Centurion North Extension Project

Environmental Authority Amendment Application Supporting Information

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

Level 14, 31 Duncan Street, Fortitude Valley,
Queensland 4006

Prepared by:

SLR Consulting Australia Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Revision: 2.0

Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
2.0	23/01/2026	A. Hudson, E. Blandthorn	B. Brooks, M Gibbons	B. Brooks

Basis of Report

This report has been prepared by SLR Consulting Australia Pty Ltd (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 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.

Centurion Coal Mining Pty Ltd proposes to undertake exploration activities and early works (the Project) to support future longwall extraction within ML 1790. Exploration and early work activities include coal seam gas (CSG) exploration, construction of gas risers, service boreholes, boreholes for sampling and exploration, a bleeder shaft, disturbance for future surface works, construction of gate roads, and Underground In-Seam (UIS) gas drainage works.

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_V3 is required. The proposed changes include:

- EA P-EA-100658735:
    - Inclusion of an additional Environmentally Relevant Activity;
    - Inclusion of a new condition in Schedule A;
    - Modification of Condition 15 Schedule A;
    - Condition 7 Schedule F;
    - Condition 22 Schedule F;
- PRCP P-PRCP-100669070_V3:
    - Section B - Figure 1 and Figure 2;
    - Section C - (RA1) Rehabilitation area 1; and
    - Section C – Rehabilitation area milestones.

Assessments for groundwater, surface water, terrestrial ecology, aquatic ecology, air quality, greenhouse gas, noise and vibration, 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 to medium risk of causing environmental harm/nuisance beyond that authorised by the EA for most EVs. Significant to high risks for the Project include risks to terrestrial ecology relating to vegetation clearing and habitat removal, and fauna injury and mortality.

Given the scale and location, the Project activities can be largely 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 EVs from the Project.

Additional mitigation and management measures have been presented in this Supporting Report to further reduce the extent of impact. In particular, the Project will aim to avoid impacts to Matters of State Environmental Significance (MSES) for terrestrial and aquatic ecology where possible, particularly large and intact areas supporting or potentially supporting conservation significant species.

Despite the implementation of mitigation and management measures, the Project has the potential to result in a significant residual impact to two MSES – regulated vegetation (RE 11.8.11) and koala habitat. Suitable offsets, as required under the Queensland environmental offset framework, are expected to be conditioned as part of approvals for the Project.

For the remaining MSES identified or considered to potentially occur in the Study Area, the Project is considered unlikely to cause significant residual impact due to the relatively small scale of clearing, the extent of habitat remaining elsewhere in the region, and/or the lack of ecologically significant locations.

An ALD was received from the Department of the Environment, Tourism, Science and Innovation (DETSI) on 17 November 2024, which considered that the proposed amendments to the EA and PRCP schedule is a major amendment.

Table of Contents

Tables

Figures

Appendices

Acronyms and Abbreviations

ALD	Assessment level decision
AUSRIVAS	Australian River Assessment System
BAR	Bioacoustic recorders
Biosecurity Act	*Biosecurity Act 2014*
BoM	Bureau of Meteorology
BSI	British Standard Institution
CCM	Centurion Coal Mine
CEFAM	Clean Energy Fuel Australia Marketing
CH4	Methane
CND	Centurion North Development
CO2-e	Carbon dioxide equivalent
CRT	Constant Rate Test
CSG	Coal seam gas
dB	Decibel
dBA	A-weighted decibel (referenced 20 µPa)
DCCEEW	Department of Climate Change, Energy, the Environment and Water
DES	Department of Environment and Science
DETSI	Department of the Environment, Tourism, Science and Innovation
Disturbance area	The extent of disturbance that incorporates all elements of the Project
DNRME	Department of Natural Resources, Mines and Energy
DNRMMRRD	Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development
DoR	Department of Resources
EA	The Environmental Authority
EA Amendment	Environmental Authority Amendment – Major Amendment under the *Environmental Protection Act 1994*.
EIS	Environmental Impact Statement under the *State Development Public Works Organisation Act 1971*
EO Act	*Environmental Offsets Act 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
EPP(Air)	*Environmental Protection (Air) Policy 2019*
EPP(Noise)	*Environmental Protection (Noise) Policy 2019 (Qld)*

EPP(WWB)	*Environmental Protection (Water and Wetland Biodiversity) Act 2019*
ERA	Environmentally Relevant Activity for which the Environmental Authority authorises under the *Environmental Protection Act 1994*.
ERC	Estimated Rehabilitation Cost
e2m	E2M Consulting Pty Ltd
EV	Environmental Value
GBMC	Goonyella Broad Meadow Complex
GDE	Groundwater Dependent Ecosystem
GHG	Greenhouse gas
GJ	Gigajoule
GMA	Groundwater management area
GM	Goonyella Middle coal seam
GWP	Global Warming Potential
ha	Hectares
HES	High Ecological Significance
HEV	High Ecological Value
Hydrobiology	Hydrobiology Pty Ltd
Hz	Hertz
ID	Identification
ISO	International Organisation for Standardisation
Kg	Kilograms
kL	Kilolitre
km	Kilometers
kPa	Kilopascals
kPa/d	Kilopascals per day
kV	kilovolt
L	Litre
L/sec	Litres per second
LA1	The A-weighted noise level exceeded for 1% during any given measurement period
LA10	The A-weighted noise level exceeded for 10% during any given measurement period
Litter	Domestic refuse such as paper, plastic and glass that is thrown, blown or left in the wrong place.
LIKT	Locally important koala tree
M	Meters
m^2	Square metres

m^3	Cubic metre
mAHD	Metres above Australian Height Datum
mbgl	Meters below ground level
mH_2O	Metres water head
MMC	Model Mining Conditions Guideline
ML	Mega litres
ML	Approved Mining Lease under the *Mineral Resources Act 1989*.
m/day	Metres per day
mm	Millimetre
mm/s	Millimetres per second
MNES	Matters of National Environmental Significance are prescribed under the *Environment Protection and Biodiversity Conservation Act 1999*.
MR Act	*Mineral Resources Act 1989*
MSES	Matters of State Environmental Significance are defined by Schedule 2 of the *Environmental Offsets Regulation 2014* and include multiple prescribed environmental matters under Queensland legislation (and associated subordinate legislation and policies) including: *Nature Conservation Act 1992, Vegetation Management Act 1999, Environmental Protection Act 1994, Regional Planning Interests Act 2014, Marine Parks Act 2004, and Fisheries Act 1994*.
Mt	Million tonnes
MWTP	Moranbah Water Treatment Plan
NC Act	*Nature Conservation Act 1992*
NEPM	National Environment Protection Measures
NGA Factors	Australian National Greenhouse Accounts Factors
NGER Act	*National Greenhouse and Energy Reporting Act 2007*
PM	Particulate matter
$PM_{2.5}$	Particulate matter with an aerodynamic diameter less than 2.5 microns
PM_{10}	Particulate matter with an aerodynamic diameter less than 10 microns
PPV	Peak particle velocity
PRCP	Progressive Rehabilitation and Closure Plan
Prescribed environmental matter	A prescribed environmental matter is either a MNES, MSES and/or a matter of local environmental significance.
Project	Centurion North Extension Project
Project Area	Defined as the area immediately and directly affected by the Project.
QLD	Queensland
RBL	Rating background levels

RE	A Regional Ecosystem is a vegetation community in a bioregion that is consistently associated with a particular combination of geology, landform and soil. Regional Ecosystems are described in the Regional Ecosystem Description Database, produced by the Queensland Herbarium.
Regulated vegetation	Vegetation that is mapped within the regulated vegetation management map produced by DNRME. Regulated Vegetation is managed under the *Vegetation Management Act 1999*.
RIDA	Regional Interests Development Approval
ROM	Run-of-mine
RPI Act	*Regional Planning Interests Act 2014*
SCADA	Supervisory Control and Data Acquisition
SCL	The Strategic Cropping Land trigger map forms the extent of the SCA. SCL is land that is, or is likely to be, highly suitable for cropping because of a combination of the land's soil, climate, and landscape features.
SDPWO Act	*State Development and Public Works Organisation Act 1971*
SIS	Surface-to-Inseam well
SLR	SLR Consulting Australia
SPRAT	Species Profile and Threats database provides information about species and ecological communities listed under the *Environment Protection and Biodiversity Conservation Act 1999*.
SRI	Significant Residual Impact
Study Area	The Study Area is defined by the geographic limits of the environmental impact assessments. The study area for each technical study is defined within the relevant chapter of the EA Amendment Supporting Document.
SWL	Sound power level
t	tonnes
TEC	Threatened Ecological Community under the *Environment Protection and Biodiversity Conservation Act 1999*.
TEP	Transitional Environment Programs
The Determination	NGER (Measurement) Determination 2008
Threatened species	Critically Endangered, Endangered and Vulnerable species under the *Environment Protection and Biodiversity Conservation Act 1999* and Endangered, Vulnerable or Near Threatened (EVNT) under the *Nature Conservation Act 1992*.
TSP	Total suspended particulates
UIS	Underground In-Seam
VPW	Vertical Production Wells
VM Act	*Vegetation Management Act 1999*
W	Watts
Water Act	Water Act 2000

Watercourse	A watercourse as determined by the Department of Natural Resources, Mines and Energy under the *Water Act 2000*.
WoNS	Weeds of National Significance
µS/cm	MicroSiemens per cm

1.0 Introduction

This section presents the background, objectives, approvals, justification and structure of this Environmental Authority (EA) Amendment Application Supporting Information Report.

1.1 Objective of this Environmental Authority Amendment

Centurion Coal Mining Pty Ltd (a subsidiary of Peabody Energy Australia Pty Ltd) (the Proponent) is seeking authorisation to undertake exploration activities and early works to support future longwall extraction. Exploration and early work activities include coal seam gas (CSG) exploration, construction of gas risers, service boreholes, boreholes for sampling and exploration, a bleeder shaft, disturbance for future surface works, construction of gate roads, and Underground In-Seam (UIS) gas drainage works on Mining Lease (ML) 1790.

To obtain authorisation for these activities, an amendment to the EA (P-EA-100658735) and Progressive Rehabilitation and Closure Plan (PRCP) (P PRCP 100669070_V3) is required.

This report has been prepared to support an amendment to P-EA-100658735 and P PRCP 100669070_V3 under Section 226A of the *Environmental Protection Act 1994* (EP Act).

1.2 Project Background

The Proponent has secured the rights to explore resources within ML 1790 and ML 70495, formerly part of Stanmore's Wards Well, located immediately adjacent to and directly north of the Centurion Coal Mine (CCM), an existing underground longwall mine located on ML 6949. This new development area is referred to as the Centurion North Development (CND).

As a result, the Proponent proposes to undertake early works on ML 1790. The activities and infrastructure associated with the early works program 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:

- **Preparation works for longwall mining**: Advance the development of longwall mining through the completion of early works. Pre-drainage of methane gas from the Goonyella Middle (GM) coal seam prior to underground mining will be enabled through the construction and operation of Surface-to-Inseam (SIS) wells, gas risers and UIS gas drainage. Transfer of materials from the surface directly to underground areas will be enabled through the construction of service boreholes, and ventilation control will be enabled through the construction of a bleeder shaft. The construction of gate roads will also enable the installation of services to ensure the safety of personnel, control of contaminants, conveyance of coal and movement of equipment underground as part of future mining operations.
- **Resource identification and characterisation**: Determine coal seam thickness and quality, coal propensity to spontaneous combustion, rock strength, stratigraphy, groundwater conditions, fault structures, and gas content in the GM coal seam. These parameters will be determined from the drilling of boreholes and the operation of SIS wells and will be used to enable safe mine planning and design.

- **Feasibility assessment**: Gain further understanding of 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 coal from ML 1790. The drilling and sampling of the resource, and data gathering from the early works enable resource and groundwater models to be built and verified. From this information, 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 early works 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 Project Approvals

An initial EA amendment was submitted in September 2024 to facilitate a pilot CSG exploration and extraction program within ML 1790, scheduled from 2025 to 2027. Updated EA conditions were received on 26 March 2025.

This current EA amendment (the Project) is proposed to support future mining approvals.

1.5 Project Justification

To support future mining approvals, CSG pre-drainage activities must commence by 2027 to allow sufficient time for gas extraction prior to the commencement of underground longwall mining in January 2030, subject to approvals. The underground longwall mining will extend the existing operations at CCM northward into the CND area and will focus on the extraction of premium low-volatile hard coking coal using the underground longwall mining method.

The Project Area includes significant reserves of high-purity methane gas from CSG. The CSG pre-drainage activities will be integrated with the underground longwall mining operations to reduce emissions while contributing to energy supply via the Queensland gas network. The high concentration of CSG in the CND area has historically been problematic for underground mining operations due to safety and economic feasibility concerns regarding pre-drainage. The CSG pre-drainage program aims to address these issues by capturing and reusing gas to meet the electricity needs of the remaining CND activities and increasing domestic gas supply via the Queensland gas network.

1.6 Report Structure

This report is structured as shown in **Table 1-1**.

Table 1-1 Report Structure

Chapter	Content
Chapter 1: Introduction	Objectives of the EA Amendment Application Supporting Report, Project background, Project objectives, and report structure.
Chapter 2: Legislative 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.
Chapter 4: Proposed EA Amendments	Conditions of EA P-EA-100658735 and PRCP P-PRCP-100669070_V3 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 Assessments	Environmental assessments, which provide a summary of the EVs, technical assessments, and mitigation measures supporting this EA Amendment Application, include the following: • Groundwater; • Surface water; • Land resources; • Aquatic ecology; • Terrestrial ecology; • Air quality, greenhouse gases (GHG); • Noise and vibration; 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: References	-

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; and
- 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 authorises surface rights to access minerals and gaseous hydrocarbons in the Project Area.

2.2 Environmental Protection Act 1994

The 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 the Environment, Tourism, Science and Innovation (DETSI), 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 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; and
- 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 DETSI Major and Minor Amendment Guideline (ESR/2015/1684) (DETSI 2025), a major amendment for an EA or PRCP schedule is an amendment that is not a minor amendment.

An assessment against the criteria indicates that this EA Amendment is a major 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 has the potential to result in a significant residual impact to two Matter of State Environmental Significance (MSES) – regulated vegetation (RE 11.8.11) and koala habitat. These impacts are discussed further in **Section 6.4.** Suitable offsets are expected to be conditioned as part of approvals for the Project.

Minor EA Amendment Threshold Criteria	This EA Amendment Application
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 significantly different impact on EVs, as demonstrated under **Section 6.0**.
d) does not significantly increase the scale or intensity of the relevant activity	The EA currently allows for a disturbed area of 1.4 hectares (ha) for drill holes and pads, 11.8 ha for vertical and lateral wells, and 0.31 ha for access tracks as per previously approved amendment works. In addition, approved disturbance for historical works (including drill holes and pads, and access tracks) is also approved as per the current EA. Project proposes an additional disturbance area of 142.98 ha associated with the establishment of 334 drill pads plus ancillary infrastructure and tracks. In addition, the Proposal includes underground activities such as the construction of gate roads and gas drainage works. The Project is therefore considered to propose a significant increase in the scale and intensity of the relevant activity.
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.
f) involves an addition to the surface area for the relevant activity of no more than 10% of the existing area	The Project will change the existing surface area for the relevant activities by more than 10%, as demonstrated under **Section 3.0**.
g) for an environmental authority for a petroleum activity— i. involves constructing a new pipeline that does not exceed 150 km 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.	Not Applicable.

2.2.1.1 Assessment Level Decision

An Assessment Level Decision (ALD) was received from DETSI on 17 November 2025. 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

Public notification for this major EA and PRCP amendment will occur for 20 business days from 2 February 2026 to 28 February 2026.

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, have 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 Intergovernmental Agreement on the Environment: (i) the precautionary principle; (ii) intergenerational equity; (iii) conservation of biological diversity and ecological integrity.	(i) Peabody has evaluated the risk of potential environmental impact in line with the precautionary principle. These evaluations have formed the 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 EVs, 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 endeavour to 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.

EP Act Reference	Legislation Requirement	How Requirement is Addressed
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 major EA Amendment Application under the EP Act. These assessments have prioritised key factors such as air quality, GHG, noise and vibration, surface water, groundwater, terrestrial and aquatic ecology, Groundwater Dependent Ecosystems (GDEs), and waste management (i.e., critical matters). They comprehensively address current EVs, 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 in 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.

EP Act Reference	Legislation Requirement	How Requirement is Addressed
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	The EA (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 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 require the authorisation of an additional ERA, as discussed further in **Section 4.1.1**.

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; and
- Providing a framework for making consistent, equitable and informed decisions about the air environment.

This EA Amendment outlines an air quality assessment in **Section 6.6**, inclusive of a summary of management and mitigation measures and risk assessment of impacts to the airshed 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; and
- 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 6.8**, 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; and
- Monitoring and reporting on the condition of water.

This EA Amendment outlines the groundwater and surface water assessments in **Section 6.1** and **Section 6.2,** respectively, 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); and
- A water resource, in relation to CSG 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 anticipated to require approval under the EPBC Act; refer to **Section 6.4** and **Section 6.5** for further details. Centurion Coal Mining Pty Ltd is actively engaged in discussions with Department of Climate Change, Energy, the Environment and Water (DCCEEW) about the application of the EPBC Act with respect to the potential impacts on MNES of the proposal.

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 during 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; and
- 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 DETSI 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 a water entitlement, a water permit or a 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 ML 1790 and other mining areas on 6 November 2013.

3.0 Activities Subject of this EA Amendment

The following activities are the subject of this EA Amendment:

- Surface activities to enable the extraction of CSG extraction and safe underground coal mining operations; and
- Underground first workings to support early-stage project development.

This section outlines these activities in detail.

3.1 Location of the Project

The Centurion North Extension Project, hereafter referred to as the 'Project', is located within ML 1790 (**Figure 3-1**), approximately 40 kilometres (km) north of Moranbah. The Project is located immediately adjacent to, and north of, the CCM, which is located in ML 6949.

The Project Area is located approximately 140 km due west of Mackay (approximately 188 km by road). The Project Area is accessed from Moranbah via the Goonyella Road, the Red Hill Road and the North Goonyella Mine Access Road.

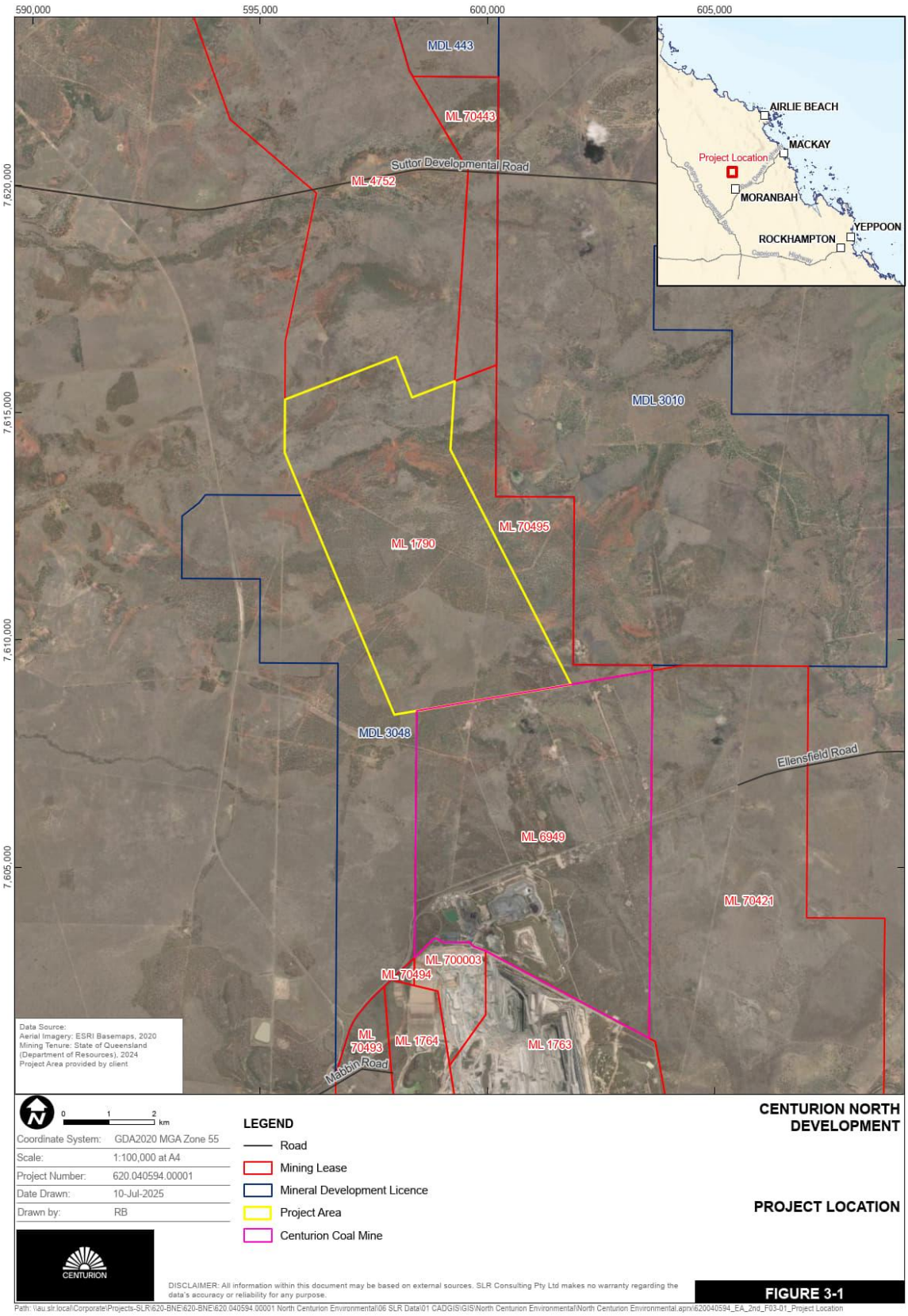


Figure 3-1 Project Location

3.2 Proposed Surface Activities

The Project involves the development of supporting infrastructure to enable CSG extraction and safe underground coal mining operations within the Project Area. All works associated with the Project will be undertaken within ML 1790.

Project activities include the following:

- Construction of new access tracks;
- Installation of a laydown area;
- Construction of drill pads for SIS wells, Vertical Production Wells (VPW), gas risers, service boreholes, a bleeder shaft, and boreholes for gas conformance, specific gas emissions, spontaneous combusting testing, geotechnical and exploration;
- Drilling and operation of vertical and lateral SIS wells to drain gas from coal seams;
- Construction of gas risers to manage gas transfer to surface facilities;
- Construction of service boreholes to transfer materials from the surface to underground;
- Drilling of boreholes for sampling of gas, coal propensity, geotechnical and exploration;
- Development of a bleeder shaft for mine ventilation and safe gas management; and
- Disturbance for future goaf drainage lines.

All drilling will be undertaken using directional drilling, blind boring technologies and other conventional drilling methods, with strict safety, environmental, and gas management measures in place.

Table 3-1 details the disturbance areas associated with drill pads, ancillary infrastructure and access tracks. This table also provides the disturbance area as both the total area of disturbance for the Project, and the total disturbance once existing approved disturbance has been considered. The proposed Project footprint is shown in **Figure 3-2.**

It is noted that the EA currently allows for a disturbed area of 1.4 hectares (ha) for drill holes and pads, 11.8 ha for vertical and lateral wells, and 0.31 ha for access tracks as per previously approved amendment works. In addition, approved disturbance for historical works (including drill holes and pads, and access tracks) is also approved as per the current EA. These areas collectively form the existing approved disturbance.

Table 3-1 Drill Pad, Ancillary Infrastructure and Access Track Disturbance Area

Component	Disturbance type	Dimensions (m)	No of pads	Area (ha)
Drill pads for wells and boreholes	Vertical and lateral SIS wells	80 x 80 m	50*	32.00
	VPW design drill pads	30 x 30 m	4	0.36
	Gas risers	80 x 80 m	43	27.52
	Service boreholes	30 x 30 m	24	2.16
	Gas conformance boreholes	30 x 30 m	145	13.00
	Specific gas emission boreholes	30 x 30 m	14	1.26
	Spontaneous combustion testing boreholes	30 x 30 m	14	1.26
	Geotechnical boreholes	30 x 30 m	38	3.42
	Exploration boreholes	30 x 30 m	2	0.18
Ancillary infrastructure and tracks	Bleeder shaft	n/a	1	1.54
	New access tracks	n/a	n/a	23.78
	Laydown area	150 x 150 m	1	1.50
	Disturbance for Future Goaf Drainage Lines	n/a	n/a	59.43
Total New Disturbance**		**334 drill pads plus ancillary infrastructure /tracks**		**167.41** (6.15% of ML 1790 area)
Total New Disturbance accounting for Existing Approved Disturbance***				**142.98** (5.25% of ML 1790 area)

Notes:

* 50 SIS well pads will be constructed, supporting a total of 66 SIS wells. Select pads will accommodate two SIS wells within the one pad footprint.

** Total disturbance area excludes overlapping drill pads.

*** Total disturbance area excluding overlapping drill pads and excluding existing approved disturbance footprints within ML 1790.

3.2.1 Boreholes

As outlined in **Table 3-1**, a number of boreholes are proposed to be installed as per this EA Amendment, as illustrated in **Figure 3-2**.

Details of borehole installation methodology is shown in **Table 3-2**.

Table 3-2 Borehole Installation Details

Borehole Type	No	Installation Methodology	Depth (mbgl)	Diameter (mm)	Casing Material	Borehole Details
Gas risers	43	Rotary drilling technology	290–570	50-150	Steel	Fitted with wellhead adapter, isolation value, pressure gauges / sensors, flame arrestors or non-return valves.
Service boreholes	24	Rotary drilling technology	290–570	100	Steel	Access to allow transfer of materials from surface to underground.
Gas conformance boreholes	145	Rotary drilling technology	290–570	100–150	NA*	Sampling of gas composition.
Specific gas emission boreholes	14	Rotary drilling technology	290–570	100-150	NA*	Sampling of gas composition.
Spontaneous combustion testing boreholes	14	Rotary drilling technology	290–570	100-150	NA*	Sampling of coal propensity to spontaneous combustion.
Geotechnical boreholes	38	Rotary drilling technology	290–570	100-150	NA*	Sampling of geotechnical properties.
Exploration boreholes	2	Rotary drilling technology	290–570	100-150	NA*	Sampling for exploration purposes.

Note:

* Casing material will not be installed in boreholes for sampling purposes.

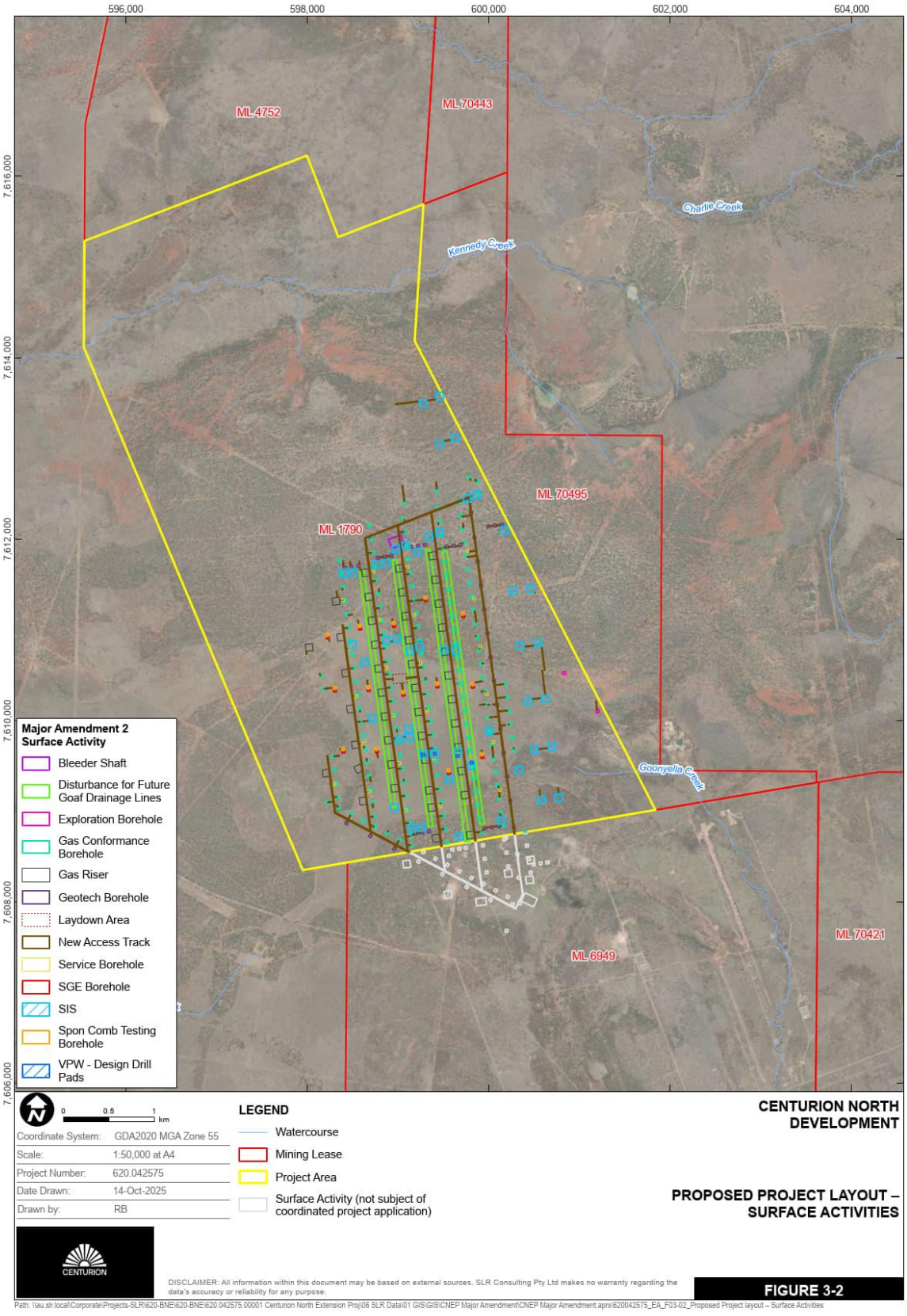


Figure 3-2 Proposed Project Layout – Surface Activities

3.2.1.1 Gas Risers

Gas risers facilitate the safe vertical transfer of CSG extracted from UIS drill holes to surface processing infrastructure. They are critical to maintaining the integrity of the gas collection system and are equipped with pressure control and isolation valves to ensure safe management of gas flow during both normal operations and emergency situations.

Once constructed, the gas risers will allow gas to flow freely to the surface, where it will be managed in accordance with the GHG Abatement Plan (**Section 3.4**).

3.2.1.2 Service Boreholes

Service boreholes will be constructed to transfer materials (i.e. cement, ballast) from the surface directly to underground areas of the mine.

3.2.1.3 Additional Boreholes

A number of other boreholes will be constructed for the purpose of sampling only. The information collected from these boreholes is critical for safe mine planning and design. These boreholes include the following:

- Gas Conformance Boreholes – sampling of gas content in underground operations from the surface;
- Specific Gas Emission Boreholes – sampling of gas content in underground operations from the surface;
- Spontaneous Combustion Testing Boreholes – sampling of coal propensity to spontaneous combustion;
- Geotechnical Boreholes – sampling of subsurface conditions including rock strength, stratigraphy, groundwater conditions and fault structures; and
- Exploration Boreholes – sampling to determine coal seam thickness and quality for resource modelling purposes. This information will inform ongoing refinement of the mine plan and optimisation of resource extraction.

Following construction, these boreholes will remain in use for the duration of longwall mining of the longwall panel relative to each borehole. These boreholes will not be required for the production of CSG.

3.2.2 Drill Pads and Laydown Area

Drill pads are designed to provide stable, prepared surfaces to accommodate drilling operations.

Their size and layout vary depending on the type of well or bore to be drilled, such as SIS wells, gas conformance boreholes or geotechnical boreholes, each tailored to meet specific operational and safety needs.

Drill pads accommodate essential infrastructure, including drilling rigs, fluid management systems, gas management infrastructure, worker amenities and equipment storage. All construction and operation activities will be confined within the designated drill pad boundaries. A separate laydown area will also be established for use during construction and operation.

Table 3-1 details the disturbance areas associated with each drill pad and the laydown area, and **Figure 3-2** shows their proposed locations. In cases where drill pads overlap, wells or bores will be strategically positioned within the combined area to minimise surface disturbance.

The extent of disturbance at each drill pad will depend on the required works and the duration of use for the drill pad.

3.2.2.1 Drill Pads for Boreholes

The construction of boreholes (i.e., gas conformance, specific gas emission, spontaneous combustion testing, geotechnical, and exploration) will be completed progressively. Typically, two drill rigs will operate across the Project Area, although this number may vary depending on the weather conditions and availability of drill rigs.

The location and construction of the boreholes are influenced by several factors, including:

- Site conditions (e.g., vehicle accessibility, track conditions, vegetation, terrain features);
- Mine planning priority (e.g., gaps in coal resource data); and
- Safety and environmental considerations, including compliance with EA conditions.

A degree of flexibility in drill site selection is therefore required, noting also that efforts will be made to avoid environmentally sensitive features such as riparian vegetation, flood-prone areas, protected vegetation (e.g. endangered REs and threatened ecological communities (TEC)), and habitats of conservation-significant species. In particular, the drill sites will be located to avoid or minimise clearance of mature trees/shrubs (>50 millimetre (mm) trunk diameter).

The CND mine site environment team will work closely with the drilling team to select drill sites that avoid and minimise impacts on EVs.

The nominated drill pad areas (30 metres (m) x 30 m) will be slashed to reduce the height of vegetation, and vegetation unsuitable for slashing will be removed. A sump approximately 2 m x 3 m will be excavated, and the excavated topsoil/spoil will be placed next to the sump for backfilling as part of rehabilitation. A disturbance area of 2 m x 2 m will be required around the drill hole for drill cuttings and other impacts of the drill operation.

The construction methodology for boreholes and associated drill pads will include the following:

- Permit to Disturb is required prior to any vegetation removal;
- Survey and demarcation of drill pad area and clearing boundaries;
- Removal of vegetation that cannot be slashed;
- Slashing of all remaining vegetation in the drill pad area using vegetation trimmers and slashers;
- Installation of a sump and other temporary water management infrastructure, such as bunds or water tanks;
- Mobilisation of light vehicles to transport personnel and equipment to and from drill sites; and
- Mobilisation of the vertical exploration drill rig to the designated location. Drill rigs are equipped with self-contained drilling fluid systems, which ensure that all fluids and rock cuttings are captured in above-ground tanks and removed from the site.

Boreholes will remain in use for the duration of longwall mining of the longwall panel relative to each borehole. Disturbed areas surrounding the boreholes will be rehabilitation within three months of drilling. All rehabilitation will be completed as discussed in **Section 3.12.1.2**.

3.2.2.2 Drill Pads for Service Boreholes

The construction of service boreholes will be completed progressively. Typically, two drill rigs will operate across the Project Area, although this number may vary depending on the weather conditions and availability of drill rigs.

The location and construction of the boreholes are strongly influenced by mine planning priorities, and there is limited opportunity to accommodate for site conditions or environmental considerations. The entire drill pad areas (30 m x 30 m) will be cleared of vegetation, stripped of topsoil, and spread with gravel to enable all-weather access.

The construction methodology for service boreholes and associated drill pads will include the following:

- Permit to Disturb is required prior to any vegetation removal;
- Survey and demarcation of drill pad area and clearing boundaries;
- Removal of all vegetation and stockpiling materials at the edge of the drill pad;
- Removal of topsoil to 200 mm and stockpiling materials at the edge of the drill pad;
- Delivery and spread of gravel to ensure the drill pad allows for all-weather access;
- Mobilisation of light vehicles to transport personnel and equipment to and from drill sites; and
- Mobilisation of the vertical exploration drill rig to the designated location. Drill rigs are equipped with self-contained drilling fluid systems, which ensure that all fluids and rock cuttings are captured in above-ground tanks and removed from the site.

Service boreholes and their associated drill pads will remain in use for the duration of longwall mining of the longwall panel relative to each borehole. All rehabilitation will be completed as discussed in **Section 3.12.1.2**.

3.2.2.3 Drill Pads for SIS Wells, Gas Risers and Bleeder Shaft

The construction and operation of SIS wells, gas risers and the bleeder shaft will require larger drill pad areas (**Table 3-1**) that will be required to be used for longer timeframes, determined by the progress of the mine schedule. Therefore, the construction methodology of these drill pads is more extensive and will include:

- Permit to Disturb is required prior to any vegetation or groundcover removal;
- Survey and demarcation of drill pad area 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; and
- Delivery and spread of gravel to ensure the drill pad allows for all-weather access.

3.2.2.4 Laydown Area

A laydown area will be established in a central location with a footprint of 150 x 150 m (**Figure 3-2**). The laydown area will be required for use during the construction and operation of the above works, determined by the progress of the mine schedule. The preparation methodology for this area is as follows:

- Permit to Disturb is required prior to any vegetation or groundcover removal;
- Survey and demarcation of laydown area and clearing boundaries;
- Removal of vegetation; and
- Delivery and spread of gravel to ensure the area allows for all-weather access.

Figure 3-3 presents an illustration of a typical SIS drill pad layout.

Figure 3-3 Example of SIS Drill Pad Arrangement

3.2.3 Surface-to-Inseam Wells

The program for early development 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 drain gas ahead of first workings mine development. 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 (**Figure 3-4**). Each lateral well is directionally drilled through the GM coal seam before intercepting the 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. SIS wells are critical to the pre-drainage of methane gas from coal seams prior to underground mining. By reducing in-situ gas content, these wells enhance the safety of mining operations, minimise the risk of gas outbursts, and improve the efficiency of subsequent coal extraction.

Two drill rigs will be used to drill the vertical and lateral wells.

Table 3-1 details the disturbance areas associated with the SIS wells (including VPW design drill pads), and **Figure 3-2** shows their proposed locations. 50 SIS well pads will be constructed, supporting a total of 66 SIS wells. Select pads will accommodate two SIS wells within the one pad footprint.

3.2.3.1 Gas Drainage 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 will be removed from the GM coal seam (seam water) through pumps located at the base of the wells and brought to the surface. Water will pass through the well head to storage tanks before being carted off and added to the CCM water management system.
- Removal of water will result in a reduction in pressure (~40 kilopascals (kPa) per day (kPa/day)) in the coal seam throughout the lateral well that each vertical well is paired with. It is anticipated that depressurising of the coal seam will take up to 90 days.
- 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 to the perforations 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 low-pressure pipeline before being used as per the GHG Abatement Plan (**Section 3.4**). It is anticipated that the CSG will comprise >99% methane (CH4), and 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 rate of 300-500 litres per second (L/sec) from each vertical well for approximately 8 – 10 years.
- 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.

Figure 3-4 presents examples of CSG well schematics.

CSG will be used as per the GHG Abatement Plan, as discussed in **Section 3.4**.

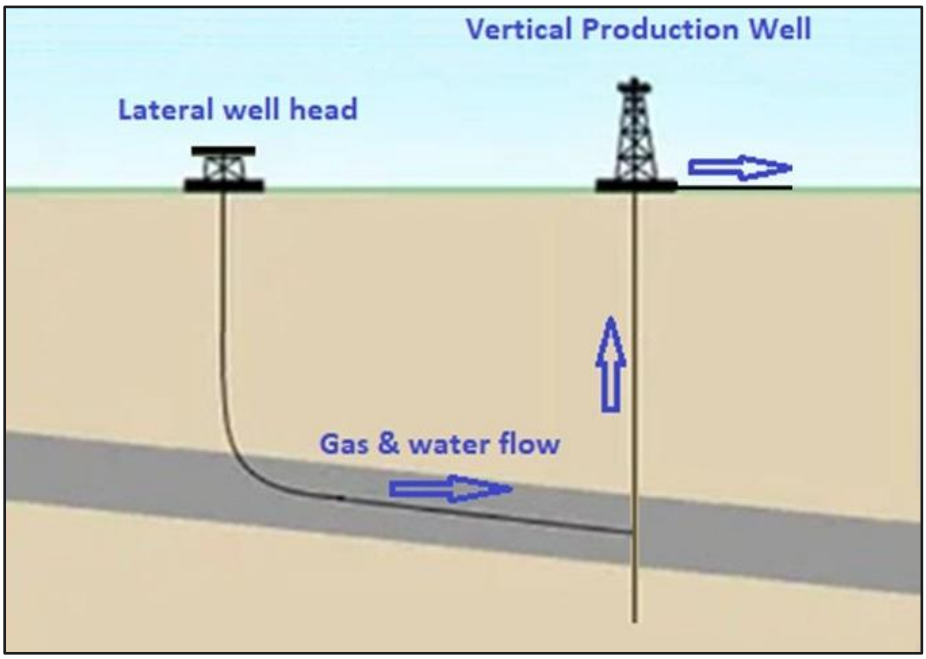


Figure 3-4 Schematic of Vertical and Lateral Wells

3.2.3.2 Vertical Wells

A total of 33 vertical wells will be drilled (**Figure 3-2**). Following the development of the drill pads, the 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 inch 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 metres below ground level (mbgl)). 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 (**Section 3.5**).
- Casing (such as steel or fibreglass) 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 in the casing at the coal seam level allow gas to flow into the well.
- The well is completed with necessary equipment for gas extraction, including pressure control values and continuous monitoring systems to optimise gas extraction and ensure operational safety.

3.2.3.3 Lateral Wells

A total of 33 lateral wells will be drilled into the GM coal seam (**Figure 3-2**) from pads located within ML 1790. Following the development of the drill pads, the 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 – 570 m). Then, using directional drilling techniques, the wellbore is deviated from 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 for a specified distance (e.g. 1000 - 1900 m) to connect with the corresponding vertical well. The horizontal well maximizes exposure to the coal seam, enhancing gas recovery.
- Casing (such as steel or fibre glass) (7 7/8 inch diameter) is run into the well and cemented to isolate the gas-producing zones. Perforations in the casing at the coal seam level allow gas to flow into the well.
- The horizontal well intercepts the vertical production well, as stated above in **Section 3.2.3.2**, where gas is then able to flow from the coal seam to the surface and is collected/transported to CSG infrastructure for further use.

3.2.4 Bleeder Shaft

A bleeder shaft is proposed to be drilled to the GM coal seam from a pad located within ML 1790 (**Figure 3-2**). **Table 3-1** details the disturbance areas associated with the construction and operation of the bleeder shaft.

A bleeder shaft is a specialised ventilation shaft that is an essential component of the underground mine's ventilation system, enabling the continuous removal of contaminated air (e.g. methane gas, dust and heat) from the mined-out area or the goaf. Proper ventilation is critical to maintaining a safe working atmosphere by delivering fresh air underground and preventing gas build-up by means of contaminated air removal. The bleeder shaft is a key component of the broader ventilation system, which includes ventilation control devices and specially designed air courses.

A vertical shaft will be constructed connecting the surface to the coal seam (depth 450 to 500 mbgl). Blind-boring techniques will be used to create the shaft, which involves drilling a shaft downwards from the surface. The shaft will have a diameter of approximately 2 to 3 m and will be steel-lined with a shaft collar for surface protection. Auxiliary fans (centrifugal or axial types) will be installed at the top of the bleeder shaft, which will draw out contaminated air from the mine and exhaust it to the surface.

3.2.5 Disturbance for Future Surface Works

The installation of four (4) goaf drainage lines will be constructed at a later date (prior to longwall commencement) (**Figure 3-2**).

Goaf drainage is essential for the controlled capture of methane from the goaf (the collapsed area behind the longwall face following coal extraction). Methane accumulation in the goaf poses a significant safety hazard; therefore, controlled drainage reduces explosion risk and allows for the potential recovery and beneficial use of the captured gas (**Section 3.4**).

Goaf drainage lines will be installed on the surface, and captured gas will be suctioned to the surface. The future goaf drainage lines will be connected to a surface pipeline network to gather and transport gas to surface gas processing infrastructure (**Section 3.4**). The surface clearing and pipe laying steps associated with goaf drainage are required to prevent interaction with other activities once longwall mining starts and due to resource availability. Peabody will seek separate approvals for these works as required.

In preparation for the installation of goaf drainage lines, surface disturbance is proposed as part of this EA Amendment, as summarised in **Table 3-1**.

Surface disturbance works will include:

- Permit to Disturb is required prior to any vegetation or groundcover removal;
- Removal of vegetation;
- Removal and stockpile of topsoil and unsuitable sub-soils; and
- Delivery and spread of gravel to ensure the drill pad allows for all-weather access.

3.3 Proposed Underground Activities

3.3.1 Gate Roads

3.3.1.1 Construction of Gate Roads

The Project will involve the construction of four (4) underground gate roads to enable safe and efficient transport of personnel, equipment and extracted materials. The gate roads are designed to advance the development of the mine by establishing the first longwall mining panels, while the subsequent mining processes undergo an EIS level assessment.

The gate road development scheduled for installation is illustrated in **Figure 3-5** and are anticipated to commence in 2028. Gate roads will be constructed using single-pass continuous miners to a width of 5.4 m and a ceiling height of 3.6 m.

Roof and rib (sidewall) support (e.g. bolts, mesh and/or shotcrete) will be installed progressively to ensure adequate strata reinforcement. Services such as ventilation systems, conveyor systems, power cables, water pipes, compressed air lines and communication systems will then be installed to ensure the safety of personnel, control of contaminants, conveyance of coal and movement of equipment. Underground roadways are constructed such that they remain stable for the life of the mine and will become unserviceable following the extraction of an adjacent longwall panel or if abandoned for a significant time.

Low levels of subsidence as a result of construction of gate roads are expected, associated with elastic compression of pillars following roadway development. The estimated surface subsidence is expected to range from 15 mm to 45 mm for the four gate roads assessed based on the depth range (SCT Operations, 2025).

While estimated subsidence outcomes could be modified by overburden mechanisms of the Tertiary strata (as discussed further in SCT, 2025), subsidence values currently predicted for the four gate roads are likely to be within the guidance published by the Independent Expert Steering Committee (2015), which states that seasonal variation can be as high as 50 mm or more due to changes in moisture content.

Due to the low levels of subsidence and associated strains and tilts as a result of gate road construction, adverse surface effects such as surface ponding and surface cracking are considered to be unlikely. In addition, the generation of only elastic compression of the strata also indicates that sub-surface cracking above the proposed underground area is not expected (SCT Operations, 2025).

3.3.1.2 Management of Coal Materials

Approximately 1-2 million tonnes (t) of coal material will be extracted from ML 1790 during the establishment of the proposed gate roads. Initial coal from the Project will be supplied to established customers of Centurion to alleviate any coal quality concerns that may arise from entering a different area of the basin, with the advantage of having a good supply of Centurion coal still available (i.e. establishing brand continuity). The extracted coal will be utilised to gain a comprehensive understanding of the coal's properties and characteristics, including quality, quantity and potential for processing. This process provides crucial information for future development, including mining techniques, coal treatment and market evaluation.

The remainder of the extracted materials will be stockpiled as raw materials, with processing and sale to occur once EA approval for mining of longwall panels in ML 1790 has been granted.

3.3.2 Underground In-Seam Gas Drainage

UIS gas drainage is a critical part of underground coal mining operations, particularly in mines with high gas content. Controlled drainage reduces explosion risk and allows for the potential recovery and beneficial use of the captured gas (refer to **Section 3.4**).

UIS gas drainage involves drilling boreholes from the gate roads into the coal seam in a fan pattern. Extracted gas is transferred to gas risers (**Section 3.2.1.1**) and transported to the surface as part of the integrated gas management system.

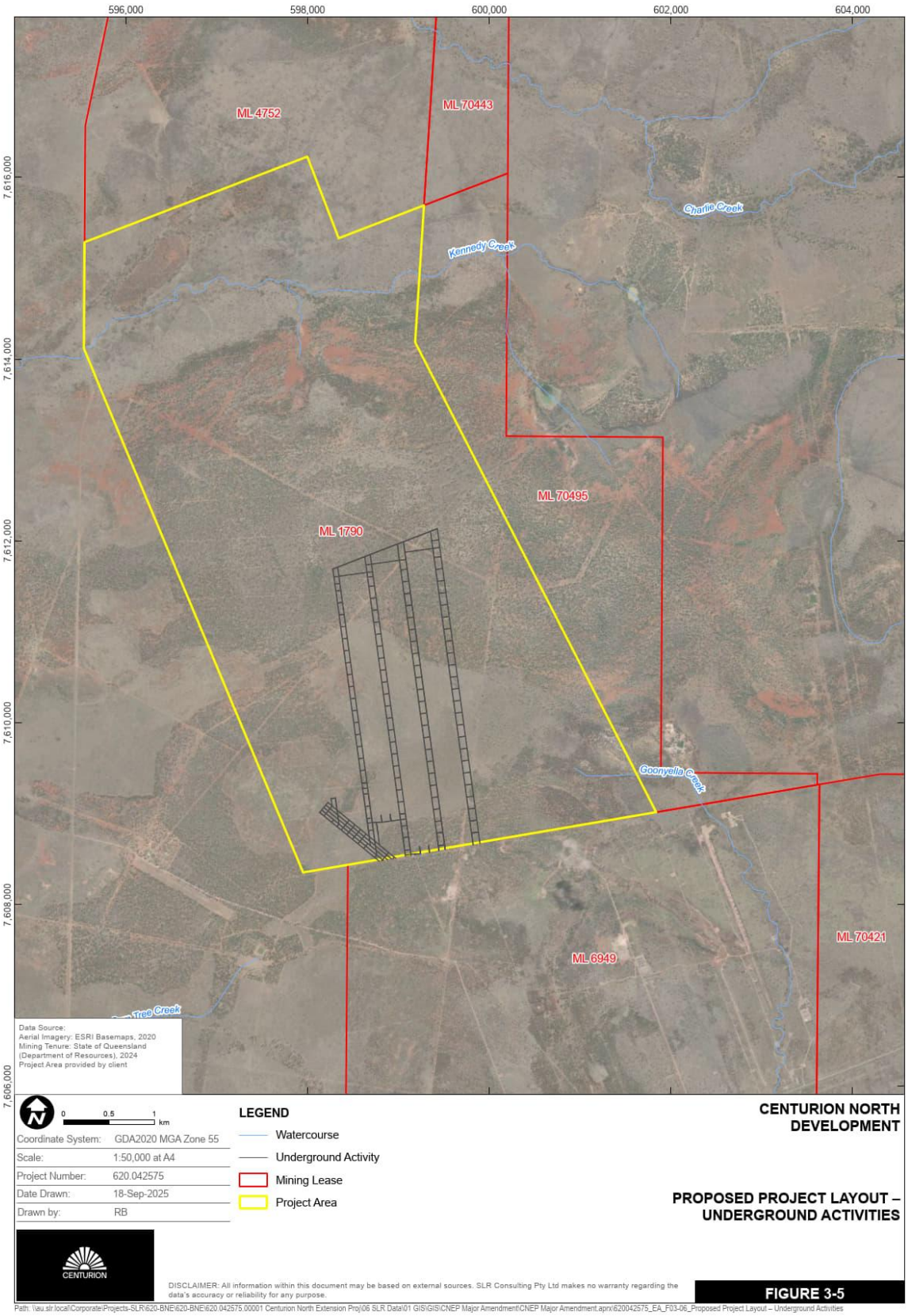


Figure 3-5 Proposed Project Layout – Underground Activities

3.4 Gas Abatement Projects

Peabody is progressing several gas abatement projects aimed at the beneficial use of CSG extracted as part of the Project, as outlined in the GHG Abatement Plan. A summary of the proposed gas abatement options is provided below:

- Transfer of gas via pipeline to a carbon abatement hub (e.g. Moranbah Gas Project or Townsville);
- Clean Energy Fuel Australia Marketing (CEFAM) Liquified Natural Gas Project; and
- Generation of electricity through a power station (approval has been granted through a separate process).

It is important to note that these gas abatement initiatives are not included as part of this EA Amendment; however do form part of the associated GHG Abatement strategy. Peabody will seek separate approvals for these projects as required.

As a last resort, CSG may be directed to candlestick flares located within the disturbance footprint of the drill pads. This flare system will allow for the controlled combustion of methane to reduce the GHG intensity of the operation or during emergency scenarios.

Refer to **Section 6.7** for further discussion on CSG abatement.

3.5 Waste

3.5.1 Surface Activities

The following surface activities are anticipated to generate waste:

- Vegetation removed from cleared drill pads and access tracks;
- Excavated soils from the development of drill pads and laydown areas; and
- By-products from the drilling of SIS wells, gas risers, boreholes and the bleeder shaft.

All waste products generated from surface activities will be managed and disposed of in accordance with the CCM Waste Management Procedure. All cleared vegetation and excavated soils will be reused for rehabilitation activities. Further information on waste management is provided in **Section 6.9**.

3.5.2 Underground Activities

All waste products generated from underground activities will be managed and disposed of in accordance with the CCM Waste Management Procedure. This will include co-disposal of minor rejects with waste generated from the CCM.

3.6 Access

3.6.1 Surface Activities

A network of existing access tracks is present across ML 1790 (**Figure 3-2**). Where feasible, these existing tracks will be used to access the proposed drill pads, minimising the need for additional surface disturbance.

However, additional access tracks will be required for drill pad locations not currently accessible. **Table 3-1** details the disturbance areas associated with the new access tracks, and **Figure 3-2** shows their proposed locations.

New tracks will be designed for all-weather access and constructed using graded and compacted materials. New access tracks will be 5 m wide and suitable for both light and heavy vehicles. The construction of access tracks will involve the following steps:

- Surveying and marking of access track alignment and clearing boundaries;
- Removal of vegetation;
- Removal and stockpiling of topsoil and unsuitable subsoils;
- Preparation of the access track base using sub-base material; and
- Installation of traffic control infrastructure, including signage.

A 30 kilolitres (kL) water cart will be used for dust suppression across all working and trafficable areas. Access tracks will be regularly maintained to ensure the safety of site personnel, to facilitate the effective transportation of equipment and personnel, and to provide uninterrupted access to gas infrastructure for monitoring, maintenance and emergency shutdown.

3.6.2 Underground Activities

Access for the development of the proposed gate roads and UIS gas drainage activities will be provided via the existing CCM underground roadway network, providing uninterrupted access between the existing CCM in ML 6949 and the new area in ML 1790.

3.7 Water

Water will be required for the construction of surface infrastructure, including the use for dust suppression on surface roads. Water will be sourced from the CCM raw water dam and delivered to construction areas via water truck.

Water required to support the proposed underground activities (e.g. dust suppression) will be sourced from the existing CCM underground water supply.

Water collected from the SIS wells during operations will be pumped to holding tanks located on the relevant drill pads. Each holding tank is designed with a capacity of 20 kL, sufficient to accommodate one day of pumping during the initial depressurising phase of the target coal seam.

Following depressurisation, the volume of water extracted is expected to decrease significantly as gas production commences. Collected water will then be transported by water truck to the CCM site, where it will be treated and incorporated into the CCM water management system.

3.8 Power

3.8.1 Surface Activities

Construction of the SIS wells, gas risers, boreholes and the bleeder shaft will require power to operate drilling equipment and pumps. It is proposed that on-site diesel generators (60 kilovolt (kV)) will be used for all power drilling operations, with one generator in use per drill rig. As 5 drill rigs will be engaged, a total of 5 diesel generators will be required for construction.

During operation, SIS well sites will require electricity for the operation of drill pumps and well pumps. One 60 kV diesel generator will be required per every two vertical drill pads.

The operation of the gas risers will require electricity for the operation of gas pumps, instrumentation and well monitoring equipment.

High-voltage connection to the electricity network on ML 6949 will provide power to the bleeder shaft site, as well as the provision of electricity to underground via the service boreholes.

3.8.2 Underground Activities

Power required for the development of the proposed underground roadways and supporting activities will be sourced from the existing CCM underground power supply. No additional power generation will be required for the proposed underground activities.

3.9 Amenities

3.9.1 Surface Activities

A typical drill pad site layout for the SIS wells is shown in **Figure 3-6** and **Figure 3-7**. The drill pad sites will include a mobile office and workshop which will be relocated as drilling progresses. Only two drill pad sites will be operating at a given time.

For the remainder of the drill pad sites, no permanent facilities are proposed. Facilities available in ML 6949 will be available for use.

3.9.2 Underground Activities

The existing approved CCM underground amenities (e.g. crib facilities, offices, workshops) will be used during the development and operation of the proposed underground activities.

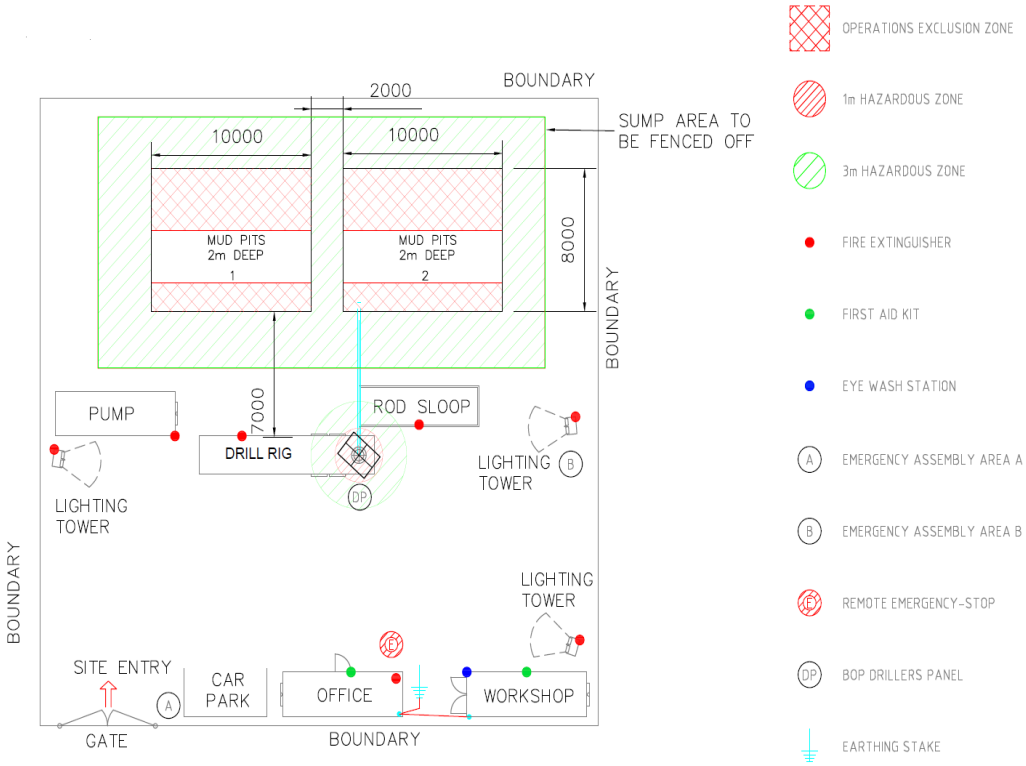


Figure 3-6 Example of Vertical Well Drill Pad Layout and Amenities

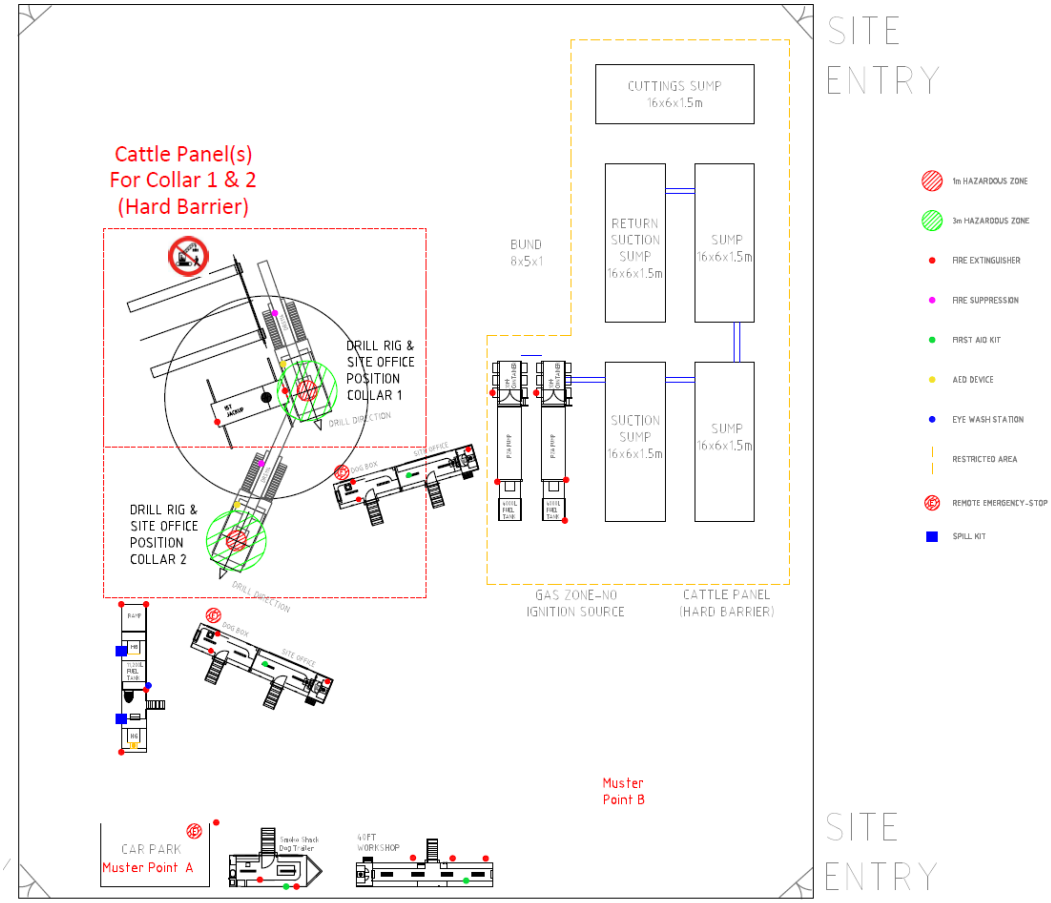


Figure 3-7 Example of Lateral Well Drill Pad Layout and Amenities

3.10 Equipment

Table 3-3 outlines the key machinery and mobile equipment (currently being utilised at the CCM) that will be used in the development, maintenance and operation of all works associated with the Project.

Table 3-3 Equipment Requirements

Equipment Description
Earth moving
Dozer such as the Caterpillar D8 for primary surface excavation 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
30 kL water truck to provide construction water requirements and collect extracted well water
Power
60 kV diesel generators to provide power to well and pump infrastructure
Drill rigs
2 SIS drill rigs
2 vertical exploration drill rigs
1 shaft sinking 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 and transport water to the surface from boreholes
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 to prevent uncontrolled release of CSG
Monitoring systems for detecting gas leaks and monitoring environmental compliance

Equipment Description
Control and automation systems
Supervisory Control and Data Acquisition (SCADA) systems for remote monitoring and control of gas production
Automation software for optimising gas extraction and processing
Underground mining equipment
Continuous miners (up to 6)
Shuttle cars (up to 6)
Breaker feeders
Auxiliary fans
Graders
Underground personnel transporters
Underground load haul dumps
Underground-to-Inseam drilling equipment
Vacuum pumps
Underground gas pipe reticulation system

3.11 Workforce and Working Hours

The Project's proposed surface and underground works are expected to operate continuously, 24 hours per day, 363 days per year.

3.11.1 Surface Activities

The Project will utilise the existing workforce at CND, with additional personnel employed where required. The required workforce for surface activities has been estimated at 23 additional personnel for the drilling and ongoing maintenance of the wells, risers, boreholes and bleeder shaft. Construction personnel will work a 12-hour day/night shift on a 7-days / 7-nights roster.

During the operation of CSG drainage works, personnel will be required 24 hours per day. Workforce requirements have been estimated at 2 personnel working 12-hour day/night shift on a 7-days / 7-nights roster (commencing 6:00am or 6:00pm). The existing CCM workforce will be used, and it is not envisaged that additional personnel will be required.

For the ongoing operation and maintenance of the risers and the bleeder shaft, existing workforce will be used, and it is not envisaged that additional personnel will be required.

The existing Centurion Village will provide accommodation for the Project workforce, in addition to local residents, during the construction and operation phases.

3.11.2 Underground Activities

The existing workforce will transition to the Project for the development of gate roads and UIS gas drainage works, and it is not envisaged that additional personnel will be required. The underground workforce will work a 12-hour day/night shift on a 7-days / 7-nights roster.

The existing Centurion Village will provide accommodation for the Project workforce, in addition to local residents, during the construction and operation phase of the Project.

3.12 Rehabilitation and Closure

3.12.1 Surface Activities

3.12.1.1 Access Tracks, Drill Pads and other Surface Infrastructure

In accordance with the P-PRCP-100669070_V3, land will be rehabilitated to a stable condition, which is defined as land that is:

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

Access tracks will also generally be closed generally in accordance with the requirements set out in Conditions B24 to B31 of the *Eligibility criteria and standard conditions for exploration and mineral development projects* (ESR/2016/1985) and will address the requirements and conditions of the existing EA. There may be instances where access tracks are retained, in agreement with land title holders, to provide for ongoing access.

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

- Borehole casings removed or cut below the surface, and holes backfilled and grouted;
- Bleeder shaft capped;
- Remove any materials and wastes from the site, including reclaiming gravel base materials;
- Windrows and drains will be pushed and deep ripped;
- Topsoil placement, amelioration and seeding with pasture grasses and trees; and
- Where 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 3-8 presents the proposed final site design to be included in the amended PRCP.

3.12.1.2 Boreholes

Boreholes will be closed and rehabilitated generally in accordance with the requirements set out in Conditions B24 to B31 of the *Eligibility criteria and standard conditions for exploration and mineral development projects* (ESR/2016/1985) and will address the requirements and conditions of the existing EA.

In general, the closure and rehabilitation process will typically be as follows:

- Demobilisation of drill rig and support equipment;
- Backfill of sump with spoil / topsoil placed next to the sump;
- Backfill chip drill hole with excess chips;
- Remove any materials and wastes from site, including reclaiming gravel base materials;
- Monitor and manage any weed infestation; and
- Remove any temporary erosion and sediment controls following drilling.

The existing EA includes rehabilitation requirements. The PRCP will also be referenced as relevant to address the rehabilitation requirements relevant to exploration activities.

3.12.2 Underground Activities

Figure 3-8 presents the proposed final site design to be included in the amended PRCP. This figure includes the maximum predicted subsidence impact area associated with the proposed underground activities.

While all underground activities are anticipated to be stable and non-subsiding, rehabilitation methodology has been included in the amended PRCP specifically for subsidence impacts, if required. In addition, monitoring for rehabilitation and closure will be completed in accordance with the amended PRCP.

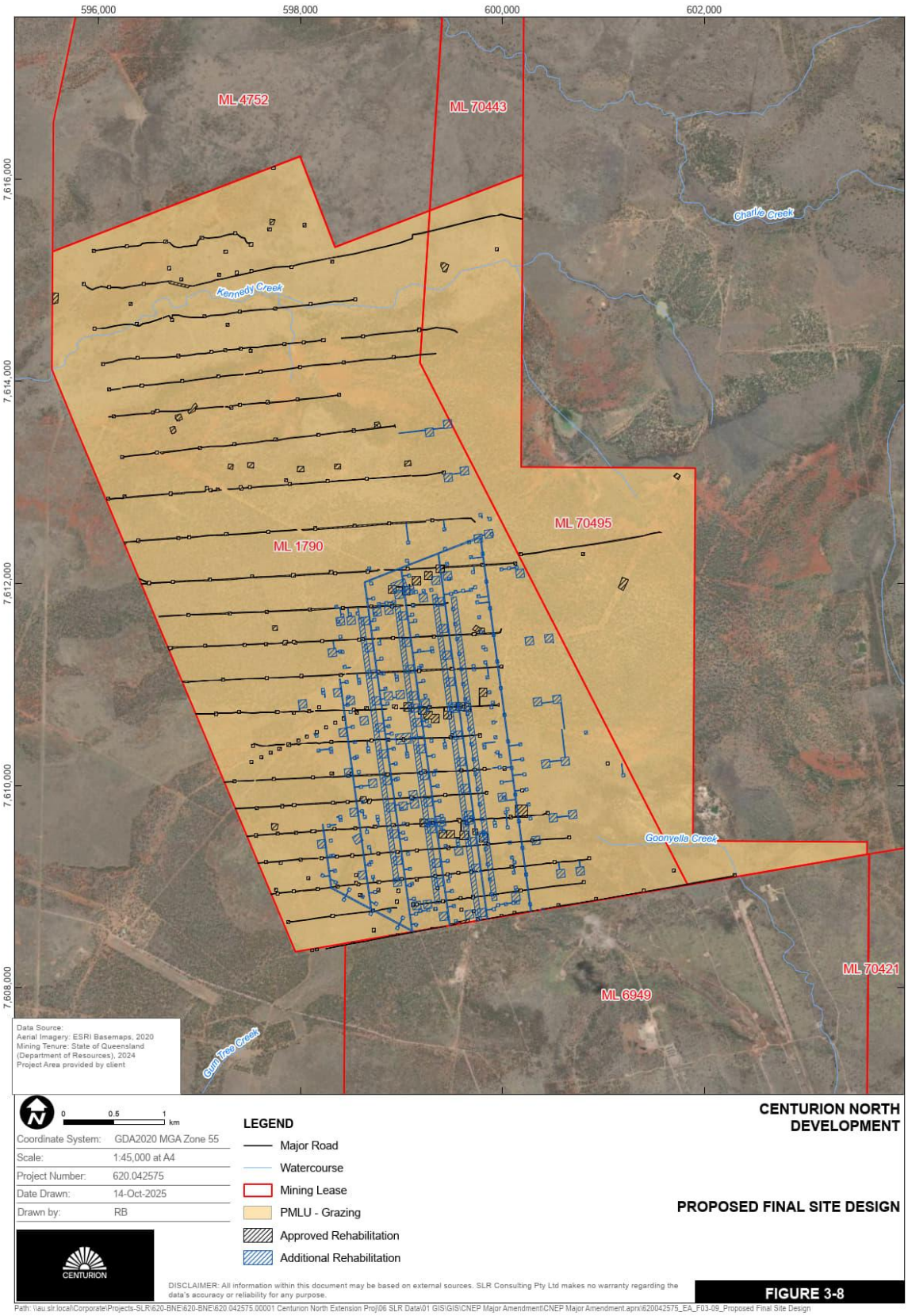


Figure 3-8 Proposed Final Site Design

3.13 Project Schedule

The proposed surface and underground activities associated with the Project are scheduled to commence in 2026.

3.13.1 Proposed Surface Activities

The construction schedule for proposed surface activities, along with indicative timeframes, is as follows:

- Installation of new access tracks – approximately 2 weeks per km;
- Preparation of drill pad sites, including clearing of vegetation and soils – approximately 4 days per drill pad;
- Construction of SIS wells – installed in approximately 15 months. Each well will require approximately 10 days to drill and approximately 15 days to install surface infrastructure;
- Construction of gas risers – installation in approximately 8 days per riser;
- Construction of boreholes – approximately 15 days for each borehole; and
- Construction of the bleeder shaft – installation in approximately 12 months.

Once the SIS wells are operational, it is anticipated that it may take up to 90 days to depressurise and de-water the wells. Vertical SIS wells will produce CSG until the commencement of longwall mining, which is anticipated to commence in 2029 subject to additional approvals. Upon completion of their operational life, all SIS well infrastructure will be decommissioned.

Rehabilitation of boreholes (including service boreholes) will commence following the extraction of the longwall panels relative to the boreholes. Rehabilitation of access tracks and drill pads is expected to commence within approximately 6 months following decommissioning (following the extraction of longwall panels).

3.13.2 Proposed Underground Works

Construction of underground works is anticipated as follows:

- Gate roads: Expected to be completed over a period of 36 months; and
- UIS Gas Drainage: To be completed within approximately 30 months.

4.0 Proposed EA and PRCP Amendments

The following section details the conditions of EA P-EA-100658735 and PRCP P-PRCP-100669070_V3 that require amendment.

4.1 Environmental Authority

This section presents the proposed amendments to the EA:

- Inclusion of an additional ERA;
- Inclusion of a new condition in Schedule A;
- Modification of Condition 15 Schedule A;
- Modification of Condition 7 Schedule F; and
- Modification of Condition 22 Schedule F.

4.1.1 Inclusion of an additional ERA

In light of the extraction of coal for the development of underground roadways, an additional ERA is proposed to be added to the 'Environmentally relevant activity and location details' table. **Table 4-1** details the proposed addition in accordance with Schedule 3 of the Environmental Protection Regulation 2019.

Table 4-1 Addition to 'Environmentally Relevant Activity and Location Details' Table

Environmentally relevant activity/activities	Location(s)
Schedule 3 13: Mining black coal	ML1790

4.1.2 Inclusion of a new condition in Schedule A

In light of the extraction of coal for the development of underground roadways, an additional condition is proposed to be added to Schedule A, as follows:

Coal Extraction

The environmental authority holder is approved for a coal extraction rate of up to 2 million tonnes of run-of-mine (ROM) ore in accordance with this environmental authority.

4.1.3 Condition A15

Table 4-2 details the existing conditions of A15 and the proposed changes subject of this EA Amendment.

Table 4-2 EA P-EA-100658735 Condition A15

Existing Condition

The only mining activities to be carried out under this environmental authority are the mining activities defined within the parameters in Table 1 (Mining Activities) and identified in Figures 1 to 4 attached to this environmental authority.

Note: Variation of mining activities to those identified within the conceptual designs is considered to be in accordance with these conditions as long as the variation is not significantly different to the conceptual design or causes a significant increase in environmental harm.

Proposed Condition

'The only mining activities to be carried out under this environmental authority are the mining activities defined within the parameters in **Table 1 (Mining Activities)** and identified in **Figures 1** to **5** attached to this environmental authority.

Note: Variation of mining activities to those identified within the conceptual designs is considered to be in accordance with these conditions as long as the variation is not significantly different to the conceptual design or causes a significant increase in environmental harm.

Change

No change to wording of condition. Table 1 and Figures 1, 3 and 4 referenced in the condition are to be amended. A new Figure 5 will be added to show the underground operations.

Table 1 will be updated and replaced by:

Mine Domain	Mine Feature Domain	Location (GDA94)	Maximum Disturbance Area
Exploration activities	Drill holes and pads Vertical and lateral wells Historical holes and pads	As per Figure 1	Total disturbance area must not exceed 234 ha
Ancillary infrastructure	Roads and tracks Bleeder shaft Laydown area Goaf Drainage Lines	As per Figure 1	
Underground activities	Gate roads	As per Figure 5	

Figure 1 in EA P-EA-100658735 will be updated and replaced by **Figure 3-2** of this report, to reflect the new surface activities as outlined in **Section 3.2.**

Figure 3 in the EA P-EA-100658735 will be updated and replaced by **Figure 6-15** of this report, to reflect the field-validated Regional Ecosystem mapping in the Study Area.

Figure 4 in the EA P-EA-100658735 will be updated and replaced by **Figure 6-16** of this report, to reflect the extent of threatened species habitat in the Study Area.

Figure 3-5 will also be added to EA P-EA-100658735 as Figure 5. **Figure 3-5** reflects the changes to the location and extent of activities (underground) for the Project outlined in **Section 3.3** of this report.
Justification
The proposed amendments ensure that the variation in activities aligns with the approved disturbance and activities outlined in Condition A15, Table 1 (Mining Activities) and Figures 1 to 5. The amendment incorporates the Project activities to complete preparation works for longwall mining and 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 F7

Table 4-3 details the existing conditions of F7 and the proposed changes subject of this EA Amendment.

Table 4-3 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
Exploration activities undertaken must be consistent with **Figures 1** to **5** attached to this environmental authority.
Change
Condition F7 will be updated to: 'Exploration activities undertaken must be consistent with **Figures 1** to **5** attached to this environmental authority.' Figure 1 in EA P-EA-100658735 will be updated and replaced by **Figure 3-2** of this report. Figure 3 in the EA P-EA-100658735 will be updated and replaced by **Figure 6-15** of this report. Figure 4 in the EA P-EA-100658735 will be updated and replaced by **Figure 6-16** of this report. **Figure 3-5** will also be added to EA P-EA-100658735 as Figure 5.
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.

4.1.5 Condition F22

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
Prescribed environmental matters – matters of State environmental significance 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
Prescribed environmental matters – matters of State environmental significance 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’.

Change

Figure 3 and Figure 4 of the EA are to be updated to **Figure 6-15** and **Figure 6-16** of this report, respectively.

In addition, Table F1 will be updated with the table provided below:

Prescribed environmental matter – 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			
Acacia harpophylla shrubby woodland with *Terminalia oblongata* on Cainozoic clay plains (11.4.9)	In accordance with Figure 3	No	0.28
Acacia harpophylla and/or *Casuarina cristata* open forest in depressions on Cainozoic sand plains and remnant surfaces (11.5.16)	In accordance with Figure 3	No	0.03
Dichanthium sericeum grassland on Cainozoic igneous rocks (11.8.11)	In accordance with Figure 3	No	3.55
Regulated Vegetation – Located in the defined distance from the defining banks of a watercourse			
None identified within the disturbance area			
Protected Wildlife Habitat – Essential habitat for an endangered or vulnerable animal or plant			
Assessment has been undertaken as field verified protected wildlife habitat			
Protected Wildlife Habitat – A habitat for endangered or vulnerable wildlife or Special Least Concern animal			
King bluegrass (*Dichanthium queenslandicum*)	In accordance with Figure 4	Unlikely	8.20
Finger panic (*Digitaria porrecta*)	In accordance with Figure 4	Unlikely	8.20
Koala (*Phascolarctos cinereus*)	In accordance with Figure 4	Likely	68.38
Squatter pigeon (southern) (*Geophaps scripta scripta*)	In accordance with Figure 4	Unlikely	71.30
Australian painted snipe (*Rostratula australis*)	In accordance with Figure 4	Unlikely	5.28
Latham's snipe (*Gallinago hardwickii*)	In accordance with Figure 4	Unlikely	5.28
Ornamental snake (*Denisonia maculata*)	In accordance with Figure 4	Unlikely	5.28
White-throated needletail (*Hirundapus caudacutus*)	In accordance with Figure 4	Unlikely	68.38
Short-beaked echidna (*Tachyglossus aculeatus*)	In accordance with Figure 4	Unlikely	77.76

Justification
The proposed amendment ensures that any necessary expansions or modifications to the Project activities, as depicted in the updated figures and Table F1, are within the scope of the EA.

4.2 Progressive Rehabilitation and Closure Plan

This section presents the proposed amendments to the following conditions:

- Section B – Figure 1 and Figure 2;
- Section C – (RA1) Rehabilitation area 1; and
- Section C – Rehabilitation area milestones.

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 and Figure 2

Existing Condition
Section B of the PRCP contains the final site design plans in **Figure 1** and the reference map in **Figure 2**.
Proposed Condition
The description of the relevant activity of RA1 is to be amended. **Figure 1** and **Figure 2** referenced in the PRCP is to be amended.
Change
The description of RA1 is to be expanded to 'Exploration activities, early works and ancillary infrastructure'. **Figure 1** (Final Site Design) in PRCP schedule P-PRCP-100669070_V3 will be updated and replaced by **Figure 10-1** of the updated PRCP report (also presented as **Figure 3-8** of this report). **Figure 3-2** of this document reflects the proposed additional changes to the location and extent of surface activities for the Project activities which include: • Clearing 150.96 ha of vegetation for well and borehole drill pads, and ancillary infrastructure and tracks; • Drilling, installing and operating 50 vertical and lateral SIS wells, 43 gas risers and 24 service boreholes; • Drilling and sampling 213 bores for gas conformance, specific gas emissions, spontaneous combustion, geotechnical and exploration; • Drilling, installing and operating a bleeder shaft; • Developing 20 ha of 5 m wide access tracks; • Developing a 150 x 150 m laydown area; • Development of future goaf drainage lines; and • Closure and rehabilitation of the wells, gas risers, boreholes, bleeder shaft, access tracks, laydown area, and other ancillary infrastructure. **Figure 2** in PRCP P-PRCP-10069070_V3 will be updated and replaced by **Figure 10-2** in P-PRCP-100669070_V4. **Figure 10-2** of the PRCP reflects the approved rehabilitation and proposed rehabilitation areas relating to the above proposed surface activities, which combined forms RA1 (Rehabilitation area 1).

Justification
The amendment incorporates the Project activities to complete preparation works for longwall mining and 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). The area of RA1 is proposed to be extended to include additional exploration activities, early works activities and ancillary infrastructure. The name of RA1 is therefore proposed to be changed to reflect the proposed amendment. Amendments to Figure 1 and Figure 2 of the PRCP Schedule will be required in light of the proposed amendment.

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_V3 Section C – (RA1) Rehabilitation Area 1

Existing Condition
Rehabilitation of the site must be undertaken as per Section C of PRCP P-PRCP-100669070_V3. Currently, 145 ha of the site is to be rehabilitated, with rehabilitation milestones to be reached within the timeframes indicated in the schedule below.
Proposed 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**							
Disturbance description	Exploration activities, early works and ancillary infrastructure							
Total size of rehabilitation area (ha)	234							
Commencement of first milestone RM1	10/12/2021							
PMLU	Cattle grazing							
Date area is available	10/12/21	10/12/55						
Cumulative area available (ha)	19	234						
Milestone completed by	**Milestone completed by**							
	10/12/26	10/12/36	10/12/41	10/12/60	10/12/70	10/12/75		
Milestone Reference	**Cumulative area achieved (ha)**							
RM1	19	19	19	234				
RM2	19	19	19	234				
RM3	19	19	19	234				
RM4	19	19	19	234				
RM5	19	19	19	234				
RM6		19	19	19	234			
RM7			19	19	19	234		

Justification
Total rehabilitation area size in Rehabilitation Area 1 (RA1) of PRCP P-PRCP-100669070_V4 is proposed to increase from 145 ha to 234 ha. The 234 ha reflects the additional disturbance involved with the aforementioned clearing of vegetation for drill pads and ancillary infrastructure associated with the Project activities. Changes to timeframes required based on the updated availability of total rehabilitation area by 10/12/28 to 10/12/2033, resulting in the extension of the final milestone completion date to 10/12/2053.

4.2.3 Section C – Rehabilitation area milestones

Table 4-7 details the existing conditions of Section C – Rehabilitation area milestones and the proposed changes subject of this PRCP amendment.

Table 4-7 PRCP P-PRCP-100669070_V3 Section C – Rehabilitation Area Milestones

Existing Condition
Rehabilitation of the site must be undertaken as per the rehabilitation Section C of PRCP P-PRCP-100669070_V3. Section C outlines the Rehabilitation area milestones that apply to this rehabilitation.
Proposed Condition
Modification of wording in RM1 to expand the project description of ‘exploration drill holes’. Very minor changes to adjust subscript references following the removal of the subscript for the definition of an ‘appropriately qualified person’ to the Rehabilitation area milestones table. These changes are applicable to RM4, RM6 and RM7. Additional minor changes to adjust reference to ‘Table 33 of the Wards Well Progressive Rehabilitation and Closure Plan, Version 3.0, 1 December 2021’ in RM6 and RM7. Addition of Locally Important Koala Tree (LIKT) species and conservation significant flora species to the pasture mix in RM5. Suggested species to be included in the pasture mix with consideration of the surrounding regional ecosystems, land use, the environment (i.e. availability of water), and local seed availability. Additional minor criteria in RM7 to account for residual subsidence impacts.
Change
Update RM1 to reference to ‘all gas risers / boreholes / bleeder shaft / SIS wells decommissioned. Adjustment of subscript references in RM4, RM6 and RM7. Add of conservation significant flora species and LIKT species to the pasture mix, including a table of the suggested species. Update of reference to ‘Table 9-6 of the Centurion North Progressive Rehabilitation and Closure Plan, Version 4.0, 31 October 2025’. Add new criteria in RM7 regarding the remediation of any residual subsidence impacts.
Justification
Updated reference in RM1 to include additional infrastructure types as proposed by this amendment. Update to Rehabilitation area milestones to adjust subscript references, as a definition of an ‘appropriately qualified person’ was not required. Updated table reference in RM6 and RM7 to reflect change in table numbering. Add suggested conservation significant flora species and LIKT species to the pasture mix to promote the growth of threatened flora species and to provide habitat for threatened fauna species. Add new criteria in RM7 to account for the remediation of any residual subsidence impacts.

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; and
- Risk assessment of potential impacts.

5.1 Terminology

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

- **Project**: Refers to the planned development which is the subject of 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 the 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. The specific methodology for the assessments of these EVs is detailed in the following sections. **Section 6.0** provides the results of such assessments.

5.2.1 Terrestrial Ecology Assessment

Terrestrial ecology values of the Study Area were assessed by e2m Pty Ltd (e2m) through a review of desktop information as well as seasonal flora and fauna surveys. Desktop information sources included state and Commonwealth vegetation, habitat and threatened species mapping, species profiles, flora and fauna databases, state and Commonwealth survey and assessment guidelines and published reports relevant to other studies and assessments undertaken in the broader region.

Seasonal field surveys were conducted to identify and characterise the presence, extent and condition of terrestrial ecology values within the Study Area. Three surveys were undertaken within the Study Area, comprising:

- Wet season from 12–21 February 2024 (10 days);
- Dry season in 8–17 July 2024 (10 days); and
- Dry season in 11–22 June 2025 (12 days).

Field surveys included Regional Ecosystem (RE) verification, threatened flora surveys, habitat quality assessments and targeted threatened fauna surveys. Flora survey techniques were undertaken in accordance with the *Methodology for surveying and mapping of regional ecosystems and vegetation communities in Queensland* (Neldner et al., 2022) and included:

- Quaternary and tertiary assessments;
- Threatened flora meanders;
- Threatened flora plot surveys; and
- Biocondition in association with habitat quality assessments.

Fauna survey techniques considered Queensland and Commonwealth survey guidelines and included:

- Pitfall and funnel trapping;
- Nocturnal spotlighting;
- Call playback;
- Bird surveys (dawn, dusk, watersource, and diurnal);
- Active searches including scat searches and microhabitat disturbances;
- Motion-activated cameras; and
- Bioacoustic recorders (BARs).

A likelihood of occurrence assessment was also undertaken to ensure that where field surveys fail to detect flora and fauna, the potential for species to occur was considered in the impact assessment for the Project.

An RE map amendment was submitted by Kleinfelder and approved by the Queensland Herbarium (MAR3577) in June 2024 to refine vegetation mapping within the Study Area prior to this current assessment. MSES impact assessments and calculations relative to MSES regulated vegetation will utilise this Queensland Herbarium certified amendment mapping. However, ground-truthed RE mapping undertaken by e2m as part of this current assessment will be utilised for habitat mapping for all other MSES values.

Refer to **Appendix C** for further details of the terrestrial ecology methodology.

5.2.2 Aquatic Ecology Assessment

A combined desktop review and field assessment approach was adopted to identify aquatic EVs, assess potential risks, and inform management measures in accordance with relevant Queensland and Commonwealth guidelines. The desktop review considered regulatory datasets including the Species Profile and Threats (SPRAT) database, Wildlife Online, the Atlas of Living Australia, recovery plans for listed species, Schedule 1 of the Environmental Protection (Water and Wetland Biodiversity) Policy 2019, and the Queensland MSES mapping tool. This process identified potential aquatic ecological features and data gaps requiring field validation.

Targeted field surveys were subsequently undertaken during the early-wet and late-wet seasons of 2024 across six aquatic sites and nine groundwater bores within and adjacent to the Project Area (**Figure 5-1** and **Figure 5-2**). Sites were selected to represent key watercourses (Goonyella Creek, Kennedy Creek, Charlie Creek, and Skull Creek) and to encompass the range of potential aquatic habitats and GDE types identified from the desktop analysis. Survey methods included aquatic habitat assessment, water quality sampling, macroinvertebrate sampling, fish and macrocrustacean sampling (including threatened species), and groundwater/stygofauna sampling.

Aquatic habitat condition was assessed using the Australian Rivers Assessment System (AUSRIVAS) Physical Assessment Protocols, water quality was measured in accordance with the Queensland Monitoring and Sampling Manual (DES 2018) and ANZG (2018) guidelines, and macroinvertebrate assemblages were collected using edge and bed AUSRIVAS sampling. Potential aquatic GDEs were investigated through geomorphic and elevation analyses supported by field validation following Eamus et al. (2006) and Doody et al. (2018).

This integrated desktop–field approach provided a robust and defensible basis for evaluating the existing aquatic EVs, assessing potential Project impacts, and determining the significance of any MSES interactions within the Project.

Further detailed information about the desktop assessment and field assessment is provided in the specialist aquatic ecology report provided in **Appendix D**.

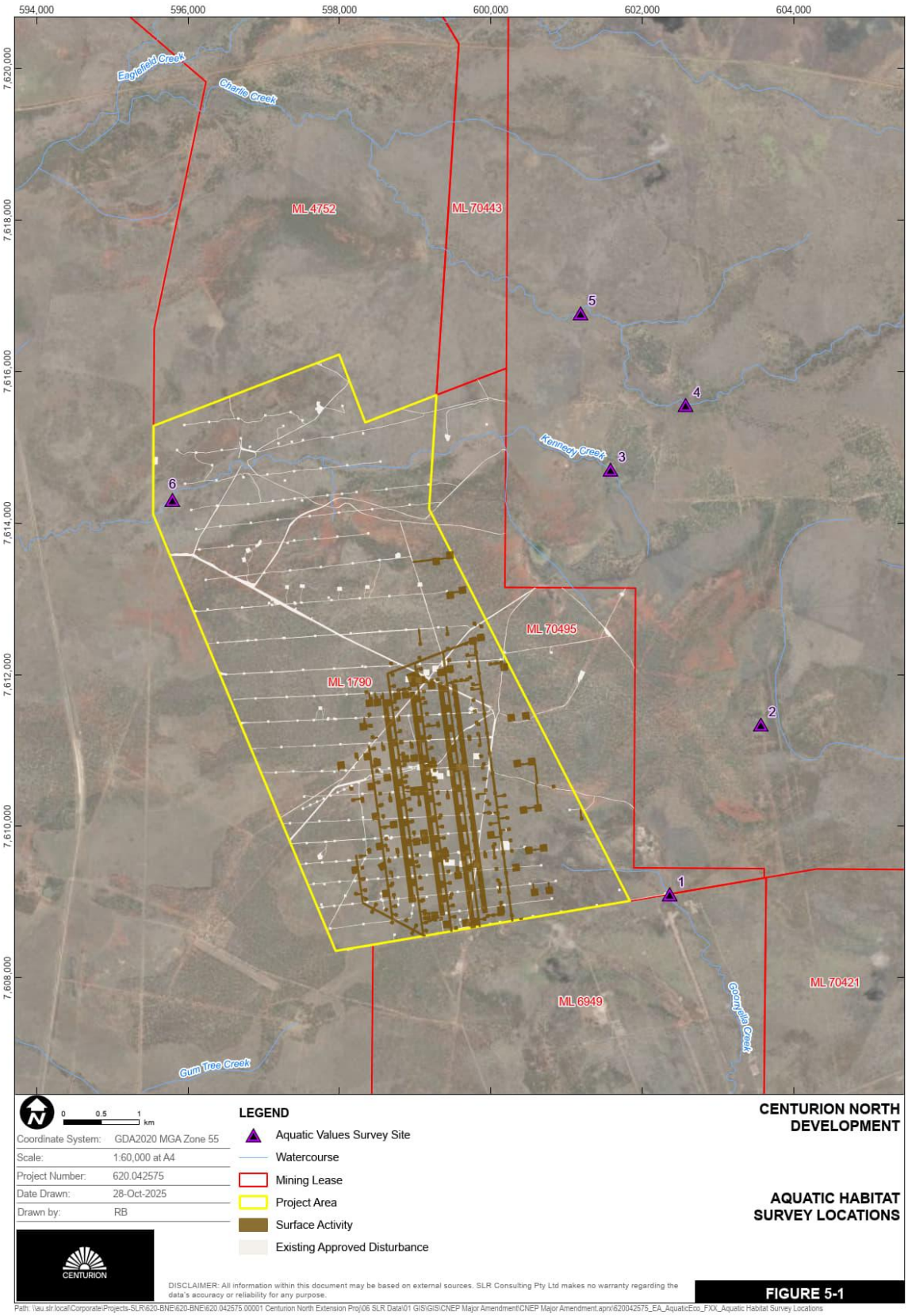


Figure 5-1 Aquatic Habitat Survey Locations

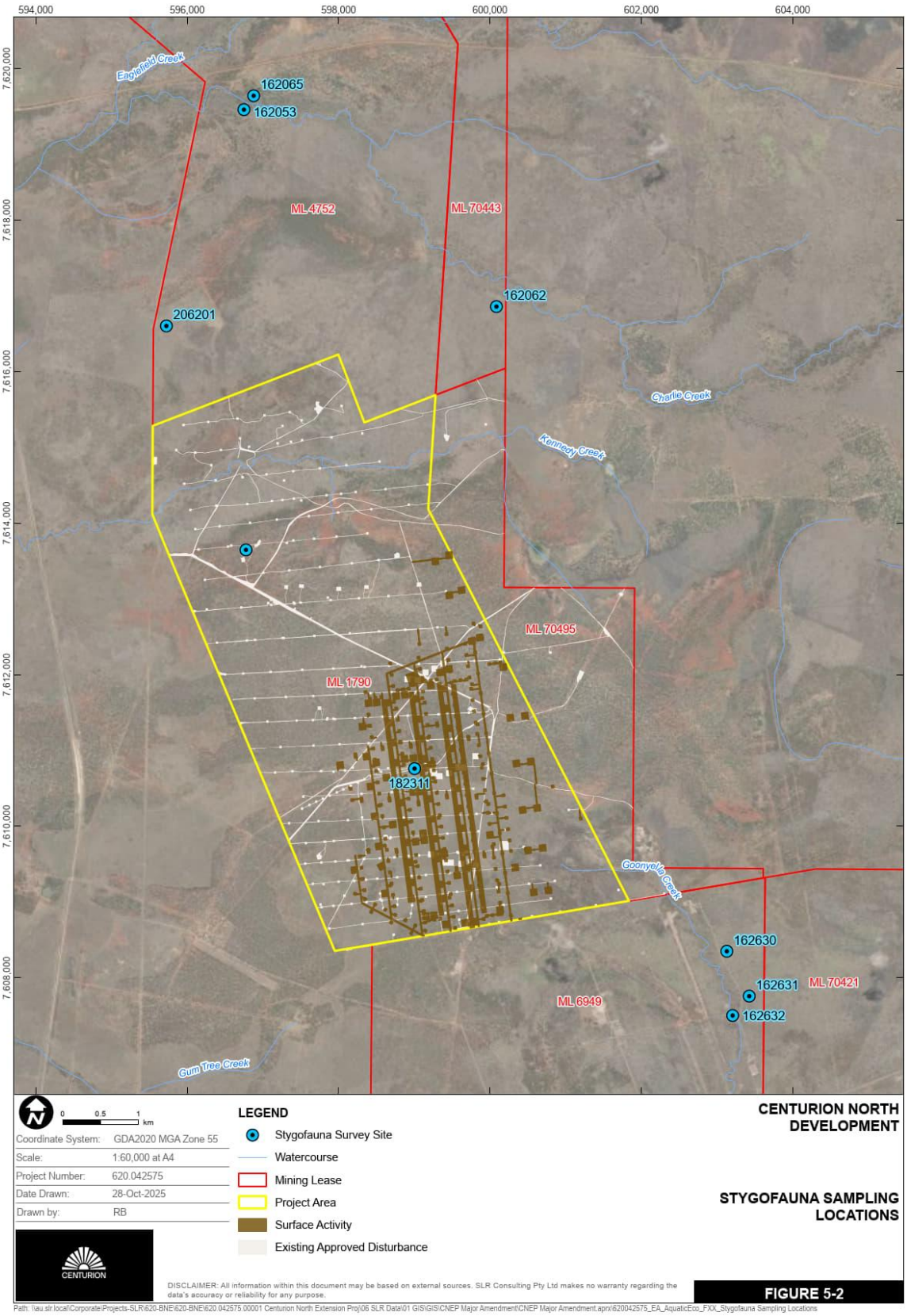


Figure 5-2 Stygofauna Sampling Locations

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
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 present the environmental assessments, which provide a summary of the EVs, technical assessments, and mitigation measures supporting this EA Amendment Application. These assessments include:

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

6.1 Groundwater

The following section describes the hydrogeological environment, and numerical modelling undertaken to assess potential impacts on groundwater receptors resulting from the Project. For the full technical report of groundwater conceptualisation and numerical modelling approach, see **Appendix A**.

Table 6-1 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 6-1 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 3.0** for a description of the proposed activities.
(b) the areas in which underground water rights are proposed to be exercised	Refer to **Section 6.1.3** 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 during the period in which resource activities are carried out;	I. Refer to **Section 6.1.2.1** for a description of the aquifers. II. Refer to **Section 6.1.2.1** and **Section 6.1.2.2** for a description of the movement and interactions of groundwater. III. Refer to **Section 6.1.3** for a description of predicted water level decline. IV. Refer to **Section 6.1.3** for anticipated water take.

Section 126A of the EP Act	Reference
(d) the EVs that will, or may, be affected by the exercise of underground water rights and the nature and extent of the impacts on the EVs;	Refer to **Section 6.1.2** and **Section 6.1.3** 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 6.1.2** and **Section 6.1.3**for a description of EV impacts.
(f) strategies for avoiding, mitigating or managing the predicted impacts on the EVs stated for paragraph (d) or the impacts on the quality of groundwater mentioned in paragraph (e).	Refer to **Section 6.1.4** for a risk assessment of predicted impacts.

6.1.1 Proposed Development Activities Relevant to Potential Groundwater Impacts

6.1.1.1 Coal Seam Gas Extraction

Proposed activities will include drilling of 66 vertical and lateral production wells to target the Lower Goonyella seam between 260-350 mbgl. 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 kPa/day, or four 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.

The CSG extraction wells are represented in the following groundwater assessment as linear features, running north to south, from well head to gas riser.

6.1.1.2 Underground Gate Roads

The Project will involve the construction of four (4) underground gate roads to enable safe and efficient transport of personnel, equipment and extracted materials. Gate roads will be constructed using single pass continuous miners to a width of 5.4 m and a ceiling height of 3.6 m. This hydrogeological assessment treats the gate roads as areas where groundwater will be drained to maintain dry operations.

6.1.2 Existing Environmental Values

6.1.2.1 Aquifers

Hydrostratigraphy

The hydrostratigraphy relevant to the Project comprises the Quaternary alluvium, Tertiary strata (basalt and sediments) and Permian strata. The surface geology of the Project Area is shown in **Figure 6-1** and a conceptual cross section of the hydrogeological setting is provided in **Image 6-1** and 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. Full description of input data and geological relationships is included in **Appendix A**.

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 25 m (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 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.

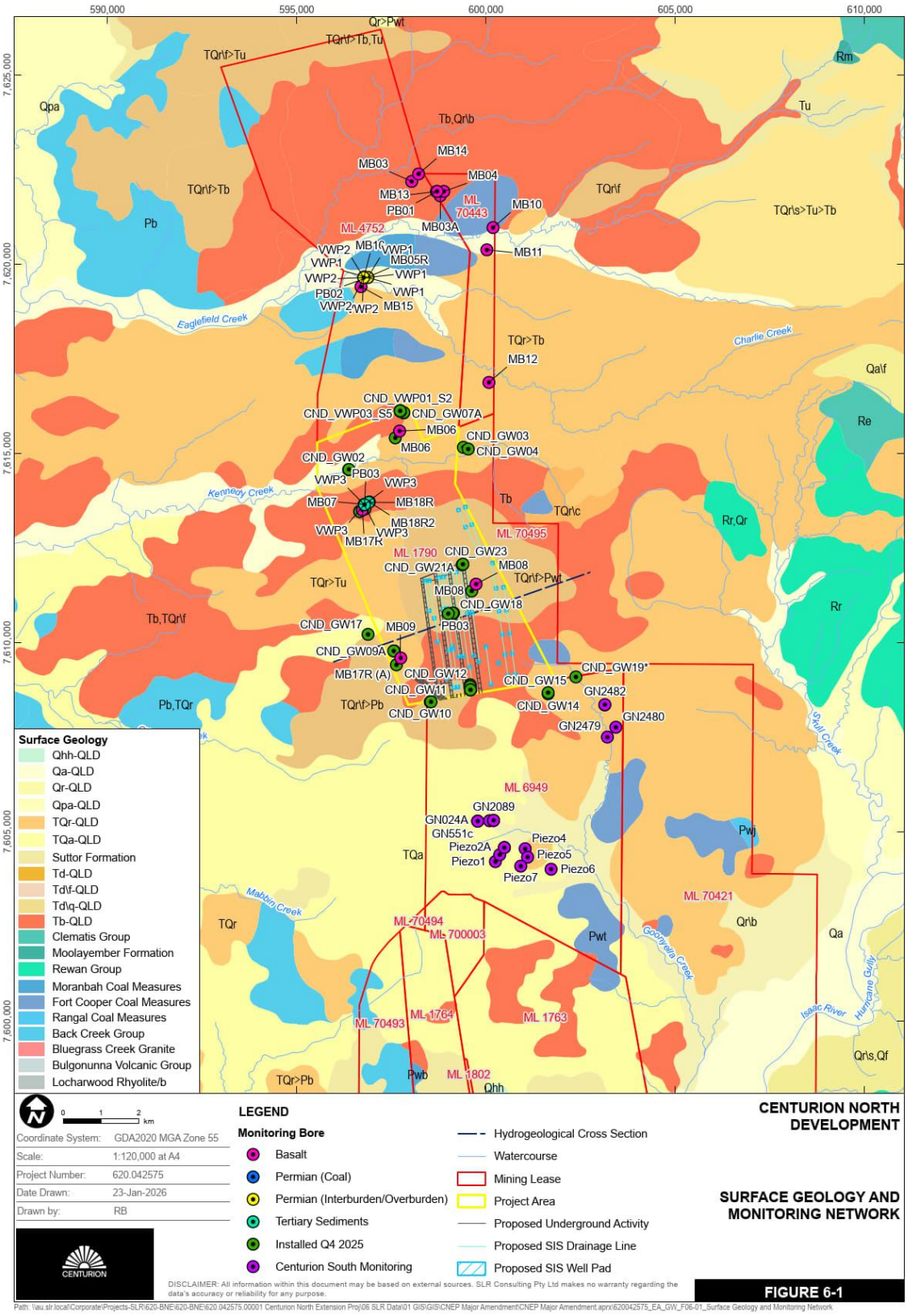


Figure 6-1 Surface Geology and Monitoring Network

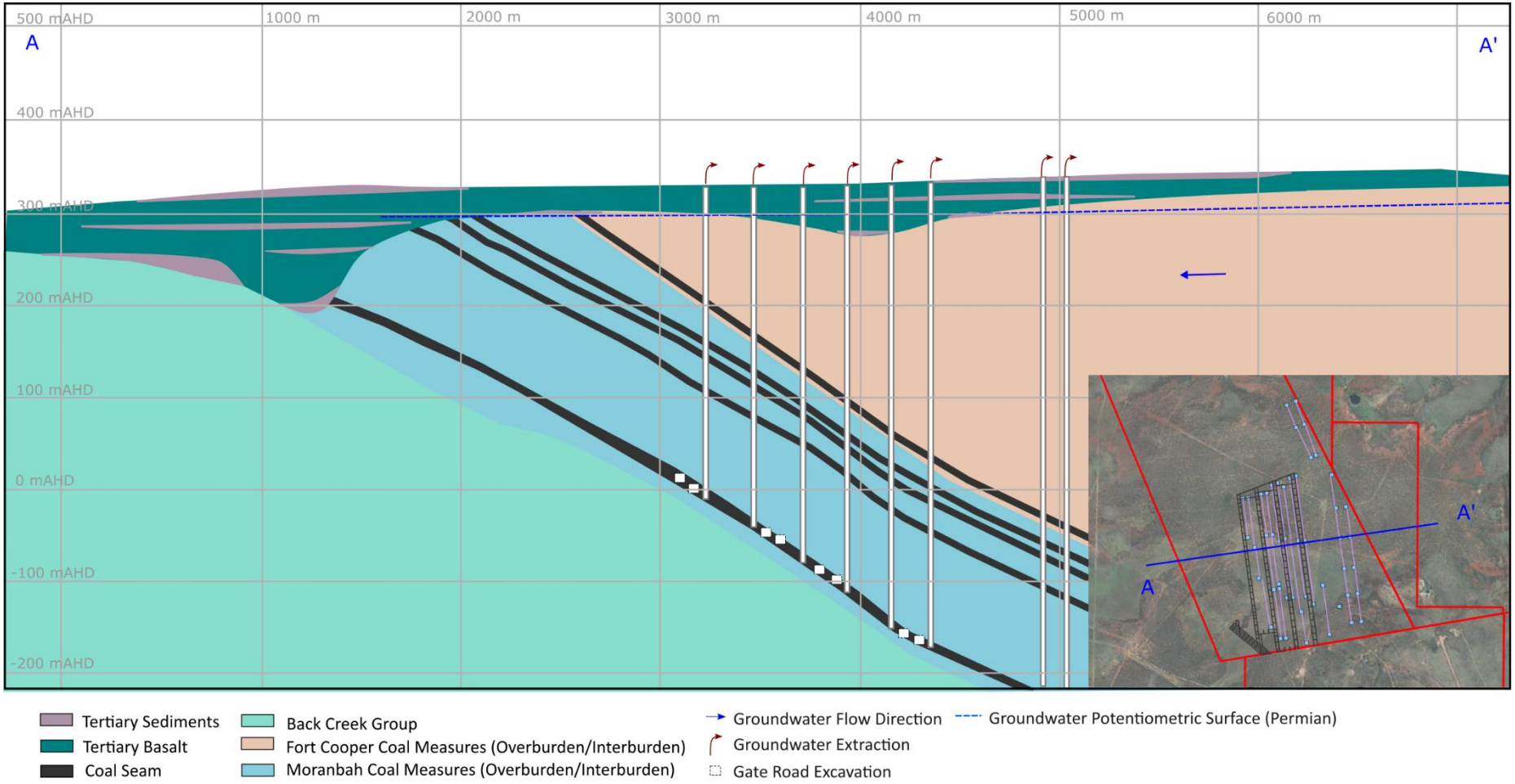


Image 6-1 Conceptual hydrogeological cross section

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. In addition to basal sands at the bottom of the unit, there are “interflow” (i.e. in between basalt flows) sands present where sediment has accumulated before the subsequent basaltic flow deposition.

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 ML 1790 and the immediate surroundings. The basalts are thickest along the western, north-western and northern edge of ML 1790 reaching thicknesses of up to 150 m, including one data point at the south-western corner of ML 1790, proximal to the proposed well field.

Permian

Beneath the Quaternary and Tertiary cover sequences, the Permian sedimentary strata are the deepest formations relevant to the Project. These units include the Fort Cooper Coal Measures (FCCM), the Moranbah Coal Measures and Back Creek Group. They are predominantly made up of siltstone, sandstone, calcareous and carbonaceous shale and coal seams, dipping between 5 and 10 degrees to the east north east in most areas of site.

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 occurs via downwards seepage from overlying aquifers, though faults or discontinuities and where these units outcrop / subcrop through the direct infiltration of rainfall 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).

Fort Cooper Coal Measures

The Fort Cooper Coal Measures conformably overlie the Moranbah Coal Measures and subcrop east of throughout the study area . Regionally, the formation has a maximum thickness of approximately 350 m (HydroSimulations, 2018) and drill logs indicate the Fort Cooper Coal Measures comprise lithic sandstone, conglomerate, mudstone, carbonaceous shale, coal, tuff and tuffaceous (cherty) mudstone.

Moranbah Coal Measures

This unit contains the target coal seams for The Project. It comprises laterally persistent sandstone, siltstone, claystone, mudstone, and coal sedimentary sequences, dipping between 5 and 10 degrees to the east in most areas. The unit contains three main seam groups within the Project Area, Goonyella Upper, Goonyella Middle and Goonyella Lower seam groups. The target unit for all proposed extractive activities is the Goonyella Middle.

Back Creek Group

Along the western margin of the Centurion mining lease is the subcrop of the Back Creek Group, comprising the German Creek Formation and other undifferentiated mudstone, sandstone, siltstone and shale packages. This unit is considered basal for the groundwater system within the Project Area, underlying the coal seams of the Moranbah Coal Measures. The contact between this unit and the overlying formations dips approximately 3° to 6° towards the east, in line with the regional syncline, and the unit subcrops to the base of tertiary cover throughout the western margin of the modelled area.

Hydraulic Properties

Site specific hydraulic conductivity estimates from field testing are presented in **Table 6-2**.

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 (**Appendix A**) 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 6-2 Hydraulic conductivity estimates from field testing[1]

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

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

6.1.2.2 Groundwater Conditions

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

The groundwater monitoring network within the Project site comprises 22 monitoring bores, the details of which are provided in Appendix A. The network includes a combination of open standpipe bores and vibrating wire piezometers. Most were installed in 2011 and monitored regularly from 2011 to 2015. There are currently no monitoring bores installed Alluvium within the Project Area. The CCM (ML 6949) groundwater monitoring network was also considered at the latest stages of groundwater model refinement.

Water Level

Historical groundwater levels within the basalt aquifer from bores located over seven km from the proposed disturbance area showed a general decline from the northeast to the southwest which following the mapped paleochannels in this unit. Water level was generally stable, with fluctuations associated primarily with climatic influence, albeit a subdued reaction in most cases.

Located in the central northern area of the Project, MB08 is screened in the basalt aquifer between 264.9 and 267.9 mAHD and gives the best indication of groundwater conditions in this aquifer within the proposed disturbance area **Image 6-2** shows a hydrograph for MB08 with Cumulative Rainfall Departure included to assess the impact of long-term rainfall variations.

Groundwater levels at MB08 show a very mild recovery trend that is counter to the general climatic trend from 2013-2015. Based on groundwater levels at MB08, Tertiary basalt groundwater levels are expected to be relatively insulated from meteoric influence. Also located in the immediate area of the Project, MB09 is screened in basalt at the level of 271-274 mAHD, and displays a similar recovering water level trend to MB08.

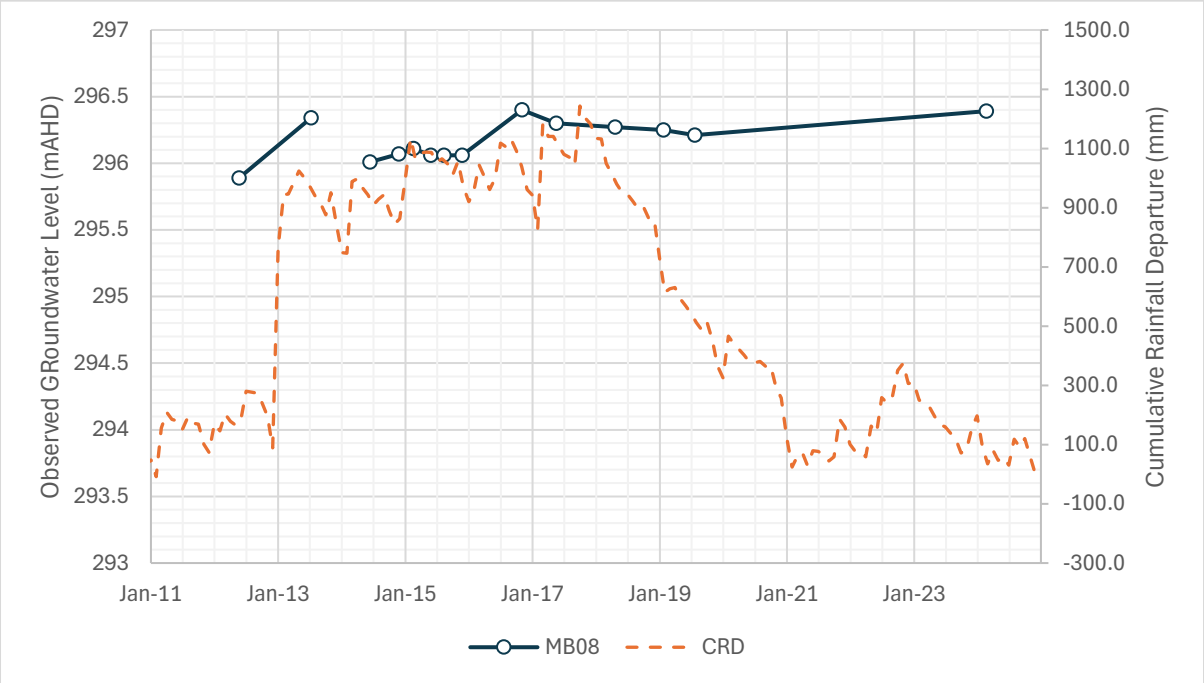


Image 6-2 Groundwater level monitoring bore MB08 hydrograph

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 6-3**. 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 mbgl (i.e., reflecting groundwater conditions in the Permian) (**Image 6-3**). 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.

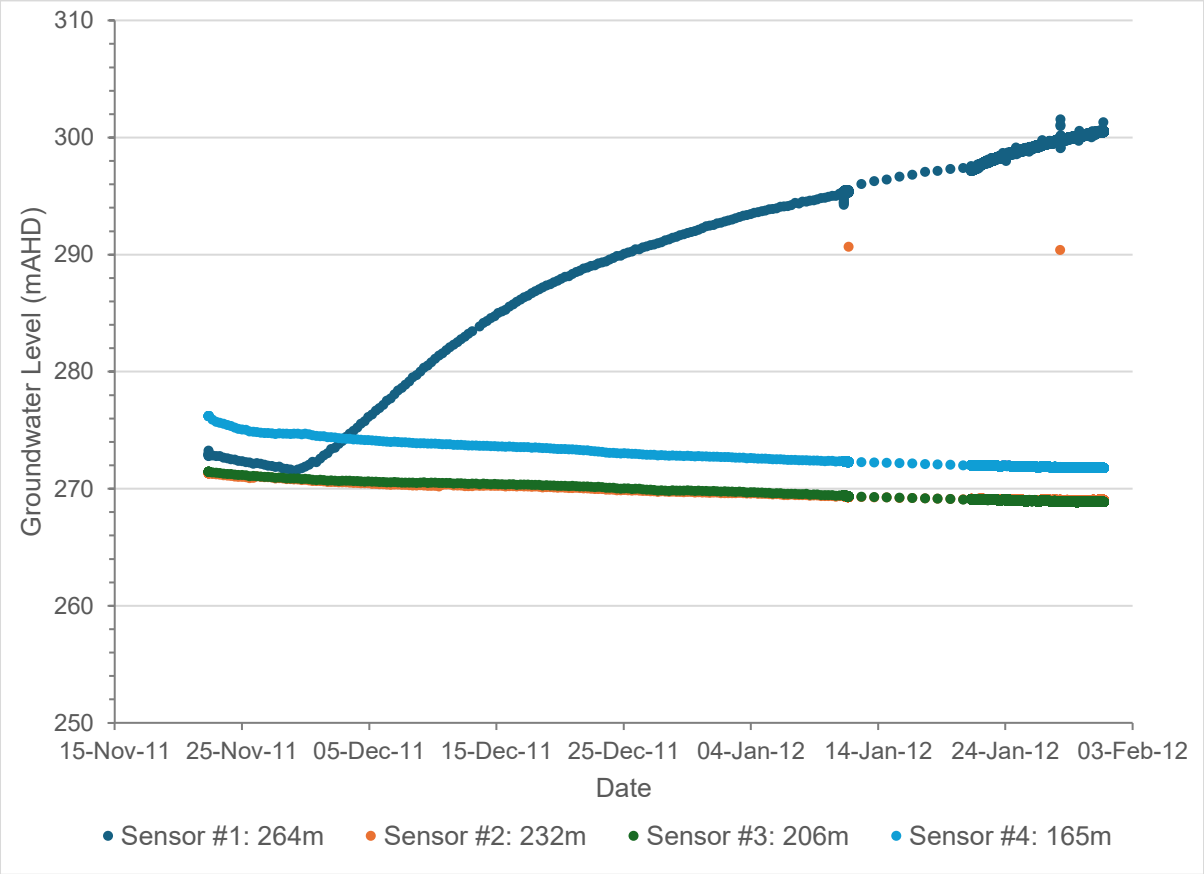


Image 6-3 VWP03 hydrograph

Groundwater levels in the Project area from 310 mAHD (Basalt - MB12) to approximately 270 mAHD (Permian – VWP1), with a downwards vertical hydraulic gradient. Though there are rheological differences at lithology contacts identified in the geological data (AGE 2012) that may increase the likelihood of compartmentalisation within groundwater systems and flow anisotropy. There is no data on the nature of interaction between Quaternary Alluvium and the underlying sediments and it is assumed that there is a degree of connection between these units as a conservative assumption for the groundwater risk assessment.

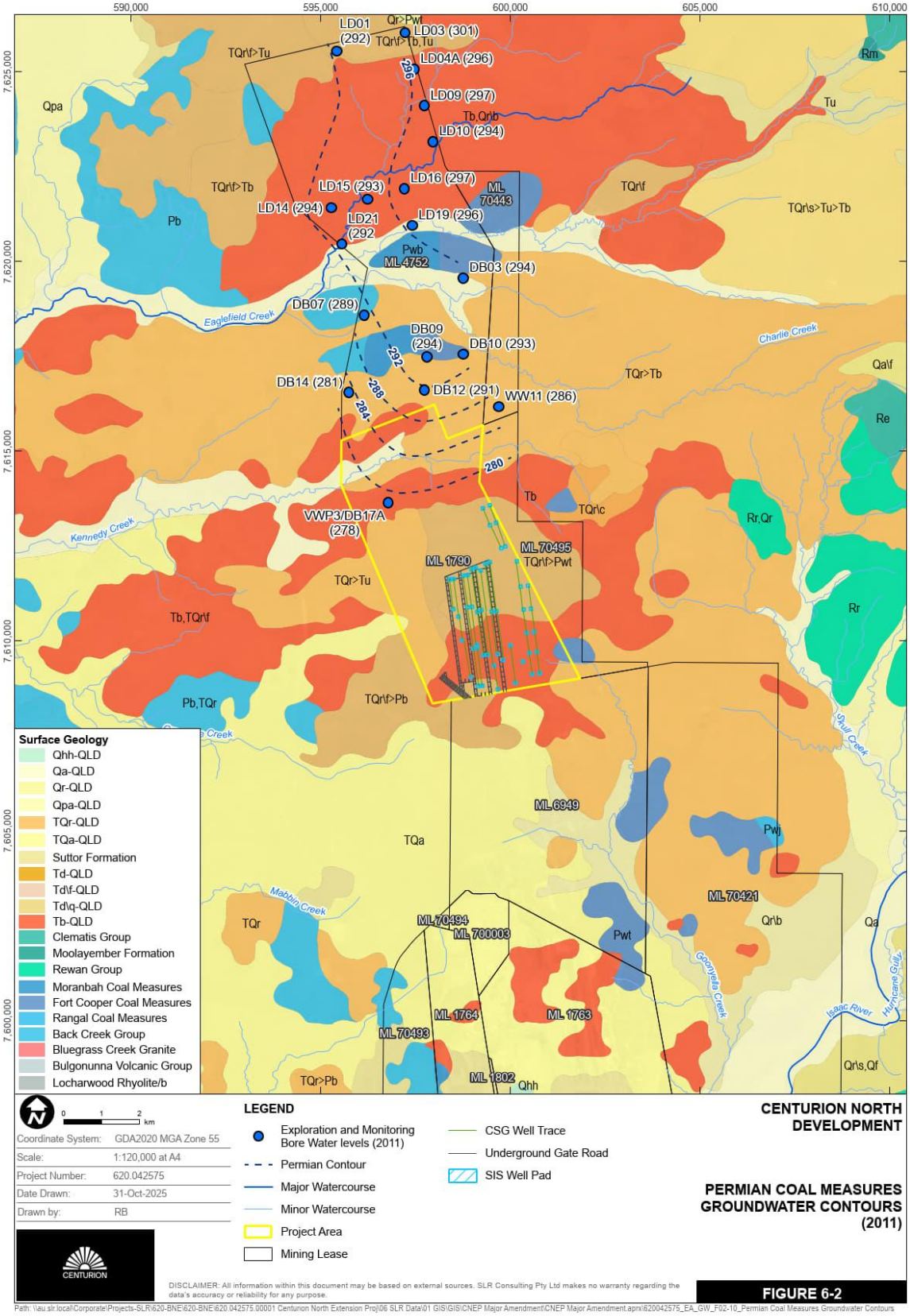


Figure 6-2 Permian Coal Measures Groundwater Contours

Water Chemistry

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

- **Tertiary Sediments**: 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.

6.1.2.3 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 Groundwater Management Area (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 EP Act) as Isaac Groundwaters of the Isaac River Sub-basin of the Fitzroy Basin water plan (WQ1310). The legislated 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; and
    - 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; and
- 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; and
    - 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.

Water Supply Bores

A search of the Queensland Government's Registered Groundwater Bore Database (DNRMMRRD 2025) 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); and
- 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 6-3**.

Groundwater Dependent Ecosystems

A 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) 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; or
- 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 6-3**). 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 6.5**) 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.

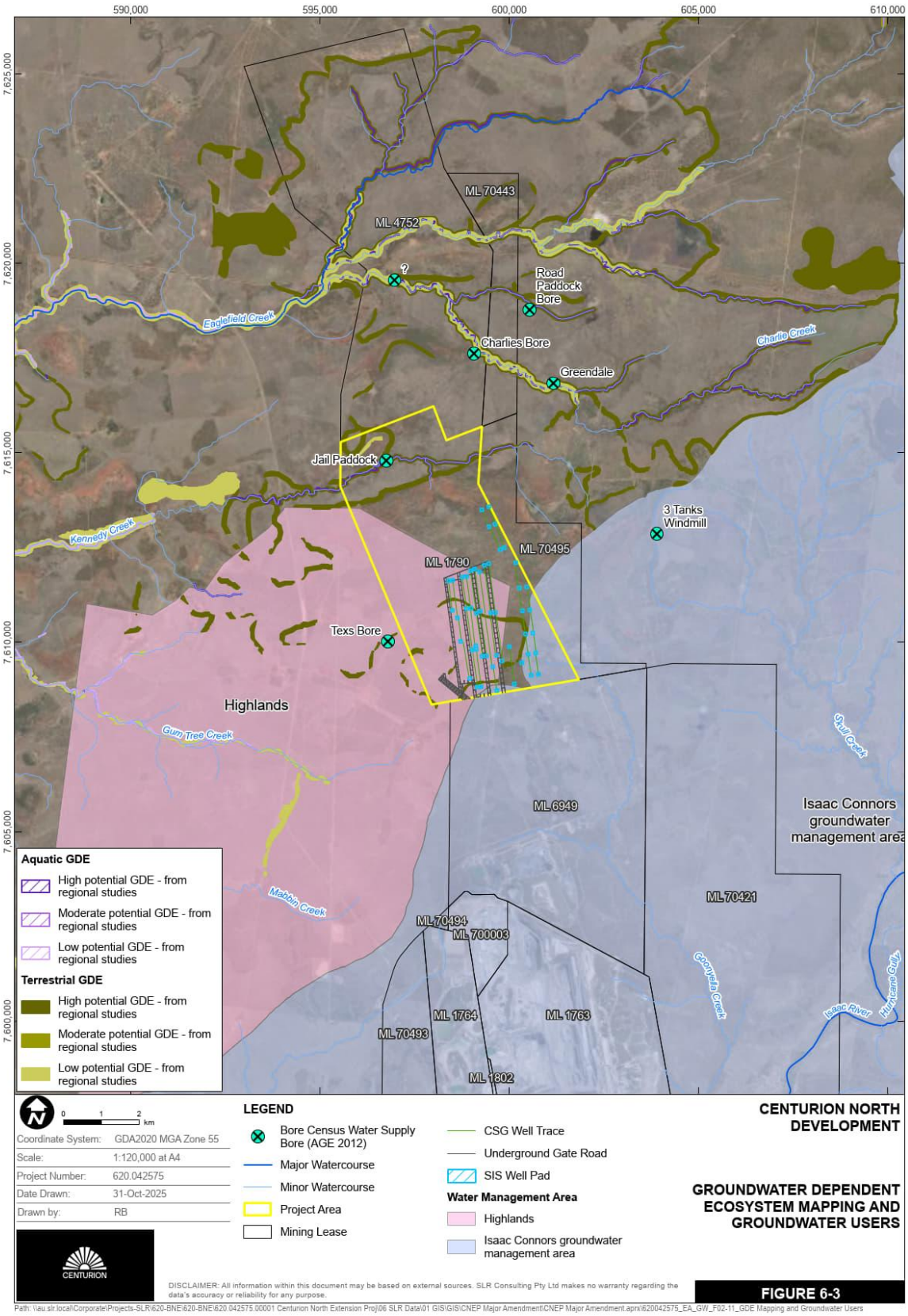


Figure 6-3 Groundwater Dependent Ecosystem Mapping and Private Bores

6.1.3 Potential Impacts

The following subsections detail the potential groundwater impacts as a result of the activities described in the project description. Impacts may result from the propagation of drawdown that results from the depressurisation of the target coal seam to groundwater receptors (**Section 6.1.2.3)**. 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.

Numerical assessment of the Project activities aimed to adopt an appropriately conservative approach to offset some of the data availability limitations and constraints on the timeframe for the assessment.

A risk-based assessment of these potential impacts is detailed in **Section 6.1.4**.

6.1.3.1 Numerical Modelling

Numerical groundwater modelling was undertaken in support of the hydrogeological assessment for the proposed CSG extraction and underground gate road excavation to evaluate the potential impacts of these proposed disturbances on the groundwater regime. This section provides a summary of the design and development of the numerical groundwater model.

The objectives of the groundwater modelling were to:

- Assess the groundwater levels in all relevant hydrogeologic units, identify the time period of maximum hydraulic influence, and evaluate associated impacts on current and potential future receptors (drawdown, water quality and groundwater flow direction);
- Assess impacts to alluvial and Tertiary hosted groundwater and any identified potential receptors; and
- Assess the influence on potential groundwater receptors associated with surface drainage lines.

A full description of numerical modelling design and execution is detailed in **Appendix A**.

6.1.3.2 Predicted Drawdown

The key quantity of interest for the groundwater assessment is drawdown induced by mining activities. In the plots below, groundwater level difference between the base case scenario (no disturbance activities) and the prediction run with proposed mine disturbance is presented as predicted drawdown at conclusion of the underground gate road construction (2032), within Layer 1 (alluvium), Layer 14 (basalt), Layer 22 (target seam), and Layer 25 (Back Creek Group):

- Layer 1 – Alluvium (**Figure 6-4**): The extent of this layer is limited to areas where surface geology mapping shows Quaternary Alluvium, with the key area being around Kennedy Creek where predicted drawdown ranges up to 2 m. Groundwater bores have recently been installed in this area to evaluate the persistence of saturation in this unit.

- Layer 14 – Basalt (**Figure 6-5**): Up to 22 m of drawdown is predicted in the basalt aquifer, located primarily to the west where Layer 22 subcrops into the basal sand and basalt aquifer. Drawdown mapping follows basal sands and is generally most developed along the paleochannel lines. Extensive drawdown propagation is likely to be due to the relatively high hydraulic conductivities used, and the representation of subcrop explicitly with increased vertical conductivity. These are all conservative assumptions. Higher drawdowns are located in the south where subsidence-induced enhanced vertical conductivity increases drawdown propagation vertically.
- Layer 16 – Fort Cooper Coal Measures (**Figure 6-6**): Up to 59 metres of drawdown is predicted, located predominantly in the central area of the proposed disturbance. This represents vertical propagation of drawdown through the Permian stratigraphy. Contours show that recharge is occurring to this unit at the sub-crop contact to the west, and flowing into the model through the general head boundaries. Conservatively high values for vertical continuity of the interburden and overburden separating the Fort Cooper Coal Measures from the Goonyella Middle seam where the extraction is occurring is likely to be contributing to this response.
- Layer 22 – GM Seam (**Figure 6-7**): Significant drawdown is simulated in Layer 22, as is consistent with the scale of groundwater extraction from this unit. Superposition of the coal seam extraction, followed by underground excavations which require voids to be maintained dry with mine water handling system, results in hydraulic levels up to 500 m lower than the base-case scenario. Drawdown in this aquifer does extend to the boundary to the east.
- Layer 25 – Back Creek Group (**Figure 6-8**): Up to 245 metres of drawdown is predicted in this unit, representing a hydraulic response to depressurisation in the overlying seams. These undifferentiated sedimentary units are understood to be low capacity aquifers and even aquitards, hence the propagation of drawdown through this unit is considered a conservative representation of impacts and not likely to have significant impact on other hydrostratigraphic features.

The lateral extent of drawdowns that reach the model boundaries suggest that future iterations of the model would expand the spatial domain of the model so that boundary conditions do not potentially influence drawdown predictions. General head boundary conditions were chosen to be applied at the model boundaries in order to permit groundwater levels at the model boundaries to increase or decline in response to groundwater behaviour within the model domain, thus minimising the potential for boundary conditions to influence drawdown (constant head boundary conditions would enforce a spatial limit to drawdown calculations). Furthermore, the drawdown hitting boundary to the south is likely to be a reflection of cumulative impacts, with depressurisation occurring due to mining abstraction.

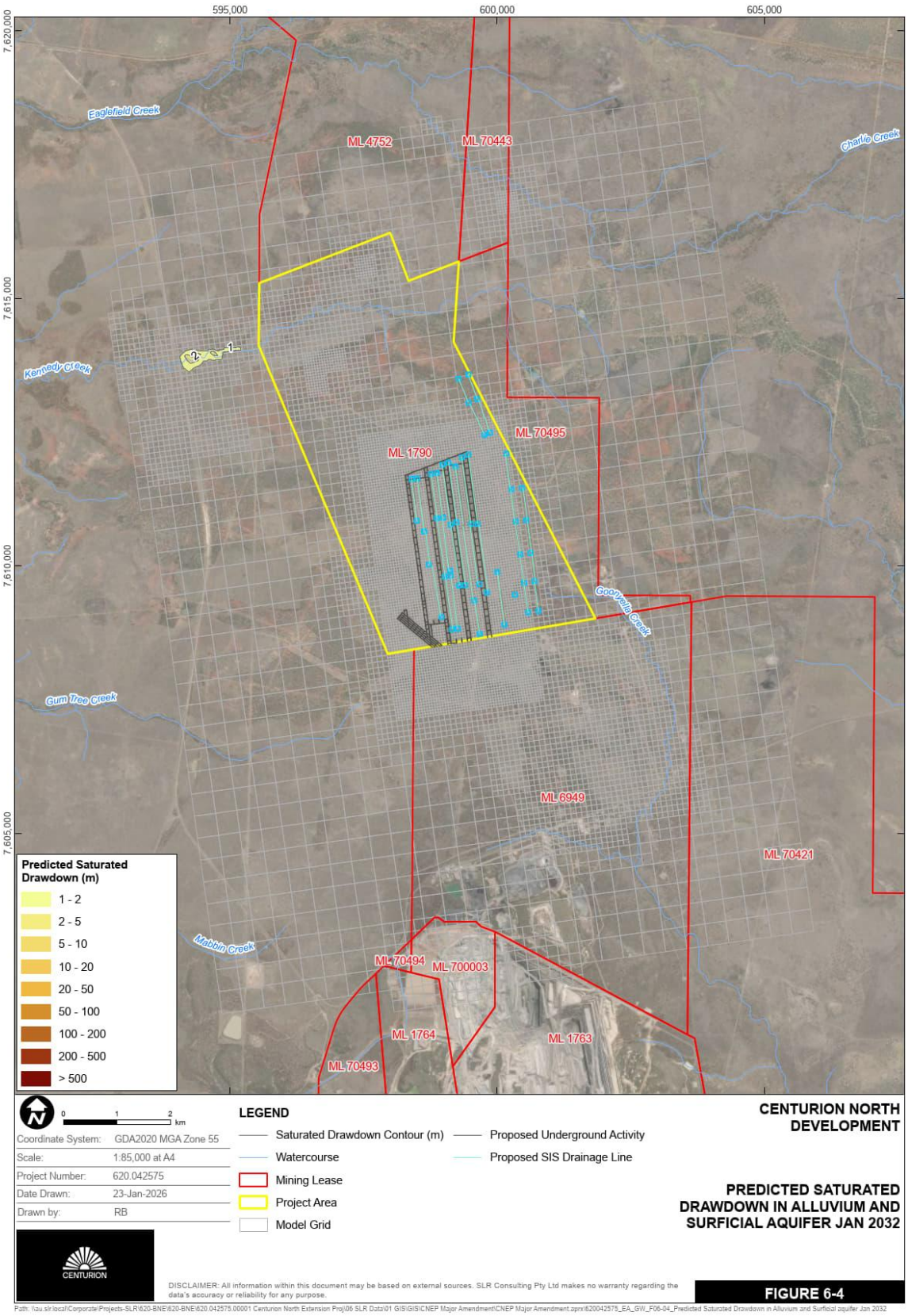


Figure 6-4 Predicted Drawdown in Alluvium and Surficial aquifer Jan 2032

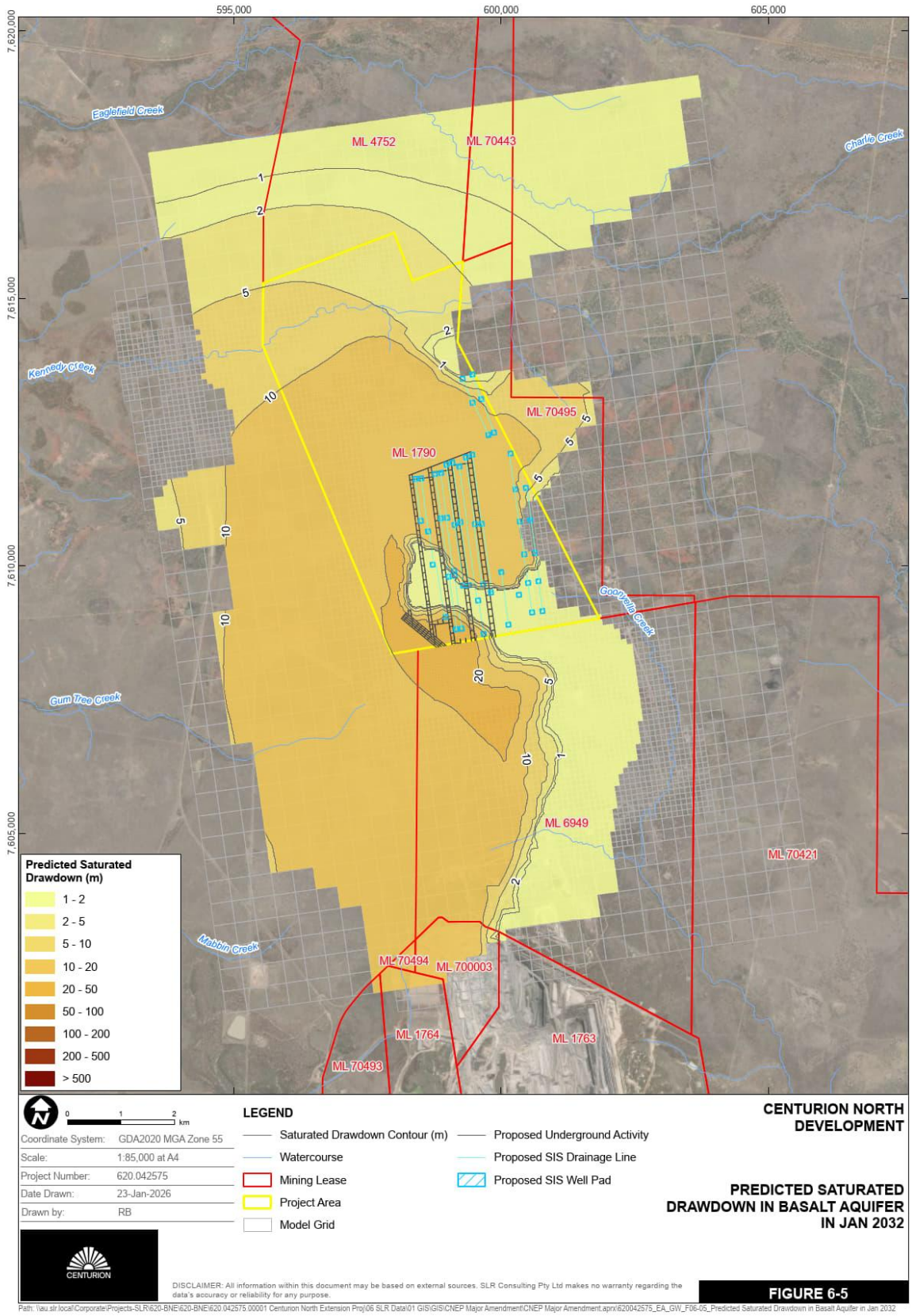


Figure 6-5 Predicted Drawdown in Basalt aquifer in Jan 2032

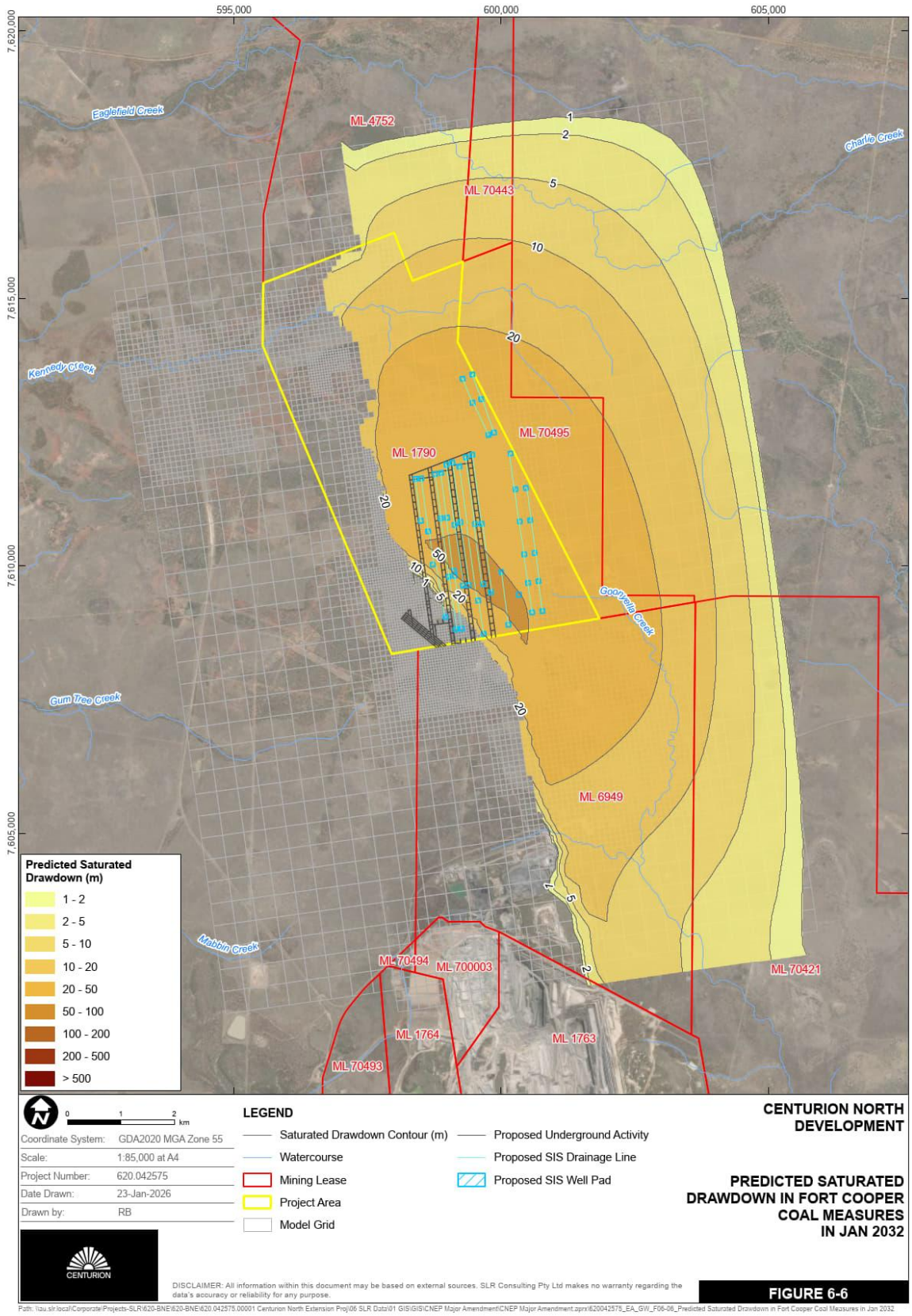


Figure 6-6 Predicted Drawdown in Fort Cooper Coal Measures in Jan 2032

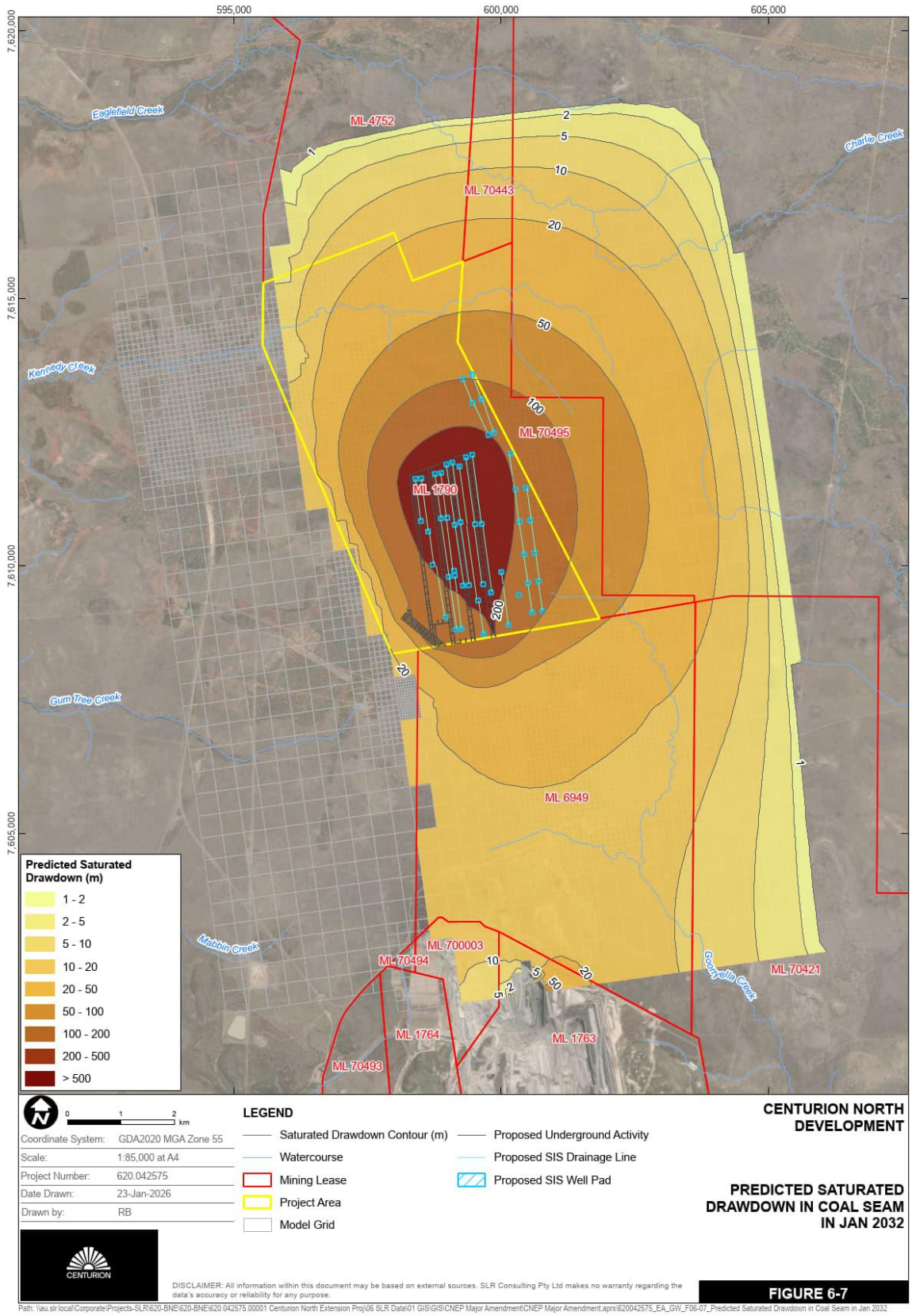


Figure 6-7 Predicted Drawdown in Goonyella Middle Coal Seam in Jan 2032

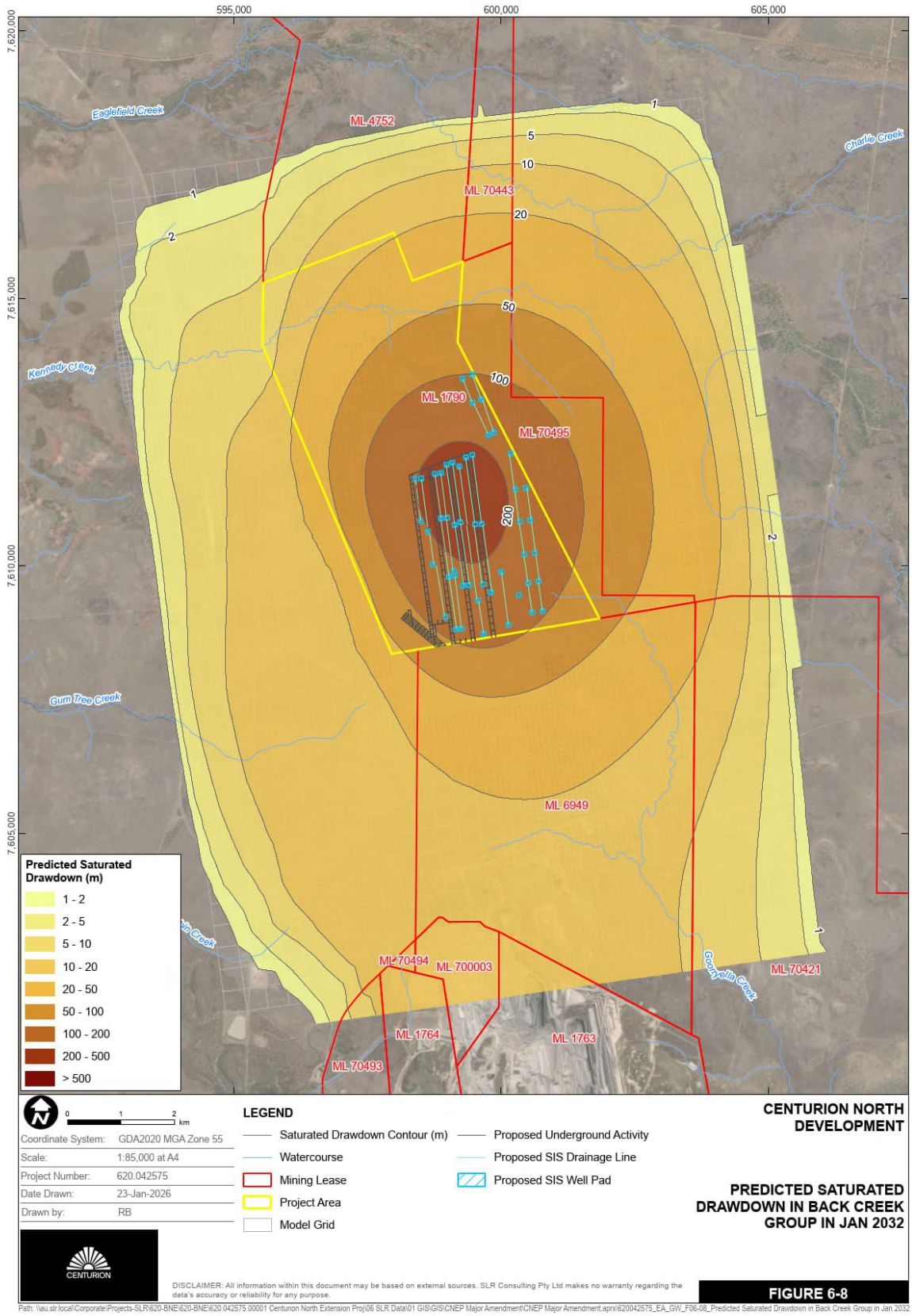


Figure 6-8 Predicted Drawdown in Back Creek Group in Jan 2032

6.1.3.3 Groundwater Level Impacts to Potential Receptors

Predictive hydrographs have been derived from the groundwater model to understand the nature of likely groundwater level change in the interpreted source aquifer for identified potential natural and anthropogenic groundwater receptors in the vicinity of the Project Area. The aim of the hydrographs is to assess the potential for additional impacts to these potential receptors in the period post-mining, i.e. identify additional potential impacts beyond those that have occurred during already approved mining operations that may be attributable to the PRCP's proposed final landform. **Figure 6-3** provides the locations of identified potential receptors, **Table 6-3** lists the locations and predicted drawdown from base case, and hydrographs are shown in **Appendix A**.

The hydrographs indicate that there is residual groundwater decline occurring throughout the area, in response to groundwater discharge in mining areas to the south of the Project. Note that there was no bore depth data available in the bore census for the Jail Paddock or 3 Tanks Windmill bores and therefore the layer assignment has not been verified. These bores may not be saturated, or may be subject to different hydraulic stressors.

Table 6-3 Predicted water level drawdown at potential receptor locations

Easting (GDA2020z55)	Northing (GDA2020z55)	Potential Receptor Name	Layer	Distance From Proposed Disturbance	Maximum Drawdown (m)
596752	7614792	Jail Paddock	Layer 7	3.2 km	7.1
603901	7612857	3 Tanks Windmill	Layer 13	4.0 km	3.8
600539	7618772	Road Paddock Bore	Layer 3	6.0 km	0.04
599069	7617620	Charlies Bore	Layer 3	4.5 km	0.6
601167	7616836	Greendale	Layer 4	4.5 km	0.7
596795	7610020	Texas Bore	Layer 13	1.6 km	16.8
595814	7614305	Kennedy Creek GDE	Layer 1	7.8 km	No predicted saturation in base-case

6.1.4 Risk Assessment

A risk assessment has been used to summarise the potential impacts on groundwater receptors arising from the proposed early works CSG extraction 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; and
- Risk rating derived from likelihood vs consequence.

The risk assessment summary is presented in **Table 6-4**. The risk of significant impacts to groundwater receptors from the proposed limited CSG and underground mining development are considered to be low. Note that the conclusions discussed here are subject to the assumptions and exclusions outlined in **Section 6.1.5**.

Table 6-4 Risk assessment summary table

Source	Pathway	Receptor	Potential Impact	Consequence	Likelihood	Risk Rating
Depressurisation of the target coal seam at depth below the basalt aquifer for the purpose of CSG production and gate road excavation.	Upward propagation of drawdown from the depressurised coal seam through the overburden into the basalt aquifer with potential expression in surficial aquifers	Landholder bores	Drawdown impacts at landholder bores – loss of yield	**Low**: Loss of water source for landholder, reputational risk for operator.	**Possible**: modelling predicts up to 3.7 meters of drawdown at 3 Tanks Windmill, Jail Paddock and up to 16.8 m drawdown at Texas Bore known water supply bores	**Medium**
		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.	**Low**: Potential Terrestrial GDEs are mapped along Kennedy Creek and other creek lines. The consequence of impacting GDE health could be considered high depending on the nature and sensitivity of the GDE.	**Unlikely**: Predicted potential drawdown in the basalt aquifer from the limited development is modelled to be moderate (<5 m). Predicted drawdown at surficial aquifer along creek lines where potential Terrestrial GDEs have been mapped up to 2 m.	**Low**
		Watercourses	Drawdown impacts reach creek locations and reduce baseflow.	**Minor**: The creeks are ephemeral and not supported by baseflow and so a reduction in basalt groundwater levels could not affect creek flows.	**Rare**: Based on available information, 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.	**Low**

Source	Pathway	Receptor	Potential Impact	Consequence	Likelihood	Risk Rating
Contaminant release through drilling or water storage activities	Hydraulic gradient away from disturbance activities, either in deep aquifer through production bores, or shallow aquifers through surficial infiltration	Landholder bores	Unable to use water for domestic or stock purposes	**Low**: loss of water source for landholder, reputational risk for operator.	**Rare**: 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. Additionally, surface water controls are to mitigate contaminant release potential at surface.	**Low**
		Terrestrial GDEs	Harm to water reliant ecosystems	**Medium**: Potential Terrestrial GDEs are mapped along Kennedy Creek and other creek lines. The consequence of impacting GDE health could be considered high depending on the nature and sensitivity of the GDE.	**Rare**: 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. Additionally, surface water controls are to mitigate contaminant release potential at surface.	**Medium**

Source	Pathway	Receptor	Potential Impact	Consequence	Likelihood	Risk Rating
		Watercourses	Harm to water reliant ecosystems	**Minor**: The creeks are ephemeral and not supported by baseflow and so a reduction in basalt groundwater levels could not affect creek flows	**Rare**: 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	**Low**

6.1.5 Model Performance and Limitations

This section details the key measures of model performance (see **Appendix A**).

Overall, the model reproduces regional groundwater flow directions in the base case steady state run, providing confidence in the model structure and parameterisation. The model is numerically stable with little mass balance error. Conservatively high hydraulic conductivity values are selected based on site-specific, long-term testing data. Overall, the model is considered fit for purpose based on the data provided and the project timeframe.

Model assessment and limitation summary is presented in **Table 6-5.**

Table 6-5 Groundwater model and data limitations

Type	Part	Status	Comment
Structural/ Conceptual	Grid and Model Extent	Fit for purpose	The model has an unstructured grid that includes detailed cell refinement around the Project site, subsidence, monitoring and along drainage features.
	Layers	Fit for purpose	Representation of geological units based on provided geology model and extensive previous investigation into surficial aquifers. Base of weathering from site specific data checked CSIRO depth to regolith surface (Wilford et, al. 2016).
	Conceptualisation – Geological Structure	Fit for purpose, improvements possible	The local structure of the geology is based on detailed data at the Project where available, including a site geology model. Specific structural features such as subcrop contacts are represented in the model explicitly. There was no data available for faulting within the project area, however the model represents known structural heterogeneity in material changes between basaltic flows.
	Conceptualisation – Surface Water Groundwater Interactions	Fit for purpose, improvements possible	Mine voids on the southern model boundary are represented as drain cells. There are no data on specific groundwater-surface water interactions along drainage channels, however model construction includes the conservative assumption that the surface alluvium is hydraulically connected with regional basalt aquifer and some interaction may occur.

Type	Part	Status	Comment
	Conceptualisation – Saturated Extent of Alluvium and Regolith	Fit for purpose, improvements possible	For the extent and thickness of alluvium and regolith within the model domain, a combination of the site geological model, regional geological mapping and the CSIRO depth of regolith surface (Wilford et, al. 2016) was used. Investigations into the thickness, extent and saturation of the alluvium will yield additional certainty in assumptions made regarding this aspect of the model. Any additional data or study on alluvium extent and thickness in the area should be reviewed and captured (where relevant) in future updates or iterations of the Project groundwater model.
Parameterisation	Hydraulic Conductivity – Depth Dependence	Fit for purpose, future improvements possible	Extensive field testing of hydraulic conductivity has been conducted in the Project Area and the nearby analogous areas. Hydraulic conductivity test results from the wider Bowen Basin were also considered. Further hydraulic conductivity tests on the individual units, focusing on the subcrop areas and constraining of storage properties can improve model calibration and refine model predictions but are not deemed required for the current impact assessment.
	Subsidence	Fit for purpose, future improvements possible	No site-specific data on subsidence impacts to vertical conductivity. Parameter selection was estimated based on previous studies at other sites.
	Rivers	Fit for purpose, future improvements possible	All watercourses within the model domain are minor ephemeral creeks. A refinement along the riverbeds was performed to capture the variation in the evapotranspiration surface along the watercourses. There are no data on specific groundwater-surface water interactions along drainage channels, however the model makes conservative assumptions that there are no inhibitors between the shallow aquifer and regional systems.

Type	Part	Status	Comment
	Recharge	Fit for purpose, future improvements possible	Chloride Mass Balance was carried out to constrain recharge estimates, and a conservatively low distributed recharge was selected. Sensitivity analysis of this parameter was carried out. No specific recharge zones were selected, based on the minimal surface geology variation and lack of data on drainage channel interaction with shallow groundwater.
Measurement Error	Observation Data Quality	Fit for purpose	Bore logs and construction details available for most site bores, and long-term site water level data available for various units. Installation of additional monitoring is currently planned for the Project, and this data should be incorporated into subsequent groundwater conceptualisation and modelling assessments.
	Temporal Spread	Fit for purpose, future improvements possible	Data is available from 2011 through to 2024. Most data located within Basalt aquifer, little data available for Permian and no data available for Alluvium. No transient calibration was carried out for this model, with approach taken to select conservative parameter ranges and assess risk with a conceptual representation of potential groundwater interactions.
Scenario Uncertainties Future stresses/ conditions	Calibration	Fit for purpose, improvements possible	A combined steady state and transient (extended transient period in which boundary conditions do not change) calibration to initial heads was performed. Heads reproduced in this period were a reasonable match for observed values, however no transient calibration was carried out to validate further. Additional data sufficient to support a transient calibration may address this limitation. Lack of data at model bounds complicated assignment of boundary head conditions that contribute to calibration performance. However, as the parametrisation section notes, parameter values guided by this calibration process were applied such that potential impacts would unlikely be underestimated (i.e., model predictions are conservative and likely to overestimate impacts to groundwater).

Type	Part	Status	Comment
	Predictive	Fit for purpose	Model prediction period covers all proposed disturbance activities.
	Sensitivity Analysis	Fit for purpose	Based on the sensitivity analysis, the model is relatively insensitive to hydraulic conductivity, and recharge, and is highly sensitive to the selected storage coefficient. A moderate value was used for all hydraulic units, based on pumping test data for the immediate area.

6.2 Surface Water

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

6.2.1 Existing Environmental Values

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

The aquatic MSES assessment (Hydrobiology Pty Ltd (Hydrobiology) 2025; **Appendix D**) for the Centurion North Development identified limited aquatic ecological values within the Study Area. Field surveys confirmed that the local creek systems are highly intermittent, with surface water and aquatic habitat only present following significant rainfall. Habitat condition ranged from poor to fair, with widespread signs of disturbance including erosion, sedimentation and grazing impacts (Hydrobiology 2025). Refer to **Section 6.5** for further details on aquatic ecology.

No Wetlands of International Importance or MSES Wetlands are mapped within the Study Area.

6.2.1.1 Land Use

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

6.2.1.2 Protected Areas

The nearest protected area is Homevale National Park, which is located approximately 50 km to the east of the Project Area (ML 1790). This Park is not hydrologically connected to the Project Area.

6.2.1.3 Regional Drainage

ML 1790 is situated within the Suttor and Isaac River sub-basins, which collectively span approximately 96,274 square kilometres (km²) (73,949 km² and 22,325 km², respectively). The majority of ML 1790 lies within the Suttor River sub-basin, a major component of the larger Burdekin Basin. The south-eastern section of ML 1790 is located within the Isaac River sub-basin, which forms a smaller part of the Fitzroy River Basin (**Figure 6-9**).

Two mapped creek systems are located within ML 1790. Kennedy Creek extends throughout the northern portion of ML 1790. This creek is a stream order 2 watercourse that runs east to west, starting to the east of ML 1790 and discharges towards the Sutton River, which is situated to the west of the Project Area in the Burdekin Basin water management area. Approximately 4.6 km of Kennedy Creek (both stream orders 1 and 2) are situated within ML 1790. These stream sections are located approximately 1.2 km from the nearest proposed surface activity (**Figure 6-9**).

Goonyella Creek originates in the south-eastern portion of ML 1790 and exits through the southern boundary as stream order 1. Goonyella Creek runs east before heading south, before joining into Isaac River in the Fitzroy Basin water management area. The section of Goonyella Creek within ML 1790 is approximately 70 m in length and is located approximately 26 m from the nearest proposed surface activity (**Figure 6-9**). Goonyella Creek is recognised under the *Water Act 2000* as a Drainage Feature.

The mapped head of Gum Tree Creek is approximately 1 km southwest of ML 1790 and drains westward, again discharging towards the Suttor River (**Figure 6-9**).

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 and March, with this flow slowing and developing into pools of stagnant water that slowly dry out until the more typical dry conditions return. Habitat condition of the creeks ranged from poor to fair due to grazing, heavy erosion, fine sediment, scouring, and channelization (Hydrobiology 2025).

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 25 km to the northwest of ML 1790. Details of flow volumes at this gauging station are provided in **Table 6-6**. 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 151 ha (1.51 km^2).

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

Table 6-6 Suttor River at Eaglefield: Flow Volume Summary (mega litres (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	114	0	3,423
May	59,461	0	108	0	3352
Jun	6,600	0	20	0	603
Jul	5,978	0	16	0	510
Aug	13,300	0	9	0	272
Sep	2,085	0	3	0	84
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	261	0	7,916

Source: Queensland Government 2025.

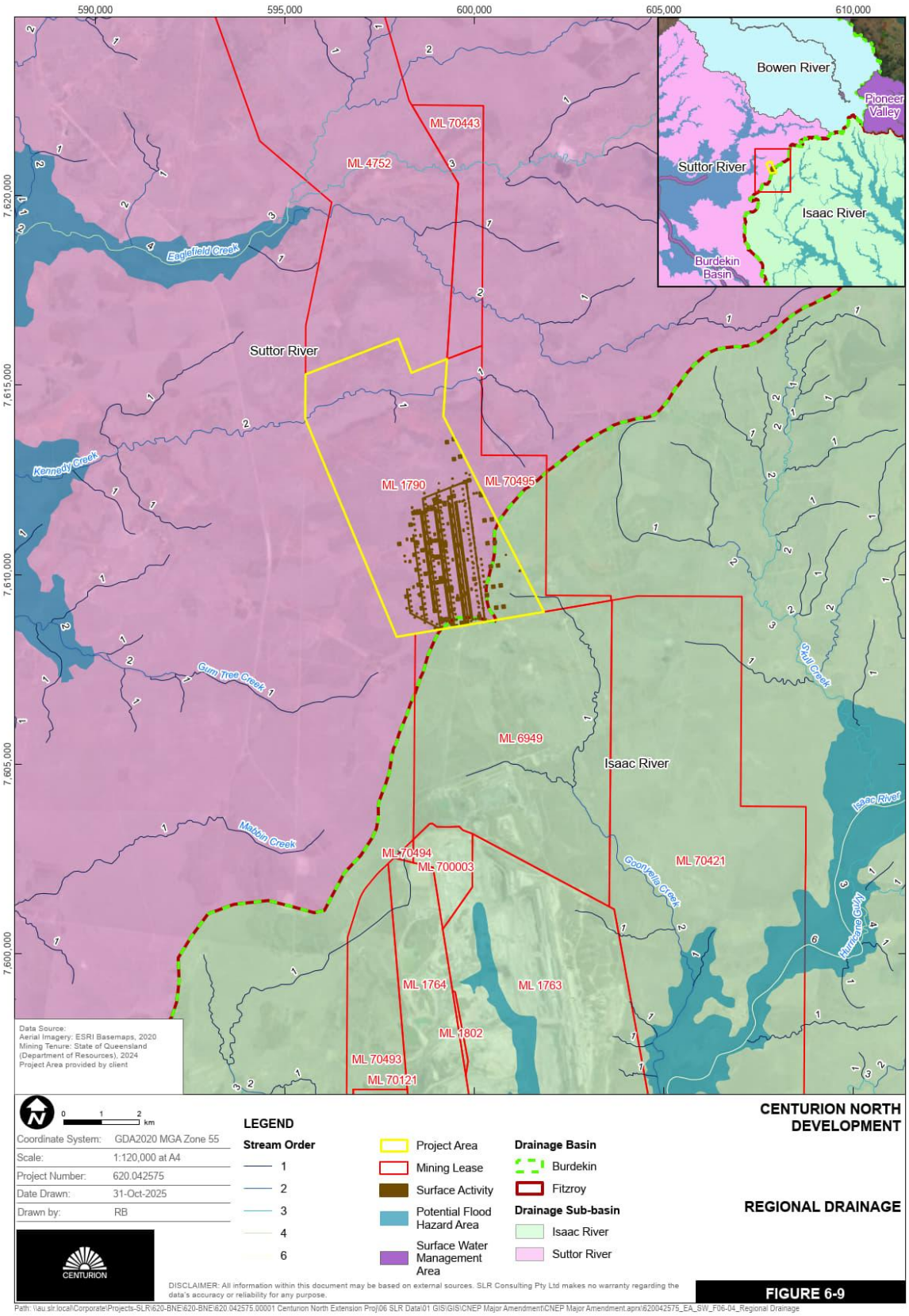


Figure 6-9 Regional Drainage

6.2.2 Potential Impacts

Potential surface water impacts as a result of the surface activities described in **Section 3.0** include:

- Clearing for access tracks, drill pads, laydown area and future goaf drainage lines will affect runoff regimes locally. Changes to localised surface water flow can impact local ponding areas and landforms. Increased surface runoff speeds and volumes can also be experienced during heavy rain events due to altered landforms, resulting in increased localised erosion and sedimentation; and
- Surface water contamination from hydrocarbon spills, leaks from gas wells and improper management of wastewater.

As there are no riparian communities or waterways within close proximity to the disturbance area, the risk of impacts to surface waters is relatively minor, provided that mitigation measures are employed for the Project. This is particularly relevant prior to high rainfall events.

A risk-based assessment of these potential impacts is detailed in **Table 6-7,** and determined that surface water impacts are low due to the scale and location of the proposed activities described in **Section 3.0**.

No impacts to surface water are anticipated as a result of the underground activities.

6.2.3 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 EVs 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 management system;
- Erosion and sediment control monitoring will 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; and
    - As soon as practical, disturbed areas will be rehabilitated to reduce the extent of exposed soils.

6.2.4 Risk Assessment

The potential surface water impacts were assessed to provide an overall risk rating, of which details are provided in **Table 6-7**.

The risk of surface water impacts is low. Any realised impacts will be low in comparison to the existing operations undertaken on ML 1790.

Table 6-7 Surface Water Risk Assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Sedimentation of surface waters resulting 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.

6.3 Land Resources

This section presents the assessment of Project related land resource impacts to EVs. Further information is provided in the Land Resources Assessment (**Appendix B**).

6.3.1 Existing Environmental Values

6.3.1.1 Soil Mapping

The Project Area lies within a region of recognised agricultural significance, with cattle grazing on buffel grass and native pastures representing the dominant land use. Patches of remnant vegetation communities are present, including Poplar Box, Bloodwood, Ironbark, Acacia and Brigalow.

The Project footprint also overlaps with land mapped as Strategic Cropping Land (SCL) within the Western Cropping Zone, as defined under the *Regional Planning Interests Act 2014*. Resource activities that were previously subject to assessment under the former *Strategic Cropping Land Act 2011*, were granted approval via a compliance certificate issued in November 2013 for ML 1790 (Application Reference SCLRD2013/000151). This provides regulatory certainty for those approved activities. However, any new disturbance associated with the current expansion that is not covered under the compliance certificate will require assessment against SCL criteria. Given the prevalence of dispersive and sodic soils within the Project Area, only limited land units are expected to meet the thresholds for sustainable cropping.

Soil units for most of the Project Area were mapped as part of the Wards Well Soil Survey (SKM 2012). SKM (2012) 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 (2012). The broad scale regional soil mapping (DNRME and DES 2024) was accessed to determine the soil order. The major soil orders present on site are Kandosols, Dermosols and Vertosols (**Figure 6-10** and **Figure 6-11**). A summary of chemical properties (**Table 6-8**) of these soil orders has been extracted from BHP (2021).

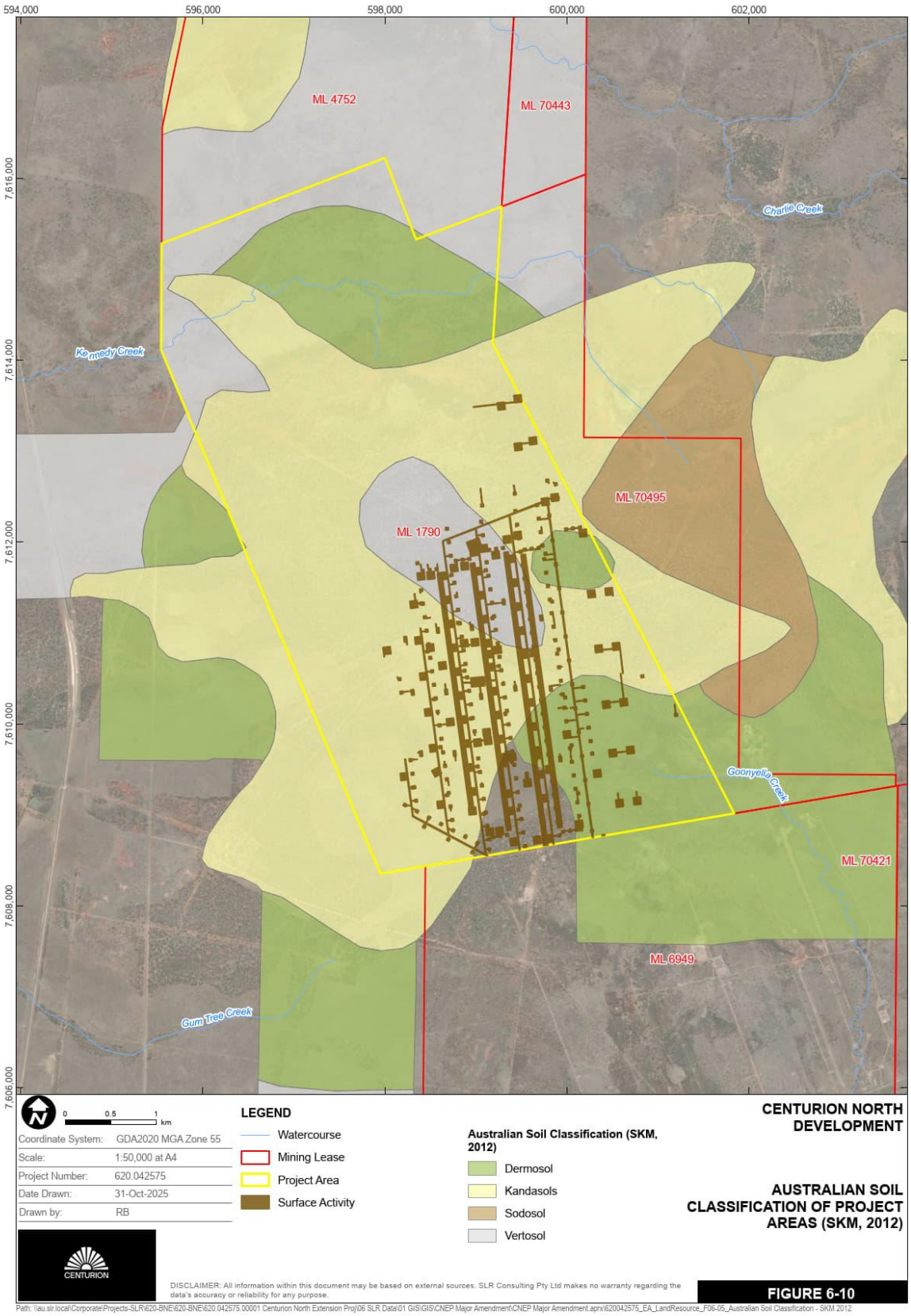


Figure 6-10 Australian Soil Classification of Project Area (SKM 2012)

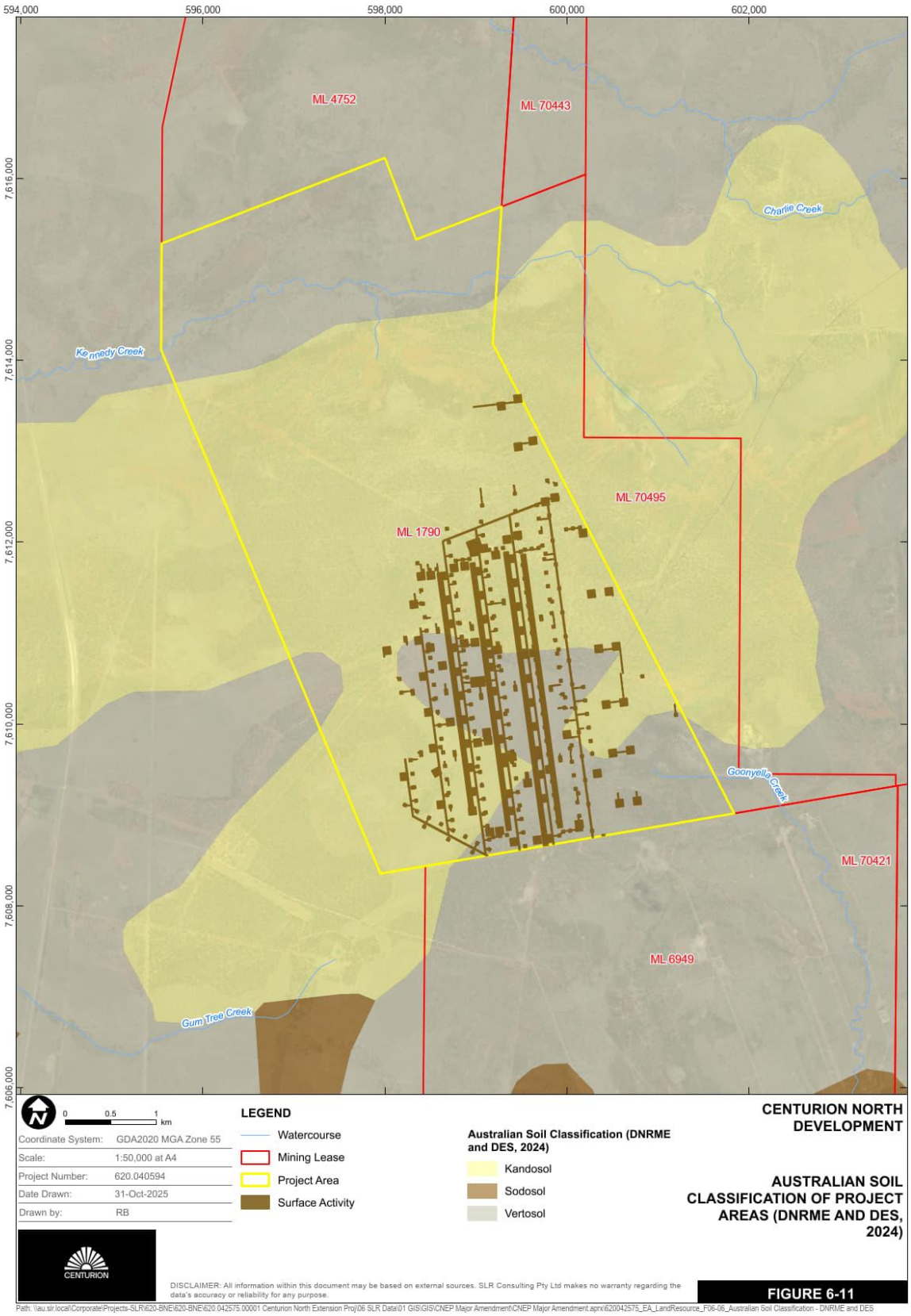


Figure 6-11 Australian Soil Classification of Project Area (DNRME and DES 2024)

Table 6-8 Soil Order Chemical Properties Summary

Parameter	Unit	Vertosol	Dermosol	Kandosol	Sodosol
pH (1:5 water)	N/A	7.8 - 8.6	7.2 - 7.8	6.7 – 7.5	7.1-8.0
Electrical Conductivity (1:5 water)	dS/m	0.1 - 0.66	0.025 - 0.15	0.014 – 0.034	0.05-0.25
Plant Available Water content	mm	125 - 450	100 - >125	>125	75-125
Organic Carbon	%	5.1	1.4	3.6	0.8 – 1.5
Cation Exchange Capacity	cmol/kg	57 - 72.4	8.1 - 20.3	17.4 – 31	6 – 15
Exchangeable Sodium Percentage	%	0 - 12	5 – 11	0 – 5	8 – 20
Calcium to Magnesium ratio	N/A	1.1 - 2.1	0.8 – 1.2	1.2 – 1.7	0.5 – 1.1
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.	Low to moderate; limited by sodicity, dispersiveness, and shallow effective rooting depth, but capable of supporting grazing under careful management.

6.3.1.2 Land Suitability

Five land suitability classes are defined for use in Queensland (**Table 6-9**). 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 (Queensland Government 2013).

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 mapping unit.

Land suitability for the Project Area was classified by SKM (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.

The land suitability assessment undertaken as part of the Wards Well Soil Survey for cropping and grazing land use (SKM 2012). 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 6-12** and **Figure 6-13**). 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.

These results confirm that the land is generally suitable for grazing but has limited potential for sustainable cropping. Post-mining rehabilitation should therefore prioritise grazing and conservation outcomes.

Table 6-9 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.

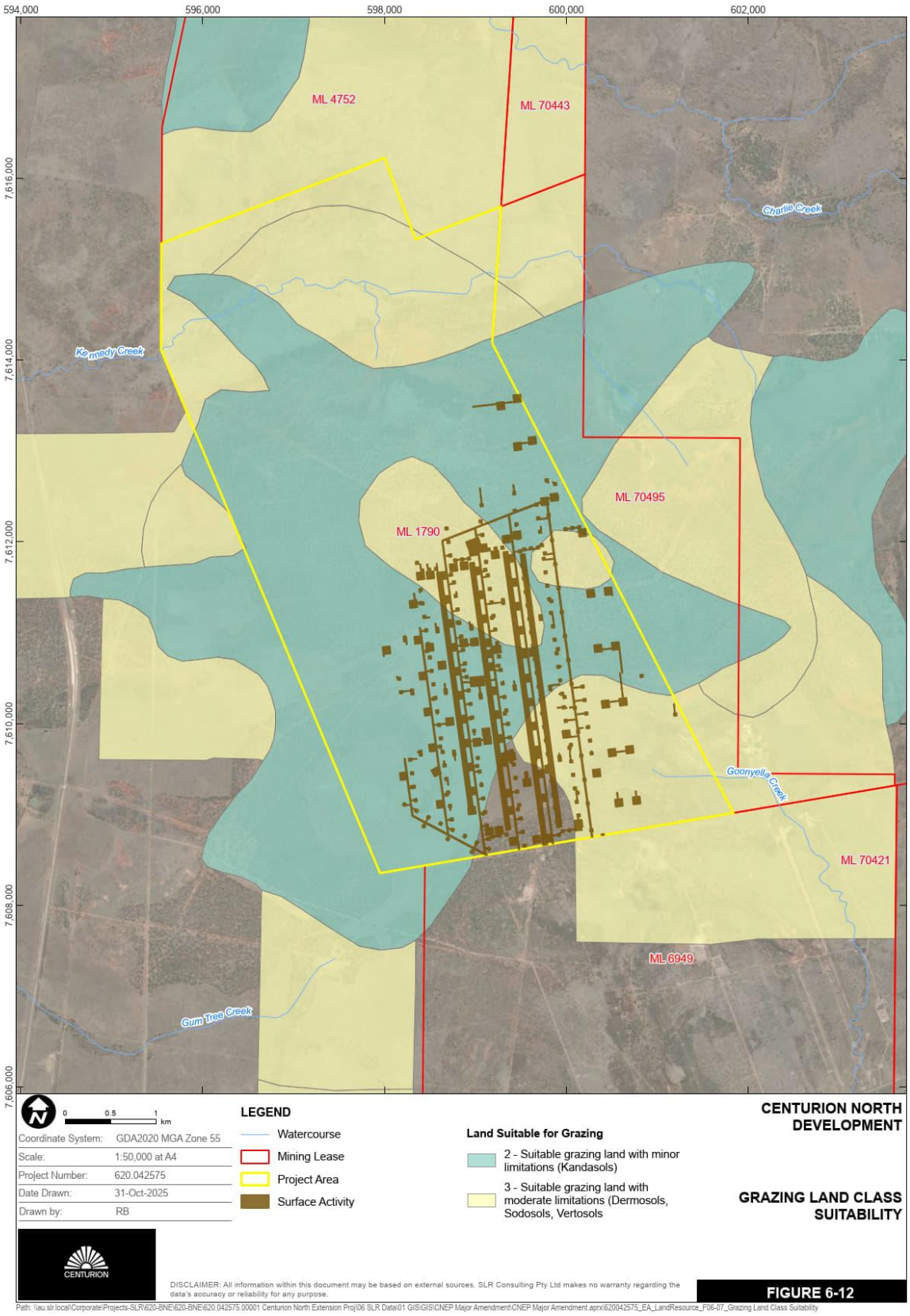


Figure 6-12 Grazing Land Class Suitability

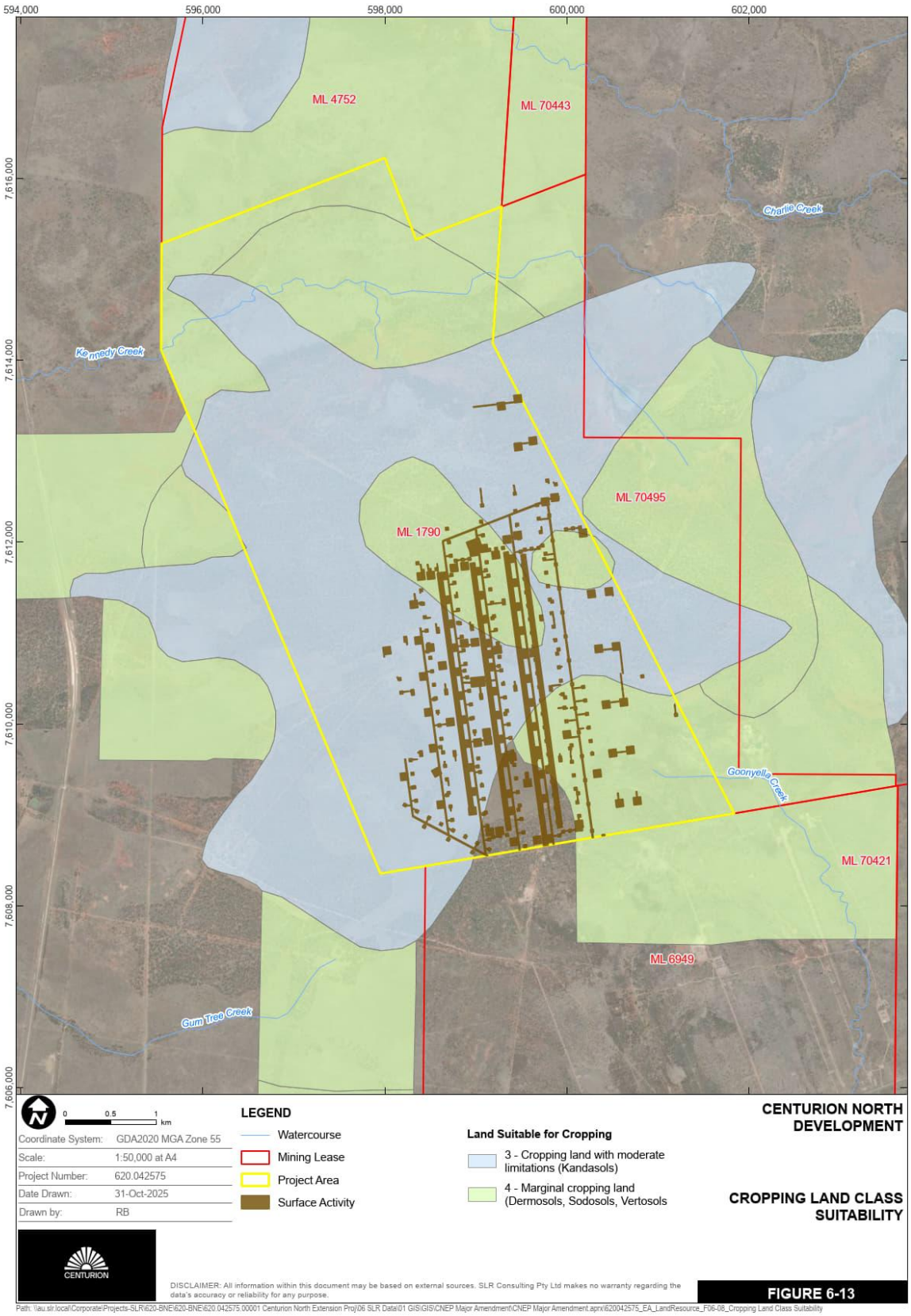


Figure 6-13 Cropping Land Class Suitability

6.3.2 Potential Impacts

The Project will result in temporary surface disturbance including access tracks, a laydown area, drill pads, SIS wells and VPWs, gas risers, service and sampling, a bleeder shaft and gas drainage lines. These activities have the potential to temporarily impact soil resources and land suitability. The potential impacts on soil and land resources are described below for the construction, operation, and closure phases.

6.3.2.1 Construction

The construction phase includes 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 have been identified as key risks to land resources. Potential land resource impacts associated with the construction phase include:

- **Soil erosion and sedimentation** – Clearing and topsoil stripping will expose Kandosol, Vertosol and Dermosol subsoils. Kandosols cover the majority of the disturbance area, followed by Vertosols then Dermosols (**Figure 6-10** and **Figure 6-11**). Kandosols throughout the Project site have non-dispersive subsoils, whilst Vertosols and Dermosols exhibit sodicity and dispersiveness below 200 mm in depth;
- **Topsoil degradation** – Topsoil may lose structural integrity, fertility, organic matter/carbon and biological activity if stripped under wet conditions, stored in large stockpiles or compacted during stockpiling;
- **Soil profile disturbance** – Subsoils with high sodicity and salinity may be exposed through cut-and-fill activities and profile inversion. This can reduce infiltration capacity, increase surface crusting, and restrict revegetation potential;
- **Soil compaction** – Construction traffic and heavy equipment operation on clay-rich Vertosols can result in soil compaction, reducing porosity, infiltration, and root penetration. Compaction impacts are long-lasting and difficult to reverse without mechanical intervention; and
- **Contamination risk** – Storage and use of fuels, drilling fluids, and construction chemicals carry risks of localised soil contamination through spills or leaks.

6.3.2.2 Operation

During operation, land resources will continue to be affected by ground disturbance associated with coal seam gas drainage, underground mining, and supporting facilities:

- **Surface stability risks** – Long-term disturbance of sodic soils around shafts, access roads, and well pads will maintain a heightened risk of erosion and gully initiation. Concentrated flow paths may develop along disturbed ground, requiring engineered drainage controls;
- **Subsidence impacts** – Underground mining is expected to result in subsidence, leading to surface cracking, ponding, and localised soil instability. Subsidence can also exacerbate waterlogging in Vertosols and degrade grazing productivity;
- **Hydrological modification** – Changes to surface runoff and infiltration patterns due to compacted areas and subsidence may lead to increased salinity expression or mobilisation of dispersive materials;

- **Soil contamination** – Operational risks include hydrocarbon spills, storage tank failures, and leakage of saline or sodic groundwater from boreholes. These impacts can lead to long-term soil quality degradation if not contained; and
- **Loss of grazing productivity** – Operational areas will be excluded from pastoral use. Adjacent soils may be affected by dust deposition, compaction from vehicle access, and reduced pasture cover, lowering carrying capacity.

6.3.2.3 Closure and Rehabilitation

Closure and rehabilitation will involve decommissioning of infrastructure, reshaping of disturbed landforms, replacement of topsoil, and re-establishment of grazing post mining land uses. Potential impacts during this phase include:

- **Topsoil Inventory** – Modelling of soil balance in SGM (2024) indicates that deficits in topsoil volumes may occur at Centurion Mine. In relation to the Project site however, sufficient topsoil exists in the in-situ native soils to establish a topsoil cover of 200 mm as required under Rehabilitation Milestone RM4(a) of the PRCP Schedule. Native Dermosol, Kandosol and Vertosol soils within the Project site disturbance footprint contain topsoil to a depth of ≥ 200 mm which will provide this topsoil resource for rehabilitation and achieving the grazing Post Mining Land Use (PMLU) rehabilitation milestone criteria;
- **Failure of rehabilitation on dispersive soils** – Vertosols, if inadequately ameliorated, are unlikely to support stable pasture cover. Dispersive subsoils may re-erode after rehabilitation, particularly on slopes greater than 5–8%;
- **Landform stability risks** – Poorly designed or executed rehabilitation may result in slope instability, concentrated flow erosion, and gully initiation on reshaped landforms. These impacts may undermine long-term grazing suitability and regulatory closure criteria; and
- **Residual contamination** – Any operational spills or legacy contamination not remediated during closure may continue to limit soil productivity and constrain final land use outcomes.

6.3.3 Management Practices

The potential impacts to soils and land resources will be managed through the application of established best-practice procedures and compliance with regulatory conditions. Management will focus on minimising the scale and duration of disturbance, protecting valuable soil resources, and ensuring progressive rehabilitation is undertaken to support post-mining land use objectives.

The following mitigation measures will be implemented across all phases of the Project:

- **Permit to Disturb controls** – All vegetation clearing and soil stripping will be undertaken only within areas approved under the Permit to Disturb process, ensuring disturbance is confined to authorised Project footprints;
- **Minimisation of disturbance** – Land disturbance will be restricted to the smallest practicable footprint and for the shortest practicable duration, thereby reducing the extent of soil exposure and erosion risk;
- **Erosion and sediment control (ESC)** – ESC measures will be designed and installed prior to the commencement of ground disturbance. Controls will be consistent with IECA (2008) Best Practice guidelines and will be maintained until disturbed areas are stabilised;

- **Delineation of disturbance boundaries** – Clear marking of disturbance limits will be established in the field before clearing or soil stripping to avoid unnecessary removal of vegetation and soil;
- **Surface water management** – Disturbance activities will be planned with regard to existing drainage patterns to minimise concentration of flows and protect downslope soils. Temporary diversion structures will be installed where necessary to reduce erosion risk;
- **Topsoil management** – Topsoil will be stripped according to designated profile depths (as confirmed during stripping operations) and direct return to rehabilitation areas will be prioritised. Direct placement reduces double handling, limits nutrient loss, and maintains the viability of the seed bank. Where direct return is not possible, topsoil will be stockpiled for later use;
- **Stockpile management** – Stockpiles will be constructed in low, stable forms, with surfaces left in a roughened state to enhance infiltration and reduce erosion. Stockpiles will be seeded or treated with temporary erosion controls until reuse;
- **Soil segregation** – Subsoils with high sodicity or salinity will be managed separately from topsoil and will not be used as growth media without prior amelioration (e.g., gypsum application, organic matter incorporation);
- **Rehabilitation practices** – Rehabilitation will be implemented progressively where practicable, with soil replacement, ripping, and amelioration followed by re-establishment of pasture cover. Disturbed areas will be monitored and maintained until they meet post-mining land use and relinquishment criteria;
- **Hydrocarbon and hazardous material management** – All hydrocarbons and chemicals will be stored and handled in bunded facilities in accordance with AS 1940 and mine site procedures to prevent contamination of soils;
- **Produced water management** – Water extracted from wells will be directed to on-site sumps located on drill pads and subsequently transported to Centurion Coal Mine (CCM) for treatment and integration into the mine water management system; and
- **Monitoring and maintenance** – Rehabilitation areas will be subject to ongoing monitoring of soil stability, vegetation cover, and land capability. Maintenance (e.g., reseeding, erosion repair, soil amelioration) will be undertaken as required until regulatory criteria for post-mining land use are achieved.

6.3.4 Risk Assessment

The potential land and soil impacts were assessed with management and mitigation controls in place to provide an overall risk rating or the proposed development, of which details are provided (**Table 6-10**).

The land resources risk assessment did not result in the identification of any high risks being posed by the Project versus those currently approved under the EA. One medium and nine low risks were identified. The medium risk, being the highest identified risk presented by the Project was in relation to having available topsoil to establish the 200 mm topsoil layer required under condition RM4(a) of the PRCP Schedule currently approved for the Project. Controls to manage this risk include using soil surveys to identify topsoil depths, topsoil stripping to these depths and stockpiling in accordance with current EA condition F4.

Table 6-10Land 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.

Stage	Potential Impact	Likelihood	Consequence	Risk Rating	Justification
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.
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 stripped to the depth determined by soil survey results, stockpiled and re-used in rehabilitation as a growth medium in accordance with EA conditions F4 and F25.

6.4 Terrestrial Ecology

The following sections describe the outcomes of the desktop review and seasonal field surveys and potential impacts of the Project, specifically:

- The vegetation and habitats identified within the Study Area;
- The likelihood for conservation significant species, habitats and other MSES to occur in the Study Area;
- Potential direct and indirect impacts on these terrestrial ecology values;
- Measures implemented to avoid impacts and mitigation strategies proposed to minimise the risk of significant impacts; and
- An assessment of significance of residual impacts to MSES.

Further detailed information about the desktop assessment and field-validated vegetation and habitat mapping is provided in the specialist terrestrial ecology report provided in **Appendix C**.

6.4.1 Overview of desktop information

A detailed review of desktop information for the Study Area and broader region is provided in **Appendix C**, including an overview of soils, geology, environmentally sensitive area mapping and a number of previous studies undertaken in the region. The following sections summarise the vegetation and species information for the region in which the Study Area is located.

6.4.1.1 Regional ecosystem mapping

Queensland Government regulated RE mapping (version 13.1) identifies remnant and high-value regrowth vegetation within the Study Area, represented by one endangered (11.8.13), two of concern (11.3.3 and 11.8.11) and four lease concern (11.3.25, 11.5.3, 11.5.15, 11.8.5) REs listed under the VM Act, inclusive of homogenous and heterogenous REs. These REs are presented below in **Table 6-11** and in **Figure 6-14**.

Table 6-11Regulated vegetation within the Study Area

RE	Short description*	Biodiversity status	VM Act class
11.3.3	*Eucalyptus coolabah* woodland on alluvial plains	Of concern	Of concern
11.3.25	*Eucalyptus tereticornis* or *E. camaldulensis* woodland fringing drainage lines	Least concern	Lease concern
11.5.3	Eucalyptus *populnea* ± *E. melanophloia* ± *Corymbia clarksoniana* woodland on Cainozoic sand plains and/or remnant surfaces	No concern at present	Lease concern
11.5.15	Semi-evergreen vine thicket on Cainozoic sand plains and/or remnant surfaces	Endangered	Least concern
11.8.5	*Eucalyptus orgadophila* open woodland on Cainozoic igneous rocks	No concern at present	Least concern
11.8.11	*Dichanthium sericeum* grassland on Cainozoic igneous rocks	Of concern	Of concern
11.8.13	Semi-evergreen vine thicket and microphyll vine forest on Cainozoic igneous rocks	Endangered	Endangered

Note: * short description sourced from the Regional Ecosystem Description Database, Version 13.1 (Queensland Herbarium 2025).

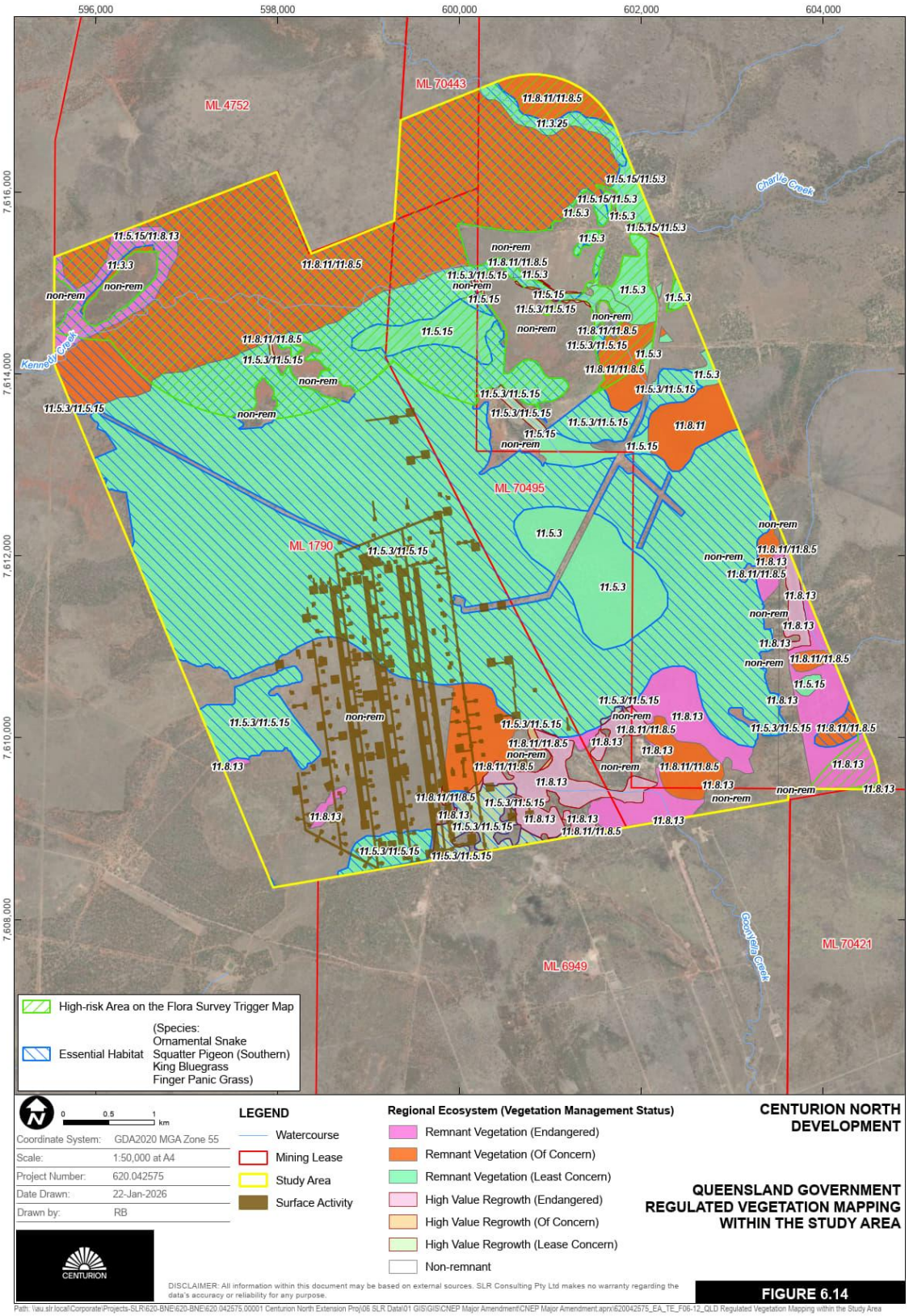


Figure 6-14 Queensland Government Regulated Vegetation Mapping within the Study Area

6.4.1.2 Watercourse vegetation

Watercourses mapped under the *Vegetation Management Act 1999* (VM Act) (DNRMMRRD 2025) are present within the Study Area. Queensland Herbarium certified mapping indicates that REs occurring within the defined distance of these watercourses comprises a number of REs as shown in Figure 5 of **Appendix C**.

6.4.1.3 Conservation significant flora and fauna

Database searches and habitat mapping identified 10 endangered, vulnerable or near threatened flora species listed under the NC Act as potentially occurring in the desktop search area. Additionally, 25 threatened fauna species were returned from database searches as potentially occurring in the search area, including 13 birds, 5 mammals and 7 reptiles. Database search results are provided in **Appendix C.** An assessment of the likelihood of these species to occur in the Study Area is also provided in **Appendix C** and discussed in the following sections.

6.4.2 Existing Environmental Values

The Study Area is situated in the agricultural and resource areas of the Isaac Region. The region primarily consists of *Eucalyptus* and *Acacia* woodlands, natural grasslands, grazing lands, mining activities and regional townships. Non-remnant areas and vegetation near dams that have frequent cattle disturbance had higher abundance of non-native pasture grasses such as buffel grass (*Cenchrus ciliaris*), Indian bluegrass (*Bothriochloa pertusa*) and parthenium (*Parthenium hysterophorus*).

Watercourses within the Study Area are of low stream order showing little evidence of bed and bank definition nor riparian vegetation. The beginning of Goonyella Creek exists in the south of the Study Area and the headwaters of Kennedy Creek are associated with dams in the east. Existing infrastructure within the Study Area consists of unsealed access roads, cattle fencing, powerlines, a homestead and dams and troughs, with historic disturbance from mining and gas exploration activities observed throughout, in the form of parallel tracks and small pads through remnant wooded vegetation, grasslands and non-remnant areas.

This section provides an outline of the terrestrial vegetation, flora and fauna values identified in the Study Area during the seasonal surveys. Detailed descriptions of these values is provided in the terrestrial ecology assessment in **Appendix C.**

6.4.2.1 Regional Ecosystems

A total of eleven remnant and high-value regrowth REs were identified and mapped by e2m within the Study Area during seasonal surveys; including three endangered REs (11.5.16, 11.5.17 and 11.9.5) and one of concern RE (11.8.11), listed under the Queensland *Vegetation Management Act 1999* (VM Act). **Figure 6-15** shows the field-validated RE mapping for the Study Area. Further information about the field-validated vegetation mapping undertaken as part of this assessment is provided in **Appendix C**.

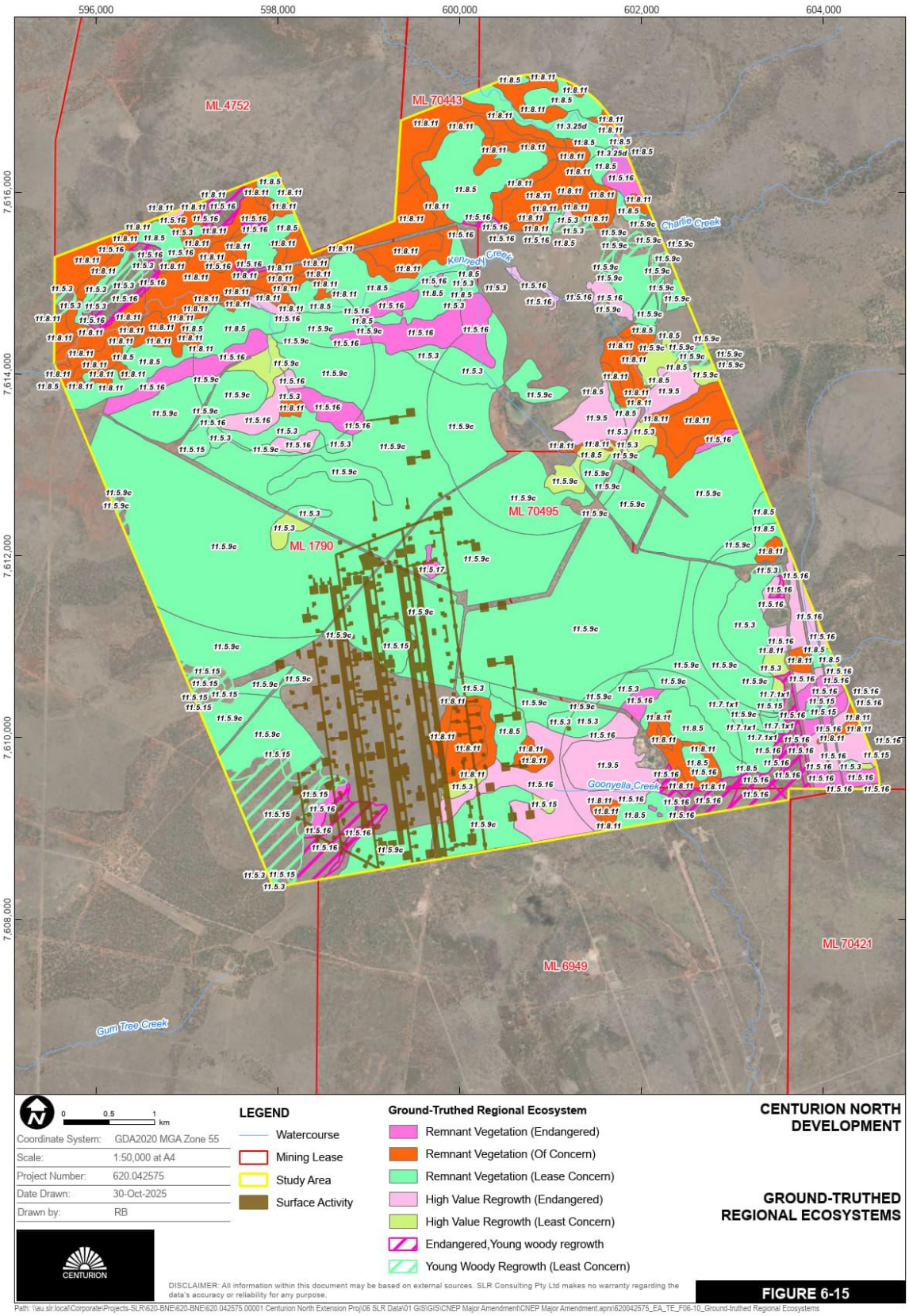


Figure 6-15 Ground-truthed Regional Ecosystems

6.4.2.2 Conservation Significant Flora

Two conservation significant flora species listed under the Queensland *Nature Conservation Act 1992* (NC Act) were identified within the Study Area during field investigations. These include:

- King bluegrass (*Dichanthium queenslandicum*) - vulnerable; and
- Finger panic (Digitaria porrecta) - near threatened.

The occurrence of these species in the Study Area is detailed below and the extent of habitat is mapped in **Figure 6-16** and shown in more detail in Figure 7 and Figure 8 of **Appendix C**, based on field-validated vegetation and habitat information. No other threatened flora species listed under the NC Act were considered likely to occur within the Study Area. An assessment of the likelihood for conservation significant flora to occur in the Study Area is provided in **Appendix C**. A list of flora identified in the Study Area during the seasonal field surveys is provided in **Appendix C**.

King bluegrass

King bluegrass is listed as vulnerable under the NC Act. A total of 1,800 tussocks of king bluegrass were recorded during the 2024 wet season survey event. An additional 820 tussocks were recorded during the 2025 dry season survey event. The species was recorded in grasslands on basalt plains (RE 11.8.11) with some individuals located in mountain coolibah woodland (*Eucalyptus orgadophila*) on basalt plains (RE 11.8.5). Locations where tussocks of this species were observed as well as known and potential habitat mapping is displayed in **Figure 6-16** and shown in more detail in Figure 7 in **Appendix C**.

Finger panic

Finger panic is listed as near threatened under the NC Act. As such, this species is not considered an MSES under the *Environmental Offsets Act 2014* (EO Ac). A total of 71 tussocks of finger panic were recorded during the 2024 wet season survey event. An additional 12 tussocks were recorded in the 2025 dry season survey event. This includes all tussocks recorded during flora meanders, threatened flora plots and incidental observations. As with the king bluegrass, individuals of finger panic were located in grasslands on basalt plains (RE 11.8.11), as well as in mountain coolibah woodland on basalt plains (RE 11.8.5). Locations of observations and extent of known and potential habitat for finger panic within the Study Area is displayed in **Figure 6-16** and shown in more detail in Figure 8 in **Appendix C**.

6.4.2.3 Pest Flora

Three weed species listed as Weeds of National Significance (WoNS) under the National Weeds Strategy and restricted matters under the Queensland *Biosecurity Act 2014* (Biosecurity Act) were recorded within the Study Area (**Table 6-12**).

Table 6-12Pest Flora in the Study Area

Scientific name	Common name	WoNS	Biosecurity Act status	Description of abundance
Harrisia martinii	Harrisia cactus	WoNS	Category 3	Multiple individuals were observed scattered across the Study Area
Opuntia tomentosa	Velvet tree pear	WoNS	Category 3	Several individuals were observed scattered across the Study Area
Parthenium hysterophorus	Parthenium	WoNS	Category 3	Patches of parthenium were observed in moderate to high densities across the Study Area associated with wetter areas and areas of high cattle traffic. Areas surrounding Kennedy creek and large dams had high infestations.

6.4.2.4 Conservation Significant Fauna

Three conservation significant species listed under the NC Act were detected during the field surveys, namely:

- Koala (*Phascolarctos cinereus*) – endangered;
- Squatter pigeon (southern) (*Geophaps scripta scripta*) - vulnerable; and
- Short-beaked echidna (*Tachyglossus aculeata*) – special least concern.

In addition to the species listed above, four threatened fauna species listed under the NC Act are considered likely to occur within the Study Area, due to the presence of suitable habitat, records in the region and the wide-ranging nature of these species. These species include:

- Australian painted snipe (*Rostratula australis*) – endangered;
- Latham's snipe (*Gallinago hardwickii*) – vulnerable;
- Ornamental snake (*Denisonia maculata*) – vulnerable; and
- White-throated needletail (*Hirundapus caudacutus*) – vulnerable.

The occurrence of these species in the Study Area is detailed below and the extent of potential habitat is mapped using field-validated vegetation and habitat information. An assessment of the likelihood for conservation significant fauna to occur in the Study Area is provided in **Appendix C**. A list of fauna identified in the Study Area during the seasonal field surveys is provided in **Appendix C**.

Koala

The koala is listed as endangered under the NC Act. Koala was identified within the Study Area through call recognition from two BARs within areas of narrow-leaved ironbark (*Eucalyptus crebra*) woodland (RE 11.5.9c) and Brown's box (*Eucalyptus brownii*) woodland (RE 11.5.3). Calls were recorded on four separate nights mostly recorded after midnight in the early hours of the morning.

No individuals were identified during spotlighting or diurnal surveys in the wet or dry season surveys, nor were scat and scratches positively identified for the species. This may indicate that the species is at a low density in the local landscape. The landscape is highly fragmented within the Study Area having limited connectivity to other tracts of remnant vegetation or major watercourses with riparian woodland where the species is commonly recorded in the region.

RE 11.3.25d in the north of the Study Area consists of a sparse canopy and a limited number of Locally Important Koala Trees (LIKTs) and is unlikely to support the species as a key connectivity corridor or an area of climate refuge. Connectivity between the Study Area and intact areas in the region is almost entirely interrupted by treeless corridors associated with the presence of natural grassland communities, and clearing for mining, petroleum and exploration activities, major roads and other historic landscape clearing and disturbance. Records and habitat mapping for this species is shown in **Figure 6-16** and shown in more detail in Figure 9 of **Appendix C**.

Squatter pigeon (southern)

The squatter pigeon (southern) is listed as vulnerable under the NC Act. Squatter pigeon (southern) records within the Study Area occurred in close proximity to dams and treed areas in which they could disperse if necessary. A total of 65 squatter pigeon (southern) individuals were recorded across the Study Area often in small groups. In consideration of the conservation advice, the ground cover during the wet season was dense and mostly unsuitable for squatter pigeon (southern). However, during the dry season grass cover became sparser demonstrating a variation of ground cover across the seasons, likely due to grazing and seasonal rainfall. Areas with trees 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.

The entirety of the Study Area is within three km of a permanent or seasonal water source, and a number of permanent water sources were identified within the Study Area. Records and habitat mapping for the squatter pigeon (southern) is provided on Figure 10 of **Appendix C**.

Australian Painted Snipe

Australian painted snipe is listed as endangered under the NC Act. Australian painted snipe was not detected during survey events. However, the species is highly mobile and may utilise areas of habitat within the Study Area intermittently for foraging and roosting and is therefore considered likely to occur.

The species may use areas within the Study Area periodically after high rain events. These areas are associated with the overflow of man-made dams and shallow to moderate gilgais containing ephemeral water. Overflow areas were significant in size and provide wetland habitat that the species has the potential to utilise seasonally. These large areas resembled lakes and lacked inland islands or fringing peninsulas which the species is known to utilise almost exclusively for breeding (DCCEEW 2022).

Few large seasonally inundated shallow to moderately deep gilgais were present in the south-west extent of the Study Area. These areas are likely to provide appropriate vegetation cover (20%) for the species. Although, the young woody regrowth brigalow was degraded from previous clearing and cattle disturbance. Potential habitat mapping for Australian painted snipe is provided in **Figure 6-16** and shown in more detail in Figure 11 of **Appendix C**.

Latham's snipe

Latham's snipe is listed as vulnerable under the NC Act. Latham's snipe was not detected during survey events however the species is highly mobile and may utilise areas of habitat within the Study Area intermittently for foraging and roosting. The species may use areas within the Study Area periodically after high rain events and is considered likely to occur. As with the Australian painted snipe, potential habitat for Latham's snipe within the Study Area is associated with the overflow area of man-made dams and shallow to moderate gilgais containing ephemeral water. Potential habitat mapping for Latham's snipe is shown in **Figure 6-16** and shown in more detail in Figure 12 of **Appendix C**.

Ornamental snake

Ornamental snake is listed as vulnerable under the NC Act. Ornamental snake was not identified in the Study Area during targeted field surveys, however habitat for the species was identified in the south-west of the Study Area where areas of large gilgai with considerable water retention were observed in the 2025 June survey. This species is considered likely to occur in these areas, which consist of remnant and young woody regrowth brigalow in RE 11.5.16. These gilgais were surrounded by woody debris and aquatic vegetation. Large cracks were not evident at the time of the survey although these are not always evident in wet conditions. Potential habitat mapping for ornamental snake is shown in **Figure 6-16** and shown in more detail in Figure 13 of **Appendix C**.

White-throated needletail

The white-throated needletail is listed as vulnerable under the NC Act. This species was not detected during the field surveys. Although the species is unlikely to use habitats within the Study Area specifically, suitable overfly habitat for the species includes a broad range of vegetation communities that are likely to support invertebrate feeding resources in the airspace above, particularly in remnant and high-value regrowth condition.

Short-beaked echidna

One individual short-beaked echidna was recorded within the Study Area during the 2024 wet season survey in remnant narrow-leaved ironbark woodland (RE 11.5.9c). Scats attributable to the species were also recorded in multiple locations in remnant vegetation within the Study Area. As a habitat generalist, the short-beaked echidna is considered likely to occur within remnant and non-remnant vegetation communities within the Study Area. However, the species is more likely to utilise areas with habitat features such as logs, dense shrubs, and ant mounds for foraging and burrowing, i.e. remnant and high-value regrowth communities. Young woody regrowth and other non-remnant areas within the Study Area did not support large woody debris, shrubby areas and logs suitable for short-beaked echidna. Habitat mapping for the short-beaked echidna is shown in **Figure 6-16** and shown in more detail in Figure 14 of **Appendix C.**

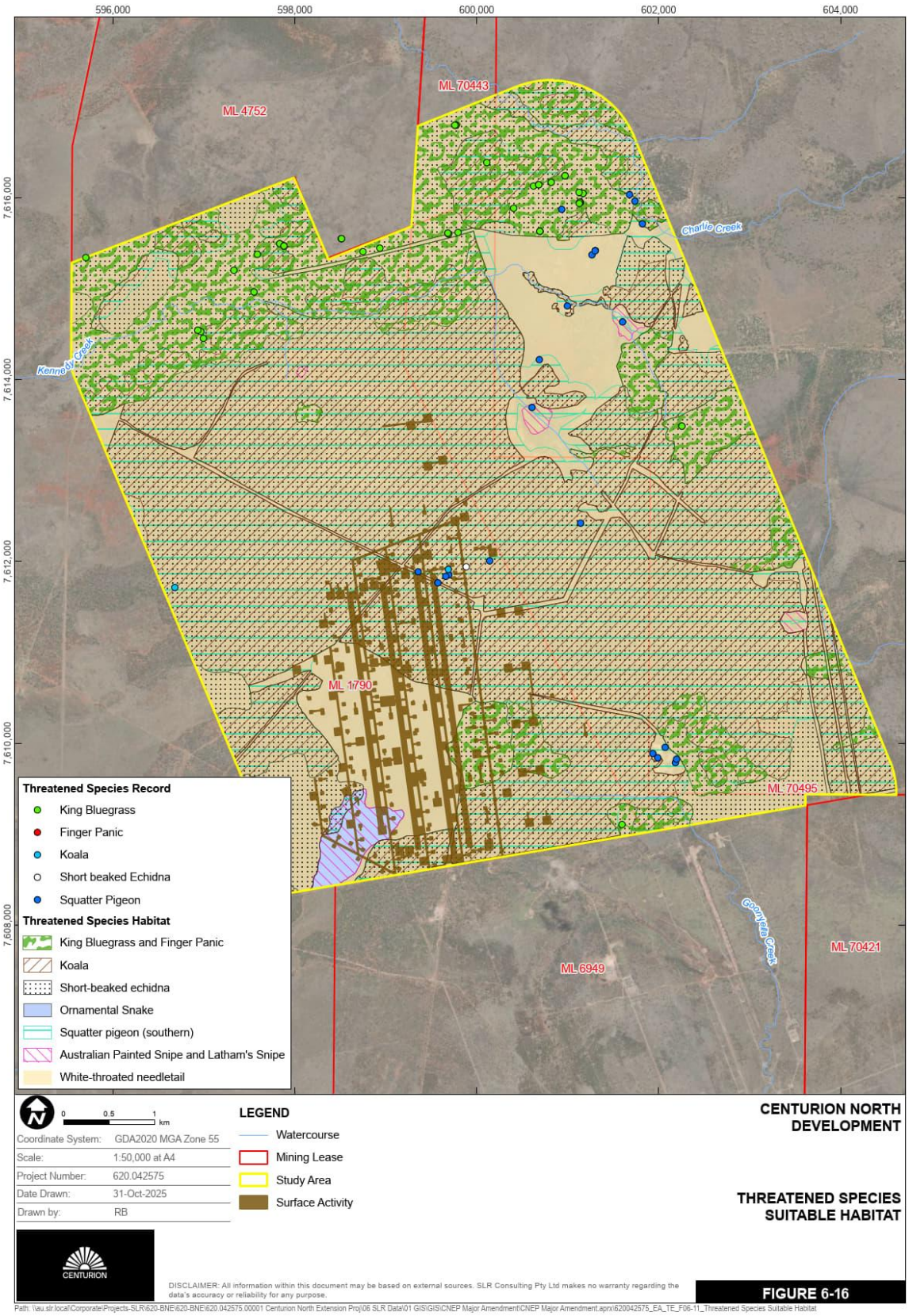


Figure 6-16 Threatened Species Suitable Habitat

6.4.2.5 Pest Fauna

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

- Cane toad (*Rhinella marina*), general biosecurity obligation;
- 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; and
- Feral pig (*Sus scrofa*) – Category 3, 4, and 6 restricted matter.

Evidence of habitat degradation caused by feral pig rooting was observed, including damage around gilgais as well as within semi-evergreen vine thicket vegetation. Wild dogs and cats were recorded on multiple occasions during surveys via direct detection during diurnal driving transects, spotlighting and on motion-activated cameras and via tracks, scats and bird remains.

6.4.2.6 Connectivity

Remnant vegetation is somewhat fragmented in the landscape from historic clearing for cattle grazing. Highly fragmented landscapes are more likely to be susceptible to further fragmentation and degradation compared with more intact landscapes.

Corridors to other areas of remnant wooded vegetation is limited. Connectivity around the Study Area is almost entirely interrupted by treeless corridors associated with the presence of natural grassland communities, and clearing for mining, petroleum and exploration activities, major roads and other historic landscape clearing and disturbance. However, a small corridor (of approximately 200 m in width) exists from the east of the Study Area through brigalow dominated vegetation to connect to woodland associated with a tributary of the Isaac River further east. This tributary provides riparian woodland habitat that is likely to facilitate dispersal for many fauna species through the landscape.

Charlie Creek eventually runs west into the Suttor River which also provides habitat connectivity in the landscape. However, Charlie Creek has a sparse cover of *Eucalyptus tereticornis* and *Eucalyptus camaldulensis* and a low tree layer of *Melaleuca bracteata* and intersects with natural grasslands, which lack vegetation and limit dispersal opportunities for many fauna species.

6.4.3 Summary of MSES

A number of terrestrial ecology values discussed above are listed MSES under the EO Act. A summary of these MSES has been provided in the **Table 6-13** below.

Table 6-13Summary of MSES within the Study Area

MSES	Likelihood to occur	VM Act[1] / NC Act status[2]	EPBC Act status[3]	Extent within the Study Area (ha)		
Endangered and of concern regulated vegetation (remnant)						
RE 11.5.16	Known	E	n/a	196.66		
RE 11.5.17	Known	E	n/a	4.16		
RE 11.8.11	Known	OC	n/a	741.57		
Protected wildlife habitat - Flora				***Known (ha)***	***Potential (ha)***	***Total (ha)***
King bluegrass (*Dichanthium queenslandicum*)	Known	V	E	864.36	298.99	1,163.35

MSES	Likelihood to occur	VM Act / NC Act status	EPBC Act status	Extent within the Study Area (ha)					
Protected wildlife habitat - Fauna				***Breeding & foraging (ha)***	***Foraging (only) (ha)***	***Foraging and roosting (ha)***	***Foraging and dispersal (ha)***	***Dispersal (ha)***	***Total (ha)***
Koala (*Phascolarctos cinereus*)	Known	E	E	2867.41				517.31	3,384.72
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Known	V	V	1087.80	2391.58			316.76	3,796.14
Australian painted snipe (*Rostratula australis*)	Likely	E	E, M			76.24			76.24
Latham's snipe (*Gallinago hardwickii*)	Likely	V	V, M			76.24			76.24
Ornamental snake (*Denisonia maculata*)	Likely	V	V	54.63					54.63
White-throated needletail (*Hirundapus caudacutus*)	Likely	V	V, M				3,398.89		3,398.89
Short-beaked echidna (*Tachyglossus aculeatus*)	Known	SLC	n/a	3,398.89				1,047.21	4,446.10
Connectivity areas									
Remnant vegetation containing a prescribed RE	Present	Various							3,081.56

[1] VM Act - E = endangered, OC = of concern, LC = least concern
[2] NC Act - CE = critically endangered, E = endangered, V = vulnerable, M = migratory, - = not listed
[3] EPBC Act - CR = critically endangered, E = endangered, V = vulnerable, OC = of concern, SLC = special least concern, - = not listed

6.4.4 Potential Impacts

The location of the Project Area is largely defined by the nature and extent of the coal deposit and associated gas seams. As such, it is constrained by resource, geographic, existing infrastructure, and feasibility considerations. Therefore, clearing and disturbance for the Project is unavoidable. Clearing and removal of native vegetation within the Project Area has the potential to directly impact MSES by:

- Clearing areas of threatened flora habitat;
- Eliminating or reducing the extent and availability of nesting, denning, roosting and shelter habitat for threatened fauna;
- Fragmenting habitat;
- Removing or reducing the availability of food and foraging habitat;
- Increasing competition through reduced availability of resources;
- Removing, reducing and restricting dispersal opportunities; and
- Causing fauna injury or mortality during clearing activities and earthworks.

In addition to direct vegetation and habitat loss, the Project may result in the disturbance and degradation of ecological values adjacent to the Project Area, via:

- Habitat degradation and edge effects;
- Establishment and spread of pest flora and fauna species;
- Noise, light and dust emissions;
- Erosion, contamination from spills and leaks;
- Increased risk of fire;
- Changes to surface water quality, quantity, and flow paths;
- Groundwater drawdown; and
- Increased risk of fire.

Indirect impacts from the Project as a result of subsidence associated with underground gate roads and future goaf drainage lines are considered negligible (39-45 mm) (SCT Operations 2025) to terrestrial ecology values and will not be considered further in this assessment.

While the location of coal seams will dictate the location of infrastructure and disturbance necessary for the Project, practical and industry accepted measures are proposed throughout all phases of the Project to avoid and minimise the risk, nature and extent of potential indirect impacts on terrestrial ecology values within the Study Area.

6.4.5 Management Practices

6.4.5.1 Avoidance

As an extension of the existing CCM, the Project was conceived with avoidance, consolidation and small footprint principles during the early stages of conception and design. Substantial areas of surface disturbance have been avoided through utilisation of CCM infrastructure. The use of existing CCM surface infrastructure (e.g. coal handling and processing plan, mine-waste co-disposal facilities, run-of-mine and product coal stockpiles, waste management infrastructure, administrative buildings, access roads and train-load out facilities) equate to a surface area of approximately 220 ha. As a result, no new off lease infrastructure is proposed to support the project. The proposed use of underground transport infrastructure instead of construction of a surface portal and associated transport infrastructure will further reduce the Project footprint.

Design and siting revisions in response to ecological constraint mapping have also been undertaken to avoid and minimise impacts to existing vegetation and habitat where possible. This has been achieved through consolidating layouts of wells, and access roads with other infrastructure and locating as much of the infrastructure as possible in non-remnant areas.

However, additional clearing and disturbance for the Project is unavoidable and therefore measures to minimise and manage impacts, as a result of this disturbance, are outlined in the following sections.

6.4.5.2 Mitigation

A large range of mitigation measures will be implemented across the Project specifically to manage:

- Native vegetation clearing and habitat removal;
- Fragmentation and edge effects;
- Pest flora and fauna management;
- Light, noise and dust management;
- Increased risk of fire;
- Erosion, sediment and spills;
- Fauna injury and/or mortality; and
- Changes in hydrology.

Mitigation measures implemented specific for the minimisation of impacts to native vegetation and fauna habitat include:

- Vegetation clearing extents will be kept to the minimum area necessary for construction. Areas that must not be cleared or damaged would also be clearly identified on construction plans.
- Use of low impact methods will be used where possible for some infrastructure, including access tracks and pads. For example, in highly sensitive areas (ESAs and habitats supporting conservation significant species) that cannot be avoided, selective meandering access (including around gilgai), and avoidance of tree and shrub removal will be implemented where possible.

- Placement of temporary infrastructure such as laydown equipment, facilities, and parking bays are to be located outside of remnant vegetation, with areas previously cleared/degraded (non-remnant) to be prioritised.
- Boundaries of areas to be cleared (e.g. construction pads, laydown areas, vehicle tracks) and areas not to be cleared are to be clearly defined during clearing activities and communicated to all necessary construction personnel. Where necessary, signage, flagging and/or barricade fencing will be used to demarcate sensitive and no-go areas.
- Threatened Species Management Plans will be developed prior to the commencement of construction to comply with Commonwealth and Queensland legislation and promote conservation outcomes for:
    - King bluegrass;
    - Koala;
    - Ornamental snake; and
    - Squatter pigeon (southern).
- The Threatened Species Management Plans will include species-specific mitigation measures and controls to minimise and mitigate long term impacts on these species, such as:
    - For koalas, a located individual is to be left to vacate the area on its own accord utilising dispersal routes and connecting trees in accordance with the Queensland *Nature Conservation (Koala) Conservation Plan 2017*.
- Queensland legislation requires preparation of a Species Management Program (SMP) to manage breeding places during construction projects. SMPs will include, but not be limited to:
    - Pre-clearance fauna surveys, to be undertaken by a suitably experienced and qualified ecologist to identify fauna at direct risk from clearing activities;
    - Identification and mapping of weed ‘hotspots’ for future monitoring and management where necessary;
    - The presence of a suitably experienced and qualified fauna spotter catcher during all clearing, earthworks where there is potential for disturbance to habitat features for animals;
    - Inspection of all hollow-bearing trees prior to removal and measures to manage active hollows;
    - Methods for felling hollow-bearing trees providing shelter for native fauna, e.g. slowly or in sections, to minimise the risk of injury to fauna;
    - Treatment of captured fauna, e.g. relocations and measures for injured fauna;
    - Methods for vegetation clearing e.g. gradual, directional and sequential clearing over the life of the Project to allow fauna species the opportunity to disperse away from clearing areas
    - Regular inspections and monitoring of work areas and excavations (trenches) to check for trapped fauna and installation of fauna shelter and escape measures; and

- Installation of fauna exclusion fencing where required and considering trench and pit depth.

Mitigation measures implemented specific for the minimisation of impacts to koalas include:

- Implementation of a Threatened Species Management Plan to reduce potential impacts from vegetation clearing and habitat removal including but not limited to:
  - Methods for vegetation clearing e.g., gradual, directional and sequential clearing over the life of the Project to allow the opportunity for dispersal away from clearing areas;
  - Installation of fauna exclusion fencing where required and consideration of trench and pit depth;
  - Regular inspection and monitoring of work areas and excavations to check for trapped fauna;
  - Allowing detected individuals to vacate the area on its own accord utilising dispersal routes and connecting trees;
  - pre-clearance fauna surveys to be undertaken by a suitably experience and qualified ecologist; and
  - Presence of a suitably experienced and qualified fauna spotter catcher during all clearing and earthworks where there is potential to disturb habitat.
- Implementation of a weed and pest management plan, including but not limited to:
  - Biosecurity monitoring to identify and assess the risk of the spread of weed and pest occurrences within the Project.
- Measures to reduce potential light, noise and dust management, including but not limited to:
  - Scheduling of activities in more sensitive areas to occur during daylight hours;
  - Implementation of directional lighting and glare guards where artificial lighting is required;
  - Avoid and minimise lighting adjacent to areas of habitat;
  - Regular maintenance of machinery and mobile plant to minimise unnecessary noise; and
  - Development and implementation of a dust management plan to avoid impacts of dust to remaining habitat.
- Implementation of a bushfire management plan by a suitably qualified expert.
- Measures to mitigate potential injury and mortality including:
- Workforce awareness training:
  - Vehicles to remain on designated tracks and adhere to site rules relating to speed limits;
  - Speed limits clearly signposted; and
  - Where fencing is required to exclude personnel or vehicular traffic, consideration given to the movement of fauna around or through such fencing.

- Implementation of a rehabilitation management plan for land to be progressively rehabilitated.

Monitoring will be undertaken during the construction and operation phases of the Project (and, where necessary, after completion of the Project) in order to assess impacts on MSES and gauge the efficacy of proposed mitigation measures. Monitoring will focus on the quality and condition of vegetation and MSES habitat adjacent to the Project Area as well as vegetation communities located downstream of the Project. Monitoring methods, frequency of monitoring, and criteria for assessing the success (or otherwise) of impact mitigation measures will be detailed in the following management plans:

- Fire/Bushfire Management Plan;
- Weed and Pest Management Plan;
- Dust Management Plan;
- Rehabilitation Management Plan;
- Threatened Species Management Plan;
- Species Management Program; and
- Erosion and Sediment Control Plan.

6.4.6 Significance of impacts to MSES

While a number of MSES have been identified within the Study Area, design of the Project has aimed to avoid impacts to MSES where possible, particularly large and intact areas supporting or potentially supporting conservation significant species. Furthermore, a number of mitigation strategies and management plans will be put in place for the Project to minimise indirect impacts to MSES.

Nonetheless, assessment of significance of impacts to MSES has found that there is a real chance or possibility of significant residual impact to two MSES – regulated vegetation (of concern RE 11.8.11) and koala habitat - as a result of the Project (**Appendix C**).

As such, suitable environmental offsets are required to compensate for significant residual impacts under the Queensland environmental offsets framework. Peabody's preferred offset mechanism are financial offsets due to the relatively small area of impact to regulated vegetation and koala habitat in this landscape context, whereby it is predicted that very large tracts of intact vegetation are required to support relatively low densities of koalas in this region. The offset required to acquit regulated vegetation and koala habitat impacts at the applied 1:4 ratio would be in the order of 285.64 ha and it is of Peabody's opinion that achieving an offset of this size would be less practical from an administrative and habitat value perspective for this species compared with the opportunities to consolidate a financial offset with other offset resources available to DETSI.

A summary of impacts to MSES and likelihood of a significant residual impact as a result of the Project is presented in **Table 6-14**.

Table 6-14Summary of Significant Impacts to MSES within the Study Area

MSES	Likelihood to occur	VM Act[1]/ NC Act status[2]	EPBC Act status[3]	Extent within the Study Area (ha)					Significant impact result
Endangered and of concern regulated vegetation (remnant)									
RE 11.5.16	Known	E	n/a					0.29	unlikely
RE 11.5.17	Known	E	n/a					0.37	unlikely
RE 11.8.11	Known	OC	n/a					6.58	likely
Protected wildlife habitat - Flora				***Known (ha)***		***Potential (ha)***			***Total (ha)***
King bluegrass (*Dichanthium queenslandicum*)	Known	V	E			8.20			unlikely
Protected wildlife habitat - Fauna				***Breeding & foraging (ha)***	***Foraging (only) (ha)***	***Foraging and roosting (ha)***	***Foraging and dispersal (ha)***	***Dispersal (ha)***	***Total (ha)***
Koala (*Phascolarctos cinereus*)	Known	E	E	64.83				3.55	likely
Squatter pigeon (southern) (*Geophaps scripta scripta*)	Known	V	V	0.11	69.78			1.40	unlikely
Australian painted snipe (*Rostratula australis*)	Likely	E	E			5.28			unlikely
Latham's snipe (*Gallinago hardwickii*)	Likely	V	V			5.28			unlikely
Ornamental snake (*Denisonia maculata*)	Likely	V	V	5.28					unlikely

MSES	Likelihood to occur	VM Act[1]/ NC Act status[2]	EPBC Act status[3]	Extent within the Study Area (ha)					Significant impact result
White-throated needletail (*Hirundapus caudacutus*)	Likely	V	V				68.38		unlikely
Short-beaked echidna (*Tachyglossus aculeatus*)	Known	SLC	n/a	68.38				9.38	unlikely
Connectivity areas									
Remnant vegetation containing a prescribed RE	Present	Various							unlikely

[1] VM Act - E = endangered, OC = of concern, LC = least concern
[2] NC Act - CE = critically endangered, E = endangered, V = vulnerable, M = migratory, - = not listed
[3] EPBC Act - CR = critically endangered, E = endangered, V = vulnerable, OC = of concern, SLC = special least concern, - = not listed

6.4.7 Risk Assessment

The following risk assessment (**Table 6-15**) has been undertaken for potential impacts of the Project on terrestrial ecology values, which include MSES. This assessment considers the measures already undertaken as part of the design phase of the Project and those proposed to be implemented for the construction and operation phases of the Project in determining the likelihood level. The risk assessment has been undertaken as per the methodology described in **Section 5.3**.

Table 6-15 Risk Assessment for Direct and Indirect Impacts to Terrestrial Ecology Values

Potential Impact	Description	Likelihood	Consequence	Risk Rating
Vegetation clearing and habitat removal	This impact is proposed as part of the Project and will have permanent impacts on terrestrial vegetation and habitats. Although measures to avoid and minimise impacts have and will be implemented, residual impacts will occur and have been assessed as potentially significant for the NC Act-listed koala.	Almost certain	Major	Significant
Fragmentation of habitat and connectivity	The nature and scale of the Project is such that the Project Area will make use of cleared areas where possible and where impacts to vegetation and habitat are unavoidable, they will be relatively small in scale in any given area and linear infrastructure will be narrow in width. As a result, the Project is unlikely to create barriers to movement and connectivity for most native flora and fauna, including conservation significant species. Therefore, the likelihood of this impact occurring for this Project is low.	Unlikely	Medium	Medium
Fauna injury and mortality	There is potential for activities associated with construction and operation of the Project to result in direct impacts, in the form of injury or mortality, to fauna, e.g. vehicle strike, entrapment in trenches. However, mitigation measures proposed are industry accepted, practical and effective at minimising the risk of this occurring. Therefore, while the consequence of this type of impact is high, the likelihood of it occurring is not.	Unlikely	Major	High
Indirect impacts	Indirect impacts as a result of the Project, such as increased dust, light and noise, edge effects to remaining vegetation and habitat, introduction and spread of pest flora and fauna, are likely to occur without mitigation. However, with best practice, industry accepted measures, indirect impacts should be able to be sufficiently managed that they are of very low likelihood and consequence to their small scale, temporary nature and overall low impact.	Unlikely	Low	Medium

6.5 Aquatic Ecology

6.5.1 Existing Environmental Values

6.5.1.1 Aquatic GDEs

Elevation and geomorphic analysis confirmed that these creeks occur within lower-lying depressions capable of receiving intermittent groundwater inputs following recharge events. Field observations, however, recorded no evidence of sustained baseflow, seepage, or permanent pools during either the early-wet or late-wet 2024 surveys. Both systems were found to be highly intermittent, with surface flow occurring only after rainfall events. These findings indicate that while groundwater may occasionally contribute to surface water expression, such inputs are short-lived and do not support persistent aquatic habitats. Consequently, any aquatic GDE expression within the Project Area is limited, spatially constrained, and of low ecological persistence.

6.5.1.2 Subterranean GDEs and Stygofauna

No subterranean GDEs are mapped within or near the Project Area, and no true stygofauna were recorded from the nine bores sampled. Regional database searches indicated the closest records occur more than 30 km south of the site. Accordingly, the Project Area does not support a significant subterranean GDE community or related ecological values.

6.5.1.3 Aquatic Habitat

Aquatic habitat assessments confirmed that all waterways within the Project Area are ephemeral, lacking permanent pools or complex in-stream features. Habitats are dominated by shallow sandy or silty substrates, low instream cover, and narrow riparian fringes typical of grazing-affected catchments.

6.5.1.4 Water Quality

Water quality results were generally consistent with background regional conditions and within the Fitzroy Basin Water Quality Objectives (DETSI 2011). Minor variations in conductivity and turbidity reflected recent rainfall and runoff events, but no exceedances indicative of sustained degradation were observed.

6.5.1.5 Macroinvertebrates

Macroinvertebrate assemblages were typical of intermittent lowland streams, dominated by tolerant taxa such as Chironomidae and Oligochaeta. AUSRIVAS analysis classified all sites as either Band B (Slightly Disturbed) or Band C (Moderately Disturbed), reflecting natural intermittency and surrounding grazing land use. No species of conservation significance were recorded.

6.5.1.6 Fish and Macrocrustaceans

Fish surveys recorded a limited assemblage of widespread species tolerant of intermittent water presence and variable water quality. Macrocrustaceans, including Cherax species, were also detected at several sites. The ephemeral nature of these creeks and absence of deep, perennial habitats limit the potential for diverse or migratory fish communities.

6.5.1.7 Threatened Species

Targeted surveys for white-throated snapping turtle (*Elseya albagula*), listed as Critically Endangered under the NC Act, and the Fitzroy River turtle (*Rheodytes leukops*), listed as Endangered under the same Act, confirmed that suitable habitat for these species is absent from the Project Area and its surrounds. Surveys also targeted the platypus (*Ornithorhynchus anatinus*), which is gazetted as Special Least Concern under the NC Act.

The highly intermittent hydrology, absence of permanent waterholes, and lack of structurally complex instream and riparian habitats render the area unsuitable for these species. Consequently, the likelihood of occurrence for all threatened and special least concern aquatic fauna within the Project Area is considered low to negligible.

6.5.2 Summary of MSES

Within the Project Area and surrounds, the only aquatic MSES value identified is waterways providing for fish passage, represented by Goonyella, Kennedy and Charlie Creeks. These creeks are mapped as low to moderate impact waterways for fish passage.

No other MSES values, such as wetlands of High Ecological Significance (HES), High Ecological Value (HEV) waters, or threatened species habitat are supported within or downstream of the site. The mapped aquatic GDE polygons in Kennedy and Charlie Creeks coincide with lower-lying geomorphic depressions; however, field evidence confirmed only limited and intermittent groundwater expression.

6.5.3 Potential Impacts

The Project will not involve any in-stream or riparian disturbance. Subsidence modelling (SCT Operations 2025) predicts no subsidence-related effects to waterways providing for fish passage. Potential surface water impacts, such as sediment-laden runoff, drilling fluids or contaminants, are assessed as low risk and readily manageable through best-practice erosion, sediment and spill-control measures.

The groundwater impact assessment (SLR, 2025b) found changes to surface or baseflow are expected to be minor and localised. Predicted groundwater drawdown within the alluvium and the Tertiary basalt aquifer of the up to approximately 2 m and 5 m, respectively, was modelled along Kennedy Creek. Along Charlie Creek, where other mapped aquatic groundwater-dependent ecosystems (GDEs) may occur, drawdown in the basalt aquifer is predicted to be up to approximately 1 m. In some locations, the model indicates that the alluvium is not saturated under base-case conditions, meaning that predicted drawdown represents a conceptual response rather than a reduction in an established groundwater table. Kennedy Creek and Charlie Creek are intermittent, lower-order watercourses with low GDE value, reflecting their modified condition, limited groundwater dependency, and the absence of state-significant aquatic species or habitat features. Consequently, any groundwater-related changes to flow or hydraulic conditions are expected to be minor, highly localised, and subordinate to climatic controls.

6.5.4 Management Practices

6.5.4.1 Avoidance

Environmental impact avoidance has been achieved through the exclusion of in-stream and riparian works, maintaining separation from waterways and sensitive habitats, and designing access and drilling locations on previously disturbed land. No waterway barrier works are proposed.

6.5.4.2 Mitigation

Mitigation measures will include the application of the IECA (2008) Best Practice Erosion and Sediment Control Guidelines, containment of drilling fluids, and implementation of spill prevention and response procedures. Surface water quality will be monitored during exploration to confirm the effectiveness of controls. Should groundwater monitoring indicate changes to baseflow or hydraulic conditions, adaptive management will be applied to prevent adverse effects on aquatic GDEs or fish passage.

6.5.5 Significant Residual Impact for MSES

An assessment of MSES was undertaken to determine whether the proposed exploration and early works could result in a Significant Residual Impact (SRI). The assessment identified that waterways providing for fish passage represent the only MSES value occurring within the Project Area. Other potential MSES, including threatened aquatic fauna, aquatic flora, wetlands of HES, and HEV waters, were screened out on the basis of absence, distance, or lack of suitable habitat.

The outcomes of the SRI assessment indicated that the proposed exploration and early works are unlikely to result in any measurable or residual impacts on fish passage or aquatic habitat. No in-stream or riparian works are proposed, and the subsidence assessment (SCT Operations, 2025) predicted no subsidence-related impacts to waterways that provide for fish passage. Surface water impacts, including potential contamination or sediment-laden runoff, are expected to be minor in scale and of low risk (**Section 6.2**).

Predicted groundwater drawdown within the alluvium (SLR, 2025b) is up to approximately 2 m along Kennedy Creek, noting that in some locations the alluvium is not saturated under base-case conditions and predicted drawdown is therefore conceptual rather than indicative of a reduction in an established groundwater table. In the Tertiary basalt aquifer, drawdown of up to approximately 5 m along Kennedy Creek and up to approximately 1 m along Charlie Creek, where mapped GDEs may occur, has been modelled. However, Kennedy Creek is an intermittent, lower-order waterway of low GDE value due to its modified condition, limited groundwater dependency, and absence of state significant aquatic species or habitat features. Consequently, any changes in groundwater–surface water interaction along Kenney Creek or Charlie Creek are expected to be minor and highly localised. On this basis, the proposed activities are not expected to cause significant impacts to aquatic ecological values or result in the loss or degradation of MSES. No impact pathways are predicted to result in mortality, habitat modification, or measurable hydrological change affecting fish movement or ecosystem function. The Project therefore does not present a Significant Residual Impact to any MSES, including waterways providing for fish passage.

6.5.6 Risk Assessment

A qualitative risk assessment was undertaken for aquatic ecology and GDEs values (**Table 6-16**). Consequence and likelihood criteria were combined to determine overall risk levels for each potential impact.

The proposed exploration and early works by Centurion Coal Mining Pty Ltd are expected to have only localised and temporary environmental impacts confined to the project footprint. With no disturbance to riparian zones or waterways and no stygofauna habitat present, ecological risks are minimal. Potential impacts, including minor groundwater drawdown, temporary aquifer pressure changes, and short-term soil disturbance, are considered low to moderate and can be effectively managed through best-practice mitigation and monitoring measures. Overall, no long-term or irreversible impacts to aquatic groundwater-dependent ecosystems, surface waters, or regional aquifer integrity are anticipated.

Table 6-16 Aquatic Ecology Risk Assessment

Phase	Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Construction	Vegetation clearing and soil disturbance within approved disturbance areas results in impacts to riparian zones	Unlikely	Medium	Medium	Clearing is confined to approved areas outside riparian zones. Impacts are short-term and reversible with progressive rehabilitation and topsoil management.
Construction	Impacts to aquatic ecosystems from local alteration of aquifer structure or flow paths due to excavation or trenching	Unlikely	Medium	Medium	Excavations will be designed to maintain structural integrity and prevent preferential flow. Monitoring and sealing post-construction will mitigate risks.
Construction	Impacts to aquatic ecosystems from reduction in groundwater pressure within coal seams during gas drainage	Possible	Low	Medium	Controlled drainage rates, pressure monitoring, and adaptive management will prevent long-term drawdown or inter-aquifer connectivity impacts.
Construction	Weed introduction and spread via vehicle and equipment movement	Possible	Low	Medium	Weed hygiene procedures, vehicle wash-downs, and inspections will reduce risk of weed spread.
Operation	Impacts to aquatic ecosystems from changes in groundwater pressure or flow during production testing	Unlikely	Medium	Medium	Groundwater extraction is expected to have localised influence. Ongoing monitoring, threshold triggers, and adaptive management will ensure minimal environmental harm.
Operation	Risk of residual groundwater chemistry alteration (e.g., pH, salinity) and impacts to aquatic ecosystems	Unlikely	Low	Low	Short-term changes from gas-water interactions will be monitored and managed through groundwater quality monitoring and comparison with baseline conditions.

Phase	Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Operation	Aquatic ecological effects adjacent to disturbance footprints	Unlikely	Low	Low	Given absence of stygofauna and riparian habitats within disturbance zones, only minor indirect changes to vegetation condition are expected. Rehabilitation and ongoing monitoring will minimise risk.

6.6 Air Quality

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

6.6.1 Existing Environmental Values

6.6.1.1 Sensitive Receptor Locations

Potential sensitive receptors surrounding the Project Area are presented in **Table 6-17** and **Figure 6-17**. 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.

It is noted that the nearest privately owned receptor is Lancewood which is located 8.9 km from the nearest drill pad. The closest receptor is Old Denham Park Homestead (2 km), which is owned by Stanmore SMC Pty Ltd and for which there is an agreement in place.

Table 6-17 Receptors Surrounding the Project

ID	Receptor Name	Easting (m)	Northing (m)	Approximate Distance to the Project (km)	Ownership/Agreement Status
1	Old Denham Park Homestead	596275	7608546	2.0	Stanmore SMC Pty Ltd (commercial agreement)
2	Wards Well	601809	7615534	3.5	Stanmore SMC Pty Ltd (commercial agreement)
3	Lancewood	593750	7619821	8.9	Privately owned
4	Lenton Downs	603922	7621398	9.6	Privately owned
5	Centurion Accommodation Camp	616790	7609005	16.5	Centurion Coal Mining Pty Ltd
6	Burton Downs	612051	7606721	11.8	Privately owned
7	Red Hill Homestead	609702	7600644	12.4	Privately owned
8	Riverside Homestead	607241	7598505	12.2	Privately owned
9	Goonyella Riverside Mine Medical Centre	598253	7593944	14.6	BMA
10	Eureka Accommodation Camp	597230	7592356	16.3	BMA
11	Lapunyah Homestead	595547	7601128	8.3	Stanmore SMC Pty Ltd
Note 1: GDA 2020 MGA Zone 55 projection.					

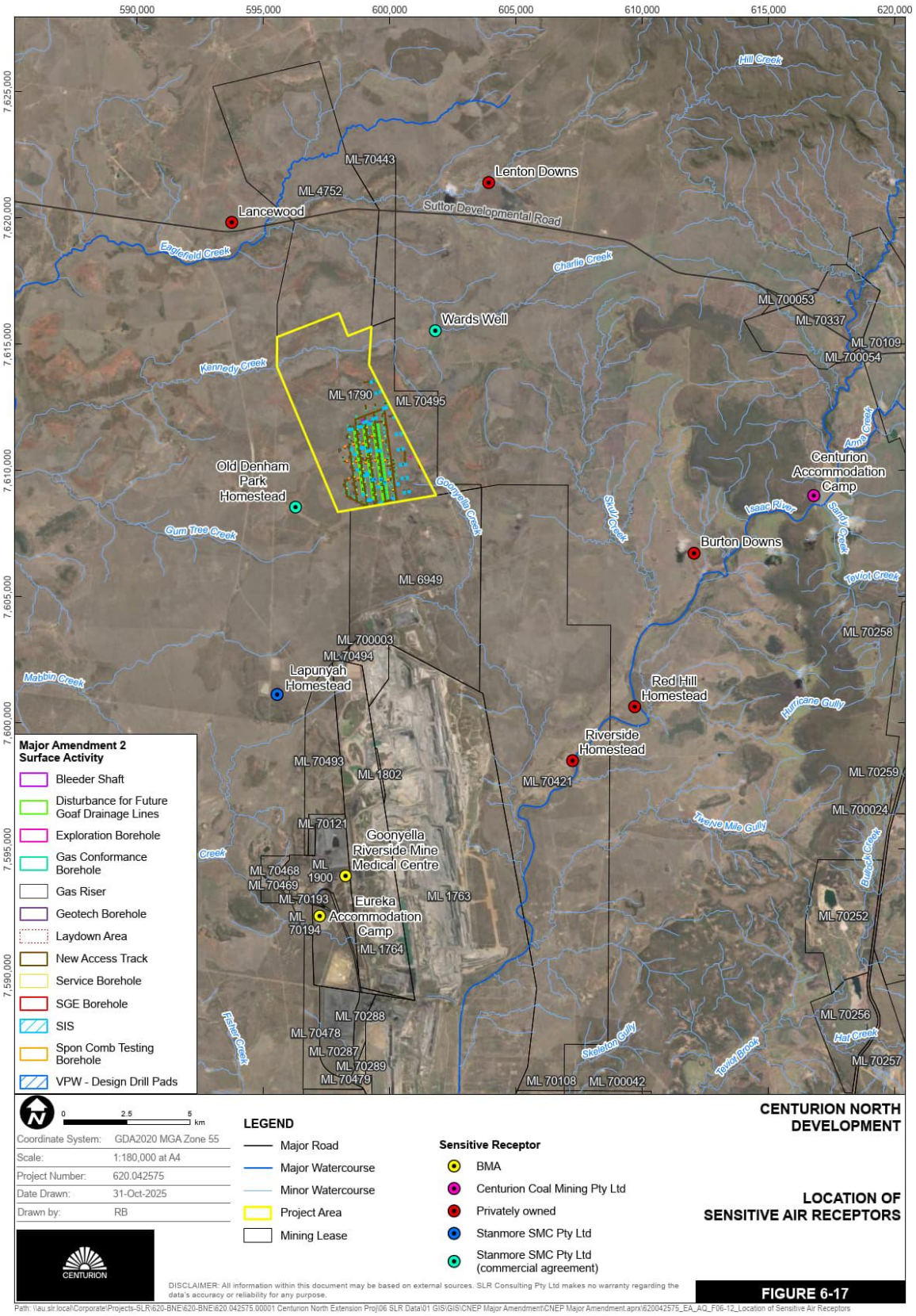


Figure 6-17 Location of Sensitive Air Receptors

6.6.1.2 Air Quality Objectives

A summary of the Queensland EPP(Air) ambient air quality objectives that are relevant to the Project is provided in **Table 6-18.**

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 6-18 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 hours	50 µg/m^3	None	QLD EPP(Air)
		Annual	25 µg/m^3	None	QLD EPP(Air)
$PM_{2.5}$	Health and wellbeing	24 hours	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 days	120 mg/m^2/day	None	QLD DETSI

6.6.1.3 Air Quality Environment

The nearest ambient air monitoring stations operated by the Queensland Department of Environment, Tourism, Science and Innovation (DETSI) are the Moranbah (Utah Drive) and the Moranbah (Cunningham Way) monitoring stations located approximately 40 km to the south-southeast of the Project (**Figure 6-18**).

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

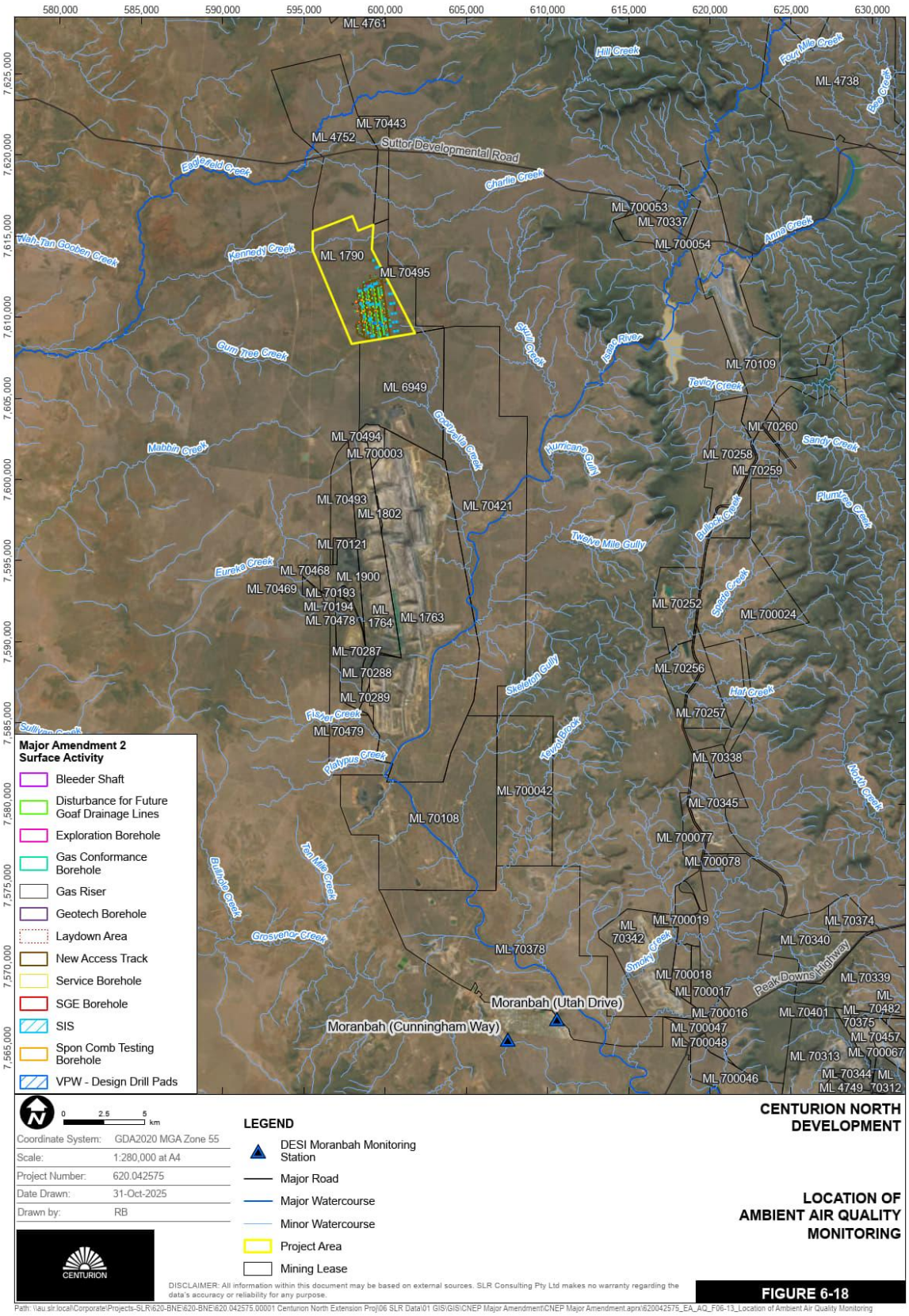


Figure 6-18 Location of Ambient Air Quality Monitoring

The DETSI 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 DETSI Moranbah (Utah Drive) monitoring station is sufficiently representative of those in the vicinity of the Project.

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 DETSI Moranbah ambient air monitoring stations.

Thus, estimates of background levels of these pollutants were based on data sets from other DETSI-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 6-19**, 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 the objective) and $PM_{2.5}$ (85% of the 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 DETSI Moranbah monitoring stations, highlight the dusty background environment within the airshed that includes the Project.

Table 6-19 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 hours	50 µg/m^3	24.4 µg/m^3	49%	DETSI(2)
		Annual	25 µg/m^3	23.8 µg/m^3	96%	DETSI(2)
$PM_{2.5}$	Health and wellbeing	24 hours	25 µg/m^3	7.6 µg/m^3	30%	DETSI(2)
		Annual	8 µg/m^3	6.8 µg/m^3	85%	DETSI(2)
TSP	Health and wellbeing	Annual	90 µg/m^3	47.6 µg/m^3	53%	DETSI(2,3)
Dust deposition	Nuisance	30 days	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) DETSI – Based on 2023 data from the DETSI 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 DETSI 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}.

(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.

6.6.2 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 6-11.**

6.6.2.1 Construction of Ancillary Infrastructure - Surface Activities

Based on information provided in **Section 3.2**, surface activities for one bleeder shaft (1.5 ha), construction of access tracks (23 ha), and disturbance for future works (69 ha) are proposed. The proposed activities include removal of vegetation, topsoil and sub-soil as well as stockpiling activities. Additionally, compacting of these areas using a roller and laying of gravel using a grader are also proposed.

These surface activities have 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. A 30 kL water cart will be used for dust suppression across all working and trafficable areas. Access tracks will be regularly maintained to ensure the safety of site personnel, to facilitate the effective transportation of equipment and personnel, and to provide uninterrupted access to gas infrastructure for monitoring, maintenance and emergency shutdown.

It is noted that these activities are anticipated to be associated with a minimal risk of air quality impacts at receptor locations due to the significant distance to the nearest receptor and relatively low footprint of disturbance area (<10% of the Project's proposed infrastructure area).

6.6.2.2 Construction of Drill Pads

Based on information provided in **Section 3.2**, a total of 334 drill pads of varying dimensions will be developed, with 50 pads designed as SIS well pads and the rest will be used for gas risers, service boreholes and sampling boreholes. The total combined footprint of all pads in areas that are not covered by existing disturbance approvals is 81 ha (not including ancillary infrastructure disturbance). 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.

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.

However, 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 and relatively low footprint of disturbance area (<10% of the Project's proposed infrastructure area).

6.6.2.3 Drilling of Vertical and Lateral Wells

As noted in **Section 3.13**, 66 SIS wells located on 50 well pads are to be constructed in approximately 15 months. Each well will require approximately 10 days to drill and approximately 15 days to install surface infrastructure. As mentioned in **Table 3-3**, two SIS drill rigs will be used for these operations.

Additionally, three types of boreholes are proposed - gas risers, service boreholes and sampling boreholes. A bleeder shaft is also proposed to be located more than four km from the nearest receptors. Based on information provided in **Section 3.8,** three drill rigs will be used for these drilling operations.

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

As a maximum of five drill rigs will be used at any one time for all drilling activities, the risk of impacts due to emissions of particulate and gases associated with the combustion of diesel fuel are anticipated to be minor at receptor locations due to the significant distance to the nearest receptor. Furthermore, the geographically dispersed nature of these activities is unlikely to cause air emission impacts as they will be distributed across different locations rather than concentrated in any single area for extended periods.

6.6.2.4 Underground Construction Activities

As noted in **Section 3.3**, the majority of the proposed activities like the construction of gate roads, excavation and handling of coal is to be undertaken underground. Thus, no above-ground air quality impacts at the receptors are anticipated from these activities. Additionally, in the case of any above-ground stockpiling activities, operations will be managed according to industry best practices, incorporating dust suppression management, thus minimizing any emissions from these sources. Thus, impacts from these sources are unlikely due to the low anticipated emissions and significant distance to the nearest receptor.

6.6.2.5 Well Operation

SIS (Vertical and Lateral) Wells

The main sources of emissions associated with SIS wells during operations are:

- Flaring - Based on information provided in **Section 3.2.3**, CSG will be extracted at a rate of up to approximately 300-500 L/sec per well or approximately 1,080-1,800 cubic metres per hour of CSG per well. It is noted that the gas released from these wells will either be captured for further use or flared using candlestick flares to allow for controlled combustion of methane. 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.
- Generator - as noted in **Section 3.8** one 60 kV diesel generator will be used per two SIS well pads to power drill pumps and well pumps. Thus, a total of 13 generators are anticipated to be in operation. 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 and the geographically dispersed nature of these activities.

Boreholes

As noted in **Section 3.2.1**, the potential sources of emissions from boreholes can be classified as follows:

- Gas risers - No significant emissions are anticipated from the gas risers during normal operations. Any gas produced will be flared prior to release. 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.
- Service boreholes - Since no activities relevant to air emissions are proposed to be conducted at the service borehole locations (primarily designed for transferring materials from the surface to underground areas of the mine), air emissions from these locations are not anticipated.

Bleeder Shaft

The bleeder shaft is primarily designed for ventilation purposes in support of operations within the underground mine. The use of auxiliary fans will aid in the dispersion of the spent air within the local airshed.

Owing to the significant distance (>4 km) between the bleeder shaft and neighbouring sensitive receptor locations, impacts associated with particulate and/or gaseous emissions associated with the bleeder shafts, at the location of the sensitive receptor(s), are anticipated to be immaterial.

6.6.2.6 Waste management, Closure and Rehabilitation

As waste produced onsite will be managed in accordance with CCM Waste Management Procedures and will be treated or disposed of offsite. Thus, no impacts due to air emissions are anticipated from these sources.

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

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 meteorological conditions.

6.6.3 Management Practices

Mitigation and management practices aimed at reducing the risk of adverse air quality impacts at the location of the sensitive receptors 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 emissions optimal manner;

- Monitoring meteorological conditions and proactively watering unsealed areas and stockpiles prior to and during adverse meteorological conditions; and
- Ensuring auxiliary fans associated with the Bleeder Shaft are operating in an optimal manner.

6.6.4 Risk Assessment

The potential for air quality impacts were assessed to provide an overall risk rating of low. Details are provided in **Table 6-20**.

Table 6-20 Air Quality Risk Assessment

Stage	Potential Impact	Emission Sources	Likelihood	Consequence	Risk Rating	Justification
Construc-tion	Mechanically generated dust due to surface activities Mechanically generated dust during drilling Gaseous and particulate emissions released from generators for construction activities	Surface activities for Drill Pads and Laydown Area Disturbance for future surface works Proposed underground activities Construction of access tracks Drilling and installation of boreholes Drilling and installation of SIS wells Drilling and installation of bleeder shaft	Unlikely	Low	Low	• Short duration of drill pad construction activities (i.e. 2-3 days each). • Overall, only 5 drill rigs to be used during construction at any given time. • Watering of disturbance areas will provide effective mitigation of dust. • Significant distance to nearest receptor (i.e. approximately 2 km). • Geographically dispersed nature of these activities causes a small footprint of disturbance area (approximately 15% of total area of proposed infrastructure area[1])

Stage	Potential Impact	Emission Sources	Likelihood	Consequence	Risk Rating	Justification
Operation	Gaseous and particulate emissions released from generators used for dewatering and CSG extraction	Operations at SIS wells Operations at gas risers (no emissions from service and sampling boreholes anticipated)	Unlikely	Low	Low	Individual generators distributed over a number of drill pads. Significant distance to nearest receptor (i.e. approximately 2 km)
Operation	Impact of emissions of gaseous pollutants due to combustion of CSG during flaring	Flaring of CSG from SIS wells and gas risers	Unlikely	Low	Low	Flares distributed over a number of drill pads. High destruction efficiency of flares. Significant distance to nearest receptor (i.e. greater than 2 km)
Operation	Emissions of spent air (gases and dust) from Bleeder shaft	Bleeder shaft	Unlikely	Low	Low	Significant distance to nearest receptor (i.e. greater than 4 km)

6.7 Greenhouse Gas

This section presents the assessment of Project related GHG emissions.

6.7.1 Existing Environmental Values

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

Table 6-21 presents a summary of the long-term monthly averaged data for:

- Daily maximum temperature;
- Daily minimum temperature; 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 6-21 Rainfall and Temperature Climate Statistics based on Data obtained from the Bureau of Meteorology (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 6-4** and **Image 6-5,** respectively, highlight the general light to moderate winds and predominately easterly and south-easterly winds experienced at this location.

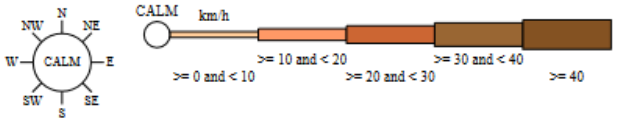
Rose of Wind direction versus Wind speed in km/h (10 Jan 1986 to 26 Mar 2012)

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%

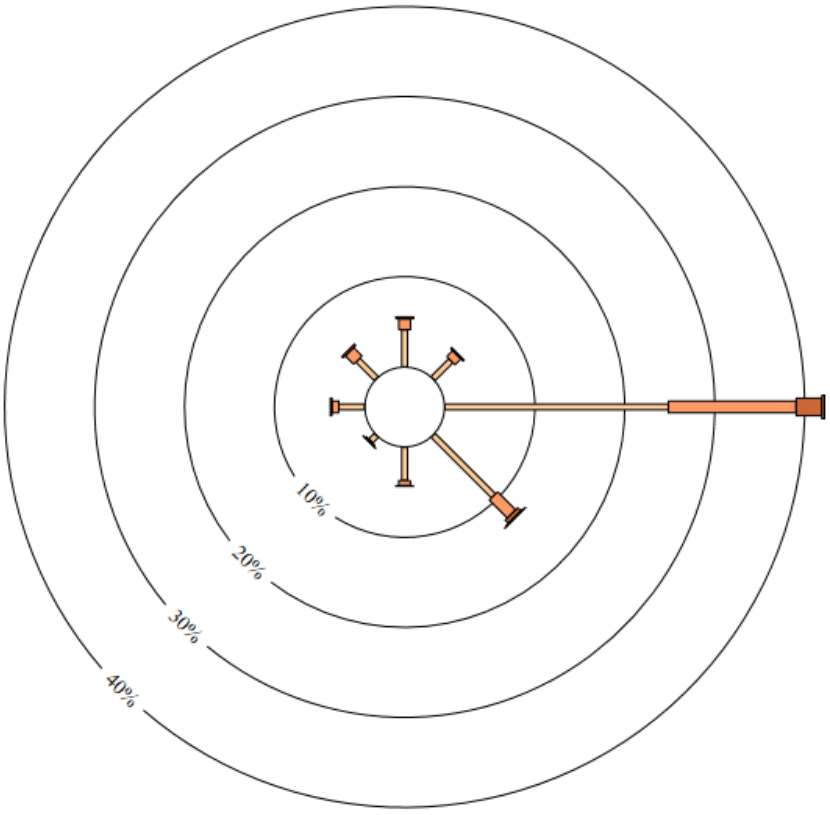


Image 6-4 Wind Rose based on data obtained at 09:00 at the MWTP (1986-2012) (Source: BoM website http://www.bom.gov.au/climate/averages/tables/cw_034038.shtml)

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.

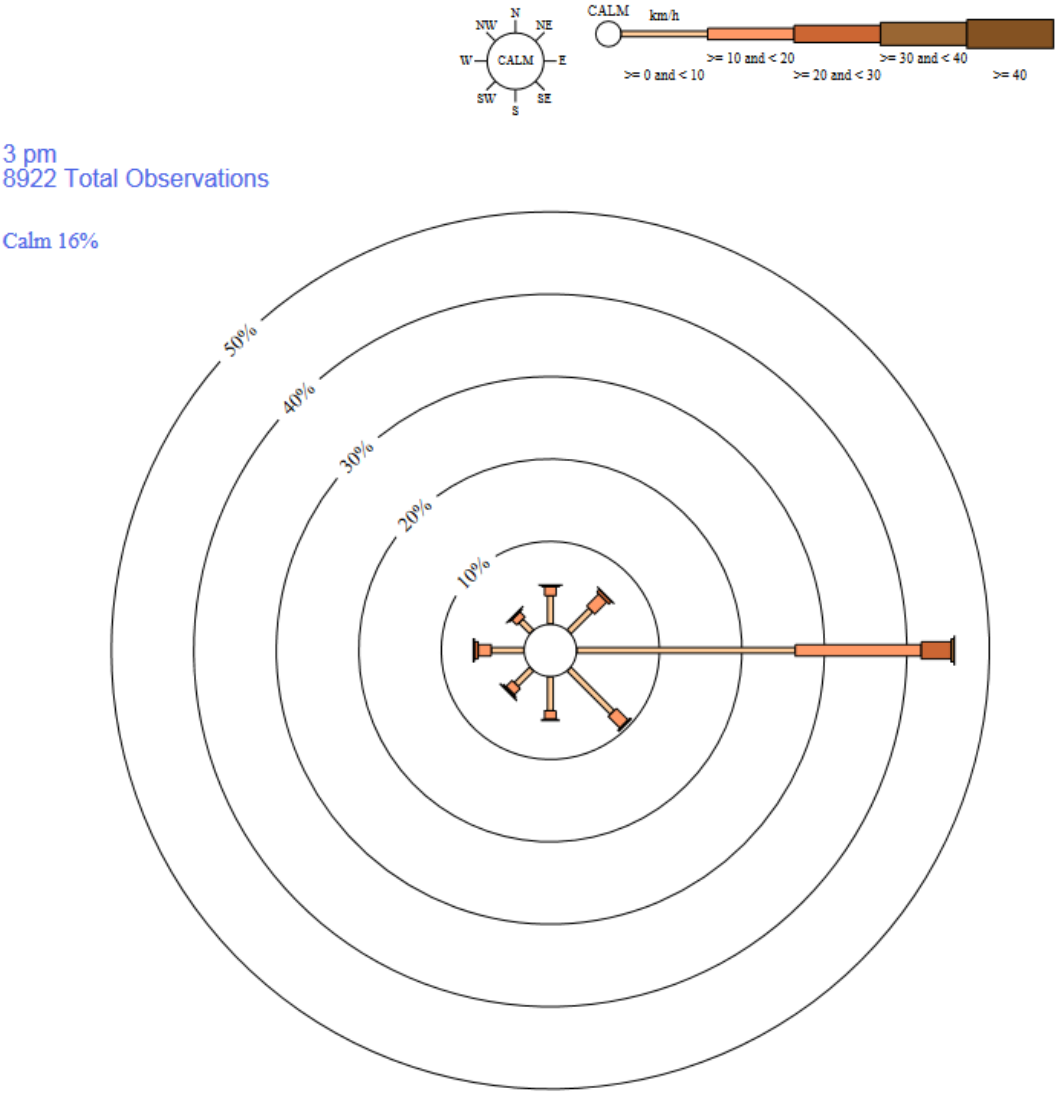


Image 6-5 Wind Rose based on data obtained at 15:00 at the MWTP (1986-2012) (Source: BoM website http://www.bom.gov.au/climate/averages/tables/cw_034038.shtml)

6.7.1.2 Greenhouse Gas Inventory

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

DCCEEW's *Australian National Greenhouse Accounts Factors* (NGA Factors 2024) (referred to as the NGA Factors) provides a methodology by which corporations can 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; and
  - Indirect emissions are generated as a consequence of an organisation's activity, but 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 on Scope 1 and Scope 2 emissions. Additionally, 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 6-22**), 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 released *before* the extraction of coal.

In consultation with the regulating authority, the estimate of emissions associated with flaring has been based on the NGA Factor for *coal mine waste gas that is captured for combustion* with the methane component of the CSG associated with the Project, estimated at greater than 99%.

Table 6-22 presents a summary of the NGA Factors used in this assessment.

Table 6-22 National Greenhouse Accounts Emission Factors for Activities Onsite

Emission Source	Energy Content[3]	Emission Factor	Units[2]	Source
Scope 1				
Coal Mine Waste Gas that is captured for combustion	0.0377 GJ/m^3	56.8	kg CO2-e/GJ	NGA[1]
Combustion of diesel fuel	38.6 GJ/kL	70.20	kg CO2-e/GJ	NGA[1]
Scope 2				
Electricity use from grid	-	0.71	kg CO2-e/kWh	NGA[1]

Note: (1) NGA – Australian Government's Department of Climate Change, Energy, the Environment and Water's National Greenhouse Accounts Factors (2024)

(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)

6.7.2 Potential Emissions

Based on the Project description provided in **Section 3.0,** the potential GHG emissions from the Project have been classified below. A risk-based assessment of these potential impacts is detailed in **Table 6-14,** and a GHG Abatement Plan is presented in **Appendix E**.

6.7.2.1 Construction of Drill Pads and Ancillary Infrastructure

Based on information provided in **Section 3.2**, a total of 334 drill pads of varying dimensions will be developed as part of the Project, and one laydown area with dimension of 150 m x 150 m will be constructed. Additionally, surface activities for one bleeder shaft (1.5 ha), construction of access tracks (20 ha), surface works causing disturbance for future works (69 ha) are also proposed. The total combined footprint for these activities is approximately 150 ha (based on information presented in **Table 3-1**).

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 and estimates of diesel fuel usage, between 1,100 and 2,100 t of CO2-e emissions are estimated to be associated with the combustion of diesel fuel during the construction of the drill pads and ancillary infrastructure.

For the purposes of this assessment, an average value of 1,600 t of CO2-e has been used as an estimate of GHG emissions during the construction of the drill pads and access track. It is assumed that these emissions will be released over 18 months. Thus, the following GHG emissions from these sources are estimated to result in:

- 1,200 t of CO2-e during FY2026; and
- 400 t of CO2-e during FY2027.

6.7.2.2 Establishment of SIS Wells, Boreholes and Bleeder shaft

As mentioned in **Section 3.8**, 5 drill rigs will be engaged for the construction of the SIS wells, gas risers, boreholes and the bleeder shaft.

The 66 SIS wells will be completed in approximately 15 months, while the construction and installation of gas risers will take approximately 1 year (**Section 3.13**). Additionally, the construction and decommissioning of boreholes is anticipated to take approximately 3 years, while the installation of the bleeder shaft will take approximately 1 year.

Based on the NGA Factors provided in **Table 6-22** and a diesel fuel consumption of approximately 14 litres per hour per generator unit, GHG emissions are estimated as:

- 7,000 t of CO2-e during FY2026;
- 4,000 t of CO2-e during FY2027; and
- 3,200 t of CO2-e during FY2028.

6.7.2.3 SIS Wells Operation

Flaring of CSG

Based on information about expected gas flow provided by Peabody for the site, the annual production rate of CSG was estimated for the 66 SIS wells.

The combustion of methane by the flaring of CSG, as opposed to 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 6-22**; and
- An assumed 95% flare-up time.

Based on the staggering of wells coming online during the project, the flaring of CSG is estimated to produce:

- 76,700 t of CO2-e during FY2027;
- 290,100 t of CO2-e during FY2028;
- 250,500 t of CO2-e during FY2029;
- 77,000 t of CO2-e during FY2030; and
- 2,200 t of CO2-e during FY2031.

Venting of CSG

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

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 are estimated to result in:

- 35,400 t of CO2-e during FY2027;
- 134,000 t of CO2-e during FY2028;
- 115,700 t of CO2-e during FY2029;

- 35,600 t of CO2-e during FY2030; and
- 1,000 t of CO2-e during FY2031.

Generators

As noted in **Section 3.8**, electricity will be required to operate the drill pumps and the well pumps. It is also noted that twenty-five 60kV diesel generators will be used to power the operations of the 66 SIS wells and gas risers.

Based on the NGA Factors provided in **Table 6-22** and conservatively assuming that all diesel generators will operate for a period of about 5 years at a diesel fuel consumption of approximately 14 litres per hour per generator unit, the following emissions due to generator use have been estimated as:

- 2,100 t of CO2-e are emitted during FY2026; and
- 8,300 t of CO2-e are emitted annually during FY2027 until 2031.

Venting of Underground Spent Air

As noted in **Section 3.2.4**, ventilation for underground areas will be provided via the bleeder shaft ventilation system, wherein spent air will be released directly to the atmosphere. Based on operational information provided by Peabody for ventilation fans, the annual release of GHG from these sources was estimated to be as follows:

- 1,500 t of CO2-e are emitted during FY2028; and
- 3,400 t of CO2-e are emitted during FY2029 to 2031.

Electricity Consumption

As noted in **Section 3.8**, high-voltage connection to the electricity network on ML 6949 will provide power to the bleeder shaft site as well as the provision of electricity to underground activities via the service boreholes during operations. It is assumed that the ventilation system will be the primary consumer of electricity. It is also assumed that the ventilation system consists of several 220 KW ventilation fans. Based on operational data provided by Peabody, the following GHG emissions were estimated:

- 2,400 t of CO2-e are emitted during FY2028; and
- 6,500 t of CO2-e are emitted during FY2029 to FY2031.

6.7.2.4 Summary of GHG Emission Estimates

Table 6-23 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 6-23 Summary of GHG Emissions

Scope	Project Phase	Source	FY2026 Tonnes of CO2-e	FY2027 Tonnes of CO2-e	FY2028 Tonnes of CO2-e	FY2029 Tonnes of CO2-e	FY2030 Tonnes of CO2-e	FY2031 Tonnes of CO2-e	Percentage of Total
1	Construction	Combustion of diesel in equipment during drill pad and ancillary infrastructure construction	1,200	400	-	-	-	-	0.1%
1	Construction	Combustion of diesel in drill rig during construction of SIS wells, boreholes and bleeder shaft	7,000	4,000	3,200	-	-	-	1.3%
1	Operation	Combustion of diesel in generators during operation of SIS wells and gas risers	2,100	8,300	8,300	8,300	8,300	8,300	3.9%
1	Operation	Flaring of CSG[1]	-	76,700	290,100	250,500	77,000	2,200	63.0%
1	Operation	Venting of CSG[1]	-	35,400	134,000	115,700	35,600	1,000	29.1%
1	Operation	Venting of underground spent air	-	-	1,500	3,400	3,400	3,400	1.1%
Scope 1 Total (t CO2-e)			**10,300**	**124,800**	**437,100**	**377,900**	**124,300**	**14,900**	**98.6%**
2	n/a	Electricity consumption	-	-	2,400	6,500	6,500	6,500	1.4
Total GHG Emissions (t CO2-e)			**10,300**	**124,800**	**439,500**	**384,400**	**130,800**	**21,400**	**100%**

Note: (1) Flaring and venting of CSG reported as per NGERs Standard Conditions for gaseous fuels.

6.7.2.5 Comparison with Australian Emissions

The latest Australian GHG emissions inventory provided in the DCCEEW *Quarterly Update of Australia's National Greenhouse Gas Inventory: March 2025* (DCCEEW 2025) indicates Australia's total GHG emissions (including land use, land use change and forestry activities) were 440.2 million tonnes (Mt) of CO2-e.

More than 74% of the Project's CO2-e emissions occur over the 2-year period FY2028 and FY2029 and are primarily associated with the flaring and venting of CSG (91.6%).

The summary of emissions provided in **Table 6-23** suggests that the maximum Project-related contribution to GHG emissions in FY2028 and FY2029 is approximately 0.44 Mt and 0.38 Mt of CO2-e per year. This represents between 0.100% and 0.087% of Australia's 2025 GHG emissions.

The latest available Queensland's contribution to the 2022 national inventory was estimated to be 124.1 Mt of CO2-e. The Project's contribution represents 0.354% to 0.310% of Queensland's 2022 emissions.

6.7.3 Management Practices

The potential impacts will be managed through current practices. These methods are used to mitigate the impacts of GHG emissions, 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.

6.7.4 Risk Assessment

The potential for impacts due to GHG emissions associated with the Project was assessed to provide an overall risk rating, of which details are provided in **Table 6-24**. The risk of GHG impacts is considered low.

Table 6-24 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	Minor	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.

6.8 Noise and Vibration

This section presents the assessment of Project related noise and vibration impacts to EVs. Further information is provided in the Noise and Vibration Impact Assessment (**Appendix F**).

6.8.1 Existing Environment

6.8.1.1 Sensitive Receptors

Potential sensitive receptors surrounding the Project Area are presented in **Table 6-25** and **Figure 6-19**. 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 6-25 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	2.0	Stanmore SMC Pty Ltd (commercial agreement)
2	Wards Well	601809	7615534	3.0	Stanmore SMC Pty Ltd (commercial agreement)
3	Lancewood	593750	7619821	8.3	Privately owned
4	Lenton Downs	603922	7621398	9.0	Privately owned
5	Centurion Accommodation Camp	616790	7609005	15.6	Centurion Coal Mining Pty Ltd
6	Burton Downs	612051	7606721	11.5	Privately owned
7	Red Hill Homestead	609702	7600644	12.2	Privately owned
8	Riverside Homestead	607241	7598505	12.3	Privately owned
9	Goonyella Riverside Mine Medical Centre	598253	7593944	14.6	BMA
10	Eureka Accommodation Camp	597230	7592356	16.3	BMA
11	Lapunyah Homestead	595547	7601128	8.2	Stanmore SMC Pty Ltd

[1] GDA 2020 MGA Zone 55 projection.

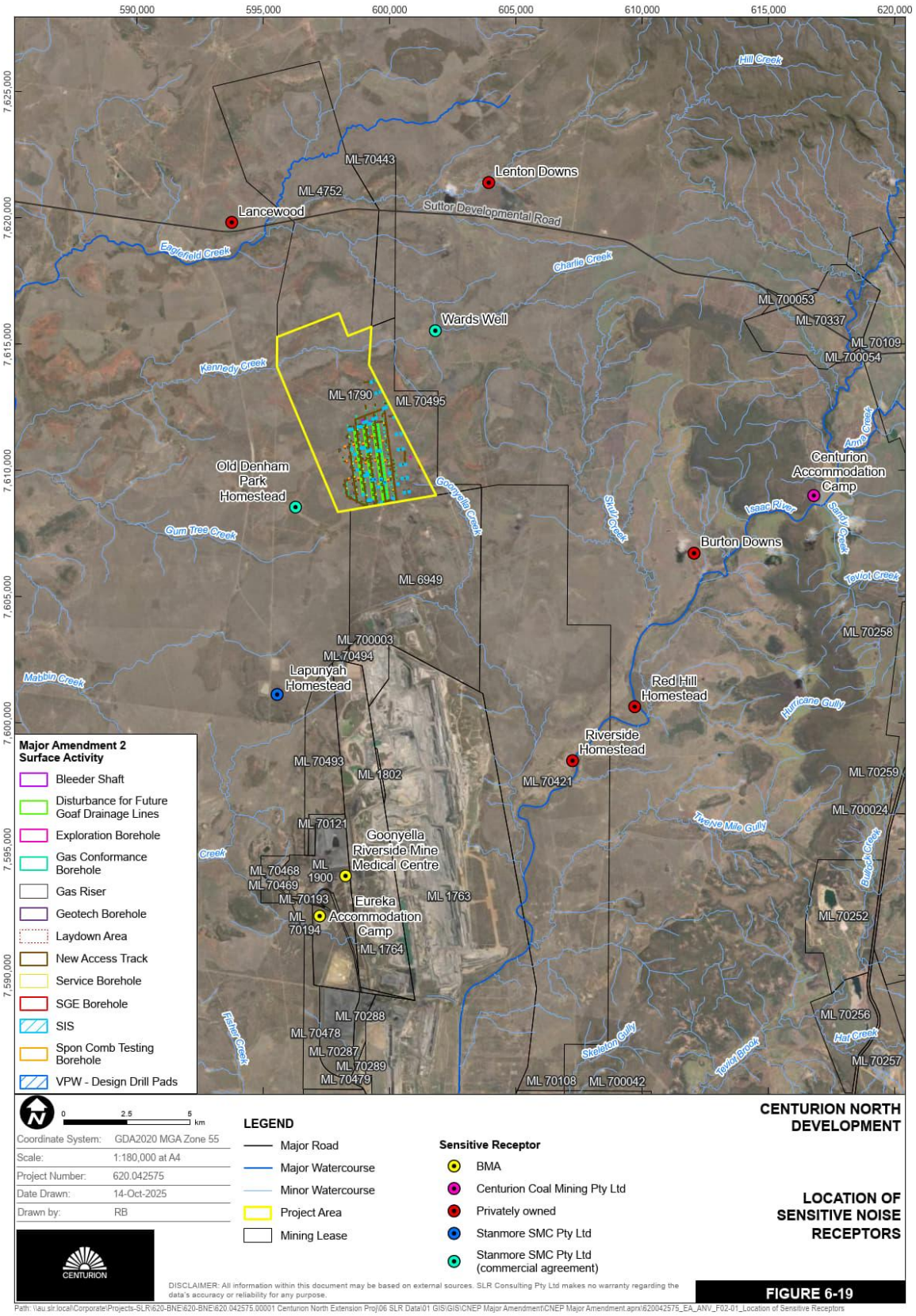


Figure 6-19 Location of Sensitive Noise Receptors

6.8.1.2 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 6-26** and have been applied to the assessment of the Project.

Table 6-26 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 6-28**.

6.8.2 Potential Impacts

6.8.2.1 Noise and Vibration Assessment Methodology

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 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 tracks, drill pads and laydown area 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 6-27** operating simultaneously during the construction. Noise from the new access tracks and drill pad construction activities have been modelled individually to identify the proposed access track and drill pad site with the highest (i.e. worst-case) predicted noise level at each receptor.
  - Vibration modelling and assessment has been carried out for the 12 t vibratory roller required for soil compaction as part of the earthmoving fleet.
- Drilling of SIS and VPWs:
  - 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 drill rig has been modelled at the closest proposed well site to each receptor. The modelled sound power level (SWL) data is summarised in **Table 6-27**.
  - No discernible sources of vibration are anticipated during this stage of the Project.
- Drilling of boreholes:
  - Noise from the borehole drill rig has been modelled at the closest borehole to each receptor. The modelled SWL data is summarised in **Table 6-27**.
  - No discernible sources of vibration are anticipated during this stage of the Project.
- Bleeder shaft construction:
  - Bleeder shaft construction noise has been modelled based on the combined fleet of plant and equipment listed in **Table 6-27** operating simultaneously within the area shown in **Figure 3-1**.
  - No discernible sources of vibration are anticipated during this stage of the Project.

- VPW operation:
  - We note that Peabody is progressing several gas abatement projects aimed at the beneficial use of CSG extracted as part of the Project. As a last resort, CSG may be directed to candlestick flares located within the disturbance footprint of the drill pads. This flare system will allow for the controlled combustion of methane to reduce the GHG intensity of the operation or during emergency scenarios. Notwithstanding this, modelling of flare noise has previously been completed by SLR for the Major EA Amendment for the gas extraction program with compliance (of the noise assessment criteria) predicted for all sensitive receptors. No further modelling and assessment of CSG flaring noise has been completed as part of this study.
  - No discernible sources of vibration are anticipated during this stage of the Project.

Table 6-27 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 (12 t)	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										
SIS/VPW drill rig	105	109	111	117	122	119	111	102	125	3.0 m
Borehole drilling										
Hydraulic drill rig	87	105	97	104	108	108	105	101	114	3.0 m
Bleeder shaft construction (blind boring/drilling)										
Delivery truck (semi)	93	91	96	99	99	98	93	88	105	3.0 m
Crawler crane	93	99	95	97	97	96	90	83	105	4.0 m
Genset	78	85	85	83	85	85	79	65	92	1.0 m
Compressor	77	83	84	95	99	98	91	84	103	1.0 m
Blind boring rig	93	111	107	112	113	112	104	95	119	5.0 m
Excavator (30t)	87	90	96	102	101	100	97	90	107	2.0 m
Water truck	84	90	95	100	100	99	95	85	106	2.0 m
Concrete truck	85	86	85	94	98	107	89	82	108	2.0 m
Concrete pump	85	89	94	100	102	104	96	90	108	1.5 m
Welding equipment	71	81	86	85	87	89	85	80	94	1.0 m

6.8.2.2 Assessment of Noise Impacts

Predicted Project noise levels associated with the proposed construction of new access tracks, drill pads, laydown areas, bleeder shaft, and drilling of wells and borehole shafts are summarised in **Table 6-28** for both neutral and adverse atmospheric conditions.

Construction and drilling for the Project is anticipated to occur continuously (i.e. 24 hours per day, 363 days per year), as such, the EA noise limits for the daytime period (i.e. 7:00am to 6:00pm), evening (i.e. 6:00pm to 10:00pm) and night-time period (i.e. 10:00pm to 7:00am) have been included for reference in **Table 6-28**.

From the noise modelling results presented in **Table 6-28**, the following is noted:

- Worst-case Project noise levels across all scenarios are predicted to comply with the EA noise limits at all sensitive receptors.
- The highest predicted Project noise level, associated with drilling of SIS and VPW wells, was 39 dBA LA10,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 19 dBA LA10,adj,10mins at Lancewood. It is important to note that this predicted noise level relates to the operation of just one (1) drill rig. If both drill rigs operate simultaneously at similar offset distances from Lancewood, a worst-case cumulative noise level of 22 dBA is predicted, which is also well below the EA night-time period noise limit of 33 dBA LA10,adj,10mins. Further to this, based on a typical +5 dB relationship between the LA10,adj,10mins and LA1,adj,10mins, a predicted noise level of 24 dBA LA1,adj,10mins complies with the 35 dBA EA night-time period noise limit.

Table 6-28 Predicted Worst-case Project Noise Levels

Receptor	EA Noise Limit $L_{A10,adj,10mins}$ (dBA)			Predicted Noise Level $L_{A10,adj,10min}$ (dBA)							
				Access tracks, drill pads and laydown		SIS/VPW Drilling		Borehole Drilling		Bleeder Shaft Construction	
	Daytime 7 am- 6 pm	Evening 6 pm – 10 pm	Night-time 10 pm to 7 am	Adverse Weather	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather	Neutral Weather	Adverse Weather	Neutral Weather
1 - Old Denham Park Homestead[1]	N/A	N/A	N/A	38	33	39	34	31	26	28	22
2 - Wards Well[1]	N/A	N/A	N/A	32	26	37	32	23	18	28	22
3 - Lancewood	35	35	33	16	<10	19	12	11	<10	18	11
4 - Lenton Downs	35	35	33	15	<10	18	10	10	<10	17	10
5 - Centurion Accommodation Camp	N/A	N/A	N/A	<10	<10	<10	<10	<10	<10	<10	<10
6 - Burton Downs	35	35	33	12	<10	14	<10	<10	<10	14	<10
7 - Red Hill Homestead	35	35	33	11	<10	13	<10	<10	<10	13	<10
8 - Riverside Homestead	35	35	33	10	<10	13	<10	<10	<10	13	<10
9 - Goonyella Riverside Mine Medical Centre[2]	35	35	33	<10	<10	11	<10	<10	<10	12	<10
10 - Eureka Accommodation Camp[2]	35	35	33	<10	<10	<10	<10	<10	<10	10	<10
11 - Lapunyah Homestead[1]	35	35	33	16	<10	19	11	12	<10	16	<10

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

[1] Receptor owned and operated by Stanmore SMC Pty Ltd.

[2] Receptor owned and operated by BMA.

6.8.2.3 Assessment of Vibration Impacts

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 12 t 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 millimetres per second (mm/s), based on guidance from the Modelled Mining Conditions Guideline (MMC guideline).

It is noted that 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 (BSI 2009)) have also been calculated and assessed for the Project.

Prediction of PPV vibration levels from the 12 t roller are 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 **Figure 6-20**.

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

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

Figure 6-20 Empirical Predictors for Groundborne Vibration from Construction Works

Based on the formulae presented in **Figure 6-20**, vibration offset buffer distances for the 12 t 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 6-17** (i.e. 8.3 km to 12.3 km for privately-owned sensitive receptors), the risk of vibration-related impacts is negligible for any sensitive receptor during the vibratory compaction works.

6.8.3 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 bleeder shaft construction 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;
- For vibratory compaction works, selecting appropriately sized equipment for the task; and
- Minimising drop height of materials when unloading on site.

6.8.4 Risk Assessment

The potential noise and vibration impacts were assessed to provide an overall risk rating, which are presented in **Table 6-29**.

Table 6-29 Noise and Vibration Risk Assessment

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Noise disturbance at sensitive receptors during new access track, drill pad construction works	Unlikely	Low	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	Low	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 well drilling works	Unlikely	Low	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.

Potential Impact	Likelihood	Consequence	Risk Rating	Justification
Noise disturbance at sensitive receptors during borehole drilling works	Unlikely	Low	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 construction of the bleeder shaft	Unlikely	Low	Low	Due to the distance to the sensitive receptors, this potential impact poses a low risk of environmental harm.

The risk-based assessment presented in **Table 6-29** has determined that noise and vibration impacts to sensitive receptors surrounding the Project are low due to the scale of the proposed activities and the distance separation to sensitive receptors.

6.9 Waste

This section presents the assessment of Project related waste impacts to EVs.

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:

- Groundwater (refer to **Section 6.1**);
- Surface water (refer to **Section 6.2**);
- Land resources (refer to **Section 6.3**);
- Terrestrial and aquatic ecological values (refer to **Section 6.4** and **Section 6.5**); and
- Air quality and GHG (refer to **Section 6.6** and **Section 6.7**).

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 6-30** outlines the waste types which are likely to be generated by Project activities.

All waste products generated from underground activities will be managed and disposed of in accordance with the CCM Waste Management Procedure. This will include co-disposal of minor rejects with waste generated from the CCM.

Table 6-30 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 and Future Goaf Drainage Lines

Site clearance activities for the establishment of new access tracks and future goaf drainage lines 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 (trees, bushes, and grasses) and stripping and removal of topsoil.

Potential waste impacts associated with site clearance in the construction 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;
- Removal of vegetation will result in increased erosion and dust; and
- Improper handling and management of topsoils can result in sedimentation in surface waters.

During the operation phase, minimal impacts are anticipated because clearance will occur for maintenance purposes. Potential generation of organic waste, which if not properly managed, may decompose on-site, attracting pests or impacting local ecology.

During the rehabilitation and closure phase, sedimentation in surface waters may result due to spreading of topsoil, ripping and other rehabilitation processes requiring soil movement.

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** include:

- 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 6.6** and **Section 6.7**);
- 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 of drilling mud and rock cuttings or spills from cement, lubricants, and other hydrocarbons 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 refuelling or unmaintained equipment; and
- Increased generation of gaseous waste from vehicular movement and operations.

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

- 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 spillages or leakages due to improper storage of hydrocarbons used for maintenance of equipment or when refuelling; and
  - Accidental overflow of produced water from dewatering activities and spillage during the transfer of produced water by truck to CCM facilities, resulting in potential contamination of soils and surface water.

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

- Improper disposal of solid waste from infrastructure dismantling activities. The majority of solid waste (i.e. steel components) will be reused or recycled where possible, and the remaining solid waste will require disposal;
- Potential contamination of soil and water resources due to improper disposal or handling of materials, including:
  - Improper sealing of wells;
  - Improper disposal of wastewater from dewatering activities;
  - Improper disposal of hazardous materials, such as fuel, oil, and cleaning chemicals used in equipment maintenance; and
- Potential sedimentation in surface waters due to removal of gravel base, spreading of topsoil, ripping and other rehabilitation processes requiring soil movement.

6.9.2.3 Laydown Area and Drill Pads for Boreholes, Gas Risers and Bleeder Shaft

The construction and operation of the laydown area and drill pads for boreholes, gas risers and bleeder shaft will comprise of vegetation clearance, stripping and removal of topsoil (for laydown area, bleeder shaft and gas risers), and the installation of borehole and shaft infrastructure which can generate waste. In addition to this, the drilling activities involve creating boreholes and shafts, which generate various forms of waste which may impact soil and water quality.

Potential waste impacts associated with the laydown area and drill pad activities in the **construction phase** include:

- 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;
- 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;
    - 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 hydrocarbons or transfer of waste products;
- Increased generation of gaseous waste from vehicular movement and operation.

Potential waste impacts associated with laydown area and drill pad activities in the **operation phase** include:

- 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; and
- Accidental spillages or leakages due to improper storage of hydrocarbons used for maintenance of equipment.

Potential waste impacts associated with laydown area and drill pad activities in the **rehabilitation and closure phase** include:

- Improper disposal of solid waste from infrastructure dismantling activities. The majority of solid waste (i.e. steel components) will be reused or recycled where possible, and the remaining solid waste will require disposal;
- Potential contamination of soil and water resources due to improper disposal or handling of materials, including:
    - Improper sealing of boreholes, risers and shaft;
    - Improper disposal of hazardous materials, such as fuel, oil, and cleaning chemicals used in equipment maintenance; and
    - Potential sedimentation in surface waters due to removal of gravel base, spreading of topsoil, ripping and other rehabilitation processes requiring soil movement.

6.9.2.4 Underground activities

All waste products generated from underground activities will be managed and disposed of in accordance with the CCM Waste Management Procedure. This will include co-disposal of minor rejects with waste generated from the CCM.

6.9.2.5 Power and Water

On-site diesel generators will be used for power generation during construction of all surface activities and operation of boreholes and SIS well sites. High-voltage connection to the electricity network on ML 6949 will provide power to the bleeder shaft site. Power required for the development of the proposed underground roadways and supporting activities will be sourced from the existing CCM underground power supply, which is sourced from the existing powerlines at CCM and connected underground via dedicated service boreholes.

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. Water required to support the proposed underground activities will be sourced in accordance with the existing CCM Water Management Plan.

Potential impacts associated with power and water requirements for the Project activities (**Section 3.0**) include the following:

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

6.9.2.6 Amenities

On-site amenities for workers will be located on the SIS 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. Potential impacts associated with these waste types includes the following:

- Potential contamination of land and water as a result of improper handling, treatment or disposal of sewage and greywater;
- Potential environmental pollution due to improper management of litter (i.e. domestic refuse such as paper, plastic and glass that is thrown, blown or left in the wrong place);
- Potential contamination of surface water and land resources, and increased risk of pests due to improper storage and disposal of organic waste; and
- Potential contamination due to accidental spillages, leakage of hazardous materials such as hydrocarbons fuels, oils, chemicals, detergents during maintenance activities and workshop operation.

A risk-based assessment of these potential impacts is detailed in **Table 6-31** and determined that waste impacts are low due to the scale and location of the Project activities.

For the remainder of proposed surface activities, existing facilities in ML 6949 will be available for use. For the proposed underground activities, existing approved CCM underground amenities will be used during construction and operation.

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, thus reducing the total volume of waste generated;
- *Waste reuse* – 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; and
- *Waste disposal* – all waste generated as part of the Project activities must be disposed of ensuring compliance with Queensland's environmental legislation, particularly the EP Act 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 of 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 minimise air and soil contamination;
- Minimise vegetation clearing to reduce green waste and decomposition, overburden, and emissions from equipment use;
- 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;
- Contain waste drilling fluids from drilling activities in properly lined storage tanks before re-use, recycling, treatment, or disposal; and
- 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 6-31**.

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

Table 6-31 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 from 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 (i.e. domestic refuse such as paper, plastic and glass that is thrown, blown or left in the wrong place)	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 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, the small staff complement will result in small scale waste generating which will pose low environmental risk.

7.0 Conclusion

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

- EA P-EA-100658735:
  - Inclusion of an additional ERA;
  - Inclusion of a new condition in Schedule A;
  - Modification of Condition 15 Schedule A;
  - Condition 7 Schedule F;
  - Condition 22 Schedule F;
- PRCP P-PRCP-100669070_V3:
  - Section B – Figure 1 and Figure 2;
  - Section C – (RA1) Rehabilitation area 1; and
  - Section C – Rehabilitation area milestones.

Assessments for groundwater, surface water, terrestrial ecology, aquatic ecology, air quality, greenhouse gas, noise and vibration, and waste management impacts resulting from the Project activities are presented in the supporting report. 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 to medium risk of causing environmental harm/nuisance beyond that authorised by the EA for most EVs. Significant to high risks for the Project include risks to terrestrial ecology relating to vegetation clearing and habitat removal, and fauna injury and mortality.

Given the scale and location, the Project activities can be largely 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 EVs from the Project.

Additional mitigation and management measures have been presented in this Supporting Report to further reduce the extent of impact. In particular, the Project will aim to avoid impacts to MSES for terrestrial and aquatic ecology where possible, particularly large and intact areas supporting or potentially supporting conservation significant species.

Despite the implementation of mitigation and management measures, the Project has the potential to result in a significant residual impact to two MSES – regulated vegetation (RE 11.8.11) and koala habitat. Suitable offsets, as required under the Queensland environmental offset framework, are expected to be conditioned as part of approvals for the Project. Peabody's preferred offset mechanism are financial offsets due to the relatively small area of impact to regulated vegetation and koala habitat in this landscape context, whereby it is predicted that very large tracts of intact vegetation are required to support relatively low densities of koalas in this region.

For the remaining MSES identified or considered to potentially occur in the Study Area, the Project is considered unlikely to cause significant residual impact due to the relatively small scale of clearing, the extent of habitat remaining elsewhere in the region, and/or the lack of ecologically significant locations.

An ALD was received from DETSI on 17 November 2024, which considered that the proposed amendments to the EA and PRCP schedule is a major amendment.

8.0 References

Australasian Groundwater & Environmental Consultants Pty Ltd (AGE). 2012. Wards Well Environmental Impact Study: Groundwater Assessment (DRAFT). Prepared for Sinclair Knight Merz. Project No. G1421/A, April 2012.

ANZG. 2018. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. In Australian and New Zealand Governments and Australian state and territory governments, Canberra ACT, Australia. www.waterquality.gov.au/anz-guidelines

BHP. 2021. Progressive Rehabilitation and Closure Plan.

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.

British Standard Institution (BSI). 2009. 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”.

British Standard Institution (BSI). 2014. British Standard BS 5228-2:2009, Evaluation and measurement for vibration in buildings - Part 2, 2014 Amendment.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2022. National Recovery Plan for the Australian Painted Snipe (Rostratula australis). Commonwealth of Australia. https://www.dcceew.gov.au/sites/default/files/documents/national-recovery-plan-australian-painted-snipe-2022.pdf

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2024. National Greenhouse Accounts Factors.

Department of Climate Change, Energy, the Environment and Water (DCCEEW). 2025. Quarterly Update of Australia’s National Greenhouse Gas Inventory: March 2025.

Department of Environment and Science (DES). 2018. Monitoring and Sampling Manual. Environmental Protection (Water) Policy 2009. Department of Environment and Science.

Department of the Environment, Tourism, Science and Innovation (DETSI). 2015. Major and Minor Amendment Guideline (ESR/2015/1684), last reviewed 11 July 2025, available at Approval processes for environmental authorities

Department of the Environment, Tourism, Science and Innovation (DETSI). 2011. Environmental Protection (Water) Policy 2009 Isaac River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Isaac River Sub-basin (including Connors River). State of Queensland (Department of Environment and Heritage Protection).

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, Mines and Energy (DNRME) and DES. 2024. Australian Soil Resource Information System.

Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD). 2025. Groundwater Database – Queensland. Available at http://qldspatial.information.qld.gov.au/catalogue/custom/search.page?q=%22Grou

Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (DNRMMRRD). 2025. Vegetation management regulated vegetation management map—Version 7.04. https://qldspatial.information.qld.gov.au/catalogue/custom/detail.page?fid={9CC053EC-585B-4C41-A713-E1D04543CCC2}

Doody, T. M., Hancock, P. J., & Pritchard, J. L. 2019. Information Guidelines explanatory note: Assessing groundwater-dependent ecosystems. Report Prepared for the Independent Expert Scientific Committee on Coal Seam Gas and Large Coal Mining Development through the Department of the Environment and Energy, Commonwealth of Australia.

Eamus, D., Froend, R., Loomes, R., Hose, G., & Murray, B. 2006. A functional methodology for determining the groundwater regime needed to maintain the health of groundwater-dependent vegetation. *Australian Journal of Botany*, *54*(2), 97.

Geoscience Australia. 2019. Australian Rainfall and Runoff Guidelines, available at ARR Guidelines - Australian Rainfall and Runoff (accessed 26/08/2025).

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.

Hydrobiology Pty Ltd (Hydrobiology). 2025. Centurion North Project, Aquatic MSES Assessment, October 2025, Document number B25239.

IECA. 2008. Best Practice guidelines.

Independent Expert Steering Committee. 2015. Monitoring and Management of Subsidence Induced by Longwall Coal Mining Activity. Report to the Department of the Environment.

Mining Safety and Health Advisory Committee. 2023. Risk Assessment Education Resource.

Neldner, V. J., Wilson, B. A., Dillewaard, H. A., Ryan, T. S., Butler, D. W., McDonald, W. J. F., Richter, D., Addicott, E. P., & Appelman, C. N. 2022. Methodology for survey and mapping of regional ecosystems and vegetation communities in Queensland v.6.0. Queensland Herbarium, Queensland Department of Environment and Science.

Queensland Herbarium. 2025. Regional Ecosystem Description Database. Version 13.1. Department of Environment, Science and Innovation.

Queensland Government. 2025. Water Monitoring Information Portal, available at https://water-monitoring.information.qld.gov.au/ (accessed 26/8/2025).

Queensland Government. 2013. Guidelines for Agricultural Land Evaluation in Queensland Second Edition.

Richardson, E, Irvine, E, Froend, R, Book, P, Barber, S & Bonneville, B. 2011. Australian groundwater dependent ecosystems toolbox part 1: assessment framework, National Water Commission, Canberra.

SCT Operations. 2025. Assessment of Subsidence Due to Development of First Workings in Initial Area at Centurion North Mine (No. NGY5910). SCT Operations PTY Limited.

SGM. 2024. Progressive Rehabilitation and Closure Plan - Centurion Mine. SGM Environmental Pty Limited.

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.

Silwa. 2011. Wards Well Overburden Model (ML 1790), Version: September 2011, report prepared by Integrated Geoscience Pty Ltd for BHP Mitsui Coal, 31 August 2011.

Wilford, John; Searle, Ross; Thomas, Mark; Pagendam, Dan; Grundy, Mike. 2016. A regolith depth map of the Australian continent. Geoderma. 2016; 266:1-13. https://doi.org/10.1016/j.geoderma.2015.11.033.

Appendix A Groundwater Assessment

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Appendix B Land Resources Assessment

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Appendix C Terrestrial Ecology Technical Report (Centurion Project – Assessment of Matters of State Environmental Significance)

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Appendix D Aquatic Ecology Technical Report (Aquatic MSES Assessment)

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Appendix E Greenhouse Gas Abatement Plan

Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026

Appendix F Noise and Vibration Impact Assessment

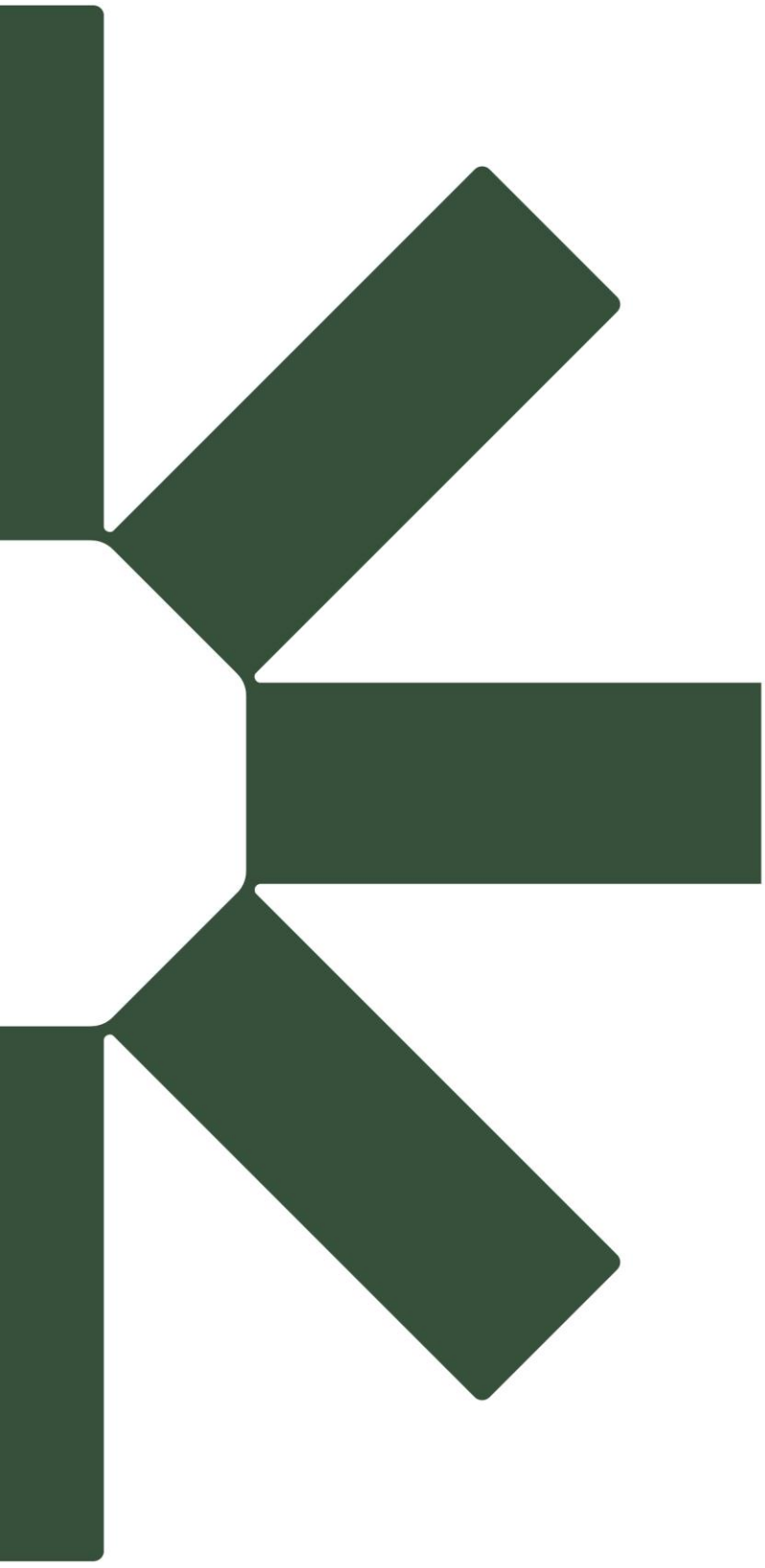
Centurion North Extension Project

P-EA-100658735 and P-PRCP-100669070_V3

Centurion Coal Mining Pty Ltd

SLR Project No.: 620.042575.00001

23 January 2026



Making Sustainability Happen