CHAPTER 7 – LAND

STANMORE ID EXTENSION PTY LTD
ISAAC DOWNS EXTENSION PROJECT

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7. LAND

7.1 Introduction

This chapter describes the existing values of the land that are relevant for the Isaac Downs Extension (IDE) Project (the Project) area and surrounding region. Potential impacts and the associated risks to these environmental values have been assessed. Strategies and management measures are presented to mitigate the potential impacts to these environmental values.

Information in this chapter is primarily based on the following technical studies:

- Materials Characterisation and Erosion Assessment for the Rehabilitated Landform (**Appendix D**) prepared by Landloch Pty Ltd (Landloch) -
- Soils Assessment (**Appendix E**) prepared by Landloch
- Geochemical Characterisation and Assessment – Mineral Waste (**Appendix F**) prepared by Terrenus Earth Sciences Pty Ltd
- Preliminary Contaminated Land Investigation (**Appendix G**) prepared by SGME Pty Limited (SGME)
- Geotechnical Assessment – Final Landform (**Appendix H**) prepared by Blackrock Mining Solutions Pty Ltd (Blackrock).

In addition, this chapter has been informed by data collected by Stanmore ID Extension Pty Ltd (the proponent), a subsidiary of Stanmore Resources Ltd (Stanmore), through geological investigations, detailed topographical assessments, and knowledge of the local area and surrounding region from Project studies and the continued operation of Isaac Plains Complex (IPC). The Project will be integrated into IPC, which comprises Isaac Plains Mine (IPM) and Isaac Downs Mine (IDM).

Overall site suitability and the location of Project activities are described in the context of land tenure, land use, land suitability, areas of regional interest and stock routes. Practical measures are identified to protect environmental values by achieving the identified environmental objectives and performance outcomes to ensure the Project operates in a sustainable manner.

The potential for the Project to result in impacts to land, air or waters is further assessed in the following chapters of the EIS:

- **Chapter 8 – Surface Water and Water Management**
- **Chapter 10 – Groundwater**
- **Chapter 15 – Air Quality**
- **Chapter 17 – Non-mining Waste.**

7.2 Regulatory Framework

The approvals process and the legislative and policy context for the Project and its activities are identified in **Chapter 2**. This chapter provides additional information on the legislative and policy context relevant to the management of the Project's environmental values, environmental objectives and performance outcomes.

7.2.1 Environmental Protection Act 1994

The *Environmental Protection Act 1994* (EP Act) uses specific mechanisms to achieve its objectives including:

- application of its subordinate legislation, the *Environmental Protection Regulation 2019* (EP Regulation), which identifies environmentally relevant activities (ERAs) that require approval (refer **Chapter 2**)
- notifiable activities set out in Schedule 2 of the EP Act (refer **Chapter 2**)
- Environmental Protection Policies (EPPs) for water, noise and air
- environmental authorities (EAs) setting out the conditions for approval of the Project
- duties of care associated with environmental harm.

Chapter 7, Part 8 of the EP Act contains the contaminated land provisions. These provisions adopt the concept of risk management through the development of two registers for the recording of contaminated land. Sites are recorded on the Environmental Management Register (EMR) or Contaminated Land Register (CLR) on the basis of risk assessment that shows a notifiable activity has been or is being conducted on the site (EMR) or the land has been contaminated by a hazardous contaminant (CLR).

Chapter 7, Part 1 of the EP Act addresses the potential for activities to result in environmental harm by imposing two main duties: the general environmental duty and the duty to notify. These duties are relevant to all persons undertaking notifiable activities or managing sites on the EMR or CLR.

Land contamination may result in serious or material environmental harm. Chapter 7, Part 1, Division 2 of the EP Act establishes a duty to notify of such harm.

The contaminated land provisions of the EP Act enable the preparation of site management plans (SMPs) for land on the EMR. In some cases, it is not necessary or practical to remove all the contamination from a site in order to prevent environmental harm and/or public health risks. In these circumstances, the administering authority can approve SMPs for land, which state how a site will be managed in order to prevent environmental harm or public health risks. Once approved, SMPs are recorded on the EMR and are provided with any related search of the register.

7.2.2 Environmentally Relevant Activities

Potential ERAs for the Project, to which a section of schedule 2 of the EP Act applies, and for which there is an aggregate environmental score prescribed in schedules 2 and 3 of the EP Regulation, are described in **Chapter 2**. The only relevant ERA identified for the Project is ERA 13 (particular resource activities) – mining black coal.

7.2.3 Notifiable Activities

Under Section 371 of the EP Act, an owner or occupier of land must notify the Department of Environment, Tourism and Innovation (DETSI) if a ‘notifiable activity’ is being carried out on the land. A list of notifiable activities is provided in Schedule 3 to the EP Act and includes activities such as storing mine wastes, mineral processing and fuel storage.

The effect of this notification is that information about the activity will be made publicly available on the EMR. Prior to approving the application for surrender of the EA, or certifying progressive rehabilitation, the administering authority must be satisfied that any land within the area subject to the Progressive Rehabilitation Report (PRR) or Final Rehabilitation Report (FRR), that is listed on the EMR because of the mining activity, has been satisfactorily rehabilitated, does not pose an unacceptable risk to human health or the environment, and if any portion of the land is to remain on the EMR, it possesses a suitable SMP.

Throughout the life of a mining project, the EA holder is required to notify the administering authority within the specified timeframe if a notifiable activity, listed in Schedule 3 of the EP Act, is being carried out on land within the mining tenement. The land is subsequently recorded on the EMR by the administering authority. See Section 7.4.6 for potential notifiable activities relevant for the Project.

7.2.4 National Environment Protection (Assessment of Site Contamination) Measure 1999

Contaminated land is managed in Queensland under the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, and the 2013 amendment[1].

7.2.5 Stock Route Management Act 2002

The *Stock Route Management Act 2002* (SRM Act) provides for the management of the stock route network in Queensland. A stock route is identified within the Project area.

7.2.6 Regional Planning Interests Act 2014

The *Regional Planning Interests Act 2014* (RPI Act) requires resource activities authorised under resource Acts and other regulated activities to align with the regional land use policies in regional plans and other applicable government policies.

The RPI Act introduces an assessment framework to manage the impact of resource activities on areas the State government has identified in the Act as an 'area of regional interest', which includes priority agricultural areas[2] (PAAs), priority living areas (PLAs), strategic environmental areas (SEAs) and strategic cropping areas (SCAs)[3].

Under the RPI Act, a resource activity, and other identified activities, cannot occur in these areas unless a regional interests development approval (RIDA) has been granted for the activity.

Based on the current government mapping of Queensland's areas of regional interest, the Project's mining lease application (MLA) 700081, MLA 700082, MLA 700083 and MLA 700084 are not within SCAs, SEAs, PAAs or PLAs, and in addition, there are no priority agricultural land uses applicable to the Project area. Therefore, the requirements of the RPI Act do not apply to the Project.

7.2.7 Soil Conservation Act 1986

The *Soil Conservation Act 1986* (SC Act) regulates the conservation of soil resources and facilitates the implementation of soil conservation measures by landholders for the mitigation of soil erosion. On areas subject to an approved project plan or property plan, persons can be required to undertake, construct and maintain soil conservation measures.

The MLAs do not overlay any project plan or property plan under the SC Act. Therefore, the requirements of the SC Act do not apply to the Project.

7.2.8 Local and Regional Plans

7.2.8.1 Isaac Regional Council Planning Scheme

The Project area (i.e. the four Project MLAs) is located within the Isaac Regional Council (IRC) local government area (LGA). Relevant activities within the IRC LGA are subject to the Isaac Region Planning Scheme 2021 (Planning Scheme), which was adopted by IRC on 24 February 2021 and came into effect on 1 April 2021. The current version of the Planning Scheme is Version 1.1 which came into effect on 1 July 2024[4]. IRC's Planning Scheme helps manage growth, plan for a sustainable future and guide the way land is used and developed in the Isaac Region.

[1] https://www.nepc.gov.au/nepms/assessment-site-contamination

[2] Note: Each PAA is a strategic area identified by the government as containing significant clusters of what are considered to be Priority Agricultural Land Uses (PALUs)—high value, intensive agricultural land uses.

[3] Note: Land mapped as SCL anywhere in Queensland when the SCL Act was repealed became an 'area of regional interest'. This applied regardless of whether a regional plan exists for the area. A RIDA is required to operate in areas of regional interest, including strategic cropping areas (SCAs).

[4] https://www.isaac.qld.gov.au/Residents/Planning-and-Development/Planning-Scheme

The Planning Scheme is a living and evolving document that provides a set of rules and guidelines that regulate how land in specific areas can be used and developed and is designed to shape future land use development decisions and address other matters related to land use and development within the Isaac region.

Activities that occur on a ML are not subject to the provisions of the Planning Scheme. The Project does not propose off tenement activities that would require approval under IRC's Planning Scheme.

7.2.8.2 Mackay, Isaac and Whitsunday Regional Plan

Queensland's regional plans are long-term, strategic documents that guide land use and infrastructure planning across its unique regions, balancing economic, social, and environmental factors. Each regional plan identifies the regional framework and desired regional outcomes for the region and takes precedence over all planning instruments and provides context for local level planning. The regional plan provides strategies to inform future decision making, which aim to address regional economic, social and environmental issues; identify strategic infrastructure and service needs and priorities; support economic prosperity and employment opportunities; highlight and respond to climate change concerns; recognise environmental values; support consolidated growth within established regional centres and townships; focus public, private and community sector responses to key regional issues; and align efforts across agencies and all levels of government (DLGP 2012).

The Project is located within the Mackay, Isaac and Whitsunday Regional Plan (MIWRP), and as a result, is located within the regional landscape and rural production area land use category as defined by the MIWRP. The regional landscape and rural production area includes land with significant biodiversity values, good quality agricultural land (GQAL, now referred to as agricultural land classes (ALC)), cultural and landscape heritage values, extractive resources of economic significance (e.g. mining), water catchments, native forests, coastal wetlands, land unsuitable for urban / rural residential purposes and rural towns and associated activities.

The MIWRP identifies coal mining as the major industry in the region and the largest employer.

7.2.9 Environmental Objectives and Performance Outcomes

The environmental objectives and performance outcomes, based on the EP Regulation and terms of reference for the Project's EIS, that are relevant to the land assessment, are provided in Table 7-1. A corresponding EIS section reference is provided in the table demonstrating how the Project meets these environmental objectives and performance outcomes for land.

Table 7-1 Environmental Objectives and Performance Outcomes – Land

Requirement	Environmental Objectives and Performance Outcomes	EIS Reference
EP Regulations Terms of Reference	The activity is operated in a way that protects the environmental values of land, including soils, subsoils, landforms and associated flora and fauna.	7.3.12, 7.3.18, 7.3.19, 7.3.22, 7.4.3, 7.4.4, 7.4.7, 7.4.9, 7.4.6, 7.4.10, 7.5 11.6, 11.6, 11.7
Performance Outcomes		
1 There is no actual or potential disturbance or adverse effect to the environmental values of land as part of carrying out the activity.		Not applicable

2 All of the following apply— (a) activities that disturb land, soils, subsoils, landforms and associated flora and fauna will be managed in a way that prevents or minimises adverse effects on the environmental values of land;		7.3.18, 7.3.19, 7.3.22, 7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.5 11.6, 11.7
(b) areas disturbed will be rehabilitated or restored to achieve sites— (i) that are safe and stable; and (ii) where no environmental harm is being caused by anything on or in the land; and (iii) that are able to sustain an appropriate land use after rehabilitation or restoration;		Not applicable as the application is accompanied by a proposed PRCP schedule (EP Regulation Part 2 2(1A))
(c) the activity will be managed to prevent or minimise adverse effects on the environmental values of land due to unplanned releases or discharges, including spills and leaks of contaminants;		7.3.12, 7.3.13, 7.3.14, 7.3.21, 7.3.22, 7.4.3, 7.4.6, 7.4.7, 7.5 8.4.3.6, 8.6.7, 8.7.2.1, 8.7.6 17.5.4, 17.5.6, 17.5.7, 17.6, 17.7.1, 17.9
(d) the application of water or waste to the land is sustainable and is managed to prevent or minimise adverse effects on the composition or structure of soils and subsoils.		7.3.22, 7.4.3, 7.4.6, 7.4.7, 7.5 8.4, 8.6, 8.7.6 17.5, 17.6, 17.9
Requirement	**Environmental Objective**	**EIS Reference**
EP Regulations Terms of Reference	The choice of the site, at which the activity is to be carried out, avoids or minimises serious environmental harm on areas of high conservation value and special significance and sensitive land uses at adjacent places.	7.3.2, 7.3.3, 7.3.10, 7.3.11, 7.3.15, 7.3.16, 7.3.17, 7.5 11.6, 11.7, 11.7.2, 11.7.3 12.5, 12.7
Performance Outcomes		
1 Both of the following apply— (a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;		11.6, 11.7, 11.7.2, 11.7.3 12.5, 12.7
(b) the activity does not have an adverse effect beyond the site.		11.5, 11.6, 11.7 12.5

2 Both of the following apply— (a) areas of high conservation value and special significance likely to be affected by the proposal are identified and evaluated and any adverse effects on the areas are minimised, including any edge effects on the areas;		11.6, 11.7, 11.7.2, 11.7.3 12.5, 12.7
(b) critical design requirements will prevent emissions having an irreversible or widespread impact on adjacent areas.		11.5.3.3, 11.5.3.8, 11.5.3.9, 11.5.3.10 12.5.5, 12.5.8
Requirement	**Environmental Objective**	**EIS Reference**
EP Regulations Terms of Reference	The location for the activity on a site protects all environmental values relevant to adjacent sensitive uses.	7.3.2, 7.3.3, 7.3.10, 7.3.11, 7.3.15, 7.3.16, 7.3.17, 7.5 11.6, 11.7 12.5
Performance Outcomes		
1 The location for the activity means there will be no adverse effect on any environmental values.		Not applicable
2 Both of the following apply— (a) the activity, and components of the activity, are carried out on the site in a way that prevents or minimises adverse effects on the use of surrounding land and allows for effective management of the environmental impacts of the activity;		7.3.12, 7.3.18, 7.3.19, 7.3.22, 7.4.3, 7.4.4, 7.4.7, 7.4.9, 7.4.6, 7.4.10, 7.5 11.6, 11.7 12.5
(b) areas used for storing environmentally hazardous materials in bulk are located taking into consideration the likelihood of flooding.		7.4.3, 7.5 9.4, 9.9.2.1 17.10
Requirement	**Environmental Objective**	**EIS Reference**
EP Regulations Terms of Reference	The design of the facility permits the operation of the site, at which the activity is to be carried out, in accordance with best practice environmental management.	7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.4.8, 7.5
Performance Outcomes		
1 The activity does not involve the storage, production, treatment or release of hazardous contaminants, or involve a regulated structure.		Not applicable
2 All of the following apply— (a) all storage provided for hazardous contaminants includes secondary containment to prevent or minimise releases to the environment from spillage or leaks;		17.5, 17.7, 17.7.1, 17.9, 17.10

(c) containers are provided for the storage of hazardous contaminants that are secured to prevent the removal of the containers from the site by a flood event;		17.10
(d) the design of the facility prevents or minimises the production of hazardous contaminants and waste;		7.3.21, 7.3.22, 7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.5 17.5, 17.7, 17.10
(e) if the production of hazardous contaminants and waste is not prevented or minimised under paragraph (d)—the design of the facility contains and treats hazardous contaminants rather than releasing them.		7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.5 17.9, 17.10
Requirement	**Environmental Objective**	**EIS Reference**
EP Regulations Terms of Reference	Any waste generated, transported, or received as part of carrying out the activity is managed in a way that protects all environmental values	7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.5 17.5, 17.9, 17.10
Performance Outcomes		
1 Both of the following apply— (a) waste generated, transported or received is managed in accordance with the waste and resource management hierarchy under the Waste Reduction and Recycling Act 2011;		17.5, 17.9, 17.10
(b) if waste is disposed of, it is disposed of in a way that prevents or minimises adverse effects on environmental values.		7.4.3, 7.4.4, 7.4.6, 7.4.7, 7.5 17.5, 17.9, 17.10

7.2.10 EIS Information Guidelines

7.2.10.1 EIS Information Guideline – Land

The EIS assessment has been undertaken in accordance with the 'EIS information guideline – Land (DETSI, 2026)'. The relevant EIS sections where the requirements of this guideline have been addressed are provided in Table 7-2.

Table 7-2 EIS Information Guideline – Land

Guideline Requirement	Section of the EIS
Topography	7.3.1, 7.5.1
Land uses, including property ownership, native title / indigenous land use agreements, areas of regional interest, stock routes, protected areas	7.3.3, 7.3.5, 7.3.6, 7.3.7, 7.3.8, 7.4.1, 7.4.2, 7.5.1, 7.5.2
Infrastructure and easement	7.3.10, 7.4.5
Geology	7.3.11
Geomorphology	9.5, 9.6, 9.9.4
Mineral resources, ore reserves, petroleum and energy resources, and GHG storage resources	7.3.15, 7.3.16

Guideline Requirement	Section of the EIS
Resource utilisation	7.4.8
Soils	7.3.18, 7.4.7, 7.5.5
Land evaluation	7.3.19, 7.4.2, 7.5.2
Contaminated land	7.3.22, 7.4.6, 7.5.6
Landscape character	7.3.23.1, 7.4.9.1
Visual amenity	7.3.23.2, 7.4.9.2, 7.5.7
Lighting	7.3.24, 7.4.10, 7.5.8

7.2.10.2 Quarry Material—EIS Information

The Project does not propose the extraction of quarry material that is not material associated with the proposed mining activities. The EIS assessment has been undertaken in accordance with the 'Quarry material—EIS information guideline (DESI, 2024a)'. The relevant EIS section where the requirements of this guideline have been addressed are provided in Sections 7.3.2.2 and 7.3.8.

7.2.10.3 DPI Environmental Impact Assessment Companion Guide

The EIS assessment has been undertaken in accordance with the 'DPI environmental impact assessment companion guide (Department of Agriculture, Fisheries and Forestry, August 2014)[5]'. The relevant sections of the EIS where the requirements of this guide have been addressed are provided in Table 7-3.

Table 7-3 DPI Environmental Impact Assessment Companion Guide

Guideline Requirement	Section of the EIS
Agriculture – land use, agricultural land classification	7.3.3, 7.3.19, 7.3.20, 7.4.2, 7.5.2
Strategic cropping areas and priority agricultural areas	Not applicable to the Project (7.2.6)
Waterway barrier works	Section 12.4 of **Chapter 12**
Quarry resources	7.3.2.2, 7.3.8
Biosecurity, weeds and pests	Sections 11.4.3 and 11.5.3 of **Chapter 11**, Section 12.4 of **Chapter 12**

7.2.10.4 RPI Act Statutory Guideline 11/16 Companion Guide

As advised in Section 7.2.6, the RPI Act does not apply to the Project. Therefore, the requirements of 'RPI Act Statutory Guideline 11/16 Companion Guide' (DSDMIP, 2019) are not relevant to the Project.

7.2.10.5 Contaminated land—EIS Information Guideline

The EIS assessment has been undertaken in accordance with the 'Contaminated land—EIS Information Guideline' (DESI, 2024b). The relevant EIS section where the requirements of this guideline have been addressed are provided in Sections 7.3.22, 7.4.6 and 7.5.6.

[5] This guideline is no longer publicly available. DPI is currently in the process of drafting an updated version.

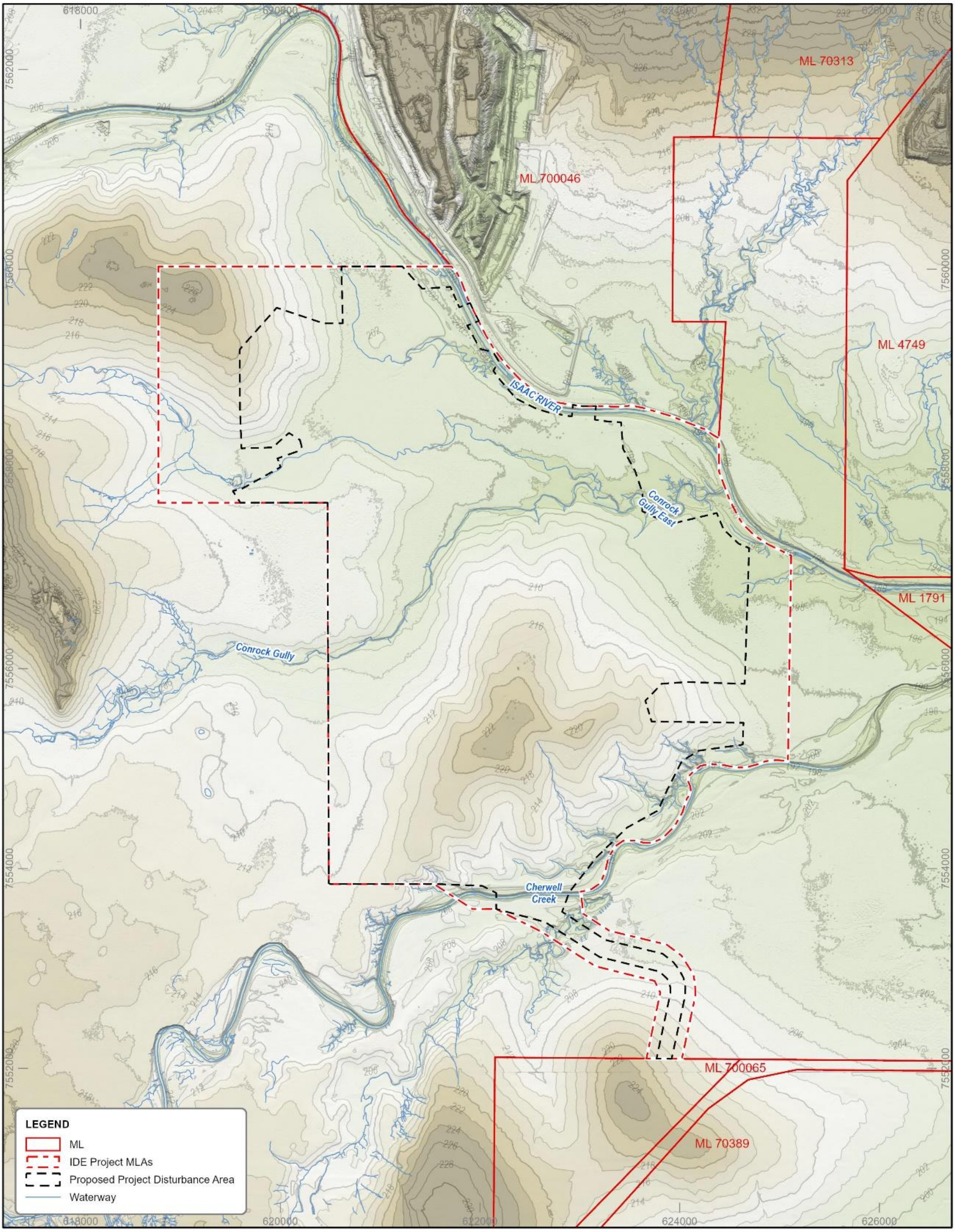
7.3 Existing Environment

7.3.1 Topography

Figure 7-1 shows the topography within and surrounding the Project area. Generally, the topography is relatively flat and falls towards the Isaac River and Cherwell Creek from the centre of the Project area. Elevation ranges between approximately 230 m AHD on a rise to the north of Cherwell Creek and 190 m AHD along the Isaac River.

Two dominant rises overlying residual Tertiary deposits are locate within the Project area, which comprise the rise to the north of Cherwell Creek and a rise towards the northwest. Quaternary alluvial deposits form a flat plain along the eastern boundary of the Project area. The Isaac River forms the eastern boundary, and Cherwell Creek forms the majority of the southern boundary. South of Cherwell Creek the topography consists of a flat plain and a gentle rise of basalt colluvium.

The Isaac River and Cherwell Creek are significant topographical features within and surrounding the Project area and are major drainage components of the Isaac River sub-basin within the greater Fitzroy River basin of Central Queensland. Further details on the Isaac River, Cherwell Creek and smaller drainage features are described in Section 8.3 of **Chapter 8**.



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Topography

Figure | 7-1

7.3.2 Cadastral and Zoning Attributes

7.3.2.1 Cadastral Features

Table 7-4 describes the property boundaries within the Project's MLAs and Figure 7-2 displays the property boundaries within and adjoining the Project's MLAs (i.e. the Project area). The Project area is largely located on Winchester Downs station (Lot 8 SP277834), overlaps a State Reserve (Lot 9 GV33) and a local road used to access Winchester Downs station, and is bounded by the Isaac River and Cherwell Creek.

The State Reserve, Lot 9 GV33, is a nominated stock route for the purpose of 'camping, water and road' and is leased by the private owner of Winchester Downs for grazing activities. This stock route is disconnected from other stock routes in the region.

No easements are located within the Project's MLAs. The Isaac River and Cherwell Creek are boundary watercourses in the Project area.

Table 7-4 Properties within the Project Area

Lot on Plan Description	Tenure	Owner
8 SP277384 (Winchester Downs)	Freehold	Private landowner
9 GV33	Reserve, with purpose of 'camping, water and road' as a stock route	State Owned
B GV33 (on Lot 9 GV33)	Lands Lease	Lease held by the owner of Lot 8 SP277384 (Winchester Downs) for grazing purposes
A GV33 (on Lot 9 GV33)	Permit to occupy	Permit to occupy held by trustees of estate for former owner of Lot 8 SP277384 (Winchester Downs) for grazing purposes
Isaac River	Boundary watercourse	State Owned
Cherwell Creek	Boundary watercourse	State Owned
Road	Local road (segment 37555066), for access to parts of Winchester Downs	State Owned (Managed by IRC)

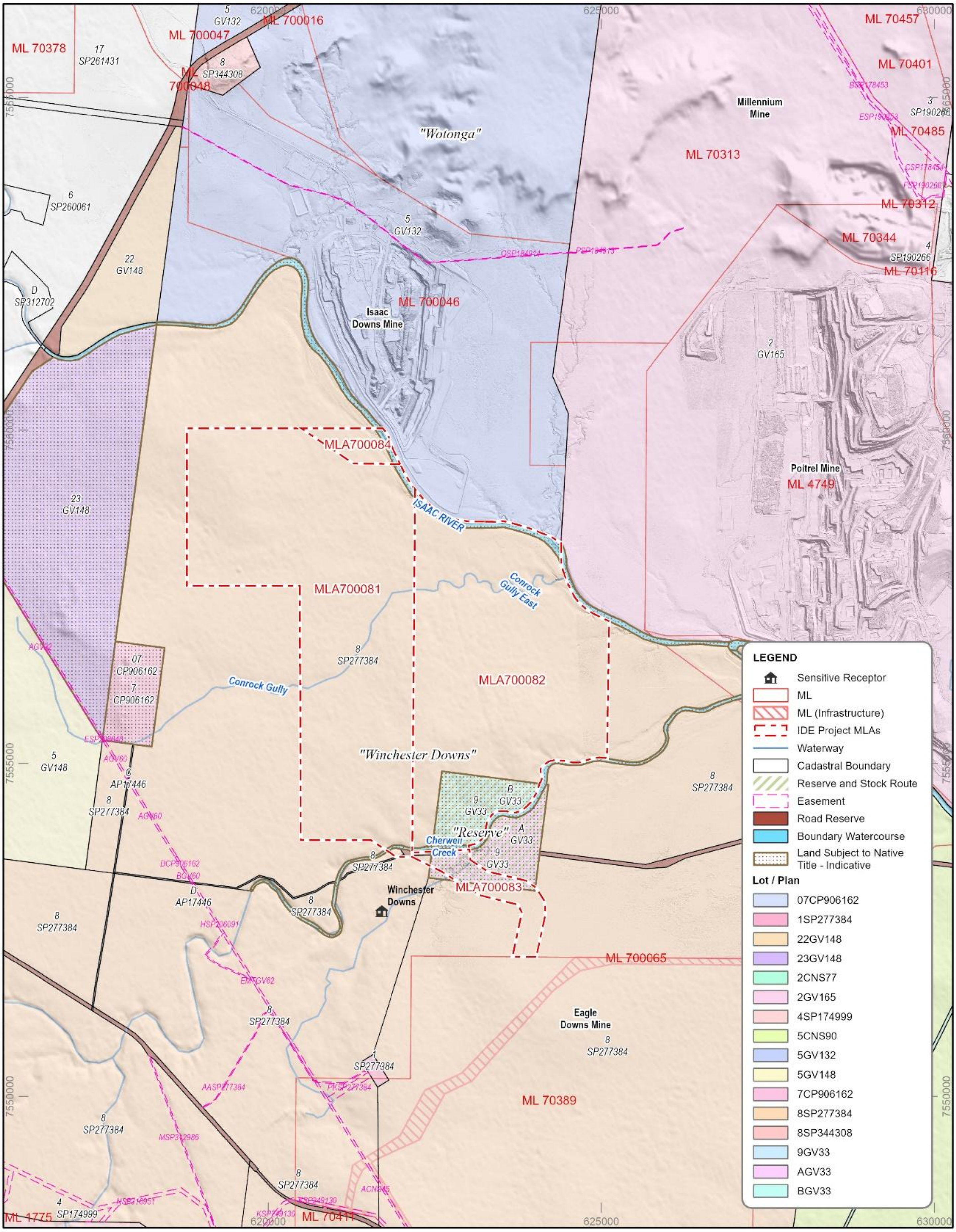
7.3.2.2 Zoning

As identified in Section 7.2.8.1, the Project is located within the IRC Planning Scheme, and as a result, the majority of the Project area and its surrounds are zoned as 'rural', with the exception of the State Reserve, which is zoned as 'community facilities'.

As the Project will be approved and developed under the *Mineral Resources Act 1989* (MR Act), it is exempt from the *Planning Act 2016* (Planning Act), and therefore, the IRC Planning Scheme.

Currently, the Project does not require any specific off site infrastructure, if circumstances change in the future and off site infrastructure is required, the proponent will seek the appropriate approvals under the Planning Act and IRC Planning Scheme, as relevant.

No 'Key Resource Areas' overlay the Project area. As described in Section 7.3.8, a 'Key Resource Processing Area' is located to the west of the Project, which is in accordance with the IRC Planning Scheme.



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Properties and Sensitive Receptors

Figure | 7-2

7.3.3 Land Uses

7.3.3.1 Overview

The properties within the Project area are utilised for cattle grazing and include:

- the Winchester Downs property (Lot 8 SP277834)
- the State Reserve (Lot 9 GV33) which is leased to the owner of Winchester Downs property
- Isaac River and Cherwell Creek boundary watercourses (see Figure 7-2).

In the vicinity of the Project, coal mining and pastoral activities (grazing on native or modified pastures) are the predominant land uses. The Project's planned coal mining activities are consistent and compatible with the surrounding land uses. An operational quarry reserve (Lot 7 CP906162 and Lot 23 GV148), known as Coolibah Quarry, is located approximately 2-3 km to the west of the Project area.

The current pastoral activities on the land will likely continue until the Project's land is required for the planned mining operations. If the Project's safety requirements can be satisfied, non-operational (buffer) land within the Project area may continue to be used for pastoral activities over the life of the Project.

7.3.3.2 Agricultural Land Use Assessment

Catchment-scale land use mapping sourced through the Australian Collaborative Land Use Management Program provides land use mapping for Australia at 1:250,000 scale with a cell grid size of approximately 6 ha (ABARES, 2023). This mapping was utilised to assess current land uses within the Project's soil study area, which includes the Project area and an area surrounding the Project area (Section 7.3.18.1). The Project's soil study area lies within the Great Barrier Reef Catchment area and within two sub-catchment areas (sc00113 and sc012), which totals an approximate area of 855,000 ha combined.

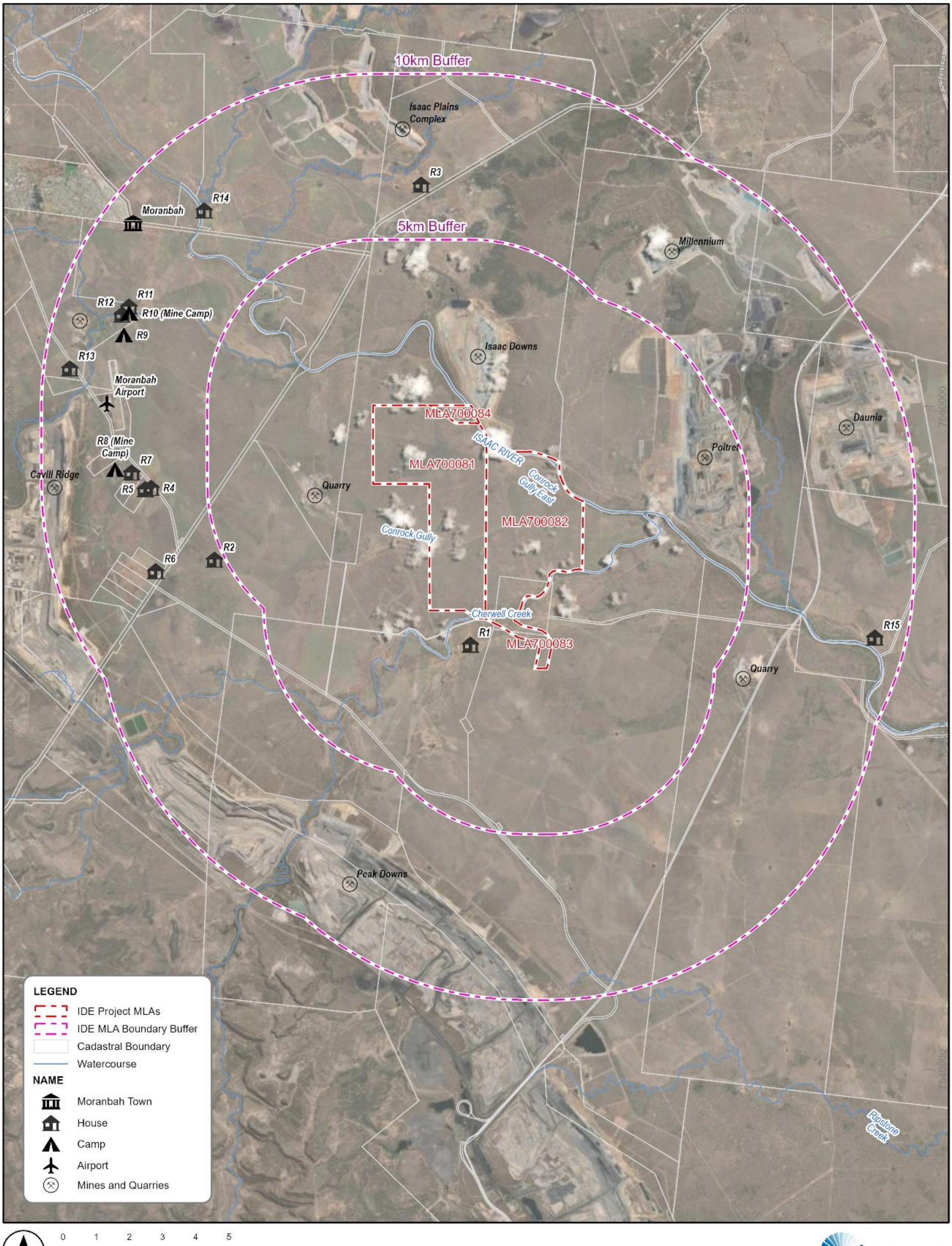
ABARES (2023) identified the current land uses within the Project's soil study area as grazing on native pastures, grazing on modified pastures and other minimal land uses (e.g. environmental). Grazing on native pastures accounts for approximately 44%, and grazing on modified pastures accounts for approximately 50%, of the mapped land use within the Project's soil study area. The other minimal land uses account for approximately 5% of the Project's soil study area and the remaining 1% is mapped as water bodies (e.g. rivers, dams and creeks).

Within the two sub-catchment areas (sc00113 and sc012), the Project's soil study area accounts for approximately 0.4% of the total grazing on native pastures and approximately 0.5% of the total grazing on modified pastures land use areas. Section 3.8 of **Appendix E** provides additional detail on the existing land uses.

7.3.4 Sensitive Receptors

Figure 7-3 shows the sensitive receptor sites within approximately 10 km of the Project's boundaries. Winchester Downs Homestead is the only sensitive receptor site (R1) in close proximity (< 2 km) to the Project's planned mining operations.

Chapter 16 and **Chapter 15,** respectively describe how identified noise and vibration and air quality impacts from mining operations at Winchester Downs Homestead will be mitigated and managed over the life of the Project. In addition, under the MR Act, the proponent will enter into a legally binding 'compensation agreement' with the owner of the Winchester Downs property to facilitate access to the property for the purpose of mining and to address other related factors that will occur because of the Project's planned mining activities (e.g. loss of amenity).



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Sensitive Receptors

Figure | 7-3

7.3.5 Native Title

The Barada Barna Aboriginal Corporation (BBAC) represents the Barada Barna People and is the registered native title holder for the land determined to possess native title within and in the vicinity of the Project. The BBAC's Native Title Tribunal file number on the National Native Title Register is 'QCD2016/007 - Barada Barna People'[6]. This reference provides the full details of the BBAC's registered native title claim on the National Native Title Register.

Where a mining tenement is to be granted over land where native title has not been extinguished, the requirements of the *Native Title Act 1993* (NT Act) must be complied with before the relevant tenure can be granted. Figure 7-4 shows where the Department of Natural Resources, Mines, Manufacturing and Regional and Rural Development (DNRMMRRD)'s mapping indicates native title is not extinguished. In summary, native title exists over areas of the Isaac River, Cherwell Creek and within the stock reserve (Lot 9 GV33) located in the southwest of the Project area.

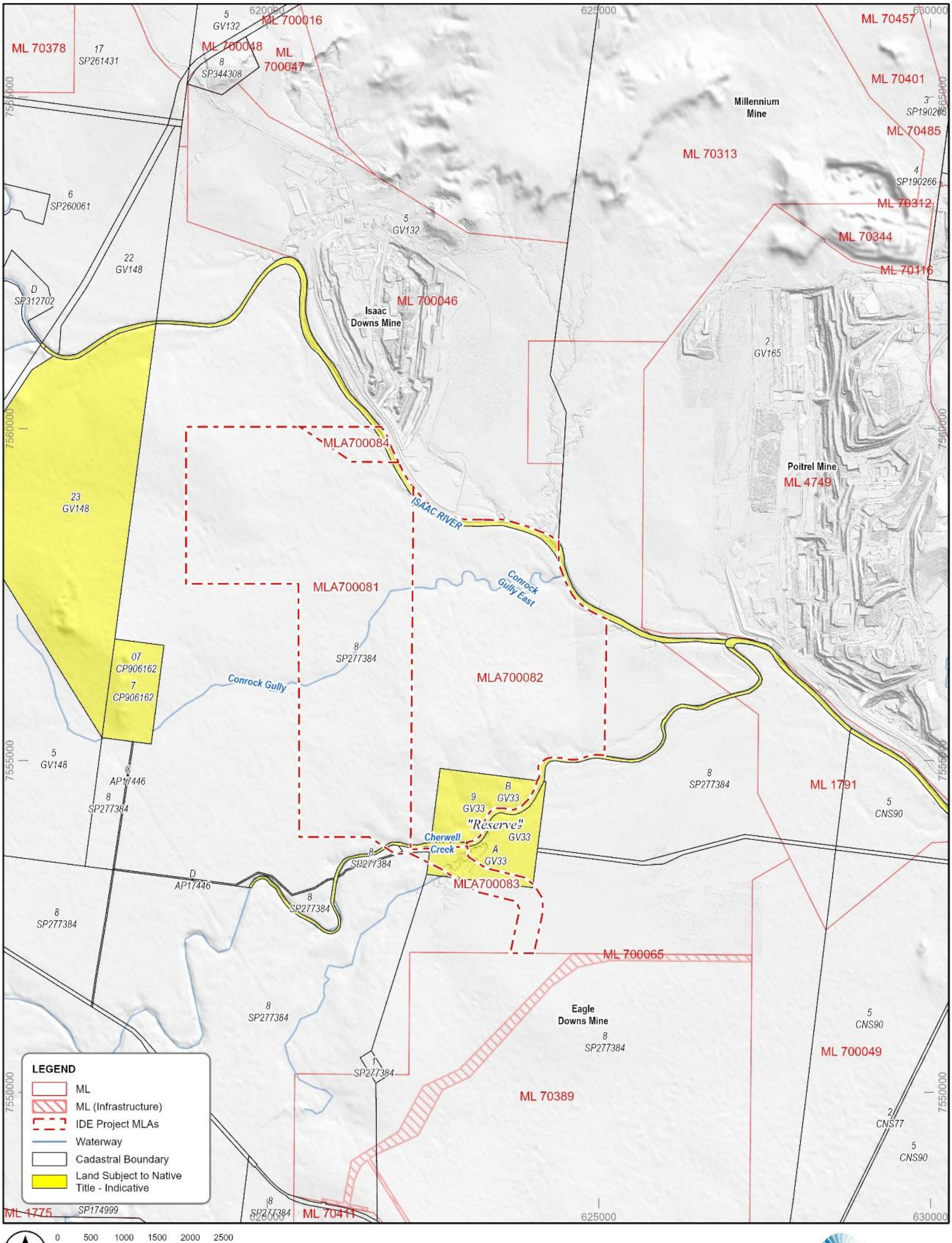
Prior to grant of the Project's mining leases, the proponent will enter into a Native Title agreement with the BBAC. The 'Right to Negotiate' process under section 29 of the NT Act, for the Project MLAs, was commenced mid-October 2025, as described in **Chapter 2**.

There are five Indigenous Land Use Agreements (ILUAs) which overlap the Project area, associated with parties and projects unrelated to the proponent or Stanmore, namely:

- Arrow and Barada Barna People LNG Project ILUA
- QGC and Barada Barna ILUA
- Barada Barna People and Local Government ILUA
- Barada Barna and Ergon Energy ILUA
- Connors River Dam and Pipelines Project ILUA.

Indigenous cultural heritage of the Project area, and management of cultural heritage, is described in **Chapter 20**.

[6] https://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/NNTR_details.aspx?NNTT_Fileno=QCD2016/007



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ISAAC DOWNS EXTENSION

Native Title

Figure | 7-4

7.3.6 Areas of Regional Interest

There are no areas of regional interest (i.e. SCAs, SEAs, PAAs or PLAs) within or in close proximity (<3 km) to the Project's MLAs.

The nearest area of regional interest is a SCA located approximately 5 km to the west of the Project. This SCA (Central Highlands Isaac) is a small, isolated area within the greater Western Cropping area (DoR, 2024). The Project will not impact agricultural operations within this SCA.

7.3.7 Stock Routes

As identified in Section7.3.2, the State Reserve, Lot 9 GV33, is a nominated stock route for the purpose of 'camping, water and road' and is leased by the private owner of Winchester Downs for grazing activities.

7.3.8 Protected Areas

Protected areas of Queensland represent those areas protected for the conservation of natural and cultural values and those areas managed for production of forest resources, including timber and quarry material.

The operational quarry reserve (Lot 7 CP906162 and Lot 23 GV148) identified in Section7.3.3, located to the west of the Project, is defined as a 'Key Resource Process Area' (Moranbah South[7])' under the IRC Planning Scheme, and therefore, would be considered a protected area for the purpose of extracting quarry material for construction purposes.

The closest protected area possessing natural and cultural values is Dipperu National Park, which is approximately 45 km northeast of the Project area.

The Project will not impact any protected areas.

7.3.9 Overlapping Tenements

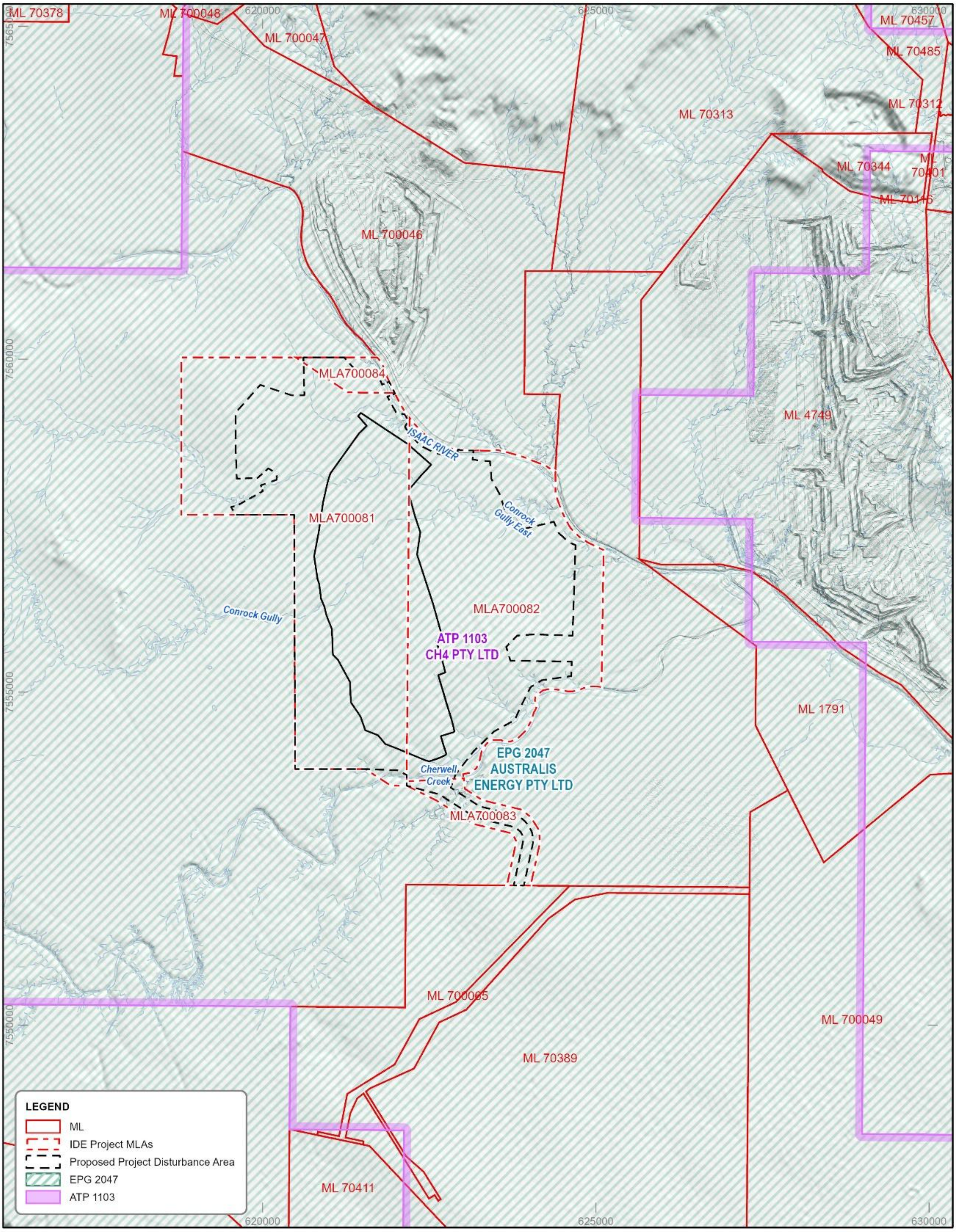
Figure 7-5 shows non-coal tenements overlapping the Project's MLAs, which comprise exploration tenements only (i.e. no production tenements):

- Authority to Prospect (ATP) 1103 – CH4 Pty Ltd (a subsidiary of Arrow Energy)
- Exploration Permit for Geothermal Application (EPGA) 2047 – Australis Energy Pty Ltd.

There are no petroleum leases or other resource production tenures that overlap with the Project's MLAs. The proponent has engaged, and will continue to engage, with the overlapping tenement holders in accordance with the applicable legislation for the management of overlapping tenements.

Further information on the status of the Project's overlapping non-coal tenements is provided in Section 7.3.17.

[7] https://www.planning.qld.gov.au/__data/assets/pdf_file/0030/94494/key-resource-area-reports-and-maps-121-to-160.pdf



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ISAAC DOWNS EXTENSION

Overlapping Tenements

Figure | 7-5

7.3.10 Infrastructure

7.3.10.1 Existing Infrastructure

As described in Section 7.3.2, the Project area is mainly owned by Winchester Downs and is currently used for grazing purposes, and therefore, possesses minor grazing-related infrastructure, including landholder tracks, fencing, stock watering troughs, pipelines and water bores.

An external water supply pipeline for Olive Downs Mine is located within the State Reserve and local roads on the south side of Cherwell Creek (see Figure 7-2 for these cadastral boundaries). This pipeline crosses the Project area to the south of the planned mining area, which includes a minor portion of MLA 700081 and a west to east traversing of MLA 700083. The only Project infrastructure that would intersect the water supply pipeline is the secondary access road on ML 700083. The water supply pipeline connects Olive Downs Mine with a Sunwater pipeline located further to the west. The proponent will seek agreement with IRC and Pembroke Resources (owners of Olive Downs Mine) for the continued safe operation of the water supply pipeline.

The proponent is not aware of any other major infrastructure items that currently exist or are planned within the Project area, including high pressure gas lines, bulk water storage infrastructure (e.g. dams), other water pipelines and pump station facilities, State-controlled Road corridors, railway transport corridors, State development areas, major sub-stations or powerlines, airports (including its light restriction zone), residential areas (current or planned), transient accommodation facilities or other industrial facilities[8].

7.3.10.2 Existing Nearby Infrastructure

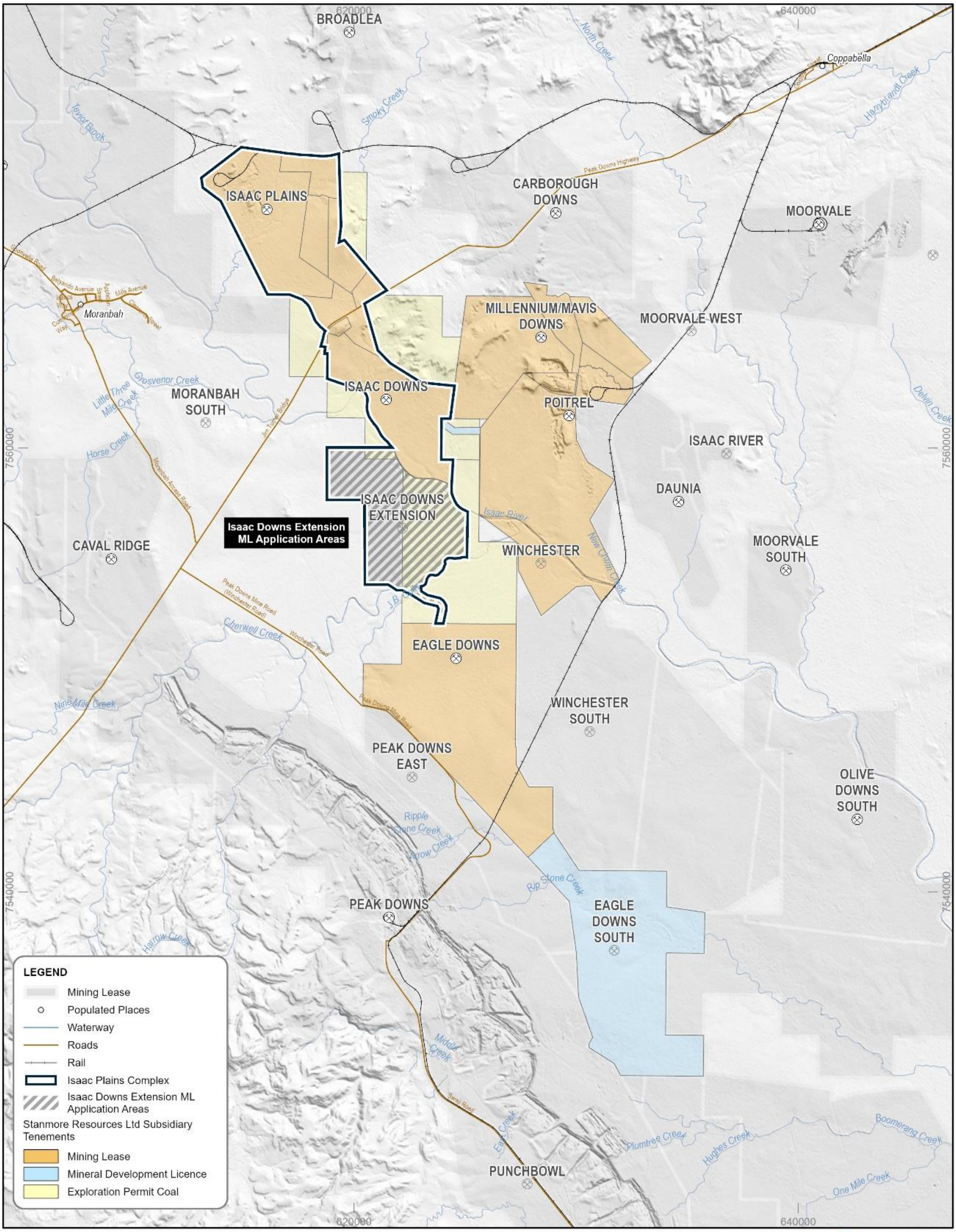
The Project is adjacent the IDM's current mining operations and infrastructure. The Project will directly adjoin IDM and will be integrated into IPC to:

- allow its run-of-mine (ROM) coal to be washed at the IPM coal handling and preparation plant (CHPP)
- allow coarse reject and tailings disposal using the IPM's existing mining dumps and voids approved for this purpose
- share the use of the mine industrial area (MIA) at IDM for machinery maintenance and other support services
- allow the continued use of IPM's rail loop and train loading facility
- allow the continued use of IDM's explosive magazine
- connect to supporting infrastructure, for example, IDM's and IPM's water management infrastructure for water supply and excess water control requirements, IDM's power supply, IPC's communication infrastructure, and IDM's and IPM's roads for primary site access, internal access and coal haulage purposes.

Figure 7-6 displays the Project's and IPC's location, inclusive of the Project being part of IPC. Section 4.6 of **Chapter 4** explains in greater detail how the Project will be integrated into IPC, and the environmental, sustainability and economic benefits of this integration. Poitrel Mine is also located nearby to the east of the Project and is owned by a subsidiary of Stanmore. However, its mining operations will not be directly linked to the Project's operation.

Other privately owned infrastructure adjacent the Project is the Winchester Downs Homestead and stockyards, an access road and a powerline to the homestead, and the adjacent external sections of the Olive Downs Mine's water supply pipeline (Section 7.3.10.1). Figure 7-3 shows the location of Winchester Downs Homestead in relation to the Project.

[8] https://www.isaac.qld.gov.au/Residents/Planning-and-Development/Planning-Scheme



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ISAAC DOWNS EXTENSION

Project Location

Figure | 7-6

7.3.11 Geology

7.3.11.1 Regional Geology

The Project's coal deposit is located in the northern part of the Permo-Triassic Bowen Basin containing principally fluvial and some marine sediments. The Bowen Basin is part of a connected group of Permo-Triassic basins in eastern Australia, which includes the Sydney and Gunnedah Basins. The Basins axis orientation is NNW-SSE roughly parallel to the Paleozoic continental margin. Tectonically, the basin can be divided into NNW-SSE trending platforms or shelves separated by sedimentary troughs. The units from west to east are the Springsure Shelf, Denison Trough, Collinsville Shelf/Comet Platform, Taroom Trough, Connors and Auburn Arches (interrupted by the Gogango Overfolded Zone) and the Marlborough Trough. Development of the basin in the Early Permian was in the form of half grabens which subsequently became areas of regional crustal sag. Variations in depositional patterns and deformation styles occur along strike suggest the possibility of NE trending deep seated crustal transfer faults referred to as a transfer corridor (JBMS, 2024).

The basin has suffered oriented NE-SW extensional and compressional events (JBMS, 2024). Structurally, the deposit lies on the western boundary of the deformed Nebo Synclinorium immediately west of a regional thrust fault system- the Isaac Thrust system. To the east and north (of the thrust) seams are repeated in the Winchester South deposit. Further to the west is the structurally simple Collinsville Shelf (JBMS, 2024).

The economic seams are contained in the Late Permian Rangal Coal Measures which are approximately 100 m thick. The Rangal Coal Measures are underlain by the Fort Cooper Coal Measures and overlain by the Late Permian to Early Triassic Rewan Group (JBMS, 2024). Figure 7-7 details the regional stratigraphy of the North Bowen Basin.

The Rangal Coal Measures comprise light grey, cross-bedded, fine to medium grained labile sandstones, grey siltstones, mudstones and coal seams. Cemented sections are common in the sandstones. The transition from the Rangal Coal Measures to the Rewan Formation is generally difficult to define and is often based on the change from the green-grey colour of the Rewan sandstones to the blue-grey colour of the Rangal sandstones. The transition between the formations is 15 to 60 m above the first major seam in the Rangal Coal Measures, the Leichhardt Seam (JBMS, 2024).

The Fort Cooper Coal Measures comprise typically tuffaceous sandstones, siltstones, mudstones and coal seams. The transition between the Rangal Coal Measures and the Fort Cooper Coal Measures is generally clearly marked by the Yarrabee Tuff - a basin-wide marker bed comprising a weak, cream to brown tuffaceous claystone (JBMS, 2024).

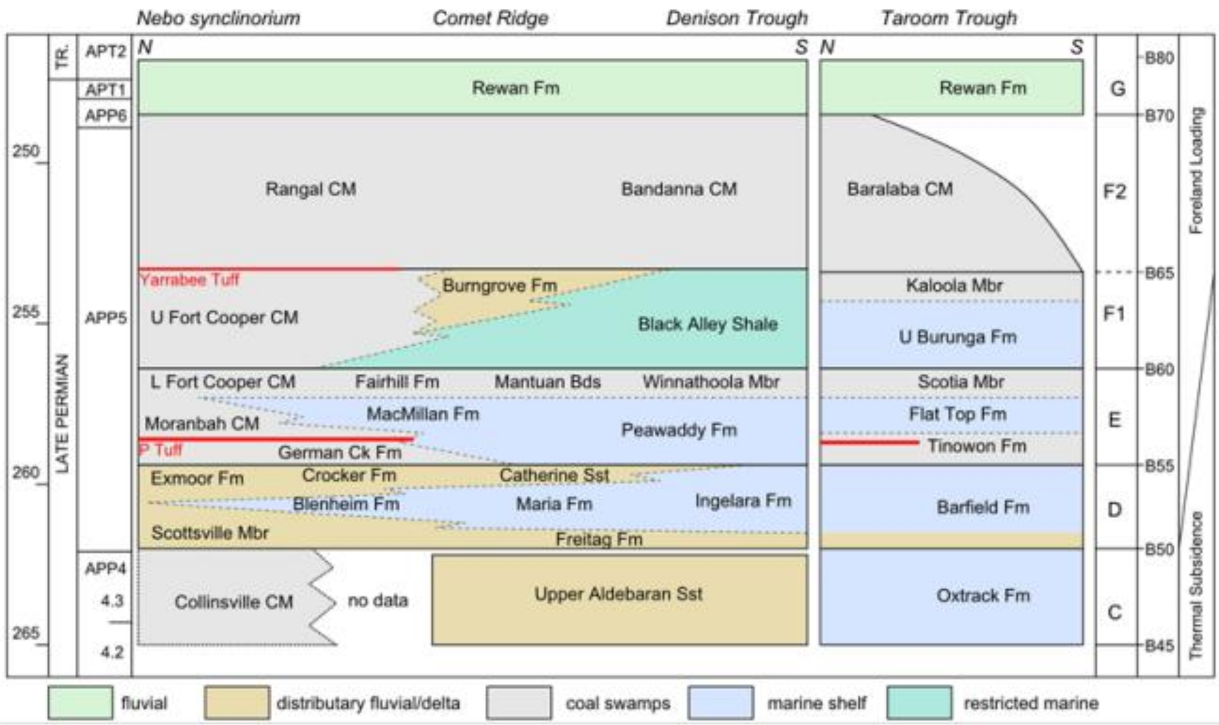


Figure 7-7 Regional Stratigraphy of the North Bowen Basin (JBMS, 2024)

7.3.11.2 Local Geology

A representative geological cross section of the Project area east west through the pit area, is shown in Figure 7-9. The location of the cross section is shown in Figure 7-10.

The geology and hydrogeology of the Project area and surrounds is further described in **Chapter 10**.

7.3.11.2.1 Tertiary/Quaternary Sediments

Quaternary sediments range in thickness from 2 to 20 m (average 7.8m) in the deposit area. To the west, close to the subcrop of the Vermont seam Quaternary sediments appear to thicken. Some thicker Quaternary is seen along the banks of the Isaac River in the north and a minor amount along Cherwell Creek to the south (JBMS, 2024). Figure 7-8 displays a typical stratigraphic column for the Project area.

7.3.11.2.2 Weathering

Depth of weathering over the whole deposit ranges from 11 to 36 m (average 20.3 m). In the seam subcrop zone, the depth of weathering averages 19.5 m. Deeper weathering zones are generally related to faulting (JBMS, 2024).

7.3.11.2.3 Overburden Lithologies

Non-coal Permian sediments consist of moderately weak to strong sandstones, siltstones and minor mudstones. Sandstone and siltstone appear to be co-dominant (JBMS, 2024).

7.3.11.2.4 Coal Seams

The Leichhardt Seam (subplies – L1 and L2) and the Vermont Seam (subplies – V1, V2, V31 and V32) form the principal economic coal resources in the Project area. The coal seams will be mined to a depth of around 100 m (JBMS, 2024). Figure 7-8 presents a diagrammatic section of the typical seam stratigraphy of the area.

The Leichhardt Seam is typically 2.5 m thick and splits down dip into the L1 and L2 seams. The L1 seam is typically 1.1 m thick, and L2 is 0.92 m thick. Once split, the L1 and L2 seams thin progressively downdip to the east and southeast. At depth the L2 seam disappears within a strong coarse sandstone sequence. In the north of the Project area, the Leichhardt and the Vermont seams coalesce to form a thickened pod of coal. The coalesced Leichhardt seam has some stone bands that are consistent over relatively short distances (JBMS, 2024).

The Vermont seam lies approximately 25 m below the Leichhardt seam and varies in total thickness between 5-9 m (V1 to V32 including parting). There are three plies identified in the Vermont seam (V1, V2 and V3, which is further split into V31 and V32 plies). V1 averages 1.8 m in thickness, V2 averages 1.4 m, V31 averages 0.4 m and V32 averages 0.4 m. The Vermont seam coalesces with the Girrah seam in the south of the Project area (JBMS, 2024).

7.3.11.2.5 Igneous Intrusions

From a review of the Department of Natural Resources regional magnetic survey, it was concluded that there are no significant Tertiary basalt flows in the Project area. Tertiary basalt flows do exist to the west of the Project area in the basalt quarry. No igneous material has been intercepted in drill holes within the Project area (JBMS, 2024).

7.3.11.2.6 Structure

In the Project area, the Rangal Coal Measures dip to the east at 2 to 6 degrees. Dips steepen in the vicinity of major faults. East of the Project’s resource a major thrust system, the Isaac Thrust, has been regionally interpreted and identified from a seismic study to the east of the Isaac River (JBMS, 2024).

7.3.11.2.7 Palaeontologic Significance

There are no sites of palaeontologic significance within the Project area.

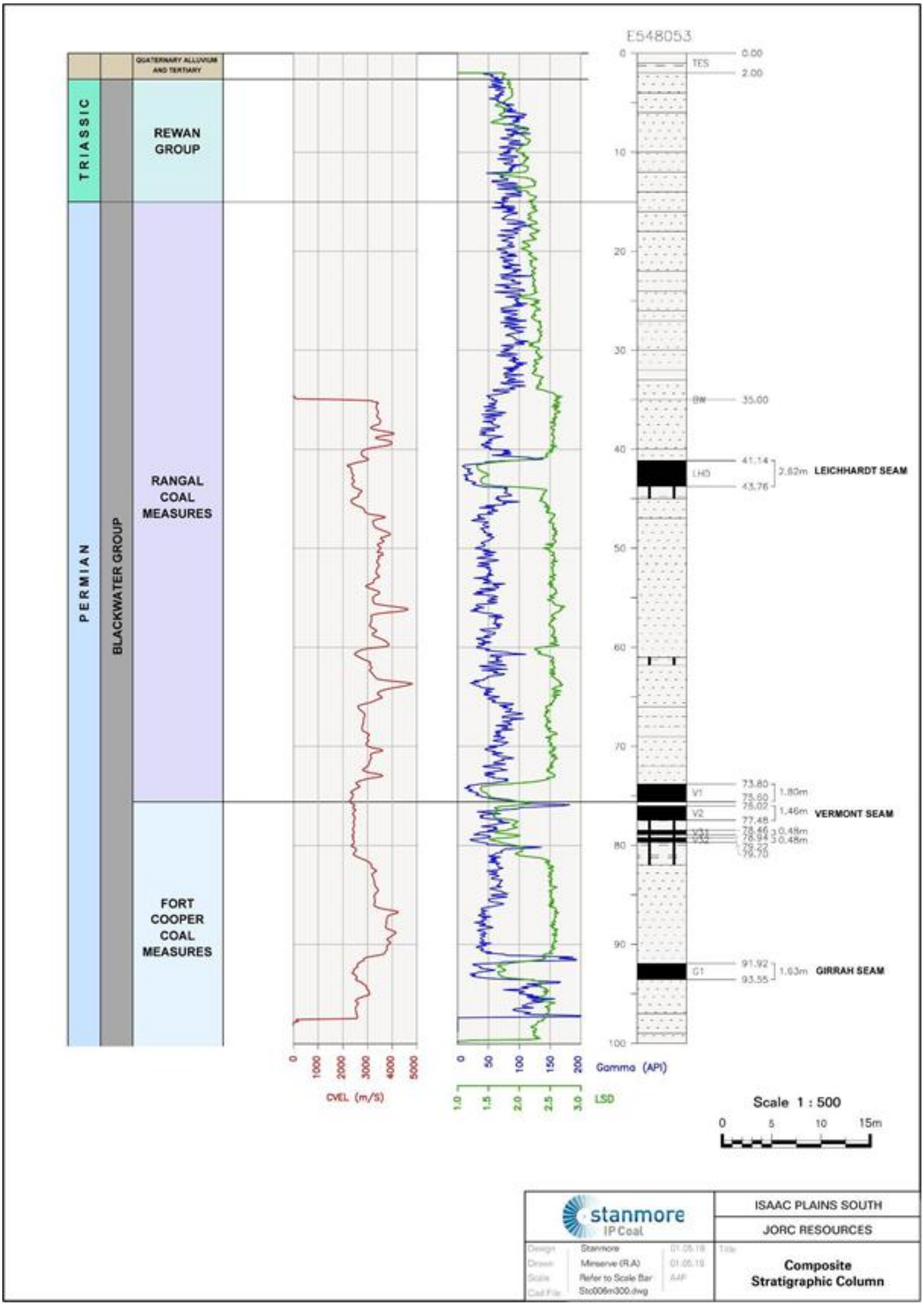


Figure 7-8 Local Stratigraphy (JBMS, 2024)

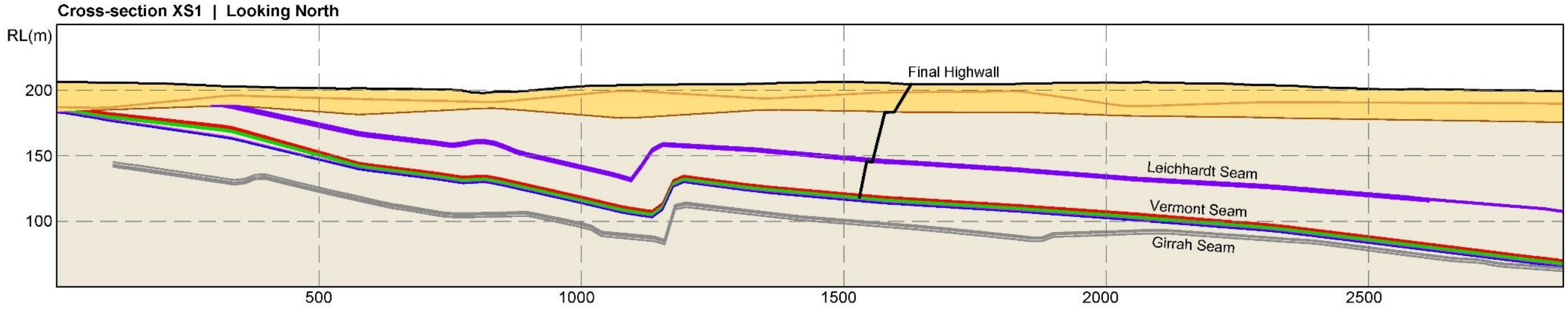


Figure 7-9 Representative Geological Cross Section

7.3.11.2.8 Aquifers

Chapter 10 and **Appendix K** describe the Project's groundwater environment in detail. The coal seams within the Permian Rangal Coal Measures are the main aquifer units in the Project area. The coal seams can be characterised as confined aquifers, with the Leichhardt and Vermont coal seams forming the main aquifer units locally. The Rangal Coal Measures overburden and interburden act as aquitards and are typically dry, or very low yielding.

In addition, the Quaternary alluvium localised to major ephemeral drainage line channels in the vicinity of the Project (Isaac River and Cherwell Creek), forms an unconfined aquifer comprising sporadically water-bearing strata of permeable unconsolidated sand or gravel with interlayered clays and silts.

7.3.12 Geochemistry – Spoil Characterisation

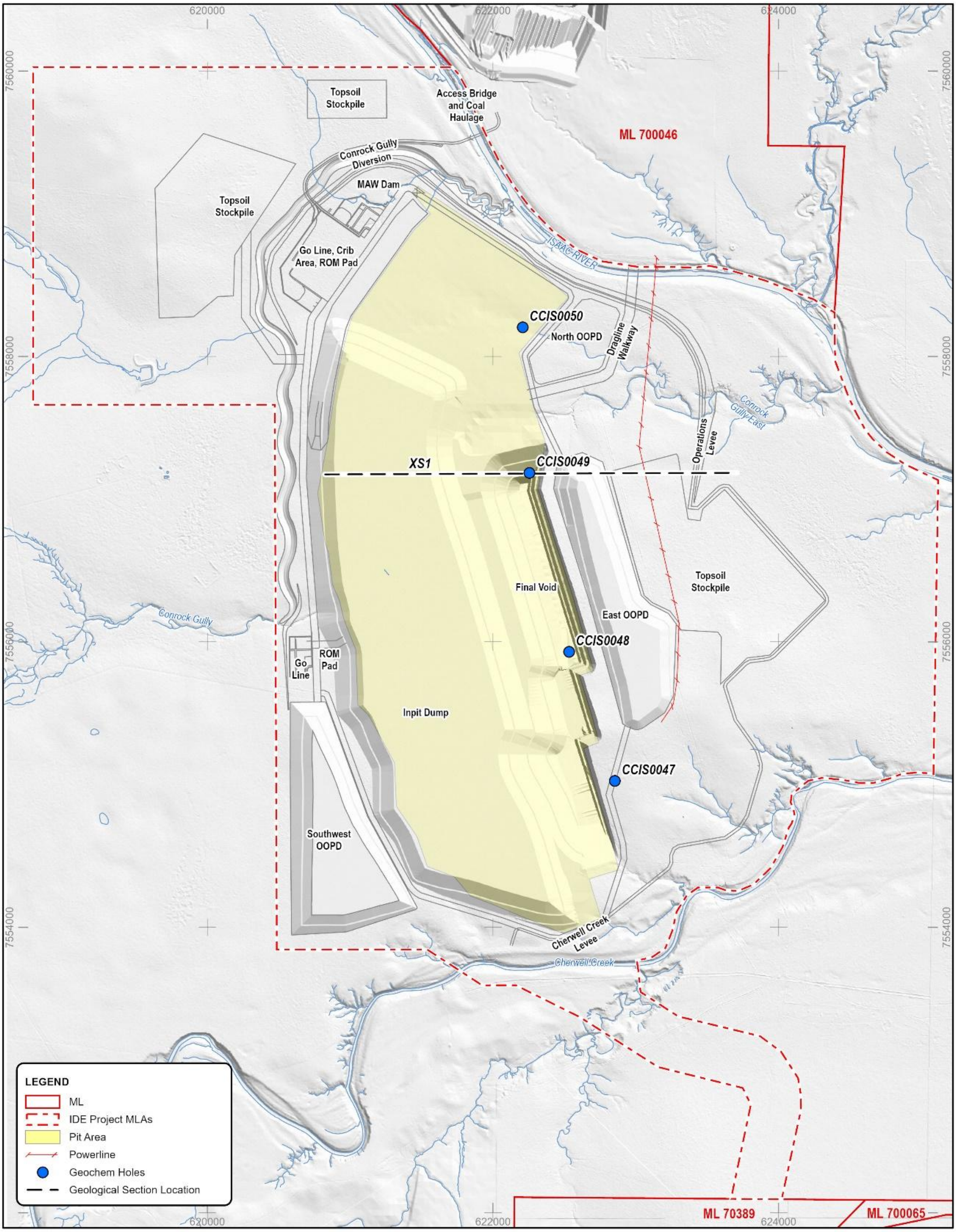
7.3.12.1 Overview

An assessment of the geochemical nature of spoil[9] and ROM coal likely to be generated by the Project was undertaken to identify relevant environmental issues / opportunities that may be associated with mining, handling and storing mineral waste (spoil and potential tailings and coarse rejects) to inform appropriate rehabilitation and management strategies. The Project's geochemical characterisation and assessment report is provided in **Appendix F**.

The Project's geochemical assessment involved sampling and laboratory test-work. Section 3 of **Appendix F** details the Project's geochemical assessment methodology. Drillhole sampling was used to collect potential spoil and coal samples for geochemical assessment. The geochemical data analysed was developed from 266 spoil samples and 38 coal samples collected from four drillholes strategically located within the Project's proposed pit area (Figure 7-10). Each drillhole was sampled from surface to full drillhole depth (i.e. to below the lowest seam planned to be mined). The drillhole samples analysed were considered representative of the geology and stratigraphy within the Project area.

The 266 spoil and 38 coal samples were subject to environmental geochemical characterisation and assessment with regard to their potential to generate acid and metalliferous drainage (AMD), which comprises acid drainage (AD), neutral and metalliferous drainage (NMD) and/or saline drainage (SD) (i.e. salinity due to sulfate derived from sulfide oxidation). The spoil and coal samples were also assessed for their potential to generate salinity (non-oxidative), and for spoil materials, their sodicity and dispersion potential.

[9] The terms 'overburden', 'spoil' and 'mine waste rock' are used synonymously in this EIS, and include interburden.



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Geochemical Drillhole and Geological Cross-section Locations

Figure | 7-10

7.3.12.2 General Details - Spoil

Over the life of the Project three main types of mineral waste will be generated, spoil, tailings and coarse rejects. However, only spoil (including minor volumes of waste coal) will be managed at the Project site. Section 4.7 of **Chapter 4** details how the Project's tailings and coarse rejects will be managed at IPM, within the existing capacity of approved tailings and coarse rejects management systems.

Spoil (overburden and interburden) is expected to comprise approximately 97.5% of all mineral waste generated by the Project and will include Tertiary- and Permian-age weathered waste and Permian-age fresh (unweathered) waste. Based on drilling logs, the Project's spoil is expected to comprise approximately 95% non-carbonaceous material and about 5% as carbonaceous spoil, with almost all carbonaceous spoil being fresh (unweathered). About 22% of the Project's spoil is expected to be weathered. The proportions of weathered versus fresh spoil and non-carbonaceous versus carbonaceous spoil are typical for spoil in the vicinity of the Project. Sections 1.2 and 3.3 of **Appendix F** provide further detail on how the spoil was characterised.

Coal was also included in the geochemical assessment. However, coal is generally not considered mineral waste, with the exception of small quantities of sub-economic coal seams that may report to the spoil dumps, and remnant coal exposed within the pit highwall / residual void.

In summary, the Project's spoil dumps are expected to comprise essentially spoil only (overburden and interburden) that is mainly non-carbonaceous. The geochemical assessment conservatively assumed that a minor proportion of waste coal may also be disposed into the Project's spoil dumps. Consequently, the geochemical assessment focused on the geochemical characteristics of spoil and waste coal likely to report to the Project's and spoil dumps. The assessment methodology for the geochemical characteristics of spoil and waste coal is provided in Section 3 of **Appendix F**. The results of the Project's geochemical assessment are provided in Section 4 and Appendix B of **Appendix F**, and summarised below.

7.3.12.3 AMD Potential - Spoil

The Project's spoil is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is typical for mine spoil within the Bowen Basin.

The total sulfur (S) concentration of the Project's spoil is very low, with a 95th percentile total S concentration of 0.14%. This characteristic when combined with the spoil's generally moderate to moderate-high acid neutralising capacity (ANC) values (median = 28 kilograms of sulfuric acid per tonne of rock (kg H2SO4/t)) that are significantly higher than the maximum potential acidity (MPA) [median 0.6 kg H2SO4/t], resulted in approximately 98% of the Project's spoil samples tested being classified as non-acid forming (NAF) or UC(NAF) (uncertain, but expected to be NAF).

Less than 2% of spoil samples (5 out of 266 samples) were classified as potentially acid forming (PAF), PAF-LC (PAF, low capacity) or UC(PAF) (uncertain, but expected to be PAF or PAF-LC). No spoil samples were classified as NAF-S (NAF, but with total S greater than one per cent). Notably, of the five spoil samples classified as PAF (of any type), four were closely associated with coal seams and could potentially end up as coal reject if mined with ROM coal.

The assessment undertaken has demonstrated that the ANC for the Project's spoil is generally expected to be about 37-67% available (median 48% available) under field conditions, with iron-dolomite being the main carbonate mineral likely to be contributing to the acid buffering potential of the spoil. Overall, the Project's spoil possesses excess acid neutralising capacity and is expected to be bulk acid consuming.

Section 4.1 of **Appendix F** outlines how the Project's acid-base accounting (potential for acid generation) results were developed based on the classification of the acid forming nature of the tested samples, using the classification criteria outlined in Section 3.4 of **Appendix F**. The acid forming nature of the tested samples is summarised in Table 4-1 of **Appendix F**.

Total metal and metalloid concentrations (assay) from 37 spoil samples tested very low compared to the average element abundance in un-mineralised soil and rock in the earth's crust. Importantly, no samples were significantly enriched with any of the elements of potential environmental interest.

Soluble multi-element results from 37 spoil samples indicate that leachate from spoil is expected to contain low concentrations of soluble metals and metalloids. For many spoil samples, particularly the weathered samples, the concentrations of most of the 17 environmentally important elements were below or marginally above to the laboratory limit of reporting (LOR). Sections 4.2 and 4.3 of **Appendix F** provide further detail on the metal and metalloid assessment results for spoil.

The assessment demonstrated that the Project's spoil possesses AMD characteristics that are comparable to spoil from nearby IDM. For the key geochemical characteristic assessed, including total S, sulfide, ANC, total metals / metalloids and soluble metals / metalloids, the Project's spoil samples had concentrations / values within the same range as spoil samples from IDM.

In summary, based on the results of 266 samples, the Project's spoil has a very low potential to generate AMD as either AD and/or NMD and/or SD. Further details around methodology and results are provided in Sections 3, 4 and 5.1 of **Appendix F**.

7.3.12.4 Salinity, Sodicity and Dispersion Potential - Spoil

The Project's spoil has low median and low-moderate 95th percentile aged electrical conductivity (aged EC) 1:5 values of 406 and 821 microSiemens per centimetre (µS/cm), respectively, and has very low total S concentrations. On this basis, contact water (run-off and seepage) from spoil is expected to be generally non-saline to slightly saline, as a result of dissolution of geogenic salts more so than from sulfide oxidation (sulfate salinity). Weathered spoil generally has higher aged EC1:5 values compared to fresh spoil. Sections 3.4 and 4.4 of **Appendix F** provide information on the assessment methodology used and additional details on the assessment results, respectively. Figure 4-11 of **Appendix F** summarises the distribution of cation exchange capacity and exchangeable sodium percentage for the Project's spoil.

The Project's spoil has generally low cation exchange capacity (CEC) values and generally high exchangeable sodium percentage (ESP) values, and as a result, all spoil samples being classified as 'sodic' to 'strongly sodic', and therefore, possess the potential for dispersion. Based on Emerson aggregate class testing to directly measure dispersion, very few of the Project's spoil samples displayed dispersive characteristics, which was generally inconsistent with the dispersion predictions from the ESP results. Despite the inconsistencies between the ESP and Emerson Class results, the data suggests that a significant proportion of the Project's spoil can be expected to be dispersive to varying degrees. Further information is provided in Sections 3.4, 4.4 and 5.2 of **Appendix F**.

7.3.12.5 AMD Potential - Coal

Coal is not regarded as waste, and under normal circumstances, ROM coal remains on-site for a relatively short period of time (i.e. from mining, to processing and transportation off site to market as product coal). It can be reasonably assumed that almost all coal mined from the Project will report as ROM coal. However, the assessment has conservatively assumed that some of the Project's minor coal ply's may be mined with spoil as waste coal, and as a result, will be broadly disposed within the Project's spoil. The assessment conservatively assumed that waste coal could represent up to 1% of mineral waste disposed at the Project.

The total S concentration of the Project's coal is low, with a 95th percentile total S concentration of 0.32%. Approximately 11% (median value) of the total S is present as sulfide (Scr), with the bulk of the total S likely present as organic S, which does not contribute to AMD. This characteristic when combined with the coal's generally moderate to moderate-high ANC values (median 23 kg H2SO4/t) that are significantly higher than the MPA (median 8.6 kg H2SO4/t), resulted in approximately 79% of the Project's coal samples tested being classified as NAF or were expected to be NAF and were classified as UC(NAF). The remaining 21% of coal samples were mostly classified as UC(PAF), with only one coal sample classified as PAF-LC.

The PAF-LC classification was based on total S, and therefore, as a coal sample was considered a highly conservative classification. No coal samples were classified as PAF or NAF-S. These assessment results suggest that potentially uneconomic coal seam material reporting to spoil dumps mixed with non-coal spoil would conservatively pose a low-moderate AMD source hazard for the Project. Sections 3.4 and 4.1 of **Appendix F** provide additional details on the assessment methodology and results, respectively, for coal.

Assay data for seven coal samples tested demonstrated that the total metal and metalloid concentrations are very low compared to the average element abundance in un-mineralised soil and rock in the earth's crust. Importantly, no samples were significantly enriched with any of the elements of potential environmental interest. Soluble multi-element results from seven coal samples tested with a range of NAF to PAF classifications, indicate that contact water (run-off and seepage) from coal is expected to contain low concentrations of soluble metals and metalloids. All seven samples produced leachate with low soluble metals and metalloid concentrations and neutral to alkaline pH. For most coal samples, the concentrations of most of the 17 environmentally important elements were below or marginally above to the laboratory LOR. Sections 4.2 and 4.3 of **Appendix F** provide further detail on the metal and metalloid assessment results for coal.

In summary, based on the results, and as a bulk material, the Project's coal is assessed as having a low-moderate potential to generate AMD as either AD, NMD and/or SD. The Project's coal, as a bulk material, is expected to generate pH-alkaline to highly alkaline contact water (run-off and seepage), which is very similar to the finding of the Project's spoil assessment provided in Section 7.3.12.3. Additional information is provided in Sections 3.4, 4.2, 4.3 and 5.1 of **Appendix F**.

7.3.12.6 Salinity, Sodicity and Dispersion Potential - Coal

The Project's coal has low median and low 95th percentile aged EC1:5 values of 238 and 409 µS/cm, respectively; and has low total S concentrations. On this basis, contact water (run-off and seepage) from the Project's coal, as a bulk material, is expected to be non-saline, as a result of dissolution of geogenic salts rather than sulfide oxidation (sulfate salinity). Further details are provided in Sections 3.4 and 5.2 of **Appendix F**.

7.3.13 Geochemistry - Tailings

Tailings will be generated at IPM's CHPP from processing the Project's ROM coal (i.e. as part of IPC). Further details are provided in Section 4.7 of **Chapter 4** on the approved tailings management at IPM.

Typically, tailings represent the clay, silt and fine sand fractions of ROM waste. The Project's tailings will be disposed as a slurry into an in-pit tailings storage facility (TSF) at IPM in accordance with approved coarse rejects and tailings management measures. Tailings are expected to comprise approximately 2 million banked cubic metres (Mbcm) of all mining waste generated by the Project. The Project site will not require any tailings storage facilities because all tailings generated from the Project's ROM coal by IPM's CHPP will be stored within IPM's TSFs.

In general, the assessment found no significant difference between the geochemical characteristics of coal from the Project compared to the coal at IDM, which is not unexpected given the Project and IDM share a similar geological setting. Therefore, the ROM coal mined from the Project and processed at IPM CHPP is expected to produce tailings with similar geochemical characteristics to the current ROM coal mined at IDM and processed at IPM CHPP.

7.3.14 Geochemistry - Coarse Rejects

Reject's will be generated at IPM's CHPP from processing the Project's ROM coal (i.e. as part of IPC). Further details are provided in Section 4.7 of **Chapter 4** on the approved Project's coarse rejects management at IPM.

Typically, coarse rejects represent the coarser and rockier coal seam roof, partings and floor material. Coarse rejects will be trucked to several locations at IPM for disposal into spoil dumps in accordance with approved coarse rejects and tailings management measures. Coarse rejects are expected to comprise approximately 7.5 Mbcm of all mining waste generated by the Project. The Project site will not require any emplacement of coarse rejects within spoil dumps, because all coarse rejects generated from the Project's ROM coal by IPM's CHPP will be stored within IPM's spoil dumps.

In general, the assessment found no significant difference between the geochemical characteristics of coal from the Project compared to the coal at IDM, which is not unexpected given the Project and IDM share a similar geological setting. Therefore, the ROM coal mined from the Project and processed at IPM CHPP is expected to produce coarse rejects with similar geochemical characteristics to the current ROM coal mined at IDM and processed at IPM CHPP.

7.3.15 Coal Resource

7.3.15.1 Overview

A JORC resource report is a public document that reports the results of mineral exploration, mineral resources, and ore reserves according to the standards set by the Australasian Code for Reporting of Exploration Results, Mineral Resources and Ore Reserves (JORC Code)[10]. It provides investors with a standardised and transparent method to evaluate a mineral or coal deposit, based on the confidence level in the geological knowledge and the economic viability of the resource.

The Project's JORC resources report was completed during October 2024 by JB Mining Services Pty Ltd in accordance with the 'Australian Guidelines for Estimation Reporting and Classification of Coal Resources' (CGCNSW & QRC 2014), and are reported in compliance with the Joint Ore Reserves Committee's 'JORC Code'.

7.3.15.2 JORC Resources

To develop the JORC resource report, the Project's regional and local geological setting was well understood and is defined by adequate drilling, comprising a total of 505 drill holes completed within the Project area (i.e. up to October 2024). Comprehensive coal quality analyses were undertaken. Table 7-5 provides the calculated 2025 JORC resources for the Project. The Project's JORC resources report advises that:

- the Project's resources are considered to possess reasonable prospects for extraction by opencut methods
- economic studies indicate open cut mining is viable to a cumulative waste to coal in-situ tonnes ratio of approximately 15:1
- the driving economic component is the value of the coking coal product (JBMS, 2024).

Table 7-5 Project's 2025 JORC Resources

Resource Status	Seams							Totals
	Leichhardt	L1	L2	V1	V2	V31	V32	
Measured	22.5	0.0	0.0	23.0	26.0	5.3	4.0	**80.8**
Indicated	0.0	2.1	0.8	13.9	6.8	2.3	2.6	**28.6**
Inferred	0.0	4.5	0.4	5.8	2.1	3.2	4.9	**20.8**
Totals:	**22.5**	**6.7**	**1.2**	**42.7**	**34.9**	**10.7**	**11.5**	**130.2**

[10] https://www.jorc.org/

7.3.16 Planned Coal Mining

Sections 4.7 and 4.9 of **Chapter 4** describes the planned extraction of the coal resource over the life of the Project. A pre-feasibility options study was completed by an independent third party to confirm the technical feasibility and economic viability of the Project. Pit optimisation techniques (margin ranking) with consideration of applicable modifying factors were used to determine the economic pit limits and estimate mineable resource. An open cut strip-mining method will be employed as the most efficient mining method based on the geological characterisation of the Project's coal deposit, and will involve the use of an excavator, a dragline, dozer push and cast blasting for overburden and interburden removal. A smaller excavator will mine the coal to minimise coal dilution and losses and maximise coal recovery. The Project will produce approximately 60% metallurgical coal and 40% thermal coal over its mine life.

7.3.17 Other Potential Petroleum and Energy Resources

7.3.17.1 Overview

As described in Section 7.3.9 and shown in Figure 7-5, non-coal tenements overlap the Project's MLAs, which comprise exploration tenements only (i.e. no production tenements). ATP 1103 is owned by CH4 Pty Ltd (a subsidiary of Arrow Energy (Arrow)) and allows coal seam gas (CSG) exploration. EPGA 2047 was lodged by Australis Energy Ltd and upon grant will allow geothermal resources exploration.

7.3.17.2 Authority to Prospect 1103

Arrow proposes to develop CSG resources in an area of approximately 8,000 km^2 that extends from approximately 30 km north of Glenden to 10 km south of Blackwater. The Bowen Gas Project forms part of the Arrow LNG Project, which involves a number of other separate but related projects including the Arrow Bowen Pipeline, Surat Gas Project, and Arrow Surat Pipeline, which are subject to separate environmental assessment and approval processes.

The gas field has been defined as two regions:

- Northern CSG fields encompassing ATP 742, ATP 749, ATP 1103, part of ATP 759, and ATP 1031 running south from Glenden to Middlemount, located mainly within the Isaac Regional Council area with a small section in the Whitsunday Regional Council area.
- Southern CSG fields encompassing ATP 1025, located near Blackwater and mainly within the Central Highlands Regional Council area, with a small section located within the southern region of the Isaac Regional Council area.

Up to 4,000 wells are proposed in staged production areas over the project life of approximately 40 years with each well operating for 15 to 20 years.

For various commercial reasons, Arrow is currently focussing on its Surat Gas Project, and therefore, no significant activities are expected on ATP 1103[11] or its Bowen Gas Project until business circumstances change.

As outlined in **Appendix T**, gas testing conducted within the Project's coal seams has yielded very low and uneconomic volumes of CSG. Therefore, Arrow's existing and future CSG exploration is likely to be in significantly deeper coal seams (e.g. Moranbah Coal Measures). Consequently, the Project's operation will not impact any future exploration for CSG resources on ATP 1103.

The proponent has engaged, and will continue to engage, with Arrow in accordance with the applicable legislation for the management of overlapping tenements.

[11] https://www.gem.wiki/Arrow_Bowen_Pipeline

7.3.17.3 EPGA 2047

No public information is available on EPGA 2047. Based on the current ungranted status of EPGA 2047 and the fact that the Project does not lie in a government-recognised geothermal prospectivity region (Talebi et al., 2014), there is currently a low expectation of future geothermal energy exploration within the Project area.

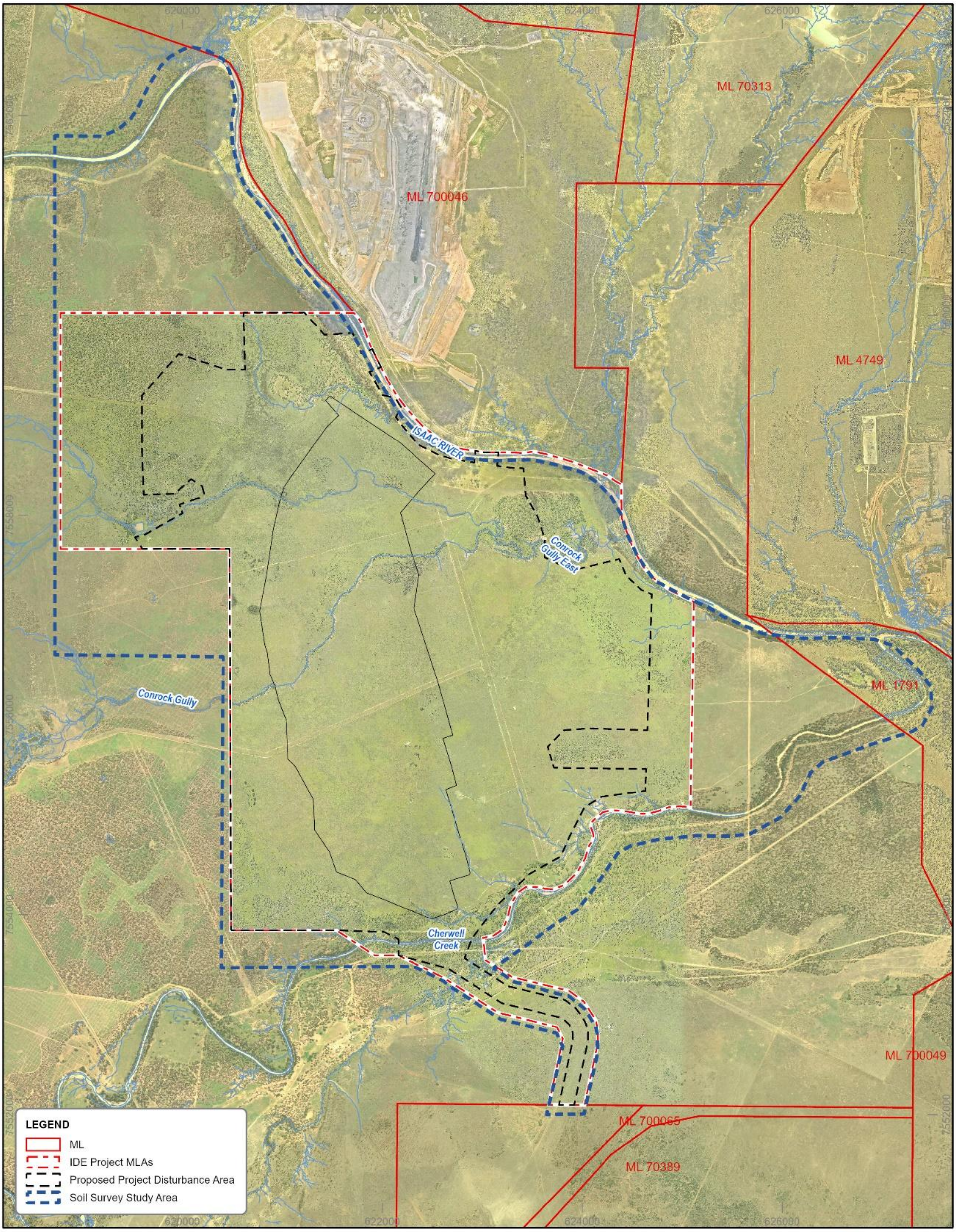
The proponent has engaged, and will continue to engage, with Australis Energy Pty Ltd in accordance with the applicable legislation for the management of overlapping tenements.

7.3.18 Soils Assessment

7.3.18.1 Overview

An assessment of the Project's soil resources, comprising a soils study area within and surrounding the Project area, was undertaken and is identified in Figure 7-11. The soils assessment characterises the Project's soils for future use in rehabilitation and provides details on the management and handling of soil materials (**Appendix E**).

The assessment describes soils across the 3,863 ha study area and included a program of soil sampling, analysis and soil characterisation. A total of 102 soil profile observations and 177 check sites were made during the field survey. An additional 91 existing soil observations across the study area were used to inform the soil types and boundaries. The site density met the requirements of a 1:25,000 scale survey. Observation sites were chosen to target specific soil types and spatial distribution. Due to landscape limitations, some areas were not accessible for sampling during the fieldwork.



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Soil Survey Study Area

Figure | 7-11

7.3.18.2 Methodology

The soil assessment was undertaken with reference to the following guidelines and references.

- Australian Soil and Land Survey: Guidelines for Surveying Soil and Land Resources (McKenzie et at., 2008).
- Australian Soil Survey and Land Survey Field Handbook (The National Committee on Soil and Terrain [NCST], 2024).
- Land – EIS information guideline, (DESI, 2024a).
- Australian Soil Classification (Isbell & NCST, 2021).
- Regional Planning Interest Act, Statutory Guideline 08/14 (RPI Act 2014).

A desktop assessment was undertaken prior to commencing field work to construct a baseline conceptual model of the soil and landscape characteristics of the study area. The desktop assessment identified preliminary mapping units that would be assessed through ground observations during the field work. This assessment included:

- reviewing the available topographic, geological, vegetation, and radiometric data, soil mapping and associated reports for the study area and surrounding region
- reviewing aerial imagery of the study area
- drafting preliminary mapping units for validation during the fieldwork.

The following information sources were referenced in the desktop assessment.

- Aerial imagery from Google Earth (2024).
- Digital elevation model (DEM) supplied by Stanmore.
- Radiometric data from Geoscience Australia (Geoscience Australia, 2019).
- Vegetation mapping from the State of Queensland (Neldner et al., 2023).
- Surficial geology from Geoscience Australia (Geoscience Australia, 2015).
- Land Suitability Assessment of the Collinsville–Nebo–Moranbah region (Story et al., 1967).
- Climate data from the Bureau of Meteorology (Bureau of Meteorology [BoM], 2024).

Analysis of existing soil, geology, and topographical data using current geographical information systems (GIS) software assisted the development of preliminary mapping units (PMUs) within the study area. The review of existing data identified tracts of land that were expected to share similar 'soil landscape' features (e.g., soil type, geology, vegetation, and landform) that can be separated from neighbouring tracts of land with a different pattern of similar attribute values. These areas were used to guide sampling locations during the field program.

7.3.18.3 Fieldwork

The required scale of mapping and the size of the proposed study area dictated the number of soil inspection sites required. The inspection site density is defined in the Guidelines for Surveying Soil and Land Resources (McKenzie et al., 2008). The objective of the survey was to:

- map the soils of the study area
- conduct a land suitability assessment
- determine the agricultural land classification.

To meet these objectives, the study area was assessed at a moderately high intensity, sufficient to determine strategic planning for intensive land uses. The intensity of the survey required an inspection site every 5 to 25 ha, with a scale of mapping that delineates areas of approximately 2.5 ha.

The entire study area (3,863 ha) was assessed at a density of 1 site per 14 ha (279 sites). Details of the ground observations for this study are provided in Table 7-6. The sampling achieved the recommended proportion of representative profiles, detailed profiles and semi detailed profiles and check sites from McKenzie et al., 2008.

Table 7-6 Survey Scale and Requisite Number of Inspection Sites

Intensity/Area	Size (ha)	Inspection Density	New Sites	Existing Sites	Publication Scale	Map Unit Type	Objective
Moderately high intensity / Disturbance areas	~3,863	~1 site per 14 ha	279	91	1:25,000 (1 site per 5-25ha)	Mainly simple, some compound, moderately detailed	Moderately intensive uses at 'field' level, detailed project planning

Data was collected from all ground observation sites with reference to the Australian Soil and Land Survey Field Handbook (NCST, 2024). At all sites, these data included, but was not limited to:

- geospatial location
- soil surface condition
- land use management
- landscape attributes (landform, vegetation, erosion, micro-relief, rock outcrops).

Full morphological descriptions (detailed and representative profiles) included the collection and recording of the following details:

- field texture
- pedality and structure
- colour (Munsell chart) and mottles
- coarse fragments and segregations
- horizon depths and designations
- horizon boundary type and distinctness.

Soil profile descriptions were made from undisturbed push-tube cores. Where available, existing exposures such as road cuttings, or gullies were observed. Detailed soil profile descriptions were made to depths of up to 1.5 m or until refusal of equipment, whichever was shallower. All soil inspection sites were located by in-field GPS.

Soil samples were collected in accordance with national and state protocols: DESI (2024), DoR (2021), and DSITI & DNRM (2015). Generalised sampling depths are 0–0.1 m, 0.2–0.3 m, 0.4–0.6 m, 0.7–0.9 m, 1.0–1.2 m, and 1.4–1.5 m with no sample interval exceeding 0.3 m in thickness. Allowances were made for horizon boundaries, with samples collected from within major soil horizons (i.e. sampling will not cross A and B horizons).

Surface soil samples were bulked by combining at least 10 sub-samples collected randomly within a 10 m radius of the soil profile and on the same landform element. All samples were identified using the Project name, unique profile number and depth range from where the sample was taken.

Laboratory analysis was undertaken by a laboratory with National Association of Testing Authorities (NATA) and Australian Soil and Plant Analysis Council (ASPAC) accreditation. Different analytical suites were adopted, based on the site description. The typical analytical suite for reference soils is itemised below. Sites that have partial analysis have one or more of these analytes measured, mainly for classification purposes.

In line with DESI (2024), the suite of laboratory analyses was split into a topsoil characterisation suite and subsoil characterisation suite (Table 7-7).

Table 7-7 Soils Observation Types and Analysis

Laboratory Suite	Target samples	Analysis
Topsoil Suite	A horizon (topsoil fertility) generally between 0 – 100 mm depth. Analyses include soil fertility as this is the 'growth media' depth of the soil profile and is a major factor in determining a soil's nutrient status. This will also include one sample from the subsoil for baseline comparison.	• pH1:5 (water) • EC1:5 • Total Cl • Exchangeable cations (K^+, Ca^{2+}, Mg^{2+}, Na^+ & Al^{3+}) • Effective CEC • ESP • Water repellence • Particle size distribution of the fine fraction (coarse sand, fine sand, silt, clay) • Organic C • Total N & Total P • Available P and K (Colwell) • PBI • Available S (KCl) • Trace elements (Cu, Zn, Mn & Fe)
Subsoil Suite	All other horizons below the topsoil (>100 mm). Analyses focus on chemical and physical properties of the soil.	• pH1:5 (water) • EC1:5 • Total Cl • Exchangeable cations (K^+, Ca^{2+}, Mg^{2+}, Na^+ & Al^{3+}) • Effective CEC • ESP • Particle size distribution of the fine fraction (coarse sand, fine sand, silt, clay)

7.3.18.4 Desktop Review

The desktop review was used to construct a baseline conceptual model of the soils and landscape characteristics of the study area. Sampling locations were chosen to capture the variety of landscapes and soil characteristics derived from the information collected in the desktop review.

The desktop review findings for climate, topography, vegetation, surface geology, and radiometric (gamma-ray spectrometric method) analysis are reported in Section 2.2 of **Appendix E**. A detailed review of the Project's climate and terrestrial ecology are provided in **Chapters 6** and **11**, respectively. Additional details on topography are provided in Section 7.3.1.

The study area is situated within Blackwater, Monteagle, Conners, Oxford, and Girrah land systems described in the 'Lands of the Isaac-Comet Area, Queensland' (Story et al., 1967). A general description and proportion of each land system within the study area is shown Table 7-8. The accompanying land resource map is provided in Appendix A of **Appendix E**.

As part of the desktop review, it was noted that good-quality agricultural land was used in the planning framework with the now repealed State Planning Policy 1/92: Development and the Conservation of Agricultural Land. This planning framework was replaced by the agricultural land classification system, and therefore, was not considered for the Project's land assessment.

The desktop review failed to identify any versatile cropping land, and therefore, it was not considered for the Project's land assessment.

Table 7-8 Land System Units Relevant to the Study Area

Land System	Description	Area (ha)	Proportion (%)
Blackwater (Bl)	Lowlands with box and texture-contrast soils on undissected Tertiary land surface.	1,749	45
Monteagle (Mo)	Brigalow plains and cracking clay soils on weathered Tertiary clay and older rocks.	1,290	34
Conners (Co)	Alluvial plains with box on texture-contrast soils throughout the area.	648	17
Oxford (O)	Downs with cracking clay soils on slightly weathered or unweathered basalt.	128	3
Girrah (Gi)	Lowlands with brigalow and cracking clay soils on unweathered Permian shale and lithic sandstone.	48	1

Soil profile classes (SPCs) were developed using the defined central concept and range of values outlined by Powell (2008) and the general principles of McDonald (1983).

The use of broad scale mapping and information sources provided guidance for the derivation of the study area soil mapping units (SMUs) and soil types. The soil maps produced were integrated with the Australian classification scheme (ASC) and Queensland based SPCs. Linkages between the land systems and SPCs are detailed in Section 3.6 of **Appendix E**.

A soil and land suitability study was previously conducted for a discontinued mining project in a similar location to the Project (Tuck and Baker (2007), for the discontinued Integrated Isaac Plains project). The soil survey was conducted at a scale of 1:25,000, with a total of 91 soils observation within the proposed Project area. The soil types derived by Tuck and Baker (2007) are described and presented in Section 3.6.2 of **Appendix E**. This soils work was relied upon to target soil sample locations, inform the general soil types and landscape patterns, and confirm mapping boundaries.

IDM's soils (northeast of the study area) were surveyed in 2020 by SGM Environmental at a scale of 1:25,000. SGM Environmental made 40 soil observations, from which, five soil units were summarised. They include:

- Chromosols – texture contrast soils that are not highly acidic and are not sodic in the upper B horizon.
- Tenosols – weak pedological arrangement, low clay content.
- Dermosols – gradational textured clay soils.
- Vertosols – clay soils with cracking surface and often gilgai microrelief.
- Kandosols – weakly structured gradational loams and clay soils.
- Sodosols – texture contrast soils with a sodic upper B horizon.

Where possible, the SGM Environmental soil units are correlated with SMUs described in Section 3.6.2 of **Appendix E** for continuity of information between IDM and the Project.

7.3.18.5 Soil Mapping Units

A total of 102 soil profile descriptions from (push tube) cores or existing vertical exposures, and a total of 177 soil observations (check sites) were made in the field. An additional 91 observation sites from Tuck and Baker (2007) were also used as check sites to confirm mapping boundaries. From the 102 soil profiles sampled, 46 received laboratory analysis. Soil observation sites, SMU and SPC descriptions and laboratory data (physio-chemical attributes) are presented in Section 4 of **Appendix E**.

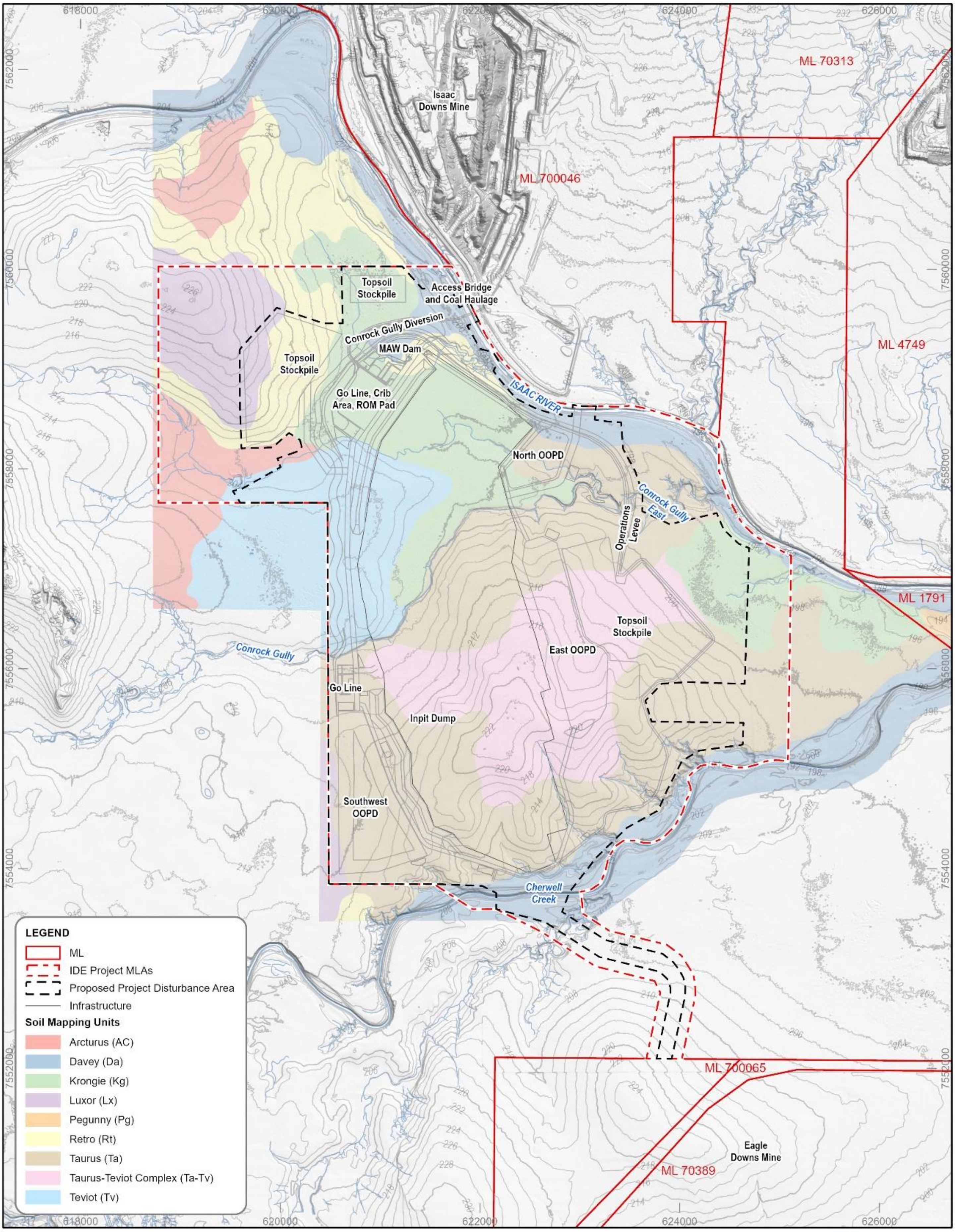
Each soil profile has been correlated with a known existing Queensland government SPC within the region (Story et al., 1967). Soil profiles were classified using the Australian Soil Classification (Isbell & NCST, 2021) before being aggregated into SMUs. Each SMU contains a dominant soil profile class, and occasionally, minor associated SPCs or unique mapping areas.

From the information gathered during the field and desktop survey, the soils identified within the study area have been grouped into a total of nine SMUs. A summary of the SMUs is presented in Table 7-9, in descending order according to the total land area (%). Their distribution is presented in Figure 7-12.

Table 7-9 Soil Mapping Units in Order of Dominance within the Study Area

SMU	Description	Tuck and Baker (2007) Soil Units	Total Land Area (ha)	Total Land Area (%)
Taurus (Ta)	Sodic texture contrast soils with moderately thick sandy surfaces. Occurs on gently undulating rises within the southern half of the study area.	Sodosols	1,122	29
Davey (Da)	Deep alluvial sands occurring on the levees along the Isaac River and Cherwell Creek.	Tenosols	692	18
Krongie (Kg)	Cracking clay soils with normal gilgai microrelief. Occurring on alluvial floodplains along the Isaac River	Vertosols	515	13
Taurus-Teviot Complex (Ta-Tv)	Complex soil unit consisting of sodic texture contrast soils (Taurus) with sporadically occurring cracking clay soils (Teviot) in gilgai depressions. Occurs on a gently undulating rise within the southern half of the study area.	Sodosols	388	10
Retro (Rt)	Sodic texture contrast soils with thin loamy surfaces. Occurs on gently undulating rises on the northern half of the study area.	Sodosols	343	9
Teviot (Tv)	Cracking clay soils in the depressions of normal gilgai microrelief. Texture contrast soils on the mounds. Occurs on gently undulating rises, central within the study area.	Vertosols	340	9
Arcturus (Ac)	Cracking clay soils derived from basalt with crabhole microrelief. Occurs on gently undulating rises and colluvial depositions on the western boundary.	Vertosols	246	6
Luxor (Lx)	Texture contrast soils with thick sandy surfaces and clay subsoils. Occurring on a prominent rise on the northern half of the study area.	Chromosols	201	5

SMU	Description	Tuck and Baker (2007) Soil Units	Total Land Area (ha)	Total Land Area (%)
Pegunny (Pg)	Cracking clay soils in low lying flood plains, subject to prolonged waterlogging. Occurs in a minor area on the southeastern tip of the study area.	Vertosols	16	1



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Soil Mapping Units

Figure | 7-12

7.3.18.6 Soil Chemical and Physical Limitations – Overview

Forty-two soil profiles within the study area were sampled for laboratory analysis. The suitability of soil for rehabilitation, and its limitations, delineated by SMUs, are discussed in the following sections through contextualising the results of the laboratory analysis.

7.3.18.7 Soil pH: Acidic Soils

The uniformly textured soils of the Davey SMU have neutral surfaces and become slightly acidic at depth. This reflects the well-draining nature of these sandy soils. These soils do not have pH limitations to plant growth.

The texture contrast soils of Taurus, Retro, and Luxor all have acidic to neutral surfaces. The low clay content and exposure to weathering have leached cations from these layers, resulting in the acidic pH trend.

The clay soils of Teviot and Pegunny have neutral surface soils on the mounds and acidic surface soils in the depressions. This trend reflects the extended waterlogging occurring in the depressions, and hence, the leaching of cations over time, lowering the soil pH. In comparison, the mounds are not exposed to prolonged waterlogging.

7.3.18.8 Soil pH: Alkaline Soils

The texture contrast soils of Taurus, Retro, and Luxor have neutral to alkaline subsoils. This reflects the depth of weathering acting on these imperfectly draining profiles, and hence, the leaching acting on these layers. The high alkalinity of the Taurus and Retro subsoils is also an indication of sodium bicarbonate in the soil solution (high exchangeable sodium), see Section 7.3.18.9.

The clay soils of Arcturus SMU are alkaline throughout the profile. This reflects the basalt parent material in which the soils are derived from. The high clay content and buffering capacity of the soils maintains the alkalinity of the soil. The high alkalinity of this soil also indicates the presence of sodium bicarbonate in the soil solution (high ESP).

The clay soils of the Krongie and Teviot become highly alkaline with depth. This trend reflects the poor drainage profile and low rainfall climate limiting the weathering acting on this soil at depth. The high clay content and high buffering capacity maintains the alkalinity of the soil. The high alkalinity of this soil also indicates the presence of sodium bicarbonate in the soil solution (high ESP).

In addition, the alkaline soils (Arcturus, Krongie, Teviot, Retro, Taurus) have calcium carbonate present within the soil (identified by soft white nodules and their reaction to 1M HCl) which buffers the soil pH to 8.3 (DERM, 2011). Calcium carbonate is generally non-toxic to plants. However, it may affect plant nutrient uptake (Moore and Scholz, 2001).

The effect of salinity is dependent on the texture of the soil. Clay soils, having greater water storage capacity, are able to dilute salts to a greater extent than sandy textured soils. Therefore, the level of salinity has a greater effect on plant growth in sandy soils than clays soils. To account for this, an industry standard adjustment factor based on soil texture is used to estimate the Saturated Extract Electrical Conductivity (ECse) from the Electrical Conductivity measured as a 1:5 soil to de–ionised water solution. The effect of salinity is generally low at ECse of < 2 dS/m.

The texture contrast soils of Taurus and Retro have saline subsoils. This reflects the imperfectly draining nature of the soil, allowing salts to accumulate within the profile over time.

The clay soils of Arcturus, Krongie and Teviot have moderate to high salinity in the subsoils. This characteristic reflects the poor profile drainage and low rainfall climate, allowing salts to accumulate at depth. The mounds of the gilgai have become saline at a shallower depth compared to the depressions. This reflects the drainage and movement (shrink swell cycles) of melon-hole gilgai formations.

7.3.18.9 Exchangeable Sodium Percentage

ESP is an indicator of a soil's susceptibility to erosion, surface crusting, hard/dense subsoils, and poor infiltration. Generally, a soil is considered sodic when ESP is > 6% and highly sodic when ESP is > 14%.

The Davey soil is the only SMU within the study area that is non-sodic. This characteristic is expected for well-drained coarse textured soils.

The subsoils of the texture contrast SMUs (Taurus, Retro, and Luxor) are all sodic. These soils are a high risk for erosion if the subsoils are exposed. Field observations identified areas of erosion where overland flow have created extensive gullying in these SMUs. Luxor SMU was the exception with little erosion observed, which is a consequence of its landscape position and low disturbance.

The clayey soils of Krongie, Teviot and Arcturus all have sodic subsoils. Field observations of erosion within these SMUs were uncommon. However, the high fine fraction (clay) percentage of these soils make them vulnerable to erosion if disturbed or subject to concentrations of overland flow.

7.3.18.10 Cation Exchange Capacity

The CEC of a soil is a contributing factor in the stability of the soil structure, nutrient availability for plant growth, soil pH, and the soils' reaction to fertilisers and ameliorants (i.e. buffering capacity) (Hazelton and Murphy, 2025).

The soils of Pegunny have moderate levels of CEC. Although, they are relatively low for a clay soil. This characteristic reflects the acidic pH, reducing the availability of exchange sites on the complex.

The clay textured soils of Arcturus, Teviot, and Krongie have high CEC. This reflects the high clay content of the soils.

The texture contrast soils of Taurus, Retro, and Luxor have low CECs in the surface, and moderate to high CEC in the subsoils reflecting the clay content of the horizons respectively.

7.3.18.11 Calcium-Magnesium Ratio

The calcium-magnesium ratio is a secondary measurement of the available calcium and magnesium in the soil. Generally, a low calcium to magnesium ratio can result in dispersive soil properties, which reduces stability and infiltration, and increases density.

The calcium-magnesium ratio for the Arcturus soils is considered balanced. This characteristic reflects the nature of the basalt parent material being high in cations such as calcium.

All other soils (Taurus, Davey, Krongie, Retro, Teviot, Luxor, Pegunny) have low calcium-magnesium ratios. Although, none are at levels which are detrimental for soil stability.

7.3.19 Land Suitability Assessment

7.3.19.1 Overview

Land suitability classification assesses the potential of land for a specific land use. The study area has been assessed on the potential for cropping and grazing as a pre-mining land use.

The assessment of land suitability has been carried out in accordance with the methodologies described in DISITI & DNRM (2015) and DSITI & DNRM (2013).

The five land suitability classes used for assessing the land use are defined in Table 7-10. Each unique mapping area (UMA) within an SMU is assessed on the hazard criteria defined for the particular land use. The land suitability class reflects the score of the most limiting attribute for a given UMA. Land suitability mapping for the study area is provided in Appendix A of **Appendix E**.

Table 7-10 Cropping Land Suitability Classes and their Defining Descriptions

Class	Suitability	Description
1	Suitable	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	Unsuitable	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.

7.3.19.2 Land Suitability for Cropping

The land suitability was assessed for four cropping systems typical of the region:

- dryland sorghum
- dryland wheat
- dryland safflower
- irrigated cotton.

The hazard criteria and detailed breakdown of the assessment of land suitability for cropping is provided in Section 6.1 of **Appendix E**.

Overall, the study area is assessed as majority (94%) Class 4 and 5 (unsuitable) with a small proportion (6%) of Class 3 (suitable) for the four cropping systems. Table 7-11 displays the proportions of land suitability class for each crop.

The common limitations of the soils were imperfect and slow drainage properties, and susceptibility to erosion. The exception was the sandy soils of the Davey SMU, which is ultimately limited by its poor water holding capacity.

The soils of the Arcturus SMU are assessed as Class 3 across the four cropping systems. These basalt soils are moderately well draining and are suitable for cropping with moderate management inputs. However, the Arcturus SMU possesses a limited extent within the study area (Figure 7-12).

Table 7-11 Proportions of the Study area suitable for Cropping

Land Use	Land Suitability (area %)				
	Class 1	Class 2	Class 3	Class 4	Class 5
Cotton	0	0	6	94	0
Safflower	0	0	6	76	18
Sorghum	0	0	6	76	18

Land Use	Land Suitability (area %)				
	Class 1	Class 2	Class 3	Class 4	Class 5
Wheat	0	0	6	76	18

7.3.19.3 Land Suitability for Grazing

The pre-mining land suitability was assessed in terms of the potential to establish and graze improved pastures. The land suitability uses hazard assessment criteria referenced in DME (1995) and Short and Highlands Environmental (2023).

Land Suitability Class 1–3 is considered suitable for grazing sown pastures and can attain maximal production levels. The grazing potential (productivity) decreases from Class 1 to Class 3. Class 1 (highly suitable) can support a wide range of pasture types and livestock production, Class 3 (marginally suitable) requires intensive management to support grazing, and may be suitable for certain pasture types only. Land Suitability Class 4 is considered to have limitations so severe that the establishment and grazing of improved pastures is not currently viable but may be possible with significant inputs and management. Class 4 can support low intensity grazing on established mixed native and introduced pasture species (i.e. similar to the basis for existing grazing land use). However, long-term productivity is reliant on climate and grazing management.

The hazard criteria and detailed breakdown of the assessment of land suitability for grazing is provided in Section 6.2 of **Appendix E**.

Overall, the study area is assessed as majority (96%) Class 4 and 5 (unsuitable) with a small proportion (6%) of Class 3 (suitable) for grazing on improved pastures. Table 7-12 displays the proportions of land suitability class for grazing on improved pastures.

The soil pH limits the potential for grazing of the Arcturus SMU to Class 3. The soils of the Pegunny SMU are assessed as suitable for grazing on improved pastures (Class 3). However, the hazard criteria do not take into account profile drainage. In consideration of the prolonged waterlogging of these soils, it would be appropriate to assign the Pegunny SMU as unsuitable (Class 5) for grazing on improved pastures.

The remaining 94% is assessed as unsuitable for improved pastures. However, low intensity grazing on native and/or introduced pasture species is viable. The Taurus, Retro, and Luxor SMUs are limited by their hard setting surfaces. The strong gilgai formations limit the grazing potential of the Krongie and Teviot SMUs. The low water holding capacity limits the grazing potential of the Davey SMU.

Table 7-12 Proportions of the Study area suitable for Grazing on Improved Pastures

Land Use	Land Suitability (area %)				
	Class 1	Class 2	Class 3	Class 4	Class 5
Grazing	0	0	6	93	1

7.3.20 Agricultural Land Classification

Overall, the Project’s soils study area is dominated by Class C2 agricultural land (approximately 72% of the study area). Class C1 accounts for 23% of the Project’s soils study area, Class B accounts for approximately 6% of the Project’s soils study area and Class C3 accounts for approximately 1% of the Project’s soils study area.

The Class C2 soils include the Taurus, Retro, Luxor, Taurus-Teviot Complex, and the Davey SMUs. These soils are considered suitable for grazing on native and mixed pastures and have lower fertility than soils of Class C1.

The Class C1 agricultural land includes the clay soils of Krongie and Teviot and are considered suitable for grazing on native and mixed pastures. Land use intensity is restricted within these SMUs, as demonstrated in the land suitability assessment (such as gilgai micro-relief), and therefore, they are not considered suitable for sown pastures. The agricultural land classification of Class C1 is designated on account of the higher fertility than the Class C2 soils.

The Arcturus SMU is the only soil that is suitable for cropping and is assessed as Class B agricultural land. This SMU is considered suitable for a narrow range of crops or for sown pastures.

The Pegunny SPC is considered as Class C3 agricultural land and is suitable for light grazing practices only on native pastures. Higher intensity land uses are restricted due to the limitation outlined in the land suitability assessment.

Agricultural land classification for the study area is presented in Figure 17 within Appendix A of **Appendix E**.

7.3.21 Acid Sulfate Soils

Acid sulfate soils (ASS) occur naturally over extensive areas of low-lying coastal land, predominantly below 5 m Australian Height Datum (AHD). These soils may be found close to the natural ground surface but may also be buried at depth in the soil profile. ASS can also be found in non-coastal areas or at elevations above 5 m AHD where soils are exposed to prolonged or periodic waterlogging. Such waterlogging may occur naturally, or occur from human disturbance or intervention (Dear et al., 2024).

The likelihood of acid sulfate soils occurring within the study area is low. No acid sulfate soils were identified in the desktop or field assessments.

7.3.22 Preliminary Contaminated Land Assessment

7.3.22.1 Overview

A preliminary contamination assessment to evaluate potential for existing (pre-mining) contamination within and surrounding the Project area was completed. The Project's preliminary contaminated land investigation assessment report is provided in **Appendix G**, with findings summarised below.

The Project's preliminary contamination assessment was developed in accordance with the requirements of the 'Contaminated land — EIS information guideline' (DESI, 2024b) and the applicable legislation, standards and guidelines for contaminated land management in Queensland.

The Project's preliminary contamination assessment comprised two main components - an initial desktop investigation and a preliminary site investigation (soil sampling).

The initial desktop investigation involved:

- a check of the EMR and CLR to determine if land parcels intersecting the Project area were listed
- a review of historical aerial imagery, ground photographs, title deeds, local histories, and trade directories to understand the history of the Project area's previous land use(s) and activities
- interviews with past and current owners, operators and occupiers to add to the understanding of the Project area's previous land use(s) and activities
- developing an understanding of the Project's characteristics to understand likely contamination pathways or sites, including current land use(s), layout, topography, geology and hydrogeology
- investigating past activities that might have resulted in land being contaminated, based on the Project area's history and characteristics

- a review of the potential for acid sulphate soils within the Project area (i.e. as a possible natural contamination source if present and disturbed).

The preliminary site investigation (soil sampling) involved:

- undertaking preliminary soil sampling and laboratory analysis of surface soil samples based on the findings of the desktop investigation
- assessing if there was a requirement for a detailed site investigation.

7.3.22.2 Contaminated Land Searches

Searches of the EMR and CLR showed that the properties, Lot 8 SP277384 (Winchester Downs) and Lot 9 GV33 (State Reserve), within the Project area were not listed on either register. No notifiable activities have been conducted within the Project area. Records of the searches are included in Appendix B of **Appendix G**.

7.3.22.3 Contamination Land – Desktop Study Findings

Based on current and past land uses, grazing and resource exploration were considered the main activities that may have contributed to land or water contamination within the Project area.

A review of aerial photography dating from 1966-2023 identified a small number of land disturbances that may have contained activities that might have resulted in contamination, which included a cattle yard/paddock, square water structure, vegetation dead spot and former and existing exploration and water bores. The relevant aerial photographs are included in Appendix C of **Appendix G**.

The Winchester Downs property manager confirmed that there were no known potential sources of soil or water contamination (including livestock operations, landfill/dumping of hazardous material, spills or leaks) that could have contributed to soil or water contamination.

In terms of potential anthropogenic contamination sources, the nearest industrial activity (exploration camp/workshop) was located approximately 2 km east of the Project area near Conrock Dam. At that location, there is an existing cattle yard and a trap yard that may have been used for spraying cattle for ticks. There was potential pesticide use at the trap yard near Conrock Dam. However, this trap yard is located outside the Project area. Potential chemicals could have migrated via Conrock Gully from the exploration camp/workshop at Conrock Dam to the Project area.

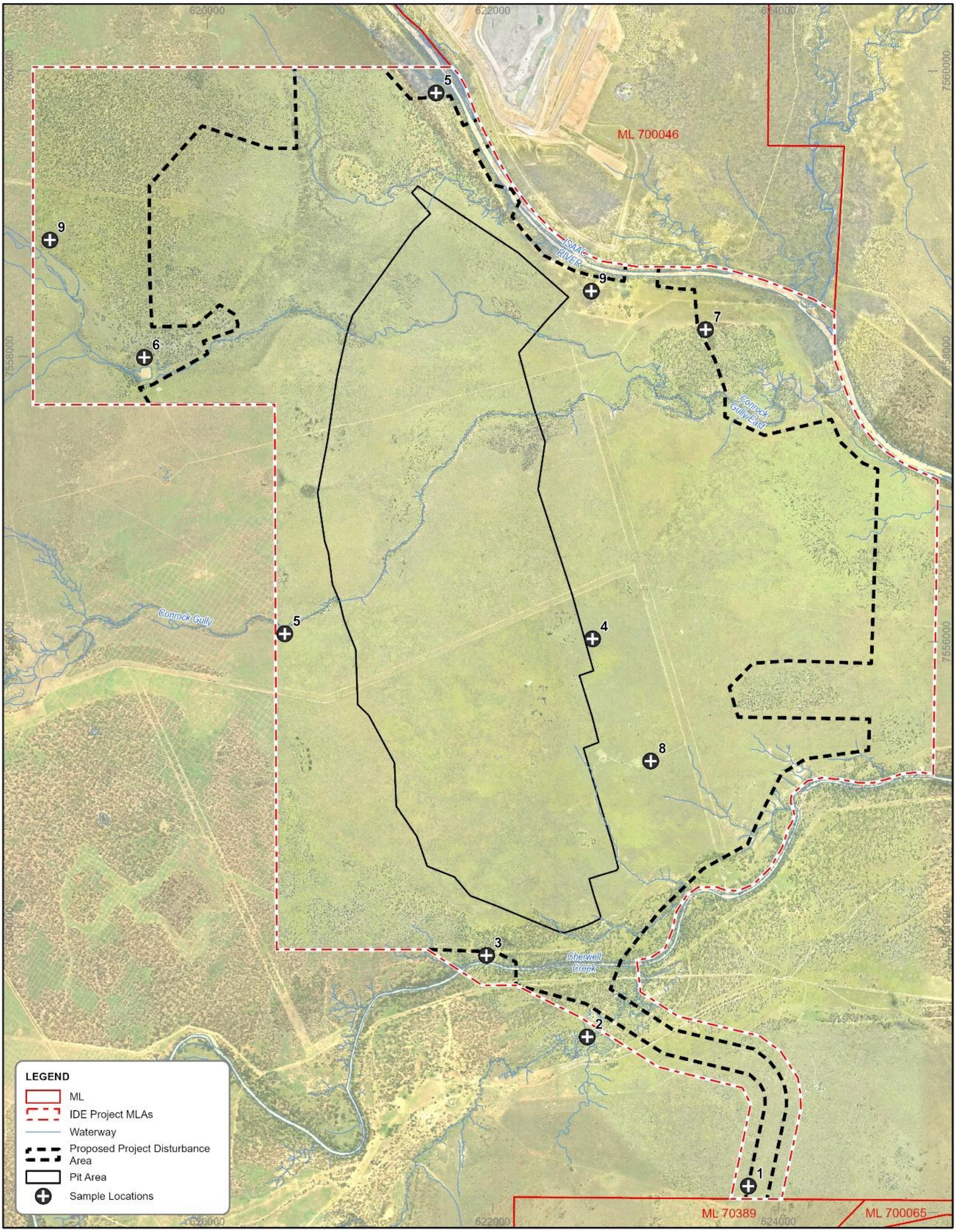
Although acid sulphate soils are not mapped comprehensively across Queensland, land elevation is a reliable indicator of risk (i.e. coastal areas < 5 m AHD and certain areas buried beneath newer soils at elevations < 20 m AHD). As the Project is located at an elevation of approximately 200 m AHD, the presence of acid sulphate soils within the Project area is considered to be highly unlikely, as evidenced by the soils field surveys.

7.3.22.4 Preliminary Site Investigation (Soil Sampling)

A total of 11 sample sites were selected for the preliminary site investigation within and adjacent the Project area based on the findings of the desktop study. Table 7-13 provides each sample site's location description and rationale for selection. Figure 7-13 displays the location of the 11 sample sites within the Project area.

Table 7-13 Sampling Location Description and Basis of Selection

Sample Location	Approximate Location	Basis of Site Selection
1	Southern border of MLA 700083	To capture contamination (if any) on MLA boundary extents
2	Near JB Gully close to MLA 700083 boundary	JB Gully traverses MLA and Winchester Downs residential property backs on to JB Gully.
3	Near Cherwell Creek on MLA 700081	Cherwell Creek traverses MLA
4	Near decommissioned CSG bores on MLA 700082	Location of decommissioned CSG bores
5	Near Conrock Gully on MLA 700081	Conrock Gully traverses MLA. There was potential pesticide use upstream at the trap yard near Conrock Dam.
6	Sample site '6' does not exist, because proposed location was inaccessible	Not applicable
7	Near Isaac River on northern section of MLA 700082	Dead vegetation patch near Isaac River
8	Near decommissioned CSG bores on MLA 700082	Location of decommissioned CSG bores
9	Near unnamed drainage lines on western edge of MLA 700081	Unnamed drainage lines traverses MLA and to capture contamination (if any) on MLA boundary extents.
10	Cattle yard/paddock near northwestern corner of MLA 700082	Cattle yard and disturbance
11	Project area boundary with IDM on northeast section of MLA 700084	Cleared tracks along Isaac River and close proximity to IDM.



Datum:	GDA2020 Zone 55
Scale:	See Scale Bar
Date:	28/04/2026 2:39 PM
Drawn:	Minserve
Source:	SGME
File:	20260415 Contamination Sampling Sites.aprx

DISCLAIMER: Third party data sources are used in this map compilation. Minserve makes no warranty regarding this data's accuracy or currency.

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Sample Locations – Existing Land Contamination

Figure | 7-13

The preliminary site investigation involved collecting a limited number of surface (0-10 cm) soil samples at the selected sampling locations with a contamination risk. Further details on the sampling methodology and quality assurance are provided in Section 3.1 of **Appendix G**. Visual observations for potential contamination sources / indicators were also made during the sampling process.

Laboratory testing was undertaken by SGS Australia Pty Limited, a NATA accredited laboratory. A total of ten samples were analysed for the following potential contaminants, selected based on the former land use and overall site history:

- eight metals
- total petroleum hydrocarbons (TPH)
- total recoverable hydrocarbons (TRH)
- polycyclic aromatic hydrocarbons (PAHs)
- polychlorinated biphenyls (PCBs)
- benzene, toluene, ethylbenzene, xylenes and naphthalene (BTEXN).

The assessment criteria applied to the laboratory results were based on the protection of human health and are detailed in Section 3.1.5.1 of **Appendix G**.

In terms of the visual observations, no obvious staining, colour changes or odours were encountered. No groundwater seepage was observed during sampling. Old or discarded machinery in the field were observed adding rust (iron oxides) in small amounts (e.g. old windmill).

The laboratory results are provided in Appendix D of **Appendix G**. The following summary statements were made in relation to the laboratory results:

- The analysis showed no exceedances off the ASC National Environment Protection Measure (NEPM)[12] assessment guidelines.
- No metals and inorganics exceeded the ASC NEPM assessment guidelines, including health investigation levels/health screening level A (the most conservative assessment guideline).
- All BTEXN components were below ASC NEPM assessment guidelines.
- PAHs and PCBs were below ASC NEPM assessment guidelines.

Based on these findings, the Project area is considered to possess a low risk of contamination that would pose a risk to human health or the environment. Therefore, no further assessment of contamination was deemed necessary.

However, due to size of the Project area, there may potentially be isolated areas of contamination that were not identified during the desktop study or captured by the sampling. Therefore, should any possible contamination sources be encountered during future Project activities, further investigation may be triggered or warranted and would be conducted in compliance with the applicable legislation, standards and guidelines for contaminated land management in Queensland.

7.3.23 Landscape Character and Visual Amenity

7.3.23.1 Landscape Character

Landscape character is the distinct, consistent pattern of elements in a landscape that makes it unique, a combination of both natural and human influences. It's what gives a place its 'sense of place', rather than being a judgment of whether one landscape is better or worse than another. These elements include natural factors like geology, soil, and topography, combined with cultural and human factors such as land use, historical development, and settlement patterns.

Therefore, from a landscape character perspective, the Project area and its surrounds are located within the Bowen Basin in Central Queensland and are characterised by the region's long history of grazing and

[12] https://www.nepc.gov.au/nepms/assessment-site-contamination

mining (i.e. as the two major land uses). These anthropogenic activities have significantly modified the vegetation and to a lesser extent the physical landscape.

The Project area possesses two gently undulating rises in the north-western and southern areas which are separated by Conrock Gully, which drains into the Isaac River along the eastern boundary. An alluvial plain follows the eastern and southern boundary of the Project area, following the Isaac River and Cherwell Creek. These landscape features are common within the Isaac River basin.

Vegetation within the Project area has been altered by grazing activities and now comprises mainly open grassland (highly modified pastures), with remnant vegetation mainly restricted to along the Isaac River, Cherwell creek, Conrock Gully and other small patches of fragmented remnant vegetation.

There are no formally listed heritage places within or in proximity to the Project area that could add to the character of the landscape (see **Chapter 20**).

No other significant landscape features exist within the Project area (e.g. geological features). The Isaac River and Cherwell Creek which border the Project's eastern and southern boundaries, respectively, along with their associated riparian vegetation, form the only landscape features of any potential note. However, these features are common within the Isaac River basin.

7.3.23.2 Visual Amenity

Visual amenity is the quality of a landscape or area that makes it pleasant for people to look at and be in, encompassing the scenic quality of views and landscape features valued by a community. It is shaped by natural elements like vegetation and topography, as well as human-made structures, and is considered from the perspective of viewers such as residents, workers, or visitors.

From a visual perspective, the Project area is relatively remote, largely located on private land and is not in close proximity to any major public roads. As described in Section 7.3.4, the Winchester Downs Homestead is the only significant sensitive receptor site in close proximity (< 2 km). All other sensitive receptors are located 5 km or more away from the Project site (Figure 7-3). The nearest public roads are 2.5 – 5 km from the Project area. Moranbah is closest township and is located approximately 15 km northwest of the Project. The quarry operations described in Section 7.3.3 is the closest industrial facility to the Project not owned by Stanmore (i.e. approximately 2-3 km to the west).

The Project abuts IDM and will be integrated into the IPC through the continued use of supporting infrastructure (e.g. CHPP) and the provision of access to the Peak Downs Highway, which is the main road in the Isaac region. Therefore, views of the Project will be limited for the general public from any direction, except for the Winchester Downs Homestead residents.

The current view towards the Project from the Winchester Downs Homestead and Stockman's Quarters, as collected in 2025, are shown in Figure 7-21 and Figure 7-22, respectively.

7.3.24 Lighting

The light environment at the Project area, while generally dark at night, would receive an ambient glow from the adjacent IDM, and nearby IPM (approximately 8 km to the north), Poitrel Mine (approximately 4.5 km to the east) and Daunia Mine (approximately 9 km to the east).

From a lighting perspective, the Project area shares the same circumstances as described for visual amenity in Section 7.4.9.2. Consequently, only the Winchester Downs Homestead residents will be subject to the Project's ambient and fugitive light, particularly from mining operations in the southern portion of the Project area.

7.4 Potential Impacts to Land

7.4.1 Land Disturbance

To extract the Project's coal resource, the land within the planned mining pit will be progressively disturbed over the life of the Project's mining operations. Section 4.7.5 of **Chapter 4** describes the Project's progressive mining disturbance.

Additional infrastructure is required to facilitate the Project's mining activities, which comprises go-lines, a crib area, run-of-mine coal pads, dams, water pipelines, powerlines, levee and levee plugs, a temporary dragline crossing of the Isaac River, bridges, roads and the diversion of Conrock Gully. These mining support activities will result in disturbance. Most of the Project's additional infrastructure will be established prior to mining during the construction phase and may require modification over the life of the Project. **Chapter 4**, **Chapter 8** and **Chapter 9** detail the Project's additional infrastructure, surface water management structures, and Conrock Gull diversion, respectively.

A Project disturbance area has been defined encompassing all proposed Project activities (see **Chapter 4**). The intensity of land disturbance differs between mining and infrastructure areas, and disturbance areas area separated into different rehabilitation areas, reflecting the nature of rehabilitation activities in each area.

The Project's mining disturbance will result in the progressive development of a new landform that comprises an in-pit dump, two out-of-pit dumps (southwest and east), and a final void that is outside the 0.1% AEP (1 in a 1,000 year) flood plain (see Section 9.4 of **Chapter 9**). The configuration of the Project's final landform is based on the most efficient mine plan for coal extraction and the development of a final landform that, following rehabilitation, supports the planned post-mining land uses (PMLUs), including the use of the final void as a beneficial water storage. Further details on the Project's final landform are provided in **Chapter 5**.

The granting of the Project's mining leases, EA and progressive rehabilitation and closure plan (PRCP) schedule will authorise the Project's disturbance. The planned rehabilitation of the final landform will be guided by the Project's PRCP and proposed PRCP schedule, which are provided in **Appendix AB** and **Appendix AC**, respectively. The PRCP and PRCP schedule are legislative requirements for mining in Queensland, can only be modified through a statutory amendment process, and are regulated by DETSI. The PRCP and PRCP schedule are designed to ensure the Project's disturbance is progressively rehabilitated to a final landform that will support the proposed PMLUs. The PRCP defines different rehabilitation areas with their won rehabilitation milestones.

Rehabilitation of the Project's disturbance is described in **Chapter 5**.

7.4.2 Land Use

7.4.2.1 Primary Disturbance

As describe in Section 7.3.3.2, cattle grazing on native and modified pastures is the major land use within and surrounding the Project area. Because of the disturbance associated with the Project's mining operations, grazing will not be able to be conducted on a majority of the land within the Project area until mining and rehabilitation is completed. Where possible and depending on safety constraints, buffer land surrounding the Project's mining activities will continue to be available for grazing activities.

The identified land uses adjacent to the Project will not be adversely impacted, and therefore, will continue to function normally over the life of the Project.

7.4.2.2 Stock Route Disturbance

As outlined in Section 7.3.3.1, the State Reserve, Lot 9 GV33, is a nominated stock route for the purpose of 'camping, water and road' and is leased by the private owner of Winchester Downs for grazing activities. Approximately a third of the stock route, which generally represents the northwestern portion of the reserve, will be disturbed by the Project's mining activities and will be unavailable over the life of the Project (Figure 7-2).

The undisturbed portion of the stock route will not be adversely impacted, and therefore, will continue to function normally over the life of the Project.

7.4.2.3 Cumulative Impacts

As identified in the economic impact assessment (**Appendix Z**), the total Project disturbance area accounts for approximately 0.04% of the livestock grazing area in the regional catchment. Therefore, the Project will make a negligible contribution to cumulative impacts on land use, further reduced by the proposed rehabilitation of the majority of the land to its pre-mining land use of livestock grazing.

7.4.3 Geochemistry – Mining Waste Assessment

As detailed in Section 7.3.12.2, only spoil, including minor volumes of waste coal, will be managed at the Project area. Therefore, the assessment focusses on the Project's spoil and minor quantities of waste coal that will report to the Project's spoil emplacements as part of final landform development.

A geochemical source hazard assessment was undertaken using an appropriate combination of weathered and fresh non-carbonaceous spoil, and weathered and fresh carbonaceous spoil. The methodology used for the geochemical source hazard assessment is provided in Section 3.4 of **Appendix F**.

The source hazard assessment methodology outlined in Section 3.4.3 (AMD hazard scoring) of **Appendix F** and Section 3.4.4 (landform AMD likelihood scoring) of **Appendix F** were applied to the spoil within each Project landform. The source materials, and their approximate proportions within each spoil landform were estimated as follows:

- Spoil, non-carbonaceous = 94%, a mix of weathered and fresh material.
- Spoil, carbonaceous = 5%, all fresh.
- Coal = 1%, all fresh.

The AMD hazard scoring table for the proposed spoil landforms at the Project is provided in Appendix C of **Appendix F**.

7.4.3.1 Geochemical Source Hazard Assessment – Spoil and Coal

A geochemical source hazard assessment was applied to the source material types within each of the Project's planned spoil landforms and the source materials expected to be exposed in the walls of the Project's residual or final void (see Section 6.1 of **Appendix F**). Based on the findings provided in Section 7.3.12, the geochemical source hazard assessment focussed on the Project's carbonaceous spoil, non-carbonaceous spoil and coal. As discussed in Sections 7.3.13 and 7.3.14, tailings and coarse rejects will be managed in accordance with approved tailings and coarse rejects waste management systems at IPM, and therefore were not included in the geochemical source hazard assessment.

The geochemical source hazard assessment developed a source hazard score, which is a formula that takes into account the propensity to generate AMD, the AMD capacity (severity) and the quantity (volume) of material within a landform or the walls of the residual void that could produce AMD. The Project's AMD source hazard scores are as follows:

- Spoil – non-carbonaceous: AMD source hazard score = 'Low'.
- Spoil – carbonaceous: AMD source hazard score = 'Low-Moderate'.

- Coal: AMD source hazard score = 'Low-Moderate'.

The Project's AMD source hazard scores were then combined with the proportion of material that could generate AMD relative to the total proportion of all materials in the final landform (spoil landforms and residual void), to develop an AMD hazard score for the Project's landforms, void highwall / end-walls and void floor at closure. Section 6.1 of **Appendix F** provides additional details on the geochemical source hazard assessment's methodology.

7.4.3.2 Spoil Landforms Assessment

Three spoil dumps, comprising an in-pit dump / spoil landform, the southwest out-of-pit dump (OOPD) / spoil landform (southwest OOPD) and the east out-of-pit dump / spoil landform (east OOPD), are planned to remain at closure as part of the Project's final landform (Figure 7-15). A fourth spoil dump called the north OOPD, will be rehandled back into the pit during late-stage operations to develop the final void, and therefore, will not exist as a post-closure landform.

The in-pit dump / spoil landform comprises mined overburden and interburden dumped behind the active mining face to form a low-wall spoil dump (effectively backfilling the pit behind the active mining face). The southwest and east OOPDs will comprise mined overburden and interburden dumped outside the pit shell adjacent to the active pit (i.e. as box-cut spoil). The southwest and east OOPDs will be reshaped to form two final spoil landforms located on the southwestern and eastern sides of the pit, respectively. As described in Section 7.3.14, none of the Project's spoil dumps or final spoil landforms will contain coarse rejects.

Therefore, considering the material quantities (proportions) and expected proportion of PAF materials reporting to each individual landform, it was assessed that each of the Project's spoil landforms pose a low AMD hazard, with AMD generation rated as highly unlikely.

In summary, the low AMD hazard of the Project's spoil landforms is largely a result of only 1.2% of non-carbonaceous spoil samples being conservatively classified as PAF of some type, and non-carbonaceous spoil comprising the overwhelming majority (about 94%) of mineral waste within each spoil landform. Additional hazard assessment supporting information is provided in Section 6.1 and Appendix C of **Appendix F**.

7.4.3.3 Residual Void Assessment

A narrow residual void will remain at closure at the centre east side of the Project's former mine pit (Figure 7-15). The void is conservatively assumed to have coal (Vermont seam group) remaining on the void (former pit) floor. Environmental geochemical data and drill-hole geological logs were used to aid in the assessment of AMD risk associated with the residual void highwall and floor.

The highwall hazard assessment concluded that approximately 2.8% of the void highwall is estimated to be PAF, which includes material classified as UC(PAF), PAF-LC and NAF-S. As a result, the assessment has found that the likelihood of AMD generation from the void highwall is highly unlikely, and any expression of AMD from the highwall is likely to be localised.

The floor of the void will be the Vermont seam group. On the highly conservative (if not overly conservative) assumption that the floor of the void is all coal, the void floor AMD hazard assessment has estimated that approximately 23% of the floor of the void is estimated to be PAF, which includes material classified as PAF, UC(PAF), PAF-LC and NAF-S. As such, the highly conservative assessment has found that the likelihood of AMD generation from the floor of the void where coal is exposed is unlikely, until the void floor becomes submerged by groundwater post-closure and changes the likelihood of AMD generation to highly unlikely. In practice, mining takes all coal to the bottom of the seam. Therefore, very little coal would be expected to remain on the floor of the void.

Additional hazard assessment supporting information is provided in Section 6.1 and Appendix C of **Appendix F**.

7.4.3.4 Geochemical Source-Pathway-Receptor Assessment

A post-closure geochemical source-pathway-receptor (SPR) assessment was conducted for the Project's spoil landforms and final void, which involved the likelihood of an event occurring (e.g. the likelihood of AMD impacting a local creek), the severity of the event should it occur and the calculated risk rating (likelihood times severity) (see Section 6.2 of **Appendix F**). A risk rating was calculated for each of the Project's spoil landforms and the residual void with respect to plausible surface water and groundwater receptors.

A post-closure conceptual site model (CSM), which applies generically to the spoil landforms and the residual void at the Project, and the broader relationship these facilities have with surface water and groundwater in the district, has been produced by SLR Consulting Australia (**Appendix K**). The CSM assists with the SPR assessment with regard to potential environmental geochemical impacts from mineral waste facilities. A key element of the CSM based on the hydrogeological assessment, which included groundwater modelling and particle tracking undertaken by SLR, was that the residual void will be a groundwater 'sink' (i.e. groundwater at the Project will flow towards/into the residual void, and the void will be the receptor of seepage from Project activities). Section 6 and Appendix D of **Appendix F** detail the risk assessment process completed for the SPR assessment.

For the rehabilitated spoil landforms, the plausible mechanisms for AMD affected water and/or non-oxidative salinity, if any, to report to post-closure receptors are identified in Table 6 1 of **Appendix F**. For the void highwall, as potential sources of AMD affected water and/or non-oxidative salinity, the only plausible receptor is the void, via surface water run-off from the void highwall.

In summary, the plausible mechanisms for AMD affected water and/or non-oxidative salinity, if any, to report from post-closure spoil landforms to receptors are:

- Surface water run-off from spoil landforms into creeks (and also includes potential seepage out of the toe of a spoil landform and continuing as surface water run-off).
- Seepage from spoil landforms via shallow permeable strata into creeks.
- Seepage from spoil landforms into the residual void (with the void as a receptor).
- Surface water run-off and seepage from the void highwall into the residual void (with the void as a receptor).

It should be noted that during mining operations, surface water runoff and seepage from spoil dumps will be captured by the Project's water management systems (see **Chapter 8**), and if required, will only be released subject to meeting the discharge criteria prescribed in the Project's EA, developed to protect downstream environmental values.

7.4.3.4.1 SPR Risk Rating of Rehabilitated Spoil Landforms

The SPR assessment identified plausible surface water and residual void receptors associated with final Project's spoil landforms, and the run-off and seepage pathways linking the sources (final spoil landforms) to the surface water and residual void receptors. In summary, with respect to AMD, the overall SPR risk rating for the Project's final spoil landforms is low. In addition, with respect to non-oxidative salinity, the overall SPR risk for the Project's final spoil landforms is also rated as low. Further supporting information is provided in Section 6.2 and Appendix D of **Appendix F**.

7.4.3.4.2 SPR Risk Rating of the Residual Void

As outlined in Section 7.4.3.4, groundwater modelling predicts that the Project's final void is likely to be a 'sink' in relation to receiving surface water run-off, seepage from spoil landforms and surface water run-off from the void highwall. The Project's residual void is expected to receive inflow from the Permian groundwater aquifer (**Chapter 10**).

The SPR assessment concluded that it's unlikely that undiluted salinity or AMD from a flooded post-closure residual void floor would impact on the residual void's water quality to any significant degree, as evapo-concentration and other processes are the key drivers of the void lake's water quality. In summary, with respect to AMD, the SPR risk rating on the overall water quality of the Project's residual void is low (Section 6.2 and Appendix D of **Appendix F**).

7.4.4 Geotechnical Assessment – Final Landform

7.4.4.1 Overview

The Project's geotechnical assessment report is provided in **Appendix H**.

The Project's proposed final landform is detailed in **Chapter 5** and shown in Figure 7-14. To demonstrate the long-term stability of the Project's conceptual final landform and to support the Project's PRCP, a geotechnical assessment of the final void's exposed residual highwall slope and re-profiled out-of-pit and in-pit spoil dumps was undertaken.

The Project's geotechnical assessment results were used to help develop the PRCP's design acceptance and completion criteria for the final landform. The key geotechnical performance criterion for the final void and landform slopes is the factor of safety (FoS).

7.4.4.2 Methodology

The Project's geotechnical assessment was based on slope stability geotechnical models developed using the two-dimensional limit equilibrium method to simulate long-term closure scenarios.

Two-dimensional limit equilibrium analyses were performed to determine the overall slope stability in terms of a FoS, which is a commonly employed measure in slope stability analysis to determine the likelihood of slope failure. The FoS is a measure of driving forces versus resisting forces in a system, where a FoS of 1 equates to a 50% probability that failure will occur. FoS values > 1 are indicative of a system likely to be stable.

Further details on the methodology and assumptions applied to the Project's geotechnical assessment are provided in Section 5.6 of **Appendix H**.

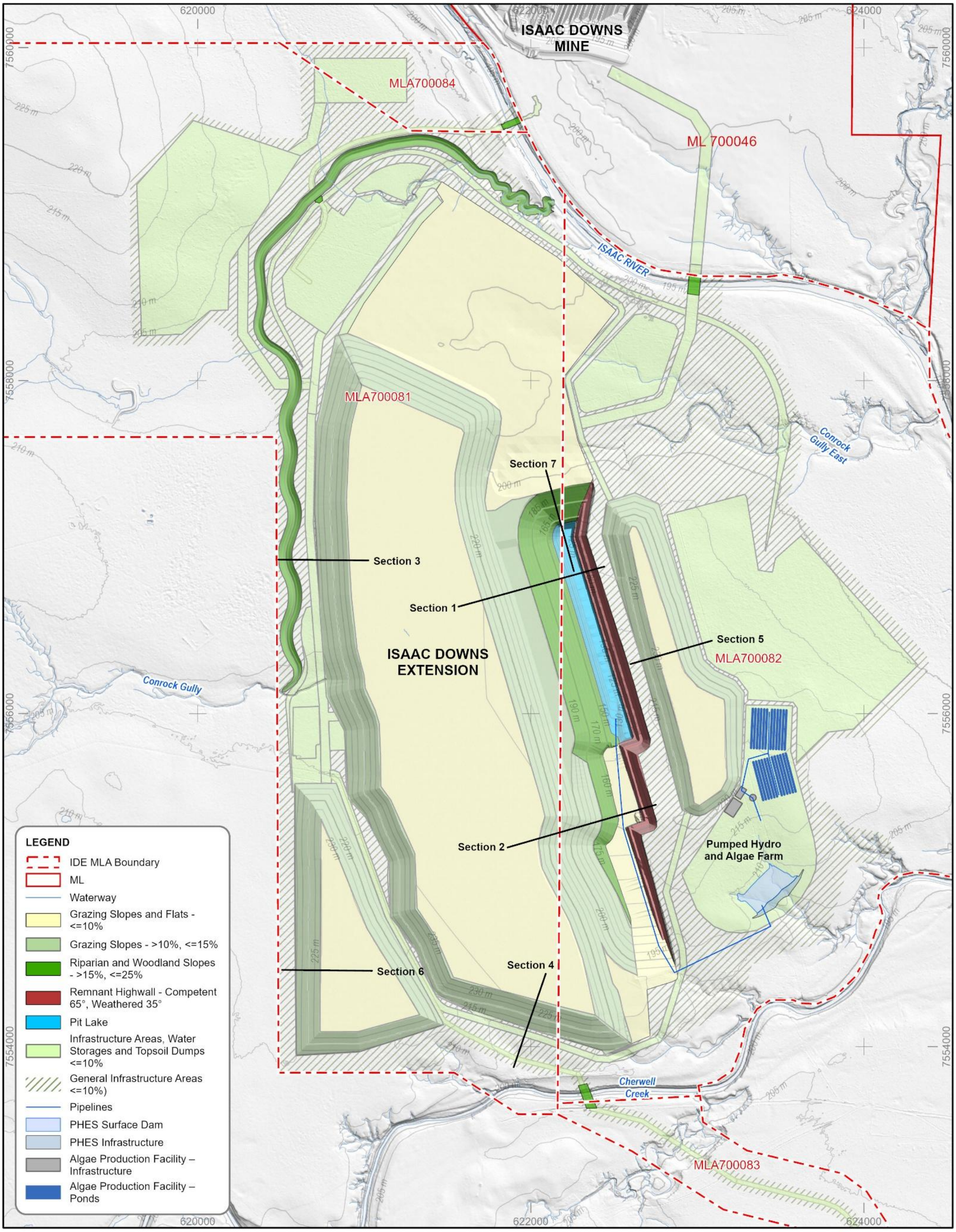
7.4.4.3 Geotechnical Analysis

7.4.4.3.1 Representative Cross-sections Selection

To ensure an accurate geotechnical analysis, representative cross-sections were selected through the final landform layouts of the Project, including backfilled in-pit dump, as presented in Figure 7-14, and as described as follows:

- Sections 1 represents the northern void area across the low wall and highwall.
- Section 2 represents the southern void area that has been partially backfilled.
- Section 3 and 4 represent re-profiled in-pit spoil dump cut on the western side and southern end, respectively.
- Section 5 and 6 represent the eastern and southwestern out-of-pit dumps, respectively.
- Section 7 represents the re-profiled in-pit dump across the backfilled low wall adjacent to the highwall crest and corresponding to the operational low wall.

Slope stability models were subsequently developed for all the selected final landform sections and are presented in Figure 5-2 to Figure 5-8 of Section 5 of **Appendix H**. The results of the analysis of the selected final landform sections are presented in Table 7-16.



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DISCLAIMER: Third party data sources are used in this map compilation. Minserve makes no warranty regarding this data's accuracy or currency.

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ISAAC DOWNS EXTENSION

Geotechnical Analysis – Representative Cross-sections

Figure 7-14

7.4.4.3.2 Northern Low wall Stability – Under Q1,000 Flood Conditions

The flood levee that protected the Project's mining pit from a Q1,000 (1:1,000-year) flood event during mining operations will be rehabilitated and will not form part of the final landform. Consequently, the Q1,000 flood event is predicted to result in surface water flowing across the backfilled pit in proximity to final landform low wall, as illustrated in Figure 5-9 within Section 5 of **Appendix H**. As demonstrated in Section 9.7 of **Chapter 9**, the Project's final void will not be flooded by Q1,000 flood event.

Based on the flood model data for the final landform provided in **Appendix J**, the peak water level associated with the Q1,000 flood event is estimated to reach approximately 202.5 m AHD, with a duration of approximately 43 hours. This timeframe is generally considered insufficient to allow significant infiltration of surface water into the underlying subsurface materials or to induce a measurable phreatic level response.

However, to assess a conservative (worst-case) scenario, a geotechnical stability model was developed to evaluate the potential impacts of an elevated phreatic surface resulting from a Q1,000 flood event, as illustrated in Figure 5-10 of Section 5 of **Appendix H**. The result of the analysis of the northern low wall's stability under Q1,000 flood conditions is presented in Table 7-16.

7.4.4.3.3 Consequent Assessment – Final Pit Geometry

A consequence assessment was conducted for the Project's final landform geometry following the guidelines suggested by Simmons et al. (2024). Table 7-14 summarises the Project's geotechnical instability consequence assessment, which is negligible to low for all scenarios.

In summary, the Project's highwall, low wall and spoil dump slopes have negligible to low consequence of geotechnical instability. Therefore, if any geotechnical instability were to occur, it is expected to result in minimal risk to personnel, the environment and critical infrastructure (i.e. based on the consequence categories presented in Table B-1 of Appendix B of **Appendix H**). The consequence assessment examined exposure and associated impacts to specific zones or areas, which included the crest, body, and toe of each slope. The consequence assessment is presented in Table B-2 and Table B-3 of Appendix B of **Appendix H**.

Table 7-14 Geotechnical Instability Consequence Assessment

Scenario	Impact (Harm)	Consequence of Geotechnical Instability
Highwall instability that extends into PMLUs behind crest	Environmental	Negligible
	Humans	Negligible
Low walls/out-of-pit dump instability extends into grazing PMLU	Environmental	Low to Negligible
	Humans	Low
Low walls/out-of-pit dump instability extends into woodland PMLU	Environmental	Negligible
	Humans	Negligible

7.4.4.3.4 Design Acceptance Criteria – Progressive Rehabilitation and Closure Plan

Instability along potential slip surfaces is generally evaluated using limit equilibrium analyses, with outcomes expressed as a FoS. For slope design, typical FoS values range from 1.3 to 1.5, with lower values considered acceptable where model uncertainty is low or the potential consequences are minor.

The Project's geotechnical model was classified as possessing a 'high uncertainty', based on the model uncertainty statement provided in Section 5.2 and Appendix A of **Appendix H**.

Consequently, the minimum FoS adopted for the Project's final landform design were developed based on the geotechnical model's classification to ensure a minimal risk of slope failure. The Project's design acceptance criteria are summarised in Table 7-15. These design acceptance criteria will be adopted as PMLU milestone criteria for a stable landform to support the applicable rehabilitation milestones within the Project's PRCP.

Table 7-15 Proposed Design Acceptance Criteria – Factor of Safety

Scenario	Design Acceptance Criteria Minimum Critical FoS
Geotechnical instability extending to critical infrastructure (e.g. watercourse channels, pumped hydro or algae ponds) behind the crest.	1.5
Geotechnical instability extending to grazing PMLU.	1.5
Geotechnical instability extending to woodland PMLU	1.5
Geotechnical instability contained within the void (remnant highwall) – below void water level	1.5

7.4.4.3.5 Geotechnical Analysis Results

The two-dimensional limit equilibrium analyses reported critical FoS values of 1.5 to 4.5 for all the selected cross-sections within the Project's final landform. The results are summarised in Table 7-16. These results meet or exceed the design acceptance criteria for final landform of a FoS ≥ 1.5, and therefore, are considered satisfactory for the long-term stability of the Project's final landform. A complete set of results for the two-dimensional limit equilibrium analyses are presented in Appendix C of **Appendix H**.

For excavated highwall and low wall slopes, kinematic mechanisms are an important mode of failure, that is wedge, planar and toppling mechanisms, which are not represented when using two-dimensional limit equilibrium techniques. Because the Project has not commenced, there is no data that allows the examination of these failure modes. Therefore, strip by strip face mapping and further assessment of kinematic mechanisms will be completed when enough data has been procured through the operational processes of pit wall mapping and photogrammetry assessment.

Table 7-16 Project – Final Landform Stability Analysis Results

Sections	Void Slope	Surface Type	Search Method	Factor of Safety
1	Highwall	Non-Circular	Block	**1.6**
	Low wall	Non-Circular	Block	**2.6**
2	Highwall	Non-Circular	Auto-Refine	**2.5**
	Low wall	Circular	Auto-Refine	**3.0**
3	Batter Slopes In-Pit Dump	Circular	Auto-Refine	**4.0**
4				**3.8**

Sections	Void Slope	Surface Type	Search Method	Factor of Safety
5	Out-of-Pit Dump	Non-Circular	Block	**4.5**
6				**4.3**
7	Final Landform Low wall	Non-Circular	Block	**1.9**
	Final Landform Low wall (Q1,000)	Non-Circular	Block	**1.7**

7.4.4.4 Long-term Geotechnical Stability – Final Landform

7.4.4.4.1 Time Dependant Degradation and Erosion

Over the long-term, pit slope faces are expected to erode to some extent due to natural weathering processes. However, the pit slope faces should maintain a similar profile as the stronger sandstone layers generally act as reinforcement within the slope.

It is difficult to ascribe a timeframe for weathering based on the variables involved. Studies carried out at Bowen Basin sites in Central Queensland show a possible degradation rate of approximately 40 to 50 mm/year on exposed pit walls, which is equivalent to approximately 1 m every 20 years (Ward, 2016). This rate of degradation is also highly dependent on the long-term water level in the void, which typically prevents exposure of the slopes and reduces the rate of weathering and erosion.

Overall, these processes are unlikely to prejudice the geotechnical stability of the entire slope. However, these processes may result in localised shallow failures, or undercutting of the slope.

7.4.4.4.2 Global Geotechnical Stability – Rock Slopes

Geotechnical stability in rock slopes is generally controlled by geological structure, as the rock itself is too strong to permit shear failure. However, rock mass strength is scale-dependent, and if the block size produced by the discontinuities is small enough compared to the slope height, steep slip pathways may be generated in high faces by linking through the discontinuities without shearing the rock itself (Simmons, 1995). This type of failure is unlikely to occur within the Project's final landform for the following reasons:

- The base of weathering across the site is approximately 20 m deep. However, where this horizon is assessed to be thicker (i.e. greater than approximately 20 m deep), failures have the potential to occur if the slope angle is above approximately 50° for weathered rock and approximately 45° for unconsolidated Cainozoic sediments.
- Rock mass strength failures are unlikely to occur at slope heights below 300 m under normal conditions (Simmons, 1995), which usually implies good rock mass conditions and minimal faulting or geological structure behind the highwall/low wall slopes. Based on the maximum height of approximately 100 m for the residual void, the buttressed highwalls and low walls are likely to be stable from mass failures in the absence of adverse geological structures and geometries on the slope faces.
- Weathered and fresh Permian coal measure rocks are generally less susceptible to erosion, compared to the Tertiary and/or Quaternary (Cainozoic) units.
- Non-weathered Permian rock units, typically mudstone and claystone and weathered Permian units are likely to be susceptible to slaking, which occurs when material breaks down upon exposure to moisture and wetting and drying cycles.
- Sandstone is typically less susceptible to degradation caused by weathering in comparison to siltstone, mudstone, or unconsolidated Cainozoic materials. In the context of an open pit slope,

preferential slaking of the less-resistant material above or below a more durable sandstone, for example, is likely to occur over time, and lead to undercutting. This occurrence introduces the risk of ongoing rockfalls and localised steepening of the slope.

- Generally, detached blocks would be small and inconsequential from a global stability perspective, with the blocks reporting directly to the void. Treatment of the slope in this situation is often impracticable, as the residual void would be filled with water.

7.4.4.4.3 Structurally Controlled Geotechnical Failure Modes

Mass failure of rock will require the presence of pre-existing discontinuities to create the freedom of movement. Conditions of instability can be generated by the presence of adversely oriented geological structures such as faults, major joints, or steep bedding, if present in the Project's final void.

7.4.4.4.4 Structurally Controlled Geotechnical Failure Modes

Fresh Permian spoil is generally blocky, but this material can be susceptible to rapid slaking, particularly as the void fills with water, which may result in a significant proportion of fines being generated.

Spoil dump surfaces, including low walls, will be rehabilitated to achieve acceptable erosion rates. Nevertheless, some erosion and fines may report to the enclosed void, which is unlikely to have a significant effect on stability (Ward, 2016).

7.4.4.5 Final Void Completion Criteria – Geotechnical Stability

Completion criteria were developed, based on a FoS, to demonstrate the geotechnical stability of the Project's final landform, and for inclusion in the Project's PRCP.

Whilst the requirements for final slopes are not specific in terms of geotechnical design parameters, slope designs typical of those used throughout the coal industry are considered suitable for closure purposes, with remedial modifications sometimes required, particularly in the Cainozoic and weathered horizons to achieve stable slopes.

From a regulatory perspective, the Project's final landform is required to be geotechnically stable, with safety and environmental risks minimised to a practicable, but acceptable extent. Table 7-17 outlines a set of possible management actions for the Project based on the adopted FoS design acceptance criteria of 1.5.

Table 7-17 Project – Completion Criteria Actions

Geotechnical Scenario	Critical infrastructure and Grazing PMLU (FoS)	Woodland PMLU (FoS)	Void Highwall (FoS)	Management Action
	≥ 1.5			• No action required.

Geotechnical Scenario	Critical infrastructure and Grazing PMLU (FoS)	Woodland PMLU (FoS)	Void Highwall (FoS)	Management Action
Static FoS Criteria	< 1.5 > 1.05			• Periodic inspections and geotechnical assessment to confirm geotechnical stability prior to closure. • Treatment of slope if practicable. Risk assessment by appropriately qualified expert. • Assessment of offset between critical minimum FoS and slip surface that reports FoS ≥1.5.
	< 1.05			• Treatment of high-risk slopes to be considered, if practicable. • Regular inspections to confirm geotechnical stability prior to closure. • Further risks assessment by appropriately qualified expert.

As a general guideline for the Project's final void and landform slopes, the following design criteria are recommended:

- Highwall and low wall batter angles up to 70°, with an inter-ramp angle of <50°.
- Weathered slope angles ≤ 45°.
- For in-pit and out-of-pit spoil dumps, a maximum overall slope angle from toe to crest not greater than approximately 25°.

The Project's final landform achieves the recommended design criteria with slope angles less than the respective recommended design criteria. A summary of the proposed completion criteria for geotechnical stability of the Project's final landform is presented in Table 7-18, based on the results of the slope stability analyses (Table 7-16). The proposed completion criteria for geotechnical stability of the Project's final landform will be incorporated into the Project's PRCP.

Table 7-18 Project – Proposed Completion Criteria – Static Conditions

Sections	Void Slope	Design Meets Criteria	Action/ Proposed Remediation
1	Highwall	Yes	No action required.
	Low wall	Yes	No action required.
2	Highwall	Yes	No action required.
	Low wall	Yes	No action required.

Sections	Void Slope	Design Meets Criteria	Action/ Proposed Remediation
3	Batter Slopes In-Pit Dump	Yes	No action required.
4	Batter slope Ex-Pit	Yes	No action required.
5	Out-of-Pit Dump	Yes	No action required.
6	Ex-Pit Dump	Yes	No action required.
7	Final Landform Low wall	Yes	No action required.
	Final Landform Low wall (Q1,000)	Yes	No action required.

7.4.4.6 Surface Water Management

Run-off over the highwall is likely to have minimal impact on the stability of the rock benches. However, concentrated run-off will erode and gully the upper weathered horizon. Additionally, ponded water is likely to infiltrate the surface layers and cause piping erosion which is difficult to manage once the process has commenced.

This process would be dependent on the nature and thickness of the Tertiary material, and measures designed to encourage diversion of surface water away from these areas should be considered as a priority.

The Project proposes measures, such as bunds, to divert surface water runoff away from the highwall, which are typical final landform design practices for mines within Queensland's Bowen Basin.

7.4.4.7 Exclusion Bund Offset

As specified by the Guidelines for the Geotechnical Assessment of Final Landforms (Simmons et al., 2024), fencing or bunding should be established at a sufficient offset from where the limit of crest instability is anticipated. In relation to the Project, because the calculated minimum FoS is ≥ 1.5 for all slopes analysed, a minimum offset distance of 15 m from the final crest position is sufficient. However, the offset distance may be greater (e.g. up to 50 m).

Exclusion bunds for the purpose of restricting access will have a minimum height of 2 m, and will be constructed of non-dispersive material, which will also redirect water away from the final void.

7.4.4.8 Geotechnical Assessment – Summary

The Project's geotechnical assessment demonstrates that the final void slopes, out-of-pit spoil dump slopes and in-pit spoil dump slopes should be geotechnically stable in the long-term. Geotechnical stability monitoring will be undertaken during operations as slopes and walls are exposed and additional geotechnical data is obtained.

7.4.5 Infrastructure

As outlined in Section 7.3.10.1, there is a portion of Olive Downs Mine's water supply pipeline within and adjacent the Project area. This water supply pipeline only intersects the Project' secondary access road, and therefore, will be able to continue its function without major management requirements. The proponent will seek agreement with IRC and Pembroke Resources (owners of Olive Downs Mine) for the continued safe operation of the water supply pipeline.

No other major infrastructure is within or currently planned within or adjacent the Project area. The closest infrastructure to the Project area is the Winchester Downs Homestead (< 2 km).

Chapter 16 explains in detail how potential air blast over-pressure and vibration impacts from blasting will be managed to ensure compliance with the applicable conditions of the Project's EA at the Winchester Downs Homestead.

7.4.6 Land Contamination - Notifiable Activities

Section 7.2.3 explains the statutory requirements for notifiable activities in Queensland under the EP Act. The proponent is committed to ensuring these requirements are addressed over the life of the Project.

The following notifiable activities may potentially occur within the Project area:

- 7 Chemical Storage (other than petroleum products or oil) – storing more than 10 t of chemicals that are dangerous goods.
- 24 Mine wastes — (a) storing hazardous mine or exploration wastes, including, for example, tailings dams, overburden or waste rock dumps containing hazardous contaminants; or (b) exploring for, or mining or processing, minerals in a way that exposes faces, or releases groundwater, containing hazardous contaminants.
- 29 Petroleum product or oil storage — storing petroleum or oil products that are class C1 or C2 combustible liquids in above ground tanks with more than 25,000 L capacity.
- 37 Waste storage, treatment or disposal — storing or disposing of regulated waste.

As explained in **Chapter 4**, the Project's infrastructure requirements are reduced due to the planned use of existing infrastructure at IPC. This beneficial arrangement also removes the requirement for certain notifiable activities to be conducted within the Project area (e.g. tailings storage facility), which provides additional environmental benefits.

The Project will not be storing other potentially hazardous mine waste within the Project area. For example, as described in Section 7.4.3.2, there is a low AMD hazard associated with the Project's spoil landforms.

In relation to the Project's potential notifiable activities, as construction and mining activities progress, the proponent upon identification of a new notifiable activity will advise the administering authority within the specified timeframe for inclusion of the site on the EMR. The proponent will maintain a register of notifiable activities conducted within the Project area as part of its environmental management system.

No other potential sources of significant contamination are expected within the Project area (e.g. disturbance of acid sulfate soils).

7.4.7 Rehabilitated Landform Erosion Assessment

7.4.7.1 Overview

A materials characterisation and rehabilitated landform erosion assessment was undertaken for the Project (see **Appendix D**), which included the following components of assessment:

- A review of information on soils and mine wastes (i.e. spoil, overburden / interburden)[13] obtained for the Project.
- Completion of additional testing of mine wastes and soils.
- Completion of two dimensional (2D) runoff/erosion modelling using the Water Erosion Prediction Project (WEPP) runoff/erosion modelling to define erosionally stable rehabilitation slope geometries.

[13] The terms 'overburden', 'spoil' and 'mine waste rock' are used synonymously in this EIS, and include interburden.

- Completion of three dimensional (3D) landform evolution modelling of the rehabilitation design.

7.4.7.2 Soils

7.4.7.2.1 Soil Characteristics

The Project's soils are described in Section 7.3.18 and **Appendix E**. For the purpose of rehabilitation, the Project's soils within the proposed disturbance area were grouped into three classes based on their characteristics, which were 'good quality topsoil', 'marginal topsoil', and 'subsoil'.

Good quality topsoil is the preferred choice for soil resources for rehabilitation and has negligible limitations to plant growth and nil to low levels of ameliorants required. Marginal topsoil can be used in rehabilitation where there is a deficit in good quality topsoil. Marginal topsoil has minor limitations to plant growth that can be ameliorated if used (e.g. slightly more acidic or alkaline, slightly elevated salinity, and/or higher sodicity). Subsoil is not recommended for use at the surface in rehabilitation but can be placed below good quality topsoil or marginal topsoil.

Key characteristics of the good quality topsoil and marginal topsoil within the proposed disturbance area at the Project are summarised in Section 2.2.2 and Table 2 of **Appendix D**, and was limited to soils in the surface 0.6 m for all soil except for Retro, which was limited to 0.25 m, and Arcturus, which was limited to 0.3 m.

7.4.7.2.2 Soil Class Recovery Depths

The depth of each class of soil within the proposed disturbance area is summarised in Table 3 of **Appendix D**. Taurus, Krongie, and Taurus-Teviot Complex soils are most common, comprising 77% of the soil within the proposed disturbance area. Good quality topsoil exists in the surface 0.3 m of the soil profile, and marginal topsoil exists from 0.3 m to approximately 0.6 m below ground level. Good quality topsoil from the other soil types exists at variable depths, ranging from 0.1 m for Arcturus soil to 1.5 m for Davey soil. The depth of marginal topsoil is also variable.

For the purpose of assessing erosion potential, it was assumed that both good quality topsoil, and marginal topsoil with suitable amelioration, may be used during future rehabilitation of the Project's landform.

7.4.7.2.3 Recoverable Soil Volumes

Soil will be recovered from all activity and infrastructure areas within the Project's larger proposed disturbance area, including the pit area, mine waste landforms (i.e. spoil, overburden / interburden), infrastructure areas (e.g. haul roads, diversion, levees and dams) and the proposed PMLU area. Table 7-19 provides the estimated volume of recoverable soils from the Project's disturbance area.

Table 7-19 Project Disturbance Area – Estimated Recoverable Soil Volumes

Soil Management Unit	Estimated Recoverable Volume (m^3)		
	Good Quality Topsoil	Marginal Topsoil	Subsoil
Arcturus	11,769 (0.1%)	23,538 (0.2%)	47,076 (0.4%)
Davey	968,051 (8.4%)	0 (0%)	0 (0%)
Krongie	819,944 (7.1%)	956,602 (8.3%)	956,602 (8.3%)

Soil Management Unit	Estimated Recoverable Volume (m^3)		
	Good Quality Topsoil	Marginal Topsoil	Subsoil
Luxor	50,208 (0.4%)	50,208 (0.4%)	0 (0%)
Retro	60,129 (0.5%)	40,086 (0.3%)	420,903 (3.6%)
Taurus	2,023,299 (17.5%)	2,023,299 (17.5%)	0 (0%)
Taurus-Teviot Complex	913,478 (7.9%)	913,478 (7.9%)	0 (0%)
Teviot	261,770 (2.3%)	523,539 (4.5%)	523,539 (4.5%)
Total	**5,108,647 (44.1%)**	**4,530,750 (39.1%)**	**1,948,120 (16.8%)**

(Bracketed percentage: percentage of the total recoverable volume.)

In summary, a total 11,587,517 m^3 of soil are recoverable, comprising 5,108,647 m^3 of good quality topsoil (44.1%), 4,530,750 m^3 of marginal topsoil (39.1%), and 1,948,120 m^3 of subsoil (16.8%). Taurus, Krongie, Taurus-Teviot Complex, and Teviot soils are the dominant recoverable soils, with 85.6% of the recoverable soils captured in these soil types. These soil types also represent 78.7% of the recoverable good quality topsoil, 97.5% of the recoverable marginal topsoil, and 76.0% of the recoverable subsoil.

Additional information on the Project's recoverable soil volumes is provided in Section 2.2.4 of **Appendix D**.

7.4.7.2.4 Soil Resource Balance

The recoverable soils will be placed on rehabilitated areas as part of rehabilitation works. This process requires determination of the surface area of the areas to which soil will be applied as part of rehabilitation. It was assumed that all rehabilitation areas except for the Conrock Gully diversion bed, the pit lake / high wall, and the proposed PMLU area, will have soil reapplied.

The rehabilitation surface area was determined by calculating the 3D surface area of the landform rehabilitation design that contained the proposed mine waste landform shapes, which increases the surface area of the final landform compared to its pre-mining surface area. The surface areas of the proposed Conrock Gully diversion bed, pit lake / high wall and proposed PMLU area shapes will not be covered in soil, which decreases the surface area of the final landform that requires soil to be applied.

Using this surface area, an estimated 0.7 m thickness of soil in rehabilitation would fully utilise the good quality topsoil and marginal topsoil, without the subsoil being required. If only the good quality topsoil was used in rehabilitation without using the marginal topsoil or subsoil, soils could be placed at an estimated thickness of 0.37 m.

In reality, stripping of some areas such as infrastructure areas and roads may simply push soils into windrows ready for their respreading over the same area when rehabilitated. If it is assumed that the only source of soils for use in rehabilitation will come from the mine waste landform and pit area footprints, the good quality topsoil would result in a 0.23 m thick growth medium layer. If both the good quality topsoil and marginal topsoil is used, it is estimated that a 0.46 m thick soil layer could be used in rehabilitation.

Based on this assessment, it was concluded that creation of a soil layer that is 0.5 m thick is achievable if both good quality topsoil and marginal topsoil are stripped and used in rehabilitation. Sufficient volumes of good quality topsoil and marginal topsoil can be recovered for rehabilitation, and as a result, the recovery and use of the subsoils that have properties less suited to being a growth medium is not required. As a conservative measure the proponent has defined a soil layer with a 0.3 m depth, comprising all or majority good quality topsoil, as a suitable depth for use in rehabilitation.

More detail on the soil balance is given in Appendix E of **Appendix D**.

7.4.7.3 Mine Wastes

7.4.7.3.1 Mine Waste Types

For assessment purposes, the Project's mine wastes (i.e. spoil, overburden / interburden) were defined into two groups that align with the material groups used for the Project's geochemical waste characterisation study (Section 7.3.12):

- fresh, non-carbonaceous waste
- fresh, carbonaceous waste.

Other groups not considered for assessment, include weathered non-carbonaceous wastes and coal. Weathered wastes were not considered because they are unlikely to be used as rock armouring at the surface of the rehabilitated landform to increase erosion resistance. Coal was not considered as it is mined for processing at IDM, and therefore, will not be stored in the final landforms.

Waste characterisation data for the Project was sourced from samples taken from four drill holes, and is presented in Table 5 of **Appendix D**. Fresh non-carbonaceous wastes account for 65.9–80.9% of the wastes encountered and averaged 73% when all four holes are considered together. The remaining waste is 22.3% weathered non-carbonaceous wastes and 4.7% fresh carbonaceous waste.

In summary, for all four drill holes, fresh wastes account for 77.7% of the waste and weathered wastes account for the remaining 22.3% of waste. As a result, it was concluded that fresh waste, and particularly fresh non-carbonaceous wastes are very common and potentially available for rehabilitation purposes as rock armouring.

7.4.7.3.2 Mine Waste Geochemistry

The acid producing potential of 185 fresh non-carbonaceous waste samples was assessed for the Project, and it was found that 183 samples (99%) were NAF, 1 sample was PAF (low capacity), and 1 sample had an uncertain classification. The geochemical properties of the NAF fresh non-carbonaceous waste and NAF fresh carbonaceous waste are summarised in Table 6 of **Appendix D**.

The risk of these wastes producing acid is considered low. The MPA is lower than the ANC, indicating that any acid that might be produced would be effectively neutralised. These findings are consistent with the Project's geochemical assessment (Section 7.3.12.3).

The pH values of the Project's fresh non-carbonaceous waste and topsoils were established to assess the use of fresh non-carbonaceous waste for rehabilitation purposes as rock armouring. From the results, it was concluded that the elevated pH of the fresh non-carbonaceous waste does not preclude its use for rock armouring. However, it was considered prudent to assess the impact of elevated pH on vegetation growth if a soil-rock mixture is adopted as a rehabilitation surface on the Project's final landform.

The Project's fresh non-carbonaceous waste has slightly higher electrical conductivity (EC) values than the topsoils. This elevated EC is not likely to significantly limit vegetation growth if the fresh non-carbonaceous waste is used as rock armouring.

The Project's fresh non-carbonaceous waste has ESP values that are commonly extremely sodic, and higher than the ESP commonly found in the Project's topsoils. The impact of the sodicity of the fresh waste non-carbonaceous waste will be reduced by the waste's abundant coarse fragment content. The structural stability of materials with coarse fragment contents greater than approximately 60% is maintained by the coarse fraction, and therefore, it is possible that a rocky waste can remain structurally stable even with a fine fraction that is sodic. As a result, it is concluded that the sodicity of the fresh non-carbonaceous waste does not preclude its use for rock armouring.

Section 2.3.2 of **Appendix D** provides further details on the pH, EC and ESP assessments of the Project's fresh non-carbonaceous waste and topsoils.

7.4.7.3.3 Mine Waste Physical Properties

Understanding the susceptibility to breakdown of the rock fraction of a waste is important when considering them in rehabilitation plans as a potential armour against erosion. Where rock particles are observed to break down, this can result in an increase in the proportion of fines over time, which would either increase erosion potential in the long-term or sustain elevated erosion rates for longer periods, and as a result, would reduce the efficiency of the rock armouring.

The breakdown of rock particles can also occur during landform re-shaping using heavy machinery, whereby rock particles of a certain size become smaller as machinery traverses over them, push them, and rip into them. Where rocks are shown to be durable, they could be considered for use as a rock armour to reduce erosion potential of rehabilitation landform batters if required.

The degree to which a rocky waste can successfully mitigate risks associated with erosion is related not only to rock durability, but also to the size and abundance of rock, the geometry of the landforms being considered, and the climate in which the landform is situated. Therefore, the rock durability results provide a useful indication of potential rock armour materials.

For the assessment, the durability of rock particles was classed as 'excellent', 'good', 'marginal', or 'poor' based on their lithology, particle density, and water absorption values to for determine the quality and durability of armour-stone from a quarry source.

Forty samples of the NAF fresh non-carbonaceous waste and fresh carbonaceous waste were assessed for particle density and water absorption to understand the waste material's durability. For the 40 samples, the lithology, mean particle density and water absorption values were consistent with a material of marginal durability. Of the 40 samples assessed, 18 were sandstones and 22 were siltstones/mudstones. A comparison of the mean particle density and water absorption results from the sandstone samples and siltstone/mudstone samples, indicated that fresh sandstones was more durable than fresh siltstones/mudstones

Section 2.3.3, Table 7 and Table 8 of **Appendix D** provide further detail on the assessment of the waste's physical properties.

7.4.7.3.4 Mine Waste Summary

The Project's fresh wastes are overwhelmingly NAF. Their pH is higher than the Project's topsoils, but this chemical property does not preclude their use as a rock armouring element when mixed with soil. As a precaution, it would be prudent to assess the impact of elevated pH on vegetation growth if a soil-rock mixture is adopted as a rehabilitation surface on the final landform (e.g. on 25% gradient low wall slopes). The Project's fresh wastes are slightly more saline than the Project's topsoils, but this chemical property is not likely to significantly limit vegetation growth, if the fresh non-carbonaceous waste is used as rock armouring. The fine fraction of the Project's fresh wastes is extremely sodic. However, their structural stability will likely be maintained by the abundant coarse fraction. The coarse fraction of the fresh sandstone is more durable than the coarse fraction of the fresh siltstone/mudstone.

It is concluded that fresh non-carbonaceous sandstone and carbonaceous sandstone could be targeted for use as rock armouring in preference to fresh non-carbonaceous and carbonaceous siltstones/mudstones. Of the four drill holes assessed, approximately half of the fresh waste is non-carbonaceous and carbonaceous sandstone.

Therefore, a soil-rock mixture was developed for the Project's erosion modelling that aimed to represent a mixture of good quality topsoil or marginal topsoil mixed with fresh non-carbonaceous or carbonaceous sandstone.

7.4.7.4 Modelling Method – Long-term Runoff/Erosion Modelling

The methodology used for the Project's WEPP runoff/erosion modelling is described in Section 3.1 of **Appendix D**. In summary, the Project's WEPP runoff/erosion modelling involved the following components:

- The selection of the WEPP runoff/erosion model to predict runoff, erosion, and deposition for the landform batter slopes (Section 3.1.1 of **Appendix D**).
- The development of a climatic sequence that was based on historical data and adjusted for the region's SSP3-7.0 climate change predictions (Section 3.1.2 of **Appendix D**).
- The input of soil erodibility parameters based on ten 1 m^3 bulk samples of different topsoil from the Project site that were assessed for their physical properties and analysed using laboratory-based erodibility testing to establish erodibility parameters and sediment properties (Section 3.1.3 of **Appendix D**).
- The effects of vegetation groundcover (plant material, living or dead, that lies on or near the soil surface) on surface detachment and infiltration capacity at 80%, 65%, 50%, and 0% groundcover (Section 3.1.4 of **Appendix D**).
- The effects of rock armouring on erosion (Section 3.1.5 of **Appendix D**).
- The development of a definition for 'acceptable' erosion (Section 3.1.6 of **Appendix D**), with a target mean average annual erosion rate of <5 tonnes per hectare per year (t/ha/y) and a mean peak annual erosion rate of <10 t/ha/y.

7.4.7.5 Modelling Method – Landform Evolution Modelling

The methodology used for the Project's SIBERIA landform evolution modelling is fully described in Section 3.2 of **Appendix D**. In summary, the modelling involved the following components:

- The selection of the SIBERIA landform evolution model to predict the long-term, 3D development of erosion features and hillslopes (e.g. landform batters) in a catchment based on runoff, erosion, and deposition (Section 3.2.1 of **Appendix D**).
- The selection and derivation of suitable model input parameters to ensure that the parameters are effectively benchmarked to the WEPP output (Sections 3.2.2 and 3.2.3 of **Appendix D**).
- The development of the model settings to produce the required outputs for each landform modelled at years 50, 100, 200, and 300 (i.e. maximum gully depth, average and cumulative erosion and visual predictions of material movement) (Section 3.2.4 of **Appendix D**).
- The establishment of the model's assumptions (Section 3.2.5 of **Appendix D**).

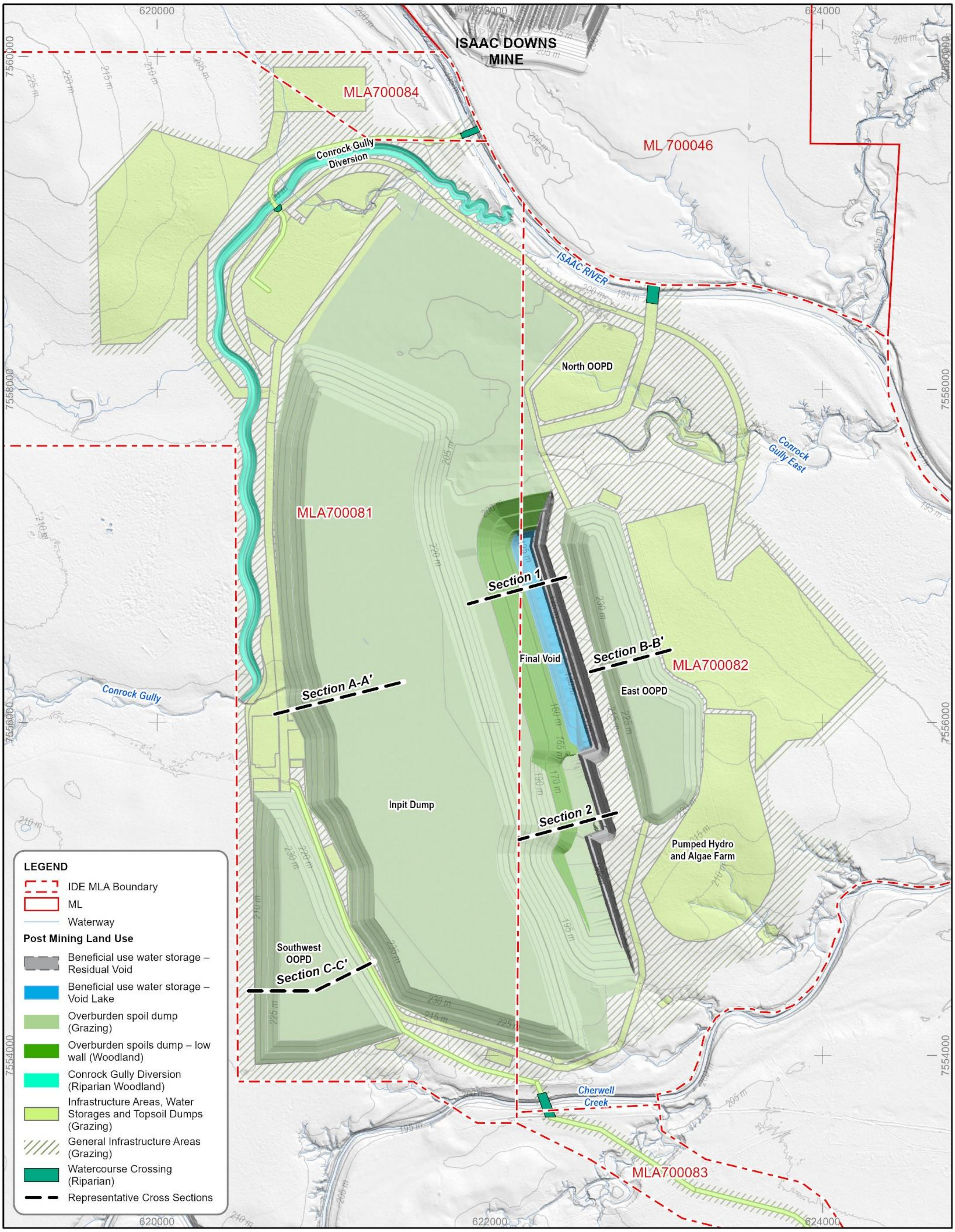
7.4.7.6 Modelling Method – Proposed Final Landform

The Project's proposed final landform shape is shown in Figure 7-15. The final landform design possesses the following primary landform components (with terminology used for the landform erosion modelling assessment):

- Main landform – Mine waste landform associated with the open cut pit comprising majority in-pit dumping, but with some out of pit dumping near the initial strips of mining, with the majority of runoff draining to the final void, and which is the largest waste landform.
- South-west (SW) landform – Small out of pit mine waste landform to the south-west of the final void, which is externally draining.

- East landform – small out of pit waste landform to the east of the final void, which is externally draining.

The location of the selected representative cross-sections within the Project's final landform are shown in Figure 7-15 and each representative cross-section is provided in Figure 7-16. A detailed description of the main dump slopes (lengths and gradients) of the Project's final landform is provided in Section 3.3 of **Appendix D**.



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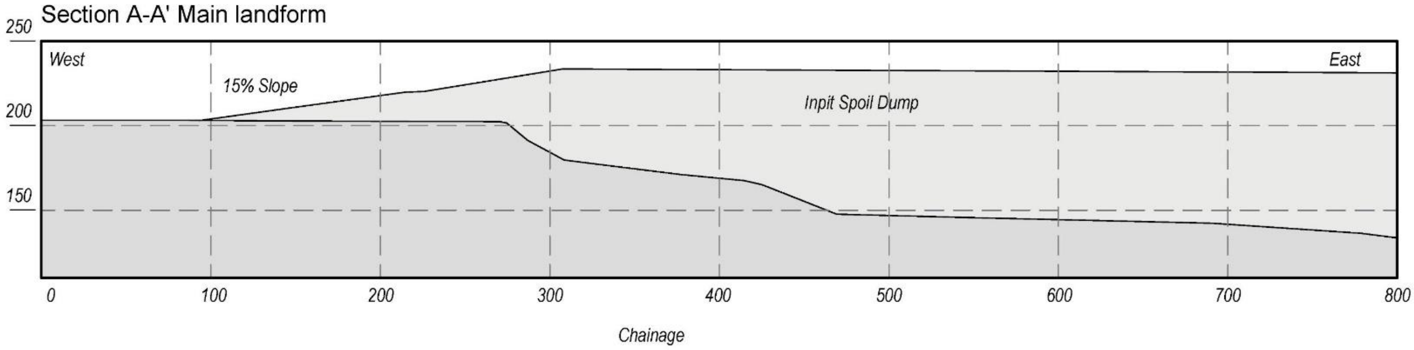
ISAAC DOWNS EXTENSION

Conceptual Final Landform
– Representative Cross-section Locations

Figure 7-15

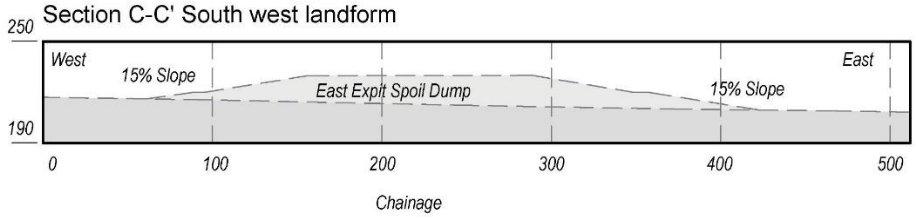
SPOIL DUMP SECTIONS

Section A-A' Main landform



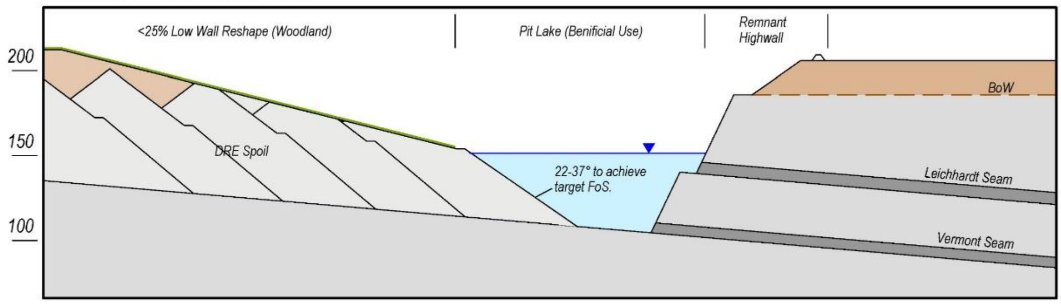
Section B-B' East landform

Section C-C' South west landform

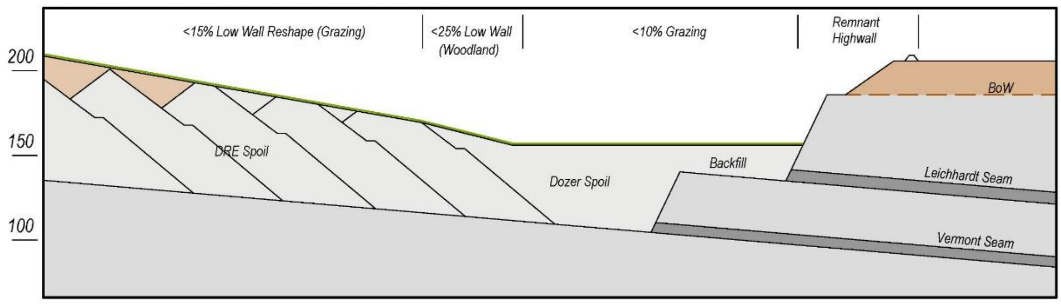


VOID SECTIONS

Section 1 - Northern Void



Section 2 - Southern Void and Backfill



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DISCLAIMER: Third party data sources are used in this map compilation. Minserve makes no warranty regarding this data's accuracy or currency.

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ISAAC DOWNS EXTENSION

Representative Cross-sections

Figure | **7-16**

7.4.7.7 Erosion Modelling Results – Long-term Runoff/Erosion Model

7.4.7.7.1 Modelling Completed

WEPP runoff/erosion modelling was undertaken to investigate a range of scenarios using five soils for which erodibility parameters were derived (Table 11 of **Appendix D**): Taurus, Taurus-Teviot, Krongie, Teviot, and Retro. The Taurus, Taurus-Teviot, and Krongie soil types are the most common soils within the proposed disturbance area (Section 7.4.7.2.2) and the soils likely to be recovered for use in rehabilitation (Sections 7.4.7.2.3 and 7.4.7.2.4).

WEPP modelling was also completed for the five selected soils but with the addition of rock armour, assumed to only be fresh non-carbonaceous sandstone or fresh carbonaceous sandstone.

WEPP simulations considered slope lengths up to 500 m to ensure that the modelling included the maximum slope length within the proposed final landform design (Section 3.3 of **Appendix D**). Slope gradients of 10% and 15% were modelled for soil-covered slopes, assuming groundcover levels of 0%, 50%, 65%, and 80%. The 0% vegetation groundcover was modelled to show the erosion potential of the soils soon after rehabilitation when vegetation is absent. The 80% groundcover was modelled to show the erosion potential that could be expected if vegetation groundcover levels consistent with the land in the vicinity of the Project are achieved. The 50% vegetation groundcover was modelled to show the erosion potential of poorly performing rehabilitation on soil-covered slopes. The 65% vegetation groundcover was modelled as the mid-point between 50% and 80% groundcover. Slope gradients >15% were not considered for soil-covered slopes as establishment of grasses on steeper slopes is normally more difficult to achieve as gradient increases.

Slope gradients of 10%, 15%, 20%, and 25% were modelled for slopes covered in soil incorporated into rock armour. A vegetation groundcover level of 30% was modelled, assuming that vegetation growth in rocky soils may be reduced.

7.4.7.7.2 Erosionally Stable Slope Geometries – Summary

The results of the different modelled scenarios are detailed in Appendix C of **Appendix D**. Predicted maximum erosionally stable slope lengths for the Project's six soils for a range of materials, uniform slope gradients and cover conditions are provided in Table 7-20, and are based on achieving a target mean average annual erosion rate of <5 t/ha/y and a mean peak annual erosion rate of <10 t/ha/y.

Table 7-20 Predicted Maximum Erosionally Stable Slope Lengths for a Range of Surface Covers and Slope Gradients

Surface Cover	Slope Gradient (%)	Maximum Erosionally Stable Slope Length (m)				
		Taurus Soil	Taurus-Teviot Soil	Krongie Soil	Teviot Soil	Retro Soil
0% Groundcover	10	35	30	5	30	30
	15	20	20	5	15	15
50% Groundcover	10	500	140	100	500	500
	15	500	60	60	500	185
65% Groundcover	10	500	500	270	500	500
	15	500	335	150	500	500
80% Groundcover	10	500	500	500	500	500
	15	500	500	500	500	500

Surface Cover	Slope Gradient (%)	Maximum Erosionally Stable Slope Length (m)				
		Taurus Soil	Taurus-Teviot Soil	Krongie Soil	Teviot Soil	Retro Soil
Rock Armour + 30% Groundcover	10	500	480	485	500	500
	15	500	285	295	350	400
	20	500	205	210	240	305
	25	260	160	165	185	210

7.4.7.7.3 Erosionally Stable Slope Geometries – Unvegetated Soils

Predicted long-term erosion rates of the Project's unvegetated soils are high, except for the Krongie soil, where a maximum slope length can be achieved before erosion rates become unacceptably high at 30–35 m for a 10% gradient slope and 15–20 m for a 15% gradient slope. The Krongie soil is highly erodible and is predicted to erode at unacceptably high rates when unvegetated, even on very short slope lengths of 5 m.

7.4.7.7.4 Erosionally Stable Slope Geometries – Vegetated Soils

Taurus and Teviot soils are predicted to erode at acceptable rates when groundcover levels are ≥50%. Taurus and Teviot soils are considered suitable for use on all the slopes of all three landforms except for the steep, 25% eastern low wall slope of the main landform that drains to the final void. This result also suggests that the narrow, approximately 10 m berms could be removed as part of progressive rehabilitation.

For Retro soil, the groundcover level needs to be ≥65% for 15% gradient slopes to be stable to 500 m. When the groundcover level is only 50%, the maximum stable slope length is predicted to be 185 m. Retro soil could be used on all three landforms except for the steep, 25% eastern slope of the main landform that drains to the final void.

For Taurus-Teviot soil, erosion rates are high when only 50% groundcover is achieved. However, when the groundcover level is ≥65%, which is considered achievable, the stable slope length is at least 335 m. Therefore, Taurus-Teviot soil could be used on all three landforms except for the steep, 25% eastern slope of the main landform that drains to the final void.

For the Krongie soil, erosion rates are higher than other soils and a groundcover of ≥80% is needed to achieve erosional stability. To reduce erosion risk, Krongie soil could be preferentially placed on low gradient portions of the final landform, for example, the landform tops or the southern end of the backfilled surface of the final void.

7.4.7.7.5 Erosionally Stable Slope Geometries – Rock Armoured Soils

The rock-armoured soils are all suitable for use on the gradients >15%. For the southern section of the low wall dump slope of the main landform with a 25% gradient slope and a slope length of approximately 200 m, the rock-armoured Taurus and rock-armoured Retro soils, with 30% groundcover, are predicted to be acceptably stable.

For the northern section of the low wall dump slope of the main landform with a 25% gradient slope and a slope length of approximately 300 m, the erosion rates are predicted to be within acceptable rates. The Taurus and Retro soils perform the best. Taurus soil is predicted to have an acceptable mean average annual rate of 1.2 t/ha/y and a peak average annual rate of 4.9 t/ha/y. Retro soil is predicted to have an acceptable mean average annual rate of 1.4 t/ha/y and a peak average annual rate of 5.4 t/ha/y.

7.4.7.8 Erosion Modelling Results – Landform Evolution Model

The Project's proposed final landform design was 3D modelled using SIBERIA landform evolution model, based on the following surface materials:

- Taurus soil with 65% groundcover on the slopes of the main landform, except the low wall with 25% gradient which was modelled using rock-armoured Taurus soil with 30% groundcover.
- Taurus-Teviot soil with 65% groundcover on the outer slopes of the SW landform.
- Retro soil with 65% groundcover on outer slopes of the east landform.

The soils were selected for use on the slopes to reflect the range of soils available within the Project's disturbance area. The soils could be used interchangeably on any of the surfaces. For example, it is noted that Retro soil is in limited supply, but there is sufficient Taurus, Taurus-Teviot, and Teviot soils to use on this landform instead (Section 7.4.7.2.4).

On all the Project's landforms, the lower-gradient surfaces were covered with vegetated Krongie soil as a means of mitigating their higher erosion potential.

The Project's landforms were modelled using the SSP3-7.0 climate prediction to simulate potential future climate change impacts.

Figure 7-17, Figure 7-18 and Figure 7-19 show the SIBERIA landform evolution model output after 300 years of simulation for the Project's three landforms (i.e. the main, SW and east landforms, respectively). Importantly, this long-term simulation demonstrates that the Project's landforms after 300 years are stable under the current climate change predictions for the region.

All the modelled visualisations for 50, 100, 200, and 300 years are provided in Appendix D of **Appendix D**.

The statistically predicted maximum gully depths, average erosion rates, and cumulative average erosion for the Project's main landform, SW landform, and east landform from the SIBERIA landform evolution modelling are summarised in Table 7-21. These statistical predictions were derived from the steep-batter slope only, with the low gradient landform top and base of the final void excluded.

The Project's landforms are predicted to typically erode at acceptable erosion rates. The acceptable long-term mean average annual erosion rate was set at 5 t/ha/y, being a rate at which the risk of rill erosion being initiated is low.

For the Project's main landform, the mean average annual erosion rate is 3.7 t/ha/y after 50 years of simulation, increasing to 4.5 t/ha/y after 300 years of simulation.

For the Project's SW landform, the mean annual average erosion is 2.9 t/ha/y after 50 years of simulation, increasing to 4.6 t/ha/y after 300 years of simulation.

For the Project's east landform, the mean average annual erosion is 3.9 t/ha/y after 50 years of simulation, increasing to 5.4 t/ha/y after 300 years of simulation.

Table 7-21 Predicted Maximum Erosion Conditions for the Project's Main, SW and East Landforms

Simulation Year	Maximum Gully Depth (m)	Average Annual Erosion (t/ha/y)	Cumulative Average Erosion (mm)
Main Landform – Taurus Soil with 65% Groundcover			
50	0.3	3.7	12
100	0.6	4.2	40
200	0.8	4.5	100
300	1.0	4.5	190
SW Landform– Taurus-Teviot Soil with 65% Groundcover			
50	-	2.9	10
100	0.4	3.8	35
200	0.7	4.4	94
300	0.9	4.6	185
East Landform– Retro Soil with 65% Groundcover			
50	0.3	3.9	13
100	0.5	4.8	45
200	0.8	5.3	116
300	1.0	5.4	223

Figure 7-17 Long-term Erosion rates at 300 years for the Project's Main Landform

Figure 7-18 Long-term Erosion rates at 300 years for the Project's SW Landform

Title:	Long-term erosion rates for East landform at 300 years of simulation, using Retro soil with 65% groundcover			N ↑	Long-term Erosion Rate (t/ha/y)
Project:	Isaac Downs Extension Rehabilitated Landform Study	Coordinate System:	MGA Zone 55 GDA94		<5 / 7.5-10
Landloch		Model:	SIBERIA		5-7.5 / >10

Figure 7-19 Long-term Erosion rates at 300 years for the Project's East Landform

7.4.7.9 Erosion and Stability Assessment Summary

7.4.7.10 Topsoil Selection and Vegetation Cover

The minimum groundcover levels of vegetated soils for the slope geometries found on the Project's final landform are summarised in Table 7-22. As described in Section 7.4.7.6, the Project's final landform comprises three primary structural components, the main landform, SW landform, and east landform. The slopes considered include the main landform (other than the low wall slope at 25%, which will include rock armouring and vegetation cover), the SW landform, and the east landform.

Table 7-22 Minimum Groundcover Level – Vegetated Soils – Project's Main, SW and East Landforms

Landform	Slope Gradient (%)	Max. Slope Length (m)	Minimum Groundcover Level (%):				
			Taurus Soil	Taurus-Teviot Soil	Krongie Soil	Teviot Soil	Retro Soil
Main Landform	15	230	50	65	80	50	65
SW Landform	15	160	50	65	80	50	50
East Landform	15	160	50	65	80	50	50

Taurus and Teviot soils are considered suitable for use on all the slopes of all three landforms except for the steeper, 25% eastern slope of the main landform that drains to the final void. This assumes that ≥50% groundcover is sustained. This result is considered achievable given that groundcover levels in the vicinity of the Project are approximately 80%.

For Retro soil, the groundcover level needs to be ≥65% for 15% gradient slopes on the main landform and ≥50% on the SW landform and east landform. This result is considered achievable given that groundcover levels in the vicinity of the Project are approximately 80%.

For Taurus-Teviot soil, the groundcover levels must be ≥65% for 15% gradient slopes on all landforms. This result is considered achievable given that groundcover levels in the vicinity of the Project are approximately 80%. However, to reduce erosion risk, this soil could be preferentially used on either of the SW landform or east landform that have shorter overall slope lengths.

The Krongie soil is the most erodible soil at the Project site. It requires a groundcover level of ≥80% to achieve erosional stability. This result is achievable. However, there is no allowance for poorer than expected vegetation performance. To reduce the erosion risk posed by this soil, Krongie soil will be preferentially placed on low gradient portions of the final landform, for example, the landform tops or the backfilled surface of the southern end of the final void.

Sufficient volumes of good quality topsoil and marginal topsoil can be recovered from the Project's disturbance area for rehabilitation. As a result, the recovery and use of the Project's subsoils that have properties less suited to being a growth medium is not required.

These findings have been incorporated into the Project's PRCP (**Appendix AB**).

7.4.7.11 Vegetation Establishment

Establishment of vegetation, and in particular groundcover, is critical for long-term erosional stability of the Project final landform. There is a period directly after seeding when the landform surface will be unconsolidated and have low vegetation groundcover levels. This period represents a risk to rehabilitation success. Rainfall that leads to significant runoff during this period is likely to lead to the development of rills and potentially gullies, particularly for those Project soils that possess a low infiltration capacity.

All efforts will be made to encourage rapid establishment of vegetation groundcover. Seed mixes will include a significant proportion of grasses, preferentially stoloniferous grasses as they spread in contact with the soil surface and provide better erosion control than tussocky grasses. The use of a fast germinating sterile cover crop is also advantageous within the seed mix as it provides a temporary ground cover while the permanent grass species are establishing.

If required, consideration may be given to temporary soil stabilisation techniques such as the use of hydromulches, surface tackifiers, or compost blankets. These techniques are able to provide resistance to erosion for the initial 1–2 years as the groundcover develops. The specific techniques used would be trialled, with the results of the trial used to inform progressive rehabilitation plans for the Project.

The Project's rehabilitation areas will be scientifically monitored to demonstrate rehabilitation success and guide maintenance of rehabilitation areas that are under performing. The Project's monitoring and maintenance regime for rehabilitation is specified in the Project's PRCP.

7.4.7.12 Subsurface Growth Media

The wastes below the topsoils and incorporated into the topsoil for rock-armoured slopes may require treatment with gypsum to mitigate the risks posed by clay dispersion. This requirement applies to the 25% gradient low wall areas only. The rate of gypsum will be determined by an appropriately qualified person. This management action is best performed just prior to commencement of rehabilitation works when the surface materials are identifiable and available for sampling.

7.4.7.13 Rock Armour

Fresh non-carbonaceous sandstone and carbonaceous sandstone should be targeted for use as rock armouring in preference to fresh non-carbonaceous and carbonaceous siltstones/mudstones. As identified in Section 7.4.7.3.4, approximately half of the Project's fresh waste is expected to be non-carbonaceous sandstone and carbonaceous sandstone.

When fresh non-carbonaceous sandstone and carbonaceous sandstone are used as rock armour, the rock fraction must have good to marginal durability or better. That is, the rock fraction should be considered particles greater than approximately 50 mm in diameter. Indicative quality indicators include rock particle density values of >2.5 g/cm^3 and water absorption values of <5.0%. The rock fraction should have a mean particle size, D50, of at least 75 mm. The rock source should contain less than 40% fines that are <2 mm diameter.

The degree to which a rocky waste can successfully mitigate risks associated with erosion is related not only to rock durability, but also to the size and abundance of rock, the geometry of the landforms being considered, and the climate in which the landform is situated. Therefore, the rock durability results provide a useful indication of potential rock armour materials. However, more comprehensive particle size distribution and erodibility testing, and landform design modelling will be considered to improve the understanding of the limits of the rock armour material.

7.4.7.14 Unsuitable Wastes

Tertiary sediments and weathered wastes are likely to be highly erodible and not suitable for use at or near the surface of rehabilitated surfaces. Therefore, fresh non-carbonaceous waste and/or fresh carbonaceous waste will be preferentially placed below the growth media layer. Below the surface layer, the recommended thickness for the placement of Tertiary sediments and weathered wastes is 1.5 m.

7.4.7.15 Slope Design

The results of the Project's rehabilitated landform erosion modelling show that the linear slopes present within the final landform design are predicted to erode at acceptable rates in the long-term when appropriately covered with the soils progressively sourced from the Project's disturbance area and when the required vegetation groundcover levels are achieved.

For guidance, predicted maximum erosionally stable slope lengths for the Project's six soils for a range of materials, uniform slope gradients and cover conditions are provided in Table 7-20. In addition, the predicted maximum gully depths, average erosion rates, and cumulative average erosion for the Project's main, SW, and east landforms are summarised in Table 7-21.

Specific rehabilitation actions for the Project to ensure acceptable erosion rates are as follows:

- The Krongie soil will be used on very low gradient areas, for example, landform tops or the backfill surface of the southern final void.
- Vegetation groundcover levels of ≥50% for Taurus and Teviot soil and ≥65% for Taurus-Teviot and Retro soils will be targeted on slopes with a ≤15% gradient.
- Groundcover levels of ≥30% will be targeted on 25% gradient slopes that are also rock armoured.

7.4.7.16 Cross-slope Berms

The current final landform design for the Project includes narrow, approximately 10 m wide cross-slope berms to store and infiltrate water. The berms represent points of potential weakness in the design as they may unevenly fill with sediment and overtop. During rehabilitation, berms will be monitored for signs of tunnel erosion or uneven settlement/filling on a regular basis, that is both annually and after large rainfall events. Where tunnel erosion or uneven settlement/filling are observed, remedial actions will be undertaken to ensure the continued efficient function of the impacted berm.

Future refinement of the Project's final landform design to remove the berms will be considered to ensure a stable landform is achieved. Based on the erosion modelling results, this action could be achieved by removing the berms as part of progressive rehabilitation. For example, the berms in place to manage runoff and sediment from upslope sections during operations and the initial stages of rehabilitation could be removed when the lower slopes are rehabilitated and suitably vegetated.

7.4.7.17 Landform Tops

Uncontrolled runoff from the landform top is a common cause of gullying and landform failure. This risk can be mitigated by the installation of crest bunds around the perimeter of the landform tops.

Alternatively, as the landform top is to be free draining, such as on the top of the main landform that drains to the final void, the landform top surface will be roughened to increase its depression storage and decrease the ability of surface water to move laterally across the top, which reduces the likelihood that flows can concentrate and discharge at discrete locations onto the downslope slope sections. Roughening of the landform top can be achieved by deep ripping.

7.4.7.18 Surface Ripping

It is critical that flow concentration on the slopes is minimised. Concentration of runoff can be prevented by minimising the size of cross-slope rip lines. Rip lines that are no deeper than 300 mm from peak to trough of the rip line once settlement has occurred will be targeted. To achieve this outcome, an unconsolidated rip line of approximately 500 mm deep will be targeted. Ripping will be desirable to reduce machinery compaction, remove track marks that are not on contour, and incorporate amendments if required, as determined by an appropriately qualified person for the available growth media to encourage rapid vegetation growth.

For more precise results, equipment used for rehabilitation works may have guidance systems installed, and use operators that are highly skilled and experienced.

7.4.7.19 Landform Position and Flood Scour

The position of the Project's landform within the landscape will play an important role in long-term erosional stability. The northern end of the Project's main landform (i.e. the northern section of the spoil dump above pre-mining topography) is located within the 1% AEP Isaac River flood event (see Section 9.4

of **Chapter 9**). The southern end of the Project's main landform is not located within the 1% AEP flood event for the Isaac River or Cherwell Creek. Maximum flow velocities adjacent the northern end of the main landform are predicted to be 0.5–1.0 m/s. The Project's SW and east landforms are not positioned within the 1% AEP flood area for either the Isaac River or Cherwell Creek.

The velocities predicted for the northern end of the main landform are likely to lead to scour erosion when the soils are bare of vegetation, which is not the intention for rehabilitation of this area. The Soil Conservation Guidelines for Queensland[14] recommend a maximum permissible velocity for easily eroded bare soils on low gradient land of 0.5 m/s (1% is the lowest reported). When the landform is vegetated, the maximum permissible velocity increases. The guideline indicates that the maximum permissible velocity increases to 1.2 m/s for 50% vegetation groundcover and 1.5 m/s for 75% vegetation groundcover. These maximum permissible velocities are greater than the maximum predicted velocities of a 1% AEP flood event. Therefore, the proposed vegetation groundcover of the main landform would mitigate the risk of scour erosion.

7.4.7.20 Conclusion

The results the Project's erosion and stability assessment indicate that vegetated soil and vegetated rock-armoured soil surfaces can be used to create a rehabilitated landform that is erosionally stable in the long-term. The shape of the Project's final landform was developed and confirmed with consideration of the following factors:

- The development of rehabilitated surfaces with a low tendency for rill erosion to achieve erosion rates consistent with the soil erosion targets.
- The application of erodibility testing of the Project's soils and soil-fresh rock mixtures to guide rehabilitation requirements to achieve stable slopes.
- The inclusion of rainfall erosivity of the climate at the Project, with the appropriate adjustment for climate change as part of the development of the rehabilitation requirements to achieve stable slopes.
- The assessment of the suitability of the soils and fresh Permian waste as a primary growth media and the fresh wastes as secondary growth media for application under the primary growth media layer. The assessment findings were used to direct the correct application of the growth media to achieve stable slopes.
- The defining of the required groundcover for each growth media to achieve the best possible rehabilitation outcomes to support stable slopes.
- The development of predicted long-term erosion rates for land surfaces planned within the Project's final landform to confirm the long-term acceptability of the design.
- The modelled demonstration that the Project's landforms after 300 years are stable under the current climate change predictions for the region.

7.4.8 Resource Utilisation

The proponent has undertaken detailed mine planning to maximise the economic extraction of the coal resource, and where possible, minimise adverse environmental impacts. As described in Section 7.3.16, an open cut strip-mining method will be employed as the most efficient mining method based on the geological characterisation of the Project's coal deposit. The proponent is committed to ensuring the Project's coal mining operations are conducted in a sustainable manner that maximises the economic benefits to the company and Queensland.

As explained in Section 7.3.17, the Project's operation will not prevent the future extraction of local CSG, geothermal or other local resources.

[14] https://www.publications.qld.gov.au/dataset/soil-conservation-guidelines

7.4.9 Landscape Character and Visual Amenity

7.4.9.1 Landscape Character

Based on the landscape character assessment provided in Section 7.3.23.1, the Project is not expected to have a significant impact on the local landscape character. The Project's operations are largely isolated and are consistent with other mining operations within the Bowen Basin (i.e. as a major land use in the Isaac region). In addition, at the completion of rehabilitation and closure, the Project's final landform is expected to integrate back into the local landscape with a rehabilitated landform that is similar to other natural and mined landforms in the Bowen Basin, and will continue to support the current land use of grazing.

7.4.9.2 Visual Amenity Assessment

From the description of the existing visual environment provided in Section 7.3.23.2, the Project is not expected to have a significant impact on visual amenity for the general public. The residents of Winchester Downs Homestead, as the only nearby sensitive receptor, may experience impacts to visual amenity from the Project, in particular from southern mining activities such as the SW OOPD. The appearance of these areas will change during operations and as they are rehabilitated.

As a result, a view shed analysis was conducted to assess the potential visual amenity impacts at Winchester Downs homestead (comprising the homestead and nearby stockman's quarters) from the Project's southern mining activities and rehabilitated final landform. A viewshed analysis is a commonly used visual assessment tool that utilises a 3D geospatial technique to determine the visible and non-visible areas of a landscape from a specific viewpoint (observer point). It calculates line-of-sight based on elevation data from a digital elevation model and identifies areas hidden by terrain or other obstructions.

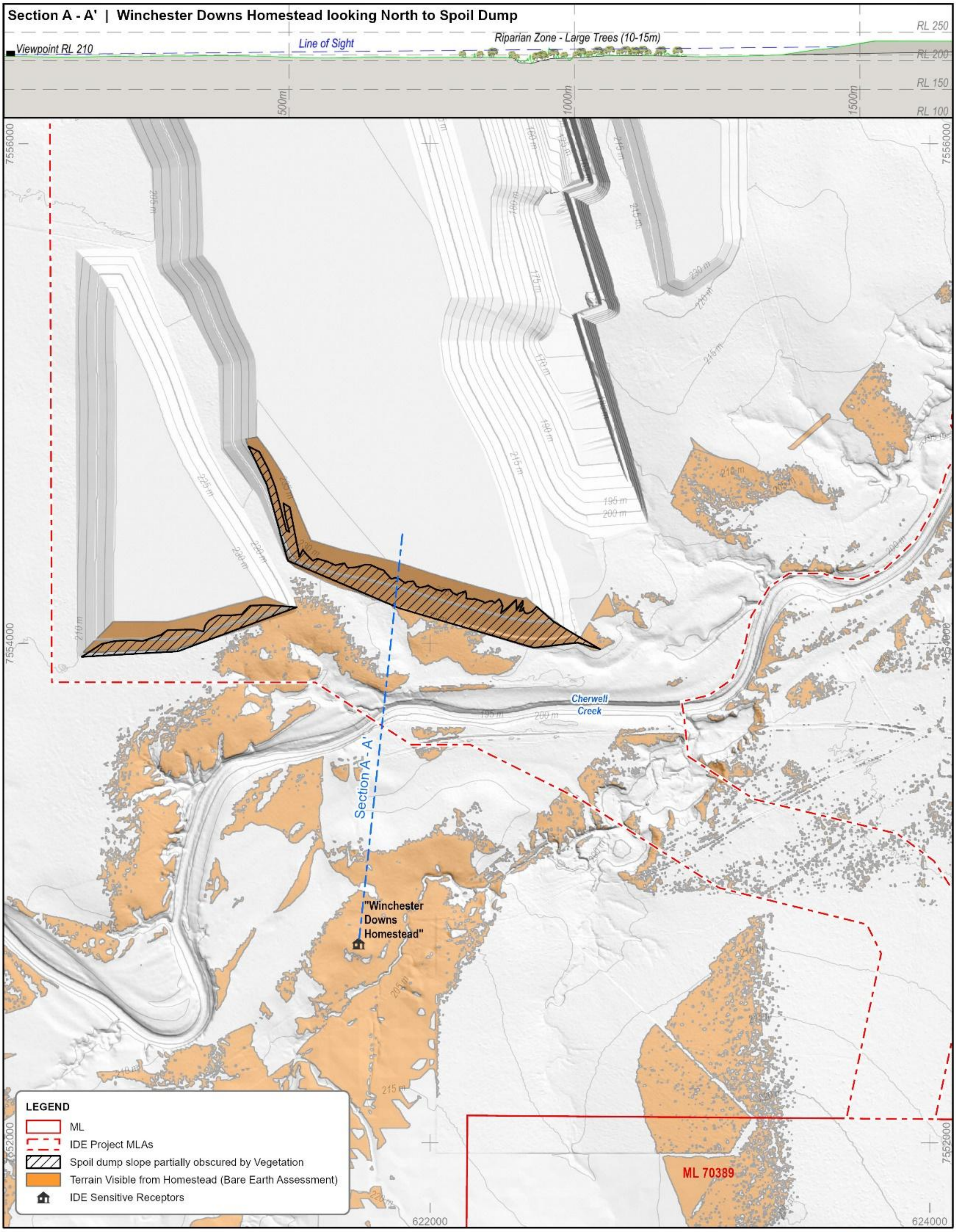
The view shed analysis investigated the visual impacts looking towards the Project's southern mining area from external locations at the Winchester Downs homestead and stockman's quarters for the following years

- 2025 – current view
- 2043 – during mining operations as the SW OOPD reaches a maximum height of RL 230 m AHD, which is 5 – 10 m above the planned height to simulate a worst case scenario
- 2058 – representing the rehabilitated final landform.

The two locations were considered the best perspective for people living at the Winchester Downs homestead and stockman's quarters on a daily basis, and potentially looking towards the Project's southern mining area. The view height was set at 2 m at both view points and the view interpretation at both viewpoints accounted for trees or other vegetation obscuring or blocking the views of the Project's southern mining area.

Figure 7-20 provides a plan of the viewshed analysis' line of sight used from the Winchester Downs homestead and stockman's quarters towards the Project's southern mining area. Figure 7-21 and Figure 7-22 show the perspective views towards the Project's southern mining area for 2025, 2043 and 2058 at the Winchester Downs homestead (viewpoint 1) and stockman's quarters (viewpoint 2), respectively. The Project's view shed analysis from the Winchester Downs homestead, using a worst case scenario, highlights that the 2043 view and 2058 view at both viewpoints are two-thirds obscured by vegetation, with the SW OOPD with limited visibility in the distance. In addition, the 2058 view at both viewpoints is enhanced by the rehabilitated state of the final landform because it blends naturally into the surrounding landscape.

Therefore, the visual impacts in 2043 and 2058 at Winchester Downs homestead because of the Project are considered minor during operations and negligible for the final, rehabilitated landform.



0 100 200 300 400 500

Metres

Datum:	GDA2020 Zone 55
Scale:	See Scale Bar
Date:	28/04/2026 2:55 PM
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Source:	Minserve
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ISAAC DOWNS EXTENSION

Winchester Downs Homestead
Viewshed Analysis Plan

Figure | 7-20

Photomosaic - 2025

End of Operations - Approximate Year 2043

Final Revegetated Landform - Approximate Year 2058

Datum:	GDA2020 Zone 55
Scale:	See Scale Bar
Date:	28/04/2026 5:05 PM
Drawn:	Minserve
Source:	Minserve
File:	20260206 Winchester South VA - Homestead.aprx

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ISAAC DOWNS EXTENSION

Winchester Downs Homestead
Project View: 2025, 2043 and 2058

Figure | 7-21

Photomosaic - 2025

End of Operations - Approximate Year 2043

Final Revegetated Landform - Approximate Year 2058

Datum:	GDA2020 Zone 55
Scale:	See Scale Bar
Date:	26/04/2026 5:07 PM
Drawn:	Minserve
Source:	Minserve
File:	20260206 Winchester South VA - Quarters.aprx

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ISAAC DOWNS EXTENSION

Downs Stockman's Quarters
Project View: 2025, 2043 and 2058

Figure | **7-22**

7.4.10 Lighting

The overall impact of night lighting on the Winchester Downs Homestead residents (the only nearby sensitive receptor) can be determined by a number of contributing factors, including:

- proximity of the sensitive receptor
- landscape topography
- light orientation and shielding measures
- clarity of skies (e.g., factors such as fog, smog and cloud would contribute to sky glow)
- community perception on acceptable lighting levels.

As the Project's open-cut mining will operate 24 hour per day, night lighting will be mandatory for safe operations. Lighting will be needed to illuminate mine face work as well as associated mining infrastructure. Permanent lighting at the Project site will be located around go-line infrastructure to the north of the Project area (i.e. greater than 5km from the Winchester Downs homestead). The Project's temporary lights will include mobile lighting plants used to illuminate active work areas at night, for example, mine pit faces, dump areas and haul roads. It is anticipated that LED lighting will be used as much as practical.

7.5 Avoidance and Mitigation Management Measures

7.5.1 Land Disturbance

As described in Section 7.4.1, the rehabilitation of the Project's disturbance will be managed in accordance with the PRCP and PRCP schedule, which are designed to ensure the land disturbed by mining is returned to a safe, stable and non-polluting state that will support one or more beneficial land uses in a long-term sustainable manner.

7.5.1.1 PRCP Rehabilitation Areas and Post-Mining Land Uses

The PRCP defines the Project's disturbance area into 10 separate rehabilitation areas (RAs), which are defined in Table 7 and shown in Figure 12 of **Appendix AB**, respectively. Each RA will be rehabilitated to a specific PMLU. The Project's PRCP proposes the following PMLUs (also see **Chapter 5** for a description of the proposed PMLUs):

- native vegetation (riparian woodland) – Conrock Gully
- grazing, for the majority of disturbed land
- native vegetation (woodland) – final low wall batter slopes (≤25%)
- native vegetation (riparian) – river/creek crossings
- beneficial water storage in the final void
- permanent infrastructure – pumped hydro energy storage (PHES) scheme and algae production facility
- buffer land.

The Project's main PMLU is grazing, which is designed to return the majority of the disturbed land back to its pre-mining land use and to support the landholder's pastoral activities.

The Project's PMLU for its final void is a beneficial water storage, which will provide livestock drinking water for the landholder's pastoral activities, and the permanent infrastructure – PHES scheme and algae production facility PMLU.

The native vegetation (riparian woodland) – Conrock Gully, native vegetation (woodland) – final low wall batter slopes (≤25%) and native vegetation (riparian) – river/creek crossings PMLUs are based on native revegetation similar to local regional ecosystems.

The permanent infrastructure - PHES scheme and algae production facility PMLU are commercially and technically feasible opportunities that use the final void's water for:

- a long-term source of power or income for landholder or another third party (PHES scheme)
- income generation from the sale of commercial algae production (algae production facility)
- a potential cattle feed supplement (algae production)
- new industry developments for the local region, with commensurate employment opportunities

The buffer PMLU is designed for the land within the Project's disturbance area that is not materially disturbed by mining activities (i.e. the land that surrounds the planned mining activities). In reality, this PMLU is unlikely to be required by the Project, and where possible, will be used for grazing purposes. However, if the buffer land is disturbed, its outcome is the same as the grazing PMLU (i.e. to ensure the return of the disturbed land to a state of sustainable grazing).

7.5.1.2 PRCP Rehabilitation Milestones and Criteria

Specific rehabilitation milestones (RMs) have been developed with defined timeframes to progressively achieve the Project's PMLUs (see Table 8 of **Appendix AB**). Each RM is supported by a set of defined milestone criteria that must be achieved to demonstrate successful rehabilitation (see Table 12 of **Appendix AB**). The studies completed for the Project's EIS have been used to scientifically justify specific milestone criteria for the various RMs (see **Appendix AB**). It should be noted that not all RMs apply to every PMLU because of the nature of the mining activities conducted within the applicable RAs.

Achievement of the Project's RMs and their associated milestone criteria will be supported by a monitoring regime. A maintenance regime is also defined within the Project's PRCP to rectify any rehabilitation issues identified by the Project's monitoring regime. Section 2.8 of **Appendix AB** provides the monitoring and maintenance regimes for the Project's progressive rehabilitation and closure.

7.5.1.3 PRCP Schedule

The PRCP schedule (**Appendix AC**) sets out the planned rehabilitation schedule for each RA to achieve its PMLU and is based on obtaining the applicable RMs for that PMLU within their specified timeframes. Overall, the PRCP schedule is important because it sets the timing for the Project's progressive rehabilitation and closure to achieve the nominated PMLUs and requires regulatory approval before mining can commence.

7.5.2 Land Use

7.5.2.1 Grazing Impact Management

As identified in Section 7.4.2.1, grazing on native and modified pastures will be the main land use impacted by mining operations within the Project area. To manage this impact, the majority of the Project's disturbance will be rehabilitated to a grazing PMLU of a similar standard to pre-mining grazing conditions. Section 7.5.1 provides an overview of how this outcome will be achieved under the Project's PRCP and PRCP schedule. Rehabilitation of the Project's disturbance is also described in **Chapter 5**.

As outlined in Section 7.3.4, the proponent will enter into a compensation agreement under the MR Act with the landowner for the temporary loss of grazing land and amenity caused by the Project's operation. Importantly, it is the proponent's intention to return a majority of the land disturbed by mining to a similar grazing standard for re-incorporation into the landowner's pastoral activities.

7.5.2.2 Stock Route Impact Management

As described in Section 7.5.2.1, under the Project's PRCP and PRCP schedule, the intention is to return a majority of the Project's disturbed land to a grazing PMLU, which includes the disturbed portion of the stock route identified in Section 7.4.2.2. To manage the predicted impacts specific to the stock route, the proponent continues to consult with DNRMMRRD as the reserve owner, IRC as the day-to-day administrator for the reserve, and the landowner as the lessee for the reserve, with the goal of achieving a suitable outcome for all parties involved. A potential final outcome for the stock route may involve the re-incorporation of the successfully rehabilitated portion with the undisturbed portion.

7.5.3 Geochemistry - Mining Waste Management

The Project's geochemical assessment (see Section 7.4.7.3) found that the environmental risks posed by the planned final spoil landforms at closure are predicted to be low.

Therefore, no specific AMD management measures are expected to be required to manage spoil dumps at the Project during rehabilitation and closure (e.g. alkaline amendment or engineered capping systems). Importantly, the operational mixing and burial of small quantities of PAF waste with the predominantly NAF waste during spoil placement and landform reshaping activities, ensures that AMD generation is insignificant and highly unlikely to cause environmental harm (see Section 7 of **Appendix F**). These outcomes are consistent with other nearby mines in the Bowen Basin.

The Project's geochemical assessment found that spoil is expected to be sodic to strongly sodic with potential for dispersion and erosion if left unrehabilitated and exposed to climatic conditions over a period of time (e.g. rainfall events). The Project's landform erosion modelling (see Section 7.4.7) demonstrates that vegetated soil and vegetated rock-armoured soil surfaces can be used to create a rehabilitated landform that is erosionally stable in the long-term.

Surface water run-off and seepage from the Project's spoil landforms will be monitored for 'standard' water quality parameters including, but not limited to, pH, EC, major anions, major cations and a broad suite of soluble metals and metalloids at high resolution analysis. Section 8.7.11 of **Chapter 8** provides further details on the Project's proposed surface water monitoring regime, which will also be a requirement of the Project's EA.

Implementation of the proposed management and mitigation measures for the Project's mineral wastes, being essentially benign spoil only, will ensure there is a low risk of environmental harm and the Project operates in compliance with its EA and PRCP.

The proponent will continue to undertake geochemical test-work of overburden and interburden throughout the life of the Project to compare against the test-work undertaken for the assessment and to reaffirm the planned management and rehabilitation measures. To support the future test-work undertaken for this geochemical assessment, a program of kinetic leaching test-work of the Project's spoil under unsaturated and saturated conditions has commenced. The kinetic leaching program is designed to test the assumptions around seepage water quality from the OOPD spoil landforms (unsaturated conditions) and the deeper zone of the in-pit spoil landform (saturated to partially saturated conditions).

7.5.4 Geotechnical Stability Management

The Project's geotechnical stability management actions were developed from the Project's geotechnical assessment provided in Section 7.4.4. The Project's geotechnical assessment demonstrates that the final landform should be geotechnically stable in the long-term. Several additional management actions were also proposed as a part of the Project's geotechnical assessment to minimise the risk of adverse impacts.

As advised in Section 7.4.4.3.5, because the Project has not commenced, there is no data that allows the examination of kinematic mechanisms as an important mode of failure. Therefore, strip by strip face mapping and further assessment of kinematic mechanisms may be completed when enough data has been procured through the operational processes of pit wall mapping and photogrammetry assessment. The application of this form of slope failure assessment is likely to be applied on a risk based approach as the Project's mining operations progress.

As required, remedial slope modifications involving re-grading the slope to a shallower angle and the installation of surface drains to reduce erosion may be undertaken to re-achieve stable slopes, particularly in the Cainozoic and weathered horizons.

Table 7-17 outlines a set of possible management actions for the Project based on the adopted minimum FoS design acceptance criteria of 1.5. As required, these management actions may be applied. However, based on the current findings of the Project's geotechnical assessment, they are unlikely to be required.

The design criteria for the Project's final void and landform slopes, are proposed as follows, with lower slope angles than those recommended in Section 7.4.4.5:

- Highwall and low wall batter angles up to 65°, with an inter-ramp angle of <50°.
- Weathered slope angles ≤ 35°.
- For in-pit and out-of-pit spoil dumps, a maximum overall slope angle from toe to crest not greater than approximately 25%, but mostly less or equal to than 15%.

Bunds will be installed to divert surface water runoff away from the highwall to minimise the risk of erosion at the pit crest.

As standard practice, exclusion bunds for the purpose of restricting access will have a minimum height of 2 m and will be established at the recommended minimum offset distance of 15 m from the final crest position. However, the offset distance may be greater (e.g. up to 50 m). Exclusion bunds will be constructed of non-dispersive material.

7.5.5 Rehabilitated Landform Erosion Management

The management measures for erosion and stability of the Project's final landform are derived from the Project's rehabilitated landform erosion assessment, which is summarised in Section 7.4.7.

The following rehabilitation criteria and/or management actions will be adopted to ensure the Project's final landform achieves stable slopes with acceptable long-term erosion rates:

- Based on the general 15% slope gradient and the maximum slope lengths of the Project's main landform (except its 25% eastern low wall slope adjacent the void), SW landform and east landform, a minimum groundcover of ≥65% will be adopted, which will allow the use of all the Project soils, except Krongie soil.
- Krongie soil will be preferentially placed on low gradient portions of the final landform, for example, the landform tops or the backfilled surface of the southern end of the final void.
- Sufficient volumes of good quality topsoil and marginal topsoil will be recovered from the Project's disturbance area for rehabilitation to avoid the use of the Project's subsoils as a growth medium.
- All efforts will be made to encourage rapid establishment of vegetation groundcover. Seed mixes will include a significant proportion of grasses, preferentially stoloniferous grasses as they spread in contact with the soil surface and provide better erosion control than tussocky grasses. If required to improve rehabilitation success, a fast germinating sterile cover crop will be incorporated into the seed mix to provide a temporary ground cover while the permanent grass species are establishing.
- Groundcover levels of ≥30% are required on the 25% gradient low wall areas that are located within the Project's main landform and are also rock armoured.
- Where possible, fresh non-carbonaceous sandstone and carbonaceous sandstone will be targeted for use as rock armouring in preference to fresh non-carbonaceous and carbonaceous siltstones/mudstones.
- For the 25% gradient low wall areas only, that are located within the Project's main landform, wastes incorporated into the topsoil for rock-armoured slopes may require treatment with gypsum to mitigate the risks posed by clay dispersion. If required, the rate of gypsum application

will be determined by an appropriately qualified person, and will be undertaken prior to commencement of rehabilitation works.

- As required, Tertiary sediments and weathered wastes will not be placed 2 m or less below the surface layer.
- For the top of the Project's main landform that drains to the final void, if required, the surface of the landform will be roughened by deep ripping to reduce the risk of concentrated flows overtopping and causing erosion.
- During rehabilitation, berms will be monitored for signs of tunnel erosion or uneven settlement/filling, both annually and after large rainfall events. As required, remedial actions will be undertaken to repair identified damaged areas.
- As required, cross-slope rip lines will be established on the landform slopes to reduce the risk of the concentration of runoff and improve vegetation establishment by increasing water infiltration into the growth media. The rip lines will be no deeper than 300 mm and 500 mm for settled and unconsolidated areas, respectively.
- For the northern end of the Project's main landform that may interact with a 1% AEP Isaac River flood event after the removal of the Isaac River flood levee, a suitable groundcover will be established as soon as possible to minimise the risk of scour should this event occur post-mining.

7.5.6 Land Contamination Management

7.5.6.1 Notifiable Activities

In accordance with proposed PRCP requirements, during the decommissioning phase, each notifiable activity site will be subject to a preliminary site investigation to identify if any residual contamination remains. Based on the outcomes of this preliminary site investigation, the proponent will make a risk-based management decision that may involve one of the following actions:

- If no contamination is identified, an application will be made to the administering authority for removal of the site from the EMR.
- If residual contamination is identified, the proponent may undertake remediation of the site and then conduct another site investigation to demonstrate that the residual contamination has been treated. At this stage, if no contamination is identified, an application would be made to the administering authority for removal of the site from the EMR.
- If residual contamination is identified, the proponent may elect to maintain the site on the EMR and provide an SMP to the administering authority for long-term management of the site.

For each of the above possible management actions, the required supporting information would be provided to the administering authority (i.e. as a statutory requirement to assist the regulatory decision making process).

7.5.6.2 Other Potential Contamination Sources

The proponent will manage potential hazardous materials at the Project site in accordance with the IPC Safety and Health Management System. As result, the potential for land contamination will be minimised.

The proponent will monitor those areas of the Project site where hazardous materials have been used for spills and evidence of land contamination, and if required, may undertake remediation actions, such as in-situ treatment or removal of the contaminated soil for external treatment. The remedial action taken will be risk-based and guided by the extent of the contamination. As required, the proponent will engage the services of a suitably qualified person to assist in the management of land contamination.

7.5.7 Visual Amenity

As presented in Section 7.4.9.2, the Project's visual impacts in 2043 and 2058 at Winchester Downs Homestead are considered negligible to minor. However, it should be noted that there is a degree of subjectivity attached to the Project's viewshed analysis based on the viewer's perspective.

Consequently, the proponent continues to consult with the owners of the Winchester Downs property in relation to the Project's potential impacts. Importantly, to facilitate the grant of the Project's MLAs, the proponent will enter into a compensation agreement under the MR Act, with the owners of the Winchester Downs property, which will include compensation for loss of amenity.

In addition, while the Project will modify the landscape during its construction and mining activities, the progressive rehabilitation of the former mine site back to mainly a grazing final land use, will ensure at the completion of rehabilitation, visual amenity will be returned to a similar status for the residents of Winchester Downs Homestead as pre-mining. This outcome is confirmed by the Project's viewshed analysis results for 2058. **Chapter 5** describes the Project's proposed progressive rehabilitation and closure.

7.5.8 Lighting Management

Lighting on the revised Project site will be oriented inwards and screened from the outside where possible. Night lighting with be located as required for safety and security, but focussed on the mandatory areas, with shields around the globes to limit extraneous light where necessary. On set up of mobile lighting within the Project's mining areas, the Project's Open-cut Examiners will assess the risk of light spilling towards the Winchester Downs Homestead, and as required, will make the necessary adjustments to remove or reduce potential light impacts.

The Winchester Downs residents will be provided a 24 hour contact number for the Project's operation for emergency, complaint and impact management purposes. This fast response contact arrangement will allow:

- the residents to contact the Project operator if an issue arises (e.g. fugitive light is spilling towards the Winchester Downs Homestead)
- the Project operator to make adjustments to mobile lighting to remove or reduce the issue in a timely manner (i.e. where possible).

7.6 Conclusion

A comprehensive assessment of the Project's potential impacts on the existing features and environmental values of land within and in the vicinity of the Project area was completed in accordance with the EIS's terms of reference. Detailed field studies, a range of expert reports, publicly available information and proponent derived knowledge were used to support the Project's impact assessment of land.

The main land use within the Project area was identified as predominantly grazing on native and modified pastures. In addition, in the vicinity of the Project, coal mining and pastoral activities (grazing on native or modified pastures) are the predominant land uses. The Project's planned coal mining activities are consistent and compatible with the surrounding land uses. No areas of regional interest, soil conservation plans, key resource areas or protected areas are within or in close proximity to the Project area.

A disjunct stock route for the purpose of 'camping, water and road' was identified partially within the southern section of the Project area and is currently leased by the private owner of Winchester Downs for grazing activities. To manage the predicted impacts specific to the stock route, the proponent continues to consult with state agencies responsible for the stock route as well as the landowner. Only a portion of the stock route will be impacted by Project activities, with that portion of the stock route rehabilitated to grazing use post mining.

A preliminary contamination assessment to evaluate potential for existing (pre-mining) contamination within and surrounding the Project area was completed and concluded that there was a low risk of contamination that would pose a risk to human health or the environment. Due to size of the Project area, there may potentially be isolated areas of contamination that were not identified during the desktop study or captured by the field sampling. Therefore, should any possible contamination sources be encountered during future Project activities, further investigation may be undertaken in compliance with the applicable legislation, standards and guidelines for contaminated land management in Queensland.

The Project's regional and local geology, and coal seams is described based on geological studies. In summary, the Project's coal deposit is located in the northern part of the Permo-Triassic Bowen Basin containing principally fluvial and some marine sediments. The Leichhardt Seam and the Vermont Seam form the principal economic coal resources in the Project area. The coal seams will be mined to a depth of around 100 m. The Project's JORC resources report concluded that the coal resources are considered to possess reasonable prospects for extraction by opencut methods.

An assessment of the Project's soil resources, comprising a soils study area within and surrounding the Project area, characterised the Project's soils for future use in rehabilitation and provided details on the management and handling of soil materials. The soils identified within the Project's soil study area have been grouped into a total of nine soil management units. No acid sulfate soils were identified by the Project's soil assessment.

The Project's soil assessment identified approximately 11.5 Mm^3 of soil are recoverable, comprising good quality topsoil (44.1%), marginal topsoil (39.1%), and subsoil (16.8%). Taurus, Krongie, Taurus-Teviot Complex, and Teviot soils are the dominant recoverable soils, with 85.6% of the recoverable soils captured in these soil types. Sufficient volumes of good quality topsoil and marginal topsoil can be recovered for the Project's rehabilitation, and the recovery and use of the subsoils that have properties less suited to being a growth medium is not required. As a conservative measure the proponent has defined a soil layer with a 0.3 m depth, comprising all or majority good quality topsoil, as a suitable depth for use in rehabilitation.

The Project's soils assessment included a classification of the land suitability for cropping and grazing purposes and an agricultural land classification. In relation to land suitability, the Project's soil study area for grazing was classified as majority (94%) Class 4 (suitable with management) and 5 (unsuitable) with a small proportion (6%) of Class 3 (suitable) for grazing on improved pastures. The Project's soil study area was largely unsuitable for cropping with only a small proportion (6%) of Class 3 (suitable) identified for the four cropping systems evaluated. In relation to the agricultural land classification, the Project's soils study area contains Class C2 agricultural land (72% of the study area), Class C1 (23%) and Class B (6%) which is are suitable for grazing on native and mixed pastures to varying degrees.

The Project will disturb land within the Project area as part of the proposed mining activities. Disturbed land will be progressively rehabilitated, including developing landforms that comprise an in-pit dump, two out-of-pit dumps (southwest and east), and a final void that is outside the 0.1% AEP (1 in a 1,000 year) flood plain. The configuration of the Project's final landform is based on the most efficient mine plan for coal extraction and the development of a final landform that following rehabilitation supports the planned post-mining land uses, including the use of the final void as a beneficial water storage. The granting of the Project's mining leases, EA and PRCP schedule will authorise the Project's disturbance. The planned rehabilitation of the final landform will be guided by the Project's PRCP and PRCP schedule. The PRCP and PRCP schedule are designed to ensure the Project's disturbance is progressively rehabilitated to a final landform that will support the proposed PMLUs.

To demonstrate that the Project's rehabilitated final landform design will be safe, stable and non-polluting, a series of detailed assessments were completed, which comprised a geotechnical assessment, a rehabilitated landform erosion assessment, and a geochemical assessment. The assessments informed the PRCP.

The geotechnical assessment was undertaken to demonstrate that the Project's final landform was safe and stable. The assessment demonstrated that the final void slopes, out-of-pit spoil dump slopes and in-pit spoil dump slopes would be geotechnically stable in the long-term because they met or exceeded the design acceptance criteria of a Factor of Safety ≥ 1.5

The rehabilitated landform erosion assessment was undertaken to demonstrate the long-term erosional stability of the various final landform slopes. The rehabilitated landform erosion assessment was used to predict maximum erosionally stable slope lengths for the Project's soils using a range of materials, uniform slope gradients and cover conditions. The rehabilitated landform erosion assessment demonstrated that the final landform slopes should typically erode at acceptable erosion rates. The acceptable long-term mean average annual erosion rate was set at 5 t/ha/y, being a rate at which the risk of rill erosion being initiated is low.

For the Project's main landform (in-pit dump), the mean average annual erosion rate was 3.7 t/ha/y after 50 years of simulation, increasing to 4.5 t/ha/y after 300 years of simulation. For the Project's southwest landform (out-of-pit dump), the mean annual average erosion was 2.9 t/ha/y after 50 years of simulation, increasing to 4.6 t/ha/y after 300 years of simulation. For the Project's east landform (out-of-pit dump), the mean average annual erosion was 3.9 t/ha/y after 50 years of simulation, increasing to 5.4 t/ha/y after 300 years of simulation.

The Project's geochemical assessment was undertaken to demonstrate that in the long-term the final landform would be non-polluting, and involved a geochemical source hazard assessment and a post-closure geochemical SPR assessment.

The geochemical source hazard assessment of the source material types within the spoil landforms (in-pit and two out-of-pit dumps) of the Project's final landform, and the source materials expected to be exposed in the walls of the Project's final void, demonstrated that each of the Project's closure landforms pose a low AMD hazard, with AMD generation rated as highly unlikely.

In addition, the geochemical source hazard assessment found that the likelihood of AMD generation from the void highwall is highly unlikely, and any expression of AMD from the highwall is expected to be localised. In relation to the floor of the final void assessment found that the likelihood of AMD generation, when the void floor becomes submerged by groundwater post-closure, is highly unlikely.

The post-closure geochemical SPR assessment was conducted for the Project's spoil landforms and final void. The geochemical SPR assessment concluded, with respect to AMD, that the overall SPR risk rating for the Project's final spoil landforms was low. In addition, with respect to non-oxidative salinity, the overall SPR risk for the Project's final spoil landforms was also rated as low. In relation to the final void, the SPR assessment concluded that it's unlikely that undiluted salinity or AMD from a flooded post-closure residual void floor would impact on the residual void's water quality to any significant degree, as evapo-concentration and other processes are the key drivers of the void lake's water quality. In addition, with respect to AMD, the SPR risk rating on the overall water quality of the Project's residual void was low.

Winchester Downs Homestead is the only sensitive receptor site in close proximity (<2 km) to the Project's planned mining operations. Therefore, a view shed analysis was conducted to assess the potential visual amenity impacts at Winchester Downs homestead from the Project's southern mining activities at maximum elevation during operations and for the rehabilitated final landform. The viewshed analysis concluded that the visual impacts at Winchester Downs Homestead were minor during operations and negligible for the rehabilitated final landform. Under the MR Act, the proponent will enter into a 'compensation agreement' with the owner of the Winchester Downs property to facilitate access to the property for the purpose of mining and to address other related factors that will occur because of the Project's planned mining activities (e.g. loss of amenity).

To further minimise the potential for impacts to land, comprehensive avoidance and management measures area provided for land disturbance, land use, geochemical mine waste, geotechnical stability, rehabilitated landform erosion, land contamination, visual amenity and lighting.

The assessment of the Project's potential impacts on the existing features and environmental values of land within and adjoining the Project area demonstrated that the environmental objectives and performance outcomes for land can be achieved, and the Project's final landform will be safe, stable and non-polluting, and will sustainably support the proposed PMLUs.

7.7 References

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