSEWPC). (2011b). Survey guidelines for Australia's threatened reptiles. Australian Government. https://www.awe.gov.au/sites/default/files/documents/survey-guidelines-reptiles.pdf

Department of Sustainability, Environment, Water, Population and Communities (SEWPaC). (2013, February 26). Approved Conservation Advice for Dichanthium queenslandicum (king blue-grass). Department of Sustainability, Environment, Water, Population and Communities (SEWPaC).

Department of the Environment (DotE). (2013). Approved Conservation Advice for the Brigalow (Acacia harpophylla dominant and co-dominant) ecological community. Department of the Environment. http://www.environment.gov.au/biodiversity/threatened/communities/pubs/028-conservationadvice. pdf

Department of the Environment (DotE). (2015, September). Draft referral guideline for 14 birds listed as migratory species under the EPBC Act. Department of the Environment (DoE). https://www.dcceew.gov.au/sites/default/files/documents/migratory-birds-draft-referral-guideline.pdf

Department of the Environment, Water, Heritage and the Arts (DEWHA). (2010). Survey guidelines for Australia's threatened birds. Australian Government. https://www.awe.gov.au/sites/default/files/documents/survey-guidelines-birds-april-2017.pdf

Department of the Environment. (2022). Geophaps scripta scripta—Squatter Pigeon (southern) in Species Profile and Threats (SPRAT) Database. http://www.environment.gov.au/cgi-bin/sprat/public/publicspecies.pl?taxon_id=64440

DESI's Noise Measurement Manual (EPA 2020).

Doody, T. M., Hancock, P. J., & Pritchard, J. L. (2019). Information Guidelines Explanatory Note: Assessing groundwater-dependent ecosystems. Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment and Energy, Commonwealth of Australia.

DotE. (2014, April 29). Approved Conservation Advice for Denisonia maculata (Ornamental Snake). Department of the Environment (DotE).

Eamus, D., Froend, R., Hose, G., & Murray, B. (2006). A Functional Methodology for Determining the Groundwater Regime Needed to Maintain Health of Groundwater Dependent Vegetation. Australian Journal of Botany, 54, 97–114.

ESRI. (2020). Basemaps. Accessed 9/09/2024. https://support.esri.com/en-us/technical-paper/esri-data-maps-2000-325

Evans, K. (2000). Methods for assessing mine site rehabilitation design for erosion impact. Australian Journal of Soil Research, 38, 231–247.

Eyre, T. J., Ferguson, D. J., Smith, G. C., Mathieson, M. T., Venz, M. F., Hogan, L. D., Hourigan, C. L., Kelly, A. L., & Rowland, J. (2022). Terrestrial Vertebrate Fauna Survey Assessment Guidelines for Queensland (V. 4.0). Department of Environment and Science.

Fitts, C. R. (2002). Groundwater science. Elsevier.

Golder Associates, (2017). BHP Billiton Mitsui Coal Wards Well Water Management Options Assessment. Prepared for BMC, report reference 1668010-003-R-Rev1.

Golder Associates, (2020). Wards Well Mine - Progressive Rehabilitation and Closure Plan Hydrogeological Conceptual Model. Prepared for BMC, report reference 20360652-001-R-Rev0.

GTES Pty Ltd. (2006). BMA South Walker Creek Mine Surface Area 4, Soils and Land Suitability.

GTES Pty Ltd. (2006). South Walker Creek Mine Surface Area 4, Soils and Land Suitability.

Hemker, K., & Post, V. (2012). MLU for Windows. Well flow modeling in multilayer aquifer systems. Amsterdam.

Independent Expert Scientific Committee (IESC). (2018). Information guidelines for proponents preparing coal seam gas and large coal mining development proposals. https://www.iesc.gov.au/sites/default/files/2022-07/iesc-information-guidelines-may-2018.pdf

Laurance, W. F., & Yensen, E. (1991). Predicting the impacts of edge effects in fragmented habitats. Biological Conservation, 55(1), 77–92.

Queensland Government. (2013). Guidelines for Agricultural Land Evaluation in Queensland Second Edition.

Risk Assessment Education Resource (Mining Safety and Health Advisory Committee 2023)

SGM Environmental Pty Limited. (2024). Progressive Rehabilitation and Closure Plan - Centurion Mine.

SGM Environmental Pty Limited. (2024). Progressive Rehabilitation and Closure Plan – Centurion Mine.

Shields, P. G., & Williams, B. M. (1991). Land Resource Survey and evaluation of the Kilcummin Area, Queensland. Coorparoo: Queensland Department of Primary Industries.

SKM. (2012). Wards Well Soil Survey. Sinclair Knight Merz.

SKM. (2012). Wards Wells: Soil Survey Draft report.

State of Queensland. (2014). Act Guideline 08/14: how to demosntrate that land in the strategic cropping area does not meet the criteria for strategic cropping land.

Victorian Resources Online (VRO). (2021). Soil. Victorian Resources Online. Accessed 9/09/2024. https://vro.agriculture.vic.gov.au/dpi/vro/vrosite.nsf/pages/soil-home

Weisstech Pty Ltd. (2023) North Goonyella SIS North side Performance Review. July 2023

Appendix A Terrestrial Ecology and Aquatic Ecology Methodology to Identify Environmental Impacts

Environmental Authority Amendment Application Supporting Report

P-EA-100658735 and P-PRCP-100669070_V1

SLR Project No.: 620.040594

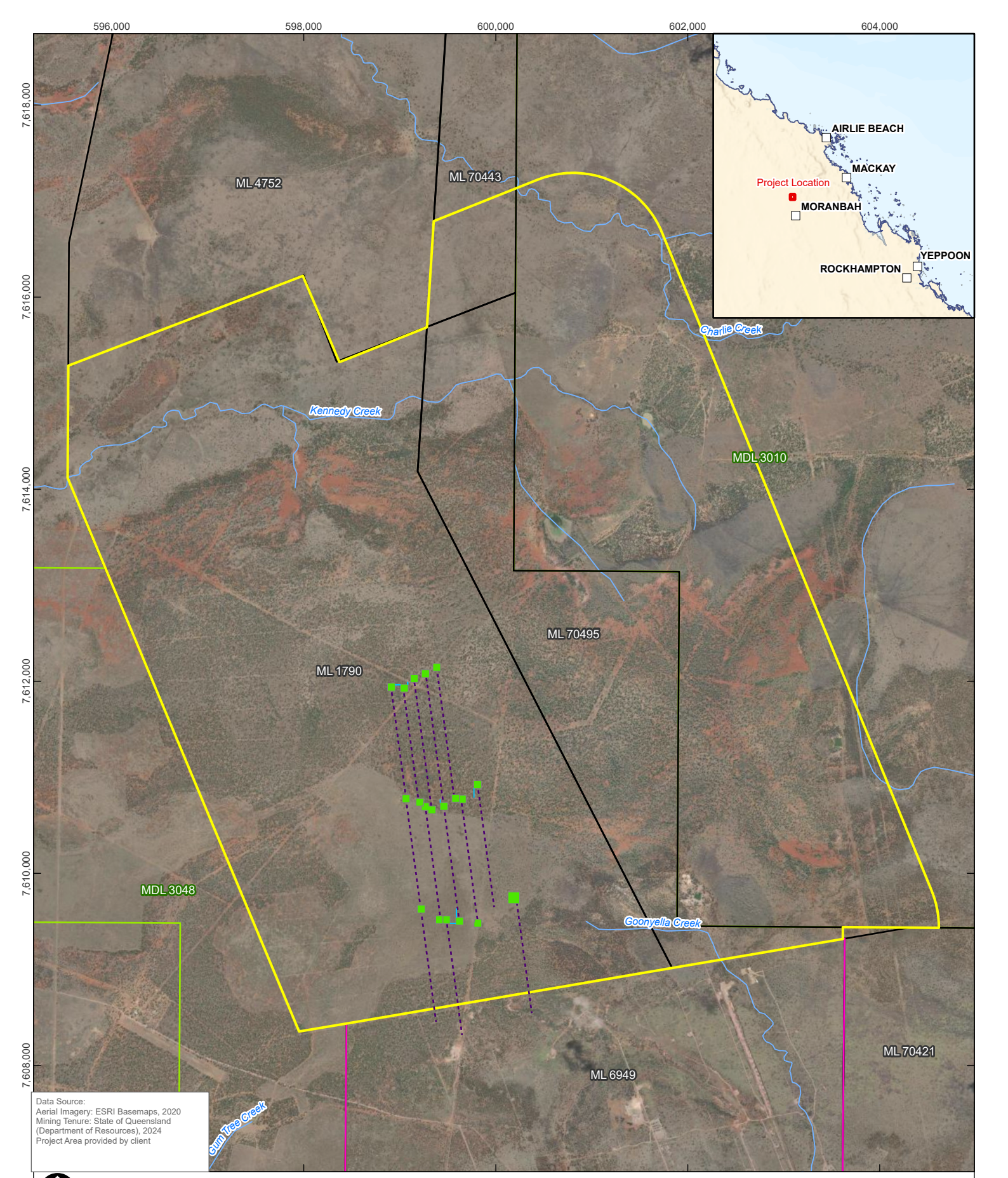
7 November 2024

Terrestrial Ecology Methodology to Identify Environmental Impacts

Terrestrial ecological assessments were undertaken by E2M Consulting Pty Ltd (E2M) within a broader Study Area encompassing the Project Area and surrounds located within MLs 1790, 70495 and 70443 and MDL 3010 (**Table A.1**). Within the Study Area, E2M have undertaken two field surveys; comprising a:

- 'Wet season' survey undertaken in mid-February 2024, and
- 'Dry season' survey undertaken in July 2024.

These surveys aligned with the optimal timing and were undertaken during suitable survey conditions for the identification of target Matters of National Environmental Significance (MNES) and Matters of State Environmental Significance (MSES) within the Study Area.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

LEGEND

- Watercourse
- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

ECOLOGY STUDY AREA

SLR

APPENDIX A.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_APP-A-01_Ecology Study Area

Flora Survey

Vegetation and flora surveys were undertaken to categorise vegetation groups and understand floristic diversity within the Study Area. Threatened ecological community (TEC) and threatened flora surveys were also undertaken to determine the presence of any Commonwealth and/or State listed entities within the Study Area.

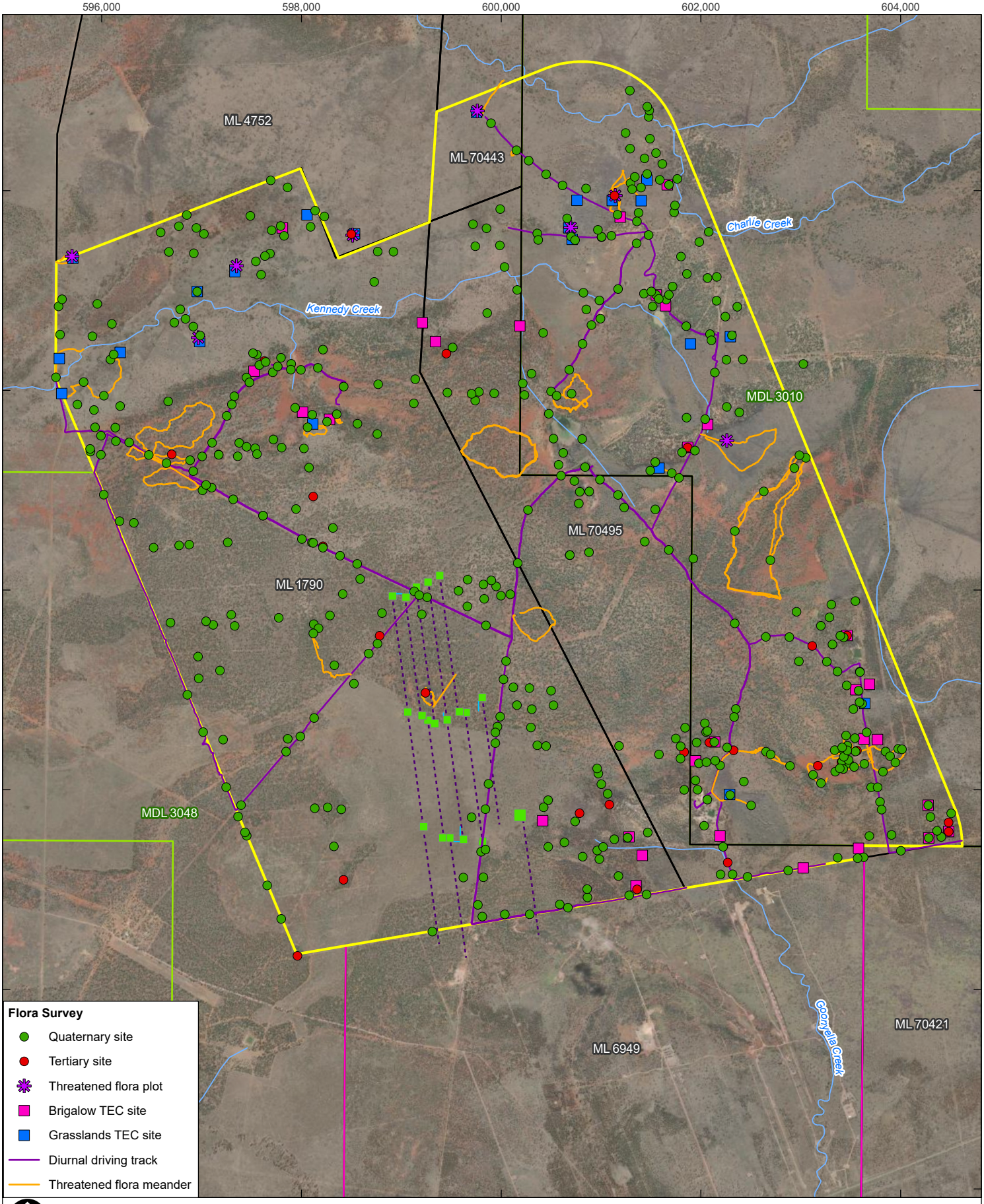
Regional Ecosystems

Ground-truthing and verification of vegetation community mapping within the Study Area was conducted in accordance with the methodology for surveying and mapping of regional ecosystems and vegetation communities in Queensland (Neldner et al., 2022). Tertiary and quaternary vegetation assessments were undertaken across the Study Area over the wet and dry season surveys as depicted in **Figure A.2** Tertiary assessments comprise comprehensive survey of flora species (by strata), relative abundance and overall vegetation structure, such as height and cover. Tertiary assessments are typically undertaken during wet season conditions with the emergence of annual herbs and grasses, which more accurately reflects species richness and composition. Quaternary surveys are a rapid assessment used to verify regional ecosystem (RE) based on the structure, composition and condition of the ecologically dominant layer.

Vegetation was categorised into three classes based on RE description, vegetation structure and condition. These categories comprised:

- Remnant vegetation - communities that conform with the definition under the *Queensland Vegetation Management Act 1999* (VM Act) and referenced by Neldner et al. (2022). Specifically, this comprises 'vegetation, part of which forms the predominant canopy of the vegetation:
    - Covering more than 50% of the undisturbed predominant canopy
    - Averaging more than 70% of the vegetation's undisturbed height, and
    - Composed of species characteristic of the vegetation's undisturbed predominant canopy.'
- Mature regrowth – vegetation communities that have previously been cleared but meet the broad floristics and structural characteristics consistent with a particular RE. Specifically, this comprises native vegetation regrowth that is greater than 15 years old and meets either the minimum cover or the minimum height requirements to be considered remnant vegetation.
- Non-remnant vegetation – all vegetation that is not mapped as remnant vegetation. This included:
    - Young woody regrowth: vegetation that contained species composition consistent with a particular RE, but failed to meet the undisturbed height and canopy cover consistent with that of remnant vegetation, and
    - Other vegetation: communities that have been historically cleared/disturbed or heavily modified (i.e. improved pastures, weed encroachment etc).

Where benchmark strata height and cover data was unavailable for a particular RE, information provided in the Regional Ecosystem Technical Descriptions for the Brigalow Belt (DES, 2018b) and vegetation formations defined by (Specht, 1970) were used to determine remnant height thresholds.



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

LEGEND

- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

FLORA SURVEY SITES

SLR

APPENDIX A.2

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_APP-A-02_Flora Survey Sites

Threatened Ecological Communities

In conjunction with tertiary and quaternary assessments, TEC assessments were undertaken to verify the presence and condition of EPBC Act listed TECs. The locations of TEC survey sites are depicted in **Table A.2**.

Specific condition criteria and characteristics used for the assessment are based on respective information provided within the listing advice published for each TEC. The following sections provide further details on the key diagnostic characteristics and condition thresholds assessed for each TEC assessed.

Brigalow (Acacia harpophylla dominant and co-dominant)

To determine whether a community meets the condition requirements of the Brigalow TEC (DotE, 2013), brigalow communities were assessed on whether they met the minimum thresholds pertaining to patch size and weed encroachment. Each community was also assessed on whether brigalow (*Acacia harpophylla*) was the dominant or co-dominant species within the tree layer. Using the recommendations of Butler (2007), vegetation communities of poor condition were excluded from the Brigalow TEC if they included any of the following characteristics:

- Where regrowth was less than 15 years old
- Had a patch size smaller than 0.5 ha, or
- The cover of exotic perennial plants was greater than 50%, assessed in a minimum area of 0.5 ha (100 m by 50 m).

E2M calculated the cover of exotic perennial plants for each structural layer. Exotic covers were then weighted by the percentage cover contribution of each structural layer to the RE, in accordance with published benchmarks (Queensland Herbarium, 2023), and summed.

Within Queensland, 16 REs are associated with the Brigalow TEC (DotE, 2013). Relevant Brigalow REs within the Study Area were assessed against the threshold criteria outlined in the approved conservation advice (DotE, 2013) to determine their status as the Brigalow TEC (see **Figure A.2**).

Semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions

The semi-evergreen vine thickets of the Brigalow Belt (North and South) and Nandewar bioregions TEC (SEVT TEC) is an extreme form of dry seasonal subtropical rainforest occurring on soils of high to medium fertility that is characterised by the presence of trees with microphyll size leaves, Brachychiton spp. in the emergent layer and thickets (TSSC, 2001).

Within the Brigalow Belt bioregion, this TEC comprises the following REs: 11.2.3, 11.3.11, 11.4.1, 11.5.15, 11.8.3, 11.8.6, 11.8.13, 11.9.4, 11.9.8 and 11.11.18 (TSSC, 2001).

An additional RE relevant to this assessment, RE 11.7.1x1 is also considered analogous to the SEVT TEC after its addition into the Regional Ecosystem Description Database in 2002, following the listing of this TEC (DCCEEW, 2024).

Natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin

The Commonwealth listing advice for the natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin (TSSC, 2009) characterises the community as containing a:

- Usually sparse or absent tree canopy (less than 10% projective crown cover)

- Shrub layer of less than 50% projected crown cover, and
- Dominance of perennial native grasses and the presence of at least three indicator native grass species outlined by the TSSC (2009b).

Within the Brigalow Belt bioregion, the Queensland Herbarium (2019) has defined the following REs as being associated with this TEC: 11.3.21, 11.4.4, 11.4.11, 11.8.11, 11.9.3, 11.9.12 and 11.11.17. Each community was assessed for whether they belong to at least one of these REs to determine whether it fits the classification of the TEC (TSSC, 2009).

Relevant REs must be a patch that is considered 'good quality' or 'best quality' to be classified as this TEC. The thresholds for defining these conditions are outlined in **Table A.1.**

Table A.1 Condition classes for the natural grasslands of the Queensland Central Highlands and northern Fitzroy Basin TEC

Criteria	Best quality	Good quality
Patch size	At least 1 ha.	At least 5 ha.
Grasses	At least 4 native perennial grass species from the list of perennial native grass indicator species.	At least 3 native perennial grass species from the list of perennial native grass indicator species.
Tussock cover	At least 200 native grass tussocks.	At least 200 native grass tussocks.
Woody shrub[1] cover	Total projected canopy cover of shrubs is less than 30%.	Total projected canopy cover of shrubs is less than 50%.
Introduced species	Perennial non-woody introduced species are less than 5% of the total projected perennial plant cover.	Perennial non-woody introduced species are less than 30% of the total projected perennial plant cover.
[1] The shrub layer is typically absent. However, where shrubs are present, they are defined as woody plants, more than 0.5 m tall that occupy the mid vegetation layer. The upper, or tree canopy layer, also is typically absent but may comprise scattered trees to less than 10% projective crown cover.		
Sampling would be based upon a quadrat size of 0.1 ha (e.g. 50 m x 20 m) selected in an area with the most apparent native perennial grass species. Unless exceptional circumstances apply, to maximise the assessment of condition, sites must be assessed during a good season, two months after cessation of disturbance (fire/grazing/mowing/slashing) and within two months of effective rain.		

Threatened Flora Meanders

The random meander technique (Cropper, 1993) was undertaken to survey for potential threatened flora throughout the Study Area. The technique involves traversing each habitat type that is suitable for the target species within the Study Area in a manner that maximises the coverage of habitat and potential to encounter threatened flora species. This method also allows for exploration of microhabitat features and the discovery of clumps of individuals encountered during survey. The tracks from these meander sites are depicted in **Figure A.2**.

A variation of this method has been adopted as the preferred method under the Queensland Nature Conservation Act 1992 Flora Survey Guidelines -Protected Plants (DES 2020) and Draft Survey Guidelines for Australia's Threatened Orchids (DoTE 2013). No specific Commonwealth survey guideline is currently available for other threatened flora species.

Threatened Flora Plot Surveys

Plot surveys were undertaken in accordance with the Queensland Government Flora Survey Guidelines (DES, 2020) to estimate population sizes of threatened or near threatened flora

species known to occur in the Study Area. The locations of these plots are depicted in **Figure A.2**.

Plot survey sites comprised a 50 m x 4 m plot and were undertaken when target species were first recorded in a patch. A patch being a contiguous area of habitat and homogenous vegetation. Within each plot, the number of target threatened flora species were recorded. This method was undertaken in the late wet season survey to identify population estimates across the Study Area. In the case of one of the target species, *Digitaria porrecta*, as the grass tussock ages the central portion dies and the resultant ring of plantlets eventually separate and become independent tussocks (TSSC, 2013). Since target species that were detected were not rhizomatous, separate grass tussocks were counted as individuals within the plot.

Population size (tussocks per ha) was estimated by finding the average count per plot within the habitat area and then multiplying to convert to a density per hectare. This density is based on areas of suitable habitat where the species is present.

Opportunistic Observations

Flora species, including threatened species, observed that were not recorded via other survey methods, were also collected as opportunistic observations. This included those species observed while driving or walking between survey sites.

Fauna Survey

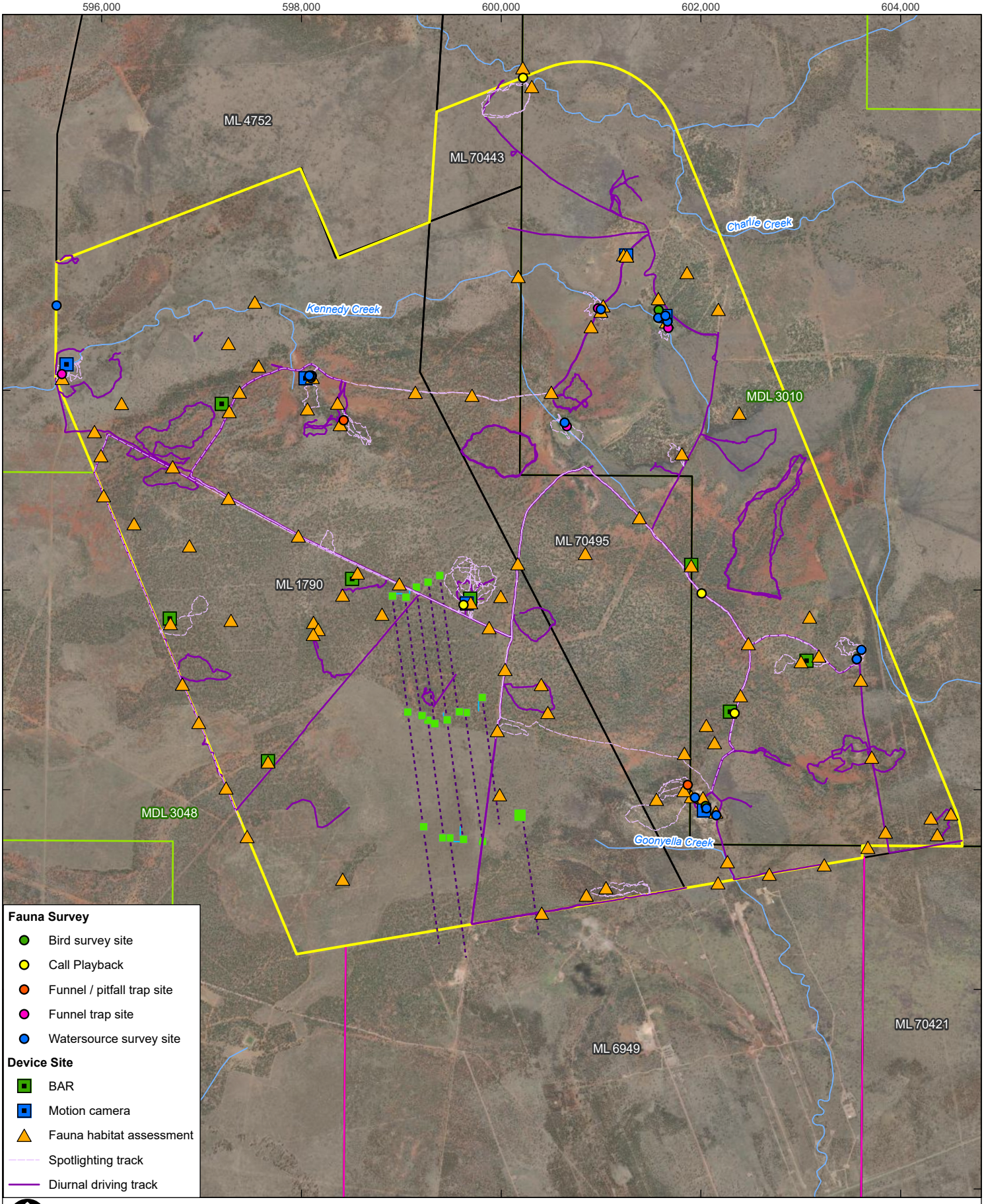
A suite of fauna survey methods were undertaken to detect the presence of target MNES and MSES species within the Study Area, in accordance with relevant Commonwealth and State Government survey guidelines.

Habitat Assessment

Habitat assessments were undertaken throughout the Study Area to identify the presence of habitat features that may support fauna. Assessments were completed at 90 sites during the wet season and focused on the identification of key microhabitat features for general fauna as well as threatened species (refer to **Figure A.3**). Fauna habitat assessments were conducted within representative habitat throughout the Study Area to document:

- The presence and condition of watercourses, wetlands, or artificial waterbodies (e.g., dams), including relative permanency of water
- Abundance of feed trees and Locally Important Koala Tree species (LIKTs) and ancillary shelter species as identified by (Youngentob et al., 2021)
- Presence and abundance of native grasses and forbs
- Abundance of hollow bearing trees and logs
- Abundance of coarse, woody debris and leaf litter
- Soil crack abundance and depth, and
- Evidence of existing threats, including:
    - Presence and abundance of feral species (i.e. wild dogs, feral cats, European foxes etc.)
    - Woody weed encroachment, and
    - Presence and abundance of barbed wire fencing, etc.

The outcomes of these habitat assessments were used to direct additional fauna survey effort in the dry season.



0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

LEGEND

- Watercourse
- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

FAUNA SURVEY SITES

SLR

APPENDIX A.3

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_APP-A-03_Fauna Survey Sites

Pitfall and Funnel Trapping

Pitfall and funnel trapping was undertaken during the wet season to target threatened reptile species, particularly ornamental snake (*Denisonia maculata*), in accordance with the Draft Referral Guidelines for Nationally Listed Brigalow Belt Reptiles (DSEWPC, 2011a). Each trap site utilised the 'T configuration', comprising a 30 m and 15 m drift fence with pitfall buckets and funnel traps arranged at set distance along the drift fences, as described by (Eyre et al., 2022). Two sites contained both funnel and pitfall traps, while four sites only contained funnel traps. A total of six trap sites were installed within suitable habitat each deployed over a four-night period at the locations depicted in **Figure A.3**.

Nocturnal Spotlighting

Nocturnal spotlighting surveys were undertaken to target fauna that are most active and detectable at night and are a prescribed survey method for applicable species under the following guidelines:

- Survey guidelines for Australia's threatened reptiles (DSEWPC, 2011b)
- Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al., 2022)
- Draft Referral Guidelines for Nationally Listed Brigalow Belt Reptiles (DSEWPC, 2011a), and
- Species specific guidelines published by the Commonwealth DCCEEW (2024).

A team of two ecologists walked parallel, meandering transects using a handheld torch and/or a head torch to detect eye shine and investigate microhabitats (e.g. peeling bark or lifting coarse woody debris). Nocturnal spotlighting commenced approximately 30 minutes after sunset for a duration of approximately four to five hours per night for a combined nine nights over the wet and dry season surveys. This method was used to target greater glider (*Petauroides volans*), koala (*Phascolarctos cinereus*) and ornamental snake (*Denisonia maculata*). Spotlighting tracks are depicted in **Figure A.3**.

During the dry season, slow drive vehicle transects were the primary survey technique employed, allowing for more extensive areas to be surveyed efficiently. The slow-drive transects involved scanning suitable vegetation with handheld spotlights (50-100W). This method was used to target greater glider (*Petauroides volans*) and koala (*Phascolarctos cinereus*) in areas of eucalypt woodlands.

Call Playback

Call playback was undertaken at four locations within the Study Area in association with spotlighting surveys, as shown in **Figure A.3**. Calls of koala were broadcast on a loudspeaker for a period of two minutes, followed by 15 minutes of silence, during which observers listened for call backs. Calls of koala were then broadcast a second time (for a period of two minutes) followed a by another 15-minute listening period.

Diurnal Bird Surveys

Standardised bird surveys were undertaken in the early morning and late afternoon across multiple sites within the Study Area (**Figure A.3**). Bird surveys occurred in accordance with the area search method prescribed in the Survey guidelines for Australia's threatened birds (DEWHA, 2010). Surveys were completed within 100 x 200 m survey sites (2 ha) located in suitable habitat and any threatened bird species observed and/or heard during the survey period were recorded.

Bird surveys were undertaken at eight water sources targeting threatened and migratory species, such as Latham's snipe (Gallinago hardwickii), Australian painted snipe (*Rostratula australis*), glossy ibis (Plegadis falcinellus) and squatter pigeon (southern) (*Geophaps scripta scripta*). These visual and flushing surveys were undertaken at dawn, dusk and other times of day, as depicted in **Figure A.3**.

Diurnal Searches

Diurnal active searches were undertaken concurrently with diurnal bird surveys and opportunistically with other fauna habitat assessments, following methods prescribed in the Terrestrial Vertebrate Fauna Survey Guidelines for Queensland (Eyre et al., 2022). Active searches involved searching suitable microhabitat (e.g. fallen woody debris, leaf litter, decorticating bark) for the species or evidence of the species presence (e.g. scats, scratches, burrows). These surveys were targeted to ornamental snake, koala and squatter pigeon (southern).

Diurnal slow-drive vehicle transects were also undertaken when moving between survey sites targeting squatter pigeon (southern).

Motion Cameras

Baited camera traps were deployed at six locations within the Study Area (**Figure A.3**) over seven consecutive nights during the dry season survey. This assisted in the detection of targeted threatened fauna and pest fauna species that may pose a threat to native species (i.e. wild dogs, feral cats and feral pigs).

Bioacoustic Recorders

Four bioacoustics records (BARs) were deployed (and moved) over seven consecutive nights during the wet season survey. BARs were installed at eight locations of suitable habitat within the Study Area (**Figure A.3**) to record calls projected by koalas.

Opportunistic Surveys

Fauna species for which evidence of presence was not detected via other survey methods, were recorded as opportunistic observations. Non-target fauna observed during fauna surveys and driving between survey sites were also recorded.

Species Habitat Mapping

The results of desktop and field surveys were used to generate habitat mapping for threatened flora and fauna species assessed as known or likely within the Study Area. Specifically, species habitat was mapped using the following categories:

- Preferred habitat: is most important to the species and provides breeding, roosting and/or foraging habitat that is required for the species to persist in the area.
- Suitable habitat: is habitat that provides breeding, roosting and/or reliable foraging habitat but is not essential for the species to persist in the area. It may occasionally provide resources or be in low density of resources and only be used intermittently.
- Marginal habitat: is habitat that provides limited resources for the species and may only be occupied infrequently, during transit between suitable habitat, or when desired habitat is scarce. The species is unlikely to be undertaking key activities such as breeding, roosting or extensive foraging.

Not all categories are relevant for each species due to their ecological role and regional context. What constitutes these categories for each species is discussed in **Sections 6.5.1.3**, **6.5.1.5** and **6.5.1.6**.

Likelihood of Occurrence Assessment

A likelihood of occurrence assessment evaluates the qualitative probability that a flora or fauna species, can physically occupy the Study Area during all or part (e.g. breeding season, migration) of its life cycle. The assessment evaluates:

- Species-specific ecological and physiological requirements.
- Recorded species observations including during field surveys and existing records.
- The resources and constraints present in the Study Area informed by the desktop assessment.
- The resources and constraints present in the Study Area informed by the field surveys.

Following the field surveys, the likelihood of occurrence assessment was evaluated for the Study Area using the field data to modulate the target species list prior to further assessment. It has now been re-evaluated for the Project Area to direct the assessment of Project impacts.

The likelihood of occurrence assessment criteria is detailed in **Table A.2**.

Table A.2 Likelihood of threatened and migratory species to occur in the Project Area

Assessment Outcome	Criteria
Known to occur	The species or community has been observed within the Study Area or Project Area
Likely to occur	Suitable habitat to support the species/community is present; and the species/community has been previously recorded within the desktop search extent based on field observations and/or contemporary records.
Possible to occur	The Project Area is located within the species/community's known distribution and suitable habitat to support the species/community is present, however: • The species/community has not previously been recorded within the desktop search extent; and/or • Suitable habitat is degraded, limited in extent, and/or isolated from areas of known occupied habitat, thereby reducing the likelihood of occurrence.
Unlikely to occur	The Project Area does not comprise suitable habitat for the species/community and/or is outside of the species known distribution; or failure to detect the species during targeted surveys suggests the species is likely absent from the Project Area.

Aquatic Ecology Assessment

Aquatic ecological assessments were undertaken by Hydrobiology Pty Ltd (Hydrobiology) within a broader Study Area encompassing the Project Area and surrounds located within MLs 1790, 70495, and MDL 3010 (**Figure A.4**) and some areas just outside of this. Hydrobiology have undertaken two field surveys, comprising:

- An 'early-wet season' survey undertaken in mid February 2024, and
- A 'late-wet season' survey undertaken in late April 2024.

These surveys were timed to adequately capture the nature and spatial extent of seasonal ecological / hydrological changes. More specifically, they were conducted at times where the aquatic habitat(s) and/or wetland(s) were assessed at their full range of productivity and inherent seasonal variation, while also capturing the dynamics of fish and other aquatic biota migratory responses to seasonal variability.

Aquatic Values

During the fieldwork planning phase, potential sites within representative habitats and relevant localities were identified that appeared to be accessible. Specifically, the site locations were selected on the basis that:

- They encompass all four creeks relevant to the Project, these being Kennedy Creek, Charlie Creek, Goonyella Creek and Skull Creek. They also include the ultimate receiving environment, the Isaac River
- They best represent identified habitat variation within the Study Area (determined from aerial imagery and review of historical reports and State and Federal databases)
- They encompassed the range of potential Groundwater Dependent Ecosystem (GDE) types present in the Study Area (BoM 2019)
- They could be readily accessed through existing infrastructure, and
- The selected survey techniques could be safely carried out.

Survey Sites

Sites surveyed for aquatic values are listed in **Table A.3** and shown in **Figure A.4**. All sites were within the Study Area except for site four, located approximately 350 m northwest from the Study Area boundary. Sites one and three were dams and Sites one, four, five and six were identified aerially as containing potential creek habitat.

Table A.3 Aquatic values and survey sites

Site	Latitude	Longitude	Lot and Plan	Survey Techniques*
1	-21.6181	147.989	2 SP214117	H, G, L
2	-21.5978	148.0005	2 SP214117	H, G, M, IW, E, F, B, C, L
3	-21.5677	147.9812	2 SP214117	H, G, M, IW, E, F, B, C, L
4	-21.5598	147.9907	8 GV807254	H, G, L
5	-21.5489	147.9772	2 SP214117	H, G, L
6	-21.5715	147.9253	2 SP214117	H, G, M, IW, E, F, L

* H: Habitat, G: Groundwater Dependant ecosystems, M: Macroinvertebrate, IW: In situ water, E: electrofishing, F: fyke netting, B: Box traps, C: Cathedral traps and L: Likelihood of occurrences

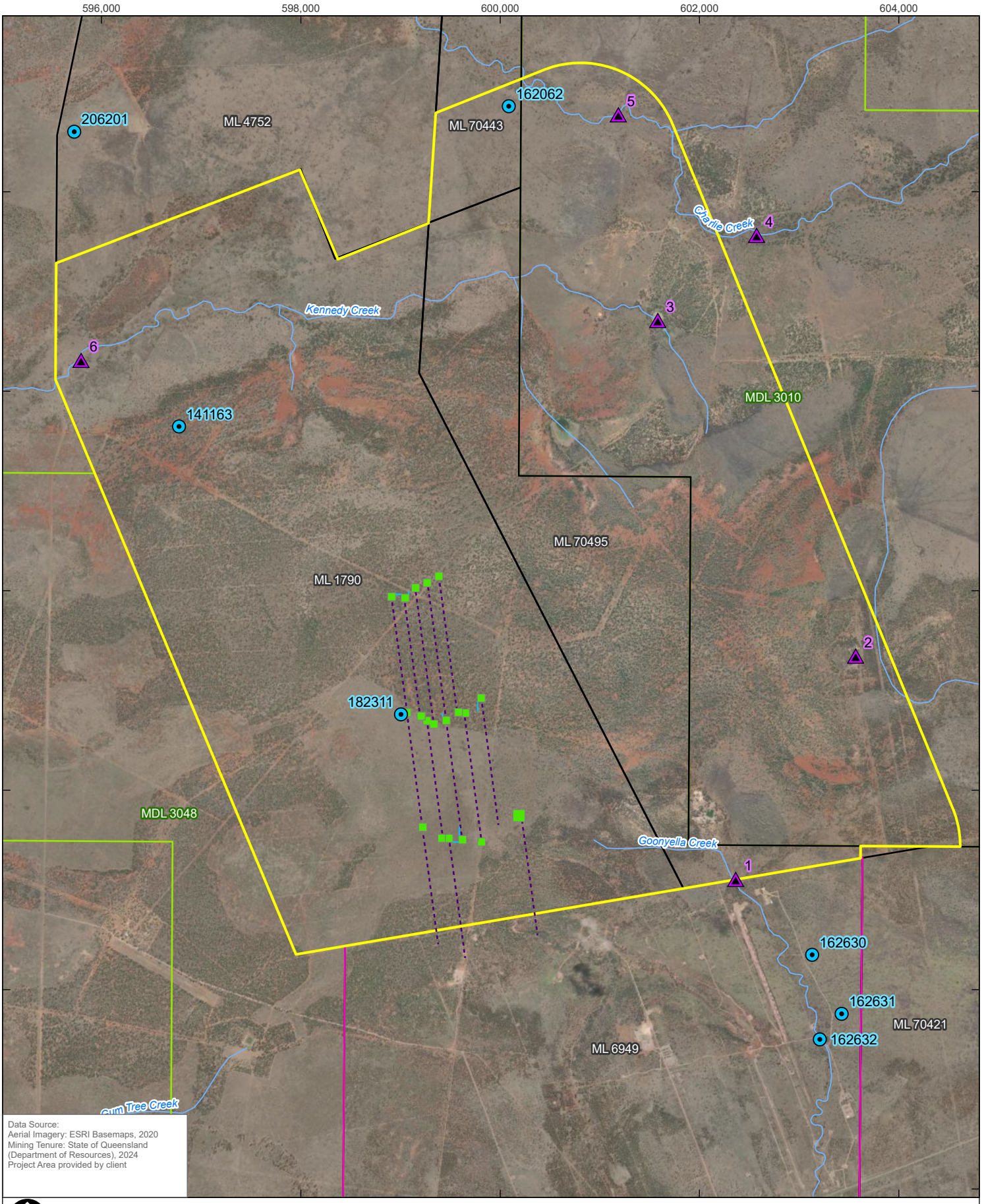
Methods

An overview of implemented methods is displayed in **Table A.4**. The implemented survey methods for the identified threatened and special least concern species included both passive (habitat assessments and visual assessment) and active (cathedral trapping and fyke netting) survey techniques. Identified active survey methods for the survey of *Elseya albagula* (white throated snapping turtle), (*Rheodytes leukops*) Fitzroy River turtle; and (*Ornithorhynchus anatinus*) platypus followed current defined guidelines as detailed in **Table A.4**.

Table A.4 Sampling methods for the Study Area and associated guidelines

Species	Method	Guideline and Standards
Aquatic Fauna		
Fish	Overnight fyke netting. Overnight box trapping. Visual observations. Likelihood of occurrence assessments based off areas occurrence and presence of preferred habitat features.	DES (2018a) Monitoring and sampling manual. DSEWPaC (2011) Guidelines for Threatened Fish.
Turtles	Overnight cathedral trapping. Visual observations. Likelihood of occurrence assessments based off areas occurrence and presence of preferred habitat features.	DSEWPaC (2011b) Guidelines for threatened reptiles. DES (2018a) Monitoring and sampling manual.
Platypus	Overnight fyke netting. Burrow searches and visual observations. Likelihood of occurrence assessments based off areas occurrence and presence of preferred habitat features.	DES (2018a) Monitoring and sampling manual. Lugg et al. (2017) Optimal survey designs for eDNA sampling.
Habitat and Water Quality		
Aquatic habitat (including macrophytes) and stream condition	Habitat and condition assessments in accordance with AUSRIVAS and State of the Rivers protocols. Macro (riffles, pools, runs, dry, etc.) and micro habitat (large woody debris, leaf litter, etc.) presence/cover. Macrophyte identification and density. River bioassessment condition assessment. Bank and stream morphology. Identification of local land use and pressures. Documentation of erosion and sedimentation Substrate analysis.	Parsons et al. (2002) Australian River Assessment System: AusRivAS Physical Assessment Protocol. DNRM (2001) AusRivAS for Queensland streams. Cover estimate methods as per DNRM (2001).

Species	Method	Guideline and Standards
Aquatic GDEs	Analysis of aerial imagery to identify water permanence. Ground-truthing of surface GDE presence based on the series of questions described in Eamus et al. (2006) and Doody et al. (2019) in IESC (2018). GDE value characterisation as per the criteria identified in IESC (2018). To characterise groundwater connectivity, both surface and groundwater quality results regarding major ion composition will be relied upon to determine chemical signature matches.	Eamus et al. (2006). Doody et al. (2019). IESC (2018).
In-situ water quality	In-situ physiochemical analysis including temperature, pH, turbidity, dissolved oxygen, electrical conductivity.	DES (2018a) Monitoring and sampling manual.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 0.5 1 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:50,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

- Aquatic Values Survey Site
- Stygofauna Survey Site
- Watercourse
- Study Area
- Mining Lease
- Centurion Coal Mine
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

EA AMENDMENT P-EA-100658735

AQUATIC ECOLOGY SURVEY SITES

SLR

APPENDIX A.4

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_TerrestrialEco_APP-A-04_Aquatic Ecology Survey Sites

Stygofauna

The stygofauna pilot survey was conducted in accordance with the Guideline for the Environmental Assessment of Subterranean Aquatic Fauna (DSITI 2015) using the methods described in DES (2018a). A single sampling event was undertaken during the early-wet season survey between the 12th and 17th of February 2024.

Survey Sites

A total of 19 bores were visited, however only nine groundwater bores could be sampled for stygofauna with sampling sites located both on-lease and off-lease (**Table A.5** and **Figure A.4**). The remaining 10 bores were either too narrow for sampling or not present at the registered coordinates.

Table A.5 Stygofauna bore sampling sites

Bore ID	Latitude	Longitude	Lot and Plan	Standing Water Level (SWL) (m)	Type
141163	-21.5775	147.934809	2SP214117	-26.02	Deep
162053	-21.525	147.934208	2SP214117	-11.07	Shallow
162062	-21.5482	147.96652	2SP214117	-13.53	Shallow
162065	-21.5233	147.93544	411SP285383	-11.54	Shallow
162630	-21.625	147.996484	411SP285383	-20.33	Shallow
162631	-21.6303	147.99938	411SP285383	-18.32	Shallow
162632	-21.6327	147.99728	411SP285383	-15.76	Shallow
182311	-21.6035	147.956487	11SP235906	-25	Deep
206201	-21.5508	147.924516	2SP214117	-25.93	Deep

Appendix B MSES significant residual impact assessments

Environmental Authority Amendment Application Supporting Report

P-EA-100658735 and P-PRCP-100669070_V1

SLR Project No.: 620.040594

7 November 2024

B.1 MSES protected wildlife habitat

Definitions and terminology

Term	Definition under the EO Act
Habitat	An area occupied, or periodically or occasionally occupied, by any species, population or ecological community and includes all the different aspects (both biotic and abiotic) used by species during the different stages of their life cycles.
Essential Habitat	A Category B area shown on the regulated vegetation management map under the *Vegetation Management Act 1999*: i. that has at least three essential habitat factors for the protected wildlife that must include any essential habitat factors that are stated as mandatory for the protected wildlife in the essential habitat database; OR ii. in which the protected wildlife, at any stage of its life cycle, is located. **Please Note:** Under the SRI Guidelines, Essential Habitat is assessed in accordance with the MSES Protected Wildlife assessment criteria.
Long-term decrease	Any decline in a local population that is greater than which would be apparent without the action being present.
Population	An occurrence of the species in a particular area. In relation to Endangered, Vulnerable and Special Least Concern species, occurrences include but are not limited to: • a geographically distinct regional population, or collection of local populations; or • a population, or collection of local populations, that occurs within a particular bioregion.

B.1.1 *Dichanthium queenslandicum* (king blue-grass)

MSES protected wildlife habitat for *Dichanthium queenslandicum* identified within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The Project will result in the direct clearing of 1.53 ha of preferred habitat for *D. queenslandicum*. This amount comprises less than 1% of preferred habitat for the species mapped within the broader Study Area. Any individuals to be removed would be a small portion of the population within the habitat patch that is being disturbed. Any indirect activities from the project are unlikely to reduce the quality of surrounding habitat to the point where populations will decline. Therefore, while some habitat for the species will be cleared, it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** *D. queenslandicum* is found across three population areas, including the area between Nebo and Monto and west to Clermont and Rolleston (SEWPaC 2013). The extent of occurrence of the species is estimated at around 245 km^2 (SEWPaC 2013). Given that the Project Area is central to this range and that the extent of clearing equates to less than 0.01% of the extent of occurrence of the species, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The Project will result in the direct clearing of 1.53 ha of preferred habitat for *D. queenslandicum* across two gas extraction wells. Small portions of the habitat patch will be removed however the patch will not be split into two or more patches. The species is wind dispersed and is therefore not limited by small scale linear network infrastructure. Therefore, it is considered unlikely that the Project will fragment an existing population of the species.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The Project will result in the direct clearing of 1.53 ha of preferred habitat for *D. queenslandicum* across two gas extraction wells. Small portions of the habitat patch will be removed however the patch will not be split into two or more patches. The species is wind dispersed and is therefore not limited by small scale linear network infrastructure. Therefore, it is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**Significant residual impact unlikely** One of the known threats to *D. queenslandicum* is invasion from weeds such as *Parthenium hysterophorus* (parthenium) and *Parkinsonia aculeata* (SEWPaC 2013). Parthenium has been recorded within the broader Study Area in high densities in wet areas. The implementation of weed control and monitoring to reduce and prevent the incursion and spread of weeds and pests (refer to Section 6.5.4.2) will minimise the potential for parthenium and other invasive species to become established in *D.*

MSES Significant Residual Impact Guideline criteria	Response
	queenslandicum habitat. As such, the Project is considered unlikely to result in invasive species harmful to *D. queenslandicum* spreading or becoming established in retained habitat.
Introduce disease that may cause the population to decline	**Significant residual impact unlikely** There are no known diseases that impact *D. queenslandicum* and therefore it is considered unlikely that the Project will introduce disease that may cause the population to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely** There is no current State or Commonwealth recovery plan for *D. queenslandicum.* The Project will result in the direct clearing of 1.53 ha of preferred habitat for the species, which equates to less than 0.01% of the extent of occurrence of the species (SEWPaC 2013). Therefore, it is considered unlikely that the Project will interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The Project will result in the direct clearing of 1.53 ha of preferred habitat for *D. queenslandicum*, however, this comprises less than 1% of preferred habitat for the species mapped within the broader Study Area. Retained habitat in the Study Area will continue to support individuals of the species and provide habitat, and therefore it is considered unlikely that the Project will disrupt ecologically significant locations for the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on *D. queenslandicum.*

B.1.2 Koala (*Phascolarctos cinereus*)

MSES protected wildlife habitat for koala identified within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala. This comprises less than 1% of suitable habitat for the species mapped within the broader Study Area. The species was recorded on bioacoustic devices and was not identified during extensive spotlighting surveys nor were scat frequently observed within the Study Area. The Project Area does not contain any preferred habitat for the species such as riparian areas with large eucalypts that contain high-moisture content. Areas of preferred habitat are limited to Charlie creek in the north of the Study Area. Therefore, the species is considered to be at low densities within the Study Area. Due to the small proportion of habitat being cleared for the Project and low density of individuals, it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** The listed population of the koala has a wide but patchy distribution that spans the coastal and inland areas of Queensland north to the Herberton area, extending westwards into hotter and dryer semi-arid climates of central Queensland, New South Wales and the Australian Capital Territory (DAWE 2022). In Queensland, the species are widespread and patchy across their range, often occurring in low density populations (DAWE 2022). The extent of occurrence of the species is estimated at around 1,665,850 km2 (DAWE 2022). The Project is not located near the edge of this known distribution and the extent of clearing equates to less than 0.01% of the extent of occurrence of the species. Therefore, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala across multiple gas extraction wells. These wells are located within an area of relatively contiguous suitable habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. Koala has a wide but patchy distribution within Queensland in which it is generally present in low density populations (DAWE 2022) and it has been recorded once within 25 km of the Project Area (BMA 2014). Therefore, it is considered unlikely that the Project will fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala across multiple gas extraction wells. These wells are located within an area of relatively contiguous suitable habitat for the species as mapped within the Study Area. The 19 well gas

MSES Significant Residual Impact Guideline criteria	Response
	network will not prevent dispersal for the species within the Study Area. Koala has a wide but patchy distribution within Queensland in which it is generally present in low density populations (DAWE 2022) and it has been recorded once within about 25 km of the Project Area (BMA 2014). Therefore, it is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**Significant residual impact unlikely** Known threats to koala relevant to the Project Area include: • direct predation from dogs leading to mortality of individuals; and • invasion of weeds leading to habitat degradation (DAWE 2022). Wild dogs (*Canis lupus*) have been recorded multiple times within the broader Study Area. Pest fauna will be monitored, and control actions will be undertaken to limit the abundance and spread of pest fauna in the Project Area and adjacent land (refer to **Section 6.5.4.2**). Invasive flora within the Study Area is not considered to pose a threat to the point where Koala dispersal is hindered. The implementation of mitigation measures to reduce and prevent the incursion and spread of invasive species (refer to **Section 6.5.4.2**) will minimise the potential for invasive species to become established in retained habitat. Therefore, it is considered unlikely that the Project will result in invasive species harmful to koala spreading or becoming established in retained habitat.
Introduce disease that may cause the population to decline	**Significant residual impact unlikely** One of the known threats to koala is infection from diseases and viruses in the population, including *Chlamydia pecorum*, koala retrovirus and koala herpesvirus (DAWE 2022). The implementation of mitigation measures to reduce and prevent the incursion and spread of these diseases (refer to **Section 6.5.4.2**) will minimise the potential for diseases to become established in retained habitat. Therefore, it is considered unlikely that the Project will introduce disease that may cause the population to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely** The national recovery plan for the koala includes the follow strategies: • build and share knowledge • engage and partner with the community in listed koala conservation • increase the area of protected habitat for the listed koala • integrate koala conservation into policy, statutory and land use plans • strategically restore listed koala habitat; and • actively management koala metapopulations (DAWE 2022). The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala across multiple gas extraction wells. Due to the

MSES Significant Residual Impact Guideline criteria	Response
	small proportion of habitat being cleared for the project and low density of individuals, the clearing of koala habitat within the Project Area is considered unlikely to interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for koala across multiple gas extraction wells. The species was identified through bioacoustic recorders and was not identified during spotlighting surveys nor were scat frequently observed within the Study Area. The Project Area does not contain any preferred habitat for the species such as riparian areas with large eucalypts that contain high-moisture content. Areas of preferred habitat are limited to Charlie creek in the north of the Study Area. This area would be considered an ecologically significant location. Due to the small proportion of habitat being cleared for the project and low density of individuals, it is considered unlikely that the Project will disrupt ecologically significant locations for the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on koala.

B.1.3 Ornamental snake (*Denisonia maculata*)

MSES protected wildlife habitat comprising Essential Habitat for ornamental snake mapped within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake. Seasonal targeted surveys for the species (comprising pitfall trapping and spotlighting) within the Study Area failed to detect the species, and suitable habitat was not identified. Therefore, ornamental snake is assessed as unlikely to occur within the Study Area and Project Area and it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** The distribution of ornamental snake includes the Brigalow Belt North and South Bioregions, with the stronghold of the species being within the Fitzroy and Dawson River catchments, particularly in the area surrounding Moranbah (DCCEEW 2024). The extent of occurrence for the species has not been estimated. The Project is not located near the edge of this known distribution and the species is identified as unlikely to occur within the Study Area and Project Area. Therefore, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake across multiple gas extraction wells. These wells are located within an area of relatively contiguous DoR mapped Essential Habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. In addition, the ornamental snake is identified as unlikely to occur within the Study Area and Project Area after the completion of seasonal targeted surveys failed to detect the species, and suitable habitat was not identified. Therefore, it is considered unlikely that the Project will fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake across multiple gas extraction wells. These wells are located within an area of relatively contiguous DoR mapped Essential Habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. In addition, the ornamental snake is identified as unlikely to occur within the Study Area and Project Area after the completion of seasonal targeted surveys failed to detect the species, and suitable habitat was not identified. Therefore, it is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.

MSES Significant Residual Impact Guideline criteria	Response
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**Significant residual impact unlikely** Known threats to ornamental snake relevant to the Project Area include: • destruction of wetland habitat by feral pigs (Sus scrofa) • poisoning from the ingestion of cane toads (Rhinella marina); and • invasive weeds (DCCEEW 2024; DotE, 2014). Both feral pigs and cane toads have been recorded multiple times within the broader Study Area. Pest fauna will be monitored, and control actions will be undertaken to limit the abundance and spread of pest fauna in the Project Area and adjacent land (refer to **Section 6.5.4.2**). Three weed species have been recorded within the broader Study Area. The implementation of mitigation measures to reduce and prevent the incursion and spread of invasive species (refer to **Section 6.5.4.2**) will minimise the potential for invasive species to become established. In addition, the ornamental snake is identified as unlikely to occur within the Study Area and Project Area after the completion of seasonal targeted surveys failed to detect the species, and suitable habitat was not identified. Therefore, it is considered unlikely that the Project will result in invasive species harmful to the species spreading or becoming established in retained habitat.
Introduce disease that may cause the population to decline	**Significant residual impact unlikely** There are no known diseases that impact ornamental snake and therefore it is considered unlikely that the Project will introduce disease that may cause the population to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely** There is no current State or Commonwealth recovery plan for ornamental snake, however conservation actions in the conservation advice for the species include: • reducing habitat loss and disturbance • controlling fauna pests (particularly cane toads); and • raising awareness with the community (DotE, 2014). The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake across multiple gas extraction wells. However, the ornamental snake is identified as unlikely to occur within the Study Area and Project Area after the completion of seasonal targeted surveys failed to detect the species, and suitable habitat was not identified. Therefore, it is considered unlikely that the Project will interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of DoR mapped Essential Habitat for ornamental snake. Seasonal targeted surveys for the species (comprising pitfall trapping and spotlighting) within the Study Area failed to detect the species, and suitable

MSES Significant Residual Impact Guideline criteria	Response
	habitat was not identified. Therefore, ornamental snake is assessed as unlikely to occur within the Study Area and Project Area. As such, the Study Area and Project Area is not considered to be an ecologically significant location and it is considered unlikely that the Project will disrupt ecologically significant locations for the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on ornamental snake.

B.1.4 Short-beaked echidna (*Tachyglossus aculeatus*)

MSES protected wildlife habitat for short-beaked echidna identified within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of suitable habitat for short-beaked echidna. This comprises less than 1% of suitable habitat for the species mapped within the broader Study Area. The species was recorded once during field surveys within the Study Area and additional evidence of presence was not observed. Short-beaked echidna has a relatively widespread distribution and occurs where ant and termite species are available, including across a range of modified habitats (Van Dyck & Strahan, 2008). Due to the small portion of habitat being cleared for the Project and widespread distribution of the species across the landscape, it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** The short-beaked echidna is relatively widespread and occurs throughout Australia in a broad variety of habitats (Van Dyck & Strahan, 2008). The extent of occurrence for the species has not been estimated. The Project is not located near the edge of the known distribution of the species. Therefore, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of suitable habitat for short-beaked echidna across multiple gas extraction wells. These wells are located within an area of relatively contiguous suitable habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. Short-beaked echidna has a widespread distribution, occurring throughout Australia in a broad variety of habitats (Van Dyck & Strahan, 2008) and it has been recorded multiple times within about 25 km of the Project Area (AECOM 2015; DESI 2024). Therefore, it is considered unlikely that the Project will fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of suitable habitat for short-beaked echidna across multiple gas extraction wells. These wells are located within an area of relatively contiguous suitable habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. Short-beaked echidna has a widespread distribution, occurring throughout Australia in a broad variety of habitats (Van Dyck & Strahan, 2008) and it has been recorded multiple times within about 25 km of the Project Area (AECOM 2015; DESI 2024). Therefore, it

MSES Significant Residual Impact Guideline criteria	Response
	is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The Project will result in the direct clearing of 6.45 ha of suitable habitat for short-beaked echidna across multiple gas extraction wells. The species was recorded once during field surveys within the Study Area and additional evidence of presence was not observed. Short-beaked echidna has a widespread distribution, occurring throughout Australia in a broad variety of habitats (Van Dyck & Strahan, 2008) and it has been recorded multiple times within about 25 km of the Project Area (AECOM 2015; DESI 2024). Ecologically significant locations for the species have not been identified and so the precautionary approach can be taken to classify all habitat areas as ecologically significant. Retained habitat in the broader landscape within the Study Area and surrounds will continue to support individuals of the species and provide suitable habitat that individuals will be able to move into and use for breeding, feeding and as a refuge area. Due to the small portion of habitat being cleared for the Project and widespread distribution of the species across the landscape, it is considered unlikely that the Project will disrupt ecologically significant locations of the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on the short-beaked echidna.

B.1.5 Squatter pigeon (southern) (*Geophaps scripta scripta*)

MSES protected wildlife habitat for squatter pigeon (southern) identified within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern). This comprises less than 1% of suitable habitat for the species within the broader Study Area. A total of 65 squatter pigeon (southern) individuals were recorded across the Study Area, all of which were nearby dams. Such permanent and seasonal waterbodies are known to be important habitat features for the species (Squatter Pigeon Workshop, 2011). Squatter pigeon (southern) is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) where it is considered to be common in grazing country north of the Tropic of Capricorn (DCCEEW 2024). Due to the small proportion of habitat being cleared and fact that the Project Area does not intercept with permanent or seasonal waterbodies, it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** Squatter pigeon (southern) is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) where it is considered to be common in grazing country north of the Tropic of Capricorn (DCCEEW 2024). The extent of occurrence of the species is estimated at around 440,000km^2 (DCCEEW 2024). The Project is not located near the edge of this known distribution and the extent of clearing equates to less than 0.01% of the extent of occurrence of the species. Therefore, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern) across multiple gas extraction wells. These wells are located within an area of relatively contiguous suitable habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. Squatter pigeon (southern) is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) where it is considered to be common in grazing country north of the Tropic of Capricorn (DCCEEW 2024). In addition to records during E2M's field surveys, the species has been recorded a total of 13 times within the Study Area and twice within 25 km of the Project Area (AECOM 2015; BMA 2014). Therefore, it is considered unlikely that the Project will fragment an existing population.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern) across multiple gas extraction

MSES Significant Residual Impact Guideline criteria	Response
	wells. These wells are located within an area of relatively contiguous suitable habitat for the species within the Study Area. The 19 well gas network will not prevent dispersal for the species within the Study Area. Squatter pigeon (southern) is locally abundant within the northern part of its range (i.e. Brigalow Belt (North) and Desert Uplands Bioregions) where it is considered to be common in grazing country north of the Tropic of Capricorn (DCCEEW 2024). In addition to records during E2M's field surveys, the species has been recorded a total of 13 times within the Study Area and twice within 25 km of the Project Area (AECOM 2015; BMA 2014). Therefore, it is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**Significant residual impact unlikely** Known threats to squatter pigeon (southern) include: • direct predation from feral cats (*Felis catus*) and foxes (*Vulpes vulpes*) • trampling of nests by livestock • habitat degradation by invasive weeds; and • overgrazing of habitat by livestock and feral herbivores such as rabbits (Oryctolagus cuniculus) (DCCEEW 2024; TSSC 2015). Feral cats and rabbits have been recorded within the broader Study Area. Pest fauna will be monitored, and control actions will be undertaken to limit the abundance and spread of pest fauna in the Project Area and adjacent land (refer to **Section 6.5.4.2**). Three weed species have been recorded within the broader Study Area. The implementation of mitigation measures to reduce and prevent the incursion and spread of invasive species (refer to **Section 6.5.4.2**) will minimise the potential for invasive species to become established in retained habitat. Therefore, it is considered unlikely that the Project will result in invasive species harmful to squatter pigeon (southern) spreading or becoming established in retained habitat.
Introduce disease that may cause the population to decline	**Significant residual impact unlikely** There are no known diseases that impact squatter pigeon (southern) and therefore it is considered unlikely that the Project will introduce disease that may cause the population to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely** There is no current State or Commonwealth recovery plan for squatter pigeon (southern), however conservation actions in the conservation advice for the species include: • identify sub-populations of high conservation priority • protect and rehabilitate areas of vegetation that support important sub-populations • protect sub-populations through the development of covenants, conservation agreements or inclusion in reserve tenure • develop and implement a stock management plan for key sites

MSES Significant Residual Impact Guideline criteria	Response
	• develop and implement a management plan, or nominate an existing plan to be implemented, for the control and eradication of feral herbivores in areas inhabited by the squatter pigeon (southern) • raise awareness of the squatter pigeon (southern) within the local community • monitor selected sub-populations, and • undertake a range of activities for information and research priorities (TSSC 2015). The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern) across multiple gas extraction wells. Due to the small proportion of habitat being cleared and the Project Area's location within the broader distribution of the species, it is considered unlikely that the Project will interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The Project will result in the direct clearing of 5.98 ha of suitable habitat for squatter pigeon (southern) across multiple gas extraction wells. A total of 65 squatter pigeon (southern) individuals were recorded across the Study Area, all of which were nearby dams. Such permanent and seasonal waterbodies are known to be important habitat features for the species (Squatter Pigeon Workshop, 2011). Such features could be considered ecologically significant locations. Retained habitat in the broader landscape within the Study Area and surrounds will continue to support individuals of the species and provide suitable habitat that individuals will be able to move into and use for breeding, feeding and as a refuge area. Due to the small proportion of habitat being cleared and fact that the Project Area does not intercept with permanent or seasonal waterbodies, it is considered unlikely that the Project will disrupt ecologically significant locations of the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on squatter pigeon (southern).

B.1.6 White-throated needletail (*Hirundapus caudacutus*)

MSES protected wildlife habitat for white-throated needletail identified within the Project Area has been assessed against the SRI Guideline below.

MSES Significant Residual Impact Guideline criteria	Response
Lead to a long-term decrease in the size of a local population	**Significant residual impact unlikely** The white-throated needletail is a wide-ranging nomadic species that is almost exclusively aerial in Australia (DCCEEW 2024). The species can occur over most habitat types, however, because the species is aerial, it has been suggested that conventional habitat descriptions are inapplicable (DCCEEW 2024). As such, the clearing of vegetation is considered largely inconsequential to the species. Aerial space above the Project Area is considered to comprise marginal habitat for white-throated needletail. Due to the species use of a broad range of habitats and its wide-ranging distribution, it is considered unlikely that the Project will lead to a long-term decrease in the size of the local population.
Reduce the extent of occurrence of the species	**Significant residual impact unlikely** The white-throated needletail is a wide-ranging nomadic species that is almost exclusively aerial in Australia, and as such the clearing of vegetation is considered largely inconsequential to the species (DCCEEW 2024). Therefore, it is considered unlikely that the Project will reduce the extent of occurrence of the species.
Fragment an existing population	**Significant residual impact unlikely** The white-throated needletail is a wide-ranging nomadic species that is almost exclusively aerial in Australia, and as such the clearing of vegetation is considered largely inconsequential to the species (DCCEEW 2024). Due to the mobile nature of the species (i.e. movement by flight), it is considered unlikely that the Project will fragment a population of the species.
Result in genetically distinct populations forming as a result of habitat isolation	**Significant residual impact unlikely** The white-throated needletail is a wide-ranging nomadic species that is almost exclusively aerial in Australia, and as such the clearing of vegetation is considered largely inconsequential to the species (DCCEEW 2024). Furthermore, the species is a non-breeding visitor to Australia that migrates to the northern hemisphere during the breeding season (DCCEEW 2024). Therefore, it is considered unlikely that the Project will result in genetically distinct populations forming as a result of habitat isolation.
Result in invasive species that are harmful to an endangered or vulnerable species becoming established in the endangered or vulnerable species' habitat	**Significant residual impact unlikely** There are no known invasive species that are harmful to the white-throated needletail and therefore it is considered unlikely that the Project will result in invasive species harmful to the species spreading or becoming established in retained habitat.
Introduce disease that may cause the population to decline	**Significant residual impact unlikely**

MSES Significant Residual Impact Guideline criteria	Response
	There are no known diseases that impact white-throated needletail and therefore it is considered unlikely that the Project will introduce disease that may cause the population to decline.
Interfere with the recovery of the species	**Significant residual impact unlikely** There is no current State or Commonwealth recovery plan for white-throated needletail. Due to the species use of a broad range of habitats and its wide-ranging distribution, it is considered unlikely that the Project will interfere with the recovery of the species.
Cause disruption to ecologically significant locations (breeding, feeding, nesting, migration or resting sites) of a species.	**Significant residual impact unlikely** The white-throated needletail is a wide-ranging nomadic species that is almost exclusively aerial in Australia, and as such the clearing of vegetation is considered largely inconsequential to the species (DCCEEW 2024). Furthermore, the species is a non-breeding visitor to Australia that migrates to the northern hemisphere during the breeding season (DCCEEW 2024). It is therefore considered that Australia is not part of an ecologically significant location. Due to the species use of a broad range of habitats and its wide-ranging distribution, it is considered unlikely that the Project will disrupt ecologically significant locations of the species.
Conclusion	The Project is **unlikely to result in a significant residual impact** on white-throated needletail.

B.2 MSES Regulated Vegetation- Endangered of Of Concern Regional Ecosystems

MSES regulated vegetation identified within the Project Area includes regulated vegetation that is an 'endangered' or 'of concern' REs. Impacts on MSES regulated vegetation has been assessed against the SRI Guideline below.

RE	Structure category	Assessment criteria	Self-assessment
Regulated vegetation that is an endangered or of concern regional ecosystem			
11.8.11	Woody grassland	For clearing other than clearing for linear infrastructure, the clearing cannot exceed 5 ha in a grassland (structural category).	**Significant residual impact unlikely** Clearing of remnant RE 11.8.11 will comprise 1.53 ha.
Conclusion			The Project is **unlikely to result in a significant residual impact** to RE 11.8.11.

B.3 Connectivity areas

MSES connectivity areas identified within the Project Area have been assessed against the SRI Guideline below. The Landscape Fragmentation and Connectivity Tool was used to assess the significance of impact on connectivity areas.

Output	Value
Significance test one	
Regional total area	139,258.37 ha
Regional extent of core remnant	57,952.33 ha (41.61%)
Area of core at the local scale (pre impact)	5,700.58 ha
Area of core at the local scale (post impact)	5,679.82 ha
Percent change of core at the local scale (post impact)	0.36%
Significance test two	
The number of core remnant areas occurring on the site	1
The number of core remnant areas occurring on the site post impact	1
Result	
This analysis has determined no significant impact on connectivity areas.	

Appendix C Greenhouse Gas Abatement Plan

Environmental Authority Amendment Application Supporting Report

P-EA-100658735 and P-PRCP-100669070_V1

SLR Project No.: 620.040594

7 November 2024

Greenhouse Gas Abatement Plan

P-EA-100658735 and P-PRCP-100669070_V1

Centurion Coal Mining Pty Ltd.

Moranbah, Queensland 4744

Prepared by:
SLR Consulting Australia

SLR Project No.: 620.040594.00001

7 November 2024

Revision: 2.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
1.0	13 September 2024	D. Heuff	R. Byrne	R. Byrne
2.0	7 November 2024	D. Heuff, R. Byrne	R. Byrne	C. Wilson
	Click to enter a date.			
	Click to enter a date.			
	Click to enter a date.			

Basis of Report

This report has been prepared by SLR Consulting Australia (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Centurion Coal Mining Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

Table of Contents

Tables

Figures

1.0 Introduction

Centurion Coal Mining Pty Ltd (a subsidiary of Peabody Energy Australia PCI PTY LTD) has recently secured the rights to further explore resources under a portion of ML 1790 and ML 70495 located immediately adjacent to and directly north of the Centurion Coal Mine (CCM), an existing underground longwall mine located on ML 6949.

As a result, Centurion Coal Mining Pty Ltd proposes to undertake a pilot CSG exploration and extraction programme on ML 1790 (the Project). The Project is the subject of an amendment to environmental authority (EA) P-EA-100658735 and associated progressive rehabilitation and closure plan (PRCP) P-PRCP-100669070_V1.

As the Project consists of petroleum and gas activities, it is considered to be a 'medium to high' emission category, as per Table 3 of the Queensland Government's Department of Environment, Science and Innovation (DESI) *Guideline: Greenhouse gas emissions* (2024) (the Guidelines). As such, the EA amendment application is required to be accompanied by the following:

- Greenhouse gas (GHG) emissions inventory
- GHG emission mitigation and management practices
- A risk assessment that outlines the scale of expected GHG emissions from the activity and how they are expected to contribute to climate change impacts on Queensland's environmental values, and
- GHG abatement plan (this document).

This document provides the GHG Abatement Plan for the Project. A GHG Abatement Plan identifies the GHG emissions to be generated by a project and details ongoing emission mitigation and management measures proposed to be implemented throughout the life of the project to progressively reduce Scope 1 and Scope 2 GHG emissions. This will ensure long-life projects contribute to transitioning to a low carbon global economy.

This GHG Abatement plan is structured as follows:

- Section 1: Introduction
- Section 2: Project details
- Section 3: Corporate GHG Strategy
- Section 4: Project GHG Strategy including GHG emission estimates, reference point, reduction target, reduction program, advancing technologies, monitoring and auditing and reporting, and
- Section 5: GHG Risk Assessment.

2.0 Project Details

The Project is to be located on mining lease (ML) 1790, approximately 40 kilometres north-west of Moranbah, Queensland (Figure 2.1). This section provides a description of the activities subject of GHG Abatement Plan.

2.1 Access Tracks

A network of access tracks for light and heavy vehicles is present across ML 1790 and connects to the existing road network (i.e. North Goonyella Mine Access Road) (**Figure 2.1**) due to existing and historical activities within ML 1790. The existing access tracks will be used as much as possible to connect the proposed drill pads and minimise requirements for additional surface disturbance.

Where new access tracks are required due to the location of the drill pads, these will be constructed to allow for light and heavy vehicles. The new access tracks will be 5 m wide and will extend a cumulative 0.31 km, typically in an East-West direction (**Figure 2.2**).

2.2 Coal Seam Gas Exploration

The program for exploration and evaluation of CSG has been designed as a network of gas extraction wells, extending from the ground surface down to the GM coal seam with lateral in-seam drainage to maximise the coverage of data acquisition from the exploration program. These wells will be supported by surface infrastructure for CSG processing, monitoring, and control.

Vertical wells are drilled from the surface directly downwards. The lateral wells are drilled near vertically from the surface and are then deviated through a tight radius bend to intercept the target coal seam parallel to the bedding planes (**Image 2.1**). The lateral wells are then directionally drilled through the GM coal seam to incept its corresponding vertical well. The vertical wells are used for collecting and conveying the CSG and associated water to the surface from within the lateral well that passes through the GM coal seam.

2.2.1 Drill Pad

Each CSG well will be constructed and operated from within the boundaries of a drill pad. A total of nineteen (19) drill pads are proposed for the vertical and lateral wells. **Table 2.1** presents details of the drill pad disturbance area and **Figure 2.2** illustrates their locations.

Table 2.1 Drill pad disturbance area

Drill pads	No	Dimensions (m)	Disturbance area (ha)
Drill pad	19	80 X 80 m	12.65
Less existing approved disturbance			(0.85)
Total new disturbance			**11.80**

Figure 2.2 illustrates the proposed layout of vertical and lateral wells across the drill pads. Some drill pads will be dual propose and accommodate both vertical and lateral wells within them.

2.2.2 Vertical Wells

A total of thirteen (13) vertical wells will be drilled (**Figure 2.2**). Following development of the drill pads, construction methodology for the vertical wells is as follows:

- The initial step involves drilling a pilot hole (known as spudding). A larger diameter hole (12 ¾" diameter) is then drilled to a shallow depth (24 m) and a steel casing is installed to prevent the well from collapsing. The hole is then drilled to the target GM coal seam depth (290 - 570 m). Drilling fluid (mud) is used to lubricate the bit, control pressure, and carry cuttings to the surface. The cuttings will then be collected at the surface, where they will be disposed of in line with the CCM waste management procedure.
- Casing (such as steel, fibre glass or high-density polyethylene (HDPE)) is run into the hole to the total depth and cemented in place to prevent groundwater and gas from moving outside of the well and between geological layers. Perforations are made in the casing at the coal seam level to allow gas to flow into the well.
- The well is completed with necessary equipment for gas extraction. Initial production tests are conducted to evaluate the well's performance.
- During the extraction evaluation operation, the CSG from the vertical well will be connected via a low-pressure pipeline to a candle stick flare kit located within the disturbance footprint of the drill pad. The flare will enable combustion of all extracted methane gas to minimise the emission intensity of the evaluation operation.

2.2.3 Lateral Wells

Ten (10) lateral wells will be drilled into the GM coal seam (**Figure 2.2**) from pads located within ML1790. A further three (3) lateral wells will be drilled from pads located within ML6949 and will intercept vertical wells that are within ML1790 such that a total of thirteen (13) paired lateral and vertical wells are completed to enable gas extraction from the GM seam. Following development of the drill pads, construction methodology for the lateral wells follows the same methodology as for vertical wells:

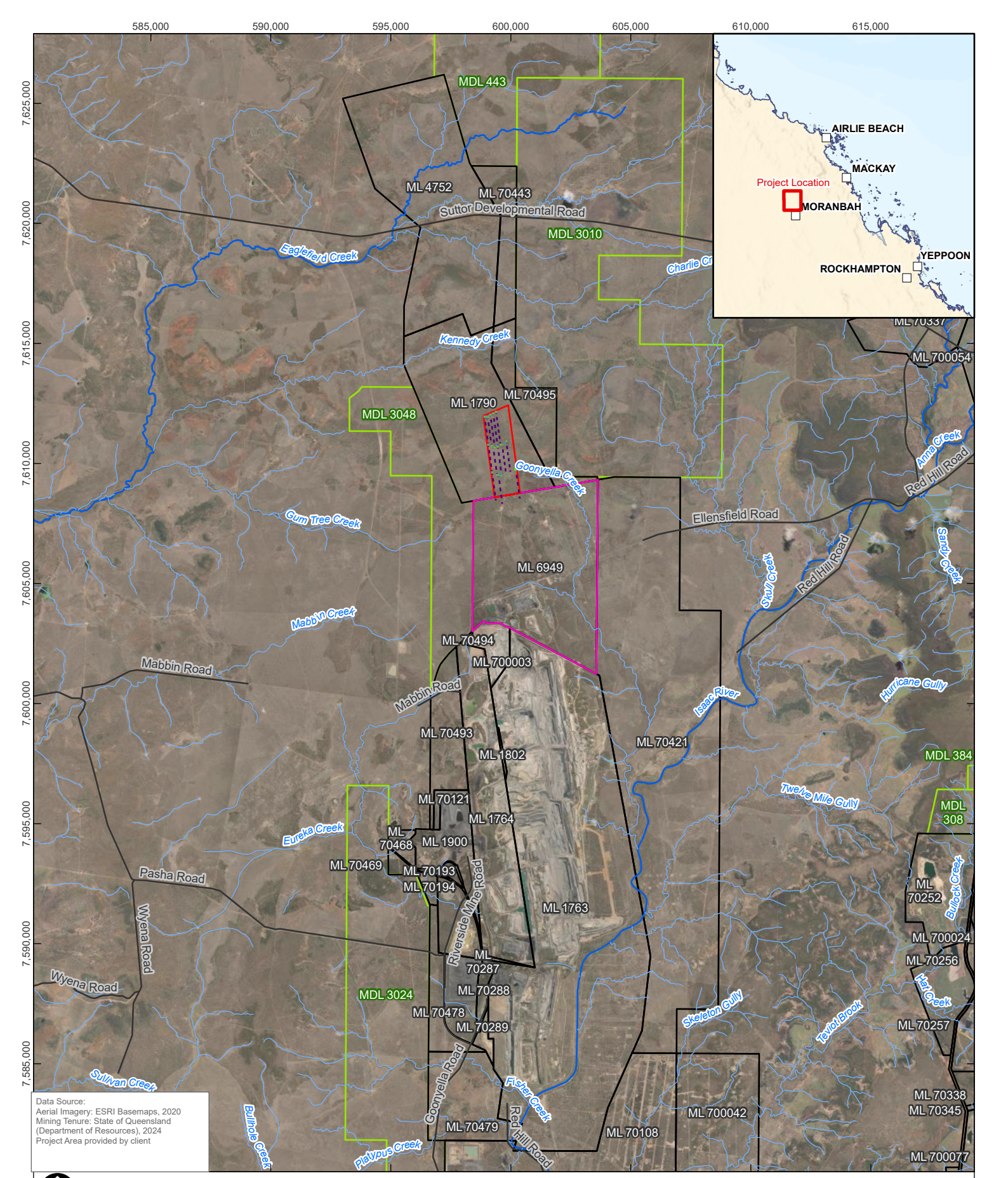
- A vertical section is drilled to a depth above the target GM coal seam (290 - 570m). Then, using directional drilling techniques, the wellbore is gradually deviated from the vertical to horizontal, forming a curve. This requires specialized downhole motors and tools.
- Once the curve is horizontal, it is drilled along the coal seam (1000-1900 m) for a specified distance to connect with the vertical well. The horizontal well maximizes exposure to the coal seam, enhancing gas recovery and the spatial extent of data acquisition.
- Casing (such as steel, fibre glass or HDPE) (7 7/8” diameter) is run into the well and cemented to isolate the gas-producing zones. Perforations are made in the casing at the coal seam level to allow gas to flow into the well.
- The horizontal well is completed with equipment designed for gas production, including perforating the casing along the horizontal section.

2.2.4 Exploration Method

Following drilling of the vertical and lateral wells and installation of the necessary extraction and monitoring equipment, CSG will be extracted as follows:

- Water in the GM coal seam (formation water) will be removed through the vertical wells, reducing the pressure in the coal seam (by ~40 kpa/day) throughout the lateral well that each vertical well is paired with. Pumps located at the base of the vertical wells, are operated to bring water to the surface.
- It is anticipated that depressurising of the coal seam will take up to 90 days. The water will pass through the well head to storage tanks and be carted off and added to the CCM mine water management system.
- The reduction in pressure within the coal seam allows CSG to be desorbed from the coal. The CSG will migrate through the coal's natural fractures (cleats), through the perforations made in the casing and into the lateral well.
- The desorbed CSG will flow along the lateral well and up into the connected vertical well to the surface, where it will be separated from any remaining water.
- The CSG will pass through a steel pipe before being flared. It is anticipated that the CSG will comprise >99% methane (CH_4) and will be flared 24 hours per day. Data logging will take place to record the amount of CSG produced from the wells. It is anticipated that CSG will be produced at an average flow rate of 500 l/sec from each vertical well.
- Water and gas monitoring data collected during the evaluation will enable the development of decline curves which will better inform the gas-in-place, geological and hydrogeological models for the resource.

Image 2.1 and **Image 2.2** present examples of CSG well schematics.



Data Source:
Aerial Imagery: ESRI Basemaps, 2020
Mining Tenure: State of Queensland (Department of Resources), 2024
Project Area provided by client

0 2.5 5 km

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:200,000 at A4
Project Number:	620.040594.00001
Date Drawn:	11-Sep-2024
Drawn by:	RB

LEGEND

- Road
- Project Area
- Centurion Coal Mine
- Mining Lease
- Mineral Development Licence
- Lateral Well Length
- Drill Pad
- Access Track

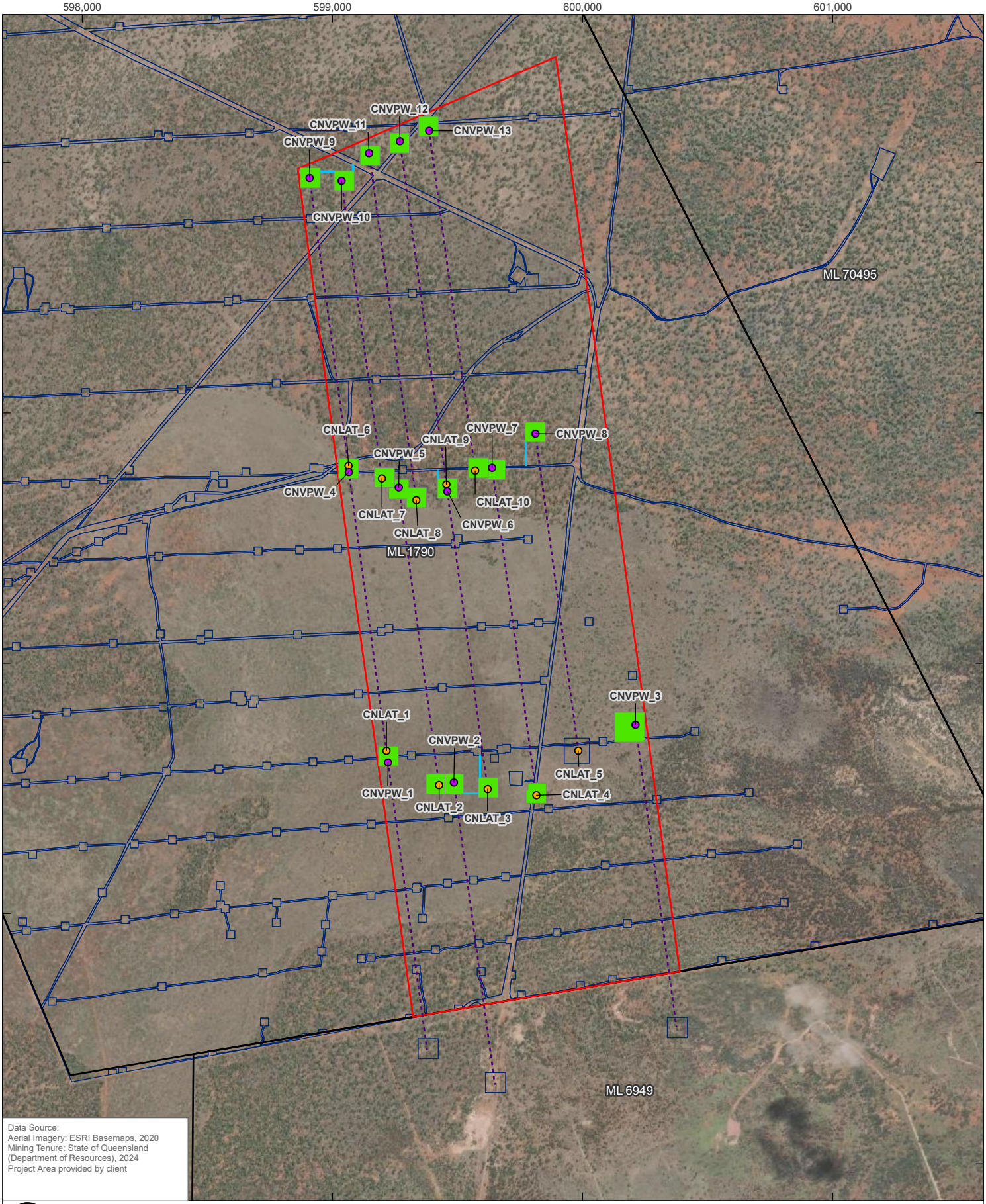
EA AMENDMENT P-EA-100658735

PROJECT LOCATION

SLR

FIGURE 2.1

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_F03-01_Project Location



EA AMENDMENT P-EA-100658735

Coordinate System:	GDA2020 MGA Zone 55
Scale:	1:20,000 at A4
Project Number:	620.040594.00001
Date Drawn:	09-Sep-2024
Drawn by:	RB

PROPOSED PROJECT LAYOUT

SLR

FIGURE 2.2

Path: \\au.slr.local\Corporate\Projects-SLR\620-BNE\620-BNE\620.040594.00001 North Centurion Environmental\06 SLR Data\01 CADGIS\GIS\North Centurion Environmental\North Centurion Environmental.aprx\620040594_EA_F03-02_Proposed Project Layout

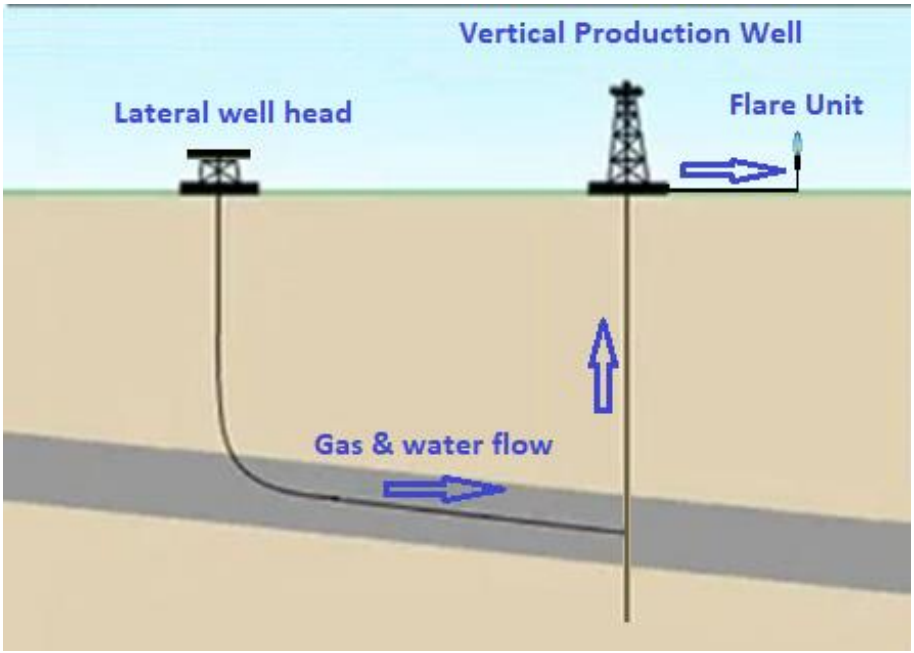


Image 2.1 Schematic of vertical and lateral wells

Image 2.2 Example of drill pad arrangement

2.3 Water

Construction water requirements will be supplied via water truck to the drill pad and well locations. Approximately 5,000 kL of water sourced from the CCM raw water dam is anticipated to be required for construction of the 19 drill pads and drilling of the 23 wells.

Water collected from the wells during operations will be pumped to holding tanks located on the relevant drill pads. Each holding tank is designed to hold a capacity of 20 kL of water / sufficient for one day of pumping during initial depressurising of the target coal seam. It is expected that water collected from the wells following depressurisation will reduce. From the holding tank, the water will be collected by a water truck and taken to CCM where it will be treated and integrated into the CCM mine water management system.

2.4 Power

The Project electricity requirements are for the drill pumps and well pumps. It is proposed that on-site generators are used to provide electricity for vertical drill pads. One 60 kV diesel generator is required per vertical drill pad, a total of thirteen (13) generators are required.

High-voltage connection to the electricity network will not be required.

2.5 Amenities

The drill pad sites will include a mobile office and workshop which will be relocated as drilling progresses.

2.6 Equipment

Table 2.2 outlines the earth moving and drilling equipment (currently being utilised at the CCM) that will be used in the construction, maintenance and operation of the access tracks, drill pads and wells.

Table 2.2 Equipment requirements

Equipment Description
Earth moving
Dozer such as the Caterpillar D8T for primary excavation surface of drill pads and access tracks
Grader, such as Caterpillar Grader 150
Truck, such as Caterpillar 745 Articulated Truck
Vibratory soil compactor, such as Caterpillar Roller 256B
Vegetation slasher
Water
30kL water truck to provide construction water requirements and collect extracted well water
Power
60kV diesel generator to provide power to well and pump infrastructure
Drill rigs
1 SIS **drill rig and** 1 vertical drill rig
Wellhead equipment
Wellhead assemblies to control the pressure and flow of CSG to the surface

Equipment Description
Valves and fittings to control and direct the flow of CSG to the surface
Flares and venting systems for controlled burning of CSG
Pumps
Water pumps to remove water from the coal seam
G**as pumps f**or extracting CSG from the well
Mud pumps and systems for drilling fluid circulation
Gas Separation and processing equipment
Separators to separate CSG from water and other impurities
Measurement and monitoring devices
Flow meters to measure the amount of CSG being extracted
Pressure gauges to monitor pressure levels in the well
Gas analysers to analyse the composition and quality of the CSG
Safety and environmental control equipment
Blowout preventers (BOPs) to prevent uncontrolled release of CSG
Monitoring systems for detecting gas leaks and monitoring environmental compliance
Control and automation systems
SCADA systems for remote monitoring and control of gas production
Automation software for optimising gas extraction and processing

3.0 Corporate GHG Strategy

3.1 Overview

Peabody has a social responsibility to reduce our GHG emissions and has established an ambition of achieving net-zero emissions (Scope 1 and 2) by 2050 through setting measurable, near-term emission reduction goals. We are creating value by reducing emissions at our operations and developing opportunities to support our customers' climate commitments, including investment in advancing technology and the development of renewables.

As operators of both thermal and metallurgical mines in the United States and Australia, Peabody's corporate greenhouse gas (GHG) strategy must reasonably balance the regulatory environment, customer expectations, and market segments in which we operate to drive outcomes that support our operations. We believe the transition to a net-zero emissions economy must balance the need for a timely transition with the necessity for affordable, reliable energy and steel.

Peabody continues to responsibly mine its existing domestic thermal coal reserves in the United States, while reducing annual volumes from this segment by 20-40 million tons by 2035 (versus 2021 production), which will result in emission reductions in this segment.

Within the Australian operations, Peabody operates six mines that are subject to the Australian Safeguard Mechanism and are committed to aligning our emission reduction strategy to the targets established by the Clean Energy Regulator. For each Peabody facility, we are assessing emission reduction opportunities that best align with the facility emission and production profiles, as well as the technical and financial feasibility of potential emission mitigation activities.

Peabody currently reports Scope 1 and 2 emissions annually in both our Sustainability report, as well as through the National Greenhouse Gas and Energy Reporting (NGER) Scheme in Australia.

Peabody's Scope 1 direct emissions include consumed diesel fuel and fugitive emissions from our operations, and our Scope 2 emissions result from the consumption of purchased electricity. In 2023, our emission intensity per ton of mined coal decreased by five percent compared to 2022, while overall emissions also decreased by more than five percent. Peabody's Scope 1 and 2 emissions have decreased over 35 percent since 2018, resulting from GHG emissions reduction efforts and the impact of lower production volumes.

After achieving the first emission reduction target, Peabody intends to set the next near-term targets to reduce our Scope 1 and 2 emissions in late 2024, with a continued commitment to establish incremental, measurable and actionable targets to reach our net-zero emission aspiration.

For Australian operations, we are currently assessing future production volumes, opportunities to implement emission reduction technologies and initiatives that drive operational excellence, and the targets established under the Safeguard Mechanism to ensure these targets support long-term economic, social and environmental sustainability.

While Peabody has not established specific targets related to the reduction of Scope 3 emissions, Scope 3 emissions related to the Australian operations will be reported in 2026, in compliance with the recent addition of climate-related metrics to financial disclosure requirements. Further, Peabody will continue to support the research, development and deployment of technology that will reduce emissions within our value chain. These efforts include investments in renewables development on previously mined land through the R3

joint venture, support of high-efficiency, low-emissions coal-fuelled generation (HELE) and Carbon Capture and Storage (CCS), as well as future coal-derived products.

Figure 3.1 illustrates Peabody's scope 1 and 2 emissions from 2018 – 2023 measured at a corporate level and this information is publicly available in the Peabody 2024 Sustainability Report.

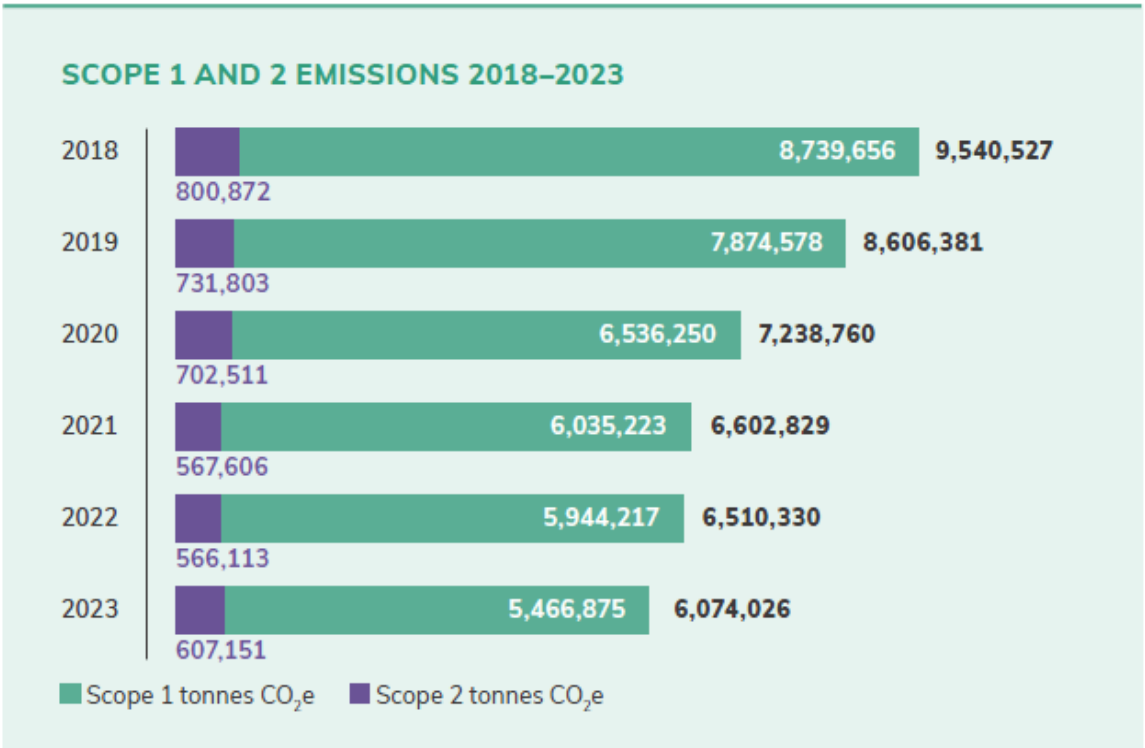


Figure 3.1 Peabody Scope 1 and 2 emissions from 2018 – 2023

3.2 Commitments

Table 3.1 presents a summary of Peabody's GHG emission commitments.

Table 3.1 Summary of Peabody's GHG Abatement Plan

Element	Comments
Peabody emissions reference point	Emission reduction will be measured based on the site-specific emission intensity approved by the Clean Energy Regulator for the Centurion Complex, comprising CCM and Centurion North. Adoption of this reference point is considered appropriate for the Project due to the aggregated emissions from CCM and Centurion North being reported under the same Safeguard Facility. Emission reduction initiatives will be focused at a Facility level to deliver maximum impact and to support the investment in those initiatives regardless of the source of emissions from the various Facility tenements.
Peabody emissions reduction targets	Centurion Coal Mining Pty Ltd is implementing emission reductions in alignment to the annual targets outlined by the Department of Climate Change, Energy, the Environment and Water (DCCEEW) Safeguard Mechanism.

Element	Comments
Emission reduction measures	Flaring of drained CSG is currently utilized as a key emission reduction measure.
Abatement opportunities / advancing technologies	Communication enhancement to optimize equipment runtime.
Reporting	Annual reporting of emissions in compliance with the NGERS Act

4.0 Project GHG Strategy

This section provides details on the Project estimated GHG emissions, the reference points, reduction target, monitoring, auditing and reporting.

4.1 GHG Emission Estimates

4.1.1 Greenhouse Gas Inventory

The *'National Greenhouse and Energy Reporting Act 2007*' (NGER Act) provides a framework for the annual reporting of corporate greenhouse gas (GHG) emissions, energy consumption and production.

DCCEEWs *'Australian National Greenhouse Accounts Factors'* (NGA Factors 2023) provides a methodology by which corporations estimate GHG emissions associated with their activities, including:

- GHG emissions are reported in units of carbon dioxide equivalent or CO2-e
- GHG sources are classified as being either 'direct" or 'indirect':
    - Direct emission sources (or Scope 1) are produced from sources within the boundary of an organisation and as a result of that organisation's activities
    - Indirect emissions are generated as a consequence of an organisation's activity, but which are physically produced by the activities of another organisation. There are two classes of indirect emissions: electricity (Scope 2) and other sources (Scope 3), and
- It is noted that the NGER Act requires the reporting of Scope 1 and Scope 2 emissions, however the reporting of Scope 3 emissions is voluntary.

The focus of this GHG assessment is Scope 1 emissions. Scope 2 emissions are not applicable as the Project electricity requirements will be locally generated using diesel generators and not consumed from the national grid. Furthermore, the Project will not produce a product, therefore there are no downstream Scope 3 emissions. Upstream Scope 3 emissions have not been considered.

In relation to the NGA Factors used in the assessment (Table 6.7) it is noted that options for the combustion of the extracted gas within the NGA Factors include:

- Coal seam methane that is captured for combustion, and
- Coal mine waste gas that is captured for combustion.

Chapter 3, Part 3.2, Division 3.2.1 of the NGER (Measurement) Determination 2008 (the Determination), refers to available methods for estimating emissions with a differentiation between the release of fugitive emissions during mining operations and those that are release *before* the extraction of coal. Method 4 under Part 1.3 of the Determination has been used to estimate fugitive emissions associated with venting.

Estimates of emissions associated with flaring have been based on the NGA factor for *coal seam methane that is captured for combustion* with the methane component of the CSG associated with the Project, estimated at greater than 99%. This emission factor was considered appropriate for the Project as it is extracting CSG from the GM seam without mining the coal. As such the use of the coal mine waste gas factor was not selected as there is no coal mining associated with the Project.

Table 4.1 presents the scope 1 NGA Factors considered in this assessment.

Table 4.1 National Greenhouse Accounts Emission Factors (Scope 1)

Emission Source	Energy Content (3)	Emission Factor	Units(2)	Source
Coal seam methane that is captured for combustion	0.0377 GJ/m^3	51.63	kg CO2-e/GJ	NGA(1)
Combustion of diesel fuel	38.6 GJ/kL	70.20	kg CO2-e/GJ	NGA(1)

Note: (1) NGA – Australian Government's Department of Climate Change, Energy, the Environment and Water's National Greenhouse Accounts Factors (2023)

(2) kg CO2-e/GJ – kilograms (KG) of carbon dioxide equivalent (CO2-e) per gigajoule (GJ)

(3) (a) GJ/m^3 – gigajoule (GJ) per cubic metre (m^3)

(3) (b) GJ/kL – gigajoule (GJ) per kilolitre (kL)

4.1.2 Emission Estimates

The following subsections detail the potential GHG impacts as a result of the activities described in **Section 2**.

4.1.2.1 Construction of Drill Pads and Access Tracks

Based on information provided in **Section 2.0**, a total of 19 drill pads (11.80 ha) and 0.2 ha of access tracks will be developed as part of the Project. Combustion of diesel fuel will be associated with activities undertaken by the dozer, articulated truck, roller and grader during the construction of the drill pads and access tracks.

Based on the NGA Factors provided in **Table 4.1** and estimates of diesel fuel usage, between 170 and 260 tonnes of CO2-e emissions are estimated to be associated with the combustion of diesel fuel during the construction of the drill pads and access tracks.

For the purposes of this assessment, an average value of 215 tonnes of CO2-e has been used as an estimate of GHG emissions during the construction of the drill pads and access track. These emissions are assumed to emitted during FY2025.

4.1.2.2 Establishment of Vertical and Lateral Wells

Based on information provided in **Section 2.2**, the 13 vertical well will require approximately 10 days of drilling time. Lateral wells will each taking approximately 20 days. Thus in total, approximately 330 days of drilling will be undertaken to complete drilling of the network of vertical and lateral wells.

Based on the NGA Factors provided in **Table 4.1** and a drill rig diesel fuel consumption range of 75 to 110 litres per hour, approximately 1,600 to 2,400 tonnes of CO2-e emissions is estimated to be associated with the drilling of the network of vertical and lateral wells.

For the purposes of this assessment, an average value of 2,000 tonnes of CO2-e is used as an estimate of GHG emissions during the establishment of the wells. These emissions are assumed to be distributed between FY2025 and FY2026.

4.1.2.3 Vertical and Lateral Wells Operation

Flaring

Based on information provided in **Section 2.2**, each of the 13 vertical wells will produce CSG at a rate of approximately 500 l/sec per well.

The combustion of methane by the flaring of CSG, as opposed the release of CSG directly to the atmosphere, has the benefit of significantly reducing the global warming potential (GWP) of the released gases into the atmosphere due to the conversion through combustion of methane with a GWP of 28 into carbon dioxide with a GWP of 1.

Estimates of GHG emissions associated with the flaring of CSG have been based on:

- The NGA Factor provided in **Table 4.1**
- An assumed 95% flare up-time
- Due to the staggering of wells coming online during the first half of FY2026, an equivalent of 9.58 wells will be operating for the 12-month period
- Due to the staggered shutdown of wells during the second half of FY2027, an equivalent of 9.92 wells will be operating for the 12-month period, and
- The wells will produce CSG at an average rate of 500 l/s per well.

Thus, the flaring of CSG is estimated to produce:

- 279,420 tonnes of CO2-e during FY2026, and
- 289,140 tonnes of CO2-e during FY2027

Venting

The venting of CSG may occur when the flare is unavailable which is estimated to occur less than 5% of the time.

Method 4 of Part 1.3 of the NGER (Measurement) Determination 2008 has been used to estimate fugitive emissions during venting of CSG.

Based on the assumptions as per those applied in the estimation of GHG emissions associated with flaring with an assumed 5% flare down-time, fugitive emissions due to the venting of CSG is estimated to result in:

- 45,900 tonnes of CO2-e during FY2026, and
- 47,500 tonnes of CO2-e during FY2027.

Generators

As noted in **Section 2.4**, electricity will be required to operate the drill pumps and the well pumps. A total of thirteen 60 kV diesel generators will be co-located with the vertical wells.

Based on the NGA Factors provided in **Table 4.1** and conservatively assuming that all diesel generators will operate for a period of c. 27 months at a diesel fuel consumption rate of between 8 to 14 litres per hour, between 5,500 to 9,700 tonnes of CO2-e emissions are estimated to be associated with the operation of the generators.

For the purposes of this assessment, an average value of 3,400 tonnes of CO2-e per 12 months is used as an estimate of GHG emissions. Thus, it is estimated that:

- 850 tonnes of CO2-e are emitted during FY2025

- 3,400 tonnes of CO2-e are emitted during FY2026, and
- 3,400 tonnes of CO2-e are emitted during FY2027.

4.1.2.4 Summary of GHG Emission Estimates

Table 4.2 provides a summary of estimated Scope 1 GHG emissions over the life of the Project, highlighting the flaring of CSG as the primary source of emissions.

Table 4.2 Summary of GHG Emissions

Scope	Project Phase	Source	FY2025 Tonnes of CO2-e	FY2026 Tonnes of CO2-e	FY2027 Tonnes of CO2-e	Percentage of Total
1	Construction	Combustion of diesel in equipment during drill pad and access track construction	215	n/a	n/a	0.03%
1	Construction	Combustion of diesel in drill rig during construction of vertical and lateral wells	1,000	1,000	n/a	0.30%
1	Operation	Combustion of diesel in generators during operation of vertical and lateral wells	850	3,400	3,400	1.14%
1	Operation	Flaring of CSG	n/a	279,420	289,140	84.63%
1	Operation	Venting of CSG	n/a	45,900	47,500	13.90%
2	n/a	Electricity consumption	0	0	0	0%
Total GHG Emissions (tonnes CO2-e)			**2,065**	**329,720**	**340,040**	**100%**

4.1.3 Comparison with Australian Emissions

The latest Australian GHG emissions inventory (2021-2022) provided in the DCCEEW '*National Inventory Report 2022'* (DCCEEW, 2024) indicates Australia's total GHG emissions (including land use, land use change and forestry activities) was 432.6 million tonnes (Mt) of CO2-e.

More than 99.6% of the Project's CO2-e emissions occur over the 2-year period FY2026 and FY2027 and are primarily associated with the flaring of CSG (84.6%).

The summary of emissions provided in **Table 4.2** suggests an annual Project-related contribution to GHG emissions in the range of approximately 0.33 Mt and 0.34 Mt of CO2-e per year. This represents between 0.076% and 0.079% of Australia's 2022 GHG emissions.

Queensland's contribution to the 2022 national inventory was estimated to be 124.1 Mt of CO2-e. The Project's contribution represents 0.266% to 0.274% of Queensland's 2022 emissions.

4.2 GHG Emission Reference Point

As noted in Table 3.1 emission reduction will be measured based on the site-specific emission intensity approved by the Clean Energy Regulator for the Centurion Complex, comprising CCM and Centurion North.

Adoption of this reference point is considered appropriate for the Project due to the aggregated emissions from CCM and Centurion North being reported under the same Safeguard Facility. Emission reduction initiatives will be focused at a Facility level to deliver maximum impact and to support the investment in those initiatives regardless of the source of emissions from the various Facility tenements.

The emission intensity factor (EIF) which has been approved by the Clean Energy Regulator for the Facility is 0.3871 CO2-e t / ROM t. This EIF will be utilized as the production variable for establishing the annual emissions baseline in this reporting. This will ensure that the Safeguard Mechanism applies to the Centurion Complex as GHG emissions would always be above the Safeguard DLF threshold.

4.3 GHG Emissions Reduction Target

The interim and long-term Scope 1 GHG emission reduction targets will be in line with the Safeguard Mechanism baseline annual reduction for the Safeguard Facility. **Table 4.3** presents the GHG emission reduction targets under the Safeguard Mechanism for the Facility.

Table 4.3 GHG Emission Reduction Targets

FY (Jul-Jun)	Reference EIF	Target EIF	Reduction, %
25	0.3871	0.3201	17.3
26	0.3871	0.2889	25.3
27	0.3871	0.2594	33.0

Due to the shortened period of the Project, the proposed mitigation of GHG emissions was deemed to be most effective abatement strategy and emission reductions from this control strategy align with the emission reductions outlined in the Safeguard Mechanism, in comparison to an unabated base case.

4.4 GHG Emissions Reduction Program

The following GHG emission reduction measures are proposed for the Project:

- Operation of flares at >95% availability
- Real time monitoring of the flare's ignition system with alarms (1)
- Full-time Gas Drainage Engineer employed to monitor and address performance of gas drainage and flare operation
- Use of personal methane gas monitors to detect fugitive emissions
- Tracking response times to alarms
- Use and maintenance of fuel-efficient plant and equipment
- Monitoring of diesel use, and

- Operator training.

4.5 Advancing Technologies and Opportunities

Centurion Coal Mining Pty Ltd has overhauled and upgraded or purchased upgraded flare units that have higher reliability and auto-ignition functions for CCM. If the flare stops, the temperature sensor triggers an auto-reignite to immediately re-start flaring. If for any reason the auto-reignite fails, then an alarm is sent to the control room and an operator is dispatched to rectify, response times are generally within 20 minutes. With the new systems in place the flare rate has increased to above 99%. This system will be applied to the Project.

4.6 Monitoring and Auditing

Centurion Coal Mining Pty Ltd currently undertake the following monitoring and assurance actions for GHG emissions:

- Monthly review of incoming and outgoing reports. This includes disclosure to internal key stakeholders of set annual emission intensity targets and Safeguard Baseline, and how Centurion Coal Mining is tracking against them
- Quarterly report review of activity data and emission estimates
- Annual review and summary report as outlined in **Section 3.0**, and
- Targeted third-party voluntary assurance engagements on NGER emissions and energy estimates, which can be extended to also cover emission reduction targets.

4.7 Reporting

In addition to the above-mentioned monitoring, auditing and annual reporting, Centurion Coal Mining Pty Ltd will be required to disclose climate-related risks and opportunities under the Australian Sustainability Reporting Standards (ASRS) from financial year 2025 onwards, including:

- Scope 1 and 2 emissions
- Scope 3 emissions (optional)
- GHG reduction targets (optional)
- Climate scenario analysis
- Climate resilience assessment
- Climate transition plan, and
- Governance.

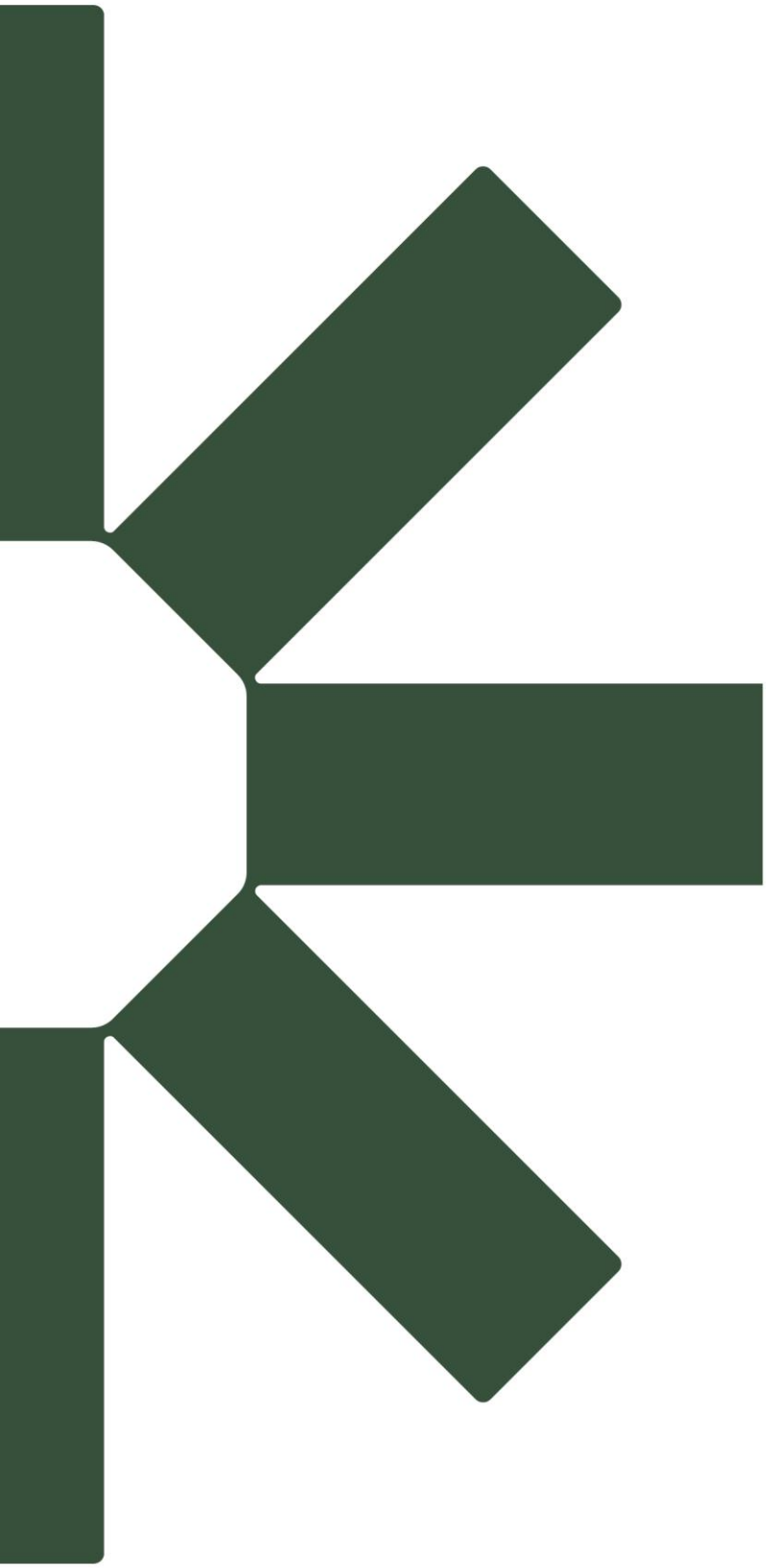
However, the disclosures may not show the level of granularity that will capture this scope of work as a standalone asset given all the existing and future projects associated with the Centurion Complex will be treated as a single Safeguard Facility from financial year 2024 onwards.

5.0 GHG Risk Assessment

The risk that impacts of GHG emissions associated with the Project will have a material change on Queensland's Climate Outcomes is considered Low (**Table 3.1**).

Table 5.1 Greenhouse Gas Risk Assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Fugitive emissions of GHG associated with the Project will contribute to climate change	Possible (3)	Minor (1)	Low	Although any contribution to GHG may contribute to climate change in theory, it is unlikely that the scale of the contribution of fugitive emissions of greenhouse gases from the project would result in a material change in climate outcomes. Nonetheless, all practicable strategies to reduce the risk of fugitive emissions of CSG throughout the life of the Project should be implemented.



Making Sustainability Happen