Whitehaven

Blackwater North Extension Project

Appendix A
Soils and Land Suitability Assessment



Soils and Land Suitability Assessment

BLACKWATER NORTH EXTENSION PROJECT

Prepared for Whitehaven Blackwater Pty Ltd

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EXECUTIVE SUMMARY

GT Environmental Pty Ltd was commissioned by Resource Strategies Pty Ltd on behalf of the Proponent, Whitehaven Blackwater Pty Ltd, to complete a Soils and Land Suitability (SALS) Assessment for the Blackwater North Extension Project (the Project). Whitehaven Blackwater is a wholly owned subsidiary of Whitehaven Coal Limited.

The Project would comprise an extension of open cut mining operations into Surface Area (SA) 7 on Mining Lease (ML) 1762 and SA 10 on ML 1759 herein referred to as the study area. The study area covers an area of approximately 6,907.60 hectares (ha) and is located wholly within the Central Highlands Regional Council Local Government Area.

The Project would allow mining of additional coal reserves of approximately 200 million tonnes (Mt) until 2055 with an approximate start date of 2030, at a rate of up to 19 million tonnes per annum (Mtpa) run-of-mine coal.

The key conclusions of the SALS Assessment are as follows:

- 22 Soil Profile Classes (SPCs) across 83 Unique Mapping Areas (UMAs) are present in the study area.
    - Soils range from shallow clay loam soils, sodic subsoil clays texture contrast soils to structured, moderate to very deep clay soils to clays with microrelief on limited to completely cleared, level to gently undulating plains and rises.
    - SPCs have been classified in four of the 14 Australian Soil Classification orders including Dermosol, Kandosols, Sodosol and Vertosols.
- The suitability framework for each SPC was assessed against the nominated Regional Frameworks (Department of Science, Information Technology, Innovation and the Arts and Department of Natural Resources and Mines, 2013) for the Inland Fitzroy and Southern Burdekin Area land uses. These land uses include dryland and furrow irrigated barley, chickpea, cotton, maize, millet, mungbean, oat, safflower, sorghum, soybean, sunflower, triticale and wheat.
    - One SPC, 18Bl(Ro), has been identified as being able to support crop land uses for cotton, maize, mungbean, safflower, sorghum, soybean and sunflower.
    - Three SPCs, SPCs 2Dn(Te), 8Dn(Te) and 20Bl(Ro), can support cotton.
    - All remaining SPCs and UMAs as follows are unsuitable and presented severe or extreme limitations with respect to supporting crop land uses. 2Dn(Te) (UMA 5), 3Bl(Te), 4Bl(Te), 8Dn(Te) (UMA 12), 9Dn(Ro), 10Ct(Ro), 11Bl(Ta), 12Da(Te), 14Bl(Ro), 15Bl(Ro), 17Bl(Ro), 19Bl(Ro), (UMAs 50,51) 16Bl(Ta), 21Bl(Ta) and 22Bl(Wy)

- The SPCs were assessed against Suitability for Beef Cattle Grazing Land Suitability Assessment Techniques (Department of Minerals and Energy, 1995) with reference for beef cattle grazing in the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991). Beef cattle grazing was assessed across the SPCs and specific UMAs with the following results:
    - SPCs 11Bl(Ta), 12Da(Te), 18Bl(Ro) and 22Bl(Wy) were assessed as Class 3, suitable land which is moderately suited to beef cattle grazing but which requires significant inputs to ensure sustainable use.
    - SPCs 2Dn(Te), 3Bl(Te), 4Bl(Te), 8Dn(Te), 9Dn(Ro), 10Ct(Ro), 11Bl(Ta) (UMAs 50,51) 14Bl(Ro), 15Bl(Ro), 16Bl(Ta), 17Bl(Ro), 19Bl(Ro) and 20Bl(Ro) were assessed as Class 4, marginally suited for beef cattle grazing and would require major inputs to ensure sustainability.
    - SPCs 2Dn(Te) (UMA 7) and 21Bl(Ta) were assessed as Class 5, unsuitable land with extreme limitations in which the land is unsuited and cannot be sustainably used for a proposed agricultural use.
- The assessment of Agricultural Land Classes (ALCs) across the study area based on the Regional Frameworks, additional land use limitations and beef cattle grazing classes indicated the following:
    - Approximately 73.36 ha is ALC A1, assessed as suitable for a wide range of current and potential broadacre and horticultural crops.
    - Approximately 810.11 ha is ALC B, assessed as land that is suitable for a narrow range of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology including the availability of water for spray or furrow irrigation.
    - Approximately 3,755.39 ha is ALC C1, assessed as suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.
    - Approximately 2,081.02 ha is ALC C2, assessed as suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
    - Approximately 184.72 ha is ALC C3, assessed as suitable for light grazing of native pastures in accessible areas.
    - ALC A, A2, and D were not mapped within the study area. No areas were designated as disturbed.
    - Soil assessed as suitable for potential cropping land may be impacted as part of the disturbance (approximately 492.86 ha, 7.6 percent of the disturbance footprint), however the assessed cropping land is currently been used as cattle grazing (pre mine land use). The rehabilitation of soils to support the post mine land use (PMLU) of beef cattle grazing indicates that soils are likely to still support the potential agricultural land uses such as cropping in the future, if agricultural land uses were to change.
- The *Regional Planning Interests Act 2014* and *Regional Planning Interests Regulation 2014* identify and protect areas of Queensland that are of regional interest. The study area was

assessed against Strategic Cropping Area (SCA) and Priority Agricultural Area (PAA) requirements.

  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Globe, 2026) confirmed that no SCA was located within the study area.
  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Globe, 2026) confirmed that no PAA was located within the study area.

- An Acid Sulfate Soil field assessment was undertaken during the SALS Assessment. The field observations were reviewed and the result (i.e., very low field indicators for potential acid sulfate soils [PASS]) is consistent with the desktop review against the Atlas of Australian Acid Sulfate Soils mapping which showed the study area as "Extremely low probability of occurrence."
  - It is assessed as highly unlikely the study area includes actual acid sulfate soils and / or PASS, however, environmental management plans should consider proactive procedures to visually monitor and identity acid sulfate soils during the Project's lifespan.
- In summary, topsoil resources from the majority of SPCs contain soils that are suitable for reuse in rehabilitation activities.
  - Topsoil in the study area consisted of fair to poorly structured, low fertility, shallow to deep soils which are indicative of the area, however, all are suitable for reuse in rehabilitation. Approximately 3,519,715 cubic metres is available as topsoil within the disturbance area.
  - Subsoils for six SPCs (1Dn(Te), 2Dn(Te), 12Da(Te), 18Bl(Ro), 20Bl(Ro)and 22Bl(Wy)) had no limitations and were similar in physical and chemical attributes where the subsoil may be stripped to depth and used as topsoil.

    Nine of the SPCs (3Bl(Te), 4Bl(Te), 5Dn(Ro), 7Bl(Pg), 8Dn(Te), 13Bl(Ta), 14Bl(Ro), 15Bl(Ro) and 19Bl(Ro)), were similar, however did have sodic subsoils at depth. Separation of the five SPCs with no limitations and the eight SPCs with sodic subsoils would be recommended with respect to stockpiling. This would prevent impacts to the five subsoils and the need for any additional amelioration treatment.
  - Soil amelioration recommendations such as gypsum application may benefit some of the deeper sodic subsoils as well as organic matter and fertiliser application. These amelioration recommendations are only for situations where the PMLU of beef cattle grazing is not being achieved. General management, storage and handling recommendations have been provided to retain and improve the quality of topsoil for rehabilitation reuse.

1 INTRODUCTION

1.1 Project Title and Proponent

The Blackwater North Extension Project, (herein referred to as the Project) involves an extension of open-cut mining operations into areas located within Surface Area (SA) 7 on Mining Lease (ML) 1762 and SA 10 on ML 1759. The Blackwater Mine (BWM) is a joint venture between Whitehaven Coal Limited (Whitehaven) (70 percent [%]), Nippon Steel Corporation (20%) and JFE Steel Corporation (10%). Whitehaven Blackwater Pty Ltd (Whitehaven Blackwater), a wholly owned subsidiary of Whitehaven, is the operator of the BWM and Proponent for the Project.

1.2 Project Commission

GT Environmental Pty Ltd (GTE) was commissioned by Resource Strategies Pty Ltd on behalf of the Proponent to complete a Soils and Land Suitability (SALS) Assessment for the Project.

1.3 Project Overview

The existing BWM comprises a series of open-cut mining pits along an approximate 80 km long strike length. The BWM extracts coal using drill and blast methods, draglines, dozers and truck and shovel fleets for overburden removal and haulage. Existing infrastructure at BWM includes two rail spurs and balloon loops from the Bauhinia Railway Line, a coal handling and preparation plant (CHPP), thermal coal plant (TCP), product stockpiles, run-of-mine (ROM) coal stockpiles, tailings storage facility, in-pit spoil (i.e. waste rock) dumps, train-load out facilities, water management infrastructure and other supporting infrastructure (e.g. haul roads, access roads, laydown areas, electricity transmission lines, workshops and offices).

Whitehaven Blackwater proposes to develop the Project, which would extend the current open cut mining development at the BWM to within SA 7 on ML 1762 and SA 10 on ML 1759 (Figure 1). The Project is expected to optimise mining operations at BWM allowing ongoing employment and economic benefits from the BWM to the local area, region, and State of Queensland.

The Project would include the following activities:

- extension of open cut operations into SA 7 on ML 1762 and SA 10 on ML1759 to allow mining of additional coal reserves to approximately 2055;
- extraction of an additional 200 million tonnes (Mt) (approximately) of ROM coal;
- continued extraction of up to 19 million tonnes per annum (Mtpa) of ROM coal;
- continued use of existing BWM infrastructure (e.g. CHPP, TCP, ROM and product coal stockpiles, train load-out, water management, tailings management and other supporting infrastructure);
- construction and operation of new water management and water storage infrastructure in support of extended mining operations;
- development of waste rock emplacement areas;
- continued co-disposal of coarse rejects with waste rock and disposal of tailings into an approved tailings storage facility or in-pit void;
- construction of semi-permanent tailings cells to be utilised for the disposal of fine rejects;
- progressive rehabilitation activities of the Project;

- ongoing exploration activities in the Project area; and
- other associated infrastructure, equipment and activities.

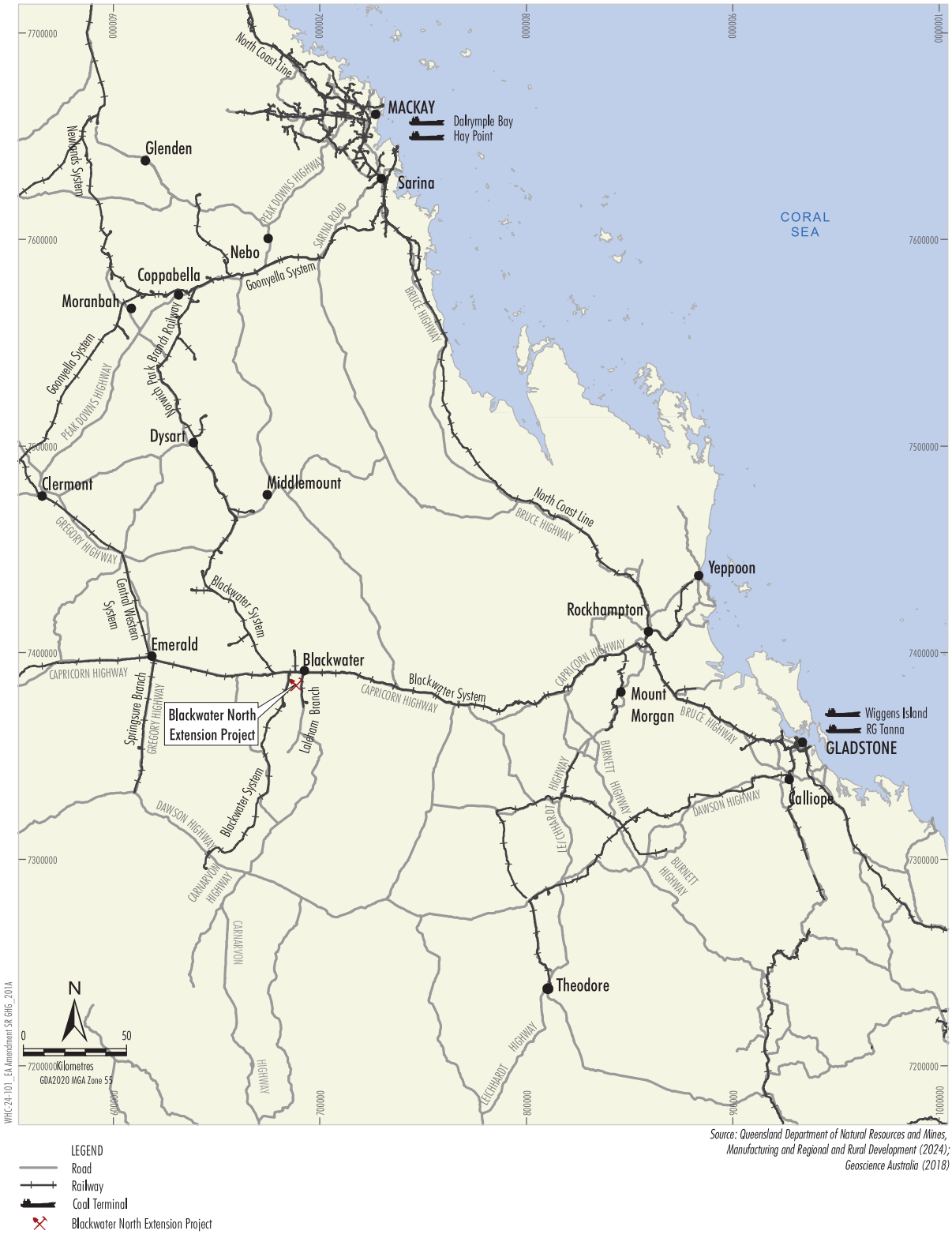
The Project layout is shown on Figure 2.

1.4 Scope of Report

This report provides a baseline assessment, agricultural land assessment and topsoil materials balance assessment as part of the SALS Assessment for the study area including:

- a description of the study area setting (Section 2),
- a description of the assessment methods and relevant guidelines (Sections 3 and 4),
- identification and description of soil profile classes (SPCs) and their distribution across the study area (Section 5),
- an assessment of the selected cropping land uses and Agricultural Land Classes / Classifications (ALCs) for each SPC (Section 6),
- an assessment of the Regional Planning Interests (RPI) for the study area (Section 7),
- an assessment of field and laboratory indicators for potential and actual acid sulfate soils (PASS / AASS) (Section 8), and
- an assessment of the soil values and suitability of each SPC for reuse in mine rehabilitation activities and soil management requirements, including soil stripping, storage, placement and amelioration (Section 9).

Figure 1: Regional Context



Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Geoscience Australia (2018)

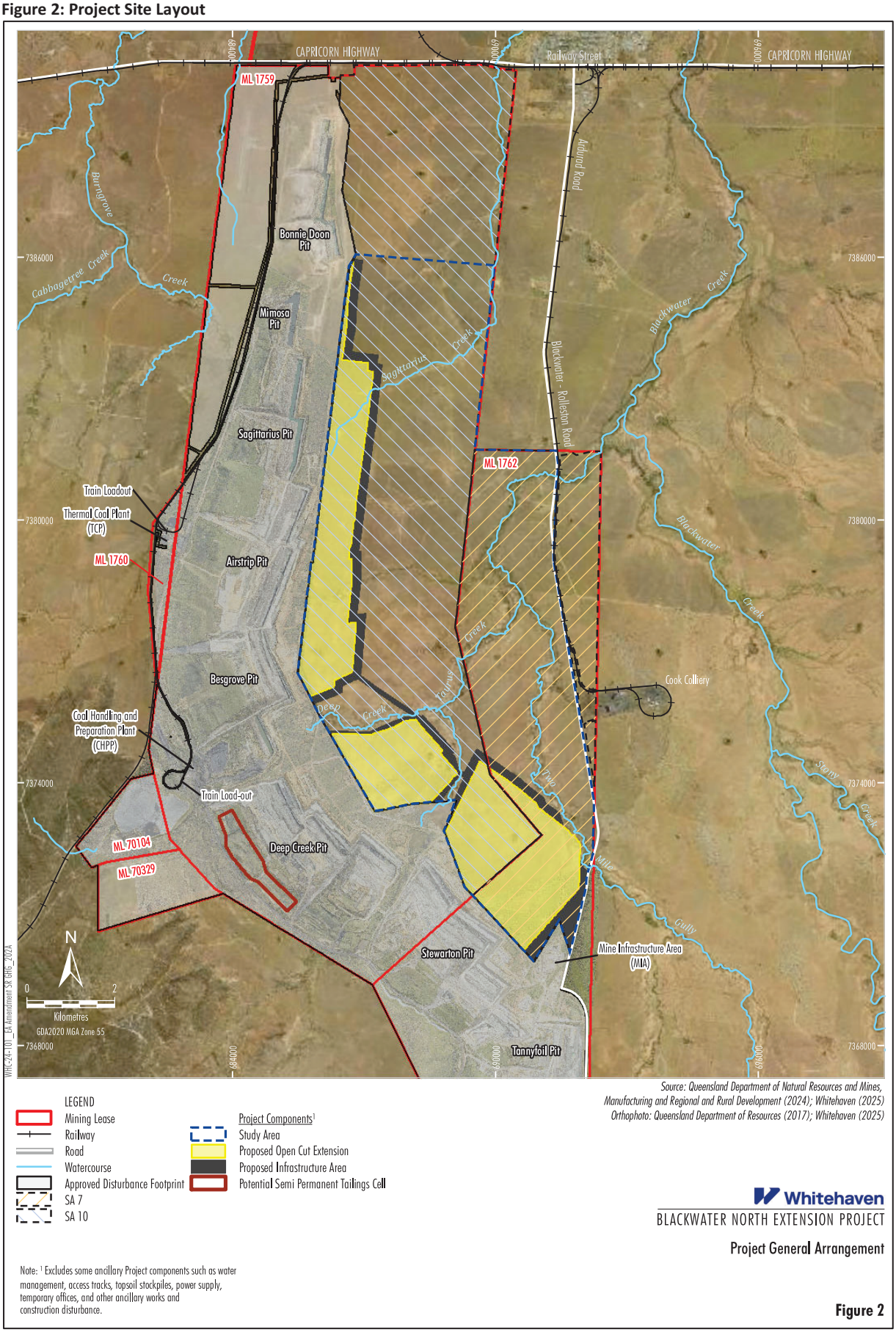
LEGEND
- Road
- Railway
- Coal Terminal
- Blackwater North Extension Project

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BLACKWATER NORTH EXTENSION PROJECT

Regional Location

Figure 1

Figure 2: Project Site Layout



Source: Queensland Department of Natural Resources and Mines, Manufacturing and Regional and Rural Development (2024); Whitehaven (2025)
Orthophoto: Queensland Department of Resources (2017); Whitehaven (2025)

LEGEND

- Mining Lease
- Railway
- Road
- Watercourse
- Approved Disturbance Footprint
- SA 7
- SA 10

Project Components[1]

- Study Area
- Proposed Open Cut Extension
- Proposed Infrastructure Area
- Potential Semi Permanent Tailings Cell

Note: [1] Excludes some ancillary Project components such as water management, access tracks, topsoil stockpiles, power supply, temporary offices, and other ancillary works and construction disturbance.

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BLACKWATER NORTH EXTENSION PROJECT

Project General Arrangement

Figure 2

2 PROJECT SETTING

2.1 Local and Regional Context

The Project is located in the Central Highlands Regional Council LGA, approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (shown in Figure 1).

2.2 Land Use

The dominant land use observed within the study area includes beef cattle grazing, agricultural activities on sown pastures and native pastures on high fertility soils (Queensland Globe, 2026).

2.3 Climate

The nearest Bureau of Meteorology (BoM) weather station able to provide all required data is located at Blackwater airport (BoM Station Number 035134), approximately 3.5 km north-west of the study area. A summary of weather statistics (BoM, 2024) is provided below in Table 2-1.

Table 2-1: Climate Summary Information, BoM weather station - Blackwater Airport

Climate Statistic	Value
Mean Maximum Temperature (May 2013- September 2024)	30.3 degrees Celsius (°C)
Mean Minimum Temperature (May 2013- September 2024)	16.3 °C
Mean Annual Rainfall (May 2013- September 2024)	548.4 millimetres (mm)

2.4 Topography and Hydrology

The topography of the study area includes level and gently undulating plains. The elevation across the study area ranges from approximately 188 metres (m) Australian Height Datum (AHD) to 230 m AHD.

Drainage lines, from north to south of the Project include Sagittarius creek, Taurus Creek and Two Mile Gully, all are tributaries of Blackwater Creek. Several unnamed tributaries associated with these Creeks transect the study area. These local tributaries generally drain in a northeasterly direction and join Blackwater Creek to the east of the Project area.

2.5 Regional Geology

The study area is located within the Bowen Basin. Detailed surface geology (Queensland Globe, 2026) indicates the study area is underlain by four major surface geologies. These are summarised in Table 2-2.

Table 2-2: Regional Surface Geology of the Study Area

Rock Unit Name	Lithological Summary	Age	Dominant Rock
Rangal Coal Measures	Calcareous sandstone, calcareous shale, mudstone, coal, concretionary limestone	Late permian	Arenite-midrock
Rewan Group	Lithic sandstone, pebbly lithic sandstone, green to reddish brown mudstone and minor volcanilithic pebble conglomerate (at base)	Early Triassic – middle triassic	Arenite-midrock
TQa-QLD	Locally red-brown mottled, poorly consolidated sand, silt, clay, minor gravel; high-level alluvial deposits (generally related to present stream valleys but commonly dissected)	Late tertiary - quaternary	Alluvium
Qa-QLD	Clay, silt, sand and gravel; flood-plain alluvium	Quaternary	Alluvium

2.6 Vegetation

The composition of vegetation communities is generally associated with the topography, soils and geologic material. The dominant vegetation observed across the study area included *Acacia harpophylla* (Brigalow) and *Lysiphyllum hookeri* (Bauhinia).

3 OVERVIEW OF STUDY METHODS AND GUIDELINES

An overview of the study methods and supporting guidelines and standards is provided below.

3.1 General Soil Survey

This soil survey was scoped and conducted in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008), *Queensland Soil and Land Resource Survey Information Guideline* (Department of Resources [DoR], 2021) and *Queensland Land Resource Assessment Guidelines, Volume 1: Soil and Land Resource Assessment* (Department of Environment and Science [DES], 2021a).

3.2 Soil Type Classification

Soil characteristics and soil profiles have been described in accordance with the *Australian Soil and Land Survey Field Handbook, Fourth Edition* (National Committee on Soil and Terrain [NCST], 2024), DoR (2021) and DES (2021a).

Soils have been grouped according to their parent material and position in the landscape and classified in accordance with the *Australian Soil Classification* (ASC) (Isbell, 2021). Soils have also been correlated to soils mapped in Commonwealth Scientific and Industrial Research Organisation land system boundaries, such as *Lands of the Isaac-Comet Area, Queensland* (Story et al., 1967) over the study area.

3.3 Soil Type Collection and Assessment

Collection of soil samples for laboratory analysis was undertaken based on Land Suitability Assessment Techniques (LSAT) outlined in the *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (Department of Minerals and Energy [DME], 1995), DoR (2021) and DES (2021a).

The physical and chemical properties of soils relevant to the potential for erosion has been determined for analysed site samples within the soil profile based on field and laboratory assessment of dispersive attributes including, but not limited to, texture, R1 dispersion and Emerson Aggregate Test (EAT) results.

Interpretation of the field and analytical results were undertaken with review against the following documents:

- *Analytical methods and interpretations used by the Agricultural Chemistry Branch for soil and land use surveys* (Bruce and Rayment, 1982),
- *Interpreting Soil Analysis for Agricultural Use in Queensland* (Baker and Eldershaw, 1993),
- *Interpreting Soil Test Results, Third Edition* (Hazelton and Murphy, 2016),
- *Soil Survey Standard Test Method Emerson Aggregate Test* (Department of Sustainable Natural Resources, n.d),
- *Soil Analysis, an Interpretation Manual* (Peveril et al., 1999),
- *Soil Chemical Methods – Australia* (Rayment and Lyons, 2011),
- *Soil Physical Measurement and Interpretation for Land Evaluation* (McKenzie et al., 2002),
- *Soil Testing and Some Test Interpretations used by the Queensland Department of Primary Industries (QDPI)* (Bruce and Rayment, 1984), and

- *Understanding Soils and Soil Data*, pp 109–133 (Shaw, 1988).

3.4 Land Capability, Suitability and Agricultural Land Classification

Land classification is based on the Land Capability Classification (LCC) in Queensland, outlined in the *Guidelines for Agricultural Land Evaluation* (GALE) (Department of Science, Information Technology and Innovation [DSITI] and Department of Natural Resources and Mines [DNRM], 2015), QDPI (1994) and DME (1995).

This land classification covers the evaluation of land attributes for arable, pastoral and other agricultural land uses. It is appropriate where evaluation for a limited range of agricultural land uses is required at a broadscale intensity over a large area.

Determination of land suitability for the study area has been conducted based on the GALE (DSITI and DNRM, 2015), *Regional Land Suitability Frameworks for Queensland* (Department of Science, Information Technology, Innovation and the Arts [DSITIA] and DNRM, 2013), DoR (2021) and DES (2021a).

The suitability of soils for rehabilitation has been assessed using field and laboratory assessment of texture, fertility, dispersive and structural attributes.

Groupings of soils with similar attributes are described as soil types in DES *Application requirements for activities with impacts to land* (DES, 2025). Soil types are defined either as the ASC suborder or SPC within *Queensland Soil and Land Resource Survey Information Guideline* (DoR, 2021). For this assessment and to adhere to the more relevant DES (2021a), SPC terminology and assessment has been used.

Other guidelines and reports that have assisted in soil classification, nominating criterions and assessing effective rooting depth (ERD) include the *Salinity Management Handbook, Second Edition* (Department of Environment and Resource Management [DERM], 2011) and '*Soil salinity – electrical conductivity and chloride*' in *Soil Analysis: an interpretation manual* (Shaw, 1999).

The soil assessment comprised a desktop study, field surveys and data analysis and interpretation. Section 4 provides a detailed description of the soil assessment methodology.

3.5 Topsoil Resource Assessment

Assessment of the topsoil resource was undertaken with the soil assessment and land suitability assessment. This assessed the available topsoil resource, its suitability, limitations and recommendations for reuse in mine rehabilitation and seeks to provide information for inclusion in the Progressive Rehabilitation and Closure Plan (PRC Plan).

The assessment of the impacts on land and topsoil resources will also include review of the DES *Application requirements for activities with impacts to land* (DES, 2025)*, Mine Rehabilitation, Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016), Perry et al., (1964), and *Mine Rehabilitation Handbook* (Minerals Council of Australia, 1998) were reviewed with the field and laboratory results in assessing topsoil resource quality and quantity.

3.6 Regional Planning Interests Assessment

The *Regional Planning Interests Act 2014* (RPI Act) and *Regional Planning Interests Regulation 2014* (RPI Regulation) identifies and protects areas of Queensland that are of regional interest. The RPI Act protects each of the following areas of regional interest:

- Priority Living Areas (PLAs),
- Strategic Environmental Areas (SEAs),
- Priority Agricultural Areas (PAAs), and,
- Strategic Cropping Areas (SCAs).

The study area was assessed against the SCAs and PAAs.

3.7 Acid Sulfate Soil Assessment

Assessment of Acid Sulfate Soils (ASS) was undertaken with the SALS Assessment. This included review of available desktop resources such as Queensland Globe and Australian Soil Resource Information System (ASRIS) including Atlas of Australian Acid Sulfate Soils mapping (ASRIS, 2025).

Fieldworks included field observations for indicators for ASS materials of observation sites for SPCs. These observations have been reviewed against Table 5-1 of the *National Acid Sulfate Soils Guidance, National acid sulfate soils sample and identification methods manual* (Sullivan et al., 2018).

4 DETAILED METHODOLOGY

4.1 Desktop Study

GTE reviewed the available soils and land resources information for the study area to develop preliminary distributions of SPCs to inform the development of the field survey program.

4.1.1 Regional Land and Soils Report References and Documentation

The following soils studies and publicly available information were reviewed to identify available data and recommendations relevant to the study area, and to determine potential field sampling locations:

- *Land Resources Assessment Report, Blackwater Mine - North Extension Project* (SLR Consulting Australia [SLR], 2023).
    - This study encompasses the entire study area. Soil survey and mapping was conducted to a survey density of 1 site per 11 ha, exceeding 1:125,000 survey intensity and includes 43 detailed sites, 20 analysed and 37 check sites. Detailed and analysed sites were conducted to a maximum of 1.20 metres below ground level (mbgl) with soil testing to a depth of 1.00 mbgl consisting of pH, electrical conductivity (EC), cation exchange capacity (CEC), exchangeable sodium percentage (ESP), particle size analysis (PSA) and EAT.
    - This SLR (2023) report, including field and laboratory data, was extensively reviewed and incorporated into this SALS Assessment.
- *Lands of the Isaac-Comet Area, Queensland* (Story et al., 1967).
    - The area of Isaac-Comet encompasses the study area. Based on Story et al. (1967), a potential of over 40 soil types across the various land systems may be present including gently undulating plains of Poplar Box woodlands to Brigalow downs, undulating country with cracking clays.
- *Land Resource Survey and Evaluation of the Kilcummin Area, Queensland* (Shields and Williams, 1991).
    - This survey area is to the west, outside of the study area. However, it provides a practical application of land evaluation of the Land Resources Branch (*Guidelines for Agricultural Land Evaluation in Queensland*, Land Resource Branch, Department of Primary Industries, 1990) LSAT.
- Soil and Land Information (SALI) (Queensland Globe, 2026).
    - Review of the available soils information on Queensland Globe, SALI, existing soils sites and varying degrees of information. The information included the following observation sites for Project Central West Region Salinity Investigations Site SALTC293 and SALTC294. These two sites are presented in Figure 3 and in Appendix G. Soil sites observed located to the east of the study area associated with The Survey of the Isaac-Comet Area (Story et al., 1967) included ZDK170, ZDK172, ZDK173 and Fitzroy Soil Erodibility Mapping Project, site FSE194. Other information reviewed included detailed surface geology, contours, water courses, ALCs and ASSs.

- Queensland Agricultural Land Audit, Central Queensland (Department of Agricultural, Fisheries and Forestry, 2013).
    - The Queensland Agricultural Land Audit for Central Queensland covers the Project site. The audit outlines the regional agricultural profile, the current and potential agricultural land use, data confidence and mapping for the region.

      The general findings and key regional issues of the region state there is a good soil resource base and rainfall with productive agricultural and pastoral land that supports agricultural industry. Reliable water resources are present for irrigation. The central Queensland area is a major cattle breeding region for northern Australia with major abattoirs and cattle saleyards.

      Weaknesses of the region consist of invasive plants and animals, infrastructure funding, road transport infrastructure through declining road conditions, access to skilled labour throughout the area due to competing mining industry and unreliable and inadequate telecommunications.

4.1.2 Satellite Imagery

Satellite Imagery from Google Earth and Queensland Globe (viewed January 2026) was reviewed as part of the desktop study. The satellite imagery assisted with creating preliminary boundaries, site locations and access on site.

4.2 Field Work

4.2.1 Survey Timing

Five field surveys were undertaken across the study area between the following dates:

- 7 July 2025,
- 8 to 10 September 2025,
- 13 to 16 October 2025,
- 20 to 23 October 2025, and
- 3 to 7 November 2025.

4.2.2 Survey Team

All fieldwork trips were led by Reece McCann, Associate Environmental Scientist with a degree in Environmental Technology and over 15 years' experience in conducting SALS and Strategic Cropping Land (SCL) assessments over a 20-year plus professional career as a consultant in contaminated land and environmental soil science.

Reece was assisted in the field by environmental consultants Greg Tuck, Matthew Mooney and Lewis Arnold. Project assistance during the fieldworks was provided by Project Director Greg Tuck.

4.2.3 Survey Techniques

Preliminary sampling locations were derived from the desktop review of background information, existing available soils information and an examination of satellite imagery patterns. The specific locations of the survey sites were further refined in the field based on available site access, and whether the location was likely representative of the SPC being described. An SPC may be defined as a three-dimensional soil body such that any profile within the body has a similar number and arrangement of horizons whose attributes are within a defined range (Donnollan et al., 1998).

Free, integrated survey, and gradient-oriented transect (Gradsect) techniques (McKenzie et al., 2008) were used to verify SPCs and assign boundaries to each. Free survey is a commonly used method in land assessment as it enables flexibility in site selection (over grid mapping techniques), to achieve a more accurate and time effective result. It is well suited to detailed-scale surveys and is commonly used in soil surveys for resource projects in Queensland. Gradsect techniques were utilised across accessible tracks of varying topography. This provided a detailed cross section of the landscape and assisted in identifying patterns of soil variation.

Surveyed polygons were identified as individual mapped polygons, referred to as Unique Mapping Areas (UMAs).

4.2.4 Soil Survey Intensity

A medium intensity (McKenzie et al., 2008 and DES, 2021a) soil survey was selected for the study area based on previously submitted and approved SALS assessments for recent comparable projects. The survey intensity outlined below has been submitted previously for areas in central and north Queensland regions and is deemed acceptable based on the complexity of the landscape.

The nominated soil survey intensity considered the layout of the study area while being in accordance with the relevant guidelines for the proposed mine site components for the study area.

The soil survey considered available information within the *Land Resources Assessment Report, Blackwater Mine - North Extension Project* (SLR, 2023). In conducting the soil survey, GTE were able to leverage existing sites (SLR, 2023) to meet targeted soil survey intensities for disturbance and non-disturbance areas. Every observation site class exceeded the minimum percentage required numbers, as outlined in DES (2021a). Every UMA identified contains at least one observation site to assist in soil classification.

New Class IV(a) and Class IV(b) sites are generally placed in the proposed disturbance areas as SLR (2023) sites generally satisfy Class IV(a) and IV(b) site density requirements for non-disturbance areas.

The following soil survey intensities for proposed disturbance and non-disturbance components of the study area were achieved, with totals for each class of site exceeding the minimum required by DES (2021a):

- Areas planned for mining disturbance – 1:25,000, McKenzie et al. (2008) and DES (2021a).
- Areas not planned for mining disturbance – 1:100,000, McKenzie et al. (2008) and DES (2021a).

4.2.5 Soil Survey Observation Sites

Soil survey sites were conducted in accordance with McKenzie et al. (2008), DES (2021a) and DoR (2021):

- Detailed sites:
  - Class I - detailed profile description with no laboratory analysis.
  - Class II (a) - deep bore (greater than [>] 2.00 m) detailed profile description with no laboratory analysis.
- Analysed sites:
  - Class II (b) - deep bore (> 2.00 m) detailed profile description with limited or non-standard laboratory analysis,
  - Class III (a) - profile with limited or non-standard laboratory analysis:
    - these profiles are associated with the nominated laboratory analysis for existing SLR analysed sites.
  - Class III (b) - profile with standard laboratory analysis:
    - these profiles are associated with the nominated laboratory analysis for GTE analysed sites.
- Brief Mapping Observation sites:
  - Class IV (a) - brief profile description with some soil morphological data recorded.
  - Class IV (b) - brief mapping observation with no soil morphological data recorded.

Detailed site locations were assessed prior to fieldworks and placed across the study area. If an area was observed to benefit from additional detailed sites, these were conducted. Class IV sites were conducted at either regular intervals, to either define SPC boundaries or to confirm an area based on the landform, vegetation, surface conditions or soil morphological conditions.

The detailed sites for the mine site were generally conducted to 1.50 mbgl, in line with current expectations of SALS assessments referenced against McKenzie at al. (2008), DoR (2021) and DES (2021a) guidelines.

Naming conventions for soil survey sites are as follows:

- Detailed sites with “D” prefix indicate a detailed, analysed and detailed (deep boring) including Class I, Class II (a), Class II (b), Class III (a) and Class III (b) sites described as part of the assessment.
- Brief mapping observation sites with “C” prefix indicate Class IV (a) and Class IV (b) sites described as part of the assessment.
- SLR (2023) sites with “B” prefix indicate Class IV (a) sites and with “C” prefix indicate Class IV (b) sites.

The soil survey site types are labelled separately with unique colour identifiers on Figure 3.

Class I, II (a), II (b) and III Sites

Class I and II (a) (herein known as detailed sites) were undertaken at 44 locations, Class II (b) and Class III (herein known as analysed sites) were undertaken at 22 locations (Figure 3).

The sites were used to describe the range of soil profile morphological attributes as per the NCST (2024) including landforms, slope, surface conditions, rock cover, major vegetation and soil colour (as per Munsell Color [2009] Soil Colour Charts). At each detailed site, an assessment was also made of the quality, depth and quantities of reusable soil resources.

The soil profile at each detailed site was exposed using the excavator test pit method and where not possible, 100 mm hand auger (with various attachments) where access dictated, as well as shovel, crowbar and picks for exposing the A horizon. Soil profiles were undertaken in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al., 2008).

The information recorded from detailed sites included:

- location (Geocentric Datum of Australia [GDA] 2020) and type of soil observation (e.g., erosion exposed cutting or hand auger),
- major vegetation types,
- landform type, position of the site and slope gradient,
- surface condition (e.g., presence of cracks, surface crust, rocks, stones and cobbles, erosion status, microrelief),
- types and vertical extent of soil horizons,
- colour (as per Munsell Color [2009] Soil Colour Charts) and mottling of each horizon,
- observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence and pedality and moisture content for each horizon,
- the presence of organic matter, roots and prevalence of biological activity,
- the presence of gleyed horizons, iron staining and jarosite presence, and
- photographs of the soil profile and surrounding landscape.

Class II (a), II (b), III (a) and III (b) including soil sampling of profiles was conducted as per McKenzie et al. (2008), with samples taken at standard depths incorporating the surface and every horizon change in the soil profile (typically at depths of 0.00-0.10 m, 0.20-0.30 m, 0.50-0.60 m, 0.80-0.90 m, 1.10-1.20 m and 1.40-1.50 m). Two additional soil samples were collected for depths below 1.50 m, generally at 1.70-1.80 m and 1.90-2.00 m pending soil horizons observed.

These depths were modified for sites in which field observations revealed soil horizons intersecting at these nominated depths, to ensure samples were collected in each separate horizon, and not across multiple horizons or in sub-horizon boundaries. These analysed sites were assessed against a nominated laboratory suite, as outlined in Section 4.3.

The data collected from the detailed sites are shown in Appendix A.

Class II sites were undertaken at 9 locations (Figure 3). The sites were randomly selected within SPCs that allowed augering beyond 1.50 mbgl.

Class IV (a) and IV (b) Sites

Class IV (a) and IV (b) sites were undertaken at 40 and 53 locations respectively (Figure 3). These sites were used to confirm SPC type and refine mapped soil boundaries.

For Class IV (a) and IV (b) sites, basic soil attributes were recorded at each observation site to confirm the SPC, and surface conditions including rock, slope percentage, landform type and position, major vegetation and land condition were also noted. Class IV(a) sites were augered to a nominal depth in which salient features for soil and SPC classification could be undertaken (i.e., depth of A horizon, exposing the B21 horizon). The data collected from the Class IV (a) and IV (b) sites is shown in Appendix B.

4.2.6 Laboratory Analysis

Soil samples were collected from all dominant SPCs present in the study area. For each site selected as an analysed site, the soil samples were collected from a detailed site that was representative of that SPC.

Laboratory analysis was undertaken to assist in determining the overall characterisation of the soils and to establish any physical and chemical limitations of soils. Laboratory analysis was also used to identify soils that may require specific management measures.

Samples were analysed at Environmental Analysis Laboratory who are accredited by the National Association of Testing Authority and certified by the Australasian Soil and Plant Analysis Council.

Soil samples were analysed for a laboratory suite, based on recommended standard suites within guidelines DoR (2021), DES (2021a), the Suitability Frameworks for the Gulf Plains area (DSITIA and DNRM, 2013) and indicators for soil resource quality for mine rehabilitation (Australian Government, 2016).

Existing SLR (2023) sites were reviewed with existing laboratory data to be utilised within this SALS Assessment Report. Applicable new sites where SLR (2023) data was chosen to be leveraged, were conducted at SLR (2023) site locations. Identified gaps within the existing SLR (2023) site laboratory analysis was completed to meet the nominated GTE laboratory suite for the Project.

The laboratory analysis parameters and rationale for soil horizons of each analysed site are shown in Table 4-1.

Table 4-1: Analytical Program and Number of Samples

Test	Soil Profile Horizon	Justification
Field measurements pH	All	Used for 'on the spot' estimates of pH to assist in initially categorizing soils, potential chemical barriers, general health and ERD. This field measurement is based on the Standard Operating Procedure (SOP) outlined in *Queensland Land Resource Assessment Guidelines – Volume 2: Field tests Version 1.0* (DES, 2021b).
Field measurements Dispersion	All	Used for 'on the spot' indicators of dispersion and slaking of soil, specifically peds of soils. This field measurement is based on the SOP outlined in *Queensland Land Resource Assessment Guidelines – Volume 2: Field tests Version 1.0* (DES, 2021b).
pH	All	Measurement of pH is a useful indicator of various soil properties (e.g., values > 8.5 usually indicate high exchangeable sodium levels and the presence of carbonates and nutrient availability limitations).
EC	All	The measure of EC is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.
Chloride (Cl^-)	All	The chloride anion is usually present in soil associated with sodium. It is highly mobile making it a valuable indicator of salt and water movement. It provides additional confirmation of soil salinity.
Effective Cation Exchange Capacity (ECEC), Exchangeable Cations, Calcium : Magnesium ratio (Ca:Mg), ESP	All	The amounts and relative proportions of the exchangeable cations in soil have important effects on both physical and chemical properties. High levels of exchangeable sodium cause dispersion and increased swelling, reducing water movement and affecting near surface aeration, whereas exchangeable calcium flocculates colloids and would reduce swelling tendencies. Excessively high or low concentrations of one or the other of the cations may impact buffering capacity and, as a result, soil nutrient availability.
PSA (less than [<] 2 mm)	All	PSA data provides an assessment of the composition of a soil (based on the dominant grain size in a soil). This assists with confirmation of field observations as well as providing better grounds for identification of SPC and water holding capacity.
R1 Dispersion	All	The measure of R1 dispersion is useful when used in conjunction with ESP and the Ca:Mg for predicting soil physical behaviour.
EAT	All	The measure of EAT is useful when determining soil physical behaviour.
Available Nitrogen (N), Total N and Nitrate	Topsoil	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Extractable Potassium	Topsoil	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Phosphorus (P) / Phosphorus Buffering Index (PBI)	Topsoil	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Organic Matter / Carbon	Topsoil	Testing for soil organic matter provides an indication of the general fertility of soils and thus suitability as a topdressing agent. It also assists in interpretation of soil structural properties and provides information on stored nutrients which may not yet be accessible to plants but may become available in the future.
Sulfur	Topsoil	Total levels of sulfur help identify whether organic matter or gypsum are present in a soil profile.
Selected Trace Elements	Topsoil	The analysis of copper, zinc, manganese and iron will assess extractable concentrations of these micronutrients in the soil, potential deficiencies (copper, zinc, manganese and iron) as well as any potential phytotoxicity issues that may exist (all elements).

The laboratory results assessments are provided in Section 5 for each SPC, with the laboratory summary for each SPC provided in Appendix C and laboratory certificates in Appendix L.

4.3 Interpretation of Key Field and Laboratory Soils Data

Key field and laboratory data for each SPC was assessed based on the following guidelines. These guidelines assisted with the classification of the SPCs, land suitability and topsoil resource for mine rehabilitation. The basis for the assessment is provided in Appendix D which outlines the key assessed attributes and nominated criteria.

4.4 Effective Rooting Depth

ERD is defined by the depth in which approximately 90% of plant roots will extract water and is defined by physical or chemical attributes (barriers) within the subsoil that restrict growth and affect Plant Available Water Capacity (PAWC).

Land Resource Assessment of the Windeyers Hill Area (Burgess, 2003) and RPI Guideline 08/14 (Department of State Development, Manufacturing, Infrastructure and Planning [DSDMIP], 2019) outline ERD criteria with respect to physical and chemical barriers. Burgess (2003) includes a catchment area of the Isaac-Connors and Mackenzie River which cover an area of approximately 35,404 kilometres squared (km^2), where the Project site is located within. DSDMIP (2019), which includes criteria relevant to cropping land uses, was also considered.

Based on this document and guideline, Table 4-2 outlines the nominated physical and chemical barrier criteria for ERD.

Table 4-2: Initial Nominated Effective Rooting Depth Criteria

Physical/Chemical Value	Criteria
pH	≤ 5 and ≥ 9 for rigid soils (non-shrink swell soils, such as Dermosols, and Sodosols). ≤ 5 for non-rigid soils (Shrink swell clays, Vertosols)
EC (1:5 water)	> 0.8 deciSiemens per metre (dS/m)
Cl^-	> 1,000 milligrams per kilogram (mg/kg)[1]
Strongly Sodic Conditions	ESP > 15% (where clay content was 20% and CEC is > 3.0 centimoles per kilogram [cmol(+)/kg])
Extremely low exchangeable Ca:Mg	≤ 0.1
Depth to C or R horizons	Physical barrier presence at depth including hard pans, gravel layers, bedrock or other hard materials

1- Chloride levels are reviewed against EC and Exchangeable Calcium levels where if EC / Chloride levels are high to very high then chloride levels are not high enough to be a limiting property i.e., high EC is influenced by calcium sulfate (gypsum).

Shaw (1999) was reviewed in conjunction with DERM (2011) against nominated land uses for the Project site. The SALFPREDICT model assesses the water uptake weighted profile mean EC, saturated extract (ECse) throughout the rootzone of the soil to determine a likely salt load that will affect a crop. It also calculates the likely leaching fraction of the soil to help determine the likelihood of salt removal from the rootzone to deeper in the soil profile. It predicts a potential impact of salinity on a range of crops, indicating likely yield responses.

To assess a yield percentage, available nominated crop land uses and Class II(b) / III site laboratory data was entered within the SALFPREDICT model. Nine crop land uses (Barley, Cotton, Maize [Corn], Oat, Safflower, Sorghum, Soybean, Sunflower and Wheat were identified as having data available within the SALFPREDICT model and were assessed. To minimise any outside influence of saline waters, 'rainfall – irrigation water' (DERM, 2011) was utilised as the water input. The SALFPREDICT Quick Calculator and Predictive Calculator were completed and provided results, including PAWC.

Plant salt-tolerance data was also assessed against based on the ECse (SALFPREDICT) values from the SALFPREDICT model with Class III laboratory data. This assessed the depth of the soil of which the ECse against 90, 75 and 50% yield criteria were exceeded. This would assist in identifying any low yields based on a nominated rooting depth of 0.60 m. The proposed depth was based on seedling and root establishment, not germination or early seedling establishment (DERM, 2011). A total of 13 crop land uses were assessed.

Any physical barrier that prevented further excavation or augering of a test pit or borehole respectively, including bedrock, coarse gravel layer or regolith were recorded as refusal.

During discussions with the regulator regarding EC, Chloride and Sodium as ERD as outlined in Burgess (2003), it was advised that these attributes are transient and will change following disturbance, stockpiling, mixing (with other less salty subsoil) and weather exposure as well as application of good quality irrigation water.

Table 4-3 outlines the nominated physical and chemical barrier criteria for ERD. Assessment of plant yield and plant salt-tolerance data for the available crop land uses is presented for each SPC in Section 5.

Table 4-3: Proposed Effective Rooting Depth Criteria

Physical / Chemical Value	Criteria
pH	≤ 5 and ≥ 9 for rigid soils (non-shrink swell soils, such as Dermosols, and Sodosols). ≤ 5 for non-rigid soils (Shrink swell clays, Vertosols)
Extremely low exchangeable Ca:Mg	≤0.1
Plant yield based on SALFPREDICT modelling for the following crop land uses; Barley, chickpea, cotton, maize, millet, mungbean, oat, safflower, sorghum, soybean, sunflower, triticale and wheat.	A yield response > 65% for any particular crop is considered suitable.
Plant Salt-Tolerance Data (DERM, 2011) for the following crop land uses; Barley, chickpea, cotton, maize, millet, mungbean, oat, safflower, sorghum, soybean, sunflower, triticale and wheat.	A yield response > 65% for any particular crop is considered suitable within a nominated root zone of 0.60 m.
Depth to C or R horizons	Physical barrier presence at depth including regolith, gravel layers, bedrock or other hard materials

4.5 Land Suitability and Agricultural Land Assessment

Land suitability is primarily based on classifications provided within the GALE (DSITI and DNRM, 2015) and Regional Frameworks (DSITIA and DNRM, 2013).

ALC is based on a simple hierarchical scheme that is applicable across Queensland. It allows the interpreted land evaluation data to indicate the location and extent of agricultural land that can be used for a wide range of land uses with minimal land degradation.

This evaluation scheme has evolved through various guidelines and state planning policies and is currently referenced in regional or shire council planning schemes. ALC assessment guidelines are shown in Section 6.

4.6 Regional Planning Interests

The RPI Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The RPI Act protects PLAs, SEAs, PAAs and SCAs.

As part of the SALS desktop study, applicability for assessments for PAA and SCA was conducted.

4.7 Acid Sulfate Soils Assessment

Review of the ASRIS including the Atlas of Australian Acid Sulfate Soils mapping (ASRIS, 2025) was undertaken. The ASS mapping is classified with a nationally consistent legend that includes a risk assessment.

5 SOIL AND LAND SUITABILTY RESULTS

The following sections outline the SPCs observed across the study area, the land suitability, ALC and soil resources.

5.1 Soil Profile Classes Summary

A total of 22 SPCs have been observed and mapped encompassing 83 UMAs within the study area (shown in Figure 3).

Table 5-1 lists the SPCs identified in the study area and provides a description of each SPC concept including basic soil morphology, position in the landscape, and applicable UMAs and sites.

SPCs have been classified in accordance with the ASC (Isbell, 2021) in which four of the 14 ASC Soil Orders have been observed (shown in Figure 4). The UMAs, detailed sites, ALC, topsoil thickness and areas are presented in Table 5-1.

Detailed descriptions of each SPC and their Class III analysed site are provided in the following sections (Sections 5.1.2 to 5.1.23). Appendix A presents Class I, II and III site descriptions.

5.1.1 SLR Soil Summary and Associated GTE Sites and SPCs Summary

As discussed in Section 4.1.1, sites from a previous Land Resource Assessment (SLR, 2023) was available for review and use across the study area. A review of the report and all associated observation sites were undertaken to assess their potential use in the SALS Assessment.

On review, GTE decided to reference the observation sites and include them to assist in meeting the nominated survey scale. A review of the check sites indicated generally surface observation sites, which were nominated as Class IV(b) within this SALS Assessment. Detailed sites were assessed in greater detail where attributes to soil classification, observations of microrelief and inclusion of laboratory data were considered. These were nominated as Class IV(a) sites due to test pit depths of 1.20 mbgl and a nominal depth description up to 1.00 mbgl. A further review of this detailed and check site data is presented in Appendix E and F.

The key data from the SLR (2023) report was the reuse of detailed sites used for analysis. Seven soil mapping units were located within the study area with six SLR (2023) sites identified, where the intent was for GTE to re-visit the location, conduct an analysed site and complete the field and laboratory data gaps where required. Table 5-2 provides a summary of these sites.

Table 5-1: Land Summary of SPCs in the Study Area as per the SALS Assessment

SPC map code[1] / Report No.	SPC Concept	ASC (Dominant to sub-order)	UMAs (*Analysed)	Detailed sites (*Analysed)	SLR (2023) Analysed Site relevant to GTE Analysed site	Regional Frameworks / Limitations Suitability	Beef Cattle Grazing / Limitations Suitability	ALC	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total Area (ha)
1Dn(Te)	Deep, reddish brown clay soil with a soft surface and strongly structured, sodic subsoils and is associated with flat to gently undulating plains with Bauhinia.	Brown Vertosol	1*	D1*	-	Cotton (Class 4). Remaining land uses (Class 5)	Class 4	Class C2	0.20-0.40	139.54
2Dn(Te)	Deep, dark grey clay soil with a self-mulching surface and moderately to strong structured subsoil and is associated with flat to gently undulating plains with cleared Bauhinia vegetation.	Black Vertosol	2, 3*, 4, 5, 6, 7, 8	D3*, D55	B25	UMAs 2, 3, 4, 6, and 8: Cotton (Class 3). Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5) UMA 5: Cotton (Class 4). Remaining land uses (Class 5) UMA 7: All land uses (Class 5)	UMA 7: Class 5 UMAs 2, 3, 4, 5, 6, 7, and 8: Class 4	UMAs 2, 3, 4, 6, and 8: Class B UMA 5: Class C2 UMA 7: Class C3	0.20-1.00	414.16
3Bl(Te)	Very deep, brown clay sandy soil with a firm surface and strong structured subsoils and is associated with flat to gently undulating rises with sparse woodlands of whitewood vegetation and grasslands	Black Dermosol	9*	D5*	-	All land uses (Class 4)	Class 4	Class C2	0.20-0.80	12.39
4Bl(Te)	Very deep, grey clay soil overlying weathered substrate with self-mulching/flake surface and strong structured subsoils and is associated with gently undulating plains with grasslands.	Grey Dermosol	10, 11	D6*, D20	-	Cotton (Class 4). Remaining land uses (Class 5)	Class 4	Class C1	0.20-0.60	46.17

SPC map code[1] / Report No.	SPC Concept	ASC (Dominant to sub-order)	UMAs (*Analysed)	Detailed sites (*Analysed)	SLR (2023) Analysed Site relevant to GTE Analysed site	Regional Frameworks / Limitations Suitability	Beef Cattle Grazing / Limitations Suitability	ALC	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total Area (ha)
5Dn(Ro)	Deep, grey clay soils with a cracking surface and strong structured subsoils and is associated with gently undulating rises with drainage and depressions with sparse acacia vegetation and grasslands.	Grey Vertosol	13, 14*, 15, 16, 17	D7*, D26, D33, D42, D50	-	Cotton (Class 3). Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 4	Class B	0.20-0.45	239.28
6Bl(Pg)	Gilgaied, deep, brown clay soils with a cracking surface and strong structured, sodic and salinity impacted subsoils and is associated with gently undulating plains with open Brigalow scrub vegetation.	Brown Vertosol	18*, 19, 20, 21, 22, 23	D12m/d*, D9m/d	-	All land uses (Class 4)	Class 5	Class C2	-	141.38
7Bl(Pg)	Very deep, grey clay soil with a cracking surface and strong structured subsoils and is associated with gently undulating plains with sparse Brigalow scrub.	Grey Vertosol	24, 25*, 26, 27, 28	D14m/d*, D15	-	All land uses (Class 4)	Class 5	Class C2	0.00-0.50	304.18
8Dn(Te)	Moderately deep, grey clay soil with a self-mulching and moderate structured subsoils and is associated with gently undulating rises with lower lying and drainage areas.	Grey Dermosol	12, 29, 30*, 31	D19*, D34	-	UMA 12: Cotton (Class 4). Remaining land uses (Class 5) UMAs 29, 30 and 29: Cotton (Class 3). Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 4	UMA 12: Class C2 UMAs 29, 30 and 29: Class B	0.00-0.50	180.85
9Dn(Ro)	Very deep, black on grey, brown clay soil with a self-mulching, sometimes cracking surface and strong structured subsoils and is associated with flat plains with Mitchell grasslands and sparse Prickly Acacia vegetation.	Black Vertosol	33*, 34, 36, 37, 38, 39, 40, 41, 42	D21*, D28	-	All land uses (Class 4)	Class 4	Class C1	-	589.65

SPC map code[1] / Report No.	SPC Concept	ASC (Dominant to sub-order)	UMAs (*Analysed)	Detailed sites (*Analysed)	SLR (2023) Analysed Site relevant to GTE Analysed site	Regional Frameworks / Limitations Suitability	Beef Cattle Grazing / Limitations Suitability	ALC	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total Area (ha)
10Ct(Ro)	Very deep, grey on clay soil with self-mulching, no coarse fragment surface and strong structured subsoils and is associated with flat and gently undulating plains associated with drainage and low-lying areas with sparse bauhinia and brigalow.	Grey Vertosol	43, 44*, 45, 46, 47, 48	D16, D17, D22*, D23, D25, D27, D30, D31, D35, D40, D47, D48, D51, D53, D54, D56, D57, D60	B10	All land uses (Class 4)	Class 4	Class C1	-	1773.82
11Bl(Ta)	Moderately deep, texture contrast loam on medium clay soil with a hard-setting, with coarse fragments on the surface and sodic subsoils on shallow substrate and is associated with flat plains with sparse Prickly Acacia and Vine tree.	Brown Sodosol	49, 50, 51, 52*, 53, 54, 55, 56	D24*	-	UMAs 50 and 51: Cotton (Class 4). Remaining land uses (Class 5) UMAs 49, 52, 53, 54, 55 and 56: Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	UMAs 50 and 51: Class 4 UMAs 49, 52, 53, 54, 55 and 56: Class 3	UMAs 50 and 51: Class C2 UMAs 49, 52, 53, 54, 55 and 56: Class C1	-	218.42
12Da(Te)	Very deep clay loam on structured clay soil with a firm surface and is associated with residual rises with sparse brigalow.	Grey Dermosol	57, 58	D4, D32*	B12	Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 3	Class C1	0.20-0.90	203.00
13Bl(Ta)	Very deep, clay soil with a firm surface, with coarse fragments, mottled subsoils and is associated with flat, gently undulating plains with sparse current bush.	Brown Dermosol	59, 60, 61*	D36*	-	Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 4	Class C2	0.20-1.40	111.47

SPC map code[1] / Report No.	SPC Concept	ASC (Dominant to sub-order)	UMAs (*Analysed)	Detailed sites (*Analysed)	SLR (2023) Analysed Site relevant to GTE Analysed site	Regional Frameworks / Limitations Suitability	Beef Cattle Grazing / Limitations Suitability	ALC	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total Area (ha)
14Bl(Ro)	Very deep, black on grey-brown clay soil with a cracking surface and strong structured subsoils and is associated with low lying areas and drainage depressions located near residual rises with sparse bauhinia vegetation.	Black Vertosol	35*	D37*	B05	All land uses (Class 4)	Class 4	Class C2	0.20-0.50	64.20
15Bl(Ro)	Moderately deep clay soil with a self-mulching surface deep bedrock and is associated with gently undulating plains with sparse bauhinia	Brown Vertosol	62, 63, 64, 65*, 66	D2, D8, D10, D11, D13, D39*, D61, D66	-	All land uses (Class 4)	Class 4	Class C2	0.20-0.60	1040.57
16Bl(Ta)	Very shallow; clay loam surfaced on clay subsoils with a hard-setting on shallow bedrock and is associated with hillslopes and Bauhinia.	Grey Sodosol	32, 67*, 68, 69	D43*	-	Cotton (Class 4). Remaining land uses (Class 5)	Class 4	Class C2	-	38.52
17Bl(Ro)	Deep clay uniform soil with a cracking surface and is associated with gently undulating plains and is associated with sparse bauhinia and brigalow	Grey Vertosol	70, 71, 72, 73*	D29, D38, D41, D44*, D46	B01	All land uses (Class 4)	Class 4	Class C1	-	348.24
18Bl(Ro)	Very deep, grey clay uniform soil with self-mulching surface and is associated with gently undulating plains with sparse bauhinia and brigalow.	Grey Vertosol	74*	D45*	-	Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 3). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 4)	Class 3	Class A1	0.20-1.00	76.36
19Bl(Ro)	Very deep, brown clay soils with a surface flake and strong structured subsoils and is associated with gently undulating plains and rises with sparse bauhinia and brigalow vegetation.	Brown Vertosol	75*, 76, 77, 78, 79, 80	D18, D49, D52*, D62, D63, D64	-	Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 4	Class C1	0.20-1.40	756.86

SPC map code[1] / Report No.	SPC Concept	ASC (Dominant to sub-order)	UMAs (*Analysed)	Detailed sites (*Analysed)	SLR (2023) Analysed Site relevant to GTE Analysed site	Regional Frameworks / Limitations Suitability	Beef Cattle Grazing / Limitations Suitability	ALC	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total Area (ha)
20Bl(Ro)	Moderately deep, uniform grey clay soils with surface flake and strong structured clay subsoils and is associated with gently undulating plains with open woodland including brigalow vegetation	Grey Vertosol	81*	D58*	-	Cotton (Class 3). Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	Class 4	Class B	0.20-0.80	27.81
21Bl(Ta)	Very deep, texture contrast brown sandy loams on grey and yellow brown mottled clay subsoils with hard-setting surface and is associated with gently undulating plains with sparse Brigalow vegetation on grasslands.	Grey Sodosol	82*	D59*	B21	All land uses (Class 5)	Class 5	Class C3	0.20-0.45	167.19
22Bl(Wy)	Deep, gradational textured, weakly structured soils with firm surfaces loamy subsoils and is associated with gently undulating plains with sparse brigalow and bauhinia vegetation.	Brown Kandosol	83*	D65*	-	Cotton (Class 4). Remaining land uses (Class 5)	Class 4	Class C1	0.45-1.00	13.54

1 - SPC name codes are based on the dominant land system in which they occupy. The letters in the brackets are based on the soil type within the landscape it resembles. The number is an internal number ordering system used by GTE.

Figure 3: Soil Profile Classes

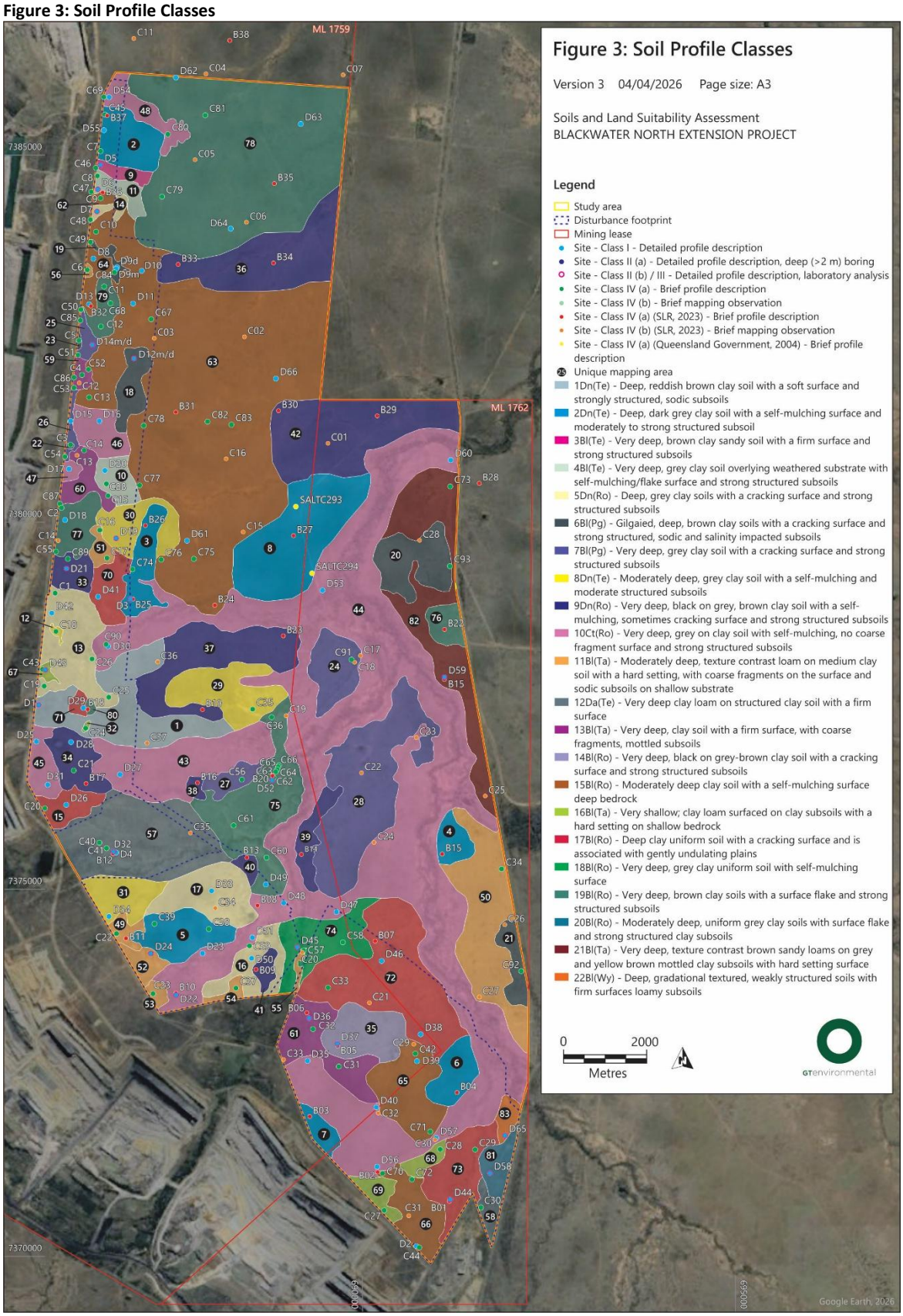


Figure 4: Australian Soil Classification

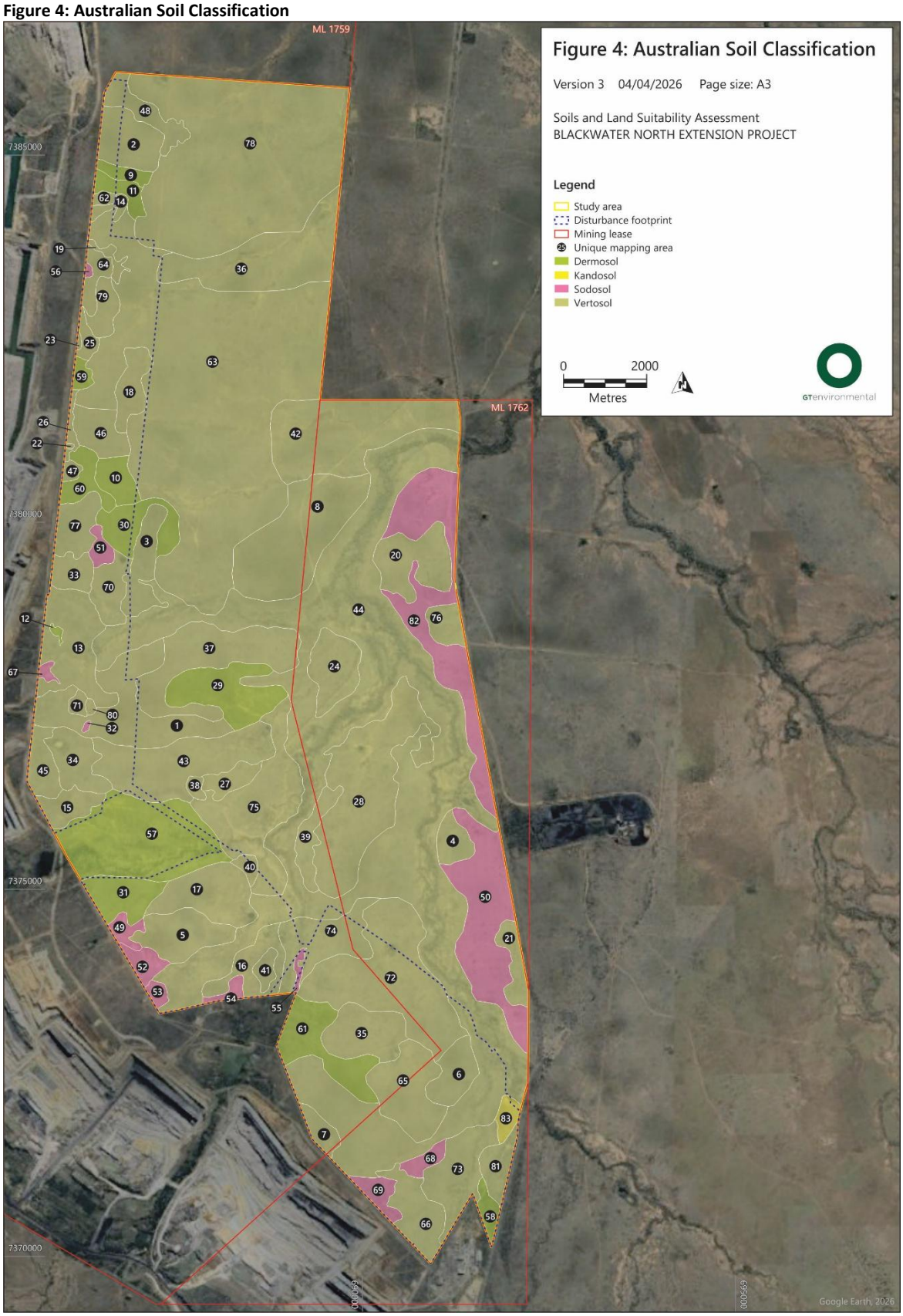


Table 5-2: SLR (2023) Detailed (Analysed) Sites Review for GTE SALS Assessment Summary

SLR Soil Mapping Unit	SLR Classification / Soil Types	Nominated SLR Detailed (Analysed) Site	Samples Analysed	Number of Samples	GTE Review	Nominated GTE Class III(a) Sites
2B	Eutrophic Red Dermosol	B01	Yes	4	No profile to review	D44
1	Self-Mulching Black Vertosol	B05	Yes	4	Gilgai observed as present	D37
1	Self-Mulching Red Vertosol	B10	Yes	4	Gilgai observed as present	D22
3	Eutrophic Red Chromosol	B12	Yes	4	No profile to review	D32
1	Subnatric Brown Sodosol	B21	Yes	4	No gilgai observed	D59
1	Self-Mulching Brown Vertosol	B25	Yes	4	Gilgai observed as present	D3
2A	Eutrophic Red Dermosol	B28	Yes	4	Soil Map Unit (SMU) appears to be similar if not the same as SMU 2B. GTE do not recommend this is separated based on SLR description.	-

5.1.2 Soil Profile Class 1Dn(Te): Brown Vertosol

Overview and Concept

1Dn(Te) is characterised by deep, reddish brown clay soil with a soft surface and strongly structured, sodic subsoils. The SPC is associated with flat to gently undulating plains with Bauhinia. The SPC is situated in the centre-west portion of the study area over an area of 139.54 ha.

Analysed site

The nominated analysed site, site D1, is summarised in Table 5-3. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-4. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-3: Land Summary 1Dn(Te) - Analysed Site D1

Item	Description
Analysed Site	D1
UMAs	1

Representative Landscape Photograph



Soil Profile Photograph



(Profile viewed top to bottom, 0.60 m)

Location GDA2020 ZONE 55	685633 7377526
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Bauhinia
Disturbance	Extensive clearing
Landform pattern / pattern	Simple slope, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / Moderate
Slope (%) / Erosion	2.0 / 3.0, No erosion observed

Table 5-3: Land Summary 1Dn(Te) - Analysed Site D1 (continued)

Surface condition / Surface coarse fragments or segregations		Self-mulching, no coarse fragments					
SPC ASC Order / Suborder		Brown Vertosol					
Associated Land System / Soil		Daunia / Teviot					
Total area (ha)		139.54					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Light medium clay	Moderate / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	2.5Y5 / 2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 8.0 No dispersion after 10 minutes No slaking
B21 0.20-0.40 Abrupt 5-20 mm	Light clay	Moderate / Firm Angular blocky 20-50 mm Slickensides	< 2% calcium carbonate 2-6 mm	2.5Y5 / 3 Light olive brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine < 1 mm Few	0.30 / 7.5 No dispersion after 10 minutes Partial slaking
BC 0.40-0.60 End of borehole (EOBH)	Medium clay	Massive / Loose Angular blocky 20-50 mm Slickensides	20-50% coarse fragments 20-60 mm 20-50% coarse fragments 6-20 mm	10YR5 / 3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.50 / 9.0 No dispersion after 10 minutes No slaking
	Refusal on cemented pan						

Table 5-4: Soil Chemistry and Assessment for 1Dn(Te), Analysed Site D1

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils increase from moderately alkaline to strong alkaline
EC	Topsoil is low in EC levels. Subsoil increases from high to very high
ECEC	High throughout the profile
ESP	Non-sodic levels in topsoil. Subsoil is non-sodic and increase below 0.40 mbgl
Ca:Mg	Very high throughout the profile
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Light medium clay in topsoil. Subsoils consist of medium clays with silty clay loam in BC horizon
EAT	Topsoil is non-dispersive with carbonate and gypsum present. Subsoil in B21 disperses after remoulding. BC horizon has indicated some dispersion.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.018
SALFPREDICT PAWC (PAWCER) Total (mm/60cm)	72.7
ERD	Soil Depth on BC horizon is 0.40 mbgl and 0.60 mbgl on refusal

Key Analysis	Assessment Summary
	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90 to 75% for all crop land uses. The limitation for ERD is soil depth of 0.40 m.
Summary of limitations and management	The soil has less than favourable PAWC, very low nutrient levels, fertility status and moderate soil structure. Topsoil pH is moderately alkaline with low EC non-sodic levels and favourable surface conditions with shallow subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

5.1.3 Soil Profile Class 2Dn(Te): Black Vertosol

Overview

2Dn(Te) is characterised by deep, dark grey clay soil with a self-mulching surface and moderately to strong structured subsoils. The SPC is associated with flat to gently undulating plains with cleared Bauhinia vegetation. The SPC is situated across the Project site in the centre and south portion of the study area over an area of 414.16 ha.

Analysed site

The nominated analysed site, site D3, is summarised in Table 5-5. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-6. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-5: Land Summary 2Dn(Te), Analysed Site D3

Item	Description
Analysed Site	D3
UMAs	2, 3, 4, 5, 6, 7, 8
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.00 m)
Location GDA2020 ZONE 55	686900 7378950
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Bauhinia
Disturbance	Limited clearing
Landform pattern / pattern	Simple slope, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / Moderate
Slope (%) / Erosion	1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Self-mulching (Flake), no coarse fragments

Table 5-5: Land Summary 2Dn(Te), Analysed Site D3 (continued)

SPC ASC Order / Suborder		Black Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Teviot					
Total area (ha)		414.16					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.10 Clear 20-50 mm	Light clay	Strong / Very firm Subangular blocky 5-10 mm No Slickensides	< 2% coarse fragments 6-20 mm	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2 mm Common	0.05 / 8.0 No dispersion after 10 minutes Partial slaking
B21 0.10-0.30 Clear 20-50 mm	Light clay	Moderate / Very firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.20 / 8.0 No dispersion after 10 minutes Partial slaking
B22 0.30-0.65 Clear 20-50 mm	Medium clay	Strong / Firm Angular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR2 / 2 No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	0.45 / 8.0 No dispersion after 10 minutes Complete slaking
B23 0.65-0.84 Clear 20-50 mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.75 / 8.5 No dispersion after 10 minutes Complete slaking
BC 0.84-1.00 EOBH	Light medium clay Silty	Massive / loose Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20 mm	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	No roots	0.92 / 9.0 No dispersion after 10 minutes Partial slaking
	Refusal on weathered substrate						

Table 5-6: Soil Chemistry for 2Dn(Te), Analysed Site D3

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils range from slightly acid to neutral to strongly alkaline
EC	Topsoil is low in EC levels. Subsoil remains low.
ECEC	High throughout the profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic
Ca:Mg	Very high throughout the profile
P	High in topsoil. Low in the B21 horizon of subsoil
PSA	Topsoil is clay loam. Subsoil consists of light clay increasing to medium heavy clay with clay loam in BC horizon
EAT	Topsoil disperses after remoulding. Subsoil in B21 is non-dispersive with carbonate and gypsum present
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	78.80
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% yield was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses. The limitation for ERD is soil depth of 1.00 m.
Summary of limitations and management	The soil has less than favourable PAWC, high nutrient levels, fertility status and moderate to strong soil structure. Topsoil pH is neutral alkaline with low EC, non-sodic levels and favourable surface conditions with deep subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.50 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

Associated SLR (2023) Site Assessment

The analysed site undertaken by SLR (2023) was site B25, described as a Self-Mulching Brown Vertosol within Soil Unit 1 (Self-Mulching Black Brown Vertosol) with incipient gilgai.

GTE conducted site D3 within 5.50 m of B25 (SLR, 2023) and the classification indicated it was a Black Vertosol with no gilgai observed at or within the area. Based on the D3 profile observation, GTE are confident that this site should be classified as a Black Vertosol, therefore site B25 (SLR, 2023) is considered an unmappable sub-dominant soil type within this SPC.

The laboratory analysis was utilised with D3 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

5.1.4 Soil Profile Class 3Bl(Te): Black Dermosol

Overview

3Bl(Te) is characterised by very deep, brown clay sandy soil with a firm surface and strong structured subsoils. The SPC is associated with flat to gently undulating rises with sparse woodlands of whitewood vegetation and grasslands. The SPC is situated in the north western portion of the study area over an area of 12.39 ha.

Analysed site

The nominated analysed site, site D5, is summarised in Table 5-7. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-8. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-7: Land Summary 3Bl(Te), Analysed Site D5

Item	Description
Analysed Site	D5
UMAs	9
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.00 m)
Location GDA2020 ZONE 55	686565 7384805
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Whitewood, grassland
Disturbance	Limited clearing
Landform pattern / pattern	Hillslope, flat, gently undulating rises
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderately well / Slow
Slope (%) / Erosion	2.0 / 2.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Firm, no coarse fragments

Table 5-7: Land Summary 3Bl(Te), Analysed Site D5 (continued)

SPC ASC Order / Suborder		Black Dermosol					
Associated Land System / Soil		Blackwater / Teviot					
Total area (ha)		12.39					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking
B21 0.20-0.40 Clear 20-50 mm	Medium clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	0.30 / 8.0 Slight Dispersion after 10 minutes Partial slaking
B22 0.40-0.80 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	0.60 / 8.0 Slight Dispersion after 10 minutes Partial slaking
B23 0.80-1.30 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3 / 3 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	1.05 / 6.0 Slight Dispersion after 10 minutes Partial slaking
B24 1.30-1.60 Clear 20-50 mm	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	5YR5 / 6 Yellowish red Mottles: 10YR4 / 2 Dark greyish brown Few 2%-10% Few < 5 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.45 / 5.5 No dispersion after 10 minutes Partial slaking
C 1.60-2.00 End of test pit (EOTP)	-	-	-	-	-	-	1.80 / 5.5 No dispersion after 10 minutes Partial slaking
	Refusal on bedrock						

Table 5-8: Soil Chemistry for 3Bl(Te), Analysed Site D5

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils range from moderately alkaline to strongly alkaline
EC	Topsoil is low in EC levels. Subsoil increases from moderate to very high
ECEC	High throughout the profile
ESP	Non-sodic levels in topsoil. Subsoils range from non-sodic to strongly sodic
Ca:Mg	Topsoil is very high. Subsoil decreases to high and moderate at depth
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium clay Subsoil consists of medium heavy clay to medium clay
EAT	Topsoil has some dispersion Subsoil has some dispersion throughout the profile
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	125.10
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% yield was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses. There are no limitations for ERD
Summary of limitations and management	The soil has favourable PAWC, very low nutrient levels, fertility status and strong soil structure. Topsoil pH is neutral alkaline with low EC, non-sodic levels and favourable surface conditions with deep subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.80 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 15.1 tonnes per hectare (t/ha)for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.40 mbgl

5.1.5 Soil Profile Class 4Bl(Te): Grey Dermosol

Overview

4Bl(Te) is characterised by very deep, grey clay soil overlying weathered substrate with self-mulching / flake surface and strong structured subsoils. The SPC is associated with gently undulating plains with grasslands. The SPC is situated in the east-west portion of the study area over an area of 46.17 ha.

Analysed site

The nominated analysed site, site D6, is summarised in Table 5-9. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-10. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-9: Land Summary 4Bl(Te), Analysed Site D6

Item	Description
Analysed Site	D6
UMAs	10, 11, 12
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.60 m)
Location GDA2020 ZONE 55	686529 7384441
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Grassland
Disturbance	Complete clearing, not cultivated
Landform pattern / pattern	Simple slope, gently undulating rises
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	2.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Surface flake, no coarse fragments

Table 5-9: Land Summary 4Bl(Te), Analysed Site D6 (continued)

SPC ASC Order / Suborder		Grey Dermosol					
Associated Land System / Soil		Daunia / Teviot					
Total area (ha)		46.17					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Light medium clay Silty	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking
B21 0.20-0.60 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2 mm Common	0.40 / 7.5 Slight Dispersion after 10 minutes No slaking
B22 0.60-0.90 Clear 20-50 mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 4 Dark yellowish brown Mottles: Pale orange-brown, Few 2%-10%	Dry Imperfect drained	Fine 1-2 mm Few	0.75 / 7.5 Slight Dispersion after 10 minutes Partial slaking
B3 0.90-1.20 Clear 20-50 mm	Clay Loam	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 4 Dark yellowish brown Mottles: Pale orange-brown, Few 10%-20%	Very poorly drained	No roots	-
C 1.20-1.60 EOTP	-	-	-	-	Very poorly drained	No roots	-
	Refusal on weathered substrate						

Table 5-10: Soil Chemistry for 4Bl(Te), Analysed Site D6

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils range from moderate alkaline to strongly alkaline
EC	Topsoil is very low. Subsoil increases from moderate to very high
ECEC	Topsoil is moderate. Subsoil ranges from high to moderate with depth
ESP	Non-sodic levels in topsoil. Subsoils range from non-sodic to strongly sodic
Ca:Mg	High throughout soil profile
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is light clay Subsoil consists of medium heavy clay to clay loam in the BC horizon
EAT	Topsoil disperses after remoulding Subsoil disperses after remoulding with some dispersion below 0.80 m
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.025

Key Analysis	Assessment Summary
SALFPREDICT PAWC (PAWCER) Total (mm/50cm)	65.80
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses. The SPC is assessed as a Dermosol. As such, it has been assessed against the pH limitations. It was assessed from 0.50 mbgl, pH was > 9.0, therefore the PAWC based on the SALFPREDICT modelling has been assessed at this depth. There are limitations for ERD, relating to subsoil pH.
Summary of limitations and management	The soil has favourable PAWC, low nutrient levels, fertility status and strong soil structure. Topsoil pH is neutral alkaline with very low EC, non-sodic levels and favourable surface conditions with deep subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.60 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.60 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 12.6 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.00 mbgl

5.1.6 Soil Profile Class 5Dn(Ro): Grey Vertosol

Overview

5Dn(Ro) is characterised by deep, grey clay soils with a cracking surface and strong structured subsoils. The SPC is associated with gently undulating rises with drainage and depressions with sparse acacia vegetation and grasslands. The SPC is situated in the centre and south-west portions of the study area over an area of 239.29 ha.

Analysed site

The nominated analysed site, site D7 is summarised in Table 5-11. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-12. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-11: Land Summary 5Dn(Ro), Analysed Site D7

Item	Description
Analysed Site	D7
UMAs	13, 14, 15, 16, 17
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.20 m)
Location GDA2020 ZONE 55	686513 7384178
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Grassland
Disturbance	Complete clearing, not cultivated
Landform pattern / pattern	Simple slope, gently undulating rises
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed

Table 5-11: Land Summary 5Dn(Ro), Analysed Site D7 (continued)

Surface condition / Surface coarse fragments or segregations	Cracking, no coarse fragments						
SPC ASC Order / Suborder	Grey Vertosol						
Associated Land System / Soil	Blackwater, Daunia / Rolleston						
Total area (ha)	239.28						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-015 Clear 20-50 mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 20-60 mm	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking
B21 0.15-0.45 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 20-60mm	10YR4 / 2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2 mm Common	0.30 / 7.5 No dispersion after 10 minutes Partial slaking
B22 0.45-0.60 Clear 20-50 mm	Medium clay	Strong / Firm Subangular blocky 50-100 mm Slickensides	< 2% coarse fragments and nodules 2-6 mm	10YR4 / 2 Dark greyish brown Mottles: 10YR4 / 3 Brown Very few < 2% Medium 5-15 mm	Moderately moist Imperfectly drained	Fine 1-2 mm Common	0.60 / 7.5 Moderate dispersion after 10 minutes Complete slaking
C 0.60-1.20 EOTP	-	-	-	-	-	-	-
	Refusal on weathered substrate						

Table 5-12: Soil Chemistry for 5Dn(Ro), Analysed Site D7

Key Analysis	Assessment Summary
Soil pH (H_20)	Moderately alkaline throughout soil profile
EC	Topsoil is low. Subsoil increases from low to high
ECEC	High throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils range from non-sodic to strongly sodic
Ca:Mg	High throughout soil profile
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium clay Subsoil is medium heavy clay
EAT	Topsoil is non-dispersive with carbonate and gypsum present Subsoil has some dispersion
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015

Key Analysis	Assessment Summary
SALFPREDICT PAWC (PAWCER) Total (mm/60cm)	86.0
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses except Maize at 75%. The limitation for ERD is soil depth of 0.60 m.
Summary of limitations and management	The soil has unfavourable PAWC, very low nutrient levels, fertility status, strong soil structure and moderately deep soils. Topsoil pH is moderately alkaline with low EC, non-sodic levels and favourable surface conditions with deep subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.45 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.45 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 9.1 t/ha for each 0.10 m to achieve ESP of 5.5 based on the highest sodic levels at 0.50 mbgl.

5.1.7 Soil Profile Class 6Bl(Pg): Brown Vertosol (Gilgai)

Overview

6Bl(Pg) is characterised by gilgaied, deep, brown clay soils with a cracking surface and strong structured, sodic and salinity impacted subsoils. The SPC is associated with gently undulating plains with open Brigalow scrub vegetation. The SPC is situated in small areas across the study area over an area of 141.38 ha.

Analysed site

The nominated analysed site, site D12 mound (m), is summarised in Table 5-13 with D12 depression (d) in Appendix A. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-14. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-13: Land Summary 6Bl(Pg), Analysed Site D12m

Item	Description
Analysed Site	D12m (Mound position)
UMAs	18, 19, 20, 21, 22, 23
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.20 m)
Location GDA2020 ZONE 55	687003 7382185
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Open Brigalow Scrub
Disturbance	Extensive clearing
Landform pattern / pattern	Plain, gently undulating rises
Microrelief / Rock outcrop	Normal microrelief, no rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed

Table 5-13: Land Summary 6Bl(Pg), Analysed Site D12m (continued)

Surface condition / Surface coarse fragments or segregations	Cracking, no coarse fragments						
SPC ASC Order / Suborder	Grey Vertosol						
Associated Land System / Soil	Blackwater, Daunia / Pegunny						
Total area (ha)	141.38						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 8.0 No dispersion after 10 minutes Partial slaking
B21 0.20-0.60 Gradual 50-100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5 / 3 Brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2 mm Common	0.40 / 5.5 No dispersion after 10 minutes Partial slaking
B22 0.60-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	No inclusions or segregations	10YR5 / 4 Yellowish brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2 mm Few	1.20 / 6.5 No dispersion after 10 minutes Complete slaking

Table 5-14: Soil Chemistry for 6Bl(Pg), Analysed Site D12m

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly acidic. Subsoils are moderately acid to slightly alkaline below 1.20 m
EC	Topsoil is moderate. Subsoil increases from very high to extreme
ECEC	Topsoil is high. Subsoil is moderate to high throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are sodic
Ca:Mg	Topsoil is high. Subsoils are moderate to high
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium heavy clay Subsoil is medium heavy clay throughout
EAT	Topsoil is non-dispersive with carbonate and gypsum present Subsoil has some dispersion
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	131 (115.2 Depression location)

Key Analysis	Assessment Summary
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for barley and cotton crop land uses. Maize, oat, sorghum, soybean, sunflower and wheat present 50% yield. There are no limitations for ERD.
Summary of limitations and management	Topsoil recovery may be difficult with the undulating nature of gilgai areas. Care is recommended when stripping the topsoil as to avoid mixing with sodic subsoils. Otherwise, gypsum application may be required, refer to Subsoil recommendation below. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.20 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 14.7 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels of the depression location at 0.80 mbgl.

5.1.8 Soil Profile Class 7Bl(Pg): Grey Vertosol (Gilgai)

Overview

7Bl(Pg) is characterised by very deep, grey clay soil with a cracking surface and strong structured subsoils. The SPC is associated with gently undulating plains with sparse Brigalow scrub. The SPC is situated mainly in the eastern and centre portions of the study area over an area of 304.18 ha.

Analysed site

The nominated analysed site, site D14m, is summarised in Table 5-15. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-16. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-15: Land Summary 7Bl(Pg), Analysed Site D14m

Item	Description
Analysed Site	D14m (Mound position)
UMAs	24, 25, 26, 27, 28
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 2.20 m)
Location GDA2020 ZONE 55	686471 7382392
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Open Brigalow scrub
Disturbance	Limited clearing
Landform pattern / pattern	Plain, gently undulating plains
Microrelief / Rock outcrop	Normal microrelief, no rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Cracking, no coarse fragments

Table 5-15: Land Summary 7Bl(Pg), Analysed Site D14m (continued)

SPC ASC Order / Suborder		Grey Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Pegunny					
Total area (ha)		304.18					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Gradual 50-100 mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking
B21 0.20-0.40 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	< 2% coarse fragments 20-60 mm	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.30 / 7.0 No dispersion after 10 minutes Partial slaking
B22 0.40-0.60 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	< 2% coarse fragments 20-60 mm	10YR5 / 2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	0.50 / 6.5 Moderate dispersion after 10 minutes Complete slaking
B23 0.60-1.90 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 100-200 mm Slickensides	< 2% coarse fragments 20-60 mm	10YR5 / 2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	1.00 / 7.0 1.50 / 7.0 No dispersion after 10 minutes Complete slaking
B24 1.90-2.20 EOTP	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	10-20% coarse fragments 20-60mm 2-10% coarse fragments 6-20mm	10YR5 / 2 Greyish brown Mottles: Brown Few 2%-10% Few < 5 mm	Moderately moist Imperfectly drained	Very fine < 1 mm Few	2.00 / 7.0 No dispersion after 10 minutes Complete slaking

Table 5-16: Soil Chemistry for 7Bl(Pg), Analysed Site D14m

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly acidic. Subsoils are moderately alkaline to slightly alkaline below 1.20 m
EC	Topsoil is low. Subsoil varies from moderate to extreme throughout soil profile
ECEC	Topsoil is moderate. Subsoil is moderate to high throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic increasing to sodic below 0.50 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to moderate with depth
P	Moderate in topsoil. Very low in the B21 horizon of subsoil

Key Analysis	Assessment Summary
PSA	Topsoil is medium heavy clay Subsoil is medium heavy clay throughout
EAT	Topsoil is non-dispersive with carbonate and gypsum present Subsoil has some dispersion
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	110.9 (106.8 Depression location)
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses except Maize at 75%. There are no limitations for ERD.
Summary of limitations and management	Topsoil recovery may be difficult with the undulating nature of gilgai areas. Care is recommended when stripping the topsoil as to avoid mixing with sodic subsoils. Otherwise, gypsum application may be required, refer to Subsoil recommendation below. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.40 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 17.9 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels of the mound location at 0.80 mbgl.

5.1.9 Soil Profile Class 8Dn(Te): Grey Dermosol

Overview

8Dn(Te) is characterised by moderately deep, grey clay soil with a self-mulching and moderate structured subsoils. The SPC is associated with gently undulating rises with lower lying and drainage areas. The SPC is situated in the centre and centre-south portions of the study area over an area of 180.85 ha.

Analysed site

The nominated analysed site, site D19, is summarised in Table 5-17. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-18. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-17: Land Summary 8Dn(Te), Analysed Site D19

Item	Description
Analysed Site	D19
UMAs	29, 30, 31, 32
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.10 m)
Location GDA2020 ZONE 55	686719 7379753
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse shrubbery including ruby salt bush and emu apple
Disturbance	Extensive clearing
Landform pattern / pattern	Drainage depression, gently undulating plains
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Moderate
Slope (%) / Erosion	3.0 / 3.0, No erosion observed

Table 5-17: Land Summary 8Dn(Te), Analysed Site D19 (continued)

Surface condition / Surface coarse fragments or segregations	Surface flake, < 2% coarse fragments 6-20mm						
SPC ASC Order / Suborder	Grey Dermosol						
Associated Land System / Soil	Daunia / Teviot						
Total area (ha)	180.85						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.05 Clear 20-50 mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 2-6 mm	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.03 / 7.0 No dispersion after 10 minutes Partial slaking
B21 0.05-0.30 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 6-20 mm	10YR5 / 2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.18 / 7.5 No dispersion after 10 minutes Partial slaking
B22 0.30-0.50 Gradual 50-100 mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20 mm	10YR5 / 2 Greyish brown Mottles: Brown Common 10%-20% Few < 5 mm	Dry Imperfectly drained	Very fine < 1 mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking
B3 0.50-0.60	Clay Loam Coarse	Massive / Weak No Slickensides	20-50% coarse fragments 6-20 mm	10YR5 / 4 Yellowish brown Mottles: Brown Many 20%-50% Few < 5 mm	Dry Imperfectly drained	No roots	0.55 / 7.0 Slight Dispersion after 10 minutes Partial slaking
BC 0.60-0.90	Clay Loam Coarse	Massive / Weak No Slickensides	50-90% coarse fragments 6-20 mm	10YR5 / 4 Yellowish brown Mottles: Brown Many 20%-50% Few < 5 mm	Dry Imperfectly drained	No roots	0.55 / 7.0 Slight Dispersion after 10 minutes Partial slaking
C 0.90-1.10 EOTP	-	-	-	-	-	-	-
	Refusal on cemented pan						

Table 5-18: Soil Chemistry for 8Dn(Te), Analysed Site D19

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils are moderately alkaline with neutral to slightly alkaline below 0.50 m
EC	Topsoil is very low. Subsoil varies from low to high throughout soil profile
ECEC	Topsoil is high. Subsoil is high to moderate throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic increasing to strongly sodic below 0.50 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high at 0.50 m
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium clay Subsoil is light medium clay to clay loam and light clay to depth
EAT	Topsoil disperses after remoulding Subsoil indicates disperses after remoulding and some dispersion below 0.40 m
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	95.90
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for barley, cotton, sorghum and wheat crop land uses. Maize, oat, soybean and sunflower present 75 and 50% yield. The limitation for ERD is soil depth of 0.60 m.
Summary of limitations and management	The soil has favourable PAWC, low nutrient levels, fertility status and moderately deep soils. Topsoil pH is moderately alkaline with very low EC, non-sodic levels and favourable surface conditions with moderately deep, sodic subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Topsoil horizon is shallow, however, refer to subsoil for additional recommendations. Subsoil to 0.50 mbgl may be stripped to this depth and utilised as topsoil. Subsoil below 0.50 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 11.2 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.50 mbgl.

5.1.10 Soil Profile Class 9Dn(Ro): Black Vertosol

Overview

9Dn(Ro) is characterised by very deep, black on grey, brown clay soil with a self-mulching, sometimes cracking surface and strong structured subsoils. The SPC is associated with flat plains with Mitchell grasslands and sparse Prickly Acacia vegetation. The SPC is situated across the majority of the study area, over an area of 589.65 ha.

Analysed site

The nominated analysed site, site D21, is summarised in Table 5-19. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-20. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-19: Land Summary 9Dn(Ro), Analysed Site D21

Item	Description
Analysed Site	D21
UMAs	33, 34, 36, 37, 38, 39, 40, 41, 42
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 2.10 m)
Location GDA2020 ZONE 55	686057 7379329
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Flat plain, gently undulating plains
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / < 1.0, No erosion observed

Table 5-19: Land Summary 9Dn(Ro), Analysed Site D21 (continued)

Surface condition / Surface coarse fragments or segregations	Cracking, < 2% coarse fragments 6-20 mm						
SPC ASC Order / Suborder	Black Vertosol						
Associated Land System / Soil	Blackwater, Daunia / Rolleston						
Total area (ha)	589.65						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.10 Clear 20-50 mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 6-20 mm	10YR3 / 1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.05 / 8.0 No dispersion after 10 minutes Complete slaking
B21 0.10-0.60 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR3 / 1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.35 / 7.5 No dispersion after 10 minutes Partial slaking
B22 0.60-1.00 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.80 / 7.5 No dispersion after 10 minutes Complete slaking
B23 1.00-1.90 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5 / 2 Greyish brown Mottles: Brown Common 10%-20% Few < 5 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.40 / 7.0 No dispersion after 10 minutes Complete slaking
C 1.90-2.10 EOTP	-	-	-	-	-	-	-

Table 5-20: Soil Chemistry for 9Dn(Ro), Analysed Site D21

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils are moderately alkaline with neutral to slightly alkaline below 1.40 m
EC	Topsoil is very low. Subsoil varies from high to moderate throughout soil profile
ECEC	Topsoil is high. Subsoil is high to moderate throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are sodic increasing to strongly sodic below 1.40 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high at 1.40 m
P	Low in topsoil. Very low in the B21 horizon of subsoil

Key Analysis	Assessment Summary
PSA	Topsoil is light medium clay Subsoil is medium heavy clay to medium clay to depth
EAT	Topsoil indicates no dispersion. Carbonates and gypsum may be present Subsoil indicates disperses after remoulding and some dispersion below 0.50 m
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	124.80
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for barley and cotton crop land uses. Maize, oat, sorghum, soybean, sunflower and wheat present 75 and 50% yield. There are no limitations for ERD.
Summary of limitations and management	The soil has favourable PAWC, low nutrient levels, fertility status and very deep soils. Topsoil pH is moderately alkaline with very low EC, non-sodic levels and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.10 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 16.3 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.80 mbgl.

5.1.11 Soil Profile Class 10Ct(Ro): Grey Vertosol

Overview

10Ct(Ro) is characterised by very deep, grey clay soil with self-mulching, no coarse fragment surface and strong structured subsoils. The SPC is associated with flat and gently undulating plains associated with drainage and low-lying areas with sparse bauhinia and brigalow. The SPC is situated across the majority of the study area, over an area of 1,773.82 ha.

Analysed site

The nominated analysed site, site D22, is summarised in Table 5-21. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-22. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-21: Land Summary 10Ct(Ro), Analysed Site D22

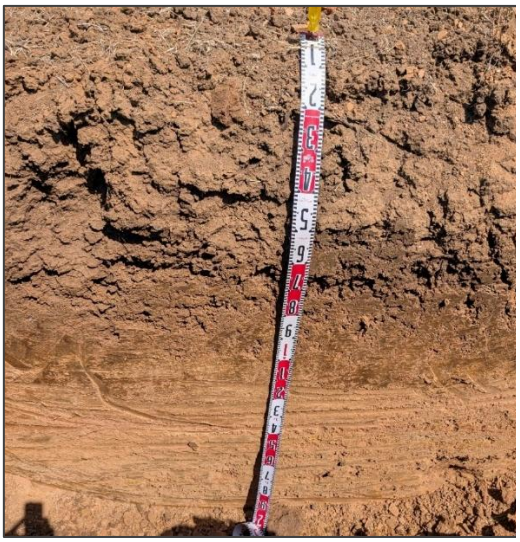
Item	Description
Analysed Site	D22
UMAs	43, 44, 45, 46, 47, 48
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 2.10 m)
Location GDA2020 ZONE 55	687457 7373577
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Flat plain, gently undulating plains
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed

Table 5-21: Land Summary 10Ct(Ro), Analysed Site D22 (continued)

Surface condition / Surface coarse fragments or segregations	Surface flake, No coarse fragments						
SPC ASC Order / Suborder	Grey Vertosol						
Associated Land System / Soil	Blackwater, Daunia / Rolleston						
Total area (ha)	1,773.82						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.10 Clear 20-50 mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.05 / 7.0 No dispersion after 10 minutes Partial slaking
B21 0.10-0.50 Gradual 50-100 mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.30 / 7.5 No dispersion after 10 minutes Partial slaking
B22 0.50-0.80 Diffuse > 100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 4 Dark yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2 mm Few	0.65 / 7.5 No dispersion after 10 minutes Complete slaking
B23 0.80-1.10 Diffuse > 100 mm	Medium clay Sandy	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR5 / 4 Reddish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	0.95 / 5.5 Slight Dispersion after 10 minutes Complete slaking
B24 1.10-1.80 Gradual 50-100 mm	Medium clay	Strong / Firm Angular blocky 20-50 mm No Slickensides	< 2% coarse fragments 6-20 mm	7.5YR4 / 4 Brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.45 / 5.5 No dispersion after 10 minutes Complete slaking
C 1.80-2.00 EOTP	-	-	-	-	-	-	-

Table 5-22: Soil Chemistry for 10Ct(Ro), Analysed Site D22

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils vary between moderately alkaline and neutral to slightly alkaline
EC	Topsoil is low. Subsoil varies from moderate to very high with depth
ECEC	Topsoil is high. Subsoil is high to moderate throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are sodic increasing to extremely strongly sodic below 0.50 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high at 0.50 m
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium clay Subsoil is medium heavy clay to light clay to depth
EAT	Topsoil indicates disperses after remoulding Subsoil indicates disperses after remoulding and some dispersion below 1.00 m
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	116.70
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for barley, cotton, oat, sorghum, sunflower and wheat crop land uses. Maize and soybean present 75 and 50% yield. There are no limitations for ERD.
Summary of limitations and management	The soil has favourable PAWC, low nutrient levels, fertility status and very deep soils. Topsoil pH is moderately alkaline with low EC, non-sodic levels and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.10 mbgl may benefit from gypsum application due to extremely sodic levels. SodiCalc (2026) recommends approximately 15 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.

Associated SLR (2023) Site Assessment

The analysed site undertaken by SLR (2023) was site B10, a Self-Mulching Red Vertosol within Soil Unit 1 (Self-Mulching Black Brown Vertosol) with incipient gilgai.

GTE conducted site D22 within 1.7 m of B10 and the classification indicated it was a Grey Vertosol with no gilgai observed at or within the area. Based on the observation sites undertaken by GTE, no Red Vertosol was encountered, therefore, this is considered an anomaly, more so than a sub-dominant soil type.

The laboratory analysis was utilised with D22 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

5.1.12 Soil Profile Class 11Bl(Ta): Brown Sodosol

Overview

11Bl(Ta) is characterised by moderately deep, texture contrast loam on medium clay soil with a hard-setting, with coarse fragments on the surface and sodic subsoils on shallow substrate. The SPC is associated with flat plains with sparse Prickly Acacia and Vine tree. The SPC is situated in the centre and centre-east portions of the study area, over an area of 218.42 ha.

Analysed site

The nominated analysed site, site D24, is summarised in Table 5-23. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-24. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-23: Land Summary 11Bl(Ta), Analysed Site D24

Item	Description
Analysed Site	D24
UMAs	49, 50, 51, 52, 53, 55,
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.20 m)
Location GDA2020 ZONE 55	687133 7374146
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Simple slope, gently undulating plains
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / Slow
Slope (%) / Erosion	2.0 / < 1.0, No erosion observed

Table 5-23: Land Summary 11Bl(Ta), Analysed Site D24 (continued)

Surface condition / Surface coarse fragments or segregations	Hard-setting, < 2% coarse fragments 6-20 mm						
SPC ASC Order / Suborder	Brown Sodosol						
Associated Land System / Soil	Blackwater, Daunia / Taurus						
Total area (ha)	218.42						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Gradual 50-100 mm	Loam	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 6.0 No dispersion after 10 minutes Complete slaking
B21 0.20-0.60 Gradual 50-100 mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	0.40 / 7.5 No dispersion after 10 minutes Partial slaking
B22 0.60-1.00 Clear 20-50 mm	Medium clay	Strong / Firm Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Few	0.80 / 7.5 No dispersion after 10 minutes Complete slaking
C 1.00-1.20 EOTP	-	-	-	-	-	-	-

Table 5-24: Soil Chemistry for 11Bl(Ta), Analysed Site D24

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils vary between neutral to slightly alkaline to strongly alkaline
EC	Topsoil is very low. Subsoil is high
ECEC	Topsoil is low. Subsoil is moderate throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are strongly sodic
Ca:Mg	Topsoil is high. Subsoils are moderate throughout soil profile
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is loam Subsoil is medium clay to light clay to depth
EAT	Topsoil indicates disperses after remoulding Subsoil indicates some dispersion
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.040

Key Analysis	Assessment Summary
SALFPREDICT PAWC (PAWCER) Total (mm/80cm)	78.40
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for barley, cotton, sorghum, sunflower and wheat crop land uses. Maize and oat present 75 and 50% yield. The SPC is assessed as a Sodosol. As such, it has been assessed against the pH limitations. It was assessed from 0.80 mbgl, pH was > 9.0, therefore the PAWC based on the SALFPREDICT modelling has been assessed at this depth. There are limitations for ERD, relating to subsoil pH.
Summary of limitations and management	The soil has less than favourable PAWC, low nutrient levels, fertility status, moderately deep sodic soils and hard-setting surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.20 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 11.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.

5.1.13 Soil Profile Class 12Da(Te): Grey Dermosol

Overview

12Da(Te) is characterised by very deep clay loam on structured clay soil with a firm surface. The SPC is associated with residual rises with sparse brigalow. The SPC is situated in two UMAs located centre west and to the south east of the study area, over an area of 203.00 ha.

Analysed site

The nominated analysed site, site D32, is summarised in Table 5-25. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-26. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-25: Land Summary 12Da(Te), Analysed Site D32

Item	Description
Analysed Site	D32
UMAs	57, 58
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.80 m)
Location GDA2020 ZONE 55	686675 7375468
Current Use	Beef Cattle Grazing
Geology (Dominant)	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Residual rise, gently undulating rises
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 2.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Firm, < 2% coarse fragments 6-20 mm

Table 5-25: Land Summary 12Da(Te), Analysed Site D32 (continued)

SPC ASC Order / Suborder	Grey Dermosol						
Ass. Land System / Soil	Blackwater, Daunia / Teviot						
Total area (ha)	203.00						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abund-ance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Clay loam Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking
B21 0.20-0.50 Gradual 50-100 mm	Medium clay Sandy	Moderate / Very strong Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	7.5YR4 / 2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.35 / 6.5 No dispersion after 10 minutes Partial slaking
B22 0.50-0.80 Clear 20-50 mm	Medium clay Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.65 / 8.0 Moderate dispersion after 10 minutes Partial slaking
B23 0.80-1.20 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm No Slickensides	2-10% calcium carbonate 2-6mm	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	1.00 / 8.0 Slight Dispersion after 10 minutes Partial slaking
B24 1.20-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR3 / 1 Very dark grey Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.50 / 7.0 No dispersion after 10 minutes Complete slaking

Table 5-26: Soil Chemistry for 12Da(Te), Analysed Site D32

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils vary between neutral to slightly alkaline to moderately alkaline
EC	Topsoil is very low. Subsoil increases from very low to very high below 1.10 m
ECEC	Topsoil is low. Subsoil is moderate throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are strongly sodic
Ca:Mg	Topsoil is very high. Subsoils are high decreasing to moderate at depth
P	Low in topsoil. Low in the B21 horizon of subsoil
PSA	Topsoil is loam Subsoil varies between clay loam and light medium clay at depth
EAT	Topsoil indicates disperses after remoulding Subsoil indicates dispersion after remoulding some dispersion to 1.10 m, with no dispersion to 1.40 m with some dispersion to 1.80 m

Key Analysis	Assessment Summary
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.040
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	77.50
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has less than favourable PAWC, low nutrient levels, fertility and firm surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.90 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

Associated SLR (2023) Site Assessment

The analysed site undertaken by SLR (2023) was site B12, a Eutrophic Red Chromosol within Soil Unit 3 (Eutrophic Black Brown Dermosols). No soil profile was provided within the SLR (2023) report, therefore, no review of the fieldwork data or photos could be assessed.

GTE conducted site D32 within 1.7 m of B12 and the classification indicated it was a Grey Dermosol. Based on the observation sites undertaken by GTE, no Red Chromosol was encountered, therefore, this is considered an anomaly, more so than a sub-dominant soil type.

The laboratory analysis was utilised with D32 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

5.1.14 Soil Profile Class 13Bl(Ta): Brown Dermosol

Overview

13Bl(Ta) is characterised by very deep, clay soil with a firm surface, with coarse fragments, mottled subsoils. The SPC is associated with flat, gently undulating plains with sparse current bush. The SPC is located within three UMAs situated in the north west and south of the study area, over an area of 111.47 ha.

Analysed site

The nominated analysed site, site D36, is summarised in Table 5-27. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-28. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-27: Land Summary 13Bl(Ta), Analysed Site D36

Item	Description
Analysed Site	D36
UMAs	59, 60, 61

Representative Landscape Photograph



Soil Profile Photograph



(Profile viewed top to bottom, 1.20 m)

Location GDA2020 ZONE 55	689214 73732
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Flat plain, gently undulating plains
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	2.0 / 2.0, No erosion observed

Table 5-27: Land Summary 13Bl(Ta), Analysed Site D36 (continued)

Surface condition / Surface coarse fragments or segregations	Firm, 2-10% coarse fragments 20-60 mm
SPC ASC Order / Suborder	Brown Dermosol
Associated Land System / Soil	Blackwater, Daunia / Taurus
Total area (ha)	111.47
Phases and / or variants	None

Soil Profile Morphology Summary

Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 20-60 mm	7.5YR4 / 2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking
B21 0.20-0.40 Gradual 50-100 mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4 / 2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.30 / 6.5 No dispersion after 10 minutes Partial slaking
B22 0.40-0.70 Gradual 50-100 mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6 mm 2-10% calcium carbonate 6-20 mm	7.5YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.55 / 7.0 No dispersion after 10 minutes Partial slaking
B23 0.70-0.90 Gradual 50-100 mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6 mm 2-10% calcium carbonate 6-20 mm	7.5YR5 / 4 Reddish brown Mottles: Pale brown Very few < 2% Medium 5-15 mm	Dry Moderately well drained	Very fine < 1 mm Few	0.80 / 8.0 No dispersion after 10 minutes Partial slaking
B24 0.90-1.70 Gradual 50-100 mm	Medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6 mm 2-10% coarse fragments 6-20 mm	10YR5 / 6 Yellowish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.30 / 7.5 No dispersion after 10 minutes Complete slaking
BC 1.70-2.00 EOTP	Sandy loam	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20 mm 20-50% coarse fragments 2-6 mm	10YR5 / 6 Yellowish brown No mottles or bleaching	Dry Moderately well drained	No roots	1.85 / 7.5 No dispersion after 10 minutes Complete slaking

Table 5-28: Soil Chemistry for 13Bl(Ta), Analysed Site D36

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils vary between moderately alkaline to strongly alkaline
EC	Topsoil is very low. Subsoil is low increasing to high throughout the soil profile
ECEC	Topsoil is moderate. Subsoil is high decreasing to low throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic increasing to sodic below 1.40 m
Ca:Mg	Topsoil is very high. Subsoils are high reducing to moderate
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is light medium clay Subsoil is medium clay to clay loam and light clay at depth
EAT	Topsoil reports dispersion after remoulding Subsoil reports no dispersion with carbonates and gypsum present to 1.40 m. Some dispersion below 1.40 m is reported
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.018
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	97.8
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all land uses. The SPC is assessed as a Dermosol. As such, it has been assessed against the pH limitations. It was assessed from 0.50 mbgl, pH was < 9.0, therefore the PAWC based on the SALFPREDICT modelling has been assessed at this depth. There are limitations for ERD, relating to subsoil pH.
Summary of limitations and management	The soil has less than favourable PAWC, very low nutrient levels, fertility status and firm setting surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 1.40 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 6.8 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.40 mbgl.

5.1.15 Soil Profile Class 14Bl(Ro): Black Vertosol

Overview

14Bl(Ro) is characterised by very deep, black on grey-brown clay soil with a cracking surface and strong structured subsoils. The SPC is associated with low lying areas and drainage depressions located near residual rises with sparse bauhinia vegetation. The SPC is situated in one UMA located to the centre south over an area of 64.20 ha.

Analysed site

The nominated analysed site, site D37, is summarised in Table 5-29. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-30. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-29: Land Summary 14Bl(Ro), Analysed Site D37

Item	Description
Analysed Site	D37
UMAs	35
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.90 m)
Location GDA2020 ZONE 55	689679 7372849
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse bauhinia
Disturbance	Extensive clearing
Landform pattern / pattern	Gently undulating rises, drainage depression
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	2.0 / 2.0, No erosion observed

Table 5-29: Land Summary 14Bl(Ro), Analysed Site D37 (continued)

Surface condition / Surface coarse fragments or segregations		Cracking, < 2% coarse fragments 20-60 mm					
SPC ASC Order / Suborder		Black Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Rolleston					
Total area (ha)		64.20					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 6-20 mm	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking
B21 0.20-0.60 Gradual 50-100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3 / 1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking
B22 0.60-1.30 Diffuse > 100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown Mottles: Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	0.95 / 7.5 No dispersion after 10 minutes Complete slaking
B23 1.30-1.90 EOTP	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20 mm	10YR5 / 3 Brown Mottles: Orange, 10-20%, 5-15 mm Dark grey, 10%-20% 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.55 / 7.5 No dispersion after 10 minutes Complete slaking

Table 5-30: Soil Chemistry for 14Bl(Ro), Analysed Site D37

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils are generally moderately alkaline
EC	Topsoil is low. Subsoil varies from low to very high throughout soil profile
ECEC	Topsoil is high. Subsoil is very high to high throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic to 0.50 m. Increases to sodic below 0.50 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high at 1.10 m
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium heavy clay Subsoil is medium heavy clay to light clay to depth

Key Analysis	Assessment Summary
EAT	Topsoil reports no dispersion. Carbonates and gypsum may be present Subsoil reports no dispersion. Carbonates and gypsum may be present. Below 1.40 m, some dispersion is reported
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.040
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	124.30
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where no value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is above 90% for all crop land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has favourable PAWC, very low nutrient levels, fertility status. Topsoil pH is moderately alkaline with low EC, non-sodic levels and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 0.50 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 0.00 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.00 mbgl. Based on this calculation result, if visual observations of sodic soils are observed, an application of 2.5 t/ha may be adequate.

Associated SLR (2023) Site Assessment

The analysed site undertaken by SLR (2023) was site B05, a Self-Mulching Black Vertosol within Soil Unit 1 (Self-Mulching Black Brown Vertosol). No soil profile was provided within the SLR (2023) report, therefore, no review of the fieldwork data or photos could be assessed.

GTE conducted site D37 within 3.0 m of B05 and the classification indicated it was a Black Vertosol.

The laboratory analysis was utilised with D37 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

5.1.16 Soil Profile Class 15BI(Ro): Brown Vertosol

Overview

15BI(Ro) is characterised by moderately deep clay soil with a self-mulching surface, deep bedrock. The SPC is associated with gently undulating plains with sparse bauhinia. The SPC is situated within five UMAs, the majority to the north of the study area, over an area of 1,040.57 ha.

Analysed site

The nominated analysed site, site D39, is summarised in Table 5-31. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-32. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-31: Land Summary 15BI(Ro), Analysed Site D39

Item	Description
Analysed Site	D39
UMAs	62, 63, 64 ,65, 66
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.65 m)
Location GDA2020 ZONE 55	690706 7372655
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse bauhinia
Disturbance	Extensive clearing
Landform pattern / pattern	Gently undulating plain, flat plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	2.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Self-mulching, < 2% coarse fragments 20-60 mm

Table 5-31: Land Summary 15Bl(Ro), Analysed Site D39 (continued)

SPC ASC Order / Suborder		Brown Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Rolleston					
Total area (ha)		1,040.57					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium clay Sandy Fine	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking
B21 0.20-0.50 Gradual 50-100 mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm Slickensides	< 2% coarse fragments 2-6 mm	7.5YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Medium 2-5 mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking
B22 0.50-0.90 Clear 20-50 mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	50-90% coarse fragments 200-600 mm 50-90% coarse fragments 0.6m-2.0 m	10YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	0.70 / 8.0 No dispersion after 10 minutes Partial slaking
BC 0.90-1.40 Gradual 50-100 mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20 mm	10YR4 / 4 Dark yellowish brown Mottles: Yellow Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.15 / 8.0 No dispersion after 10 minutes Partial slaking
R 1.40-1.65 EOTP	-	-	-	-	-	-	-
	Refusal on bedrock						

Table 5-32: Soil Chemistry for 15Bl(Ro), Analysed Site D39

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils are moderately alkaline increasing to strongly alkaline
EC	Topsoil is very low. Subsoil increases from low to very high throughout soil profile
ECEC	Topsoil is moderate. Subsoil is generally high throughout soil profile
ESP	Topsoil is non-sodic. Subsoils are non-sodic to 0.80 m. Increases to sodic and strongly sodic below 1.10 m
Ca:Mg	Topsoil is very high. Subsoils are generally very high
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is medium clay

Key Analysis	Assessment Summary
	Subsoil is medium clay, clay loam to light clay to depth
EAT	Topsoil reports dispersion after remoulding Subsoil reports no dispersion. Carbonates and gypsum may be present. Subsoil below 0.80 m, some dispersion is reported
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.040
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	100.90
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at or above 90% for all crop land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has favourable PAWC, very low nutrient levels, favourable surface conditions with moderately deep subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 0.60 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 17.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.80 mbgl.

5.1.17 Soil Profile Class 16Bl(Ta): Grey Sodosol

Overview

16Bl(Ta) is characterised by very shallow clay loam surfaced on clay subsoils with a hard-setting on shallow bedrock. The SPC is associated with hillslopes and Bauhinia. The SPC is situated in three UMAs located in the centre west and southern portions of the study area, over an area of 38.52 ha.

Analysed site

The nominated analysed site, site D43, is summarised in Table 5-33. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-34. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-33: Land Summary 16Bl(Ta), Analysed Site D43

Item	Description
Analysed Site	D43
UMAs	67, 68, 69
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.35 m)
Location GDA2020 ZONE 55	685753 7378011
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse bauhinia
Disturbance	Extensive clearing
Landform pattern / pattern	Gently undulating plain, flat plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, Scald erosion observed
Surface condition / Surface coarse fragments or segregations	Hard-setting, < 2% coarse fragments 20-60 mm

Table 5-33: Land Summary 16Bl(Ta), Analysed Site D43 (continued)

SPC ASC Order / Suborder		Grey Sodosol					
Associated Land System / Soil		Blackwater, Daunia / Taurus					
Total area (ha)		38.52					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.10 Clear 20-50 mm	Clay Loam Sandy Fine	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR4 / 2 Brown No mottles or bleaching	Dry Well drained	Fine 1-2 mm Common	0.05 / 6.0 Moderate dispersion after 10 minutes Partial slaking
B21 0.10-0.20 Clear 20-50 mm	Medium heavy clay	Moderate / Very firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	0.15 / 6.0 Slight Dispersion after 10 minutes Partial slaking
B22 0.20-0.40 EOBH	Medium clay	Strong / Very firm Subangular blocky 5-10 mm No Slickensides	< 2% coarse fragments 6-20 mm	2.5Y4 / 1 Dark grey No mottles or bleaching	Dry Imperfectly drained	Very fine < 1 mm Few	0.25 / 8.0 No dispersion after 10 minutes Partial slaking
	Refusal on bedrock						

Table 5-34: Soil Chemistry for 16Bl(Ta), Analysed Site D43

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils are moderately alkaline
EC	Topsoil is low. Subsoil is moderate
ECEC	Topsoil is low. Subsoil is moderate
ESP	Topsoil is non-sodic. Subsoils are sodic
Ca:Mg	Topsoil is high. Subsoils are high
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is clay loam Subsoil is medium clay
EAT	Topsoil reports some dispersion Subsoil reports some dispersion
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/40cm)	60.3

Key Analysis	Assessment Summary
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is above 90% for all crop land uses. The limitation for ERD is soil depth of 0.35 m.
Summary of limitations and management	The soil has unfavourable PAWC, low nutrient levels, unfavourable surface conditions and shallow subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.40 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 4.6 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.10 mbgl.

5.1.18 Soil Profile Class 17Bl(Ro): Grey Vertosol

Overview

17Bl(Ro) is characterised by a deep clay uniform soil with a cracking surface. The SPC is associated with gently undulating plains with sparse bauhinia and brigalow. The SPC is situated in four UMAs located in the centre and southern areas of the study area, over an area of 348.24 ha.

Analysed site

The nominated analysed site, site D44, is summarised in Table 5-35. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-36. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-35: Land Summary 17Bl(Ro), Analysed Site D44

Item	Description
Analysed Site	D44
UMAs	70, 71, 72, 73
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.60 m)
Location GDA2020 ZONE 55	691122 7370776
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse Bauhinia and Brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Gently undulating plain, flat plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Cracking, no coarse fragments

Table 5-35: Land Summary 17Bl(Ro), Analysed Site D44 (continued)

SPC ASC Order / Suborder		Grey Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Rolleston					
Total area (ha)		348.24					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.10 Clear 20-50 mm	Light clay Sandy	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 6-20 mm	7.5YR3 / 2 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.05 / 6.0 No dispersion after 10 minutes Partial slaking
B21 0.10-0.20 Clear 20-50 mm	Light medium clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	< 2% coarse fragments 20-60 mm	7.5YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.15 / 6.5 No dispersion after 10 minutes Partial slaking
B22 0.20-0.40 Gradual 50-100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	< 2% coarse fragments 2-6 mm	7.5YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking
B23 0.40-0.80 Diffuse > 100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	< 2% coarse fragments 2-6 mm < 2% calcium carbonate 2-6 mm	7.5YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.60 / 8.0 No dispersion after 10 minutes Complete slaking
B24 0.80-1.20 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 2-6 mm < 2% calcium carbonate 2-6 mm Manganese nodules	7.5YR4 / 4 Brown Mottles: Pale Grey Few 2%-10% Few < 5 mm	Dry Moderately well drained	Very fine < 1 mm Few	1.00 / 7.5 No dispersion after 10 minutes Complete slaking
C 1.20-1.60 EOTP	-	-	-	-	-	-	-

Table 5-36: Soil Chemistry for 17Bl(Ro), Analysed Site D44

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is slightly acidic to neutral. Subsoils are neutral to slightly alkaline increasing to strongly alkaline
EC	Topsoil is low. Subsoil increases from low to high throughout the profile
ECEC	Topsoil is low. Subsoil is moderate to high

Key Analysis	Assessment Summary
ESP	Topsoil is non-sodic. Subsoils are sodic
Ca:Mg	Topsoil is very high. Subsoils are very high to high at 1.10 m below
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is clay loam Subsoil is light clay increasing to medium heavy clay
EAT	Topsoil reports dispersion after being remoulded Subsoil reports dispersion after being remoulded and increases to some dispersion below 1.40 m
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.015
SALFPREDICT PAWC (PAWCER) Total (mm/30cm)	114.40
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at or above 90% for all crop land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has a favourable PAWC, very low nutrient levels, and unfavourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below 0.10 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 5.0 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.50 mbgl

Associated SLR (2023) Sites Assessment

The analysed site undertaken by SLR (2023) was site B01, a Eutrophic Red Dermosol within Soil Unit 2B (Eutrophic Red Dermosols). No soil profile was provided within the SLR (2023) report, therefore, no review of the fieldwork data or photos could be assessed.

GTE conducted site D44 within 5.1 m of B01 and the classification indicated it was a Grey Vertosol. Based on the observation sites undertaken by GTE, no Red Dermosol was encountered, therefore, this is considered an anomaly, more so than a sub-dominant soil type.

The laboratory analysis was utilised with D44 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

SLR (2023) site B07 reported a Self-Mulching Vertosol. Based on GTE field observations across UMA 72, and generally across the project site, no ASC of Red Vertosol was observed. It is therefore, aggregated within the larger observed ASC of Grey Vertosol.

5.1.19 Soil Profile Class 18Bl(Ro): Grey Vertosol

Overview

18Bl(Ro) is characterised by a very deep, grey clay uniform soil with a self-mulching surface. The SPC is associated with gently undulating plains with sparse bauhinia and brigalow. The SPC is situated in one UMA located in the centre-southern portion of the study area, over an area of 76.36 ha.

Analysed site

The nominated analysed site, site D45, is summarised in Table 5-37. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-38. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-37: Land Summary 18Bl(Ro), Analysed Site D45

Item	Description
Analysed Site	D45
UMAs	74

Representative Landscape Photograph



Soil Profile Photograph



(Profile viewed top to bottom, 1.60 m)

Location GDA2020 ZONE 55	689137 7374206
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse Bauhinia and Moreton Bay Ash
Disturbance	Extensive clearing
Landform pattern / pattern	Gently undulating plain, flat plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Moderate
Slope (%) / Erosion	< 1.0 / < 1.0, Scald erosion observed
Surface condition / Surface coarse fragments or segregations	Surface flake, no coarse fragments

Table 5-37: Land Summary 18Bl(Ro), Analysed Site D45 (continued)

SPC ASC Order / Suborder		Grey Vertosol					
Associated Land System / Soil		Blackwater, Daunia / Rolleston					
Total area (ha)		76.36					
Phases and / or variants		None					
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium heavy clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2 mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking
B21 0.20-0.40 Gradual 50-100 mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking
B22 0.40-0.80 Diffuse > 100 mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.60 / 7.5 No dispersion after 10 minutes Partial slaking
B23 0.80-1.40 Diffuse > 100 mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3 / 1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	1.10 / 7.5 No dispersion after 10 minutes Complete slaking
B24 1.50-2.00 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3 / 1 Very dark grey Mottles: Brown Few 2%-10% Few < 5 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.75 / 6.0 No dispersion after 10 minutes Partial slaking
	Refusal on cemented soil						

Table 5-38: Soil Chemistry for 18Bl(Ro), Analysed Site D45

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils are moderately alkaline decreasing to slightly acidic to neutral
EC	Topsoil is low. Subsoil levels reported at very low increasing to moderate
ECEC	Topsoil is moderate. Subsoil is high to moderate at depth
ESP	Topsoil is non-sodic. Subsoils are non-sodic
Ca:Mg	Topsoil is very high. Subsoils are very high

Key Analysis	Assessment Summary
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is clay loam Subsoil is light medium clay increasing to medium heavy clay
EAT	Topsoil reports dispersion after being remoulded Subsoil reports no dispersion, carbonate and gypsum present to 1.10 m. Some dispersion is reported below 1.10 m
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/30cm)	104.50
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is above 90% for all crop land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has a favourable PAWC, very low nutrient levels and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 2.00 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

5.1.20 Soil Profile Class 19Bl(Ro): Brown Vertosol

Overview

19Bl(Ro) is characterised by very deep, brown clay soils with a surface flake and strong structured subsoils. The SPC is associated with gently undulating plains and rises with sparse bauhinia and brigalow vegetation. The SPC is situated across six UMAs, the majority in the northern portion of the study area, over an area of 756.86 ha.

Analysed site

The nominated analysed site, site D52 is summarised in Table 5-39. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-40. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-39: Land Summary SPC 19Bl(Ro), Analysed Site D52

Item	Description
Analysed Site	D52
UMAs	75, 76, 77, 78, 79, 80
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 2.20 m)
Location GDA2020 ZONE 55	688782 7376440
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse Bauhinia and brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Flat plain, gently undulating rises
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	1.0 / 1.0, No erosion observed

Surface condition / Surface coarse fragments or segregations	Surface flake, < 2% coarse fragments 6-20 mm
SPC ASC Order / Suborder	Brown Vertosol
Associated Land System / Soil	Blackwater, Daunia / Rolleston
Total area (ha)	756.86
Phases and / or variants	None

Soil Profile Morphology Summary

Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Light clay Sandy	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20 mm	10YR3 / 2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking
B21 0.20-0.40 Clear 20-50 mm	Medium clay Sandy	Strong / Strong Subangular blocky 20-50 mm Slickensides	< 2% coarse fragments 2-6 mm	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0..30 / 7.0 No dispersion after 10 minutes No slaking
B22 0.40-1.00 Gradual 50-100 mm	Medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% calcium carbonate 6-20 mm < 2% coarse fragments 2-6 mm	10YR4 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.70 / 8.0 No dispersion after 10 minutes Complete slaking
B23 1.00-1.70 Diffuse > 100 mm	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	< 2% coarse fragments 2-6 mm	10YR5 / 3 Brown Mottles: Dark Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.35 / 7.5 No dispersion after 10 minutes Partial slaking
B24 1.70-2.20 EOTP	Medium clay Sandy Coarse	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6 mm	10YR4 / 3 Brown Mottles: Dark Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	1.95 / 7.5 No dispersion after 10 minutes Partial slaking

Table 5-40: Soil Chemistry for 19Bl(Ro), Analysed Site D52

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils vary between moderately alkaline and neutral to slightly alkaline
EC	Topsoil is very low. Subsoil varies from very low to very high throughout soil profile
ECEC	Topsoil is low. Subsoil varies from very low to very high throughout soil profile
ESP	Non-sodic levels in topsoil. Subsoils are non-sodic, increasing to sodic below 1.40 m
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to moderate at 1.40 m

Key Analysis	Assessment Summary
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is clay loam Subsoil is clay loam to light clay
EAT	Topsoil disperses after remoulding Subsoil reports no dispersion. Carbonates and gypsum may be present. Some dispersion below 0.80 m
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	83.6
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses except Maize. Maize was reported at 75% yield within 0.60 m. There are no limitations for ERD.
Summary of limitations and management	The soil has less than favourable PAWC, low nutrient levels, fertility status. Topsoil pH is neutral with very low EC, non-sodic levels and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 1.40 mbgl may benefit gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 9.3 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.70 mbgl.

SLR (2023) Sites associated with 19Bl(Ro)

SLR (2023) site B22 reported a Self-Mulching Black Vertosol. On review of the major colours within the upper 0.50 m of the B21 horizon, the soil profile was classified as a Brown Vertosol. This fits in with the SPC and associated UMA 76, which includes this site.

5.1.21 Soil Profile Class 20Bl(Ro): Grey Vertosol

Overview

20Bl(Ro) is characterised by moderately deep, uniform grey clay soils with surface flake and strong structured clay subsoils. The SPC is associated with gently undulating plains with open woodland including brigalow vegetation. The SPC is situated in one UMA, located in the southern portion of the study area, over an area of 27.81 ha.

Analysed site

The nominated analysed site, site D58 is summarised in Table 5-41. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-42. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-41: Land Summary 20Bl(Ro), Analysed Site D58

Item	Description
Analysed Site	D58
UMAs	81

Representative Landscape Photograph



Soil Profile Photograph



(Profile viewed top to bottom, 0.80 m)

Location GDA2020 ZONE 55	691692 7371103
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Open woodland including brigalow
Disturbance	Limited clearing
Landform pattern / pattern	Flat plain, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / moderate
Slope (%) / Erosion	2.0 / 1.0, No erosion observed

Surface condition / Surface coarse fragments or segregations	Surface flake, < 2% coarse fragments 6-20 mm
SPC ASC Order / Suborder	Grey Vertosol
Associated Land System / Soil	Blackwater/ Rolleston
Total area (ha)	27.81
Phases and / or variants	None

Soil Profile Morphology Summary

Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Medium clay	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking
B21 0.20-0.40 Clear 20-50 mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4 / 1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.30 / 7.5 Slight Dispersion after 10 minutes Partial slaking
B22 0.40-0.80 EOBH	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm Slickensides	< 2% calcium carbonate 2-6 mm	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Common	0.60 / 8.0 No dispersion after 10 minutes Complete slaking
	Refusal on bedrock						

Table 5-42: Soil Chemistry for 20Bl(Ro), Analysed Site D58

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is moderately alkaline. Subsoils vary between moderately alkaline and strongly alkaline
EC	Topsoil is very low. Subsoil increases from low to high throughout soil profile
ECEC	Topsoil is high. Subsoil decreases from high to moderate throughout soil profile
ESP	Topsoil is non-sodic. Subsoils are non-sodic
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high from 0.70 m
P	Very low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is light medium clay Subsoil is light medium clay to light clay
EAT	Topsoil disperses after remoulding Subsoil reports no dispersion. Carbonates and gypsum may be present. Some dispersion below 0.80 m
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.018
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	98.7

Key Analysis	Assessment Summary
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is at 90% for all crop land uses except Maize. Maize was reported at 75% yield within 0.60 m. There are no limitations for ERD.
Summary of limitations and management	The soil has favourable PAWC, very low nutrient levels and fertility status. Topsoil pH is neutral with very low EC, non-sodic levels, very high cation exchange and favourable surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.80 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

5.1.22 Soil Profile Class 21Bl(Ta): Grey Sodosol

Overview

21Bl(Ta) is characterised by very deep, texture contrast brown sandy loams on grey and yellow brown mottled clay subsoils with a hard-setting surface. The SPC is associated with gently undulating plains with sparse Brigalow vegetation on grasslands. The SPC is situated in one UMA, located in the centre-east portion of the study area, over an area of 167.19 ha.

Analysed site

The nominated analysed site, site D59, was undertaken to complete data gaps in the existing SLR (2023) site, B21, and is summarised in Table 5-43. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-44. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-43: Land Summary 21Bl(Ta), Analysed Site D59

Item	Description
Analysed Site	D59
UMAs	82
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 1.80 m)
Location GDA2020 ZONE 55	691156 7377835
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow
Disturbance	Extensive clearing
Landform pattern / pattern	Simple slope, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfect / Slow
Slope (%) / Erosion	2.0 / 1.0, No erosion observed

Table 5-43: Land Summary 21Bl(Ta), Analysed Site D59 (continued)

Surface condition / Surface coarse fragments or segregations	Hard-setting, no coarse fragments						
SPC ASC Order / Suborder	Grey Sodosol						
Associated Land System / Soil	Blackwater / Taurus						
Total area (ha)	167.19						
Phases and / or variants	None						
Soil Profile Morphology Summary							
Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A1 0.00-0.20 Clear 20-50 mm	Sandy loam	Weak / Weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR3 / 2 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2 mm Many	0.10 / 6.0 No dispersion after 10 minutes Complete slaking
A2 0.20-0.45 Abrupt 5-20 mm	Sandy loam	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4 / 2 Brown No mottles or bleaching	Dry Well drained	Fine 1-2 mm Common	0.33 / 6.5 No dispersion after 10 minutes Complete slaking
B21 0.45-0.90 Gradual 50-100 mm	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	< 2% coarse fragments 2-6 mm	7.5YR4 / 1 Dark grey Mottles: Brown Many 20%-50% Medium 5-15 mm	Dry Imperfectly drained	Very fine < 1 mm Few	0.65 / 8.5 Slight Dispersion after 10 minutes Partial slaking
B22 0.90-1.80 EOTP	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	10-20% calcium carbonate 20-60 mm 10-20% calcium carbonate 6-20 mm Coarse fragments < 2%, 2-6 mm	10YR5 / 4 Yellowish brown Mottles: Dark Grey Common 10%-20% Few < 5 mm	Dry Imperfectly drained	No roots	1.35 / 8.5 No dispersion after 10 minutes Complete slaking

Table 5-44: Soil Chemistry for 21Bl(Ta), Analysed Site D59

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils vary between moderately alkaline and strongly alkaline
EC	Topsoil is low. Subsoil increases from low to very high throughout soil profile
ECEC	Topsoil is low. Subsoil varies between low and high throughout soil profile
ESP	Topsoil is non-sodic. Subsoils are sodic to strongly sodic, decreasing below 1.10 m
Ca:Mg	Topsoil is very high. Subsoils very between moderate to very high
P	Very low in topsoil. Very low in the B21 horizon of subsoil

Key Analysis	Assessment Summary
PSA	Topsoil is sandy loam Subsoil is light clay
EAT	Topsoil disperses after remoulding Subsoil reports some dispersion throughout the soil profile
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/50cm)	43.7
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is above 90% for all crop land uses. The SPC is assessed as a Sodosol. As such, it has been assessed against the pH limitations. It was assessed from 0.50 mbgl, pH was > 9.0, therefore, the PAWC based on the SALFPREDICT modelling has been assessed at this depth. There are limitations for ERD, relating to subsoil pH.
Summary of limitations and management	The soil has less than favourable PAWC, very low nutrient levels, fertility status, low cation exchange, hard-setting surface conditions and sodic subsoils. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below 0.45 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 7.4 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.

SLR (2023) Sites associated with 21Bl(Ta)

SLR (2023) site B21 reported a Subnatric Brown Sodosol within Soil Unit 1 (Self-Mulching Black Brown Vertosols). GTE conducted site D59 within 5.1 m of the original site and colour graded a Grey Sodosol. Based on the experience of two of GTE field personnel at the time, review of the SLR profile and observations onsite, the assessment is the area is a Grey Sodosol.

The laboratory analysis was utilised with D59 laboratory providing additional data and completing data gaps based on the nominated laboratory suite.

5.1.23 Soil Profile Class 22Bl(Wy): Brown Kandosol

Overview

22Bl(Wy) is characterised by deep, gradational textured, weakly structured soils with firm surfaces and loamy subsoils. The SPC is associated with gently undulating plains with sparse brigalow and bauhinia vegetation. The SPC is situated in one UMA, located in the southern portion of the study area, over an area of 13.54 ha.

Analysed site

The nominated analysed site, site D65, is summarised in Table 5-45. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 5-46. Detailed site descriptions, Class IV site descriptions and the laboratory analysis summary are available in Appendix A, B and C, respectively.

Table 5-45: Land Summary 22Bl(Wy), Analysed Site D65

Item	Description
Analysed Site	D65
UMAs	83

Representative Landscape Photograph



Soil Profile Photograph



(Profile viewed top to bottom, 0.80 m)

Location GDA2020 ZONE 55	691894 7371606
Current Use	Cattle Grazing
Geology	Stratified Unit dominated by volcanic and metamorphic rock
Vegetation	Sparse brigalow and bauhinia
Disturbance	Extensive clearing
Landform pattern / pattern	Flat plain, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Moderate well / moderate
Slope (%) / Erosion	1.0 / 1.0, No erosion observed

Surface condition / Surface coarse fragments or segregations	Firm, < 2% coarse fragments 6-20 mm
SPC ASC Order / Suborder	Brown Kandosol
Associated Land System / Soil	Blackwater / Taurus, Wyesby
Total area (ha)	13.54
Phases and / or variants	None

Soil Profile Morphology Summary

Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH Dispersion Field Test
A11 0.00-0.05 Clear 20-50 mm	Sandy loam	Weak / Weak Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine < 1 mm Many	0.03 / 6.5 No dispersion after 10 minutes Partial slaking
A12 0.05-0.20 Clear 20-50 mm	Sandy loam	Weak / Weak Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4 / 2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine < 1 mm Common	0.14 / 6.0 No dispersion after 10 minutes No slaking
A2 0.20-0.45 Gradual 50-100 mm	Sandy loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3 / 3 Dark brown No mottles or bleaching	Dry Well drained	Very fine < 1 mm Few	0.32 / 6.0 Slight Dispersion after 10 minutes Partial slaking
B21 0.45-0.80 Gradual 50-100 mm	Clay loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	< 2% coarse fragments 2-6 mm	10YR5 / 3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine < 1 mm Few	0.62 / 7.5 Moderate dispersion after 10 minutes Partial slaking
B21 0.80-1.00 EOBH No recovery	Silty loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	< 2% coarse fragments 2-6 mm	10YR5 / 3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.90 / 7.5 No dispersion after 10 minutes Complete slaking

Table 5-46: Soil Chemistry for 22Bl(Wy), Analysed Site D65

Key Analysis	Assessment Summary
Soil pH (H_20)	Topsoil is neutral to slightly alkaline. Subsoils vary between neutral to slightly alkaline to strongly alkaline at depth
EC	Topsoil is low. Subsoil increases from low to moderate at depth
ECEC	Topsoil is very low. Subsoil increases from very low to low throughout soil profile
ESP	Topsoil is non-sodic. Subsoils are non-sodic
Ca:Mg	Topsoil is very high. Subsoils are very high decreasing to high from 0.50 m

Key Analysis	Assessment Summary
P	Low in topsoil. Very low in the B21 horizon of subsoil
PSA	Topsoil is sandy loam Subsoil is clay loam to sandy clay loam
EAT	Topsoil disperses after remoulding Subsoil disperses after remoulding with some dispersion at 0.50 m, then no dispersion. Carbonates and gypsum may be present from 0.80 m. Some dispersion below 0.80 m
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.030
SALFPREDICT PAWC (PAWCER) Total (mm/100cm)	73.2
ERD	Review of analytical data in SALFPREDICT, eight crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall, except Safflower where 7% value was provided. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.60 m, assessment against the plant salt-tolerance data (DERM, 2011) crop land use yield is above 90% for all crop land uses. There are no limitations for ERD.
Summary of limitations and management	The soil has less than favourable PAWC, low nutrient levels, very low cation exchange and unfavourable firm surface conditions. Topsoil resource may be recommended for use on flat to sloped areas. Subsoil to 0.45 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

6 LAND SUITABILITY ASSESSMENT

6.1 Agricultural Land Suitability

The assessment of the study area for agricultural land suitability includes evaluating the potential of the land for land management options such as cropping or grazing.

Agricultural land suitability assessment involves defining the classes to assess against the appropriate land management options (shown in Section 6.2) for the area based on available frameworks (shown in Section 6.3) and the land use requirements and limitations to assess the conditions for the land management options (shown in Section 6.4).

6.2 Land Suitability Classes

GALE (DSITI and DNRM, 2015) was utilised to assess Land Suitability Classes and ALC. GALE defines five Land Suitability Classes for use in Queensland (Table 6-1) in which the land suitability for agriculture (i.e., cropping or grazing) decreases progressively from Land Suitability Class 1 to Class 5, based on the severity of the land use limitations.

Table 6-1: Land Suitability Classes

Land Suitability Class	Suitability	Limitations[1]	Definition[2]
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Land with limitations that either constrain production or require more than the simple management practices of class 1 land to maintain economic production.
3	Suitable	Moderate	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	Severe / Marginally suitable	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	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

1 - Definitions from GALE (DSITI and DNRM, 2015) and LSAT (DME, 1995) where applicable
2 - Definitions from GALE (DSITI and DNRM, 2015)

Land rated as Land Suitability Classes 1 to 3 is considered suitable for agricultural land use with negligible to moderate limitations. It should be noted that with the use of soil improvement techniques (e.g., fertiliser, amelioration) Class 3 land may be just as productive as Class 1 or 2 land.

Land rated as Land Suitability Class 4 is unsuitable for agricultural land use due to the severity of one or more limitations. However, in some circumstances it may be possible to upgrade Class 4 land to a more suitable class with the implementation of considerable soil improvement measures.

Land rated as Land Suitability Class 5 is considered entirely unsuitable for the specified land use as the limitation(s) are so severe that the inputs required to initiate and maintain the specified land use are not sustainable.

6.3 Land Suitability Use and Assessments

The Regional Frameworks (DSITIA and DNRM, 2013) provides the attributes, limitations and suitability subclass values for land suitability limitations assessment.

In reviewing the Regional Frameworks (DSITIA and DNRM, 2013) suitability subclasses and attributes, the following assessments were undertaken:

- An assessment was undertaken for each SPC for the 13 land management options listed for the Suitability Framework for the Inland Fitzroy Southern Burdekin Area. These included:
    - Dryland cropping land uses, barley, chickpea, maize, millet, mungbean, oat, safflower, sorghum, soybean, sunflower, triticale and wheat.
    - Furrow irrigated cropping land uses, cotton.

It is noted that the Suitability Framework for the Inland Fitzroy and Southern Burdekin Area does not include beef cattle grazing (rainfed) as a subclass for a potential agricultural land use. Therefore, assessment of beef cattle grazing was completed using the LSAT (DME, 1995) beef cattle grazing land suitability frameworks for semi-arid sub tropics of Queensland with additional guidance from Shields and Williams (1991).

The associated limitations have been summarised in Section 6.4.

6.3.1 SLR (2023) Land Suitability Assessment Review

A review of SLR (2023) indicates a land suitability assessment was conducted for cropping and beef cattle grazing in accordance with current guidelines for cropping land use (GALE, DSITI and DNRM, 2015 and Regional Frameworks, DSITIA and DNRM, 2013) and nominated guidelines for beef cattle land use, including *A rule-set for land suitability assessment of sustainable beef cattle grazing on land rehabilitated after open cut coal mining in the Bowen Basin, Queensland.* Highlands Environmental, pp.1-10 (Queensland draft, Short, 2013).

Land use limitations were selected based on these guidelines and assessed against the Regional Frameworks (DSITIA and DNRM, 2013); however, no specific crop land uses were specified. Land suitability and land capability results are provided in Appendix E (SLR, 2023).

GTE's review of these sections and results indicate that although an assessment was conducted, GTE understands that this may not meet current expectations or be in accordance with the guidelines which is stated; for example, but not limited to:

- No individual cropping land uses are nominated for any SMU in Appendix E (SLR, 2023),
- No assessment of limitations for beef cattle grazing is presented (i.e., as per Appendix E) (SLR, 2023), just the results within Figure 5-6,
- No individual UMA assessment is addressed or present within the assessment, however, based on Figure 4-1 (SLR, 2023), only four UMAs were identified, and
- LCC was conducted; however, this is more suited for scales of 1:250,000 or smaller. The SLR (2023) assessment was undertaken exceeding a scale of 1:125,000, in which the LCC was not required.

Based on GTE's review of presented field and laboratory data within SLR's (2023) SALS assessment, GTE have undertaken a Land Suitability Assessment for the project site. Where relevant, field and laboratory data from SLR (2023) has been used, however, no land suitability or capability results have carried over to this SALS Assessment.

6.4 Land Use Limitations and Simple and Complex Diagnostic Attributes

The following land use limitations have been considered and proposed where applicable based on available information from field, laboratory and available report documents. The land use limitations are assessed on simple or complex diagnostic attributes. Simple diagnostic attributes are those that are measured in the field or laboratory and complex diagnostic attributes are made up of several contributing diagnostic attributes and are generally difficult to measure directly or calculate.

6.4.1 Cropping Suitability, Land Use Limitations

The following land use limitations have been considered where applicable based on available information, for the Suitability Framework for the Inland Fitzroy and Southern Burdekin Area:

- water erosion (E),
- erosion hazard, subsoil erodibility (Es),
- soil water availability (M),
- narrow moisture range (Pm),
- surface soil condition (Ps),
- rockiness (R),
- microrelief(Tm), and
- wetness (W).

The remaining limitations have been assessed by review of Table 8 of the GALE (DSITI and DNRM, 2015) where limitations have diagnostic attributes and indicators for the agricultural land uses.

6.4.2 Beef Cattle Grazing, Land Use Limitations

An assessment was undertaken for beef cattle grazing using the LSAT (DME, 1995) beef cattle grazing land suitability frameworks for the semi-arid sub tropics of Queensland. This assessment includes the following land use limitations:

- water availability,
- nutrient deficiency,
- soil physical factors,
- salinity,
- rockiness,
- microrelief,
- pH,
- wetness,
- topography,
- water erosion, and
- flooding.

Vegetation regrowth land use limitation is not assessed as this pertains to a management limitation and is excluded from the assessment.

Guidance was also taken from Shields and Williams (1991) and the expectations of the Queensland DoR with respect to the limitations, specifically water availability and salinity.

6.5 Regional Frameworks, Complex Limitations SPC Assessment Summary

The following sub-sections provide summaries of the Regional Frameworks and complex limitations for the SPCs.

6.5.1 Regional Frameworks SPC Assessment Summary

Desktop, field and laboratory data collected from analysed sites in the study area were reviewed against the Regional Frameworks (DSITIA and DNRM, 2013) limitations for each selected land use.

Table 6-2 providing a detailed description of the land attributes and limitations in the study area and the corresponding Land Suitability Classes providing a summary of the limitations for each SPC.

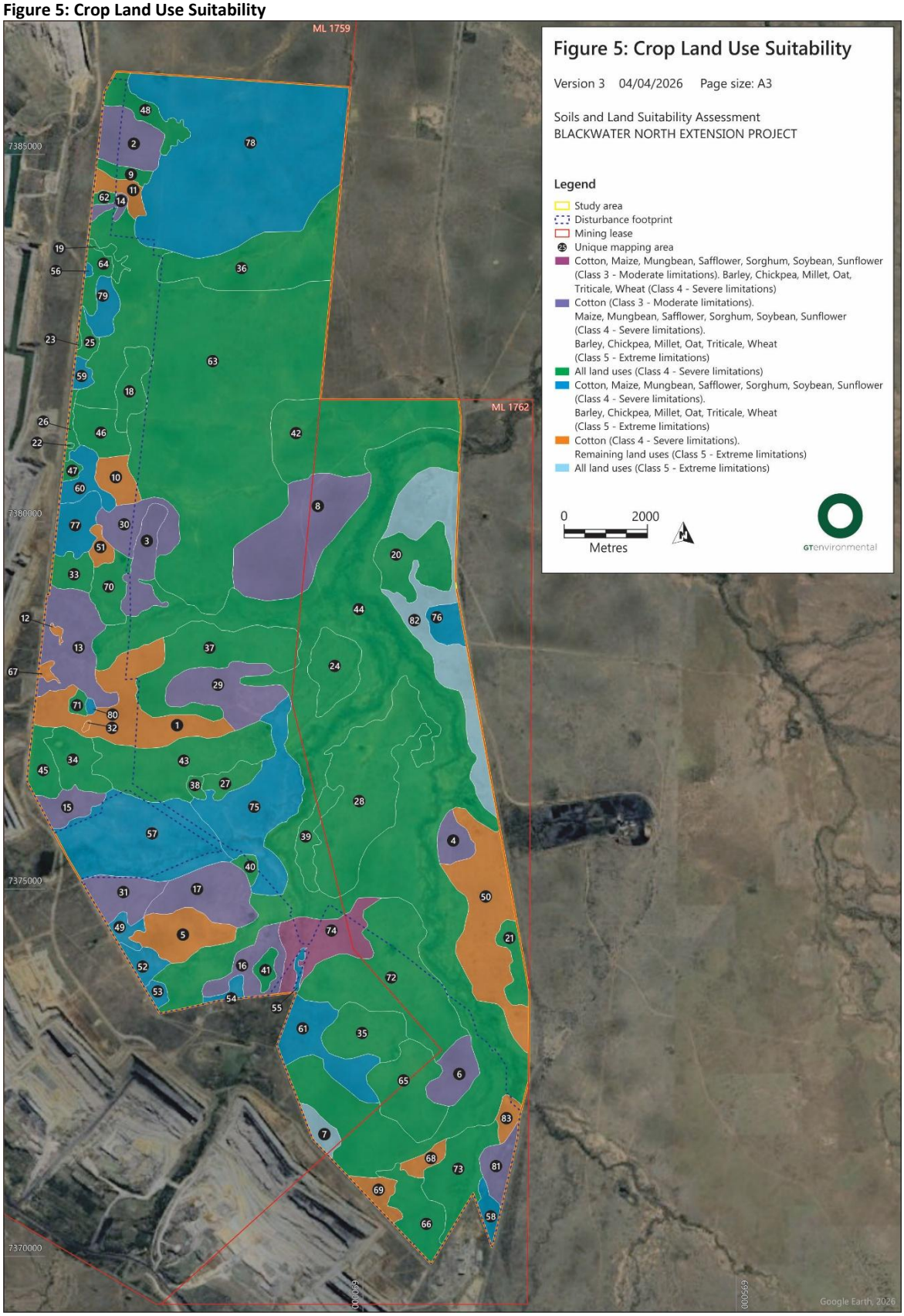
The assessed categories of Land Suitability Classes for each crop land use and associated SPC are detailed in Appendix H, summarised and shown in Table 6-2 and on Figure 5.

Table 6-2: SPCs for Regional Frameworks, Suitability Subclasses for Land Uses

Regional Frameworks Assessment	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 3). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 4)	18Bl(Ro)	74	76.36	54.59
Cotton (Class 3). Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	2Dn(Te)	2, 3, 4, 6, 8	810.11	438.27
	5Dn(Ro)	13, 14, 15, 16, 17		
	8Dn(Te)	29, 30, 31		
	20Bl(Ro)	81		
All land uses (Class 4)	3Bl(Te)	9	4,245.99	1,265.76
	6Bl(Pg)	18, 19, 20, 21, 22, 23		
	7Bl(Pg)	24, 25, 26, 28		
	9Dn(Ro)	33, 34, 36, 37, 38, 39, 40, 41, 42		
	10Ct(Ro)	43, 44, 45, 46, 47, 48		
	14Bl(Ro)	35		
	15Bl(Ro)	62, 63, 64, 65, 66		
	17Bl(Ro)	70, 71, 72, 73		
Cotton, Maize, Mungbean, Safflower, Sorghum, Soybean, Sunflower (Class 4). Barley, Chickpea, Millet, Oat, Triticale, Wheat (Class 5)	11Bl(Ta)	49, 52, 53, 54, 55	1,123.88	292.3
	12Da(Te)	57, 58		
	13Bl(Ta)	59, 60, 61		
	19Bl(Ro)	75, 76, 77, 78, 79, 80		
Cotton (Class 4). Remaining land uses (Class 5)	1Dn(Te)	1	466.54	247.39
	2Dn(Te)	5		
	4Bl(Te)	10, 11		
	8Dn(Te)	12		
	11Bl(Ta)	50, 51		
	16Bl(Ta)	32, 67, 68, 69		
	22Bl(Wy)	83		

Regional Frameworks Assessment	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
All land uses (Class 5)	2Dn(Te)	7	184.72	18.23
	21Bl(Ta)	82		

Figure 5: Crop Land Use Suitability



6.5.2 Beef Cattle Grazing SPC Assessment Summary

The SPCs were assessed against the Suitability for Beef Cattle Grazing LSAT (DME, 1995) (refer to Appendix E) with reference to beef cattle grazing in the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991).

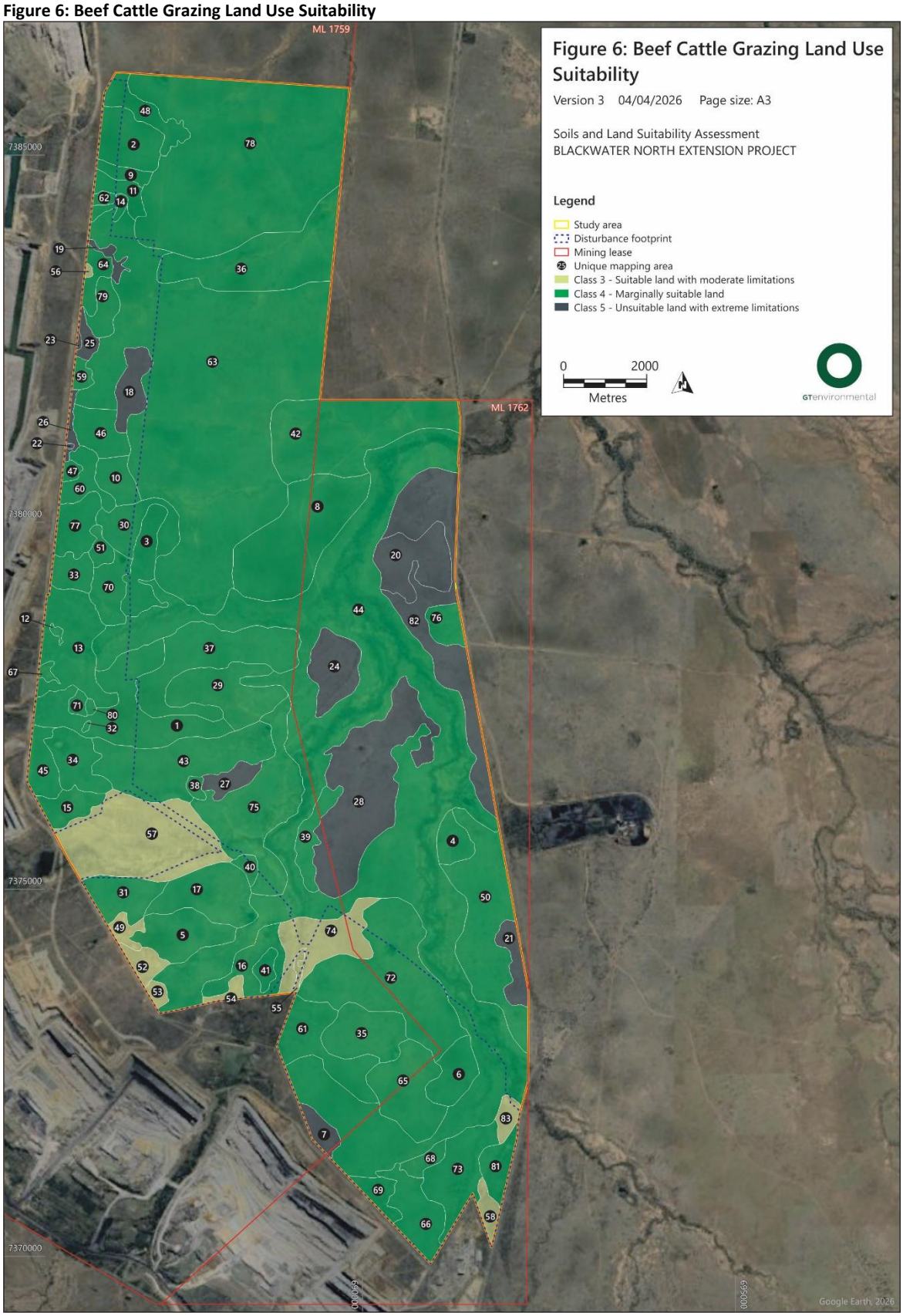
The assessment is presented in Appendix I and summarised in Table 6-3. This assessment will assist in determining the limitations for beef cattle grazing and the ALC with the regional frameworks overall class. Land suitability classes for beef cattle grazing is shown in Figure 6.

Table 6-3: SPCs for Beef Cattle Grazing, Suitability Subclasses for Land Uses

Beef Cattle Grazing Assessment	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
Class 3 Agricultural – Suitable land with moderate limitations	11Bl(Ta)	49, 52, 53, 54, 55, 56	345.45	167.23
	12Da(Te)	57, 58		
	18Bl(Ro)	74		
	22Bl(Wy)	83		
Class 4 Agricultural – Marginally suitable land	1Dn(Te),	1	5,931.87	2,065.57
	2Dn(Te)	2, 3, 4, 5, 6, 8		
	3Bl(Te)	9		
	4Bl(Te)	10, 11		
	5Dn(Ro)	13, 14, 15, 16, 17		
	8Dn(Te)	12, 29, 30, 31		
	9Dn(Ro)	33, 34, 36, 37, 38, 39, 40, 41, 42		
	10Ct(Ro)	43, 44, 45, 46, 47, 48		
	11Bl(Ta)	50, 51		
	13Bl(Ta)	59, 60, 61		
	14Bl(Ro)	35		
	15Bl(Ro)	62, 63, 64, 65, 66		
	16Bl(Ta)	32, 67, 68, 69		
	17Bl(Ro)	70, 71, 72, 73		
	19Bl(Ro)	75, 76, 77, 78, 79, 80		
	20Bl(Ro)	81		

Beef Cattle Grazing Assessment	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
Class 5 Agricultural – Unsuitable land with extreme limitations	2Dn(Te)	7	630.28	83.74
	6Bl(Pg)	18, 19, 20, 21, 22, 23		
	7Bl(Pg)	24, 25, 26, 28		
	21Bl(Ta)	82		

Figure 6: Beef Cattle Grazing Land Use Suitability



6.5.3 Regional Frameworks Summaries for Non-Analysed UMAs

As land suitability assessments are not conventionally conducted at such a scale in which additional laboratory analysis is available, the assessment of Class III, Class IV(a) and Class IV(b) sites may be undertaken. This assessment includes reviewing surface conditions such as slope, microrelief, rockiness and soil profile depth in SPC associated UMAs, in which the analysed site is not located.

This provides further accuracy for the Regional Frameworks for cropping and beef cattle grazing and ALC assessment across the study area. These may include SPC phases or variants observed in which a change was observed in an SPC e.g., depth to rock.

To allow for this additional information to be used to assess Land Suitability Classes for the Regional Frameworks, all UMAs will remain assessed as per their SPC analysed site land suitability and ALC unless surface conditions and / or soil profile indicated otherwise.

To provide further context to the information used, from this SALS Assessment and SLR (2023), UMA confidence codes (DES, 2021a and DoR, 2021) provide a qualitative statement in the relative confidence in delineating the spatial extent of a UMA and / or describing its attributes. UMA confidence codes range from one to six, depending on the level of desktop and / or fieldwork undertaken. UMA confidence codes have been applied to each UMA. The land use limitation summaries, review and amended assessment with confidence codes is presented in Appendix J as well on Figures 5, 6 and 7 where applicable. Tables 6-2, 6-3 and 6-6 include the amended results, where applicable of these assessments.

6.5.4 Agricultural Land Class

ALC is based on a simple hierarchical scheme that is applicable across Queensland. It allows the interpreted land evaluation data to indicate the location and extent of agricultural land that can be used for a wide range of land uses with minimal land degradation.

This evaluation scheme has evolved through various guidelines and state planning policies and is currently referenced in the GALE (DSITI and DNRM, 2015). The ALC evaluation scheme is shown in Table 6-4.

Table 6-4: Agricultural Land Classes

ALC	Land Suitability	Description	Number of Land Uses	Suitability Class
Crop Land	A	Land that is suitable for a wide range[1] of current and potential crops with nil to moderate limitations to production.	-	-
	A1	Suitable for a wide range of current and potential broadacre and horticultural[2] crops.	>=4	1-3
	A2	Suitable for a wide range of current and potential horticultural crops only.	>=4	1-3
Limited Crop Land	B	Land that is suitable for a narrow range[3] of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology.	<=3	1-3
Pasture Land	C	Land that is suitable only for improved or native pastures due to limitations that preclude continuous cultivation for crop production. Some areas may tolerate a short period of ground disturbance for pasture establishment.	-	-
	C1	Suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.[4]	n/a	4/5
	C2	Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.	n/a	4/5
	C3	Suitable for light grazing of native pastures in accessible areas and includes steep land more suited to forestry or catchment protection.	n/a	5[7]
Non-Agricultural Land[5]	D	Land not suitable for agricultural use, including land alienated from agricultural use.	n/a	5
Complex Classes	A/C A/D B/C C/D	Land that is a complex of class A, B C or D land where it is not possible to delineate the land class at the map scale. The dominant class is the first code in the sequence and is assumed to be > 50% of the area, but <70%[6].	n/a	-

1. A wide range of crops is four or more crop types of local commercial significance.
2. Horticulture includes intensively grown small crops (e.g., vegetables) as well as tree crops (e.g., grown for nuts, seeds or fruit). Silviculture (plantation forestry) is not included.
3. A narrow range of crops is three or fewer crop types (broadacre or horticulture) of local commercial significance. Silviculture (plantation forestry) may be included. Crops with similar agronomic requirements e.g., maize and grain sorghum, peaches and nectarines are not generally regarded as different crop types. Different management regimes (including irrigation strategies) for the same crop do not increase the number of crops.
4. Class C1 includes brigalow and gidgee lands that are not suitable for cropping.
5. Non-agricultural land includes land that cannot be placed in any of the other land classes and includes land alienated from agricultural use (e.g., urban areas) and land with high order conservation tenure (e.g., national parks). It is noted that the State Forests within the study area have been assessed as part of this SALS Assessment.
6. In cases where two or more land classes are equally dominant and none are > 50%, judgement is used to identify the most appropriate ALC for the unit.
7. Include land uses where the majority are class 5 with the exception of only one land use of class 4.

Table 6-5 lists the outcome of the agricultural land assessment using the ALC evaluation scheme as shown in Table 6-4 and the Land Suitability Classes of each SPC. The ALCs within the study area are shown in Figure 7.

Table 6-5: Agricultural Land Classification Assessment Summary

ALC	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
A - Crop Land	-		0	0
A1 - Crop Land	18Bl(Ro)	74	76.36	54.59
A2 - Crop Land	-		0	0
B - Limited Crop Land	2Dn(Te)	2, 3, 4, 6, 8	810.11	438.27
	5Dn(Ro)	13, 14, 15, 16, 17		
	8Dn(Te)	29, 30, 31		
	20Bl(Ro)	81		
C - Pasture Land	-		0	0
C1 - Pasture Land	4Bl(Te)	10, 11	3,755.39	1,031.45
	9Dn(Ro)	33, 34, 36, 37, 38, 39, 40, 41, 42		
	10Ct(Ro)	43, 44, 45, 46, 47, 48		
	11Bl(Ta)	49, 52, 53, 54, 55, 56		
	12Da(Te)	57, 58		
	19Bl(Ro)	75, 76, 77, 78, 79, 80		
	22Bl(Wy)	83		
	17Bl(Ro)	70, 71, 72, 73		
C2 - Pasture Land	1Dn(Te)	1	2,081.02	774.00
	2Dn(Te)	5		
	3Bl(Te)	9		
	6Bl(Pg)	18, 19, 20, 21, 22, 23		
	7Bl(Pg)	24, 25, 26, 27, 28		
	11Bl(Ta)	50, 51		
	13Bl(Ta)	59, 60, 61		
	14Bl(Ro)	35		
	15Bl(Ro)	62, 63, 64, 65, 66		

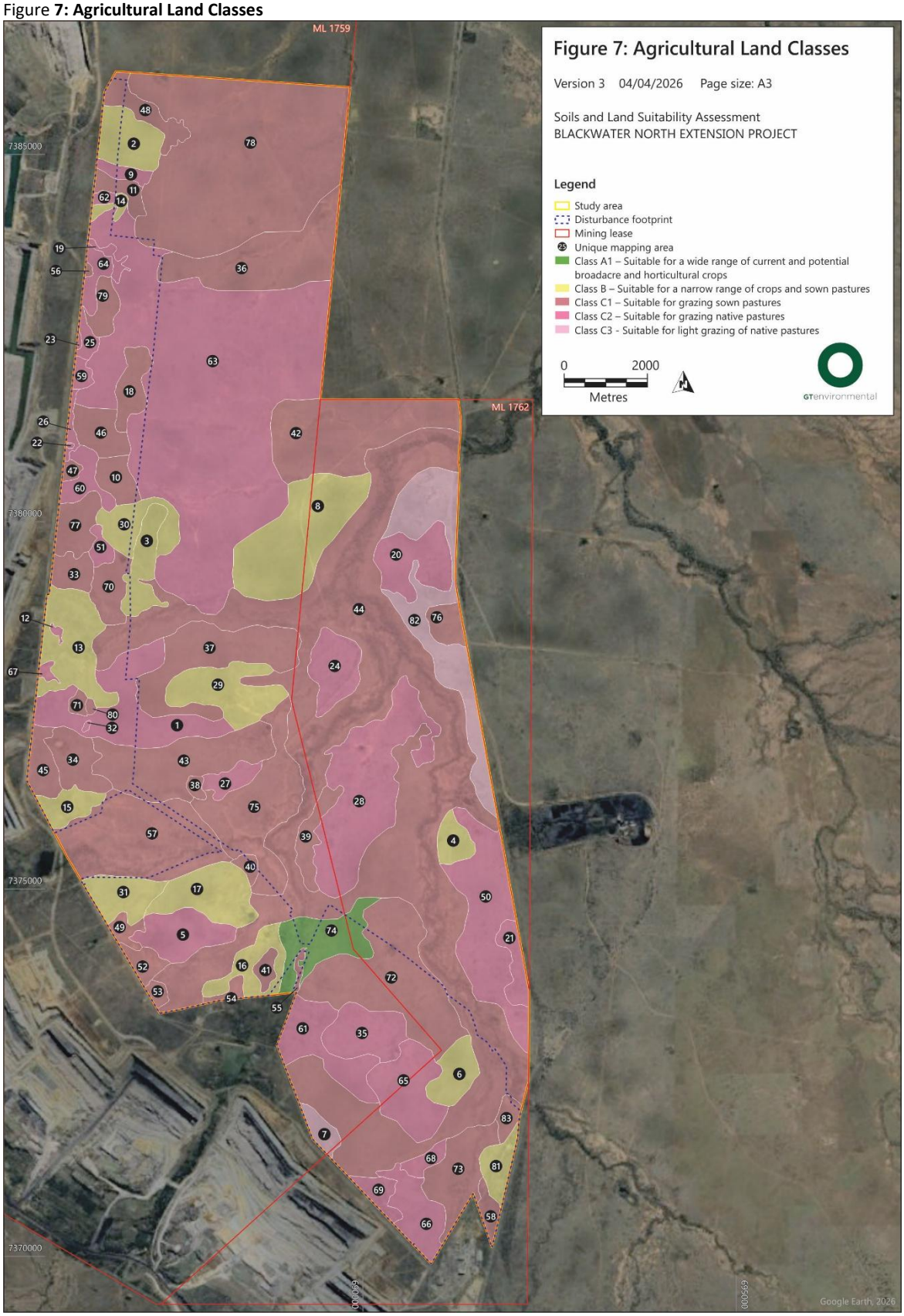
ALC	SPCs	UMAs	Area within the Study area (ha)	Area within the Project area (ha)
	16Bl(Ta)	32, 67, 68, 69		
C3 - Pasture Land	2Dn(Te)	7	184.72	18.23
	21Bl(Ta)	82		
D - Non-Agricultural Land	-		0	0

The assessment of ALC for the study area indicates the following classes:

- Approximately 73.36 ha is ALC A1,
    - Suitable for a wide range of current and potential broadacre and horticultural crops.
- Approximately 810.11 ha is ALC B,
    - Land that is suitable for a narrow range of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology including the availability of water for spray or furrow irrigation.
- Approximately 3,755.39 ha is ALC C1,
    - Suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.
- Approximately 2,081.02 ha is ALC C2,
    - Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
- Approximately 184.72 ha is ALC C3,
    - Suitable for light grazing of native pastures in accessible areas.

ALC A, A2, and D were not mapped within the study area. No areas were designated as disturbed.

Figure **7: Agricultural Land Classes**



7 REGIONAL PLANNING INTERESTS ASSESSMENT

The RPI Act identifies and protects areas of Queensland that are of regional interest. The RPI Act protects each of the following areas of regional interest:

- PLAs,
- SEAs,
- PAAs, and
- SCAs.

The study area was assessed against the SCAs and PAAs.

7.1 Assessment of Strategic Cropping Areas

SCAs consist of the areas shown on the SCL Trigger Map (Queensland Globe, 2026). Land mapped as a SCA is, or is likely to be, highly suitable for cropping due to a combination of the land's soil, climate and landscape features (RPI Act).

Desktop review of the SCL Trigger Map confirmed that no SCA was mapped within the study area. Therefore, an SCA Assessment in accordance with RPI 08/14 was not undertaken.

7.2 Assessment of Priority Agricultural Areas

PAAs are areas of regionally significant agricultural production that are identified in a regional plan. Identifying PAAs ensures that resource activities that seek to operate in these areas do not unreasonably constrain, restrict or prevent on-going agricultural operation.

Identification of PAAs was undertaken for the study area. Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Globe, 2026) confirmed that no PAA was located within the study area.

8 ACID SULFATE SOILS ASSESSMENT

A review of the ASRIS including the Atlas of Australian Acid Sulfate Soils mapping was undertaken. It was identified that most of the study area is shown as the following:

- C4 - Extremely low probability of occurrence, based on very low confidence.

ASS typically naturally occur in low-lying coastal areas below 5 m AHD. The study area is at an elevation of 183 to 227 m AHD and is located approximately 200 km inland from the eastern Queensland coastline.

Fieldworks included field observations for indicators for ASS materials of observation sites for SPCs. These observations have been reviewed against Table 5-1 of the *National Acid Sulfate Soils Guidance, National acid sulfate soils sample and identification methods manual* (Sullivan et al., 2018), and are summarised below in Section 8.1.

8.1 Assessment of Actual and Potential Acid Sulfate Soils

Assessment of study area SPCs for AASS and PASS included the following indicators:

- field pH:
    - AASS, field $pH_F \leq 4$, when field $pH_F > 4$ but < 5 may indicate some existing acidity, and
    - PASS, field $pH_F > 4$ and commonly neutral.
- presence of corroded shell (AASS) or shell (PASS),
- jarositic horizons or substantial iron oxide mottling in surface (AASS),
- a sulfurous smell, e.g., hydrogen sulphide or ‘rotten egg’ gas, and
- dead, dying, stunted vegetation scalded or bare low-lying areas (AASS).

Field pH was initially conducted using a pH indictor kit and meter. Laboratory pH analysis results were also reviewed. All other indicators were visually inspected within the soil profile and field as part of the SALS Assessment. A summary of the SPC assessment is shown in Table 8-1.

Table 8-1: Acid Sulphate Soil Assessment

SPC	AASS / PASS Assessment	Assessment
1Dn(Te)	The pH is moderately alkaline to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	No field indication of PASS. No field indicators of AASS.
2Dn(Te)	The pH is slightly acid to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
3Bl(Te)	The pH is neutral to moderately alkaline. One sample at 1.40-1.50 mbgl was reported to be strongly acidic, between moderately alkaline horizons. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
4Bl(Te)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
5Dn(Ro)	The pH is moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	No field indication of PASS. No field indicators of AASS.
6Bl(Pg)	The pH for the mound position is moderately acid to neutral alkaline. The pH for the depression position is neutral to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
7Bl(Pg)	The pH for the mound position is neutral to moderately alkaline. The pH for the depression position is slightly acidic to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
8Dn(Te)	The pH is neutral to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
9Dn(Ro)	The pH is neutral to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
10Ct(Ro)	The pH is slightly acid to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
11Bl(Ta)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
12Da(Te)	The pH is slightly acid to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
13Bl(Ta)	The pH is moderately alkaline to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	No field indication of PASS. No field indicators of AASS.
14Bl(Ro)	The pH is moderately alkaline to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	No field indication of PASS. No field indicators of AASS.
15Bl(Ro)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
16Bl(Ta)	The pH is neutral to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.

SPC	AASS / PASS Assessment	Assessment
17Bl(Ro)	The pH is slightly acid to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
18Bl(Ro)	The pH is slightly acid to moderately alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
19Bl(Ro)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
20Bl(Ro)	The pH is moderately alkaline to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	No field indication of PASS. No field indicators of AASS.
21Bl(Ta)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.
22Bl(Wy)	The pH is neutral to strongly alkaline. No observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS. No field indicators of AASS.

17 of the 22 SPCs, 2Dn(Te), 3Bl(Te), 4Bl(Te), 6Bl(Pg), 7Bl(Pg), 8Dn(Te), 9Dn(Ro), 10Ct(Ro), 11Bl(Ta), 12Da(Te), 15Bl(Ro), 16Bl(Ta), 17Bl(Ro), 18Bl(Ro), 19Bl(Ro), 21Bl(Ta) and 22Bl(Wy), reported pH at slightly acidic to neutral levels within the soil profile.

The remaining indicators (corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils) were not observed, therefore, the assessment indicates very low field indication of PASS, if very unlikely.

The remaining five SPCs, 1Dn(Te), 5Dn(Ro), 13Bl(Ta), 14Bl(Ro) and 20Bl(Ro) presented no field indications of AASS and / or PASS.

This result (i.e., very low field indicators for PASS) is consistent with the desktop review against the Atlas of Australian Acid Sulfate Soils mapping which showed the study area as “Extremely low probability of occurrence”.

It is assessed as highly unlikely the study area includes AASS and / or PASS.

9 SOIL MANAGEMENT MEASURES

9.1 Study Area Disturbance

The study area will have areas of disturbance including but not limited to, open cut mining pits, mine infrastructure laydown areas and associated roads and access tracks.

All SPCs in the study area have been assessed to determine their suitability for topsoil resource stripping and reuse for rehabilitation activities. This information may also be used to provide guidance for Soil and Capping Material Assessment requirements outlined within section 3.6.1 of the PRC Plan Guideline.

9.2 Proposed Post Mine Land Uses

Soil management measures are recommended for the rehabilitation of the disturbance area to the proposed post mine land use (PMLU). The Project area would be rehabilitated to land suitable for beef cattle grazing, or woodland habitat, consistent with the PMLUs described in the Blackwater Mine PRC Plan (Whitehaven, 2025).

Rehabilitation for beef cattle grazing would be undertaken in accordance with the PRC Plan and would involve seeding of native and naturised exotic species, including palatable, productive grasses and legumes, consistent with current grazing best management practices. Recommended soil management measures to achieve rehabilitation would include best practice for stripping, stockpiling and re-application of soil resources.

Woodland habitat may be included within the PMLU with the following recommendations and soil management measures assisting to support this re-establishment of vegetation communities.

Further recommendations, as discussed below, have been included to allow additional options such as organic matter and fertiliser application if the initial or ongoing rehabilitation is not achieving the desired outcome.

9.3 Topsoil Resource Assessment and Availability

Topsoil resource stripping depths for growth media have been assessed by depth of surface horizons which includes the quality of soil, nutrients for vegetation establishment and growth, as well as the properties of underlying subsoils (A12, A2 and B horizons) which may be similar, suitable or not suitable to include within the soil resource. This assessment also considers all relevant soil observations and laboratory data collected from the SPCs (e.g., soil texture, soil structure, pH, chloride, CEC, potential for dispersive attributes based on ESP and EAT, and fertility indicators).

Technical Guidelines for Environmental Management of Exploration and Mining in Queensland (DME, 1995), *Mine Rehabilitation, Leading Practice Sustainable Development Program for the Mining Industry* (Australian Government, 2016), Perry et al. (1964), and *Mine Rehabilitation Handbook* (Minerals Council of Australia, 1998) were reviewed with the field and laboratory results in assessing topsoil resource quality and quantity.

In summary, topsoil resources from the majority of SPCs are suitable for reuse as topsoil in rehabilitation activities, as shown in Table 9-1.

Topsoil in the study area in general was moderately structured, with very low to very high fertility consisting of moderately deep to very deep clay soils. 16 of the 22 SPCs had sodic subsoils which may have an impact on soil resource stripping and management.

Topsoil within these SPCs may require additional management and input (including amelioration and selective handling and storage) prior to use during rehabilitation as described in Table 9-1.

9.4 Recommended Topsoil and Subsoil Stripping Depths, Limitations and Volumes

Table 9-1 provides the recommended stripping depth, suitability for reuse in PMLU rehabilitation, identified limitations, management recommendations within each applicable SPC and approximate volume of topsoil available. The volumes of topsoil shown are calculated based on areas of SPC which intersect the disturbance area.

Table 9-2 provides a summary of recommended stripping depths and available topsoil volumes for major project components, which supports the PRC Plan (Whitehaven, 2025) in identifying topsoil quality, quantity and topsoil depth requirements. Topsoil is a valuable growth medium layer for rehabilitation and the establishment of the potential PMLUs. An assessment of the suitability of subsoil for use as a growth medium and capping material was also undertaken.

Further discussion of key limitations and management requirements is provided in Section 9.5. It is recommended that these sections be reviewed in conjunction with Table 9-1. The topsoil stripping depths are shown in Figure 8.

Table 9-1: Recommended Topsoil Stripping Depths, Limitations, Management Measures and Available Volumes

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
1Dn(Te)	0.00-0.20	0.20-0.40	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.
2Dn(Te)	0.00-0.10	0.10-1.00	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are favourable for topsoil with very high phosphorus levels. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 1.00 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
3Bl(Te)	0.00-0.20	0.20-0.80 / 0.80-1.60	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.80 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.80 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 15.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.40 mbgl.
4Bl(Te)	0.00-0.20	0.20-0.60 / 0.60-1.20	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.60 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.60 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 12.6 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.00 mbgl.
5Dn(Ro)	0.00-0.20	0.20-0.45 / 0.45-0.60	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.45 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.45 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 9.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.50 mbgl.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
6Bl(Pg)	0.00-0.20	0.20-1.80	Yes / Subsoil has recommendations	Topsoil Topsoil recovery may be difficult with the undulating nature of gilgai areas. Care is recommended when stripping the topsoil as to avoid mixing with sodic subsoils. Otherwise, gypsum application may be required, refer to subsoil recommendation below. Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.20 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 14.7 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels of the depression location at 0.80 mbgl.
7Bl(Pg)	0.00-0.15	0.15-0.50 / 0.50-1.45	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil recovery may be difficult with the undulating nature of gilgai areas. Care is recommended when stripping the topsoil as to avoid mixing with sodic subsoils. Otherwise, gypsum application may be required, refer to subsoil recommendation below. Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported moderate levels of phosphorus. The soils of this SPC have the highest levels reported at 11 mg/kg. If the PMLU has not been achieved, topsoil may respond to an application of fertiliser. Subsoil Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below this 0.40 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 17.9 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels of the mound location at 0.80 mbgl.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
8Dn(Te)	0.00-0.05	0.05-0.50 / 0.50 – 0.90	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Topsoil horizon is shallow, however, refer to subsoil for additional recommendations. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.50 mbgl may be stripped to this depth and utilised as topsoil. Subsoil below 0.50 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 11.2 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.50 mbgl.
9Dn(Ro)	0.00-0.10	0.10-1.40	Yes / Subsoil has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.10 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 16.3 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.80 mbgl.
10Ct(Ro)	0.00-0.10	0.10-1.80	Yes / Subsoil has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.10 mbgl may benefit from gypsum application due to extremely sodic levels. SodiCalc (2026) recommends approximately 15 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
11Bl(Ta)	0.00-0.20	0.20-1.00	Yes / Subsoil has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.20 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 11.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.
12Da(Te)	0.00-0.20	0.20-0.90	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are favourable for topsoil with very high phosphorus levels. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are low, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.90 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.
13Bl(Ta)	0.00-0.20	0.20-1.40 / 1.40-1.70	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are low, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 1.40 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 1.40 mbgl may benefit gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 6.8 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.40 mbgl.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
14Bl(Ro)	0.00-0.20	0.20-0.50 / 0.50-1.90	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are low, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.50 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 0.50 mbgl may benefit gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 0.00 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.00 mbgl. Based on this calculation, no treatment is required. If visual observations of sodic soils are observed, an application of 2.5 t/ha may be adequate.
15Bl(Ro)	0.00-0.20	0.20-0.60 / 0.60-0.90	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are low, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.60 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 0.60 mbgl may benefit gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 17.1 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.80 mbgl.
16Bl(Ta)	0.00-0.10	0.10-0.40	Yes / Subsoil has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below this 0.40 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 4.6 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.10 mbgl.

SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
17Bl(Ro)	0.00-0.10	0.10-1.20	Yes / Subsoil has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below 0.10 mbgl may benefit from gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 5.0 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.50 mbgl.
18Bl(Ro)	0.00-0.20	0.20-1.00	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 2.00 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.
19Bl(Ro)	0.00-0.20	0.20-1.40 / 1.40-2.20	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported very low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are low, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 1.40 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil. Subsoil below 1.40 mbgl may benefit gypsum application due to sodic levels. SodiCalc (2026) recommends approximately 9.3 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 1.70 mbgl.

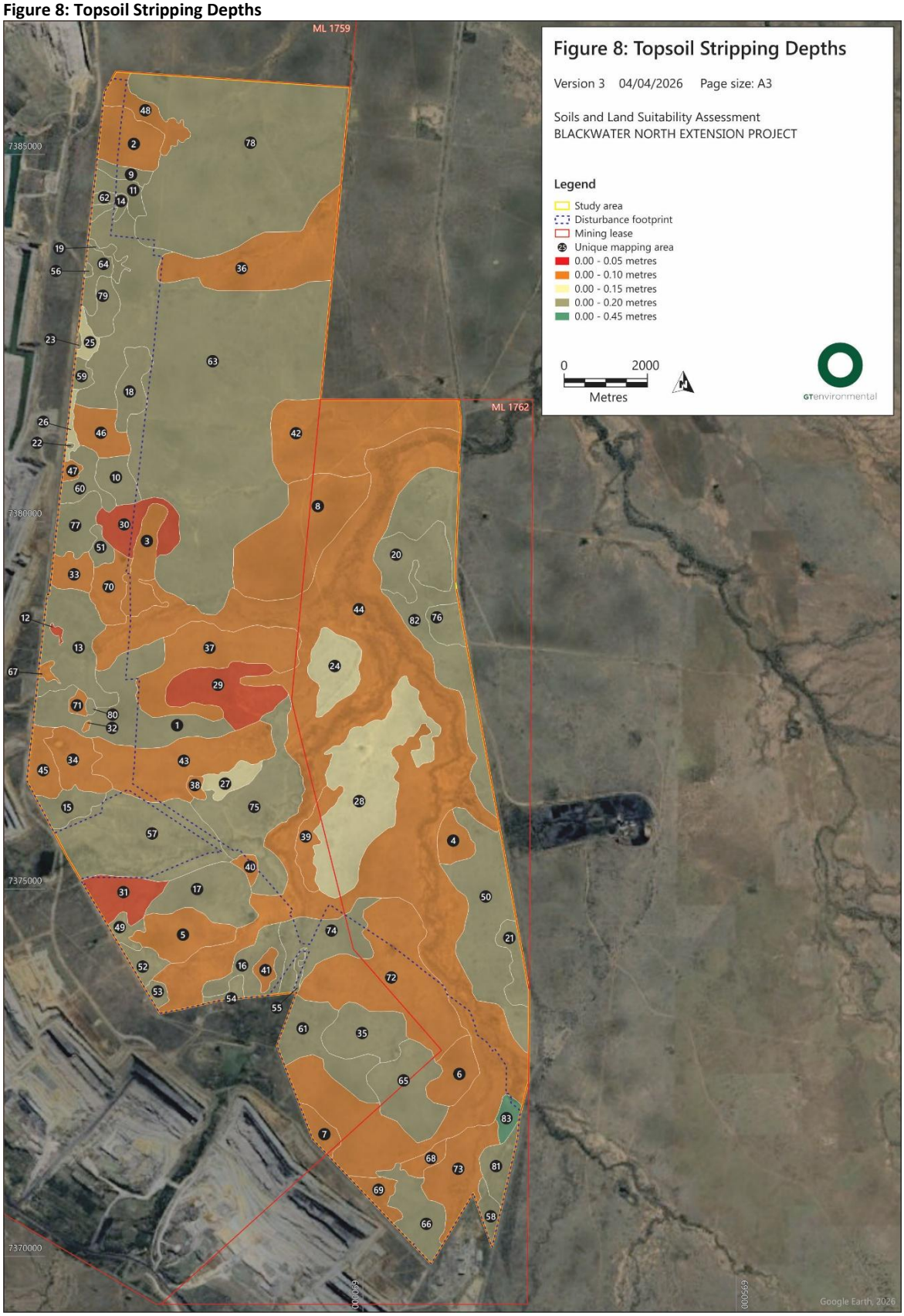
SPC	Topsoil Depth (mbgl)	Subsoil Depths (mbgl)	Suitable for Rehabilitation	Limitations and / or Recommended Amelioration and Management Measures
20Bl(Ro)	0.00-0.20	0.20-0.80	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.80 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.
21Bl(Ta)	0.00-0.20	0.20-0.45 / 0.45-1.80	Yes / Subsoil second strip depth has recommendations	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil resource may be recommended for use on flat to sloped (may benefit from treatment) areas, to support the placement of topsoil. Subsoil below 0.45 mbgl may benefit from gypsum application due to strongly sodic levels. SodiCalc (2026) recommends approximately 7.4 t/ha for each 0.10 m to achieve ESP of 5.5, based on the highest sodic levels at 0.90 mbgl.
22Bl(Wy)	0.00-0.45	0.45-1.00	Yes	Topsoil Topsoil resource may be recommended for use on flat to sloped areas. Fertility attributes are low for topsoil with reported low levels of phosphorus. Topsoil may respond to an application of fertiliser, if the PMLU has not been achieved. Subsoil Subsoil may be considered as a secondary topsoil, due to minor to no major limitation. Fertility attributes are not favourable, however, mixing with other suitable, fertile soil or treatment with organic matter and / or fertiliser may increase its suitability. Subsoil to 0.45 mbgl may be stripped to this depth and utilised as topsoil. Subsoil resource may be recommended for use on flat to sloped areas, to support the placement of topsoil.

Table 9-2: Available Topsoil and Subsoil Volumes within the Proposed Disturbance Area

SPC	Area (ha) within the proposed disturbance area	Available Topsoil Volume (Cubic metres [m³])	Available Subsoil Volume (m³) Double Stripping[1]	Available Subsoil Volume (m³) Treated Subsoil
1Dn(Te)	82.69	165,380	165,380	0
2Dn(Te)	147.06	147,060	1,323,540	0
3Bl(Te)	4.51	9,020	27,060	36,080
4Bl(Te)	34.47	68,940	137,880	206,820
5Dn(Ro)	242.45	484,900	606,125	363,675
6Bl(Pg)	45.46	90,920	0	727,360
7Bl(Pg)	20.05	30,075	70,175	190,475
8Dn(Te)	73.92	36,960	332,640	295,680
9Dn(Ro)	93.53	93,530	0	1,215,890
10Ct(Ro)	431.00	431,000	0	7,327,000
11Bl(Ta)	63.77	127,540	0	510,160
12Da(Te)	48.03	96,060	336,210	0
13Bl(Ta)	115.90	231,800	1,390,800	347,700
14Bl(Ro)	66.77	133,540	200,310	934,780
15Bl(Ro)	321.19	642,380	1,284,760	963,570
16Bl(Ta)	40.06	40,060	0	120,180
17Bl(Ro)	312.81	312,810	0	3,440,910
18Bl(Ro)	54.59	109,180	436,720	0
19Bl(Ro)	76.56	153,120	918,720	612,480
20Bl(Ro)	28.92	57,840	173,520	0
21Bl(Ta)	0	0	0	0
22Bl(Wy)	12.80	57,600	70,400	0
Total	**2,316.54**	**3,519,715**	**7,474,240**	**17,292,760**

1. Double stripping of the nominated SPC subsoils may be used to bolster topsoil volumes, as assessed in Table 9-1

Figure 8: Topsoil Stripping Depths



9.5 Soil Amelioration and Management

As discussed in Table 9-1, there are identified limitations for some SPCs which will benefit from amelioration and management to improve the topsoil resource quality.

These limitations are linked to generally neutral to moderately alkaline pH, sodic or dispersive soils, poor surface soil structure, low fertility indicators, low CEC or potentially firm to hard-setting surfaces restricting seedling emergence.

Any recommended amelioration undertaken on a topsoil or subsoil resource should be monitored to ensure the objective of the treatment has been met. The following sections look to provide further details for the management of these limitations.

9.5.1 pH Amelioration

Soil pH surface levels across the SPCs are generally neutral to moderately alkaline with subsoils ranging from strongly acid (3Bl(Te), Site D5, 1.40-1.50 mbgl) to moderate to strongly alkaline in general for subsoils. Sites D6, D36 and D59 have alkaline subsoils (pH > 9.0), which based on their soil classification have been assessed as an ERD chemical barrier.

Soils with these pH values in the strongly acidic (pH < 5.5) or strongly alkaline (pH > 9.0) range are associated with reduced availability of nutrients or root growth inhibition. Observations on site indicated vegetation species in the study area appeared to be healthy during all five fieldworks periods.

The Suitability of Beef Cattle Grazing (DME, 1995) limitation for pH indicates that surface soils are suitable (Class 2 and 3) with none assessed as unsuitable (Class 4 or 5).

Overall, pH amelioration is not recommended for the SPCs in the study area for the reestablishment of native vegetation, however, any use of organic matter and / or fertilisers for rehabilitation activities may alter a soils' pH.

9.5.2 Salinity Amelioration

Salinity within soils and potential crop land uses has been presented in Appendix K as plant yield % and plant salt-tolerance data (DERM, 2011). Based on the application of rainfall to all nine crop land uses (Section 4.4), SPCs have 100% plant yield, except for Safflower where results provided were assessed as not consistent when compared to all other land uses, which were. The plant salt-tolerance data comparison does show that 22 SPCs have potential reduced yield % within a rooting depth of 0.60 m.

It is noted that elements such as EC, Chloride and Sodium are transient and will change following disturbance, stockpiling, mixing (with other less salty subsoil) and weather exposure as well as application of good quality irrigation water.

Based on this assessment, no amelioration is recommended.

9.5.3 Sodicity / Dispersion Amelioration

ESP indicates the proportion of the CEC occupied by exchangeable sodium cations. Soils with elevated ESP may be prone to disperse on contact with water and can provide unfavourable soil conditions such as surface crusting, low infiltration, hard and dense subsoils and susceptibility to erosion.

The general rating for ESP, as outlined in Appendix D, indicates that 6 to 15 are sodic, 15 to 20 are strongly sodic and > 20 are extremely sodic. The nominated topsoil stripping depths, include recommended soil management measures (application of gypsum) for soil resources that are observed as sodic to extremely sodic.

ESP results are assessed in conjunction with ECEC and clay content (%), where if a result reports ECEC < 3 cmol(+)/kg or < 15% clay, ESP results could not be relied upon as an indicator for sodicity.

Table 9-3 summaries the ESP of subsoils for each SPC.

Table 9-3: SPC Topsoil and Subsoil ESP Assessment

Subsoil Sodicity	Subsoil Profile – Lowest EAT Class
Non-Sodic Subsoils	1Dn(Te), 2Dn(Te), 12Da(Te), 18Bl(Ro), 20Bl(Ro) and 22Bl(Wy)
Sodic Subsoils	5Dn(Ro), 6Bl(Pg), 7Bl(Pg), 13Bl(Ta), 14Bl(Ro), 16Bl(Ta) and 17Bl(Ro)
Strongly Sodic Subsoils	3Bl(Te), 4Bl(Te), 8Dn(Te), 9Dn(Ro), 11Bl(Ta), 15Bl(Ro), 19Bl(Ro) and 21Bl(Ta)
Extremely Sodic Subsoils	10Ct(Ro)

It is recommended that these soil resources, where suitable, may benefit from an application of fine grade gypsum to be used on sloped surfaces and stockpiling of these SPC's subsoils be kept separate from the remaining SPC's subsoil stockpiles. Additional information is recommended in Section 9.6.

A review of the SPCs for EAT classes indicated some SPCs had dispersion throughout the soil profile. The following indicates the SPCs and their lowest EAT classes for topsoil and subsoil, as summarised below in Table 9-4.

Table 9-4: SPC Topsoil and Subsoil EAT Assessment

SPC	Topsoil – EAT Class	Subsoil Profile – Lowest EAT Class
1Dn(Te)	Class 4 – No dispersion. Carbonate and Gypsum present	Class 2 – Some Dispersion
2Dn(Te)	Class 3 – Dispersion after remoulding	Class 4 – No dispersion. Carbonate and Gypsum present
3Bl(Te)	Class 2 – Some Dispersion	Class 2 – Some Dispersion
4Bl(Te)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
5Dn(Ro)	Class 4 – No dispersion. Carbonate and Gypsum present	Class 2 – Some Dispersion
6Bl(Pg)	Class 2 – Some Dispersion	Class 2 – Some Dispersion
7Bl(Pg)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
8Dn(Te)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
9Dn(Ro)	Class 4 – No dispersion. Carbonate and Gypsum present	Class 2 – Some Dispersion
10Ct(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion

SPC	Topsoil – EAT Class	Subsoil Profile – Lowest EAT Class
11Bl(Ta)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
12Da(Te)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
13Bl(Ta)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
14Bl(Ro)	Class 4 – No dispersion. Carbonate and Gypsum present	Class 2 – Some Dispersion
15Bl(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
16Bl(Ta)	Class 2 – Some Dispersion	Class 2 – Some Dispersion
17Bl(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
18Bl(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
19Bl(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
20Bl(Ro)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
21Bl(Ta)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion
22Bl(Wy)	Class 3 – Dispersion after remoulding	Class 2 – Some Dispersion

Further information for SPCs, amelioration and recommended soil depths is provided in Table 9-1.

9.5.4 Fertiliser Amelioration

SPCs were observed in general to have low to very high fertility indicators of macronutrients phosphorus and varying levels of available nitrogen, potassium, calcium, magnesium and sulfur levels.

Native vegetation and some introduced pasture species are adapted to low nutrient levels and in general, it may not be required to apply fertiliser where the PMLU relies on native vegetation establishment.

As detailed in Table 9-1, SPCs which may benefit from an application of fertiliser include all SPCs except 2Dn(Te), however, fertiliser application would be more appropriate during final soil replacement and seed bed preparation and any of the following recommendations are a guide only. It is recommended that appropriate fertiliser rates be determined through rehabilitation trials prior to the commencement of full-scale rehabilitation.

If an application of fertiliser is required, it is recommended that the laboratory analysed nutrient levels be reviewed against target nutrient levels for the nominated PMLU prior to removal of soils from stockpiles.

Typical application rates indicate that levels of nitrogen fertiliser of between 100 to 450 kilograms per hectare (kg/ha) may be appropriate, however, for native woodlands an initial application of 20 kg/ha may be more suitable. Nitrogen fertilisers such as Urea, Monoammonium phosphate (MAP) and Diammonium phosphate (DAP) are considered general fertilisers to use to boost nutrient levels.

Neutralising lime may be recommended with these fertilisers if pH levels reduce to 5.5 or below, however, this is unlikely based on pH rates of the SPCs of the study area. Typical application rates of neutralising lime for fertilisers such as MAP and DAP may be approximately 5.4 and 3.6 kilograms (kg) for every 1 kg of Nitrogen (Fertiliser Industry Federation of Australia Inc., 2006).

Phosphorus fertilisers which may not require any additional amelioration include single and triple super phosphate.

As stated above, application of any fertiliser should be approached with caution as it may be costly and create limitations such as acidic soil conditions, contaminated runoff or encourage weed growth. Soil sampling and analysis of proposed rehabilitation soil resources throughout the life of the mine to assess potential fertiliser application is recommended. Other variables such as slope of landform, soil texture, structure, surface and vegetation for PMLU may be considered prior to any application of fertiliser.

Amelioration and use of fertilisers is only recommended as an option if the desired outcome of the PMLU has not been achieved with all other avenues undertaken.

9.5.5 Organic Matter Amelioration

Organic matter incorporated into the topsoil would increase organic levels, improve soil structure, increase CEC, reduce erosion as well as increase water holding capacity. SPCs which may benefit from amelioration with organic matter are generally sandier, firm setting soils with low CEC and PAWC such as 22Bl(Wy) (Very low surface CEC), 12Da(Te) (Low surface CEC), 17Bl(Ro) (Low surface CEC) and 21Bl(Ta) (Low surface CEC).

It is recommended, where possible, to utilise an organic matter source generated from land clearing or stripped vegetation, where it is near the rehabilitation area and readily available. The application may depend on the vegetation type whether native species or if the desired PMLU outcome is establishing a pasture or crop, as incorporation of weed seed should be avoided. It is also noted that timing between clearing of vegetation and the commencement of rehabilitation may render organic matter unavailable. The establishment of vegetation cover on stockpiled areas may assist in providing organic matter.

The suppliers and source of material should be reviewed prior to use in the study area. A review of suppliers should include if they comply with Australian Standard (AS) AS 4454-2021 (Composts, soil conditioners and mulches). Suppliers complying with this AS will provide confidence that the product they are supplying will not include the introduction of weeds to the study area.

Where available and cost effective, the following application rates may be considered if the desired PMLU outcome has not been achieved:

- manure may be applied at a rate of between 5-30 t/ha for small to large feedlots for cattle grazing, depending on the type of manure (Tucker et al., 2015),
- compost may be applied at 70-150 t/ha (Kelly, 2006),
- biosolid application may be applied at recommended application rate of 50 dry t/ha for amelioration of compacted soils (Kelly, 2006).

The application of organic matter should be treated as per fertiliser amelioration, where it is only recommended as an option if the desired outcome of the PMLU has not been achieved with all other avenues undertaken.

9.6 Topsoil Recovery, Storage and Placement Recommendations

The following subsections are a general guide to the recovery, storage and placement of topsoil and subsoil resources.

9.6.1 General Topsoil Stripping Management

The following are recommended general management procedures for topsoil stripping activities, which also include handling measures to retain soil attributes for rehabilitation:

- HSE Environmental representatives, supervisors and competent operators should be familiar with the areas to be stripped based on existing soils mapping and recommended topsoil stripping depth.
- Current weather forecast should be checked prior to stripping of soils to reduce exposure of bare sodic, erosive soils and sediment runoff.
- If a Permit to Disturb (PTD) is required, then this shall be compiled and submitted with the proposed plan of disturbance, with approval received before commencing.
- All soil resource stripping shall be undertaken in accordance with relevant Environmental Authority and PTD
- Vegetation clearing should occur immediately prior to stripping. This will reduce the loss of topsoil and mixing with unsuitable soils and potentially reclaimed mulch. Vegetation removed may be stockpiled and reused as mulch if handled as appropriate and depending on the vegetation type with respect to the desired post-mining land use, as well as the presence of any problem weed species.
- Suitable machinery, shall comply with onsite procedures including, but not limited to, weed and feral animal management. Machinery shall be utilised in recovering topsoil and subsoil resources such as GPS assisted scrapers or dozers. Stripping and ripping should be undertaken with care to reduce the mixing of subsoils during topsoil stripping.
- Inspections of the stripped areas should be undertaken to observe any unexpected changes in soils. Inspections should occur where it is suspected that subsoils are present in the stripped topsoil based on a change in texture, soil colour and unexpected change in stripping depth. Stripping of SPCs identified with chemical barriers in subsoil such as sodic impacted subsoils should be supervised. Inspection of the stripped areas should be undertaken and if possible, surveying of the area to obtain volumes removed from the SPC.
- Stripping of topsoil and subsoils shall be undertaken in accordance with the recommendations outlined within this SALS Assessment. The collection of subsoil at increased depths as an alternative growth media may not be allowed due to the possibility of including highly sodic and dispersive subsoils.

- Areas of land upgradient and downgradient of soil stripping activities, low-lying areas or areas of observed runoff should have suitable erosion and sediment control measures in place such as clean water diversion bunds, sediment-affected water diversion bunds and / or sediment fencing prior to construction commencing.
- Topsoil suspected of being mixed with subsoils should be either resampled and analysed as the current stockpile or separated from topsoil and placed with the appropriate subsoil stockpile.
- Application of gypsum may be considered during this phase, as the earlier integration of amelioration will assist in the future reuse of sodic, impacted soils.

9.6.2 Stockpiling Management

The following are recommended general procedures for stockpile management:

- Topsoil and subsoil (not suitable for double stripping) materials should be stockpiled separately with records maintained of the material's origin in a topsoil inventory.
- Stockpile locations should be placed in areas outside the mining activities, as close to the area to be rehabilitated as possible and away from drainage lines. These include, in order of prioritisation, directing into a rehabilitation area, stockpiled on top of dump near rehab slope, low wall close to toe of dump, low wall in available locations or the high wall.
- Any known sloped areas, natural drainage pathways such as overland flow and drainage lines as well as high traffic areas should be avoided.
- The stockpiles should have appropriate measures in place to prevent erosion.
- Where possible, stockpile locations should be placed against existing vegetated areas to function as a buffer, or adjacent to any rise in landscape to provide protection from wind erosion.
- Adequate erosion and sediment control including but not limited to sediment fencing, shall be placed on the down slope area of stockpiles.
- Locations are to be designated off limits by remaining grazing stock, machinery and vehicles.
- Locations should be placed in areas where it may assist future rehabilitation reuse, i.e., near nominated project components to reduce movement of materials, where possible.
- Stockpiles should have a maximum height of 3.0 m, preferably 2.0 m with a batter recommended no steeper than 3 h : 1 v (horizontal run to vertical rise). Stockpiles required to be more than 3.0 m in height shall require additional erosion and sediment controls and ideally be temporary stored.
- The surface of the stockpile should be flat.
- The installation of plastic lined catch drains or runoff areas along the surface edge of waste or elevated landforms may assist in minimising surface runoff on batter slopes.

- Covering of the stockpiles with grasses or groundcover species appropriate to the nominated PMLU would minimise erosion and soil loss, minimise the establishment of weeds, assist in maintaining organic matter, nutrients and microbial activity and rejuvenate native vegetation through existing seedbank.
- Stockpiles consisting of dispersive subsoils (refer Section 9.5.3) may require further management to reduce sediment loss and erosion. Management recommendations may include:
    - reducing the stockpile batter to 2 h : 1 v;
    - application of fine grade gypsum at the recommended 'worst case' amount, as listed for the SPCs to be stockpiled across the surface of the stockpile; and
    - covering of the stockpile surface and batters with a product such as hydro mulch, polymer or coirweb.
- An inspection of the stockpiles should occur once they are completed with scheduled ongoing maintenance as required.

9.6.3 Topsoil Reinstatement and Placement Depth

The following are general procedures recommended for the reinstatement of topsoil:

- Review of the topsoil and subsoil resource material. SPCs that are potentially dispersive or erosive are recommended for placement on flat plains to slopes up to 10% if possible.

  If placement of topsoil or subsoil resources that are potentially dispersive or erosive is on steeper slope or visual observation during the pre-strip indicates erosive attributes such as hard-setting surfaces, an application of gypsum may be recommended.

  However, if clay content percentage is low (< 20%), gypsum may not improve the soil stability.
- Subsoil resource material should be recovered from the subsoil stockpiles and placed initially prior to topsoil resource material.
- Topsoil resource material ideally should be recovered from the stockpiles closest to the disturbance area. This would reduce handling time, haul distance of topsoil resource materials, movement of plant and machinery and ensure that placement work may occur in the shortest period (i.e., reduce exposure to rainfall events).
- Topsoil should be placed in even layers at the recommended depths to ensure enough coverage and soil to re-establish vegetation.
- Sediment and erosion controls are to be utilised to ensure that loss of soil resources is minimal and product can be recovered.
- Inspection and maintenance of rehabilitation areas are to be undertaken to ensure erosion and sediment control measures are performing as constructed. Measures are to be outlined within the Projects Erosion and Sediment Control Plan (ESCP) as detailed in Section 9.6.4.

- Topsoil should be inspected prior to reinstatement for invasive vegetation (plants and weeds) and should be controlled.
- Inspections are to be recorded, including any issues and improvements, to ensure soil resource application is appropriate across all rehabilitated areas.
- Topsoil placement depth across areas requiring rehabilitation is recommended at a depth of 0.15 to 0.20 m with a minimum depth of 0.10 m. In general, subsoils placed underneath and supporting topsoil with a recommended horizon of 0.20-0.60 m. This is to allow sufficient depth for shallow scarifying and ripping of topsoils (if required) and vegetation establishment.
- The preparation of the surface, whether it includes ripping, seeding and / or adding amelioration treatments should occur during one operation to minimise compaction and surface structure degradation.
- The application rate and method if a fertiliser is to be used should be reviewed and understood by the operator and supervisor.
- After the placement of topsoil, additional seeding should be used to assist with encouraging suitable vegetation regrowth.
- The application of good quality, irrigation water to the soil should be used to assist in the leaching of salts throughout the profile. This would assist in the establishment of vegetation, especially in potential future application of pastures or crop land uses.

9.6.4 Erosion and Sediment Control Plan

The *BWM Erosion and Sediment Control Plan* (Whitehaven, 2022) has been prepared for the approved BWM, in accordance with the International Erosion Control Association's (IECA's) 'Best Practice Erosion and Sediment Control' document (IECA, 2008).

The BWM ESCP would be reviewed and updated, where necessary, to ensure the Project achieves:

- no worsening of the existing levels of soil loss from the land in or downslope of the study area;
- no increased risk of erosion, or other land degradation, on land or in waterways downslope of the study area; and
- no net increase in the sediment load leaving the study area and entering waterways and / or watercourses.

The BWM ESCP should be reviewed to accommodate any ongoing need for erosion and sediment control for all aspects of the Project.

10 CONCLUSION

The key conclusions of the SALS Assessment are as follows:

- 22 SPCs across 83 UMAs are present in the study area.
    - Soils range from shallow clay loam soils, sodic subsoil clays texture contrast soils to structured, moderate to very deep clay soils to clays with microrelief on limited to completely cleared, level to gently undulating plains and rises.
    - SPCs have been classified in four of the 14 ASC orders including Dermosol, Kandosols, Sodosol and Vertosols.
- The suitability framework of each SPC was assessed against the nominated Regional Frameworks (DSITIA and DNRM, 2013) for the Inland Fitzroy and Southern Burdekin Area land uses. These land uses include dryland and furrow irrigated barley, chickpea, cotton, maize, millet, mungbean, oat, safflower, sorghum, soybean, sunflower, triticale and wheat.
    - One SPC, 18Bl(Ro) has been identified as being able to support crop land uses for cotton, maize, mungbean, safflower, sorghum, soybean and sunflower.
    - Three SPCs, SPCs 2Dn(Te), 8Dn(Te) and 20Bl(Ro) can support cotton.
    - All of the remaining SPCs and UMAs as follows are unsuitable and presented severe or extreme limitations with respect to supporting crop land uses. 2Dn(Te) (UMA 5), 3Bl(Te), 4Bl(Te), 8Dn(Te) (UMA 12), 9Dn(Ro), 10Ct(Ro), 11Bl(Ta), 12Da(Te), 14Bl(Ro), 15Bl(Ro), 17Bl(Ro), 19Bl(Ro), (UMAs 50,51) 16Bl(Ta), 21Bl(Ta) and 22Bl(Wy).
    - The remaining two SPCs, Tm(4Rv) and Tm(11Rv) presented severe or extreme limitations with respect to supporting crop land uses.
    - The suitability of nominated pastures was also assessed, with eight SPCs (Wn(1Rv), Bk(2Rv), Bk(5Rv), Bk(6Rv), Bk(7Rv), Bk(8Rv), Bk(9Rv), Wn(10Rv)) identified as being able to support one pasture land use.
    - The remaining three SPCs, (Nm(3Rv), Tm(4Rv) and Tm(11Rv)) presented severe or extreme limitations with respect to supporting crop land uses.
- The SPCs were assessed against Suitability for Beef Cattle Grazing LSAT (DME, 1995) with reference for beef cattle grazing in the *Land resource survey and evaluation of the Kilcummin area, Queensland* (Shields and Williams, 1991). This assessment assists in determining the limitations for beef cattle grazing. The following SPCs and specific UMAs were assessed:
    - SPCs 11Bl(Ta), 12Da(Te), 18Bl(Ro) and 22Bl(Wy) were assessed as Class 3, suitable land which is moderately suited to beef cattle grazing but which requires significant inputs to ensure sustainable use,
    - SPCs 2Dn(Te), 3Bl(Te), 4Bl(Te), 8Dn(Te), 9Dn(Ro), 10Ct(Ro), 11Bl(Ta) (UMAs 50,51) 14Bl(Ro), 15Bl(Ro), 16Bl(Ta), 17Bl(Ro), 19Bl(Ro) and 20Bl(Ro) were assessed as Class 4,

marginally suited for beef cattle grazing and would require major inputs to ensure sustainability,, and

- SPCs 2Dn(Te) (UMA 7) and 21Bl(Ta) were assessed as Class 5, unsuitable land with extreme limitations in which the land is unsuited and cannot be sustainably used for a proposed agricultural use.

- The assessment of ALCs across the study area based on the Regional Frameworks, additional land use limitations and beef cattle grazing classes indicated the following:
  - Approximately 73.36 ha is ALC A1, assessed as suitable for a wide range of current and potential broadacre and horticultural crops.
  - Approximately 810.11 ha is ALC B, assessed as land that is suitable for a narrow range of crops. The land is suitable for sown pastures and may be suitable for a wider range of crops with changes to knowledge, economics or technology including the availability of water for spray or furrow irrigation.
  - Approximately 3,755.39 ha is ALC C1, assessed as suitable for grazing sown pastures requiring ground disturbance for establishment; or native pastures on higher fertility soils.
  - Approximately 2,081.02 ha is ALC C2, assessed as suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.
  - Approximately 184.72 ha is ALC C3, assessed as suitable for light grazing of native pastures in accessible areas.
  - ALC A, A2, and D were not mapped within the study area. No areas were designated as disturbed.
  - Soil assessed as suitable for potential cropping land may be impacted as part of the disturbance (approximately 492.86 ha, 7.6% of the disturbance footprint), however the assessed cropping land is currently been used as cattle grazing (pre mine land use). The rehabilitation of soils to support the PMLU of beef cattle grazing indicates that soils are likely to still support the potential agricultural land uses such as cropping in the future, if agricultural land uses were to change.
- The RPI Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The study area was assessed against SCA and PAA requirements.
  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Globe, 2026) confirmed that no SCA was located within the study area.
  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Globe, 2026) confirmed that no PAA was located within the study area.

- An ASS field assessment was undertaken during the SALS Assessment. The field observations were reviewed and the result (i.e., very low field indicators for PASS) is consistent with the desktop review against the Atlas of Australian Acid Sulfate Soils mapping which showed the study area as "Extremely low probability of occurrence."
    - It is assessed as highly unlikely the study area includes AASS and / or PASS, however, environmental management plans should consider proactive procedures to visually monitor and identity ASS during the Project's lifespan.
- In summary, topsoil resources from the majority of SPCs contain soils that are suitable for reuse in rehabilitation activities.
    - Topsoil in the study area consisted of fair to poorly structured, low fertility, shallow to deep soils which are indicative of the area, however, all are suitable for reuse for rehabilitation.
    - Subsoils for five SPCs (1Dn(Te), 2Dn(Te), 12Da(Te), 18Bl(Ro) and 22Bl(Wy)) had no limitations and were similar in physical and chemical attributes where the subsoil may be stripped to depth and used as topsoil.

      Eight of the SPCs (3Bl(Te), 4Bl(Te), 5Dn(Ro), 8Dn(Te), 13Bl(Ta), 14Bl(Ro), 15Bl(Ro) and 19Bl(Ro)) were similar, however did have sodic subsoils at depth. Separation of the five SPCs with no limitations and the eight SPCs with sodic subsoils would be recommended with respect to stockpiling. This would prevent impacts to the five subsoils with no limitations and the need for any additional amelioration treatment.
    - Soil amelioration recommendations such as gypsum application may benefit some of the deeper sodic subsoils as well as organic matter / fertiliser application pending the PMLU i.e., if cropping land uses were selected. Management, storage and handling recommendations have been provided to retain and improve the quality of topsoil for rehabilitation reuse pending the final PMLU.

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12 GLOSSARY OF ACRONYMS, UNITS AND TERMS

The following acronyms have been used in this report.

Acronym	Description
AASS	Actual Acid Sulfate Soils
AHD	Australian Height Datum
ALC	Agricultural Land Class / Classification
AS	Australian Standard
ASC	Australian Soil Class / Classification
ASRIS	Australian Soil Resource Information System
ASS	Acid Sulfate Soils
BWM	Blackwater Mine
BoM	Bureau of Meteorology
Ca:Mg	Calcium Magnesium Ratio
CEC	Cation Exchange Capacity
CHPP	Coal Handling and Preparation Plant
Cl^-	Chloride
DAP	Diammonium Phosphate
DERM	Department of Environment and Resource Management
DES	Department of Environment and Science (Queensland)
DME	Department of Minerals and Energy (Queensland)
DNRM	Department of Natural Resources and Mines (Queensland)
DoR	Department of Resources (Queensland)
DSDMIP	Department of State Development, Manufacturing, Infrastructure and Planning (Queensland)
DSITI	Department of Science, Information Technology and Innovation
DSITIA	Department of Science, Information Technology, Innovation and the Arts
EAT	Emerson Aggregate Test
EC	Electrical Conductivity
ECEC	Effective Cation Exchange Capacity
ECse	Electrical Conductivity, saturated extract
EOBH	End of Borehole
EOTP	End of Test Pit

Acronym	Description
ERD	Effective Rooting Depth
ESCP	Erosion and Sediment Control Plan
ESP	Exchangeable Sodium Percentage
GALE	Guidelines for Agricultural Land Evaluation in Queensland
GDA	Geocentric Datum of Australia
GradSect	Gradient-oriented Transect
GTE	GT Environmental Pty Ltd
IECA	International Erosion Control Association
LCC	Land Capability Classification
LGA	Local Government Area
LSAT	Land Suitability Assessment Techniques
m AHD	Elevation in metres with respect to the Australian Height Datum
MAP	Monoammonium Phosphate
mbgl	Metres below ground level
ML	Mining lease
NCST	National Committee on Soil and Terrain
P	Phosphorus
PAA	Priority Agricultural Areas
PASS	Potential Acid Sulfate Soils
PAWC	Plant Available Water Capacity
PLA	Priority Living Areas
PMLU	Post Mine Land Use
PRC Plan	Progressive Rehabilitation and Closure Plan
PSA	Particle Size Analysis
PTD	Permit to Disturb
QDPI	Queensland Department of Primary Industries
RPI	Regional Planning Interests
SA	Surface Area
SALI	Soil and Land Information

Acronym	Description
SALS	Soil and Land Suitability
SCA	Strategic Cropping Areas
SCL	Strategic Cropping Land
SEA	Strategic Environmental Areas
SLR	SLR Consulting Pty Ltd
SMU	Soil Map Unit
SPC	Soil profile class
SOP	Standard Operating Procedure
TCP	Thermal Coal Plant
UMA	Unique Mapping Area
Whitehaven Blackwater	Whitehaven Blackwater Pty Ltd
h : v	Horizontal run to vertical rise

The following units of measurement have been used in this report.

Unit	Description
°C	Degrees Celsius. Unit of Measurement, of temperature.
%	Percent. Unit of Measurement, an amount in or for every hundred.
cmol(+)/kg	Centimoles of positive charge per kilogram
dS	deciSiemens. Unit of measurement, the system of units base unit of specific conductance (Electrical conductivity).
dS/m	deciSiemens per metre.
ha	Hectare. Unit of measurement of area. A metric unit of square measure, equal 10,000 square metres.
kg	Kilogram. Unit of measurement, the system of units base unit of mass.
kg/ha	Kilograms per hectare.
km	Kilometres. Unit of measurement of length, equal to 1,000 metres.
km^2	Kilometres squared.
m	Metre. Unit of measurement, the system of units base unit of length.
m^3	Cubic metres.
meq	Milliequivalent. Unit of measurement, a measurement of chemical activity.
meq/100g	Milliequivalents per 100 grams of soil.

Unit	Description
mg	Milligram. Unit of measurement of mass, equal to 1,000 of a gram.
mg/kg	Milligrams per kilogram.
mm	Millimetres. Unit of measurement of length, equal to 1,000 of a metre.
mm/100 cms	Millimetres per 100 cm.
Mtpa	Million tonnes per annum.
t	Tonne. Unit of measurement of mass, equal to 1,000 kilograms.
t/ha	Tonnes per hectare. Unit of volume across an area. 0.1 kg/m^2.
µm	Micrometre. Unit of measurement, equal to equalling 1×10^{-6} of a metre.

The following terms used in this report have been described below.

Term	Description
A horizon	Mineral horizon at or near the surface with some accumulation of humified organic matter, usually darker in colour than underlying horizons and with maximum biological activity for any given soil profile (NCST, 2024).
Analysed Site	A selected detailed site and location assessed as Analysed of the SPC for which characterisation, land suitability and topsoil stripping resource is assessed.
B horizon	Horizons consisting of one or more mineral soil layers characterised by one or more of the following: a concentration of silicate clay, iron, aluminium, organic material or several of these; a structure and / or consistence unlike that of the A horizons above or of any horizons below; stronger colours, usually expressed as higher chroma and / or redder hue, than those of the A horizons above or of those horizons below (The National Committee on Soil and Terrain 2009).
C Horizon	Layers below the solum (AB horizons / profiles) of consolidated or unconsolidated material, usually partially weathered, little affected by pedogenic processes, and either like or unlike the material from which the solum presumably formed.
Calcium Magnesium Ratio (Ca:Mg)	Ratios of exchangeable Calcium (Ca) to exchangeable Magnesium (Mg) are used to support assessments of subsoil dispersibility where Ca:Mg < 0.1 are often associated with highly dispersive subsoils.
Effective Cation Exchange Capacity (ECEC)	The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger. ECEC is often used as a measure of soil fertility and nutrient retention capacity.
Chromosol	Soils with a clear or abrupt textural contrast B horizon and in which the upper 0.20 m of the B horizon or major part of the entire B2 horizon if it is < 0.20 m thick, is not sodic and not strongly acid.
Clay	A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.
Colluvial	Unconsolidated, poorly sorted soil and rock material transported largely by gravity (i.e., mass movement), deposited on lower slopes.

Term	Description
Colwell P	A laboratory method for the measure of available soil phosphorus using a bicarbonate extractable method.
Compost	Decomposed organic matter.
Dermosol	Soils with structured B2 horizons greater than weak and do not have clear or abrupt textural b horizon.
Dispersion	A process by which species in solution mix with a second solution, thus reducing in concentration. In the case of sodic soils, it will predispose the soil material to lose structure and disseminate into the solution.
Dispersion Ratio (R1)	The measurement of soil dispersion when used in conjunction with ESP and the Ca:Mg ratio for predicting soil physical behaviour.
Effective Rooting Depth (ERD)	The depths of which vegetation roots may readily penetrate the soil profile and have access to water and nutrients. Usually reduced through physical and chemical barriers, for example, refusal on rock or chloride above 800 mg/kg.
Electrical Conductivity (EC)	The EC of water is a measure of its ability to conduct an electric current. The EC of soils will vary depending on the texture and amount of moisture held by the soil particles. Electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.
Emerson Aggregate Test (EAT)	The test classifies the behaviour of soil aggregates, when immersed, remoulded, their coherence in water and when disturbed.
Erosion	The displacement of soil, rock or dissolved material by wind or water flow from one location on the earth and then travels to another location.
Exchangeable Sodium Percentage (ESP)	The amount of sodium as a proportion of all cations in a soil is termed the Exchangeable Sodium Percentage. It is calculated by dividing the exchangeable sodium by the cation exchange capacity (CEC), multiplied by 100. ESP values > 6% are considered sodic, with values > 15% considered very sodic. ESP = (Exchangeable sodium (meq/100g) / CEC (meq/100g)) x 100.
Field pH	The measurement of the pH in the field by a Manutec Pty Ltd, Soil pH Test Kit. This kit consists of pH dye indicator, Barium Sulphate and reference colour chart. Also known as Raupach pH kit.
Field Texture	The size distribution of particles finer than 2 mm, reflected in the behaviour of a small handful of moistened soil kneaded into a bolus and assessment of ribbon.
Gleyed	Indicative of permanent or periodic intense reduction due to wetness and is characterised by greying, bluish or greenish colour, generally of low chroma. Mottling may be prominent as well as rusty root channel mottling.
Gradient	The rate of inclination of a slope. The degree of deviation from the horizontal.
Gully (Erosion)	The displacement of soil by running water that forms clearly defined, narrow channels that generally carry water only during or after heavy rain.
Horizon	An individual soil layer, based on texture and colour, which differs from those above and below.
Jarosite	Iron sulfate mineral found in Acid Sulfate Soils. Form distinct butter or straw-coloured mottles with a hue of 2.5Y or yellower and a value chroma of 6 or more.

Term	Description
Kandosol	Soils that have well-developed B2 horizons in which the major part if massive or has only a weak grade of structure (compare with tenic B horizon and cemented pans) and have a maximum clay content in some part of the B2 horizon which exceeds 15% (i.e., heavy sandy loam, SL+).
Lithic	Containing large amounts of fragments derived from previously formed rocks.
Loam	A medium textured soil of approximate composition 10-25% clay, 25-50% silt and > 50% sand.
Massive	Refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.
Microrelief	Refers to relief up to a few metres about the plane of the land surface with alternating mounds and depressions formed due to clay horizons shrinking and swelling with alternate drying and wetting cycles.
Mottles	Areas of contrasting colour in the overall soil colour which are caused by anerobic conditions as a result of poor aeration. Usually, an indicator of poor drainage and retention of water.
Ped	An individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.
Pedality	Describes a soil in which some or all of the soil material occurs in the form of peds in the moist state.
pH	A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.
Phase, soil	A phase is a subdivision of an SPC based on attributes that have particular significance to the use of the soil (Powell, 2008). Any attribute or combination of attributes can be used to differentiate a phase, as long as the attribute class limits stay within those defined for the SPC. Phases commonly include criteria based on texture, coarse fragments, slope, colour, erosion, depth, microrelief or salinity.
Plant Available Water Capacity (PAWC)	Amount of soil water stored between the field capacity (soil water content where water ceases to drain readily from the soil) and plant wilting point. Usually expressed as an equivalent depth of rainfall in mm.
Profile, soil	Vertical section of soil from the soil surface through all of its horizons to parent material, consolidated substrate or unconsolidated material.
Sand	Soil particles in the size range > 0.02–2.0 mm.
Silt	Soil particles in the size range 0.02–0.002 mm.
Soil Profile Class (SPC)	Soils grouped into a single management unit on the basis of similar morphology, position on the landscape, substrate and chemistry. An SPC is considered a consociation where one class (Australian Soil Class) is dominant.
Sodic	Also commonly referred to as a non-saline alkali soil. It is a soil that contains sufficient exchangeable sodium and does not contain appreciable quantities of soluble salts. A term given to soil with a level of exchangeable sodium cations > 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations > 10-15 times the square root of soluble calcium and magnesium cations.
Sodosol	Soils with a clear or abrupt textural contrast B horizon and in which the upper 0.20 m of the B horizon or major part of the entire B2 horizon is sodic and not strongly acid.

Term	Description
Solum	The soil profile that includes horizons A and B.
Subsoil	Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.
Texture	The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.
Topsoil	Part of the soil profile, typically the A1 horizon, containing material, which is usually darker, more fertile and better structured than the underlying layers.
Unique Mapping Area (UMA)	When the unique set of soil and land attributes associated with an individual polygon are described and collected, the polygon is referred to as a unique mapping area. UMAs assist in identifying different land attributes such as degree of rockiness and slope which may either be part of the same soil type or not.
UMA Confidence Codes	1 - Visited UMA, one or more observations made, confident in allocation of attributes and delineation of boundary 2 - Visited UMA, one or more observations made, low confidence in allocation of attributes and / or delineation of boundary 3 - Visited UMA, no observations made, confident in allocation of attributes and delineation of boundary 4 - Visited UMA, no observations made, low confidence in allocation of attributes and / or delineation of boundary 5 - Did not visit UMA, no observations made, confident in allocation of attributes and delineation of boundary 6 - Did not visit UMA, no observations made, low confidence in allocation of attributes and / or delineation of boundary
Variant, soil	A variant has one or more profile attributes clearly outside the defined range of any existing SPC, however it has too few profiles described for a complete definition, or it occupies an area too small to warrant its own SPC. Variants also include attributes that do not affect land use, such as colour.
Vertosol	Soils with all of the following, a clay field texture or 35% or more clay throughout the solum except for thin surface crusty horizons 30 mm or less thick, when dry, open cracks occur at some time in most years at least 5 mm wide and extend to the surface or the base of any plough layer peaty horizon self-mulching horizon or thin surface crusty horizon and slickenside and / or lenticular peds occur at some depth in the solum.
Weathered / Weathering	The chemical or physical breakdown of rocks and minerals. It may take the form of disintegration into smaller pieces of rock, or chemical weathering where minerals are converted and removed in soil solution.

13 APPENDICES

Appendix A Detailed Site Descriptions

Site D1	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 685633 7377526 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 1Dn(Te) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Auger	**Survey Date / Described by:** 10/9/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Undulating plain Plain Simple slope Slope 2.0 / 3.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia No microrelief Extensive clearing No erosion	Self-Mulching No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Light medium clay	Moderate / Very firm Subangular blocky 2-5 mm Slickensides	No inclusions or segregations	2.5Y5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 8.0 No dispersion after 10 minutes No slaking	0.00-0.10 0.20-0.30 0.50-0.60
			B21 0.20-0.40 Abrupt 5-20mm	Light clay	Moderate / Firm Angular blocky 5-10 mm Slickensides	<2% calcium carbonate 2-6mm	2.5Y5/3 Light olive brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			BC 0.40-0.60 End of borehole (EOBH)	Medium clay	Massive / Loose Angular blocky 5-10 mm Slickensides	20-50% coarse fragments 20-60mm 20-50% coarse fragments 6-20mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.50 / 9.0 No dispersion after 10 minutes No slaking	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D2	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 690677 7370147 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 11/9/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 3.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub Grassland No microrelief Extensive clearing No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.05 Clear 20-50mm	Light medium clay	Moderate / Strong Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.03 / 8.5 No dispersion after 10 minutes Complete slaking	0.00-0.05 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.30-1.40
			B21 0.05-0.30 Clear 20-50mm	Medium clay	Strong / Firm Angular blocky 50-100 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/2 Dark greyish brown Mottles: Black Very few <2% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.15 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.35-0.70 Clear 20-50mm	Medium clay	Strong / Firm Angular blocky 50-100 mm Slickensides	<2% calcium carbonate 2-6mm	7.5YR4/3 Brown Mottles: Orange and grey Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.45 / 8.5 No dispersion after 10 minutes Partial slaking	
			B23 0.70-1.00 Clear 20-50mm	Medium clay	Strong / Very firm Angular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm	7.5YR4/4 Brown Mottles: Black Few 2%-10% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.85 / 7.0 Slight Dispersion after 10 minutes Complete slaking	
			B24 1.00-1.30 Clear 20-50mm	Medium heavy clay	Strong / Very firm Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/6 Strong brown Mottles: Brown Very few <2% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	1.15 / 5.5 Slight Dispersion after 10 minutes Complete slaking	
			BC 1.30-1.40 EOBH	Medium clay	Moderate / Weak Angular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm 10-20% coarse fragments 6-20mm	7.5YR4/6 Strong brown Mottles Black Very few <2% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.35 / 5.0 Slight Dispersion after 10 minutes Complete slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site D3	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686900 7378950 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 2Dn(Te) / Black Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Auger	**Survey Date / Described by:** 13/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Whitewood, sparse No microrelief Limited clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light clay	Strong / Very firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments 6-20mm	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 0.90-1.00
			B21 0.10-0.30 Clear 20-50mm	Light clay	Moderate / Very firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.20 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.30-0.65 Clear 20-50mm	Medium clay	Strong / Firm Angular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR2/2 No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.45 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.65-0.84 Clear 20-50mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.75 / 8.5 No dispersion after 10 minutes Complete slaking	
			BC 0.84-1.00 EOBH	Light medium clay Silty	Massive / loose Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	No roots	0.92 / 9.0 No dispersion after 10 minutes Partial slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D4	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686653 7375479 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 12Da(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 13/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Residual rise Flat Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia No microrelief Extensive clearing No erosion	Surface crust <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Clay loam, sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.50 Gradual 50-100mm	Medium clay Sandy	Moderate / Very strong Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 EOBH	Medium clay Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.65 / 8.5 No dispersion after 10 minutes Complete slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site D5	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686565 7384805 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 3Bl(Te) / Black Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 14/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Hillslope Flat Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Whitewood Grassland No microrelief Extensive clearing No erosion	Firm No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.00-1.10 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 8.0 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.40-0.80 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.60 / 8.0 Slight Dispersion after 10 minutes Partial slaking	
			B23 0.80-1.30 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	1.05 / 6.0 Slight Dispersion after 10 minutes Partial slaking	
			B24 1.30-1.60 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	5YR5/6 Yellowish red Mottles: 10YR4/2 Dark greyish brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.45 / 5.5 No dispersion after 10 minutes Partial slaking	
			C 1.60-2.00 End of test pit (EOTP)	-	-	-	-	-	-	1.80 / 5.5 No dispersion after 10 minutes Partial slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D6	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686529 7384441 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 4Bl(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 14/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Complete clearing, not cultivated No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Light medium clay Silty	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20
			B21 0.20-0.60 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Common	0.40 / 7.5 Slight Dispersion after 10 minutes No slaking	
			B22 0.60-0.90 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown Mottles: Pale orange-brown, Few 2%-10%	Dry Imperfect drained	Fine 1-2mm Few	0.75 / 7.5 Slight Dispersion after 10 minutes Partial slaking	
			B3 0.90-1.20 Clear 20-50mm	Clay Loam	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown Mottles: Pale orange-brown, Common 10%-20%	Very poorly drained	No roots	-	
			C 1.20-1.60 EOTP	-	-	-	-	Very poorly drained	No roots	-	

Landscape



Surface



Soil Profile



Site D7	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686513 7384178 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 5Dn(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 14/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Drainage Depression Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland Acacia No microrelief Complete clearing, not cultivated No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-015 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 20-60mm	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90
			B21 0.15-0.45 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 20-60mm	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Common	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.45-0.60 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 50-100 mm Slickensides	<2% coarse fragments and nodules 2-6mm	10YR4/2 Dark greyish brown Mottles: 10YR4/3 Brown Very few <2% Medium 5-15 mm	Moderately moist Moderately well drained	Fine 1-2mm Common	0.60 / 7.5 Moderate dispersion after 10 minutes Complete slaking	
			C 0.60-1.20 EOTP – Weathered substrate								

Landscape



Surface



Soil Profile



Site D8	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686482 7383509 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Whitewood Grassland No microrelief Complete clearing, not cultivated No erosion	Cracking 2-10% coarse fragments 200-600mm Rock outcrop present <2% flake	A1 0.00-0.15 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR3/2 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 7.0 No dispersion after 10 minutes No slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20
			B21 0.15-0.40 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments and nodules 2-6mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.25 / 7.5 No dispersion after 10 minutes No slaking	
			B22 0.40-0.70 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm Manganese nodules and rock fragments <2mm	10YR4/4 Dark yellowish brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Moderately well drained	Fine 1-2mm Common	0.55 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.70-1.10 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm	2-10% coarse fragments 2-6mm <2% coarse fragments 6-20mm	10YR4/4 Dark yellowish brown Mottles: Pale brown Common 10%-20% Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Common	0.90 / 8.0 No dispersion after 10 minutes Partial slaking	
			C 1.10-1.20 EOTP	-	-	-	-	-	-	-	
			Refusal on weathered substrate								

Landscape



Surface





Soil Profile



Site D9 Mound	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686755 7383408 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Bl(Pg) / Brown Vertosol gilgai	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								Sample (m) / Observations
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland Normal gilgai Complete clearing, not cultivated No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 8.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.15-0.40 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.28 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-1.00 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	2-10% coarse fragments	10YR4/3 Brown Mottles: Brown and dark brown Few 2%-10% Few <5 mm	Moderately moist Imperfectly drained	Fine 1-2mm Few	0.70 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.50 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 50-100 mm Slickensides	<2% coarse fragments and manganese nodules 2-6mm	7.5YR4/4 Brown Mottles: Brown Very few <2% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	1.25 / 6.5 No dispersion after 10 minutes Complete slaking	
			B24 1.50-1.70 EOBH	Medium heavy clay	Strong / Strong Subangular blocky 50-100 mm Slickensides	<2% coarse fragments and manganese nodules 2-6mm	7.5YR4/6 Strong brown Mottles: Brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	No roots	1.60 / 6.0 No dispersion after 10 minutes Complete slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site D9 Depression	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686769 7383420 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Bl(Pg) / Brown Vertosol gilgai	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland Normal gilgai Complete clearing, not cultivated No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.40 Clear 20-50mm	Medium heavy clay	Strong / Rigid Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	2.5Y4/2 Weak red No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.20 / 7.0 Slight Dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50 1.80-1.90
			B21 0.40-0.60 Clear 20-50mm	Medium heavy clay	Strong / Very strong Subangular blocky 50-100 mm Slickensides	<2% coarse fragments 6-20mm	2.5Y4/2 Weak red No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.50 / 8.0 Moderate dispersion after 10 minutes Partial slaking	
			B22 0.60-0.80 Gradual 50-100mm	Medium heavy clay	Strong / Very strong Subangular blocky 50-100 mm Slickensides	<2% coarse fragments 6-20mm	2.5Y5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.70 / 8.0 Strong dispersion after 10 minutes Complete slaking	
			B23 0.80-1.30 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments	7.5YR4/4 Brown Mottles: Brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.05 / 6.5 No dispersion after 10 minutes Complete slaking	
			B24 1.30-1.70 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 6-20mm	7.5YR4/4 Brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.45 / 6.5 No dispersion after 10 minutes Partial slaking	
			C 1.70-1.90 EOTP	-	-	-	-	-	-	-	

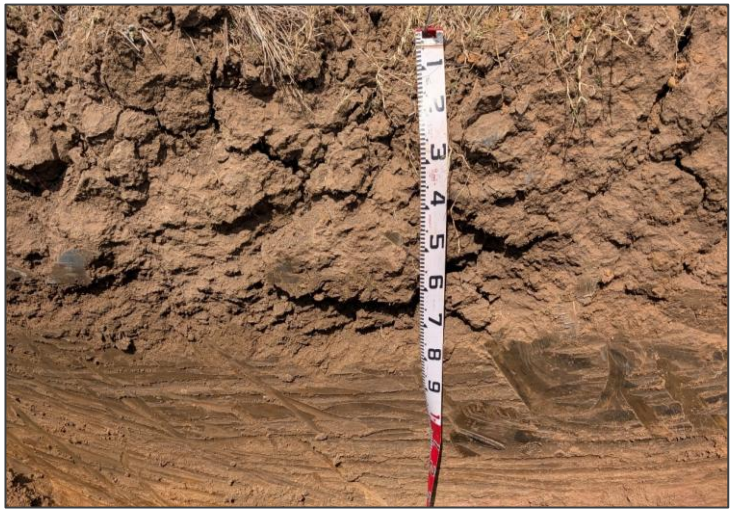
Landscape



Surface



Soil Profile



Site D10	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687134 7383371 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.45 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm <2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.33 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.45-0.80 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.62 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.80-1.20 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments and manganese nodules	7.5YR5/4 Reddish brown No mottles or bleaching	Dry Moderately well drained	No roots	1.00 / 8.0 Slight Dispersion after 10 minutes Complete slaking	
			C 1.20-1.40	-	-	-	-	-	-	-	
			R 1.40-1.50	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D11	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686985 7382892 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Lower slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse vegetation No microrelief Complete clearing, not cultivated No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.20 Abrupt 5-20mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.5 No dispersion after 10 minutes Complete slaking	No samples taken
			B21 0.20-0.50 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.35 / 8.0 No dispersion after 10 minutes Complete slaking	
			BC 0.50-0.90 Clear 20-50mm	Medium heavy clay	Moderate / Firm Subangular blocky No Slickensides	10-20% coarse fragments 20-60mm <2% coarse fragments 6-20mm	10YR4/4 Dark yellowish brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Moderately well drained	Fine 1-2mm Few	0.70 / 8.0 No dispersion after 10 minutes Complete slaking	
			C 0.90-1.00	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D12 Mound	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687003 7382185 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 6Bl(Pg) / Brown Vertosol gilgai	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse Normal gilgai Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 8.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/3 Brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Common	0.40 / 5.5 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	1.20 / 6.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D12 Depression	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 687002 7382190 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Bl(Pg) / Brown Vertosol gilgai	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class III / Test pit	Survey Date / Described by: 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse Normal gilgai Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.5 Slight Dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/3 Brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Common	0.40 / 6.5 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.60-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	No inclusions or segregations	10YR5/3 Brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	0.80 / 7.5 1.40 / 7.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D13	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686401 7382909 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 15/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-20 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	7.5YR4/3 Brown Mottles: Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Common	0.40 / 8.5 No dispersion after 10 minutes Complete slaking	
			B22 0.60-0.80 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	7.5YR5/3 Mottles: Pale brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Common	0.70 / 8.5 No dispersion after 10 minutes Complete slaking	
			B23 0.80-1.00 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/6 Yellowish brown Mottles: Grey Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	0.90 / 8.0 No dispersion after 10 minutes Partial slaking	
			C 1.00-1.70 EOTP	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D14 Mound	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686471 7382392 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 7Bl(Pg) / Grey Vertosol	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class II/III / Test pit	Survey Date / Described by: 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Whitewood Normal gilgai Limited clearing No erosion	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 20-60mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.30 / 7.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 20-60mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.50 / 6.5 Moderate dispersion after 10 minutes Complete slaking	
			B23 0.60-1.90 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 100-200 mm Slickensides	<2% coarse fragments 20-60mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	1.00 / 7.0 1.50 / 7.0 No dispersion after 10 minutes Complete slaking	
			B24 1.90-2.20 EOTP	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	10-20% coarse fragments 20-60mm 2-10% coarse fragments 6-20mm	10YR5/2 Greyish brown Mottles: Brown Few 2%-10% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	2.00 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D14 Depression	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686466 7382399 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 7Bl(Pg) / Grey Vertosol	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class III / Test pit	Survey Date / Described by: 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Whitewood Normal gilgai Limited clearing	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.15 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 6.0 Slight Dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.30-1.40
			B21 0.15-0.50 Gradual 50-100mm	Medium heavy clay	Strong / Very strong Subangular blocky 100-200 mm Slickensides	<2% coarse fragments 6-20mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 8.5 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.50-1.00 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Few	0.75 / 7.0 No dispersion after 10 minutes Partial slaking	
			B23 1.00-1.30 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 6-20mm	10YR5/2 Greyish brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Dry Imperfectly drained	Very fine <1mm Few	1.15 / 8.0 No dispersion after 10 minutes Complete slaking	
			BC 1.30-1.45 EOTP	Light medium clay, sandy	Moderate / Firm Subangular blocky 20-50 mm No Slickensides	20-50% coarse fragments 20-60mm	10YR5/2 Greyish brown Mottles: Yellow Many 20%-50% Coarse 15-30 mm	Dry Imperfectly drained	No roots	1.38 / 7.0 No dispersion after 10 minutes Complete slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D15	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686130 7381355 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 7Bl(Pg) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class II(a) / Test pit	**Survey Date / Described by:** 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Normal gilgai Limited clearing No erosion	Cracking <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Medium heavy clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 7.0 No dispersion after 10 minutes Complete slaking	No samples taken
			B21 0.15-0.30 Clear 20-50mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.22 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.30-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR5/2 Greyish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	0.45 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 0.60-1.70 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Moderately moist Moderately well drained	Fine 1-2mm Few	0.90 / 7.0 1.40 / 7.0 No dispersion after 10 minutes Complete slaking	
			B24 1.70-2.20 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Brown Many 20%-50% Coarse 15-30 mm	Moderately moist Moderately well drained	Very fine <1mm Few	2.00 / 6.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D16	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686472 7381335 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 10Ct(Ro) / Grey Vertosol	**Geology (Dominant): Alluvium**	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Ruby Salt Bush, medium height No microrelief, nearby gilgai observed but not in immediate area of this site No erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.05 Clear 20-50mm	Light medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.03 / 7.5 No dispersion after 10 minutes Complete slaking	0.00-0.05 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.05-0.45 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Coarse >5mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.45-1.30 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	<2% coarse fragments 6-20mm	7.5YR5/4 Reddish brown Mottles: Red Many 20%-50% Few <5 mm	Dry Imperfectly drained	Medium 2-5mm Few	0.90 / 5.5 No dispersion after 10 minutes Complete slaking	
			B23 1.30-1.90 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm Slickensides	<2% coarse fragments 6-20mm	10YR6/1 Grey Mottles: Red 10-20%, 5-15mm Brown, many 20%-50% Very coarse >30 mm	Moderately moist Imperfectly drained	No roots	1.30 / 5.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D17	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686079 7380691 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Mid-slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia, sparse No microrelief Limited clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.05 Clear 20-50mm	Light medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.03 / 8.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.05-0.60 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Medium 2-5mm Common	0.30 / 7.0 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.35 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR5/4 Yellowish brown Mottles: Pale brown Very few <2% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	1.00 / 7.5 Moderate dispersion after 10 minutes Complete slaking	
			BC 1.35-1.50 EOTP	Medium clay	Strong / Very firm Subangular blocky 50-100 mm No Slickensides	2-10% coarse fragments 2-6mm	2.5Y5/3 Light olive brown Mottles: Pale Grey, 10-20%, 5-15mm Dark brown, common 10%-20%, Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	1.42 / 7.5 Slight Dispersion after 10 minutes Complete slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D18	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686034 7379970 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 16/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Mid-slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia, sparse No microrelief Extensive clearing No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Light medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 20-60mm 2-10% coarse fragments 6-20mm	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 015-0.40 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 6-20mm 2-10% coarse fragments 20-60mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.28 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.60 Gradual 50-100mm	Light medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 6-20mm 10-20% calcium carbonate 20-60mm	7.5YR4/4 Brown Mottles: Brown Very few <2% Few <5 mm	Dry Imperfectly drained	Fine 1-2mm Few	0.50 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.60-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 6-20mm	7.5YR5/4 Reddish brown Mottles: Grey Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	1.40 / 8.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D19	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686719 7379753 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 8Dn(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Drainage Depression Open depression Slope 3.0 / 3.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Ruby Salt Bush Emu Apple No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.05 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.03 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.05 0.20-0.30 0.40-0.50 0.50-0.60 0.80-0.90
			B21 0.05-0.30 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.18 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.30-0.50 Gradual 50-100mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR5/2 Greyish brown Mottles: Brown Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking	
			B3 0.50-0.60	Clay Loam Coarse	Massive / Weak No Slickensides	20-50% coarse fragments 6-20mm	10YR5/4 Yellowish brown Mottles: Brown Many 20%-50% Few <5 mm	Dry Imperfectly drained	No roots	0.55 / 7.0 Slight Dispersion after 10 minutes Partial slaking	
			BC 0.60-0.90	Clay Loam Coarse	Massive / Weak No Slickensides	50-90% coarse fragments 6-20mm	10YR5/4 Yellowish brown Mottles: Brown Many 20%-50% Few <5 mm	Dry Imperfectly drained	No roots	0.55 / 7.0 Slight Dispersion after 10 minutes Partial slaking	
			C 0.90-1.10 EOTP – Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D20	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686578 7380646 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 4Bl(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Hillslope Upper slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 60-200mm No rock outcrop	A1 0.00-0.05 Clear 20-50mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.03 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.05 0.05-0.15 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.80-1.90
			B21 0.05-0.15 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.15-0.70 Clear 20-50mm	Medium heavy clay	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm <2% coarse fragments 20-60mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking	
			B3 0.70-0.90 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR4/3 Brown Mottles: Brown Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	0.80 / 7.5 No dispersion after 10 minutes Complete slaking	
			BC 0.90-1.80 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm 10-20% coarse fragments 20-60mm	10YR4/3 Brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.35 / 7.0 No dispersion after 10 minutes Partial slaking	
			C 1.80-2.00 EOTP	-	-	-	-	Dry	No roots	1.90 / 7.0 Slight Dispersion after 10 minutes Partial slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D21	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686057 7379329 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 9Dn(Ro) / Black Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class II/III / Test pit	**Survey Date / Described by:** 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 1.0 / <1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 8.0 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.10-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.00 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.80 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.90 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/2 Greyish brown Mottles: Brown Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.40 / 7.0 No dispersion after 10 minutes Complete slaking	
			C 1.90-2.10								

Landscape



Surface



Soil Profile



Site D22	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 687457 7373577 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class III / Test pit	Survey Date / Described by: 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Brigalow No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.0 No dispersion after 10 minutes Partial slaking	Site indicated as Red Vertosol in SLR (2023), however in this instance site was observed as Brown Vertosol 0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.00-1.10 1.30-1.40 1.60-1.70
			B21 0.10-0.50 Gradual 50-100mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	0.65 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 0.80-1.10 Diffuse >100mm	Medium clay Sandy	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR5/4 Reddish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.95 / 5.5 Slight Dispersion after 10 minutes Complete slaking	
			B24 1.10-1.80 Gradual 50-100mm	Medium clay	Strong / Firm Angular blocky 20-50 mm No Slickensides	<2% coarse fragments 6-20mm	7.5YR4/4 Brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.45 / 5.5 No dispersion after 10 minutes Complete slaking	
			C 1.80-2.00 EOTP								

Landscape



Surface



Soil Profile



Site D23	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 687800 7374140 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.70 Gradual 50-100mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.45 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.70-1.20 Clear 20-50mm	Medium heavy clay Sandy Fine	Moderate / Strong Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 6-20mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.95 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 1.20-1.80 Clear 20-50mm	Medium clay Sandy Fine	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/1 Dark grey Mottles: Pale brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.60 / 8.0 Moderate dispersion after 10 minutes Complete slaking	
			B24 1.80-2.00 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% calcium carbonate 6-20mm	2.5Y5/3 Light olive brown Mottles: Pale brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.90 / 7.5 Moderate dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D24	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687133 7374146 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 11Bl(Ta) / Brown Sodosol	**Geology (Dominant):** Alluvium	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 20/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Brigalow Emu Apple No microrelief Extensive clearing Scald erosion	Hard setting <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Loam	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 6.0 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20
			B21 0.20-0.60 Gradual 50-100mm	Medium clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.40 / 7.5 Slight dispersion after 10 minutes Partial slaking	
			B22 0.60-1.00 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.80 / 7.5 Slight dispersion after 10 minutes Complete slaking	
			C 1.00-1.20 EOTP								

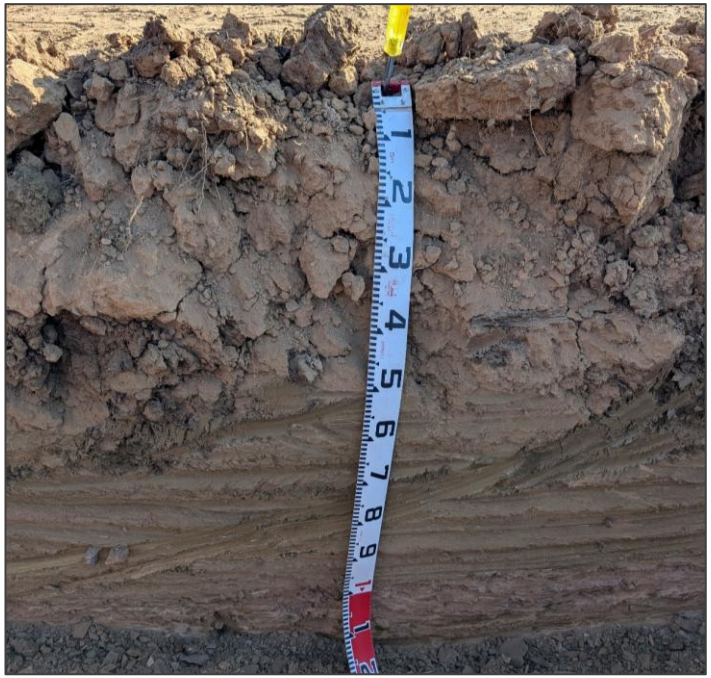
Landscape



Surface



Soil Profile



Site D25	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 685606 7377041 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 3.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia Eremophila No microrelief Extensive clearing Gully erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 6-20mm	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.00 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.80 / 7.5 Slight Dispersion after 10 minutes Partial slaking	
			B23 1.00-1.50 Clear 20-50mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	7.5YR5/4 Reddish brown Mottles: Brown Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.25 / 6.5 Slight Dispersion after 10 minutes Partial slaking	
			C 1.50-1.80 EOTP	-	-	-	-	-	-	1.65 / 5.5	

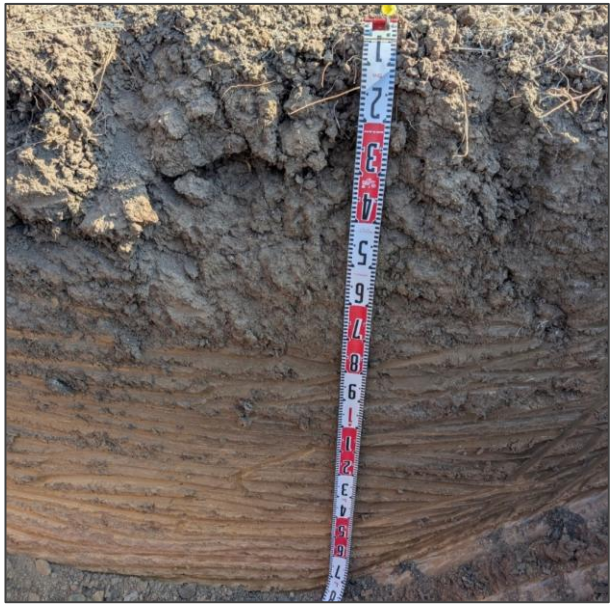
Landscape



Surface



Soil Profile



Site D26	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 685987 7376160 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.05 / 6.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.10-0.50 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey Mottles: Brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Common	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm 2-10% coarse fragments 6-20mm	2.5Y4/2 Weak red Mottles: Brown Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.65 / 7.5 Moderate dispersion after 10 minutes Complete slaking	
			BC 0.80-1.30 Clear 20-50mm	Medium clay	Massive / Firm Subangular blocky 20-50 mm No Slickensides	20-50% coarse fragments 2-6mm 20-50% coarse fragments 20-60mm	2.5Y4/3 Reddish brown Mottles: Pale brown Few 2%-10%	Dry Moderately well drained	No roots	1.05 / 6.0 No dispersion after 10 minutes Complete slaking	
			C 1.30-1.80 EOTP	-	-	-	-	-	-	1.55 / 6.0 Slight Dispersion after 10 minutes Partial slaking	
			Refusal on weathered substrate								

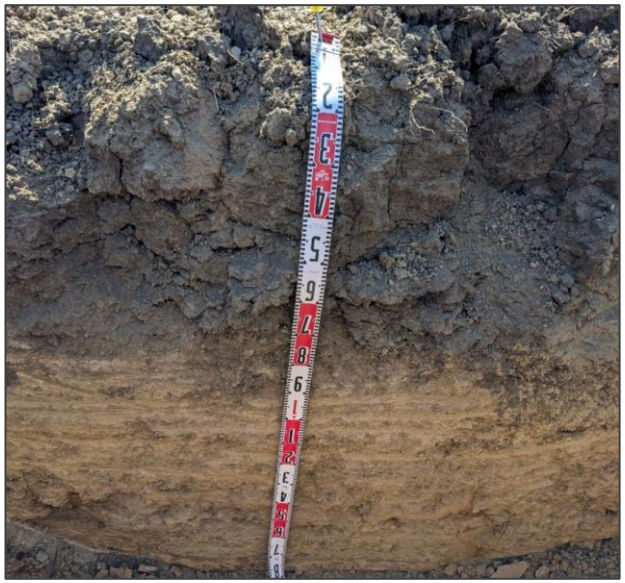
Landscape



Surface



Soil Profile



Site D27	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686688 7376571 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Medium height No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm <2% coarse fragments 20-60mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 8.0 No dispersion after 10 minutes Complete slaking	No samples taken
			B21 0.10-0.60 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.60-0.90 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 20-60mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.75 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 0.90-1.30 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/4 Brown Mottles: Black Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Fine 1-2mm Few	1.10 / 6.0 Slight Dispersion after 10 minutes Complete slaking	
			B24 1.30-2.00 EOTP	Medium heavy clay	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	10-20% coarse fragments 6-20mm	7.5YR5/4 Reddish brown Mottles: Red Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.65 / 5.5 Slight Dispersion after 10 minutes Complete slaking	

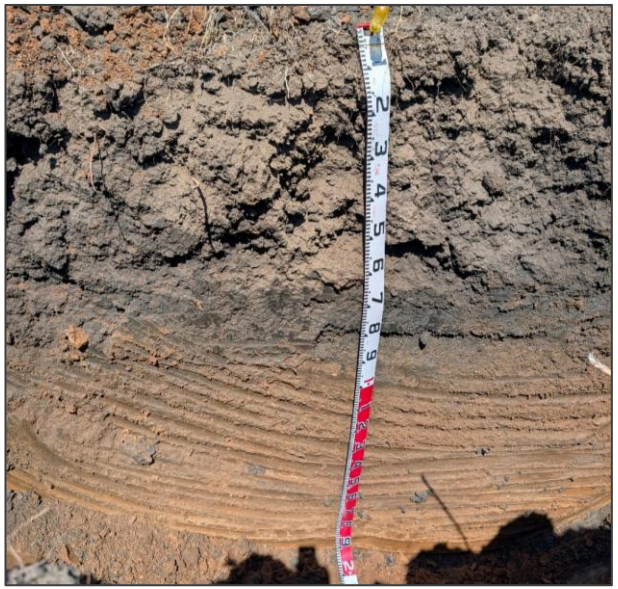
Landscape



Surface



Soil Profile



Site D28	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686087 7377007 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 9Dn(Ro) / Black Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class II(a) / Test pit	**Survey Date / Described by:** 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow. sparse No microrelief Extensive clearing	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay	Moderate / Strong Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 20-60mm 2-10% coarse fragments 6-20mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.60 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR2/1 Black No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 8.0 No dispersion after 10 minutes Complete slaking	
			B22 0.60-1.00 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.80 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.30 Diffuse >100mm	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown Mottles: Black Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.15 / 7.5 No dispersion after 10 minutes Complete slaking	
			B24 1.30-1.90 Gradual 50-100mm	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown Mottles: Black Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.50 / 6.0 No dispersion after 10 minutes Partial slaking	
			B24 1.90-2.20 EOTP	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown Mottles: Black Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	2.05 / 6.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D29	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686269 7377476 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia, sparse No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.10-0.45 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.45-0.70 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 200-600mm <2% coarse fragments 2-6mm	2.5Y4/3 Reddish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.58 / 7.5 No dispersion after 10 minutes Complete slaking	
			BC 0.70-1.00 Gradual 50-100mm	Medium clay Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 20-60mm 20-50% coarse fragments 6-20mm	2.5Y4/3 Reddish brown Mottles: Orange dark grey 10-20%, <5mm Common 10%-20% Few <5 mm	Dry Imperfectly drained	No roots	0.85 / 7.5 No dispersion after 10 minutes Partial slaking	
			C 1.00-1.85 EOTP	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D30	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686573 7378317 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class II(a) / Test pit	Survey Date / Described by: 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Poplar Box Bauhinia, sparse No microrelief Extensive clearing Gully erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80 2.00-2.10
			B21 0.20-0.50 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Brown Few 2%-10% Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Common	0.35 / 7.0 No dispersion after 10 minutes Complete slaking	
			B22 0.50-0.80 Clear 20-50mm	Light medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.65 / 7.5 No dispersion after 10 minutes Partial slaking	
			B23 0.80-1.20 Clear 20-50mm	Light medium clay Silty	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR2/1 Black Mottles: Brown Few 2%-10% Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Few	1.00 / 6.0 Slight dispersion after 10 minutes Complete slaking	
			B24 1.20-2.10 EOTP	Light medium clay Sandy Coarse	Moderate / Firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	1.60 / 7.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D31	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 685743 7376460 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse No microrelief Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 20-60mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 20-60mm <2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.60-0.90 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm <2% coarse fragments 6-20mm	10YR3/3 Dark brown Mottles: Black Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.75 / 7.5 No dispersion after 10 minutes Partial slaking	
			B23 0.90-1.80 EOTP	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR5/4 Yellowish brown Mottles: Red - 10-20%, <5mm Common Black - 10%-20% Coarse 15-30 mm	Dry Imperfectly drained	Very fine <1mm Few	1.35 / 6.0 Slight Dispersion after 10 minutes Partial slaking	

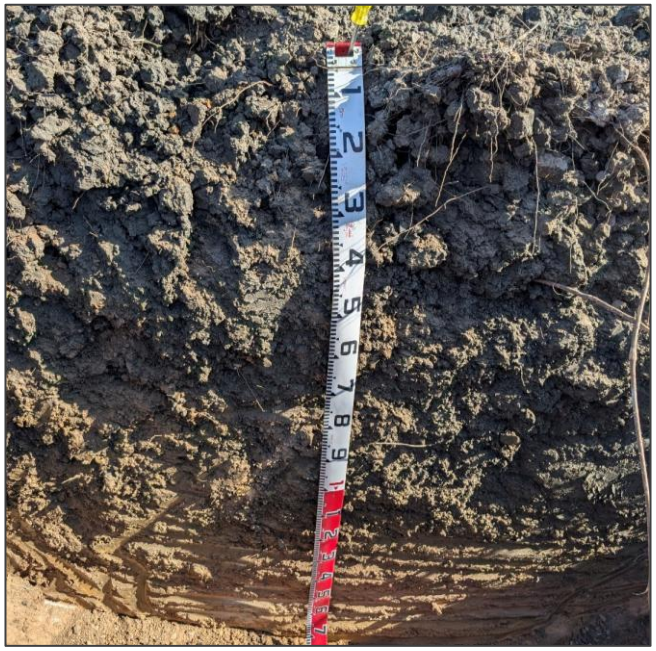
Landscape



Surface



Soil Profile



Site D32	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686675 7375468 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 12Da(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Residual rise Flat Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia No microrelief Extensive clearing No erosion	Firm <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Clay loam Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80 Similar location as D4 (auger site), revisited for D32 using test pit method
			B21 0.20-0.50 Gradual 50-100mm	Medium clay Sandy	Moderate / Very strong Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 6.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 Clear 20-50mm	Medium clay Sandy	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.65 / 8.0 Moderate dispersion after 10 minutes Partial slaking	
			B23 0.80-1.20 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm No Slickensides	2-10% calcium carbonate 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	1.00 / 8.0 Slight Dispersion after 10 minutes Partial slaking	
			B24 1.20-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 50-100 mm No Slickensides	No inclusions or segregations	10YR3/1 Very dark grey Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.50 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D33	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687993 7374979 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 5Dn(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing Scald erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00
			B21 0.20-0.50 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.70 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	10-20% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.60 / 7.0 No dispersion after 10 minutes Partial slaking	
			BC 0.70-0.90 Gradual 50-100mm	Medium clay	Moderate / Firm Angular blocky 10-20 mm No Slickensides	20-50% coarse fragments	2.5Y4/4 Olive brown Mottles: Orange 10-20%, 5-15mm Grey, Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	0.80 / 7.0 No dispersion after 10 minutes Partial slaking	
			C 0.90-1.00 EOTP	-	-	-	-	-	-	-	

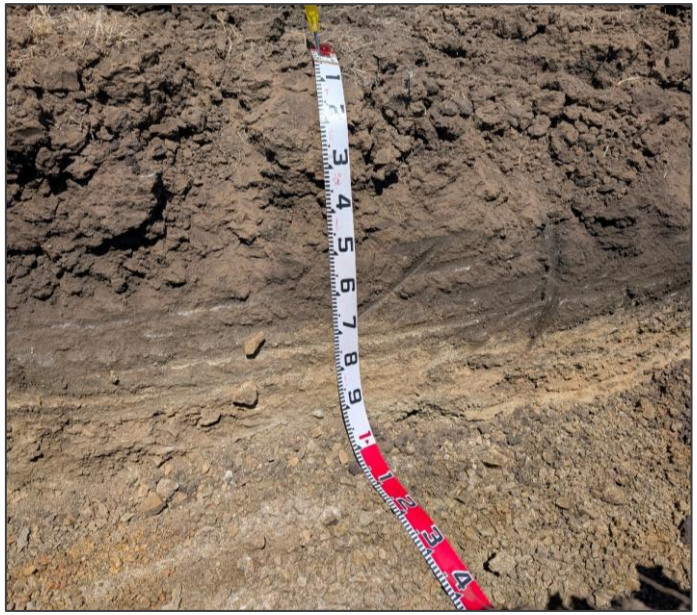
Landscape



Surface



Soil Profile



Site D34	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686564 7374628 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 8Dn(Te) / Grey Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat drainage line Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing Gully erosion	Surface flake <2% coarse fragments 60-200mm Rock outcrop present <2%	A1 0.00-0.20 Clear 20-50mm	Light clay Sandy	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm <2% coarse fragments 60-200mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 Slight Dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.55 Gradual 50-100mm	Light medium clay Sandy	Moderate / Firm Subangular blocky 20-50 mm No Slickensides	10-20% coarse fragments 2-6mm 2-10% coarse fragments 6-20mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.38 / 7.0 No dispersion after 10 minutes Partial slaking	
			BC 0.55-0.90 Clear 20-50mm	Medium clay	Moderate / Firm Angular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm	2.5Y4/4 Olive brown Mottles: Orange 10-20%, 5-15mm Grey, Common 10%-20%, Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.78 / 8.0 No dispersion after 10 minutes Partial slaking	
			C 0.90-1.10 EOTP	-	-	-	-	-	-	-	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D35	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 689238 7372672 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 3.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse No microrelief Limited clearing No erosion	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Complete slaking	Site indicated as Red Vertosol in SLR (2023), however site was observed as Grey Vertosol. Red subsoil horizon coverage not enough. No samples taken
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.40 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.60-0.90 Diffuse >100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	7.5YR4/4 Brown Mottles: Black Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.75 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 0.90-1.40 Clear 20-50mm	Medium heavy clay	Strong / Firm Angular blocky 5-10 mm No Slickensides	<2% coarse fragments 2-6mm	5YR4/6 Yellowish red Mottles: Black Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.15 / 6.0 No dispersion after 10 minutes Partial slaking	
			BC 1.40-1.70 EOTP	Medium heavy clay	Strong / Firm Angular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm	5YR5/6 Yellowish red Mottles: Pale Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.55 / 6.0 No dispersion after 10 minutes Partial slaking	

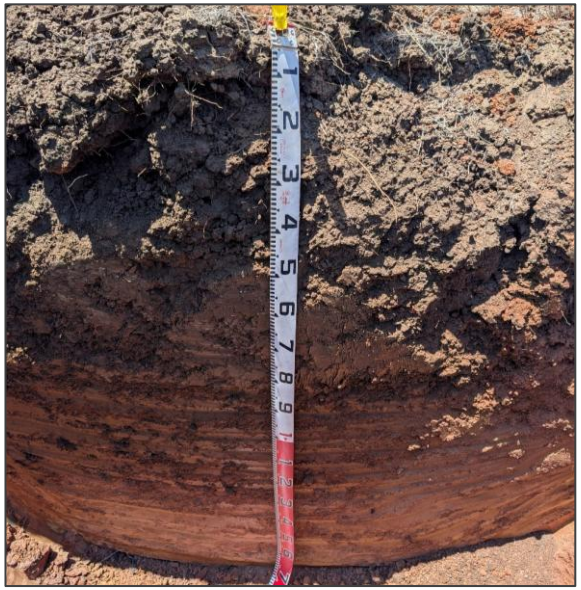
Landscape



Surface



Soil Profile



Site D36	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 689214 7373261 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 13BL(TA) / Brown Dermosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 22/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Current Bush No microrelief Extensive clearing No erosion	Firm 2-10% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 20-60mm	7.5YR4/2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Gradual 50-100mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 6.5 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.70 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm 2-10% calcium carbonate 6-20mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.55 / 7.0 No dispersion after 10 minutes Partial slaking	
			B23 0.70-0.90 Gradual 50-100mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm 2-10% calcium carbonate 6-20mm	7.5YR5/4 Reddish brown Mottles: Pale brown Very few <2% Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Few	0.80 / 8.0 No dispersion after 10 minutes Partial slaking	
			B24 0.90-1.70 Gradual 50-100mm	Medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm 2-10% coarse fragments 6-20mm	10YR5/6 Yellowish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.30 / 7.5 No dispersion after 10 minutes Complete slaking	
			BC 1.70-2.00 EOTP	Sandy loam	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm 20-50% coarse fragments 2-6mm	10YR5/6 Yellowish brown No mottles or bleaching	Dry Moderately well drained	No roots	1.85 / 7.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D37	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 689679 7372849 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 14Bl(Ro) / Black Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 21/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Drainage Depression Open depression Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia Open woodland No microrelief Extensive clearing Gully erosion	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.60 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.30 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.95 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 1.30-1.90 EOTP	Medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR5/3 Brown Mottles: Orange, 10-20%, 5-15mm Dark grey, 10%-20% 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.55 / 7.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D38	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 690733 7372998 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class II(a) / Test pit	**Survey Date / Described by:** 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia, sparse No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm, No Slickensides	No inclusions or segregations	2.5Y4/2 Weak red No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.5 No dispersion after 10 minutes, Partial slaking	No samples taken
			B21 0.10-0.20 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 10-20 mm, Slickensides	2-10% coarse fragments 2-6mm	2.5Y4/2 Weak red No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.15 / 7.5 No dispersion after 10 minutes, Partial slaking	
			B22 0.20-0.50 Gradual 50-	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm, Slickensides	2-10% coarse fragments 2-6mm	2.5Y4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 7.5 No dispersion after 10 minutes, Partial slaking	
			B23 0.50-0.80 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm, Slickensides	2-10% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or	Dry Moderately well drained	Very fine <1mm Common	0.65 / 8.0 No dispersion after 10 minutes, Complete slaking	
			B3 0.80-1.00 Gradual 50-100mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm, No Slickensides	10-20% coarse fragments 20-60mm 20-50% coarse fragments 6-20mm	2.5Y4/3 Reddish brown No mottles or bleaching	Dry Imperfectly drained	Fine 1-2mm Few	0.90 / 7.0 No dispersion after 10 minutes, Partial slaking	
			BC 1.00-1.20 Gradual 50-100mm	Light medium clay	Weak / Firm Angular blocky 5-10 mm, No Slickensides	50-90% coarse fragments 6-20mm	10YR5/3 Brown Mottles: Orange Few 2%-10% <5 mm	Dry Imperfectly drained	No roots	1.10 / 6.5 No dispersion after 10 minutes, Partial slaking	
			C 1.20-2.10 EOTP	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D39	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 690706 7372655 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia No microrelief Extensive clearing No erosion	Self-mulching <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Sandy Fine	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20
			B21 0.20-0.50 Gradual 50-100mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Medium 2-5mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.90 Clear 20-50mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	50-90% coarse fragments 200-600mm 50-90% coarse fragments 0.6m-2.0m	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.70 / 8.0 No dispersion after 10 minutes Partial slaking	
			BC 0.90-1.40 Gradual 50-100mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm	10YR4/4 Dark yellowish brown Mottles: Yellow Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.15 / 8.0 No dispersion after 10 minutes Partial slaking	
			R 1.40-1.65 EOTP	-	-	-	-	-	-	-	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D40	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 690167 7372041 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia, sparse No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay Sandy Fine	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 8.0 No dispersion after 10 minutes Complete slaking	No samples taken
			B21 0.10-0.60 Gradual 50-100mm	Medium clay Sandy Fine	Strong / Strong Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.60-0.80 Gradual 50-100mm	Medium clay Sandy Fine	Strong / Strong Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 2-6mm	7.5YR4/4 Brown Mottles: Black Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Common	0.70 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.80-1.30 Gradual 50-100mm	Medium clay Sandy Fine	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm 2-10% calcium carbonate 2-6mm	7.5YR4/4 Brown Mottles: Orange Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.05 / 8.0 No dispersion after 10 minutes Complete slaking	
			BC 1.30-2.00 EOTP	Medium clay Sandy Fine	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm 2-10% calcium carbonate 2-6mm	7.5YR5/6 Strong brown Mottles: Orange Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.65 / 8.0 No dispersion after 10 minutes Complete slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D41	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686462 7378980 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Open depression adjacent Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Bottle Tree Brigalow Tall height No microrelief Limited clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.10-0.30 Gradual 50-100mm	Light medium clay Sandy Fine	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.20 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.30-0.70 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.50 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.70-1.00 Clear 20-50mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.85 / 7.5 No dispersion after 10 minutes Complete slaking	
			B24 1.00-1.20 EOTP	Medium heavy clay	Moderate / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	2.5Y3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	1.10 / 7.5 No dispersion after 10 minutes Complete slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site D42	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 685856 7378774 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 5Dn(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Scrub No microrelief Limited clearing No erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	0.08 / 8.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.15-0.65 Gradual 50-100mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Coarse >5mm Common	0.40 / 8.5 No dispersion after 10 minutes Complete slaking	
			BC 0.65-0.85 EOBH	Medium heavy clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	2-10% coarse fragments 6-20mm	10YR5/3 Brown Mottles: Black Few 2%-10% Few <5 mm	Dry Imperfectly drained	No roots	0.75 / 8.5 No dispersion after 10 minutes Partial slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D43	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 685753 7378011 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 16Bl(Ta) / Grey Sodosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Auger	**Survey Date / Described by:** 23/10/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Hillslope Simple slope Slope 3.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia No microrelief Extensive clearing Scald erosion also sheet erosion, rills	Hard setting <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Clay Loam Sandy Fine	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	0.05 / 6.0 Moderate dispersion after 10 minutes Partial slaking	0.00-0.10 0.10-0.20 0.20-0.30
			B21 0.10-0.20 Clear 20-50mm	Medium heavy clay	Moderate / Very firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.15 / 6.0 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.20-0.40 EOBH	Medium clay	Strong / Very firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments 6-20mm	2.5Y4/1 Dark grey No mottles or bleaching	Dry Imperfectly drained	Very fine <1mm Few	0.25 / 8.0 No dispersion after 10 minutes Partial slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D44	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 691122 7370776 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 03/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Lower slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia and Brigalow Current Bush No microrelief Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light clay Sandy	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	7.5YR3/2 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.05 / 6.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.10-0.20 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50
			B21 0.10-0.20 Clear 20-50mm	Light medium clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 20-60mm	7.5YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.15 / 6.5 No dispersion after 10 minutes Partial slaking	
			B22 0.20-0.40 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	7.5YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.40-0.80 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.60 / 8.0 No dispersion after 10 minutes Complete slaking	
			B24 0.80-1.20 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 2-6mm <2% calcium carbonate 2-6mm Manganese nodules	7.5YR4/4 Brown Mottles: Pale Grey Few 2%-10% Few <5 mm	Dry Imperfect drained	Very fine <1mm Few	1.00 / 7.5 No dispersion after 10 minutes Complete slaking	
			C 1.20-1.60 EOTP								

Landscape



Surface



Soil Profile



Site D45	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 689137 7374206 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 18Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 03/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope <1.0 / <1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia Moreton Bay Ash No microrelief Extensive clearing Scald erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Gradual 50-100mm	Medium heavy clay Silty	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.80 Diffuse >100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.60 / 7.5 No dispersion after 10 minutes Partial slaking	
			B23 0.80-1.40 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	1.10 / 7.5 No dispersion after 10 minutes Complete slaking	
			B24 1.50-2.00 EOTP Refusal on cemented soil	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/1 Very dark grey Mottles: Brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.75 / 6.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D46	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 690276 7374005 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 4/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Drainage Depression Open depression Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia, sparse No microrelief Limited clearing Sheet erosion	Surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Medium clay Sandy	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.50 Clear 20-50mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.35 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 Clear 20-50mm	Medium heavy clay Sandy Fine	Strong / Strong Subangular blocky 10-20 mm Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.65 / 8.0 No dispersion after 10 minutes Partial slaking	
			BC 0.80-1.50 Gradual 50-100mm	Light medium clay Sandy	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 2-6mm	10YR5/4 Yellowish brown Mottles: Brown Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.10 / 8.0 No dispersion after 10 minutes Complete slaking	
			C 1.50-2.00 EOTP	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D47	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 689612 7374633 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class II(a) / Test pit	Survey Date / Described by: 4/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Grassland No microrelief Extensive clearing No erosion	Surface flake 2-10% coarse fragments 60-200mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.05 / 8.0 No dispersion after 10 minutes Complete slaking	No samples taken
			B21 0.10-0.30 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 5-10 mm No Slickensides	2-10% coarse fragments 20-60mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.20 / 7.0 No dispersion after 10 minutes Partial slaking	
			B22 0.30-0.60 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.45 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.60-1.40 Gradual 50-100mm	Medium heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	1.00 / 8.0 Slight dispersion after 10 minutes Complete slaking	
			B24 1.40-1.80 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/2 Greyish brown Mottles: Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.60 / 7.0 No dispersion after 10 minutes Complete slaking	
			BC 1.80-2.10 EOTP	Medium clay	Strong / Firm Angular blocky 5-10 mm No Slickensides	20-50% coarse fragments 6-20mm	2.5Y5/3 Light olive brown Mottles: Orange Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.95 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D48	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 688951 7374853 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class II(a) / Test pit	Survey Date / Described by: 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia, sparse No microrelief Limited clearing Scald erosion	Cracking, with surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.30 Clear 20-50mm	Medium clay Sandy Fine	Strong / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.15 / 8.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.30-0.60 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.45 / 8.0 No dispersion after 10 minutes Complete slaking	
			B22 0.60-1.50 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/3 Brown Mottles: Pale Grey Few 2%-10% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.05 / 7.0 Slight dispersion after 10 minutes Partial slaking	
			BC 1.50-2.10 EOTP	Light medium clay Sandy	Moderate / Firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown Mottles: Dark Grey Few 2%-10% Few <5 mm	Dry Imperfectly drained	No roots	1.80 / 7.5 No dispersion after 10 minutes Complete slaking	

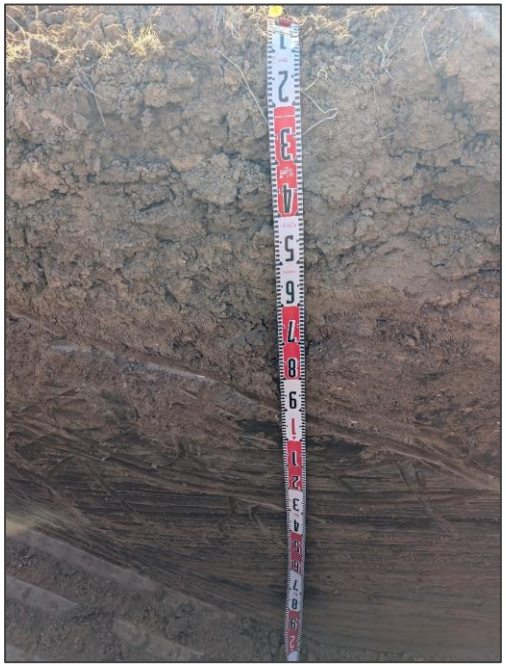
Landscape



Surface



Soil Profile



Site D49	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 688698 7375044 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia Ruby Salt Bush Grassland No microrelief Limited clearing Scald erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay Silty	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	0.05 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.10-0.40 Gradual 50-100mm	Light medium clay Silty	Strong / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.25 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.70 Diffuse >100mm	Light medium clay Silty	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 6-20mm Minor gravel layer	10YR4/4 Dark yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.55 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.70-1.20 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.95 / 8.0 No dispersion after 10 minutes Complete slaking	
			B24 1.20-1.80 EOBH	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR5/4 Yellowish brown Mottles: Grey Few 2%-10% Few <5 mm	Dry Moderately well drained	Very fine <1mm Few	1.50 / 8.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D50	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 688483 7374030 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 5Dn(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Auger	**Survey Date / Described by:** 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Whitewood Ruby Salt Bush Sparse Emu apple, willow wattle No microrelief Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop self-mulching	A1 0.00-0.15 Clear 20-50mm	Medium heavy clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.08 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90
			B21 0.15-0.50 Gradual 50-100mm	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	<2% calcium carbonate 2-6mm	2.5Y4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.95 EOBH	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	<2% calcium carbonate 2-6mm	2.5Y4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.80 / 8.0 Slight Dispersion after 10 minutes Complete slaking	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D51	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 688529 7374336 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / <1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia No microrelief Extensive clearing Scald erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.20-0.40 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.80 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.60 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.80-1.20 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.00 / 6.5 Slight Dispersion after 10 minutes Complete slaking	
			B3 1.20-1.60 Gradual 50-100mm	Medium clay Silty	Strong / Firm Angular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/4 Yellowish brown Mottles: Black Few 2%-10% Few <5 mm	Dry Imperfectly drained	No roots	1.40 / 6.0 No dispersion after 10 minutes Complete slaking	
			C 1.60-1.70 EOTP	-	-	-	-	-	-	-	
			BC 1.70+ Refusal on bedrock								

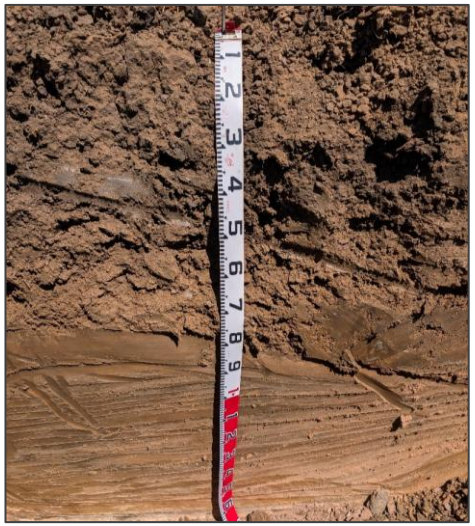
Landscape



Surface



Soil Profile



Site D52	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 688782 7376440 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Sparse Bauhinia and Brigalow No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Light clay Sandy	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 6.5 No dispersion after 10 minutes No slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80 2.00-2.10
			B21 0.20-0.40 Clear 20-50mm	Medium clay Sandy	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0..30 / 7.0 No dispersion after 10 minutes No slaking	
			B22 0.40-1.00 Gradual 50-100mm	Medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% calcium carbonate 6-20mm <2% coarse fragments 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.70 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.70 Diffuse >100mm	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown Mottles: Dark Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.35 / 7.5 No dispersion after 10 minutes Partial slaking	
			B24 1.70-2.20 EOTP	Medium clay Sandy Coarse	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown Mottles: Dark Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	1.95 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D53	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 689513 7379001 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 5/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Stream channel Open depression Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia Tall height No microrelief No effective disturbance; hoofed animals Sheet erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	2.5Y4/2 Weak red No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.45 Gradual 50-100mm	Medium heavy clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	2.5Y4/2 Weak red No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.33 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.45-1.00 Diffuse >100mm	Medium heavy clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.75 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.80 EOTP	Medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	1.40 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D54	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 686680 7385714 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class II(a) / Test pit	Survey Date / Described by: 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Whitewood Sparse No microrelief Limited clearing No erosion	Cracking Self-mulching with surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80 2.00-2.10
			B21 0.20-0.50 Gradual 50-100mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey Mottles: Pale Brown Common 10%-20% Medium 5-15 mm	Moderately moist Moderately well drained	Very fine <1mm Common	0.35 / 8.0 No dispersion after 10 minutes Complete slaking	
			B22 0.50-1.00 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown Mottles: Pale Grey 2-10%, <5mm Red - Common 10%-20% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Common	0.75 / 6.5 No dispersion after 10 minutes Complete slaking	
			B23 1.00-2.10 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown Mottles: Pale Grey Red, 10-20%, 5-15mm Common 10%-20% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Common	1.50 / 6.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface





Soil Profile



Site D55	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 686603 7385246 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 2Dn(Te) / Black Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class II(a) / Test pit	**Survey Date / Described by:** 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Level plain Plain Flat Slope <1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Complete clearing, not cultivated No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Gradual 50-100mm	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.80 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.40 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.80-1.00 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	2-10% coarse fragments 2-6mm	10YR4/2 Dark greyish brown Mottles: Black Common 10%-20% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Common	0.90 / 7.5 No dispersion after 10 minutes Complete slaking	
			BC 1.00-1.30 Gradual 50-100mm	Light medium clay Sandy Fine	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR4/4 Dark yellowish brown Mottles: Pale Grey Orange, 2-10%, <5mm Common 10%-20% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	1.15 / 7.0 No dispersion after 10 minutes Partial slaking	
			C 1.30-2.20 EOTP	-	-	-	-	-	-	-	

Landscape



Surface



Soil Profile



Site D56	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 690156 7371197 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class II(a) / Test pit	Survey Date / Described by: 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating rises Hillslope Simple slope Slope 2.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia Whitewood No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Silty	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Common	0.10 / 7.5 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.80 Diffuse >100mm	Medium clay, faint	Strong / Firm Subangular blocky 20-50 mm Slickensides	10-20% calcium carbonate 6-20mm 10-20% coarse fragments 20-60mm	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.50 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.80-1.40 Diffuse >100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	7.5YR4/4 Brown Mottles: Dark Grey Common 10%-20% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	1.10 / 7.0 No dispersion after 10 minutes Complete slaking	
			B23 1.40-2.20 EOTP	Medium clay Sandy	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	5YR5/6 Yellowish red Mottles: Dark Grey Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.80 / 7.5 No dispersion after 10 minutes Complete slaking	

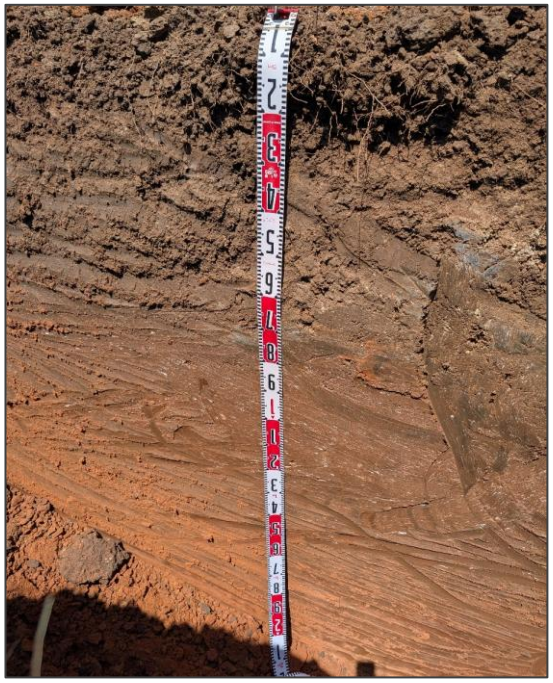
Landscape



Surface



Soil Profile



Site D57	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 690939 7371619 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow Ruby Salt Bush No microrelief Extensive clearing Scald erosion	Surface flake 2-10% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay Sandy	Strong / Firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.10 / 7.0 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Clear 20-50mm	Medium clay Sandy	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 7.0 No dispersion after 10 minutes Complete slaking	
			B22 0.40-0.80 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	2.5Y4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.60 / 8.0 No dispersion after 10 minutes Complete slaking	
			B23 0.80-1.10 Diffuse >100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.95 / 8.0 No dispersion after 10 minutes Complete slaking	
			B24 1.10-1.60 Diffuse >100mm	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm 10-20% coarse fragments 2-6mm	10YR4/3 Brown Mottles: Black Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	No roots	1.35 / 7.5 No dispersion after 10 minutes Complete slaking	
			BC 1.60-1.80 EOTP	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm 10-20% coarse fragments 2-6mm	10YR4/6 Dark yellowish brown Mottles: Pale Grey ,2-10%, <5mm Orange, Common 10%-20%, Medium 5-15 mm	Dry Imperfectly drained	No roots	1.70 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D58	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 691692 7371103 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 20Bl(Ro) / Grey Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Auger	**Survey Date / Described by:** 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Open woodland No microrelief Limited clearing No erosion	Surface flake <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80
			B21 0.20-0.40 Clear 20-50mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.30 / 7.5 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.40-0.80 EOBH	Medium heavy clay Sandy Fine	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% calcium carbonate 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.60 / 8.0 No dispersion after 10 minutes Complete slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D59	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 691156 7377835 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 21Bl(Ta) / Grey Sodosol	**Geology (Dominant):** Alluvium	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class III / Test pit	**Survey Date / Described by:** 6/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse No microrelief Extensive clearing No erosion	Hard setting No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Sandy loam	Weak / Weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR3/2 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Many	0.10 / 6.0 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			A2 0.20-0.45 Abrupt 5-20mm	Sandy loam	Moderate / Very firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	0.33 / 6.5 No dispersion after 10 minutes Complete slaking	
			B21 0.45-0.90 Gradual 50-100mm	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	7.5YR4/1 Dark grey Mottles: Brown Many 20%-50% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.65 / 8.5 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.90-1.80 EOTP	Medium heavy clay Sandy	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	10-20% calcium carbonate 20-60mm 10-20% calcium carbonate 6-20mm Coarse fragments <2%, 2-6mm	10YR5/4 Yellowish brown Mottles: Dark Grey Common 10%-20% Few <5 mm	Dry Imperfectly drained	No roots	1.35 / 8.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D60	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 691284 7380721 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 10Ct(Ro) / Grey Vertosol	Geology (Dominant): Alluvium	Soil Survey Type / Observation Class / Method: Free / Detailed Class I / Test pit	Survey Date / Described by: 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Stream channel Open depression Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Bauhinia Ruby Salt Bush Sparse No microrelief Limited clearing Sheet erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Medium 2-5mm Many	0.10 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.70-0.80 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.40 Clear 20-50mm	Medium clay	Strong / Strong Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey Mottles: Brown Few 2%-10% Few <5 mm	Dry Moderately well drained	Coarse >5mm Many	0.30 / 7.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.60 Gradual 50-100mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey Mottles: Brown Many 20%-50% Few <5 mm	Dry Imperfectly drained	Fine 1-2mm Few	0.50 / 8.0 No dispersion after 10 minutes Partial slaking	
			B23 0.60-2.00 EOTP	Medium clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown Mottles: Brown Common 10%-20% Few <5 mm	Moderately moist Imperfectly drained	Fine 1-2mm Few	1.30 / 8.0 Slight dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D61	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687657 7379698 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Risecrest Crest Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow Ruby Salt Bush Sparse No microrelief Extensive clearing Scald erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Light medium clay Sandy Fine	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.08 / 7.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20
			B21 0.15-0.70 Clear 20-50mm	Light medium clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% calcium carbonate 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Medium 2-5mm Common	0.45 / 8.0 No dispersion after 10 minutes Complete slaking	
			BC 0.70-1.10 Clear 20-50mm	Medium clay	Strong / Very firm Angular blocky 10-20 mm No Slickensides	20-50% coarse fragments 6-20mm	10YR5/4 Yellowish brown Mottles: Pale Grey 10-20%, 5-15mm Orange, Common 10%-20%, Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	0.90 / 7.0 No dispersion after 10 minutes Complete slaking	
			C 1.10-1.50 EOTP	-	-	-	-	-	-	-	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D62	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 687596 7385994 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing Scald erosion	Cracking, with surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium clay	Strong / Strong Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.10 / 7.5 No dispersion after 10 minutes Partial slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 1.10-1.20 1.40-1.50 1.70-1.80
			B21 0.20-0.65 Clear 20-50mm	Medium clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/3 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.40 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.65-1.10 Diffuse >100mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm <2% coarse fragments 6-20mm	10YR5/4 Yellowish brown Mottles: Orange Common 10%-20% Few <5 mm	Dry Moderately well drained	Very fine <1mm Common	0.90 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 1.10-1.80 EOTP	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm No Slickensides	2-10% coarse fragments 2-6mm 2-10% coarse fragments 6-20mm	10YR4/4 Dark yellowish brown Mottles: Pale Grey 2-10%, <5mm Orange, Common 10%-20%, Medium 5-15 mm	Dry Moderately well drained	Very fine <1mm Common	1.45 / 6.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D63	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 689260 7385313 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Extensive clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.08 / 8.0 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.15-0.40 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.28 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-1.00 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.70 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 1.00-1.40 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% calcium carbonate 2-6mm	7.5YR4/4 Brown Mottles: Pale Brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Common	1.20 / 7.0 No dispersion after 10 minutes Complete slaking	
			B3 1.40-1.50 Clear 20-50mm	Clay loam	Strong / Firm Subangular blocky 10-20 mm No Slickenside	<2% coarse fragments 2-6mm	10YR5/6 Yellowish brown No mottles or bleaching	Dry Moderately well drained	No roots	1.45 / 6.0 No dispersion after 10 minutes Complete slaking	
			BC 1.50-1.80 EOTP	-	-	-	-	-	-	-	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site D64	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 688292 7383905 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating rises Hillslope Simple slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow, sparse No microrelief Extensive clearing No erosion	Cracking with surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 7.5 No dispersion after 10 minutes Partial slaking	No samples taken
			B21 0.15-0.40 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% coarse fragments 20-60mm	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.28 / 8.0 No dispersion after 10 minutes Complete slaking	
			B22 0.40-1.00 Diffuse >100mm	Medium heavy clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	<2% calcium carbonate 2-6mm	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.65 / 6.0 No dispersion after 10 minutes Partial slaking	
			B23 1.00-1.80 EOTP	Medium heavy clay	Strong / Very firm Angular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Red 2-10%, <5mm Pale grey, few 2%-10% Few <5 mm	Dry Moderately well drained	No roots	1.40 / 5.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site D65	Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy: 691894 7371606 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 22Bl(Wy) / Brown Kandosol	Geology (Dominant): Arenite-Mudrock	Soil Survey Type / Observation Class / Method: Free / Detailed Class III / Auger	Survey Date / Described by: 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow Sparse No microrelief Extensive clearing No erosion	Firm <2% coarse fragments 2-6mm No rock outcrop	A11 0.00-0.05 Clear 20-50mm	Sandy loam	Weak / Weak Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Many	0.03 / 6.5 No dispersion after 10 minutes Partial slaking	0.00-0.05 0.10-0.20 0.20-0.30 0.50-0.60 0.80-0.90
			A12 0.05-0.20 Clear 20-50mm	Sandy loam	Weak / Weak Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Common	0.14 / 6.0 No dispersion after 10 minutes No slaking	
			A2 0.20-0,45 Gradual 50-100mm	Sandy loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	0.32 / 6.0 Slight Dispersion after 10 minutes Partial slaking	
			B21 0.45-0.80 Gradual 50-100mm	Clay loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.62 / 7.5 Moderate dispersion after 10 minutes Partial slaking	
			B21 0.80-1.00 EOBH No recovery	Silty loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.90 / 7.5 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site D66	**Location (mE/mS GDA2020 ZONE 5) / Method, Accuracy:** 688931 7381952 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Geology (Dominant):** Arenite-Mudrock	**Soil Survey Type / Observation Class / Method:** Free / Detailed Class I / Test pit	**Survey Date / Described by:** 7/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Crest Slope 1.0 / 2.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Scrub No microrelief Complete clearing, not cultivated	Surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Medium heavy clay Silty	Moderate Firm No slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Many	0.10 / 8.5	No samples taken
			B21 0.20-0.60 Clear 20-50mm	Medium heavy clay	Moderate Firm Slickensides	<2% calcium carbonate 2-6mm	10YR4/3 Brown Mottles: Orange Common 10%-20% Few <5 mm	Dry	Fine 1-2mm Few	0.40 / 8.0	
			BC 0.60-1.00 EOTP	Medium heavy clay	Moderate Firm Slickensides	20-50% coarse fragments 60-200mm	10YR4/4 Dark yellowish brown Mottles: Orange Common 10%-20% Medium 5-15 mm	Dry	No roots	0.80 / 8.0	
			Refusal on bedrock								

Landscape



Surface



Soil Profile





Appendix B Class IV Site Descriptions

Site C1	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 685881 7379056 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 5Dn(Ro) / Grey Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Exposed profile cutting	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Natural Woodland Gently undulating plain Plain Slope 1% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow Sparse No microrelief Extensive clearing No erosion	Self-mulching No coarse fragments 6-20mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Silty clay loam Silty	Moderate Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.10 / 7.5	-
			B21 0.20-0.70 Clear 20-50mm	Light clay	Moderate Very firm Subangular blocky 20-50 mm Faint Slickensides	<2% coarse fragments	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.40 / 8.0	
			B22 0.70-0.80 End of profile	Medium clay	Moderate Very firm Subangular blocky No Slickensides	<2% coarse fragments	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.75 / 8.0	

Landscape



Surface



Soil Profile



Site C2	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 685995 7380182 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 19Bl(Ro) / Brown Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Undulating plain Plain Mid-slope Slope 3% / 8% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Sparse No microrelief Limited clearing No erosion	Surface flake No coarse fragments	A1 0.00-0.10 Clear 20-50mm	Light clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 9.0	-
			B21 0.10-0.40 Clear 20-50mm	Light medium clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.25 / 9.0	
			B22 0.40-0.85 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.62 / 7.0	
			B3 0.85-0.95 End of bore hole (EOBH)	Light medium clay	Weak / Firm Subangular blocky 5-10 mm No Slickensides	2-10% coarse fragments 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Imperfectly drained	No roots	0.90 / 7.5	

Landscape



Surface



Soil Profile



Site C3	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686113 7381038 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Bl(Pg) / Brown Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Mid-slope Slope 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub Medium height Melon hole gilgai 20% coverage No effective disturbance; natural No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.15 Abrupt 5-20mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	-	-
			B21 0.15-1.00 EOBH	Heavy clay	Strong / Strong Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	-	

Landscape



Surface



Soil Profile



Site C4	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686283 7381960 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 13Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Open depression Slope 2.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Sparse No microrelief Limited clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Light clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	-
			B21 0.20-0.50	Light medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	
			B22 0.50-1.00 EOBH	Light medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	

Landscape



Surface



Soil Profile



Site C5	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686275 7382443 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Bl(Pg) / Brown Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat 1.0 / 1.0 **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Sparse Normal gilgai Limited clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Light clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	-
			B21 0.15-0.40 Diffuse >100mm	Light medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	
			B22 0.40-0.90 EOBH	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	7.5YR4/4 Brown No mottles or bleaching	Dry Well drained	No roots	-	

Landscape



Surface



Soil Profile



Site C6	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686387 7383392 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 11Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 07/07/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Mid-slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing No erosion	Firm No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Clay loam	Weak / Weak Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	-
			B21 0.20-0.80 EOBH	Light clay	Moderate / Strong Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site C7	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686568 7384949 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Dn(Te) / Black Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 08/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Level plain Plain Flat Slope 1% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bull Mitchell Grass No microrelief Complete clearing, not cultivated No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.15 Abrupt 5-20mm	Light clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.08 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.15-0.65 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.45 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.65-0.90 Clear 20-50mm	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/3 Dark brown Mottles: Black Very few <2% Few <5 mm	Dry Well drained	Fine 1-2mm Few	0.77 / 8.5 No dispersion after 10 minutes Partial slaking	
			B23 0.90-1.00 EOBH	Medium clay	Strong / Very firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	No roots	0.95 / 8.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C8	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686528 7384676 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 4Bl(Te) / Grey Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 08/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Simple slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bull Mitchell Grass Grassland No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.15 Abrupt 5-20mm	Light clay	Moderate / Weak Subangular blocky 10-20 mm No slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Many	0.08 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.15-0.45 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 50-100 mm No slickensides	<2% coarse fragments 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Common	0.28 / 9.0 No dispersion after 10 minutes Partial slaking	
			B22 0.45-0.60 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm No slickensides	2-10% calcium carbonate 6-20mm	2.5Y4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.52 / 9.0 No dispersion after 10 minutes Partial slaking	
			B23 0.60-1.00 EOBH	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm	2.5Y4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	No roots	0.80 / 9.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C9	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686568 7384339 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 08/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2% / 5% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bull Mitchell Grass Grassland No microrelief Complete clearing, not cultivated No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.05 Abrupt 5-20mm	Medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.03 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.05-0.35 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.20 / 7.5 No dispersion after 10 minutes Partial slaking	
			B21 0.35-0.70 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.50 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.70-1.00 EOBH	Medium clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm No roots	0.85 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C10	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686479 7383878 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 15Bl(Ro) / Brown Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 08/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bull Mitchell Grass Grassland No microrelief Complete clearing, not cultivated No erosion	Cracking <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.5 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.40 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 50-100 mm Slickensides	No inclusions or segregations	7.5YR4/3 Brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Fine 1-2mm Common	0.25 / 8.0 No dispersion after 10 minutes Complete slaking	
			B22 0.40-0.60 Clear 20-50mm	Medium heavy clay	Strong / Weak Subangular blocky 50-100 mm Slickensides	No inclusions or segregations	7.5YR5/3 Brown Mottles: Orange Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.50 / 9.0 No dispersion after 10 minutes Complete slaking	
			B23 0.60-1.00 EOBH	Medium clay	Strong / Firm Angular blocky 5-10 mm No Slickensides	No inclusions or segregations	7.5YR5/4 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.80 / 8.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C11	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686606 7383191 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Lower slope Slope 2% / 3% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland ironbark No microrelief Complete clearing, not cultivated	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Light clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.08 / 7.5 No dispersion after 10 minutes Partial slaking	-
			B21 0.15-0.85 Clear 20-50mm	Light medium clay Heavy	Strong / Firm Subangular blocky 5-10 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.50 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.85-1.20 EOBH	Medium clay	Strong / Firm Subangular blocky 5-10 mm No slickensides	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	1.00 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C12	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686568 7382663 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 19Bl(Ro) / Brown Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.05 / 8.5 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.40 Gradual 50-100mm	Light medium clay	Moderate / Very firm Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.35 / 8.5 No dispersion after 10 minutes No slaking	
			B22 0.40-0.70 Gradual 50-100mm	Medium clay	Strong / Strong Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	10YR4/4 Dark yellowish brown Mottles: Pale brown Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	0.55 / 8.5 No dispersion after 10 minutes Partial slaking	
			B23 0.70-1.20 EOBH	Medium heavy clay	Strong / Strong Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate <2mm	10YR4/4 Dark yellowish brown Mottles: Orange Few 2%-10% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	0.95 / 8.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C13	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686422 7381673 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 15Bl(Ro) / Brown Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Lower slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Extensive clearing	Cracking No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 8.0 No dispersion after 10 minutes No slaking	-
			B21 0.10-0.45	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 8.0 No dispersion after 10 minutes No slaking	
			B22 0.45-1.00 EOBH	Medium heavy clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.75 / 8.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C14	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686320 7380926 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 13Bl(Ta) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Abrupt 5-20mm	Clay loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	7.5YR4/2 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Many	0.05 / 7.0 Slight Dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.35 Clear 20-50mm	Light medium clay	Strong / Strong Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	7.5YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.20 / 8.0 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.35-1.00 EOBH	Light medium clay	Strong / Very firm Angular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm, faint	7.5YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.65 / 8.5 Slight Dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C15	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686603 7380371 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 13Bl(Ta) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH**	**Sample (m) / Observations**
Grazing Undulating plain Mid-slope Slope 4% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Abrupt 5-20mm	Light medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/4 Dark yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 7.0 No dispersion after 10 minutes	-
			B21 0.10-0.60 Clear 20-50mm	Medium clay	Strong / Firm Angular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B21 0.60-1.00 EOBH	Medium clay	Strong / Firm Angular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.80 / 9.0 Slight Dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C16	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686536 7379890 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 11Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Undulating plain Plain Simple slope Slope 3% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub No microrelief Extensive clearing Gully erosion	Cracking 2-10% coarse fragments 20-60mm No rock outcrop	A1 0-0.05 Abrupt 5-20mm	Light clay	Weak / Weak Angular blocky 5-10 mm No Slickensides	2-10% coarse fragments 6-20mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.03 / 9.0	0.00-0.05 0.20-0.30 0.50-0.60 0.70-0.80
			B21 0.05-0.85 EOBH	Light medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 20-60mm No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.45 / 6.5	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site C17	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686614 7379467 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 11Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Crest Slope 1% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Complete clearing, not cultivated	Surface flake No coarse fragments No rock outcrop	A1 0,00-0.10 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 8.0 Slight Dispersion after 10 minutes Partial slaking	0.00-0.10 0.10-0.20 0.30-0.40
			B21 0.10-0.25 Abrupt 5-20mm	Medium clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry	Fine 1-2mm Few	0.18 / 9.0 Slight Dispersion after 10 minutes Partial slaking	
			B22 0.25-0.45 EOBH	Medium clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry	Fine 1-2mm Few	0.35 / 8.0 Slight Dispersion after 10 minutes Partial slaking	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C18	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 685894 7378520 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 8Dn(Te) / Grey Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 09/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Undulating plain Plain Upper slope Slope 1% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing No erosion	Firm 2-10% coarse fragments 20-60mm No rock outcrop	A1 0-0.15 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR5/2 Greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.08 / 7.0 Slight Dispersion after 10 minutes No slaking	-
			B21 0.15-0.50 EOBH	Medium clay	Strong / Strong Angular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.32 / 7.5 Slight Dispersion after 10 minutes Partial slaking	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C19	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 685729 7377775 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 5Dn(Ro) / Grey Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Mid-slope Slope 4% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Grassland Acacia No microrelief Extensive clearing	Surface Flake No coarse fragments No rock outcrop	A1 0.00-0.13 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Moderately moist Well drained	Fine 1-2mm Few	0.07 / 6.5 No dispersion after 10 minutes Complete slaking	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90
			B21 0.13-0.60 Clear 20-50m	Medium clay Silty	Strong / Firm Subangular blocky 5-10 mm Slickensides	<2% calcium carbonate 6-20mm	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	0.40 / 7.0 No dispersion after 10 minutes Complete slaking	
			B22 0.60-0.95 EOBH	Medium clay Silty	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.75 / 7.0 No dispersion after 10 minutes Complete slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site C20	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 685717 7376110 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 17Bl(Ro) / Grey Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Undulating plain Plain Mid-slope Slope 4% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.08 / 7.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.15-1.00 EOBH	Medium clay Silty	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.60 / 7.5 No dispersion after 10 minutes No slaking	

Landscape



Surface



Soil Profile



Site C21	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686105 7376609 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 9Dn(Ro) / Black Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 1% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.15 Gradual 50-100mm	Medium clay	Moderate / Weak Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown Mottles	Dry Moderately well drained	Fine 1-2mm Common	0.08 / 7.0 No dispersion after 10 minutes No slaking	-
			B21 0.15-0.65 Gradual 50-100mm	Medium heavy clay	Strong / Firm Angular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/1 Very dark grey Mottles: Pale brown Very few <2% Few <5 mm	Moderately moist Imperfectly drained	Very fine <1mm Common	0.45 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.65-1.0 EOBH	Medium heavy clay	Moderate / Weak Angular blocky 20-50 mm Slickensides	<2% calcium carbonate 6-20mm	10YR4/2 Dark greyish brown Mottles: Brown Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.85 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site C22	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686660 7374423 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 11Bl(Ta) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Upper slope Slope 2% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Complete clearing, not cultivated	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Loam	Weak / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	7.5YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.10 / 6.5 No dispersion after 10 minutes No slaking	-
			B21 0.20-0.60 EOBH No Recovery of soil	Medium clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.40 / 9.0 Slight dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C23	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 687142 7373573 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 11Bl(Ta) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Upper slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub No microrelief Extensive clearing No erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Loam	Moderate / Strong Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Many	-	-
			B21 0.10-0.45 Gradual 50-100mm	Medium heavy clay	Strong / Weak Angular blocky 50-100 mm Slickensides	<2% coarse fragments 6-20mm <2% coarse fragments <2mm manganiferous nodules <2mm	10YR3/3 Dark brown Mottles: Brown Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	-	
			BC 0.45-0.80 EOBH	Medium clay	Weak / Very weak Subangular blocky 10-20 mm No Slickensides	2-10% calcium carbonate 6-20mm	2.5Y5/3 Light olive brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site C24	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686263 7377184 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 16Bl(Ta) / Grey Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Mid-slope Slope 2% / 3% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Open woodland No microrelief Extensive clearing No erosion	Hard setting No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Clay loam	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 8.5 No dispersion after 10 minutes Partial slaking	--
			B21 0.10-0.25 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.18 / 9.0 No dispersion after 10 minutes Partial slaking	
			BC 0.25-0.35 EOBH	Medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 9.0 No dispersion after 10 minutes Partial slaking	
			Refusal on bedrock								

Landscape



Surface



Soil Profile



Site C25	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686594 7377606 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 5Dn(Ro) / Grey Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Lower slope Slope 2% / 3% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Complete clearing, not cultivated	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	-	-
			B21 0.10-0.50 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	-	
			BC 0.50-0.60 EOBH	Medium clay	Weak / Very weak Subangular blocky 10-20 mm No Slickensides	2-10% calcium carbonate 6-20mm	2.5Y5/3 Light olive brown Mottles: Brown Common 10%-20% Medium 5-15 mm	Dry Imperfectly drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site C26	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 686409 7378079 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 5Dn(Ro) / Grey Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 10/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Lower slope Slope 1% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Open woodland No microrelief Extensive clearing No erosion	Surface flake <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Strong / Firm Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 7.5 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.55 Gradual 50-100mm	Medium clay	Moderate / Very firm Angular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Pale brown Few 2%-10% Few <5 mm	Dry Moderately well drained	Fine 1-2mm Few	0.35 / 8.5 No dispersion after 10 minutes Partial slaking	
			BC 0.55-0.80 EOBH	Light clay	Massive / Loose No Slickensides	20-50% coarse fragments 6-20mm 20-50% coarse fragments 2-6mm	10YR6/2 Light brownish grey No mottles or bleaching	Dry Moderately well drained	No roots	0.70 / 8.0 Moderate dispersion after 10 minutes No slaking	

Landscape



Surface



Soil Profile



Site C27	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 690230 7370634 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 16Bl(Ta) / Grey Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Simple slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Limited clearing No erosion	Cracking No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 7.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.50 EOBH No recovery of soil	Medium clay	Strong / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.30 / 8.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C28	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 691001 7371456 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 16Bl(Ta) / Grey Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Simple slope Slope 2% / 3% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Moderate / Very firm Angular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.35 Clear 20-50mm	Medium clay	Moderate / Very firm Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.25 / 8.5 No dispersion after 10 minutes Partial slaking	
			BC 0.35-0.60 EOBH	Light medium clay	Massive / Loose	20-50% coarse fragments 2-6mm 20-50% coarse fragments 20-60mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.50 / 8.0 No dispersion after 10 minutes Partial slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site C29	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 691447 7371443 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro)) / Grey Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow Medium height No microrelief Extensive clearing No erosion	Self-mulching No coarse fragments No rock outcrop	A1 0.00-0.10 Gradual 50-100mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Well drained	Fine 1-2mm Common	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.60 Diffuse >100mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.35 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.60-1.00 EOBH	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.80 / 9.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site C30	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 691543 7370618 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 12Da(Te)) / Grey Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Limited clearing No erosion	Firm <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Moderate / Firm Subangular blocky 10-20 mm Faint Slickensides	No inclusions or segregations	10YR4/1 Dark grey No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.40 Diffuse >100mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Faint Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.25 / 8.5 No dispersion after 10 minutes Partial slaking	
			B22 0.40-1.00 EOBH	Medium clay	Strong / Firm Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments and manganese nodules 6-20mm	10YR4/3 Brown Mottles: Pale brown Few 2%-10% Medium 5-15 mm	Dry Moderately well drained	Fine 1-2mm Few	0.70 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C31	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 689683 7372597 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 13Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Upper slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Grassland No microrelief Extensive clearing No erosion	Firm 2-10% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay	Weak / Weak Subangular blocky 5-10 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.25 Clear 20-50mm	Light medium clay	Moderate / Weak Angular blocky 20-50 mm No Slickensides	<2% calcium carbonate 6-20mm <2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.18 / 8.5 No dispersion after 10 minutes Complete slaking	
			B22 0.25-0.45 Clear 20-50mm	Light clay	Weak / Weak Subangular blocky 20-50 mm No Slickensides	2-10% calcium carbonate 6-20mm <2% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.35 / 8.5 No dispersion after 10 minutes Partial slaking	
			B23 0.45-0.70 Abrupt 5-20mm	Medium clay	Moderate / Very firm Angular blocky 20-50 mm No Slickensides	2-10% coarse fragments 6-20mm <2% calcium carbonate 2-6mm	7.5YR4/4 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.55 / 8.5 No dispersion after 10 minutes Partial slaking	
			B24 0.70-1.00 EOBH	Light medium clay	Moderate / Firm Angular blocky 20-50 mm No Slickensides	<2% coarse fragments 6-20mm <2% coarse fragments 2-6mm	7.5YR4/4 Brown Mottles: Grey Very few <2% Few <5 mm	Dry Imperfectly drained	Very fine <1mm Few	0.85 / 8.0 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C32	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 689279 7373071 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 13Bl(Ta)) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**							
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Mid-slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Open woodland No microrelief Extensive clearing No erosion	Firm 2-10% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Strong / Strong Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.40 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	2-10% calcium carbonate 6-20mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.25 / 8.0 No dispersion after 10 minutes No slaking	
			B22 0.40-0.60 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% calcium carbonate 6-20mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.50 / 8.5 No dispersion after 10 minutes Partial slaking	
			B23 0.60-1.00 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm No Slickensides	<2% calcium carbonate 6-20mm	7.5YR4/4 Brown Mottles: Pale brown Few 2%-10% Few <5 mm	Dry Moderately well drained	Fine 1-2mm Few	0.80 / 8.5 No dispersion after 10 minutes No slaking	

Landscape



Surface



Soil Profile



Site C33	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 689513 7373651 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 17Bl(Ro) / Gery Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 11/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Open depression Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow scrub No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light medium clay	Moderate / Very firm Angular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.05 / 8.0	-
			B21 0.10-0.50 Gradual 50-100mm	Medium heavy clay	Strong / Very firm Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm <2% calcium carbonate 2-6mm	2.5Y4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Common	0.35 / 9.0	
			B22 0.50-0.80 Clear 20-50mm	Medium clay	Moderate / Firm Angular blocky 20-50 mm Slickensides	<2% calcium carbonate 2-6mm No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.65 / 8.5	
			B23 0.80-1.00 EOBH	Medium heavy clay	Moderate / Weak Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	7.5YR4/4 Brown Mottles: Brown Few 2%-10% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.90 / 8.5	

Landscape



Surface



Soil Profile



Site C34	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 691878 7375159 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 11Bl(Ta) / Brown Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Open woodland No microrelief Extensive clearing	Firm No coarse fragments No rock outcrop	A1 0.00-0.18 Clear 20-50mm	Silty loam	Massive / Loose Granular No Slickensides	<2% coarse fragments 2-6mm	7.5YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.10 / 7.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.18-0.47 Clear 20-50mm	Light clay	Weak / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	7.5YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.32 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.47-0.68 EOBH	Light clay	Weak / Firm Angular blocky 10-20 mm No Slickensides	<2% calcium carbonate 2-6mm	7.5YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.58 / 8.5 Slight dispersion after 10 minutes Partial slaking	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C35	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 688588 7377380 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 8Dn(Te) / Grey Dermosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow scrub No microrelief Extensive clearing Rill erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Clay loam	Weak / Weak Angular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Many	0.10 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.20-0.35 Clear 20-50mm	Light clay	Weak / Weak Angular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.28 / 8.5 No dispersion after 10 minutes No slaking	
			BC 0.35-0.50 EOBH	Light clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.42 / 8.5 No dispersion after 10 minutes No slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site C36	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 688804 7377298 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 19Bl(Ro) / Brown Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Exposed profile cutting	Survey Date / Described by: 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH / Dispersion / Slaking	Sample (m) / Observations
Grazing Level plain Plain Open depression Slope 3% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Open woodland No microrelief Extensive clearing Gully erosion	Surface flake No coarse fragments No rock outcrop	A1 0.00-0.18 Clear 20-50mm	Light clay	Weak / Weak Angular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Many	0.10 / 8.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.18-0.35 Clear 20-50mm	Light clay	Weak / Weak Angular blocky 20-50 mm Slickensides	<2% coarse fragments 2-6mm	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Common	0.28 / 8.5 No dispersion after 10 minutes No slaking	
			B22 0.35-1.00+ End of profile	Light clay	Moderate / Firm Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Very fine <1mm Few	0.60 / 8.5 No dispersion after 10 minutes No slaking	

Landscape



Surface



Soil Profile



Site C37	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 688262 7373639 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 11Bl(Ta) / Brown Dermosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2% / 2% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Sparse No microrelief Extensive clearing	Surface flake 2-10% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.15 Clear 20-50mm	Clay loam	Massive / Loose Angular blocky 5-10 mm No Slickensides	<2% coarse fragments 2-6mm	10YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.08 / 7.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.15-0.50	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.30 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.90 EOBH	Medium clay	Moderate / Very firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.70 / 7.5 No dispersion after 10 minutes Partial slaking	
			No recovery of soil								

Landscape



Surface



Soil Profile



Site C38	**Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy:** 687935 7374475 / GPS <3.00m	**Soil Profile Class / Australian Soil Class:** 2Dn(Te) / Black Vertosol	**Soil Survey Type / Observation Class / Method:** Free / Class IV(a) / Auger	**Survey Date / Described by:** 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	**Vegetation / Microrelief / Disturbance / Erosion**	**Surface condition / surface rock / Rock outcrop**	**Soil Profile Description**								
			Horizon / Depth (m) / Boundary	**Field Texture**	**Structure / Strength / Pedality / Slickensides**	**Coarse fragments / Segregations**	**Colour / Mottle / Bleaching**	**Soil water status / Drainage**	**Roots Size / Abundance**	**Depth (m) / Field pH / Dispersion / Slaking**	**Sample (m) / Observations**
Grazing Gently undulating plain Plain Flat Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Brigalow scrub Open woodland No microrelief Extensive clearing No erosion	Cracking <2% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Strong / Very firm Angular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR3/1 Very dark grey No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Common	0.05 / 7.0 No dispersion after 10 minutes Partial slaking	-
			B21 0.10-0.50 Diffuse >100mm	Medium heavy clay	Strong / Firm Angular blocky 20-50 mm Slickensides	<2% coarse fragments <2mm	10YR3/1 Very dark grey No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.35 / 7.5 No dispersion after 10 minutes Partial slaking	
			B22 0.50-0.80 EOBH	Medium heavy clay	Strong / Very firm Angular blocky 20-50 mm Slickensides	<2% calcium carbonate 2-6mm	10YR4/1 Dark grey No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	0.65 / 7.5 No dispersion after 10 minutes Partial slaking	

Landscape



Surface



Soil Profile



Site C39	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 687178 7374537 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Dn(Te) / Black Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 12/09/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description								
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Gently undulating plain Plain Mid-slope Slope 2% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Bauhinia Sparse No microrelief Extensive clearing No erosion	Self-mulching <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Light clay	Moderate / Firm Subangular blocky 5-10 mm No Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.05 / 7.5	-
			B21 0.10-0.60 Gradual 50-100mm	Medium clay	Strong / Very firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Moderately well drained	Fine 1-2mm Few	0.35 / 7.5	
			B22 0.60-1.00 EOBH	Medium clay	Strong / Firm Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Moderately well drained	No roots	0.80 / 7.5	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C40	686376 7375625 GPS <3.00m	12Da(Te) / Class IV(b)	Date: 21/10/2025 Grazing, gently undulating rises, risecrest, crest, minor area <5 ha, aggregated into UMA 57 / 12Da(Te). Open woodland, extensive clearing, no microrelief, no rock outcrop, scald erosion. Surface: 5-10% coarse fragments, 60-200 mm	
Site C41	686511 7375532 GPS <3.00m	12Da(Te) / Class IV(b)	Date: 21/10/2025 Grazing, gently undulating rises, residual rise, lower slope, start of rise, minor area <5 ha, aggregated into UMA 57 / 12Da(Te). Open woodland, extensive clearing, no microrelief, no rock outcrop, scald erosion. Surface: 5-10% coarse fragments, 60-200 mm	
Site C42	690703 7372706 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 23/10/2025 Grazing, gently undulating plains, flat, slope <1% Bauhinia, scrub, extensive clearing, no microrelief, no erosion, no rock outcrop Surface: Self mulching, <2% coarse fragments, 20-60 mm, medium clay, 7.5YR4/3 Brown	-

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C43	685717 7378011 GPS <3.00m	16Bl(Ta) / Class IV(b)	Date: 23/10/2025 Grazing, gently undulating rises, simple slope, slope 2-3% Bauhinia, grassland, extensive clearing, no microrelief, scald and sheet erosion, no rock outcrop Surface: Firm with areas of crusting, <% coarse fragments, 20-60 mm, light medium clay, 7.5YR4/2 Brown	 
Site C44	690653 7370148 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 03/11/2025 Grazing, gently undulating plains, lower slope, slope 1% Bauhinia, Brigalow, extensive clearing, no microrelief, no erosion, no rock outcrop Surface: Firm, no coarse fragments, light sandy clay, 7.5YR3/2	-

Site C45	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy: 686634 7385472 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Dn(Te) / Black Vertosol	Soil Survey Type / Observation Class / Method: Free / Class IV(a) / Auger	Survey Date / Described by: 03/11/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer), Acid Sulfate Soil (ASS)	Vegetation / Microrelief / Disturbance / Erosion	Surface condition / surface rock / Rock outcrop	Soil Profile Description							
			Horizon / Depth (m) / Boundary	Field Texture	Structure / Strength / Pedality / Slickensides	Coarse fragments / Segregations	Colour / Mottle / Bleaching	Soil water status / Drainage	Roots Size / Abundance	Depth (m) / Field pH	Sample (m) / Observations
Grazing Level plain Plain Flat Slope 1% / 1% **ASS Attributes** pH < 5 <4: No Shell / Corroded Shell: No Jarositic horizons: Potential Sulfurous smell: No Dead, dying, stunted vegetation: No Further Assessment: No	Brigalow Grassland No microrelief Complete clearing, not cultivated No erosion	Surface flake <2% coarse fragments 20-60mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Moist Well drained	Fine 1-2mm Few	0.05 / 7.0 No dispersion after 10 minutes Partial slaking	No samples taken Recent rainfall prior to site visit
			B21 0.10-0.40 Clear 20-50mm	Medium clay	Strong / Firm Subangular blocky 20-50 mm Slickensides	2-10% calcium carbonate 6-20mm	10YR3/2 Very dark greyish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	0.25 / 8.0 No dispersion after 10 minutes Partial slaking	
			B22 0.40-0.95 Clear 20-50mm	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	0.70 / 7.5 No dispersion after 10 minutes Complete slaking	
			B23 0.95-1.00 EOBH	Medium heavy clay	Strong / Firm Subangular blocky 10-20 mm Slickensides	No inclusions or segregations	10YR4/2 Dark greyish brown Mottles: Brown Common 10%-20% Few <5 mm	Moderately moist Moderately well drained	Fine 1-2mm Few	0.97 / 7.0 No dispersion after 10 minutes Complete slaking	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C46	686518 7384762 GPS <3.00m	Boundary – 3Bl(Te) / 4Bl(Te) Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plains, lower slope, slope 1% Grassland, extensive clearing, no microrelief, no erosion, no rock outcrop Surface: Firm, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	
Site C47	686475 7384419 GPS <3.00m	Boundary – 4Bl(Te) / 15Bl(Ro) Class IV(b)	Date: 04/11/2025 Boundary – Surface colour changes to brown heading towards the south. Grey to the north.	
Site C48	686430 7384037 GPS <3.00m	5Dn(Ro) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plains, mid slope, open depression area Grassland, Acacia, extensive clearing, no microrelief, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR3/2 Very dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C49	686420 7383767 GPS <3.00m	6Bl(Pg) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plains, mid slope, open depression area Grassland, Acacia, extensive clearing, gilgai in immediate area extending to the east, no erosion, minor rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	
Site C50	686311 7382886 GPS <3.00m	Near boundary – 7Bl(Pg) / 15Bl(Ro) Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plains, mid slope Gilgai boundary site Brigalow, extensive clearing, gilgai in immediate area extending to the south (none to the north), no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey	
Site C51	686230 7382225 GPS <3.00m	Boundary – 7Bl(Pg) / 13Bl(Ta) Class IV(b)	Date: 04/11/2025 Boundary site, gilgai increases to the north. No gilgai to the south.	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C52	686389 7382028 GPS <3.00m	13Bl(Ta) / Class IV(b)	Date: 04/11/2025 Dam to the south, disturbance area covering approximately 0.5 ha. Area aggregated into UMA 59 / 13Bl(Ta)	
Site C53	686171 7381780 GPS <3.00m	Boundary – 7Bl(Pg) / 13Bl(Ta) Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, mid slope Gilgai boundary site Brigalow, extensive clearing, gilgai in immediate area extending to the south (none to the north), no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey	
Site C54	686058 7380830 GPS <3.00m	Near boundary – 7Bl(Pg) / 10Ct(Ro) Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, mid slope Gilgai boundary site Brigalow, extensive clearing, gilgai in immediate area extending to the north (none to the south), no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C55	685902 7379582 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, lower slope, 2% Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Firm, isolated area (0.5-1.0 ha) of rocks on surface – 20-600mm, light medium clay, 10YR3/2 Very dark greyish brown	
Site C56	688450 7376507 GPS <3.00m	7Bl(Pg) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, mid slope Brigalow, extensive clearing, gilgai observed, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C57	689204 7374168 GPS <3.00m	11Bl(Ta) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, drainage line, gully Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Exposed soil profile, shows 0.80 m soil depth over eroded bedrock. Surface: Cracking, no coarse fragments, clay loam, 10YR3/3 Dark brown	
Site C58	689681 7374242 GPS <3.00m	18Bl(Ro) / Class IV(b)	Date: 04/11/2025 Grazing, gently undulating plain, mid slope, 1% Sparse Bauhina, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C59	688493 7374238 GPS <3.00m	5Dn(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain, flat plain, <1% Sparse Bauhina and Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey Aerial imagery suggests boundary between north and south areas.	-
Site C60	688685 7375439 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain, gully, drainage line Sparse Bauhina, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Flake, <2% coarse fragments 20-60mm, light clay - sandy, 10YR3/2 Very dark greyish brown	
Site C61	688267 7375835 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain Sparse Bauhina, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Flake, <2% coarse fragments 2-6mm, light clay - sandy, 10YR3/2 Very dark greyish brown Isolated area with scalded surface covering <1 ha	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C62	688799 7376454 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plains Sparse Bauhina and Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Firm, no coarse fragments 2-6mm, sandy clay loam, 10YR3/2 Very dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C63	688847 7376568 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plains Sparse Bauhina, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Firm, no coarse fragments, sandy clay loam, 10YR3/3 Dark brown	 
Site C64	688865 7376603 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain Sparse Bauhina and Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Firm, no coarse fragments, sandy clay loam, 10YR3/2 Very dark greyish brown	-
Site C65	688877 7376634 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain Sparse Bauhina and Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Firm, no coarse fragments, sandy clay loam, 10YR3/2 Very dark greyish brown	-
Site C66	688885 7376665 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 05/11/2025 Grazing, gently undulating plain Sparse Bauhina and Brigalow, extensive clearing, no gilgai observed, no erosion, no rock outcrop Surface: Firm, no coarse fragments, sandy clay loam, 10YR3/2 Very dark greyish brown	-

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C67	687232 7382661 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain Sparse vegetation, extensive clearing, no erosion, no rock outcrop Minor area gilgai observed in immediate area, <10% coverage, not observed in broader area, therefore aggregated into UMA 63 / 15Bl(Ro) Surface: Self mulching, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	
Site C68	686707 7382940 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain Sparse vegetation, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Self mulching, no coarse fragments, light clay, 10YR4/2 Dark greyish brown	
Site C69	686642 7385711 GPS <3.00m	10Ct(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain, flat plain <1% Sparse vegetation, extensive clearing, no erosion, no rock outcrop Minor area gilgai observed in immediate area, <10% coverage, not observed in broader area, not observed at nearby site D54, therefore aggregated into UMA 48 / 10Ct(Ro) Surface: Self mulching, no coarse fragments, medium clay - silty, 10YR4/1 Dark grey	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C70	690192 7371142 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain, lower slope, depression, drainage line Brigalow and Bauhinia, limited clearing, no gilgai, no erosion, no rock outcrop Surface: Self mulching, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	
Site C71	690898 7371680 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain, lower slope, depression, drainage line Brigalow, limited clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C72	690621 7371071 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 06/11/2025 Grazing, gently undulating plain, lower slope, depression, drainage line Grassland, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C73	691255 7380354 GPS <3.00m	20Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, upper to mid slope, 2% Brigalow and Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Hard setting, no coarse fragments, sandy loam, 7.5YR3/2	 
Site C74	686931 7379314 GPS <3.00m	Boundary 2Dn(Te) / 17Bl(Ro) Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, flat plain, <1% Sparse Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light clay, 10YR3/2 Very dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C75	687750 7379472 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, mid slope, <1% Sparse Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	 
Site C76	687331 7379476 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, mid slope, <1% Sparse Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C77	687037 7380446 GPS <3.00m	Near boundary 15Bl(Ro) / 4Bl(Te) Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, gully, soil depth on exposed profile shows 1.2m+ Sparse Bauhinia and Brigalow, extensive clearing, no gilgai, gully erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	
Site C78	687135 7381274 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, mid slope, <1% Brigalow, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C79	687402 7384348 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, simple slope, <1% Grassland, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, medium clay, 10YR4/3 Brown	 
Site C80	687483 7385209 GPS <3.00m	10Ct(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, depression, gully Limited clearing, no gilgai, no erosion, no rock outcrop Surface: Cracking and self mulching in areas, no coarse fragments, light medium clay, 10YR4/1 Dark grey	
Site C81	687959 7385438 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, simple slope, <1% Grassland, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, medium clay, 10YR4/3 Brown	-

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C82	688039 7381267 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, mid slope, <1% Grassland, sparse Brigalow, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	 
Site C83	688340 7381227 GPS <3.00m	15Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plain, mid slope, <1% Grassland, sparse Brigalow, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, light medium clay, 10YR4/2 Dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C84	686739 7383375 GPS <3.00m	Boundary – 6Bl(Pg) / 15Bl(Ro) Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, mid slope Gilgai boundary site Brigalow, extensive clearing, gilgai in immediate area extending to the east (none to the west), no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	
Site C85	686286 7382653 GPS <3.00m	7Bl(Pg) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, mid slope Brigalow, extensive clearing, gilgai observed, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR4/1 Dark grey	-
Site C86	686188 7381933 GPS <3.00m	13Bl(Ta) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, drainage line, gully Brigalow, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, light clay, 10YR4/3 Brown	-
Site C87	685981 7380217 GPS <3.00m	19Bl(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, drainage line, gully Brigalow, extensive clearing, no gilgai, gully erosion, no rock outcrop Surface: Self mulching, no coarse fragments, light clay, 10YR3/2 Very dark greyish brown	-
Site C88	686597 7380487 GPS <3.00m	4Bl(Te) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, drainage line, gully Brigalow, extensive clearing, no gilgai, gully erosion, no rock outcrop Surface: Flake, no coarse fragments, light medium clay, 10YR3/2 Very dark greyish brown	

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C89	686064 7379484 GPS <3.00m	9Dn(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, minor drainage line Brigalow, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Cracking, no coarse fragments, medium clay, 10YR3/1 Very dark grey	
Site C90	686565 7378346 GPS <3.00m	10Ct(Ro) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, drainage line, exposed soil profile observed to 1.0m depth Bauhinia, extensive clearing, no gilgai, no erosion, no rock outcrop Surface: Flake, no coarse fragments, medium clay, 10YR4/2 Dark greyish brown	
Site C91	689908 7378062 GPS <3.00m	7Bl(Pg) / Class IV(b)	Date: 07/11/2025 Desktop site. Review of SLR (2023) site C18 landscape and surface photos, combined with aerial imagery shows gilgai. This site is within UMA 24, aerial and landscape photos show similarity with nearby UMA 28 (Grey Vertosol).	-

Site No.	Location (mE/mS GDA2020 ZONE 55) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C92	692160 7373851 GPS <3.00m	6Bl(Pg) / Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, flat, slope <1% Brigalow, extensive clearing, no erosion, no rock outcrop, Normal gilgai Surface: Flake, <2% coarse fragments, 20-60 mm, light clay, 10YR4/3 Brown	
Site C93	691275 7379297 GPS <3.00m	Boundary – 6Bl(Pg) / 21Bl(Ta) Class IV(b)	Date: 07/11/2025 Grazing, gently undulating plains, flat, slope <1% Gilgai boundary site Brigalow, extensive clearing, no erosion, no rock outcrop, Normal gilgai in immediate area extending to the east (none to the west) - 30% coverage - 0.5 to 1.0m deep mound position Surface: Flake, <2% coarse fragments, 20-60 mm, light clay, 10YR4/3 Brown	

Appendix C Analysed Site Laboratory Summary

Table AppC-1: Soil Chemistry for 1Dn(Te), Analysed Site D1

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
pH 1:5 water (pH units)	8.55	8.94	9.2
pH CaCl2 (following 4A1) pH units	7.84	8.17	8.35
Organic Carbon (W&B) % (40°C)	1.66	0.7	-
Nitrate - N (2M KCl) (mg/kg)	2.7	<1.0	-
Ammonium - N (2M KCl) (mg/kg)	1.4	<1.0	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-
PBI + Col P	100	92	-
Colwell Potassium (mg/kg)	500	150	-
KCl Sulfur (S) (mg/kg)	5.8	6.8	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	4650	3860	2520
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	458	563	536
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	415	126	92
Sodium (NH4Cl/BaCl2) (mg/kg)	200	1320	1410
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	23.2	19.3	12.6
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	3.77	4.63	4.41
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	1.06	0.322	0.234
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.87	5.73	6.15
Ca:Mg ratio	6.2	4.2	2.9
K:Mg ratio	0.28	0.07	0.05
GTRI	-	-	-
ECR (%)	6.7	20	27
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	4490	4090	2720
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	471	563	561
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	455	136	100
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	28.8	274	659
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	22.4	20.4	13.6
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	3.87	4.63	4.61
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.16	0.347	0.256

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.125	1.19	2.87
Ca:Mg ratio	5.8	4.4	2.9
K:Mg ratio	0.3	0.08	0.06
ECR (%)	4.7	5.8	15
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	27.6	26.6	21.3
Calcium (%)	81.3	76.8	63.7
Magnesium (%)	14	17.4	21.7
Potassium (%)	4.2	1.3	1.2
Sodium (%)	0.5	4.5	13
Aluminium (%)	0	0	0
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-
Chloride (mg/kg)	62	700	830
Salinity EC 1:5 (dS/m)	0.17	0.67	0.71
Boron (mg/kg)	1.4	-	-
Iron (Fe) (mg/kg)	6.2	-	-
Manganese (Mn) (mg/kg)	3.5	-	-
Copper (Cu) (mg/kg)	0.6	-	-
Zinc (Zn) (mg/kg)	0.27	-	-
Oxalate ext. Molybdenum (mg/kg)	0.81	-	-
Dumas Total Nitrogen (% dry wt)	0.21	0.12	-
TDS (mg(/L)	110	430	450
% Air-dry Moisture Content (% of dry wt)	2.9	3.2	2.6
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0288	0.0316	0.0263
Moisture (dry basis) (%)	3.01	3.17	2.09
Moisture 105Â°C (dry basis) (%)	10.1	12.5	8.1
Texture (ISSS Classification)	Clay	Clay	Silty Clay Loam
Gravel fraction (% of whole sample)	1.5	0.8	57.4

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sand fraction (%(< 2 mm fraction)	40.8	30.2	43.3
Silt fraction (% < 2 mm fraction)	14.8	17.9	28.5
Clay fraction (% < 2 mm fraction)	44.4	51.9	28.2
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.4	0.66	0.35
EAT	4	3	2
15 Bar (%)	20.3	22.7	15.1

'-' indicates no laboratory assessment was undertaken

Table AppC-2: Soil Chemistry for 2Dn(Te), Analysed Site D3 (SLR Site B25 (2023)

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D3-0.00-0.10 (B25, SLR 2023)	D3-0.20-0.30 (B25, SLR 2023)	D3-0.50-0.60 (B25, SLR 2023)	D3-0.70-0.80	D3-0.90-1.00 (B25, SLR 2023)
pH 1:5 water	7.26	6.8	8.06	-	9.13
Organic Carbon (W&B)	3.85	1.5	-	-	-
Nitrate - N (2M KCl)	3.8	47	-	-	-
Ammonium - N (2M KCl)	4.1	<1.0	-	-	-
Colwell Phosphorus	18	5.5	-	-	-
PBI + Col P	67	94	-	-	-
Colwell Potassium	1800	1100	-	-	-
KCl Sulfur (S)	11	37	-	-	-
Exchangeable Calcium	19	23	28	-	20
Exchangeable Magnesium	6.7	7.9	8.3	-	5.7
Exchangeable Potassium	0.56	0.37	0.36	-	0.18
Exchangeable Sodium	0.42	0.62	0.91	-	1.2
Exchangeable acidity	<0.02	<0.02	-	-	-
Exchangeable aluminium	<0.02	<0.02	-	-	-
This Exchangeable hydrogen	<0.02	<0.02	-	-	-
Calcium/Magnesium Ratio	2.9	2.9	3.4		3.6
ECEC	27	32	38	-	27
Calcium (%)	72	72	75	-	74
Magnesium (%)	25	25	22	-	21
Potassium (%)	2.1	1.2	0.95	-	0.64
Sodium - ESP (%)	1.6	2	2.4	-	4.3
Aluminium (%)	0.04	0.05	0.04	-	0.04
Hydrogen (%)	0	0	0	-	0
CaCl2 extr. Aluminium	<0.1	-	-	-	-
Chloride	41	380	1100	1200	740
EC	0.117	0.087	0.189	-	740
Boron	2.7	-	-	-	-
Iron (Fe)	8.1	-	-	-	-
Manganese (Mn)	11	-	-	-	-
Copper (Cu)	0.9	-	-	-	-
Zinc (Zn)	1.1	-	-	-	-
Oxalate ext. Molybdenum	0.59	-	-	-	-
Dumas Total Nitrogen	0.38	0.14	-	-	-
% Air-dry Moisture Content	2.9	3.5	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D3-0.00-0.10 (B25, SLR 2023)	D3-0.20-0.30 (B25, SLR 2023)	D3-0.50-0.60 (B25, SLR 2023)	D3-0.70-0.80	D3-0.90-1.00 (B25, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0286	0.0351	-	-	-
Moisture (dry basis)	5.75	5.67	8.57	8.4	4.62
Moisture 105Â°C (dry basis)	---	---	---	---	---
Texture (ISSS Classification)	Clay Loam	Clay	Clay	Clay	Clay Loam
Gravel fraction	2.4	1	53.7	45.7	87.1
Sand fraction	51.6	47.9	24.9	31	58.7
Silt fraction	21.4	15.2	18.1	10.7	12.4
Clay fraction	27	36.9	57	58.3	29
Moisture 40Â°C (dry basis)	2.9	5.1	7	6.3	3.3
R1 Dispersion Ratio	0.31	0.31	0.27	0.37	0.57
EAT	3	4	4	---	4
15 Bar (%)	19.5	18.1	23.4	22.4	12.4

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-3: Soil Chemistry for 3Bl(Te), Analysed Site D5

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	7.63	8.63	8.96	8.13	8.63	5.21	8.08
pH CaCl2 (following 4A1) pH units	6.42	7.67	8.12	7.52	8.01	4.6	7.4
Organic Carbon (W&B) % (40°C)	1.34	1.12	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	1.7	1.3	-	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-	-	-	-
PBI + Col P	116	112	-	-	-	-	-
Colwell Potassium (mg/kg)	97	80	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	7.5	6.3	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3900	4330	4400	2980	3450	2290	2940
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1080	1310	1360	1460	1490	1490	1420
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	115	109	88	110	121	100	116
Sodium (NH4Cl/BaCl2) (mg/kg)	566	1010	1120	2440	2110	2210	1890
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	19.5	21.6	22	14.8	17.2	11.4	14.7
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	8.89	10.8	11.2	12	12.3	12.3	11.7
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.294	0.278	0.226	0.281	0.309	0.255	0.297
Sodium (NH4Cl/BaCl2) (cmol/kg)	2.46	4.38	4.87	10.6	9.19	9.6	8.23

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	2.2	2	2	1.2	1.4	0.9	1.3
K:Mg ratio	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GTRI	-	-	-	-	-	-	-
ECR (%)	8.9	13	13	29	24	29	24
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	4060	4470	4330	3140	3570	2490	3260
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1060	1430	1530	1590	1640	1520	1660
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	144	133	105	118	120	98.8	118
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	314	532	446	1150	1020	1200	1050
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	20.3	22.3	21.6	15.7	17.8	12.4	16.3
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	8.72	11.7	12.6	13.1	13.5	12.5	13.7
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.368	0.34	0.269	0.301	0.306	0.253	0.302
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.36	2.31	1.94	4.99	4.43	5.24	4.55
Ca:Mg ratio	2.3	1.9	1.7	1.2	1.3	1	1.2
K:Mg ratio	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
ECR (%)	5.6	7.2	6.1	16	13	18	14
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	1.3	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	1.2	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	0.1	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	30.7	36.7	36.4	34	36.1	31.7	34.8
Calcium (%)	66	60.8	59.3	46.1	49.4	39.2	46.7
Magnesium (%)	28.4	32	34.7	38.4	37.5	39.4	39.3
Potassium (%)	1.2	0.9	0.7	0.9	0.9	0.8	0.9
Sodium (%)	4.4	6.3	5.3	15	12	17	13
Aluminium (%)	0	0	0	0	0	3.8	0
Hydrogen (%)	0	0	0	0	0	0.3	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	130	290	350	1400	1100	1500	1200
Salinity EC 1:5 (dS/m)	0.13	0.35	0.46	1	0.97	1	0.88
Boron (mg/kg)	1.4	-	-	-	-	-	-
Iron (Fe) (mg/kg)	27	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	28	-	-	-	-	-	-
Copper (Cu) (mg/kg)	2.2	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.18	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.3	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.11	0.092	-	-	-	-	-
TDS (mg(/L)	83	230	290	650	620	660	570
% Air-dry Moisture Content (% of dry wt)	3.5	4	5.3	4.4	3.5	4	4.3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0349	0.0395	0.0531	0.0437	0.0347	0.0404	0.0425
Moisture (dry basis) (%)	3.4	4.13	3.33	3.15	3.1	3.31	3.18
Moisture 105Â°C (dry basis) (%)	11.7	15.1	13.3	12.4	14	13.1	13.7

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Silty Clay	Clay
Gravel fraction (% of whole sample)	< 0.1	< 0.1	4.3	< 0.1	3.4	< 0.1	< 0.1
Sand fraction (%(< 2 mm fraction)	38.5	30.8	31.7	31.2	29.4	17.1	29.8
Silt fraction (% < 2 mm fraction)	10.2	13.5	11.9	13	13.5	28.2	14.8
Clay fraction (% < 2 mm fraction)	51.3	55.8	56.4	55.9	57.1	54.7	55.4
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.44	0.51	0.44	0.66	0.57	0.74	0.66
EAT	2	2	2	2	2	2	2
15 Bar (%)	25.8	28.2	27.3	26.8	27.1	28.2	29.9

'-' indicates no laboratory assessment was undertaken

Table AppC-4: Soil Chemistry for 4Bl(Te), Analysed Site D6

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
pH 1:5 water (pH units)	7.17	8.98	9.07	9.1	8.95
pH CaCl2 (following 4A1) pH units	6.06	8.09	8.26	8.37	8.14
Organic Carbon (W&B) % (40°C)	1.77	0.91	-	-	-
Nitrate - N (2M KCl) (mg/kg)	1.2	<1.0	-	-	-
Ammonium - N (2M KCl) (mg/kg)	2.5	1.2	-	-	-
Colwell Phosphorus (mg/kg)	7.3	<5.0	-	-	-
PBI + Col P	68	122	-	-	-
Colwell Potassium (mg/kg)	330	100	-	-	-
KCl Sulfur (S) (mg/kg)	4.8	8.9	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	2400	3900	3470	2110	2000
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	746	1250	1260	1060	1140
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	252	126	109	67	64
Sodium (NH4Cl/BaCl2) (mg/kg)	205	1030	1380	1680	1890
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	12	19.4	17.3	10.6	10
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.13	10.3	10.4	8.69	9.38
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.644	0.321	0.278	0.17	0.163
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.892	4.47	6.02	7.32	8.22
Ca:Mg ratio	2	1.9	1.7	1.2	1.1
K:Mg ratio	0.11	<0.05	<0.05	<0.05	<0.05
GTRI	-	-	-	-	-
ECR (%)	7.8	14	19	28	30

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2470	4020	3940	2250	2050
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	784	1440	1350	1140	1130
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	307	137	108	81.8	52.2
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	66.4	319	465	595	934
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	12.3	20.1	19.6	11.2	10.2
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.45	11.8	11.1	9.34	9.32
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.785	0.35	0.275	0.209	0.134
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.289	1.39	2.02	2.59	4.06
Ca:Mg ratio	1.9	1.7	1.8	1.2	1.1
K:Mg ratio	0.12	<0.05	<0.05	<0.05	<0.05
ECR (%)	5.4	5.2	7	12	18
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	19.8	33.6	33	23.3	23.8
Calcium (%)	62.1	59.7	59.5	48	43.1
Magnesium (%)	32.5	35.2	33.6	40	39.2
Potassium (%)	4	1	0.8	0.9	0.6
Sodium (%)	1.5	4.1	6.1	11	17
Aluminium (%)	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-
Chloride (mg/kg)	44	260	420	1100	1100
Salinity EC 1:5 (dS/m)	0.074	0.39	0.51	0.91	0.91

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
Boron (mg/kg)	0.77	-	-	-	-
Iron (Fe) (mg/kg)	25	-	-	-	-
Manganese (Mn) (mg/kg)	38	-	-	-	-
Copper (Cu) (mg/kg)	1.4	-	-	-	-
Zinc (Zn) (mg/kg)	0.96	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.84	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.16	0.093	-	-	-
TDS (mg(/L)	47	250	330	580	580
% Air-dry Moisture Content (% of dry wt)	2.4	3.4	3.2	3.3	2.9
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0243	0.0336	0.0323	0.0329	0.0289
Moisture (dry basis) (%)	1.54	3.17	2.94	1.44	2.15
Moisture 105Â°C (dry basis) (%)	3.5	15.5	16.2	5.8	7.4
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay Loam
Gravel fraction (% of whole sample)	< 0.1	0.3	1.1	47.4	0.3
Sand fraction (%(< 2 mm fraction)	48.8	32.2	36.2	43.8	50.3
Silt fraction (% < 2 mm fraction)	15.2	9	10.7	15.7	18.3
Clay fraction (% < 2 mm fraction)	36	58.8	53.1	40.5	31.4
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-
R1 Dispersion Ratio	0.39	0.54	0.6	0.69	0.5
EAT	3	3	3	2	2
15 Bar (%)	27.2	26.4	24.9	17.4	22.9

'-' indicates no laboratory assessment was undertaken

Table AppC-5: Soil Chemistry for 5Dn(Ro), Analysed Site D7

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
pH 1:5 water (pH units)	8.57	8.96	8.76
pH CaCl2 (following 4A1) pH units	7.82	8.01	7.92
Organic Carbon (W&B) % (40°C)	1.46	0.78	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-
Ammonium - N (2M KCl) (mg/kg)	1.6	<1.0	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-
PBI + Col P	133	115	-
Colwell Potassium (mg/kg)	120	120	-
KCl Sulfur (S) (mg/kg)	5.6	4.6	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	5520	4470	2990
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	796	1010	1150
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	171	132	132
Sodium (NH4Cl/BaCl2) (mg/kg)	227	530	1510
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	27.6	22.3	14.9
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.55	8.31	9.43
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.438	0.338	0.339
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.988	2.3	6.56
Ca:Mg ratio	4.2	2.7	1.6
K:Mg ratio	0.07	<0.05	<0.05
GTRI	-	-	-
ECR (%)	4	7.9	22
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	5340	4800	2690
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	813	1100	1090
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	172	137	139
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	48.7	126	725
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	26.7	24	13.4
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.69	9.07	8.93
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.439	0.349	0.355

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.212	0.55	3.15
Ca:Mg ratio	4	2.6	1.5
K:Mg ratio	0.07	<0.05	<0.05
ECR (%)	1.9	2.6	14
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	34	33.9	25.9
Calcium (%)	78.4	70.6	51.9
Magnesium (%)	19.7	26.7	34.5
Potassium (%)	1.3	1	1.4
Sodium (%)	0.6	1.6	12
Aluminium (%)	0	0	0
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-
Chloride (mg/kg)	25	57	640
Salinity EC 1:5 (dS/m)	0.16	0.23	0.58
Boron (mg/kg)	1.2	-	-
Iron (Fe) (mg/kg)	11	-	-
Manganese (Mn) (mg/kg)	4.6	-	-
Copper (Cu) (mg/kg)	1.1	-	-
Zinc (Zn) (mg/kg)	0.19	-	-
Oxalate ext. Molybdenum (mg/kg)	0.92	-	-
Dumas Total Nitrogen (% dry wt)	0.15	0.099	-
TDS (mg(/L)	100	140	370
% Air-dry Moisture Content (% of dry wt)	2.8	3.4	3.6
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0275	0.0338	0.036
Moisture (dry basis) (%)	3.35	2.84	2.69
Moisture 105Â°C (dry basis) (%)	8.6	12.6	13.4
Texture (ISSS Classification)	Clay	Clay	Clay
Gravel fraction (% of whole sample)	2.1	9.4	20

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sand fraction (%(< 2 mm fraction)	31.9	30.2	28.2
Silt fraction (% < 2 mm fraction)	16.8	14.6	16.5
Clay fraction (% < 2 mm fraction)	51.3	55.2	55.3
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.26	0.57	0.77
EAT	4	2	2
15 Bar (%)	20.9	21.9	22.8

'-' indicates no laboratory assessment was undertaken

Table AppC-6: Soil Chemistry for 6BI(Pg), Analysed Site 12m

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	7.75	5.67	5.77	5.75	7.65	7.22	7.59
pH CaCl2 (following 4A1) pH units	7.11	5.22	5.36	5.42	7.26	6.76	7.2
Organic Carbon (W&B) % (40°C)	0.75	0.42	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	1.6	1.7	-	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-	-	-	-
PBI + Col P	100	94	-	-	-	-	-
Colwell Potassium (mg/kg)	220	170	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	20	56	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3410	2040	1910	1740	2150	2390	2120
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1060	1210	1210	1210	1280	1360	1320
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	195	173	201	203	246	257	276
Sodium (NH4Cl/BaCl2) (mg/kg)	436	1470	1940	2320	2480	2570	2570
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	17	10.2	9.54	8.69	10.7	11.9	10.6
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	8.75	9.92	9.96	9.94	10.5	11.2	10.9
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.499	0.441	0.514	0.52	0.629	0.656	0.707
Sodium (NH4Cl/BaCl2) (cmol/kg)	1.9	6.4	8.43	10.1	10.8	11.2	11.2

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	1.9	1	1	0.9	1	1.1	1
K:Mg ratio	0.06	<0.05	0.05	0.05	0.06	0.06	0.07
GTRI	-	-	-	-	-	-	-
ECR (%)	8.5	25	31	36	35	34	36
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3550	2110	1910	1640	2310	2290	2080
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1110	1110	1120	1040	1380	1330	1300
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	235	201	250	226	311	285	329
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	101	471	618	560	690	690	686
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	17.7	10.5	9.52	8.19	11.5	11.4	10.4
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	9.13	9.16	9.2	8.54	11.3	10.9	10.7
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.602	0.514	0.639	0.578	0.795	0.728	0.842
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.44	2.05	2.69	2.44	3	3	2.99
Ca:Mg ratio	1.9	1.2	1	1	1	1	1
K:Mg ratio	0.07	0.06	0.07	0.07	0.07	0.07	0.08
ECR (%)	3.7	12	15	15	14	14	15
Exchangeable acidity (cmol/kg)	<0.02	0.11	0.06	0.06	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	0.06	<0.02	0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	0.05	0.04	0.03	<0.02	<0.02	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	27.9	22.4	22.1	19.8	26.7	26.1	24.9
Calcium (%)	63.5	47.1	43.1	41.4	43.2	43.8	41.7
Magnesium (%)	32.8	40.9	41.6	43.1	42.6	41.9	42.9
Potassium (%)	2.2	2.3	2.9	2.9	3	2.8	3.4
Sodium (%)	1.6	9.2	12	12	11	12	12
Aluminium (%)	0	0.3	0.1	0.1	0	0	0
Hydrogen (%)	0	0.2	0.2	0.2	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	300	1500	2200	3000	3000	2700	3300
Salinity EC 1:5 (dS/m)	0.33	1.1	1.5	2	2.1	1.9	2.3
Boron (mg/kg)	2.9	-	-	-	-	-	-
Iron (Fe) (mg/kg)	18	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	7.7	-	-	-	-	-	-
Copper (Cu) (mg/kg)	1.6	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.26	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.1	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.098	0.031	-	-	-	-	-
TDS (mg(/L)	210	700	970	1200	1400	1200	1400
% Air-dry Moisture Content (% of dry wt)	3.3	3.6	5	5.1	3.1	3.2	3.5
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.033	0.0359	0.0498	0.0508	0.0308	0.0321	0.0345
Moisture (dry basis) (%)	2.63	2.69	2.98	2.79	3.6	3.16	3.81
Moisture 105Â°C (dry basis) (%)	7.2	12.2	14.1	12.2	14.1	14.2	14.5

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Gravel fraction (% of whole sample)	0.8	< 0.1	0.2	9	18.1	17.9	2.8
Sand fraction (%(< 2 mm fraction)	31	24	24.1	25.2	25.1	23	25.2
Silt fraction (% < 2 mm fraction)	13	16.6	15.7	15.8	16.7	15.8	13.9
Clay fraction (% < 2 mm fraction)	56	59.4	60.2	59.1	58.2	61.2	60.9
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.42	0.65	0.69	0.69	0.66	0.71	0.78
EAT	4	2	2	2	2	2	2
15 Bar (%)	21.3	23.5	23.2	23.5	23.2	23.4	24.1

'-' indicates no laboratory assessment was undertaken

Table AppC-7: Soil Chemistry for 6BI(Pg), Analysed Site 12d

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	8.21	7.79	8.02	8.23	8.08	7.96	7.19
pH CaCl2 (following 4A1) pH units	7.49	7.2	7.51	7.69	7.57	7.5	6.7
Organic Carbon (W&B) % (40°C)	0.88	0.41	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	1	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-	-	-
Colwell Phosphorus (mg/kg)	5.9	<5.0	-	-	-	-	-
PBI + Col P	90	89	-	-	-	-	-
Colwell Potassium (mg/kg)	230	130	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	4.2	18	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3920	2550	2330	2250	2350	2210	1980
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	847	1090	1150	1090	1200	1270	1160
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	242	147	163	164	197	230	179
Sodium (NH4Cl/BaCl2) (mg/kg)	232	1800	2450	2310	2590	2680	1970
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	19.6	12.7	11.7	11.2	11.7	11	9.86
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.97	8.96	9.43	8.98	9.83	10.5	9.58
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.618	0.375	0.417	0.418	0.504	0.587	0.458
Sodium (NH4Cl/BaCl2) (cmol/kg)	1.01	7.83	10.7	10	11.3	11.6	8.57

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	2.8	1.4	1.2	1.3	1.2	1.1	1
K:Mg ratio	0.09	<0.05	<0.05	<0.05	0.05	0.06	<0.05
GTRI	-	-	-	-	-	-	-
ECR (%)	5.8	27	34	34	35	36	32
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3440	2390	2130	2240	2140	2060	1960
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	800	1060	1070	1100	1110	1120	1160
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	258	166	179	175	223	247	223
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	52.9	580	643	682	681	602	538
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	17.2	11.9	10.6	11.2	10.7	10.3	9.79
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.58	8.71	8.84	9.03	9.13	9.23	9.52
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.659	0.423	0.458	0.447	0.569	0.631	0.569
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.23	2.52	2.8	2.97	2.96	2.62	2.34
Ca:Mg ratio	2.6	1.4	1.2	1.2	1.2	1.1	1
K:Mg ratio	0.1	<0.05	0.05	<0.05	0.06	0.07	0.06
ECR (%)	3.6	13	14	14	15	14	13
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	24.6	23.6	22.7	23.6	23.3	22.7	22.2
Calcium (%)	69.7	50.6	46.8	47.3	45.8	45.1	44.1
Magnesium (%)	26.7	36.9	38.9	38.2	39.1	40.6	42.9
Potassium (%)	2.7	1.8	2	1.9	2.4	2.8	2.6
Sodium (%)	0.9	11	12	13	13	12	11
Aluminium (%)	0	0	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	26	1500	2200	2300	2600	3000	2500
Salinity EC 1:5 (dS/m)	0.14	1.1	1.5	1.5	1.7	2	1.6
Boron (mg/kg)	0.86	-	-	-	-	-	-
Iron (Fe) (mg/kg)	15	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	8.2	-	-	-	-	-	-
Copper (Cu) (mg/kg)	1.8	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.25	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.1	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.095	0.055	-	-	-	-	-
TDS (mg(/L)	92	690	980	980	1100	1300	1000
% Air-dry Moisture Content (% of dry wt)	2.7	3	2.6	2.7	3.2	3.1	4.1
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0267	0.0297	0.0262	0.0271	0.0323	0.0305	0.0408
Moisture (dry basis) (%)	2.39	2.57	2.61	2.47	2.37	2.74	2.73
Moisture 105Â°C (dry basis) (%)	4.7	10.6	11.3	11.1	11.9	11.7	10.6

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Clay	Clay
Gravel fraction (% of whole sample)	7	8.9	5	0.7	0.4	1.6	3.3
Sand fraction (%(< 2 mm fraction)	39.7	35.7	34.4	39.5	36.8	34.1	30.2
Silt fraction (% < 2 mm fraction)	13.1	12.3	13.4	10.3	11.4	13.6	13.7
Clay fraction (% < 2 mm fraction)	47.3	52.1	52.2	50.2	51.8	52.3	56.1
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.43	0.69	0.68	0.71	0.72	0.69	0.68
EAT	2	2	2	2	2	2	2
15 Bar (%)	18.5	21	21.2	24.2	24.5	23.8	25.1

'-' indicates no laboratory assessment was undertaken

Table AppC-8: Soil Chemistry for 7Bl(Pg), Analysed Site D14d

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.30-1.40
pH 1:5 water (pH units)	7.51	7.55	7.67	6.61	8.16	7.54
pH CaCl2 (following 4A1) pH units	6.19	6.36	7.16	5.88	7.52	6.9
Organic Carbon (W&B) % (40°C)	0.55	0.64	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	<1.0	1.1	-	-	-	-
Colwell Phosphorus (mg/kg)	11	12	-	-	-	-
PBI + Col P	84	94	-	-	-	-
Colwell Potassium (mg/kg)	180	230	-	-	-	-
KCl Sulfur (S) (mg/kg)	4.1	4	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3070	3040	3200	2260	2120	1820
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	894	911	1270	1010	1220	1130
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	193	231	179	127	197	148
Sodium (NH4Cl/BaCl2) (mg/kg)	263	394	1810	1320	1780	1720
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	15.3	15.2	16	11.3	10.6	9.1
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	7.35	7.49	10.4	8.31	10.1	9.34
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.495	0.592	0.458	0.325	0.503	0.379
Sodium (NH4Cl/BaCl2) (cmol/kg)	1.14	1.71	7.88	5.75	7.73	7.48
Ca:Mg ratio	2.1	2	1.5	1.4	1.1	1
K:Mg ratio	0.07	0.08	<0.05	<0.05	<0.05	<0.05
GTRI	-	-	-	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.30-1.40
ECR (%)	6.7	9.2	24	24	29	30
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2730	3290	3210	2080	2290	1680
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	774	955	1190	907	1360	1050
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	211	297	202	142	247	151
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	96.7	162	497	438	716	494
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	13.6	16.4	16	10.4	11.4	8.36
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.37	7.86	9.77	7.46	11.2	8.66
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.54	0.76	0.515	0.364	0.631	0.386
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.421	0.704	2.16	1.91	3.11	2.15
Ca:Mg ratio	2.1	2.1	1.6	1.4	1	1
K:Mg ratio	0.09	0.1	0.05	<0.05	0.06	<0.05
ECR (%)	4.6	5.7	9.4	11	14	13
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	21	25.7	28.5	20.1	26.4	19.6
Calcium (%)	65	63.8	56.3	51.5	43.3	42.8
Magnesium (%)	30.4	30.5	34.3	37.2	42.5	44.3
Potassium (%)	2.6	3	1.8	1.8	2.4	2

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.30-1.40
Sodium (%)	2	2.7	7.6	9.5	12	11
Aluminium (%)	0	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-
Chloride (mg/kg)	42	150	1700	1000	1500	1500
Salinity EC 1:5 (dS/m)	0.06	0.14	1.2	0.72	1	1
Boron (mg/kg)	0.53	-	-	-	-	-
Iron (Fe) (mg/kg)	28	-	-	-	-	-
Manganese (Mn) (mg/kg)	24	-	-	-	-	-
Copper (Cu) (mg/kg)	2.2	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.46	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.1	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.044	0.057	-	-	-	-
TDS (mg(/L)	38	87	770	460	650	640
% Air-dry Moisture Content (% of dry wt)	2.9	3.8	4.5	3.3	2.8	2.2
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.029	0.0378	0.0448	0.0328	0.0284	0.0218
Moisture (dry basis) (%)	2.54	2.66	3.21	2.3	2.39	2.25
Moisture 105Â°C (dry basis) (%)	5.7	6.9	12.9	8.7	8.9	10
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Clay
Gravel fraction (% of whole sample)	0.3	7.6	11.8	6.9	8.7	9.5
Sand fraction (%(< 2 mm fraction)	41.5	36.1	23.9	44.2	43.2	39.8
Silt fraction (% < 2 mm fraction)	13.8	11.7	16.2	11.4	11.6	19.5

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.30-1.40
Clay fraction (% < 2 mm fraction)	44.7	52.3	60	44.4	45.2	40.7
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-
R1 Dispersion Ratio	0.48	0.6	0.53	0.67	0.73	0.61
EAT	3	2	2	2	2	2
15 Bar (%)	21.2	22.8	25.3	20.6	21	17.4

'-' indicates no laboratory assessment was undertaken

Table AppC-9: Soil Chemistry for 7Bl(Pg), Analysed Site D14m

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
pH 1:5 water (pH units)	7.18	8.36	8.19	8.03	7.47	7.41	7.41	7.21
pH CaCl2 (following 4A1) pH units	6.34	7.7	7.36	7.57	7.02	7.01	6.96	6.73
Organic Carbon (W&B) % (40°C)	1.77	1.16	-	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	1.2	<1.0	-	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	2.2	1.3	-	-	-	-	-	-
Colwell Phosphorus (mg/kg)	10	<5.0	-	-	-	-	-	-
PBI + Col P	82	118	-	-	-	-	-	-
Colwell Potassium (mg/kg)	410	140	-	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	5.6	7.4	-	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3660	4240	2560	2380	2190	2250	2310	-
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	948	923	968	1390	1420	1460	1560	-
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	423	164	145	287	299	308	331	-
Sodium (NH4Cl/BaCl2) (mg/kg)	215	974	1070	2750	2890	3000	3110	-
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	18.3	21.2	12.8	11.9	10.9	11.3	11.5	-
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	7.8	7.59	7.96	11.4	11.7	12	12.8	-
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	1.08	0.42	0.371	0.735	0.764	0.786	0.847	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.937	4.24	4.64	12	12.6	13	13.5	-
Ca:Mg ratio	2.3	2.8	1.6	1	0.9	0.9	0.9	-
K:Mg ratio	0.14	0.06	<0.05	0.07	0.07	0.07	0.07	-
GTRI	-	-	-	-	-	-	-	-
ECR (%)	7.2	14	19	35	37	37	37	-
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3100	3780	2510	2240	1690	1650	1730	-
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	831	818	944	1280	1080	1080	1190	-
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	471	186	170	313	271	278	312	-
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	48.2	163	393	740	612	648	749	-
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	15.5	18.9	12.5	11.2	8.42	8.26	8.66	-
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.84	6.73	7.77	10.6	8.92	8.84	9.82	-
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.2	0.476	0.434	0.801	0.693	0.711	0.797	-
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.21	0.707	1.71	3.22	2.66	2.82	3.26	-
Ca:Mg ratio	2.3	2.8	1.6	1.1	0.9	0.9	0.9	-
K:Mg ratio	0.18	0.07	0.06	0.08	0.08	0.08	0.08	-
ECR (%)	6	4.4	9.6	16	16	17	18	-
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-
ECEC (cmol/kg)	23.7	26.8	22.4	25.7	20.7	20.6	22.5	-
Calcium (%)	65.2	70.5	55.8	43.4	40.7	40	38.4	-
Magnesium (%)	28.8	25.1	34.7	41	43.1	42.9	43.6	-
Potassium (%)	5.1	1.8	1.9	3.1	3.4	3.4	3.5	-
Sodium (%)	0.9	2.6	7.6	13	13	14	14	-
Aluminium (%)	0	0	0	0	0	0	0	-
Hydrogen (%)	0	0	0	0	0	0	0	-
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-	-
Chloride (mg/kg)	120	780	670	2900	3000	3000	3200	2400
Salinity EC 1:5 (dS/m)	0.13	0.62	0.49	1.9	1.9	1.9	2.1	1.6
Boron (mg/kg)	0.87	-	-	-	-	-	-	-
Iron (Fe) (mg/kg)	27	-	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	26	-	-	-	-	-	-	-
Copper (Cu) (mg/kg)	1.9	-	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.72	-	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.2	-	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.17	0.12	-	-	-	-	-	-
TDS (mg(/L)	82	390	310	1200	1200	1200	1300	1000
% Air-dry Moisture Content (% of dry wt)	2.8	3	2.6	3.9	4.7	4.7	4.2	-
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.028	0.0296	0.0255	0.0394	0.0469	0.0466	0.0418	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Moisture (dry basis) (%)	2.48	2.33	1.88	3.14	3.25	2.97	3.23	-
Moisture 105Â°C (dry basis) (%)	4.8	8.2	8.1	13.7	14.7	13.1	15	-
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Clay	Clay	-
Gravel fraction (% of whole sample)	0.3	0.9	7.2	0.2	10.2	9	19.4	-
Sand fraction (%(< 2 mm fraction)	33.6	32.3	47.7	25.4	23.7	49.2	23	-
Silt fraction (% < 2 mm fraction)	19.9	17.5	11.4	16.2	15.7	11.5	15.3	-
Clay fraction (% < 2 mm fraction)	46.6	50.2	41	58.4	60.6	39.3	61.7	-
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.38	0.35	0.61	0.7	0.76	0.99	0.79	-
EAT	3	3	2	2	2	2	2	-
15 Bar (%)	20.9	14.1	18.3	27.8	24.1	24	24.9	-

'-' indicates no laboratory assessment was undertaken

Table AppC-10: Soil Chemistry for 8Dn(Te), Analysed Site D19

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
pH 1:5 water (pH units)	8.19	8.82	8.95	7.96	8.88
pH CaCl2 (following 4A1) pH units	7.38	7.87	8.03	7.14	7.99
Organic Carbon (W&B) % (40°C)	1.64	1.1	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-
Ammonium - N (2M KCl) (mg/kg)	4.8	<1.0	-	-	-
Colwell Phosphorus (mg/kg)	9.3	<5.0	-	-	-
PBI + Col P	67	100	-	-	-
Colwell Potassium (mg/kg)	470	170	-	-	-
KCl Sulfur (S) (mg/kg)	4.2	5.7	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	4640	5050	3170	1750	3150
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	779	743	501	670	653
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	405	181	88	59	114
Sodium (NH4Cl/BaCl2) (mg/kg)	145	426	513	1750	1100
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	23.1	25.2	15.8	8.73	15.7
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.41	6.11	4.13	5.51	5.37
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	1.03	0.464	0.225	0.151	0.292
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.632	1.85	2.23	7.61	4.8
Ca:Mg ratio	3.6	4.1	3.8	1.6	2.9
K:Mg ratio	0.16	0.08	0.05	<0.05	0.05
GTRI	-	-	-	-	-
ECR (%)	5.3	6.9	11	35	19

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3890	4620	2770	1850	2910
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	684	680	440	667	602
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	453	178	77.3	70.2	112
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	36.1	105	162	917	440
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	19.4	23	13.8	9.25	14.5
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	5.62	5.59	3.62	5.49	4.95
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.16	0.456	0.198	0.18	0.285
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.157	0.458	0.705	3.99	1.91
Ca:Mg ratio	3.5	4.1	3.8	1.7	2.9
K:Mg ratio	0.21	0.08	0.06	<0.05	0.06
ECR (%)	5	3.1	4.9	22	10
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	26.4	29.6	18.4	18.9	21.7
Calcium (%)	73.7	78	75.4	48.9	67
Magnesium (%)	21.3	18.9	19.7	29	22.9
Potassium (%)	4.4	1.5	1.1	1	1.3
Sodium (%)	0.6	1.5	3.8	21	8.8
Aluminium (%)	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-
Chloride (mg/kg)	21	16	120	1000	370
Salinity EC 1:5 (dS/m)	0.099	0.15	0.21	0.76	0.38

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.00-1.10
Boron (mg/kg)	0.9	-	-	-	-
Iron (Fe) (mg/kg)	7.7	-	-	-	-
Manganese (Mn) (mg/kg)	6.2	-	-	-	-
Copper (Cu) (mg/kg)	0.94	-	-	-	-
Zinc (Zn) (mg/kg)	0.36	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.1	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.16	0.1	-	-	-
TDS (mg(/L)	64	99	130	490	240
% Air-dry Moisture Content (% of dry wt)	2.8	3	1.7	3.1	2.2
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0278	0.0301	0.0169	0.0309	0.0218
Moisture (dry basis) (%)	2.3	2.49	1.82	2.04	1.68
Moisture 105Â°C (dry basis) (%)	5.9	7.7	6.4	8.3	6.6
Texture (ISSS Classification)	Clay	Clay	Clay Loam	Clay Loam	Clay Loam
Gravel fraction (% of whole sample)	0.5	9.5	0.3	6.6	56.7
Sand fraction (%(< 2 mm fraction)	33.6	39.2	45.8	44.3	40.9
Silt fraction (% < 2 mm fraction)	18.8	19.1	22.4	23	21.9
Clay fraction (% < 2 mm fraction)	47.7	41.7	31.8	32.8	37.2
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-
R1 Dispersion Ratio	0.43	0.44	0.44	0.52	0.51
EAT	3	3	2	2	2
15 Bar (%)	19.3	17.4	13.3	16.1	14

'-' indicates no laboratory assessment was undertaken

Table AppC-11: Soil Chemistry for 9Dn(Ro), Analysed Site 21

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	8.06	8.79	8.72	8.59	8.67	7.42	7.99
pH CaCl2 (following 4A1) pH units	7.38	8.07	8.1	7.94	8.11	6.75	7.28
Organic Carbon (W&B) % (40°C)	2.37	1.1	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	2.7	<1.0	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	2.4	1.4	-	-	-	-	-
Colwell Phosphorus (mg/kg)	9.3	<5.0	-	-	-	-	-
PBI + Col P	99	118	-	-	-	-	-
Colwell Potassium (mg/kg)	640	140	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	7.2	8.5	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	5200	4570	3990	4210	3960	3180	2710
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	643	863	864	942	937	988	817
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	544	174	174	167	190	165	143
Sodium (NH4Cl/BaCl2) (mg/kg)	32.4	1530	2050	2600	2660	2580	2080
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	25.9	22.8	19.9	21	19.8	15.9	13.5
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	5.29	7.1	7.11	7.75	7.71	8.13	6.72
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	1.39	0.445	0.445	0.427	0.486	0.421	0.366
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.141	6.67	8.9	11.3	11.6	11.2	9.03

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	4.9	3.2	2.8	2.7	2.6	2	2
K:Mg ratio	0.26	0.06	0.06	0.06	0.06	0.05	0.05
GTRI	-	-	-	-	-	-	-
ECR (%)	4.7	19	26	29	31	33	32
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	4790	4620	4150	3520	3690	2360	2230
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	637	1020	975	903	828	745	648
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	690	233	233	190	191	124	122
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	10.6	528	864	983	663	851	793
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	23.9	23.1	20.7	17.6	18.4	11.8	11.1
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	5.24	8.41	8.02	7.42	6.81	6.13	5.33
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.76	0.596	0.597	0.486	0.487	0.318	0.313
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.046	2.3	3.76	4.28	2.88	3.7	3.45
Ca:Mg ratio	4.6	2.7	2.6	2.4	2.7	1.9	2.1
K:Mg ratio	0.34	0.07	0.07	0.07	0.07	0.05	0.06
ECR (%)	5.8	8.4	13	16	12	18	19
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	31	34.4	33.1	29.7	28.6	21.9	20.2
Calcium (%)	77.2	67.1	62.6	59	64.4	53.7	55
Magnesium (%)	16.9	24.5	24.2	25	23.8	27.9	26.4
Potassium (%)	5.7	1.7	1.8	1.6	1.7	1.4	1.5
Sodium (%)	<0.2	6.7	11	14	10	17	17
Aluminium (%)	0	0	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	<5	870	1500	1500	1700	1600	1100
Salinity EC 1:5 (dS/m)	0.11	0.8	1.2	1.1	1.3	1.1	0.83
Boron (mg/kg)	1.1	-	-	-	-	-	-
Iron (Fe) (mg/kg)	12	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	13	-	-	-	-	-	-
Copper (Cu) (mg/kg)	1.4	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.67	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.23	0.11	-	-	-	-	-
TDS (mg(/L)	72	510	740	720	820	710	530
% Air-dry Moisture Content (% of dry wt)	3.1	3.3	3.2	4.7	3.1	4.1	3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0309	0.033	0.0321	0.0465	0.0305	0.0413	0.0297
Moisture (dry basis) (%)	2.69	2.74	2.66	2.86	2.73	2.52	2.61
Moisture 105Â°C (dry basis) (%)	3.7	11.3	10.7	12.6	12.6	11.8	11.1

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Clay	Silty Clay	Clay
Gravel fraction (% of whole sample)	0.9	6.4	6.7	18.8	18	3.2	43.1
Sand fraction (%(< 2 mm fraction)	36.8	22.7	22.1	25.1	20.6	13.3	34.3
Silt fraction (% < 2 mm fraction)	22.5	18.3	17	16.3	20.2	27.1	17.9
Clay fraction (% < 2 mm fraction)	40.8	59	60.9	58.6	59.3	59.6	47.8
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.37	0.63	0.7	0.75	0.68	0.72	0.65
EAT	4	3	2	2	2	2	2
15 Bar (%)	20.9	22.9	22.9	23.7	22.6	22.2	16.9

'-' indicates no laboratory assessment was undertaken

Table AppC-12: Soil Chemistry for 10Ct(Ro) Analysed Site D22 (SLR Site B10 (2023)

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D22-0.00-0.10 (B25, SLR 2023)	D22-0.20-0.30 (B25, SLR 2023)	D22-0.50-0.60 (B25, SLR 2023)	D3-0.70-0.80	D22-0.90-1.00 (B25, SLR 2023)
pH 1:5 water	8.53	8.57	8.68	-	6.15
Organic Carbon (W&B)	1.33	1.25	-	-	-
Nitrate - N (2M KCl)	<1.0	<1.0	-	-	-
Ammonium - N (2M KCl)	1.2	1.1	-	-	-
Colwell Phosphorus	7.9	<5.0	-	-	-
PBI + Col P	101	118	-	-	-
Colwell Potassium	310	150	-	-	-
KCl Sulfur (S)	8.4	5.6	-	-	-
Exchangeable Calcium	23	23	19	-	11
Exchangeable Magnesium	9.3	10	11	-	10
Exchangeable Potassium	0.6	0.56	0.42	-	0.33
Exchangeable Sodium	1.4	2.7	8	-	10
Exchangeable acidity	<0.02	<0.02	-	-	-
Exchangeable aluminium	<0.02	<0.02	-	-	-
This Exchangeable hydrogen	<0.02	<0.02	-	-	-
Calcium/Magnesium Ratio	2.5	2.3	1.7	-	1.1
ECEC	34	36	39	-	32
Calcium (%)	67	63	50	-	35
Magnesium (%)	27	28	29	-	32
Potassium (%)	1.8	1.5	1.1	-	1
Sodium - ESP (%)	4	7.4	21	-	32
Aluminium (%)	0.03	0.04	0.03	-	0.5
Hydrogen (%)	0	0	0	-	0.1
CaCl2 extr. Aluminium	<0.1	-	-	-	-
Chloride	100	29	1500	1600	
EC	0.155	0.258	0.797	-	1.058
Boron	1.3	-	-	-	-
Iron (Fe)	14	-	-	-	-
Manganese (Mn)	12	-	-	-	-
Copper (Cu)	1.5	-	-	-	-
Zinc (Zn)	0.4	-	-	-	-
Oxalate ext. Molybdenum	1.2	-	-	-	-
Dumas Total Nitrogen	0.13	0.12	-	-	-
% Air-dry Moisture Content	3.5	3.6	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D22-0.00-0.10 (B25, SLR 2023)	D22-0.20-0.30 (B25, SLR 2023)	D22-0.50-0.60 (B25, SLR 2023)	D3-0.70-0.80	D22-0.90-1.00 (B25, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0345	0.0361	-	-	-
Moisture (dry basis)	5.95	7.12	7.25	-	6.23
Moisture 105Â°C (dry basis)	---	---	---	-	---
Texture (ISSS Classification)	Clay	Clay	Clay	-	Clay
Gravel fraction	2	18.2	84.1	-	27.3
Sand fraction	34.4	25.6	27.9	-	36.3
Silt fraction	16.9	16.4	15	-	19.8
Clay fraction	48.8	58	57.1	-	43.9
Moisture 40Â°C (dry basis)	0.3	3.4	7.6	-	6.6
R1 Dispersion Ratio	0.35	0.37	0.61	-	0.59
EAT	3	4	4	-	4
15 Bar (%)	20.4	20.9	21.5	18.9	-

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-13: Soil Chemistry for 10Ct(Ro), Analysed Site D22

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.00-1.10	1.30-1.40	1.60-1.70
pH 1:5 water (pH units)	6.01	6.08	5.71
pH CaCl2 (following 4A1) pH units	5.26	5.27	5
Organic Carbon (W&B) % (40°C)	-	-	-
Nitrate - N (2M KCl) (mg/kg)	-	-	-
Ammonium - N (2M KCl) (mg/kg)	-	-	-
Colwell Phosphorus (mg/kg)	-	-	-
PBI + Col P	-	-	-
Colwell Potassium (mg/kg)	-	-	-
KCl Sulfur (S) (mg/kg)	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	2010	1970	1840
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1140	1150	1120
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	103	100	109
Sodium (NH4Cl/BaCl2) (mg/kg)	2040	1860	2120
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	10	9.82	9.2
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	9.39	9.44	9.23
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.263	0.254	0.278
Sodium (NH4Cl/BaCl2) (cmol/kg)	8.89	8.1	9.21
Ca:Mg ratio	1.1	1	1
K:Mg ratio	<0.05	<0.05	<0.05
GTRI	-	-	-
ECR (%)	32	30	34
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2020	2040	1940
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1010	1050	1080
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	101	109	108
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	940	956	981
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	10.1	10.2	9.66
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	8.28	8.65	8.86
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.258	0.277	0.276

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.00-1.10	1.30-1.40	1.60-1.70
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	4.09	4.16	4.27
Ca:Mg ratio	1.2	1.2	1.1
K:Mg ratio	<0.05	<0.05	<0.05
ECR (%)	19	19	20
Exchangeable acidity (cmol/kg)	<0.02	<0.02	0.62
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	0.55
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	0.07
ECEC (cmol/kg)	22.7	23.2	23.7
Calcium (%)	44.4	43.7	40.8
Magnesium (%)	36.5	37.2	37.4
Potassium (%)	1.1	1.2	1.2
Sodium (%)	18	18	18
Aluminium (%)	0	0	2.3
Hydrogen (%)	0	0	0.3
CaCl2 extr. Aluminium (mg/kg)	-	-	-
Chloride (mg/kg)	1400	1500	1400
Salinity EC 1:5 (dS/m)	0.92	0.95	0.92
Boron (mg/kg)	-	-	-
Iron (Fe) (mg/kg)	-	-	-
Manganese (Mn) (mg/kg)	-	-	-
Copper (Cu) (mg/kg)	-	-	-
Zinc (Zn) (mg/kg)	-	-	-
Oxalate ext. Molybdenum (mg/kg)	-	-	-
Dumas Total Nitrogen (% dry wt)	-	-	-
TDS (mg(/L)	590	610	590
% Air-dry Moisture Content (% of dry wt)	2.7	3.3	3.1
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0265	0.0334	0.0312
Moisture (dry basis) (%)	2.56	2.23	2.11
Moisture 105Â°C (dry basis) (%)	9.4	9.7	8.7
Texture (ISSS Classification)	Clay	Clay	Silty Clay Loam
Gravel fraction (% of whole sample)	< 0.1	49.7	0.4

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.00-1.10	1.30-1.40	1.60-1.70
Sand fraction (%(< 2 mm fraction)	36.5	39.7	32.8
Silt fraction (% < 2 mm fraction)	22.6	18.4	28
Clay fraction (% < 2 mm fraction)	41	42	39.2
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.51	0.59	0.42
EAT	2	2	2
15 Bar (%)	18.3	18.5	17.8

'-' indicates no laboratory assessment was undertaken

Table AppC-14: Soil Chemistry for 11Bl(Ta), Analysed Site D24

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90
pH 1:5 water (pH units)	7.69	7.64	8.38	9.07
pH CaCl2 (following 4A1) pH units	6.38	6.72	7.5	8.11
Organic Carbon (W&B) % (40°C)	0.8	0.57	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	20	-	-
Ammonium - N (2M KCl) (mg/kg)	1.4	2.2	-	-
Colwell Phosphorus (mg/kg)	6	<5.0	-	-
PBI + Col P	51	118	-	-
Colwell Potassium (mg/kg)	300	89	-	-
KCl Sulfur (S) (mg/kg)	4.4	8.7	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	1490	1660	1920	1640
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	596	1180	1240	1090
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	201	85	100	86
Sodium (NH4Cl/BaCl2) (mg/kg)	151	1530	1570	1560
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	7.44	8.26	9.56	8.19
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	4.9	9.75	10.2	8.98
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.515	0.218	0.257	0.22
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.656	6.64	6.84	6.8
Ca:Mg ratio	1.5	0.9	0.9	0.9
K:Mg ratio	0.11	<0.05	<0.05	<0.05
GTRI	-	-	-	-
ECR (%)	8.7	28	26	29
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1450	1590	1890	1500
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	593	1150	1310	1020
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	236	106	117	91.2

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	44.7	740	860	751
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	7.24	7.91	9.41	7.47
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	4.88	9.48	10.8	8.41
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.603	0.27	0.3	0.233
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.194	3.22	3.74	3.27
Ca:Mg ratio	1.5	0.8	0.9	0.9
K:Mg ratio	0.12	<0.05	<0.05	<0.05
ECR (%)	6.2	17	17	18
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	12.9	20.9	24.3	19.4
Calcium (%)	56.1	37.9	38.8	38.6
Magnesium (%)	37.8	45.4	44.6	43.4
Potassium (%)	4.7	1.3	1.2	1.2
Sodium (%)	1.5	15	15	17
Aluminium (%)	0	0	0	0
Hydrogen (%)	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-
Chloride (mg/kg)	40	900	890	630
Salinity EC 1:5 (dS/m)	0.057	0.68	0.68	0.54
Boron (mg/kg)	0.49	-	-	-
Iron (Fe) (mg/kg)	15	-	-	-
Manganese (Mn) (mg/kg)	26	-	-	-
Copper (Cu) (mg/kg)	0.9	-	-	-
Zinc (Zn) (mg/kg)	0.46	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.64	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90
Dumas Total Nitrogen (% dry wt)	0.09	0.084	-	-
TDS (mg(/L)	37	440	430	350
% Air-dry Moisture Content (% of dry wt)	1.6	3.7	3.2	3.3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0163	0.037	0.0319	0.0325
Moisture (dry basis) (%)	1.1	2.37	2.14	1.9
Moisture 105Â°C (dry basis) (%)	2.8	12.8	10.7	9.4
Texture (ISSS Classification)	Clay Loam	Clay	Clay	Clay Loam
Gravel fraction (% of whole sample)	1.1	1.1	1.1	21
Sand fraction (%(< 2 mm fraction)	68.3	36.1	39.8	46.8
Silt fraction (% < 2 mm fraction)	10	13.3	16.3	17.3
Clay fraction (% < 2 mm fraction)	21.7	50.6	43.9	35.9
Moisture 40Â°C (dry basis) (%)	-	-	-	-
R1 Dispersion Ratio	0.47	0.43	0.65	0.56
EAT	3	2	2	2
15 Bar (%)	12.8	17.5	19.7	18.5

'-' indicates no laboratory assessment was undertaken

Table AppC-15: Soil Chemistry for 12Da(Te), Analysed Site D32 (SLR Site b12 (2023))

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D32-0.00-0.10 (B12, SLR 2023)	D32-0.20-0.30 (B12, SLR 2023)	D32-0.50-0.60 (B12, SLR 2023)	D32-0.80-0.90	(B12 0.90-1.00, SLR 2023)
pH 1:5 water	6.87	7.04	8.28	-	8.89
Organic Carbon (W&B)	1.38	0.55	-	-	-
Nitrate - N (2M KCl)	<1.0	<1.0	-	-	-
Ammonium - N (2M KCl)	5.4	<1.0	-	-	-
Colwell Phosphorus	8.2	6.2	-	-	-
PBI + Col P	38	53	-	-	-
Colwell Potassium	170	220	-	-	-
KCl Sulfur (S)	5.4	13	-	-	-
Exchangeable Calcium	8.7	8.6	11	-	14
Exchangeable Magnesium	4.4	4.4	6.6	-	8.3
Exchangeable Potassium	0.45	0.4	0.53	-	0.63
Exchangeable Sodium	0.64	0.57	0.91	-	2.7
Exchangeable acidity	<0.02	<0.02	-	-	-
Exchangeable aluminium	<0.02	<0.02	-	-	-
This Exchangeable hydrogen	<0.02	<0.02	-	-	-
Calcium/Magnesium Ratio	2	1.9	1.7	-	1.6
ECEC	14	14	19	-	25
Calcium (%)	61	61	59	-	54
Magnesium (%)	31	32	34	-	33
Potassium (%)	3.1	2.9	2.7	-	2.5
Sodium - ESP (%)	4.5	4.1	4.7	-	11
Aluminium (%)	0.09	0.08	0.06	-	0.04
Hydrogen (%)	0	0	0	-	0
CaCl2 extr. Aluminium	<0.1	-	-	-	-
Chloride	6	67	300	760	
EC	0.046	0.042	0.13	-	0.498
Boron	0.57	-	-	-	-
Iron (Fe)	12	-	-	-	-
Manganese (Mn)	19	-	-	-	-
Copper (Cu)	0.79	-	-	-	-
Zinc (Zn)	0.56	-	-	-	-
Oxalate ext. Molybdenum	0.47	-	-	-	-
Dumas Total Nitrogen	0.11	0.05	-	-	-
% Air-dry Moisture Content	1.2	1.9	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	D32-0.00-0.10 (B12, SLR 2023)	D32-0.20-0.30 (B12, SLR 2023)	D32-0.50-0.60 (B12, SLR 2023)	D32-0.80-0.90	(B12 0.90-1.00, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0117	0.0192		-	-
Moisture (dry basis)	5.95	7.12	7.25	-	6.23
Moisture 105Â°C (dry basis)	---	---	---	-	---
Texture (ISSS Classification)	Clay	Clay	Clay	-	Clay
Gravel fraction	2	18.2	84.1	-	27.3
Sand fraction	34.4	25.6	27.9	-	36.3
Silt fraction	16.9	16.4	15	-	19.8
Clay fraction	48.8	58	57.1	-	43.9
Moisture 40Â°C (dry basis)	0.3	3.4	7.6	-	6.6
R1 Dispersion Ratio	0.35	0.37	0.61	-	0.59
EAT	3	4	4	-	4
15 Bar (%)	8.5	14.5	12.9	13.3	-

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-16: Soil Chemistry for SPC 12, Analysed Site D32

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	8.67	8.66	8.46
pH CaCl2 (following 4A1) pH units	8.09	8.15	8.04
Organic Carbon (W&B) % (40°C)	-	-	-
Nitrate - N (2M KCl) (mg/kg)	-	-	-
Ammonium - N (2M KCl) (mg/kg)	-	-	-
Colwell Phosphorus (mg/kg)	-	-	-
PBI + Col P	-	-	-
Colwell Potassium (mg/kg)	-	-	-
KCl Sulfur (S) (mg/kg)	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	2160	2190	2090
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1010	1190	1210
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	247	262	286

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Sodium (NH4Cl/BaCl2) (mg/kg)	797	1100	1140
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	10.8	10.9	10.4
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	8.28	9.78	10
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.632	0.671	0.73
Sodium (NH4Cl/BaCl2) (cmol/kg)	3.47	4.78	4.95
Ca:Mg ratio	1.3	1.1	1
K:Mg ratio	0.08	0.07	0.07
GTRI			
ECR (%)	18	21	22
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1990	2020	1910
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1130	1260	1280
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	283	298	331
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	91.7	169	137
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	9.95	10.1	9.53
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	9.32	10.4	10.5
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.724	0.762	0.846
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.399	0.735	0.598
Ca:Mg ratio	1.1	1	0.9
K:Mg ratio	0.08	0.07	0.08
ECR (%)	5.5	6.8	6.7
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	20.4	22	21.5
Calcium (%)	48.8	45.8	44.3
Magnesium (%)	45.7	47.4	49
Potassium (%)	3.6	3.5	3.9
Sodium (%)	2	3.3	2.8
Aluminium (%)	0	0	0

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	-	-	-
Chloride (mg/kg)	740	1000	1300
Salinity EC 1:5 (dS/m)	0.71	0.89	1.1
Boron (mg/kg)	-	-	-
Iron (Fe) (mg/kg)	-	-	-
Manganese (Mn) (mg/kg)	-	-	-
Copper (Cu) (mg/kg)	-	-	-
Zinc (Zn) (mg/kg)	-	-	-
Oxalate ext. Molybdenum (mg/kg)	-	-	-
Dumas Total Nitrogen (% dry wt)	-	-	-
TDS (mg(/L)	450	570	700
% Air-dry Moisture Content (% of dry wt)	1.9	2.3	2.2
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0185	0.0232	0.0217
Moisture (dry basis) (%)	1.57	1.86	1.8
Moisture 105Â°C (dry basis) (%)	9.3	10.2	9.4
Texture (ISSS Classification)	Clay	Clay	Clay
Gravel fraction (% of whole sample)	13.2	50.9	7.8
Sand fraction (%(< 2 mm fraction)	49.1	43.6	43.5
Silt fraction (% < 2 mm fraction)	13.2	14.5	16.4
Clay fraction (% < 2 mm fraction)	37.7	41.9	40.1
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.59	0.57	0.5
EAT	4	2	2
15 Bar (%)	15.5	17.9	15.5

'-' indicates no laboratory assessment was undertaken

Table AppC-17: Soil Chemistry for 13Bl(Ta), Analysed Site 36

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	8	8.52	9.01	9.06	9.03	8.7	8.39
pH CaCl2 (following 4A1) pH units	6.94	7.74	8.12	8.31	8.27	7.91	7.36
Organic Carbon (W&B) % (40°C)	1.23	0.69	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	2.1	1.3	-	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-	-	-	-
PBI + Col P	86	157	-	-	-	-	-
Colwell Potassium (mg/kg)	110	72	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	6.2	5.2	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3210	3620	2720	2240	2190	1400	1010
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	794	1050	1170	1180	1090	924	605
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	115	92	82	86	89	70	53
Sodium (NH4Cl/BaCl2) (mg/kg)	79.9	324	778	839	879	777	620
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	16	18.1	13.6	11.2	10.9	6.99	5.03
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.53	8.61	9.65	9.73	8.97	7.6	4.98
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.295	0.236	0.21	0.219	0.227	0.18	0.135
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.348	1.41	3.39	3.65	3.83	3.38	2.7

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	2.4	2.1	1.4	1.1	1.2	0.9	1
K:Mg ratio	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05
GTRI	-	-	-	-	-	-	-
ECR (%)	2.8	5.8	13	16	17	20	22
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3380	3900	2830	2330	5740	1560	998
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	821	1130	1320	1320	932	1030	589
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	141	90.6	84	76.5	163	64.8	42
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	12.7	58.5	116	110	157	278	211
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	16.9	19.4	14.1	11.6	28.6	7.77	4.98
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.75	9.31	10.8	10.9	7.67	8.51	4.85
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.359	0.232	0.215	0.196	0.417	0.166	0.107
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.055	0.254	0.506	0.479	0.681	1.21	0.92
Ca:Mg ratio	2.5	2.1	1.3	1.1	3.7	0.9	1
K:Mg ratio	0.05	<0.05	<0.05	<0.05	0.05	<0.05	<0.05
ECR (%)	1.7	1.7	2.8	2.9	2.9	7.8	9.5
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	24	29.2	25.7	23.2	37.4	17.7	10.9
Calcium (%)	70.2	66.5	55	50.1	76.6	44	45.9
Magnesium (%)	28.1	31.8	42.2	47	20.5	48.2	44.7
Potassium (%)	1.5	0.8	0.8	0.8	1.1	0.9	1
Sodium (%)	0.2	0.9	2	2.1	1.8	6.9	8.5
Aluminium (%)	0	0	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	11	26	290	550	490	570	360
Salinity EC 1:5 (dS/m)	0.067	0.2	0.41	0.56	0.53	0.49	0.29
Boron (mg/kg)	1.1	-	-	-	-	-	-
Iron (Fe) (mg/kg)	11	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	11	-	-	-	-	-	-
Copper (Cu) (mg/kg)	0.92	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.22	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.98	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.1	0.084	-	-	-	-	-
TDS (mg(/L)	43	130	260	360	340	310	190
% Air-dry Moisture Content (% of dry wt)	2.9	2.6	2.6	2.4	1.9	2.3	1
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0287	0.0256	0.0262	0.0241	0.0194	0.0227	0.0103
Moisture (dry basis) (%)	1.83	2.46	2.07	1.72	1.73	1.4	1.08
Moisture 105Â°C (dry basis) (%)	5.8	9.7	8.6	7.4	7.9	6.1	5

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Sandy Clay	Sandy Clay Loam	Sandy Loam
Gravel fraction (% of whole sample)	7.2	5.5	6.1	10.2	48.8	5.5	13
Sand fraction (%(< 2 mm fraction)	55.5	49.4	49.4	52.7	62.7	63.5	78.4
Silt fraction (% < 2 mm fraction)	3.3	4.4	7.3	8.6	4	5.8	4.1
Clay fraction (% < 2 mm fraction)	41.2	46.3	43.4	38.7	33.3	30.7	17.5
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.24	0.26	0.35	0.37	0.59	0.57	0.38
EAT	3	4	4	4	4	2	2
15 Bar (%)	18.7	19.9	12.9	17.8	14.3	15.2	9.1

'-' indicates no laboratory assessment was undertaken

Table AppC-18: Soil Chemistry for 14Bl(Ro), Analysed Site D32 (SLR Site B05 (2023))

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10 (B05, SLR 2023)	0.20-0.30 (B05, SLR 2023)	0.50-0.60 (B05, SLR 2023)	0.80-0.90	0.90-1.00, (B05, SLR 2023)
pH 1:5 water	8.2	8.91	9.03	-	8.97
Organic Carbon (W&B)	1.31	1.22	-	-	-
Nitrate - N (2M KCl)	<1.0	<1.0	-	-	-
Ammonium - N (2M KCl)	2.1	1.3	-	-	-
Colwell Phosphorus	<5.0	<5.0	-	-	-
PBI + Col P	119	112	-	-	-
Colwell Potassium	120	110	-	-	-
KCl Sulfur (S)	4	6.8	-	-	-
Exchangeable Calcium	29	39	36	-	28
Exchangeable Magnesium	6.8	9.3	13	-	12
Exchangeable Potassium	1	0.47	0.48	-	0.34
Exchangeable Sodium	0.37	1.7	4.2	-	0.34
Exchangeable acidity	<0.02	<0.02	-	-	-
Exchangeable aluminium	<0.02	<0.02	-	-	-
This Exchangeable hydrogen	<0.02	<0.02	-	-	-
Calcium/Magnesium Ratio	4.3	4.2	2.8	-	2.4
ECEC	37	51	53	-	45
Calcium (%)	78	77	67	-	61
Magnesium (%)	18	18	24	-	26
Potassium (%)	2.8	0.94	0.91	-	0.76
Sodium - ESP (%)	0.98	3.3	7.9	-	13
Aluminium (%)	0.03	0.02	0.01	-	0.01
Hydrogen (%)	0	0	0	-	0
CaCl2 extr. Aluminium	<0.1	-	-	-	-
Chloride	14	340	580	1500	-
EC	0.128	0.159	0.298	-	0.688
Boron	0.9	-	-	-	-
Iron (Fe)	15	-	-	-	-
Manganese (Mn)	6.8	-	-	-	-
Copper (Cu)	1.2	-	-	-	-
Zinc (Zn)	0.12	-	-	-	-
Oxalate ext. Molybdenum	1.3	-	-	-	-
Dumas Total Nitrogen	0.15	0.1	-	-	-
% Air-dry Moisture Content	3.3	3.7	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10 (B05, SLR 2023)	0.20-0.30 (B05, SLR 2023)	0.50-0.60 (B05, SLR 2023)	0.80-0.90	0.90-1.00, (B05, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0332	0.0365	-	-	-
Moisture (dry basis)	7.97	8.2	7.92	7.77	-
Moisture 105Â°C (dry basis)	-	-	-	-	-
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	-
Gravel fraction	17.7	32.3	< 0.1	2.7	-
Sand fraction	30.1	27.7	29.4	29.9	-
Silt fraction	16.3	14.1	14.3	10.4	-
Clay fraction	53.6	58.2	56.3	59.8	-
Moisture 40Â°C (dry basis)	-	-	-	-	-
R1 Dispersion Ratio	0.29	0.49	0.49	0.44	-
EAT	4	4	4	-	4
15 Bar (%)	8.5	14.5	12.9	13.3	-

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-19: Soil Chemistry for SPC 14, Analysed Site D37

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	8.5	8.99	8.99
pH CaCl2 (following 4A1) pH units	7.91	8.18	8.26
Organic Carbon (W&B) % (40°C)	-	-	-
Nitrate - N (2M KCl) (mg/kg)	-	-	-
Ammonium - N (2M KCl) (mg/kg)	-	-	-
Colwell Phosphorus (mg/kg)	-	-	-
PBI + Col P	-	-	-
Colwell Potassium (mg/kg)	-	-	-
KCl Sulfur (S) (mg/kg)	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3360	3000	2880
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1060	992	1030
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	132	91	82

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Sodium (NH4Cl/BaCl2) (mg/kg)	1630	1590	1660
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	16.8	15	14.4
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	8.7	8.16	8.47
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.337	0.233	0.21
Sodium (NH4Cl/BaCl2) (cmol/kg)	7.11	6.91	7.24
Ca:Mg ratio	1.9	1.8	1.7
K:Mg ratio	<0.05	<0.05	<0.05
GTRI			
ECR (%)	23	24	25
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3620	3170	3050
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1170	1110	1220
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	135	91.4	89.6
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	563	601	787
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	18	15.8	15.2
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	9.62	9.09	10.1
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.346	0.234	0.229
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	2.45	2.61	3.42
Ca:Mg ratio	1.9	1.7	1.5
K:Mg ratio	<0.05	<0.05	<0.05
ECR (%)	9.2	10	13
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	30.5	27.8	28.9
Calcium (%)	59.2	57	52.6
Magnesium (%)	31.6	32.7	34.8
Potassium (%)	1.1	0.8	0.8
Sodium (%)	8	9.4	12
Aluminium (%)	0	0	0

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	-	-	-
Chloride (mg/kg)	1400	960	990
Salinity EC 1:5 (dS/m)	1	0.81	0.81
Boron (mg/kg)	-	-	-
Iron (Fe) (mg/kg)	-	-	-
Manganese (Mn) (mg/kg)	-	-	-
Copper (Cu) (mg/kg)	-	-	-
Zinc (Zn) (mg/kg)	-	-	-
Oxalate ext. Molybdenum (mg/kg)	-	-	-
Dumas Total Nitrogen (% dry wt)	-	-	-
TDS (mg(/L)	640	520	520
% Air-dry Moisture Content (% of dry wt)	2.9	3.2	3.3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0285	0.0317	0.0328
Moisture (dry basis) (%)	3.6	2.73	2.53
Moisture 105Â°C (dry basis) (%)	12	8.2	9.5
Texture (ISSS Classification)	Clay	Clay	Clay
Gravel fraction (% of whole sample)	5.6	8.6	66.4
Sand fraction (%(< 2 mm fraction)	36.6	49.5	46.1
Silt fraction (% < 2 mm fraction)	13.3	13.7	14.4
Clay fraction (% < 2 mm fraction)	50.2	36.8	39.5
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.52	0.52	0.47
EAT	3	2	2
15 Bar (%)	15.5	17.9	15.5

'-' indicates no laboratory assessment was undertaken

Table AppC-20: Soil Chemistry for 15Bl(Ro), Analysed Site D39

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20
pH 1:5 water (pH units)	7.78	8.54	8.78	9.3	9.28
pH CaCl2 (following 4A1) pH units	6.85	7.8	7.97	8.4	8.48
Organic Carbon (W&B) % (40°C)	1.5	1.61	-	-	-
Nitrate - N (2M KCl) (mg/kg)	1	8.9	-	-	-
Ammonium - N (2M KCl) (mg/kg)	1.5	<1.0	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-	-
PBI + Col P	107	141	-	-	-
Colwell Potassium (mg/kg)	160	130	-	-	-
KCl Sulfur (S) (mg/kg)	4.3	11	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	4270	5190	3930	2880	2830
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	505	615	610	935	793
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	171	146	85	71	79
Sodium (NH4Cl/BaCl2) (mg/kg)	158	313	684	2660	2230
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	21.3	25.9	19.6	14.4	14.1
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	4.15	5.06	5.02	7.69	6.52
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.437	0.373	0.216	0.182	0.202
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.686	1.36	2.97	11.6	9.72
Ca:Mg ratio	5.1	5.1	3.9	1.9	2.2
K:Mg ratio	0.11	0.07	<0.05	<0.05	<0.05
GTRI					
ECR (%)	4.2	5.3	11	35	32

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3960	4840	3510	3080	3140
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	450	616	540	907	803
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	201	161	73.7	57.2	69
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	44.4	57.2	84.5	836	892
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	19.8	24.1	17.5	15.4	15.7
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	3.7	5.07	4.45	7.46	6.61
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.515	0.412	0.188	0.146	0.176
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.193	0.249	0.368	3.64	3.88
Ca:Mg ratio	5.3	4.8	3.9	2.1	2.4
K:Mg ratio	0.14	0.08	<0.05	<0.05	<0.05
ECR (%)	2.9	2.2	2.5	14	15
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	24.2	29.9	22.5	26.6	26.3
Calcium (%)	81.8	80.8	77.8	57.7	59.5
Magnesium (%)	15.3	17	19.7	28	25.1
Potassium (%)	2.1	1.4	0.8	0.6	0.7
Sodium (%)	0.8	0.8	1.6	14	15
Aluminium (%)	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-
Chloride (mg/kg)	17	45	250	860	720
Salinity EC 1:5 (dS/m)	0.065	0.2	0.36	0.86	0.78

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20
Boron (mg/kg)	1.1	-	-	-	-
Iron (Fe) (mg/kg)	11	-	-	-	-
Manganese (Mn) (mg/kg)	16	-	-	-	-
Copper (Cu) (mg/kg)	1.4	-	-	-	-
Zinc (Zn) (mg/kg)	0.2	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.3	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.19	0.13	-	-	-
TDS (mg(/L)	42	130	230	550	500
% Air-dry Moisture Content (% of dry wt)	2.7	2.3	2.5	3.1	2.8
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0274	0.0233	0.0254	0.0307	0.0283
Moisture (dry basis) (%)	2.22	2.26	1.73	2.23	2.18
Moisture 105Â°C (dry basis) (%)	6.4	8.3	8.1	9.4	9.6
Texture (ISSS Classification)	Clay	Clay	Clay	Clay	Silty Clay Loam
Gravel fraction (% of whole sample)	3.7	0.5	20.4	43.1	55.5
Sand fraction (%(< 2 mm fraction)	43.3	40.9	56.2	34.6	31.6
Silt fraction (% < 2 mm fraction)	10.1	12	9.9	22.7	28.7
Clay fraction (% < 2 mm fraction)	46.6	47.2	33.9	42.8	39.7
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-
R1 Dispersion Ratio	0.26	0.22	0.54	0.67	0.64
EAT	3	4	4	2	2
15 Bar (%)	19.5	19.2	15.3	21.7	22.8

'-' indicates no laboratory assessment was undertaken

Table AppC-21: Soil Chemistry for 16Bl(Ta), Analysed Site D43

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
pH 1:5 water (pH units)	7.4	8.15	8.72
pH CaCl2 (following 4A1) pH units	6.16	6.99	7.76
Organic Carbon (W&B) % (40°C)	0.68	0.83	-
Nitrate - N (2M KCl) (mg/kg)	<1.0	<1.0	-
Ammonium - N (2M KCl) (mg/kg)	1.3	1.1	-
Colwell Phosphorus (mg/kg)	6.5	<5.0	-
PBI + Col P	56	89	-
Colwell Potassium (mg/kg)	240	140	-
KCl Sulfur (S) (mg/kg)	4.8	7	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	1750	2530	2860
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	625	1110	1230
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	148	125	143
Sodium (NH4Cl/BaCl2) (mg/kg)	297	700	896
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	8.71	12.6	14.3
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	5.14	9.11	10.1
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.377	0.32	0.366
Sodium (NH4Cl/BaCl2) (cmol/kg)	1.29	3.04	3.9
Ca:Mg ratio	1.7	1.4	1.4
K:Mg ratio	0.07	<0.05	<0.05
GTRI	-	-	-
ECR (%)	11	13	15
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1640	2570	2670
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	589	1130	1140
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	178	158	141
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	130	378	357
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	8.16	12.8	13.3
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	4.85	9.3	9.39
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.454	0.405	0.362

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.565	1.64	1.55
Ca:Mg ratio	1.7	1.4	1.4
K:Mg ratio	0.09	<0.05	<0.05
ECR (%)	7.3	8.5	7.8
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	14	24.2	24.6
Calcium (%)	58.2	53	54.1
Magnesium (%)	34.6	38.5	38.1
Potassium (%)	3.2	1.7	1.5
Sodium (%)	4	6.8	6.3
Aluminium (%)	0	0	0
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-
Chloride (mg/kg)	87	240	270
Salinity EC 1:5 (dS/m)	0.094	0.22	0.32
Boron (mg/kg)	0.56	-	-
Iron (Fe) (mg/kg)	14	-	-
Manganese (Mn) (mg/kg)	22	-	-
Copper (Cu) (mg/kg)	1.1	-	-
Zinc (Zn) (mg/kg)	0.56	-	-
Oxalate ext. Molybdenum (mg/kg)	0.79	-	-
Dumas Total Nitrogen (% dry wt)	0.096	0.11	-
TDS (mg(/L)	60	140	210
% Air-dry Moisture Content (% of dry wt)	1.5	4	3.3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0149	0.0396	0.0328
Moisture (dry basis) (%)	1.62	2.75	2.8
Moisture 105Â°C (dry basis) (%)	5.9	10.9	11
Texture (ISSS Classification)	Clay Loam	Clay	Clay
Gravel fraction (% of whole sample)	1.9	6.8	1.3

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Sand fraction (%(< 2 mm fraction)	57.7	34.8	36.9
Silt fraction (% < 2 mm fraction)	14.8	13.9	11.6
Clay fraction (% < 2 mm fraction)	27.5	51.3	51.5
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.59	0.63	0.65
EAT	2	2	2
15 Bar (%)	15.5	22.7	21.6

'-' indicates no laboratory assessment was undertaken

Table AppC-22: Soil Chemistry for SPC 14Bl(Ro), Analysed Site D44 (SLR Site B01 (2023))

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10 (B01, SLR 2023)	0.10-0.20	0.20-0.30 (B01, SLR 2023)	0.50-0.60 (B01, SLR 2023)	0.80-0.90	(B01 0.9-1.0, SLR 2023)
pH 1:5 water	6.79		7.68	9.03	-	9.19
Organic Carbon (W&B)	1.89	1.35	-	-	-	-
Nitrate - N (2M KCl)	3.7	<1.0	-	-	-	-
Ammonium - N (2M KCl)	1.6	1.2	-	-	-	-
Colwell Phosphorus	<5.0	<5.0	-	-	-	-
PBI + Col P	60	74	-	-	-	-
Colwell Potassium	310	86	-	-	-	-
KCl Sulfur (S)	5.4	3.7	-	-	-	-
Exchangeable Calcium	11		11	22	-	13
Exchangeable Magnesium	2.1		2.7	9.3	-	1.8
Exchangeable Potassium	0.55		0.21	0.27	-	<0.12
Exchangeable Sodium	0.4		1.1	4.5	-	1.3
Exchangeable acidity	<0.02	<0.02	-	-	-	-
Exchangeable aluminium	<0.02	<0.02	-	-	-	-
This Exchangeable hydrogen	<0.02	<0.02	-	-	-	-
Calcium/Magnesium Ratio	5		4.2	2.4	-	7.4
ECEC	14		15	36	-	17
Calcium (%)	77		74	61	-	81
Magnesium (%)	16		18	26	-	11
Potassium (%)	4		1.4	0.74	-	0.3
Sodium - ESP (%)	2.9		7.3	12	-	7.6
Aluminium (%)	0.08		0.04	0.04	-	0.09
Hydrogen (%)	0		0	0	-	0
CaCl2 extr. Aluminium	<0.1	-	-	-	-	-
Chloride	21	15	120	630	830	
EC	0.151		0.125	0.402	-	0.609
Boron	0.56	-	-	-	-	-
Iron (Fe)	18	-	-	-	-	-
Manganese (Mn)	34	-	-	-	-	-
Copper (Cu)	1.2	-	-	-	-	-
Zinc (Zn)	0.78	-	-	-	-	-
Oxalate ext. Molybdenum	0.62	-	-	-	-	-
Dumas Total Nitrogen	0.16	0.11	-	-	-	-
% Air-dry Moisture Content	1.8	2.2	-	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon					
	0.00-0.10 (B01, SLR 2023)	0.10-0.20	0.20-0.30 (B01, SLR 2023)	0.50-0.60 (B01, SLR 2023)	0.80-0.90	(B01 0.9-1.0, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0183	0.0215	-	-	-	-
Moisture (dry basis)	3.77	4.78	7.9	7.5	6.24	2.79
Moisture 105Â°C (dry basis)	---	---	---	---	---	10.8
Texture (ISSS Classification)	Clay Loam	Clay	Clay	Clay	Clay	Clay
Gravel fraction	2.5	11	20.9	4.7	13.4	11.7
Sand fraction	55.7	50.9	30.7	33.1	37.2	39.6
Silt fraction	16.9	13.8	9.3	9.3	9.2	10.5
Clay fraction	27.5	35.4	60	57.6	53.7	50
Moisture 40Â°C (dry basis)	1.9	3.9	9.5	8.5	9.3	-
R1 Dispersion Ratio	0.37	0.3	0.46	0.6	0.67	0.74
EAT	3	-	3	2	-	-
15 Bar (%)	11.3	12.7	22.8	20.1	17.9	-

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-23: Soil Chemistry for 17Bl(Ro), Analysed Site D44

Analysis (Unit)	Sample Depth (mbgl) / Horizon
	1.10-1.20
pH 1:5 water (pH units)	8.54
pH CaCl2 (following 4A1) pH units	7.72
Organic Carbon (W&B) % (40°C)	-
Nitrate - N (2M KCl) (mg/kg)	-
Ammonium - N (2M KCl) (mg/kg)	-
Colwell Phosphorus (mg/kg)	-
PBI + Col P	-
Colwell Potassium (mg/kg)	-
KCl Sulfur (S) (mg/kg)	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	2610
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	1110
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	103
Sodium (NH4Cl/BaCl2) (mg/kg)	1730
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	13
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	9.12
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.264
Sodium (NH4Cl/BaCl2) (cmol/kg)	7.52
Ca:Mg ratio	1.4
K:Mg ratio	<0.05
GTRI	
ECR (%)	26
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2700
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1170
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	98.8
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	834

Analysis (Unit)	Sample Depth (mbgl) / Horizon
	1.10-1.20
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	13.5
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	9.66
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.253
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	3.63
Ca:Mg ratio	1.4
K:Mg ratio	<0.05
ECR (%)	14
Exchangeable acidity (cmol/kg)	<0.02
Exchangeable aluminium (cmol/kg)	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02
ECEC (cmol/kg)	27
Calcium (%)	49.9
Magnesium (%)	35.7
Potassium (%)	0.9
Sodium (%)	13
Aluminium (%)	0
Hydrogen (%)	0
CaCl2 extr. Aluminium (mg/kg)	-
Chloride (mg/kg)	860
Salinity EC 1:5 (dS/m)	0.68
Boron (mg/kg)	-
Iron (Fe) (mg/kg)	-
Manganese (Mn) (mg/kg)	-
Copper (Cu) (mg/kg)	-
Zinc (Zn) (mg/kg)	-
Oxalate ext. Molybdenum (mg/kg)	-
Dumas Total Nitrogen (% dry wt)	-
TDS (mg(/L)	430
% Air-dry Moisture Content (% of dry wt)	2.9

Analysis (Unit)	Sample Depth (mbgl) / Horizon
	1.10-1.20
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0287
Moisture (dry basis) (%)	2.79
Moisture 105Â°C (dry basis) (%)	10.8
Texture (ISSS Classification)	Clay
Gravel fraction (% of whole sample)	11.7
Sand fraction (%(< 2 mm fraction)	39.6
Silt fraction (% < 2 mm fraction)	10.5
Clay fraction (% < 2 mm fraction)	50
Moisture 40Â°C (dry basis) (%)	---
R1 Dispersion Ratio	0.74
EAT	2
15 Bar (%)	18.2

'-' indicates no laboratory assessment was undertaken

Table AppC-24: Soil Chemistry for 18Bl(Ro), Analysed Site D45

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	7.54	8.25	8.16	7.71	7.28	6.51	6.95
pH CaCl2 (following 4A1) pH units	6.88	7.52	7.52	7.29	6.75	5.92	6.33
Organic Carbon (W&B) % (40°C)	1.35	1.34	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	1.5	<1.0	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	<1.0	1.5	-	-	-	-	-
Colwell Phosphorus (mg/kg)	7.2	<5.0	-	-	-	-	-
PBI + Col P	49	96	-	-	-	-	-
Colwell Potassium (mg/kg)	540	210	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	5.9	5.5	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3570	4360	5010	4990	4920	4550	3960
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	496	636	868	1020	987	905	806
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	477	203	195	210	243	251	214
Sodium (NH4Cl/BaCl2) (mg/kg)	16.3	69.6	480	681	724	714	626
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	17.8	21.7	25	24.9	24.6	22.7	19.8
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	4.08	5.23	7.14	8.37	8.12	7.45	6.63
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	1.22	0.519	0.499	0.537	0.62	0.642	0.546
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.071	0.303	2.09	2.96	3.15	3.11	2.72

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Ca:Mg ratio	4.4	4.2	3.5	3	3	3	3
K:Mg ratio	0.3	0.1	0.07	0.06	0.08	0.09	0.08
GTRI							
ECR (%)	5.6	3	7.4	9.5	10	11	11
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2820	4220	4460	4570	4240	3650	3420
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	408	611	847	915	879	746	732
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	421	226	204	214	252	257	226
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	<6.0	17.3	103	121	143	155	143
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	14.1	21.1	22.3	22.8	21.1	18.2	17.1
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	3.36	5.03	6.97	7.53	7.23	6.14	6.03
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	1.08	0.579	0.523	0.546	0.643	0.657	0.577
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.024	0.075	0.446	0.524	0.62	0.674	0.621
Ca:Mg ratio	4.2	4.2	3.2	3	2.9	3	2.8
K:Mg ratio	0.32	0.12	0.08	0.07	0.09	0.11	0.1
ECR (%)	5.9	2.4	3.2	3.4	4.3	5.2	4.9
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
ECEC (cmol/kg)	18.5	26.8	30.2	31.4	29.6	25.7	24.3
Calcium (%)	75.9	78.8	73.7	72.6	71.3	70.9	70.3
Magnesium (%)	18.1	18.8	23.1	24	24.4	23.9	24.8
Potassium (%)	5.8	2.2	1.7	1.7	2.2	2.6	2.4
Sodium (%)	<0.2	0.3	1.5	1.7	2.1	2.6	2.6
Aluminium (%)	0	0	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-
Chloride (mg/kg)	40	13	280	760	760	750	630
Salinity EC 1:5 (dS/m)	0.092	0.081	0.31	0.58	0.57	0.54	0.47
Boron (mg/kg)	0.79	-	-	-	-	-	-
Iron (Fe) (mg/kg)	11	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	7.6	-	-	-	-	-	-
Copper (Cu) (mg/kg)	0.93	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.47	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.66	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.12	0.13	-	-	-	-	-
TDS (mg(/L)	59	52	200	370	370	350	300
% Air-dry Moisture Content (% of dry wt)	2.1	2.4	4	3.9	3.9	3.8	3.9
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0214	0.0241	0.0403	0.0386	0.0387	0.0383	0.0388
Moisture (dry basis) (%)	1.57	2.21	2.66	2.7	2.69	2.77	2.29
Moisture 105Â°C (dry basis) (%)	6.4	10.4	11.5	12.1	13.6	13.6	12.3

Analysis (Unit)	Sample Depth (mbgl) / Horizon						
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80
Texture (ISSS Classification)	Clay Loam	Clay	Clay	Clay	Clay	Clay	Clay
Gravel fraction (% of whole sample)	0.8	0.2	43.6	10.1	< 0.1	4.8	1.9
Sand fraction (%(< 2 mm fraction)	52.6	35.1	29.9	23.5	26.7	26.3	32
Silt fraction (% < 2 mm fraction)	16.4	20.3	18.2	20.3	19.4	22.4	19.4
Clay fraction (% < 2 mm fraction)	31	44.6	51.9	56.3	53.9	51.3	48.6
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.49	0.33	0.31	0.35	0.53	0.56	0.61
EAT	3	4	4	4	2	2	2
15 Bar (%)	16.9	20.2	22.8	23.6	26	25.3	22.6

'-' indicates no laboratory assessment was undertaken

Table AppC-25: Soil Chemistry for 19Bl(Ro), Analysed Site D52

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
pH 1:5 water (pH units)	7.48	8.03	9.23	9.14	8.99	9.02	9.09	7.91
pH CaCl2 (following 4A1) pH units	6.38	7.11	8.21	8.4	8.33	8.29	8.32	7.1
Organic Carbon (W&B) % (40°C)	1.14	0.47	-	-	-	-	-	-
Nitrate - N (2M KCl) (mg/kg)	2.6	<1.0	-	-	-	-	-	-
Ammonium - N (2M KCl) (mg/kg)	2.3	1.2	-	-	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-	-	-	-	-
PBI + Col P	60	78	-	-	-	-	-	-
Colwell Potassium (mg/kg)	260	110	-	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	4.4	3.5	-	-	-	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	2300	2330	1890	1480	1710	1210	1360	-
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	366	467	1040	1040	1270	990	994	-
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	226	121	99	97	101	80	88	-
Sodium (NH4Cl/BaCl2) (mg/kg)	24.3	80.9	829	1080	1310	1200	1210	-
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	11.5	11.6	9.43	7.41	8.52	6.06	6.78	-
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	3.01	3.84	8.55	8.55	10.5	8.14	8.18	-
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.579	0.309	0.253	0.247	0.257	0.205	0.224	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.106	0.352	3.6	4.72	5.71	5.21	5.25	-
Ca:Mg ratio	3.8	3	1.1	0.9	0.8	0.7	0.8	-
K:Mg ratio	0.19	0.08	<0.05	<0.05	<0.05	<0.05	<0.05	-
GTRI								-
ECR (%)	4.5	4.1	18	24	24	28	27	-
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	2130	2280	1720	1470	1530	1140	1220	-
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	340	435	1030	1120	1280	1020	986	-
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	263	122	88.7	98.2	85.7	77.9	78.5	-
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	<6.0	14.6	78.1	186	256	213	329	-
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	10.6	11.4	8.59	7.32	7.62	5.67	6.08	-
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	2.8	3.58	8.44	9.22	10.5	8.38	8.11	-
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.673	0.311	0.227	0.251	0.219	0.199	0.201	-
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	<0.020	0.064	0.34	0.81	1.11	0.925	1.43	-
Ca:Mg ratio	3.8	3.2	1	0.8	0.7	0.7	0.8	-
K:Mg ratio	0.24	0.09	<0.05	<0.05	<0.05	<0.05	<0.05	-
ECR (%)	4.8	2.4	3.2	6	6.8	7.4	10	-
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	-
ECEC (cmol/kg)	14.1	15.3	17.6	17.6	19.5	15.2	15.8	-
Calcium (%)	75.3	74.2	48.8	41.6	39.1	37.4	38.4	-
Magnesium (%)	19.8	23.3	48	52.4	54.1	55.2	51.3	-
Potassium (%)	4.8	2	1.3	1.4	1.1	1.3	1.3	-
Sodium (%)	<0.2	0.4	1.9	4.6	5.7	6.1	9	-
Aluminium (%)	0	0	0	0	0	0	0	-
Hydrogen (%)	0	0	0	0	0	0	0	-
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-	-	-	-
Chloride (mg/kg)	10	49	310	670	760	840	710	810
Salinity EC 1:5 (dS/m)	0.038	0.054	0.45	0.69	0.85	0.8	0.74	0.7
Boron (mg/kg)	0.74	-	-	-	-	-	-	-
Iron (Fe) (mg/kg)	14	-	-	-	-	-	-	-
Manganese (Mn) (mg/kg)	21	-	-	-	-	-	-	-
Copper (Cu) (mg/kg)	1.2	-	-	-	-	-	-	-
Zinc (Zn) (mg/kg)	0.28	-	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.68	-	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.097	0.077	-	-	-	-	-	-
TDS (mg(/L)	24	35	290	440	540	510	470	450
% Air-dry Moisture Content (% of dry wt)	1.8	1.5	1.6	1.5	2.3	1.4	1.7	-
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0178	0.0146	0.0164	0.015	0.0231	0.0144	0.0165	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon							
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90	1.10-1.20	1.40-1.50	1.70-1.80	2.00-2.10
Moisture (dry basis) (%)	1.34	1.49	1.31	1.68	1.92	2.07	1.58	-
Moisture 105Â°C (dry basis) (%)	6.5	6.4	6.4	6	7.4	7.2	6.6	-
Texture (ISSS Classification)	Clay	Sandy Clay	Clay	Clay	Clay	Clay	Clay	-
Gravel fraction (% of whole sample)	2.7	1.9	4.2	16.5	18.1	19.3	3.9	-
Sand fraction (%(< 2 mm fraction)	61.3	62.4	54.6	54	46.6	51.7	54.7	-
Silt fraction (% < 2 mm fraction)	7.1	5.6	11.5	10.9	13.5	11.5	10.3	-
Clay fraction (% < 2 mm fraction)	31.7	32	34	35.2	39.9	36.8	35.1	-
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-	-	-	-
R1 Dispersion Ratio	0.32	0.39	0.62	0.66	0.72	0.72	0.63	-
EAT	3	4	4	2	2	2	2	-
15 Bar (%)	12.7	13.6	15	15.2	15.4	14.3	13.7	-

'-' indicates no laboratory assessment was undertaken

Table AppC-26: Soil Chemistry for SPC 20BI(Ro), Analysed Site D58

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80
pH 1:5 water (pH units)	8.49	8.61	9.01	8.93
pH CaCl2 (following 4A1) pH units	7.5	7.58	8.16	8.2
Organic Carbon (W&B) % (40°C)	1.07	1.15	-	-
Nitrate - N (2M KCl) (mg/kg)	2.5	1.5	-	-
Ammonium - N (2M KCl) (mg/kg)	1.3	1.1	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-
PBI + Col P	92	78	-	-
Colwell Potassium (mg/kg)	190	130	-	-
KCl Sulfur (S) (mg/kg)	5	10	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	3910	3870	2980	2790
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	723	751	847	878
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	181	152	111	104
Sodium (NH4Cl/BaCl2) (mg/kg)	228	657	1070	1140
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	19.5	19.3	14.9	13.9
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	5.95	6.18	6.97	7.23
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.463	0.388	0.284	0.267
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.991	2.86	4.67	4.94
Ca:Mg ratio	3.3	3.1	2.1	1.9
K:Mg ratio	0.08	0.06	<0.05	<0.05
GTRI	-	-	-	-
ECR (%)	5.4	11	18	20
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	3930	3730	3150	2470
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	750	769	915	853
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	218	183	124	121

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	62.4	291	193	211
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	19.6	18.6	15.7	12.3
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.17	6.33	7.52	7.02
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.557	0.469	0.318	0.31
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.271	1.27	0.837	0.918
Ca:Mg ratio	3.2	2.9	2.1	1.8
K:Mg ratio	0.09	0.07	<0.05	<0.05
ECR (%)	3.1	6.5	4.7	6
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	26.6	26.7	24.4	20.6
Calcium (%)	73.7	69.7	64.4	60
Magnesium (%)	23.2	23.7	30.9	34.1
Potassium (%)	2.1	1.8	1.3	1.5
Sodium (%)	1	4.7	3.4	4.5
Aluminium (%)	0	0	0	0
Hydrogen (%)	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-
Chloride (mg/kg)	29	140	500	540
Salinity EC 1:5 (dS/m)	0.1	0.22	0.56	0.58
Boron (mg/kg)	0.81	-	-	-
Iron (Fe) (mg/kg)	11	-	-	-
Manganese (Mn) (mg/kg)	6.8	-	-	-
Copper (Cu) (mg/kg)	1.3	-	-	-
Zinc (Zn) (mg/kg)	0.31	-	-	-
Oxalate ext. Molybdenum (mg/kg)	1.1	-	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.70-0.80
Dumas Total Nitrogen (% dry wt)	0.13	0.1		
TDS (mg(/L)	66	140	360	370
% Air-dry Moisture Content (% of dry wt)	3.5	3.6	2.8	2.6
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0352	0.036	0.0276	0.0255
Moisture (dry basis) (%)	2.35	3.08	1.78	1.68
Moisture 105Â°C (dry basis) (%)	10.4	10.3	8.9	8.5
Texture (ISSS Classification)	Clay	Clay	Clay	Clay
Gravel fraction (% of whole sample)	1	0.5	0.7	3
Sand fraction (%(< 2 mm fraction)	42.2	42.1	48.3	56.1
Silt fraction (% < 2 mm fraction)	14.7	14.7	10	7.3
Clay fraction (% < 2 mm fraction)	43.1	43.2	41.7	36.7
Moisture 40Â°C (dry basis) (%)	-	-	-	-
R1 Dispersion Ratio	0.35	0.55	0.51	0.62
EAT	3	2	3	2
15 Bar (%)	20.9	22.7	18.4	18.1

'-' indicates no laboratory assessment was undertaken

Table AppC-27: Soil Chemistry for 21Bl(Ta), Analysed Site D59 (SLR Site B21 (2023))

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10 (B21, SLR 2023)	0.20-0.30 (B21, SLR 2023)	0.50-0.60 (B21, SLR 2023)	D59-0.80-0.90	(B21 0.9-1.0, SLR 2023)
pH 1:5 water	7.83	8.81	9.25	-	9.25
Organic Carbon (W&B)	0.35	-	0.22	-	-
Nitrate - N (2M KCl)	<1.0	-	<1.0	-	-
Ammonium - N (2M KCl)	<1.0	-	<1.0	-	-
Colwell Phosphorus	<5.0	-	<5.0	-	-
PBI + Col P	21	-	73	-	-
Colwell Potassium	130	-	180	-	-
KCl Sulfur (S)	<2.5	-	4.8	-	-
Exchangeable Calcium	5.4	7.6	6.8	-	20
Exchangeable Magnesium	0.91	6.3	7.7	-	9
Exchangeable Potassium	0.38	0.33	0.37	-	0.35
Exchangeable Sodium	<0.065	0.98	2.1	-	5.8
Exchangeable acidity	<0.02	-	<0.02	-	-
Exchangeable aluminium	<0.02	-	<0.02	-	-
This Exchangeable hydrogen	<0.02	-	<0.02	-	-
Calcium/Magnesium Ratio	6	1.2	0.88	-	2.2
ECEC	6.8	15	17	-	35
Calcium (%)	80	50	40	-	57
Magnesium (%)	13	41	45	-	26
Potassium (%)	5.6	2.2	2.2	-	1
Sodium - ESP (%)	0.52	6.4	12	-	17
Aluminium (%)	0.17	0.1	0.07	-	0.02
Hydrogen (%)	0	0	0	-	0
CaCl2 extr. Aluminium	<0.1	-	-	-	-
Chloride	<5	5	51	170	-
EC	0.067	0.05	0.131		0.731
Boron	0.26	-	-	-	-
Iron (Fe)	4.3	-	-	-	-
Manganese (Mn)	4.7	-	-	-	-
Copper (Cu)	0.47	-	-	-	-
Zinc (Zn)	<0.08	-	-	-	-
Oxalate ext. Molybdenum	<0.25	-	-	-	-
Dumas Total Nitrogen	0.035	-	0.05	-	-
% Air-dry Moisture Content	0.3	-	1.7	-	-

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.10 (B21, SLR 2023)	0.20-0.30 (B21, SLR 2023)	0.50-0.60 (B21, SLR 2023)	D59-0.80-0.90	(B21 0.9-1.0, SLR 2023)
S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	0.0032	-	0.0169	-	-
Moisture (dry basis)	1.18	1.11	4.54	4.41	-
Moisture 105Â°C (dry basis)	-	-	-	-	-
Texture (ISSS Classification)	Sandy Loam	Sandy Loam	Sandy Clay	Clay	-
Gravel fraction	4.7	5.7	2	6.4	-
Sand fraction	87.5	83.5	57.5	57.5	-
Silt fraction	2	5.1	3.4	4.8	-
Clay fraction	10.4	11.4	39.1	37.8	-
Moisture 40Â°C (dry basis)	2.4	1.5	6.1	6.4	-
R1 Dispersion Ratio	0.44	0.42	0.69	0.68	-
EAT	3	2	2	-	2
15 Bar (%)	2.7	3.4	13.5	12.4	-

Legend
GTE Laboratory Data
SLR Site Data

'-' indicates no laboratory assessment was undertaken

Table AppC-28: Soil Chemistry for SPC 21Bl(Ta), Analysed Site D59

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
pH 1:5 water (pH units)	9.32	9.3	9.3
pH CaCl2 (following 4A1) pH units	8.36	8.31	8.39
Organic Carbon (W&B) % (40°C)	-	-	-
Nitrate - N (2M KCl) (mg/kg)	-	-	-
Ammonium - N (2M KCl) (mg/kg)	-	-	-
Colwell Phosphorus (mg/kg)	-	-	-
PBI + Col P	-	-	-
Colwell Potassium (mg/kg)	-	-	-
KCl Sulfur (S) (mg/kg)	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	1430	1610	1490
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	747	850	791
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	145	122	142

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Sodium (NH4Cl/BaCl2) (mg/kg)	814	1140	957
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	7.13	8.04	7.46
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	6.15	6.99	6.51
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.37	0.313	0.363
Sodium (NH4Cl/BaCl2) (cmol/kg)	3.54	4.98	4.16
Ca:Mg ratio	1.2	1.2	1.1
K:Mg ratio	0.06	<0.05	0.06
GTRI	-	-	-
ECR (%)	23	26	24
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	1430	1680	1500
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	820	976	826
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	165	130	154
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	95.4	123	95.4
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	7.14	8.36	7.49
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	6.74	8.03	6.79
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.423	0.333	0.395
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.415	0.536	0.415
Ca:Mg ratio	1.1	1	1.1
K:Mg ratio	0.06	<0.05	0.06
ECR (%)	5.7	5	5.4
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02
ECEC (cmol/kg)	14.7	17.3	15.1
Calcium (%)	48.5	48.4	49.6
Magnesium (%)	45.8	46.5	45
Potassium (%)	2.9	1.9	2.6
Sodium (%)	2.8	3.1	2.7
Aluminium (%)	0	0	0

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	1.10-1.20	1.40-1.50	1.70-1.80
Hydrogen (%)	0	0	0
CaCl2 extr. Aluminium (mg/kg)	-	-	-
Chloride (mg/kg)	370	670	460
Salinity EC 1:5 (dS/m)	0.48	0.69	0.55
Boron (mg/kg)	-	-	-
Iron (Fe) (mg/kg)	-	-	-
Manganese (Mn) (mg/kg)	-	-	-
Copper (Cu) (mg/kg)	-	-	-
Zinc (Zn) (mg/kg)	-	-	-
Oxalate ext. Molybdenum (mg/kg)	-	-	-
Dumas Total Nitrogen (% dry wt)	-	-	-
TDS (mg(/L)	300	440	350
% Air-dry Moisture Content (% of dry wt)	1.5	1.7	1.5
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0153	0.0167	0.0145
Moisture (dry basis) (%)	1.11	1.37	1.17
Moisture 105Â°C (dry basis) (%)	7.4	7.4	7.6
Texture (ISSS Classification)	Sandy Clay	Clay	Clay
Gravel fraction (% of whole sample)	23.3	29.3	19.5
Sand fraction (%(< 2 mm fraction)	64.9	57	58.1
Silt fraction (% < 2 mm fraction)	2.8	8	4.9
Clay fraction (% < 2 mm fraction)	32.3	35	37
Moisture 40Â°C (dry basis) (%)	-	-	-
R1 Dispersion Ratio	0.69	0.73	0.68
EAT	2	2	2
15 Bar (%)	11	12.7	12.1

'-' indicates no laboratory assessment was undertaken

Table AppC-29: Soil Chemistry for SPC 22BI(Wy), Analysed Site D65

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.05	0.10-0.20	0.20-0.30	0.50-0.60	0.80-0.90
pH 1:5 water (pH units)	7.48	7.85	7.68	8.03	9.14
pH CaCl2 (following 4A1) pH units	6.74	6.99	6.6	7.03	8.24
Organic Carbon (W&B) % (40°C)	0.64	0.49	-	-	-
Nitrate - N (2M KCl) (mg/kg)	3.1	1.1	-	-	-
Ammonium - N (2M KCl) (mg/kg)	<1.0	<1.0	-	-	-
Colwell Phosphorus (mg/kg)	5.9	<5.0	-	-	-
PBI + Col P	20	19	-	-	-
Colwell Potassium (mg/kg)	330	360	-	-	-
KCl Sulfur (S) (mg/kg)	2.5	<2.5	-	-	-
Calcium (Ca) - NH4Cl/BaCl2 (mg/kg)	616	814	862	1490	1890
Magnesium (Mg) - NH4Cl/BaCl2 (mg/kg)	114	99	201	544	613
Potassium (K) - NH4Cl/BaCl2 (mg/kg)	259	299	215	167	162
Sodium (NH4Cl/BaCl2) (mg/kg)	11.1	13	65.9	257	456
Calcium (Ca) - NH4Cl/BaCl2 (cmol/kg)	3.07	4.06	4.3	7.45	9.44
Magnesium (Mg) - NH4Cl/BaCl2 (cmol/kg)	0.94	0.813	1.65	4.47	5.04
Potassium (K) - NH4Cl/BaCl2 (cmol/kg)	0.662	0.765	0.55	0.428	0.414
Sodium (NH4Cl/BaCl2) (cmol/kg)	0.048	0.057	0.287	1.12	1.98
Ca:Mg ratio	3.3	5	2.6	1.7	1.9
K:Mg ratio	0.7	0.94	0.33	0.1	0.08
GTRI	-	-	-	-	-
ECR (%)	15	14	12	11	14

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.05	0.10-0.20	0.20-0.30	0.50-0.60	0.80-0.90
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (mg/kg)	496	542	847	1560	1740
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (mg/kg)	118	84.1	210	600	640
Potassium (K) - prewash alc. pH 8.5 NH4Cl (mg/kg)	183	185	203	182	161
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	<6.0	<6.0	7	62.9	32.7
Calcium (Ca) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	2.47	2.7	4.23	7.76	8.69
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.97	0.692	1.73	4.93	5.27
Potassium (K) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	0.468	0.472	0.518	0.465	0.411
Sodium (Na) - prewash alc. pH 8.5 NH4Cl (cmol/kg)	<0.020	<0.020	0.03	0.274	0.142
Ca:Mg ratio	2.6	3.9	2.4	1.6	1.7
K:Mg ratio	0.48	0.68	0.3	0.09	0.08
ECR (%)	12	12	8.4	5.5	3.8
Exchangeable acidity (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable aluminium (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
Exchangeable hydrogen (cmol/kg)	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol/kg)	3.92	3.87	6.5	13.4	14.5
Calcium (%)	63.2	69.7	65	57.8	59.9
Magnesium (%)	24.8	17.9	26.5	36.7	36.3
Potassium (%)	12	12	8	3.5	2.8
Sodium (%)	<0.2	0.2	0.5	2	1
Aluminium (%)	0	0	0	0	0
Hydrogen (%)	0	0	0	0	0
CaCl2 extr. Aluminium (mg/kg)	<0.1	-	-	-	-
Chloride (mg/kg)	15	<5	17	92	270
Salinity EC 1:5 (dS/m)	0.058	0.059	0.052	0.13	0.32

Analysis (Unit)	Sample Depth (mbgl) / Horizon				
	0.00-0.05	0.10-0.20	0.20-0.30	0.50-0.60	0.80-0.90
Boron (mg/kg)	0.18	-	-	-	-
Iron (Fe) (mg/kg)	13	-	-	-	-
Manganese (Mn) (mg/kg)	8.1	-	-	-	-
Copper (Cu) (mg/kg)	0.45	-	-	-	-
Zinc (Zn) (mg/kg)	0.41	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.075	0.039	-	-	-
TDS (mg(/L)	37	38	33	84	200
% Air-dry Moisture Content (% of dry wt)	0.3	0.3	0.5	1.6	1.3
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0027	0.0026	0.0046	0.016	0.0131
Moisture (dry basis) (%)	0.298	0.288	0.472	1.19	1.27
Moisture 105Â°C (dry basis) (%)	4.4	2.3	3.4	7.1	7.1
Texture (ISSS Classification)	Sandy Loam	Sandy Loam	Sandy Loam	Sandy Clay	Sandy Clay Loam
Gravel fraction (% of whole sample)	3	2.2	10.4	2	4
Sand fraction (%(< 2 mm fraction)	85.7	86.1	78.7	64.3	68.2
Silt fraction (% < 2 mm fraction)	3.9	3.6	3.9	4.4	6.8
Clay fraction (% < 2 mm fraction)	10.4	10.3	17.4	31.3	25
Moisture 40Â°C (dry basis) (%)	-	-	-	-	-
R1 Dispersion Ratio	0.32	0.43	0.49	0.61	0.59
EAT	3	3	3	2	4
15 Bar (%)	4.7	4.2	7.7	14	11.4

'-' indicates no laboratory assessment was undertaken

Appendix D Interpretation of Key Field and Laboratory Soils Data

Soil pH (1:5 soil/water)

Table AppD-1 presents the pH ratings used to interpret pH data (Adapted from Slattery et al. [1999] and McKenzie et al. [2004]).

Table AppD-1: **pH (1:5 soil/water)**

$pH_{1:5}$	Rating
<3.0 / 3.0-4.0	Very strongly acid
4.0-5.5	Strongly acid
5.5-6.0	Moderately acid
6.0-7.0	Slightly acid to neutral
7.0-8.0	Neutral to slightly alkaline
8.0-9.0	Moderately alkaline
9.0-10.0	Strongly alkaline
10.0-11.0	Very strongly alkaline

Electrical Conductivity

Table AppD-2 presents the EC 1:5 salinity ratings used to assess the significance of laboratory measured EC 1:5 data where clay content was known (Shaw, R.J. 1988).

Table AppD-2: Electrical Conductivity Ratings

Rating	EC 1:5 deciSiemens per metre (dS/m)			
	10-20 per cent (%) clay	20-40 % clay	40-60 % clay	60-80 % clay
Very low	<0.05	<0.08	<0.12	<0.18
Low	0.05-0.10	0.08-0.17	0.12-0.25	0.18-0.37
Moderate	0.10-0.25	0.17-0.40	0.25-0.58	0.37-0.85
High	0.25-0.45	0.40-0.67	0.58-1.00	0.85-1.5
Very high	0.45-0.70	0.67-1.05	1.00-1.58	1.5-2.4
Extreme	>0.70	>1.05	>1.58	>2.4

Cation Exchange Capacity

Table AppD-3 presents the ratings used to assess CEC levels in the topsoil as a guide to overall fertility status (Landon 1991).

Table AppD-3: Cation Exchange Capacity Ratings

Rating	CEC/Equivalent CEC (milliequivalent [meq]/100 grams [g] of soil)
Very low	<5
Low	5-15
Moderate	15-25
High	25-40
Very high	>40

Cation Dominance – Exchangeable Sodium Percentage

Table AppD-4 presents the ratings used to interpret sodicity levels (Baker and Eldershaw 1993).

Table AppD-4: Exchangeable Sodium Percentage Ratings

Rating	ESP (%)
Non-sodic (low)	<6
Sodic (moderate)	6-15
Strongly sodic (high)	15-20
Extremely sodic (very high)	>20

Calcium / Magnesium Ratio (Ca:Mg)

Table AppD-5 presents the ratings used to interpret Ca/Mg ratios (Baker and Eldershaw, 1993). Soils that disperse readily but have low ESP levels; often have high levels of Mg relative to the other cations. The ratio of Ca to Mg provides a guide to the relative abundance of the two major cations and is useful when used in conjunction with ESP and R1 ratio for predicting soil physical behaviour.

Table AppD-5: Ca:Mg Ratio Ratings

Rating	Ca/Mg Ratio	Comments
Very low	<0.10	Mg is >10 times more dominant than Ca
Low	0.10–0.50	Mg is 5–10 times more dominant than Ca
Moderate	0.51–1.0	Ca and Mg becoming co-dominant
High	1.1–2	Ca more dominant than Mg
Very high	>2	Ca >2 times more dominant than Mg

Phosphorus

Table AppD-6 presents Bicarbonate Extractable Phosphorus categories shown by Ahern et al. (1994). The ratings were used to assess available Bicarb. extr. P levels.

Table AppD-6: Available Phosphorus

Rating	Bicarbonate Extractable Phosphorus
Very low	<5
Low	6-9
Moderate	10-15
High	16-40
Very high	>40

Dispersion Ratio R1

Table AppD-7 presents the ratings used to interpret the R1 ratios (Baker and Eldershaw, 1993). The R1 ratio is a measure of the amount of silt and clay that disperses during testing compared with the total amount of silt and clay present. As such, it is a direct laboratory measure of soil dispersion and is useful when used in conjunction with ESP, EAT and the Ca/Mg ratio for predicting soil physical behaviour.

Table AppD-7: Dispersion Ratio Ratings

Rating	R1 Ratio
Low	<0.6
Moderate	0.6–0.8
High	0.8–0.95
Very high	>0.95

Emerson Aggregate Test

This test assesses the behaviour and cohesion of the soil aggregate in a brief period (two hours). The soil behaviours assessed were slaking and dispersion. Plate AppD-1 outlines the EAT assessment and class number and Table AppA-8 outlines the Emerson classes as per Australian Standard AS1289.3.8.1-2006 (Standards Australia, 2016).

Plate AppD-1: Determining the Emerson Class Number of Aggregates

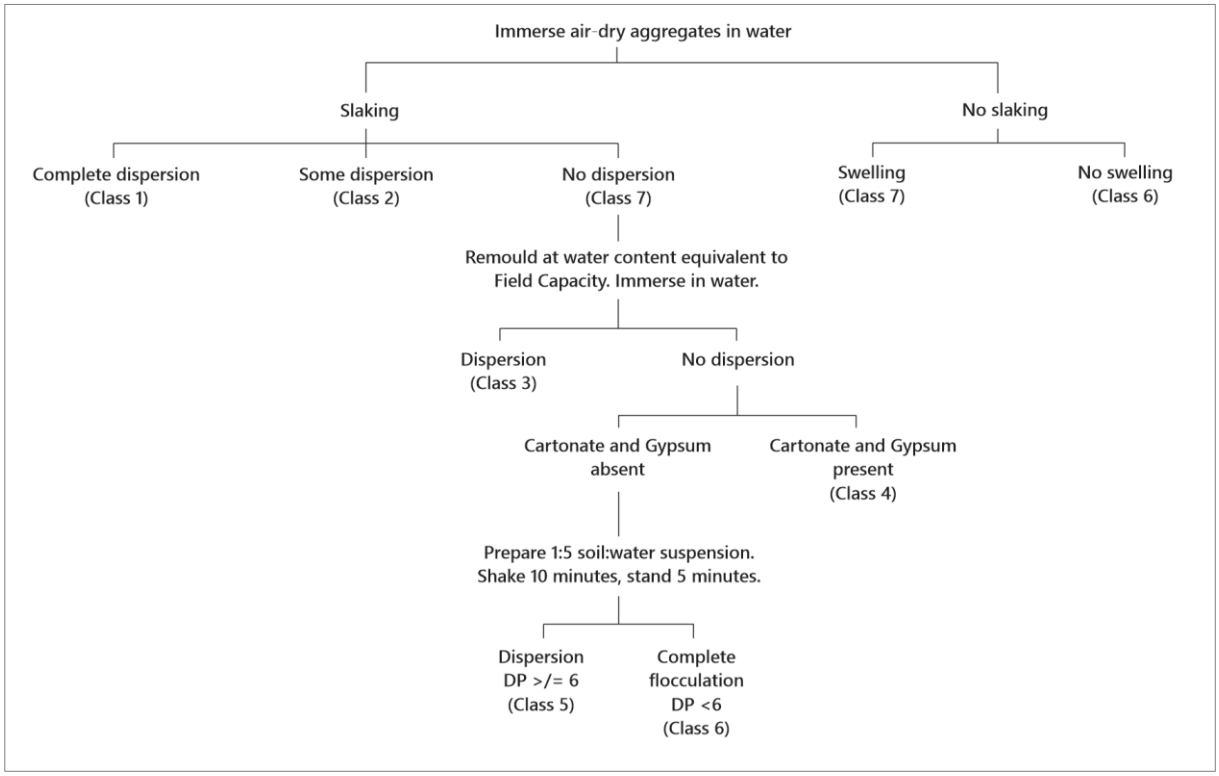


Table AppA-8: Emerson Class Descriptions

Emerson Class	Description
Class 1	Air-dried crumbs of soil show a strong dispersing reaction, i.e. a colloidal cloud covers nearly the whole of the bottom of the beaker, usually in a very thin layer. The reaction should be evident within 10 min. In extreme cases, all the water in the beaker becomes cloudy, leaving only a coarse residue in a cloud of clay.
Class 2	Air-dried crumbs of soil show a moderate to slight reaction. A moderate reaction consists of an easily recognizable cloud of colloids in suspension, usually spreading in thin streaks on the bottom of the beaker. A slight reaction consists of the bare hint of cloud in water at the surface of the crumbs.
Class 3	The soil remoulded at the plastic limit disperses in water.
Class 4	The remoulded soil does not disperse in water. Calcium carbonate (calcite) or calcium sulfate (gypsum) is present.
Class 5	The remoulded soil does not disperse in water and the 1:5 soil / water suspension remains dispersed after five minutes.
Class 6	The remoulded soil does not disperse in water and the 1:5 soil / water suspension begins to flocculate within five minutes.
Class 7	The air-dried crumbs of soil remain coherent (do not disperse) in water and swell.
Class 8	The air-dried crumbs of soil remain coherent (do not disperse) in water and do not swell.

Soil Erodibility

The Universal Soil Loss Equation (USLE) soil erodibility factor (K factor) of topsoil was estimated from suggested K factor values from Rosewell (1993). Table AppD-9 outlines the K factors from soil texture.

Table AppD-9: Estimating USLE K factors from Soil Texture

Soil texture	Suggested K factor
Sand	0.015
Clayey sand	0.025
Loamy sand	0.020
Sandy loam	0.030
Fine sandy loam	0.035
Sandy clay loam	0.025
Loam	0.040
Loam, fine sandy	0.050
Silt loam	0.055
Clay loam	0.030
Silty clay loam	0.040
Fine sandy clay loam	0.025
Sandy clay	0.017
Silty clay	0.025
Light clay	0.025
Light medium clay	0.018
Medium clay	0.015
Heavy clay	0.012

These K factor values are assessed against the soil erodibility classes from Rosewell and Loch (2002) outlined in Table AppD-10.

Table AppD-10: Estimating USLE K factors from Soil Texture

Rating	K of the USLE (t/ha/yr per unit of rainfall erosivity)
Very low	0.00-0.01
Low	0.01-0.02
Moderate	0.02-0.04
High	0.04-0.06
Very high	>0.06

Particle Size Analysis and Soil Texture

Particle size analysis (PSA) measures the composition percentage of sand, silt, and clay sized particles, this allows soil texture to be determined.

The triangular texture diagram based on international fractions (Marshall, 1947), as shown in NCST (2024) has been used to derive soil texture based on PSA laboratory results.

Plant Available Water Capacity

Plant available water capacity (PAWC) is the amount of water that may be stored within a soil profile of up to 1.20 m in depth (DSITI & DNRM, 2015) and is the difference between a drained upper limit and crop lower limit. The amount of water a soil profile may hold impacts on its ability to provide for and be used by vegetation.

The soil texture lookup table from RPI 08/14 Guideline (DSDMIP, 2019) was initially used to estimate PAWC. Using available Class III observation site laboratory data, pedotransfer modelling as per the Salinity Management Handbook (using SALFPredict) (DERM, 2011) was used to assess PAWC.

This overall PAWC total was affected by the soil texture, physical and chemical barriers, as discussed further in Section 4.4 with results outlined in SPC summaries in Section 5 and Appendix F.

Appendix E SLR (2023) Detailed Sites Review

Table AppE-1: Summary of SLR (2023) Detailed Sites Review

Site	SLR Classifciation	SMU	GTE Classficiation	Samples Analysed	Issue	Notes	Site able to be used	Report / Mapping GTE Decision 22Dec25 RM
B01	Eutrophic Red Dermosol	2B	n/a	Yes	No profile to review		Need to check for soil profile - NOT AVAILABLE	No Profile to review, site conducted by GTE. D44 conducted on site, Grey Vertosol
B02	Self-Mulching Black Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol		Colour is incorrect based on dominant colour class in the upper 0.5 m of the B2 horizon. No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Linear Gilgai noted. No gilgai mound / depression site conducted	Yes - But amendment of soiil profile assessment needed	Incorrect colour grading on SLR site. Based on SLR horizons, it would grade as a Brown soil (SPC 15). Amend change in report, UMA upidated to include this in UMA
B03	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted. Shallow site to 0.40 m	Yes - But additional informaiton provided may pull it out as a separate SPC	Additional UMA added for this site. GTE SPC 2 is too deep, remember to assess as a shallow UMA (AG land Asserssment)
B04	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Linear Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B05	Self-Mulching Black Vertosol	1	n/a	Yes	No profile to review		Need to check for soil profile - NOT AVAILABLE	No Profile to review, site conducted by GTE. D37 conducted on site, Black Vertosol
B06	Self-Mulching Red Vertosol	1	Red Dermosol, or Self mulching Red Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton provided may pull it out as a separate SPC / confirm ASC	Correct colour for Red Vertosol. Site D36 is within 75m. We could move this closer to amend this, but in any case, the area is too small and unmappable. A subdominant vertosol as D36 is a Brown Dermosoil. Highlight in report, no change to mapping
B07	Self-Mulching Black Vertosol	1	n/a	Yes	No profile to review		Need to check for soil profile - NOT AVAILABLE	No Profile to review, site conducted by GTE. D22 conducted on site, Grey Vertosol
B08	Self-Mulching Grey Vertosol	1	Grey Dermosol, or Self mulching Grey Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Normal Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton provided may pull it out as a separate SPC / confirm ASC	UMA amended for this site
B09	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Linear Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B10	Self-Mulching Red Vertosol	1	Red Dermosol, or Self mulching Red Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Linear Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton provided may pull it out as a separate SPC / confirm ASC	GTE Site D22 conducted on B10 site. Red Vertosol was not observed. Area remains as Grey Vertosol
B11	Self-Mulching Black Vertosol	1	Self-Mulching Black Vertosol			Incipient Linear Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton provided may the depth may pull it out as separate SPC	Additional UMA added for this site
B12	Eutrophic Red Chromosol	3	n/a	Yes	No profile to review		Need to check for soil profile - NOT AVAILABLE	Sub-dominant soil tyupe in SLR report. Site D32 / D4 (Grey Dermosol) was conducted within 5 metres. No Profile to review, therefore no changes made Area remains as Grey Dermosol
B13	Self-Mulching Black Vertosol	1	Self-Mulching Black Vertosol			Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton provided may the depth may pull it out as separate SPC	Additional UMA added for this site

B14	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B15	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site. SPC 2 (due to SLR refusal at 0.90 m).
B16	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B17	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B18	Self-Mulching Black Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Cant assess horizon depths due to photo placemnt. Agree it is a brown vertosol Amend change in report, amend in mapping, UMA added
B19	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	UMA amended for this site
B20	Eutrrophic Red Chromosol	3	Red Chromosol	Yes			Yes - But additional informaiton provided may the depth may pull it out as separate SPC	Sub-dominant soil tyupe in SLR report. Site D52 (Grey Dermosol) was conducted within 35 metres. Surface around B20 may indicate anotehr soil type, but area is too small to be mapped. Sites to the north east indicate mixed ssurface soils. Area remains as Grey Dermosol
B21	Subnatric Brown Sodosol	1	Brown Sodosol, or Brown Chromosol	Yes	No profile to review		Yes - Check for lab to confirm ASC	Site D59 conducted, Grey Sodosol
B22	Self-Mulching Black Vertosol	1	Red Dermosol, or Self mulching Red Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But amendment of soiil profile assessment needed	Incorrect colour grading on SLR site. Based on SLR horizons, it would grade as a Brown Vertosol (SPC 15). Amend change in report, amend in mapping, UMA amended
B23	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	UMA amended for this site
B24	Self-Mulching Black Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But amendment of soiil profile assessment needed	Incorrect colour grading on SLR site. Based on SLR horizons, it would grade as a Brown Vertosol (SPC 19). Amend change in report, amend in mapping, new UMA asdded
B25	Self-Mulching Brown Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	D3 completed within 5 m of B25. D3 is a black vertosol, and B25 wouldn't be mappabale at this scale, therefore no ASC change.
B26	Self-Mulching Brown Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But amendment of soiil profile assessment needed	Incorrect colour grading on SLR site. Based on SLR horizons, it would grade as a Black Vertosol (SPC 19). Amend change in report, amend in mapping, UMA amended
B27	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site. SPC 2 due to weathered material at 1.0m

B28	Eutrophic Red Dermosol	2A	n/a	Yes	No profile to review		Need to check for soil profile NOT AVAILABLE	Site D60 completed nearby. Agree, no ASC change.
B29	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Melonhole noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B30	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Additional UMA added for this site
B31	Self-Mulching Brown Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Loacted within Brown Vertosol SPC Agree, no ASC change.
B32	Self-Mulching Red Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But amendment of soiil profile assessment needed	Incorrect colour grading on SLR site. GTE re-assesses as a Brown Vertosol. Amend change in report, no change to mapping
B33	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Site D10 completed nearby. Additional UMA added for the site
B34	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Crabhole Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Site D64 completed nearby. Agree, no ASC change.
B35	Self-Mulching Brown Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Site D64 completed nearby. UMA Amended
B36	Self-Mulching Brown Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Draft mapping lines moved. Agree, no ASC change
B37	Self-Mulching Black Vertosol	1	Black Dermosol, or Self-Mulching Black Vertosol		No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Site C45 completed nearby. Agree, no ASC change.
B38	Self-Mulching Brown Vertosol	1	Brown Dermosol, or Self-mulching Brown Vertosol	Yes	No Slickensides and/or lenticular peds noted (discsussed in Section 4.1.1, Vertosol Description)	Incipient Gilgai noted. No gilgai mound / depression site conducted	Yes - But additional informaiton will be needed to confirm ASC	Site D62 completed to the south. Agree, no ASC change.

Appendix F SLR (2023) Check Sites Review

Table AppF-1: Summary of SLR (2023) Check Sites Review

Site	SLR Classifciation	SMU	GTE Classficiation	Issue	Notes	Site able to be used	Report / Mapping GTE Decision
C01	Self-Mulching Black Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C02	Self-Mulching Brown Vertosol	1	Self -mulching present Not enough information to confirm ASC	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C03	Self-Mulching Brown Vertosol	1	Self -mulching present Not enough information to confirm ASC	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C04	Self-Mulching Black Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Outside of project area, different soil type
C05	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C06	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C07	Self-Mulching Black Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Offsite
C08	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Offsite
C09	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Offsite
C10	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Offsite
C11	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Offsite
C12	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface appears similar, likley a vertic dermosol. Acknowledge in report
C13	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface appears similar, likley a vertic dermosol. Acknowledge in report
C14	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.

C15	Self-Mulching Brown Vertosol	1	Surface flake present B21 horizon shown but with no measurements	Surface site / profile witgh no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But additional informaiton will be needed to confirm ASC	SPC UMA Reviewed Agree, no ASC change.
C16	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C17	Brown Dermosol	1 (sub-dominant)	Surface looks soft, profile has not been scrapped back to see structure.	Surface site / profile witgh no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But additional informaiton will be needed to confirm ASC	Site is located to close / on disturbance (track). Is not considered realiable . No UMA changes
C18	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	GTE review of C18 photo indicates gilgai, as per UMA. Site C91 completed within the area
C19	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface is same colour as GTE SPC UMA. Acknowledge in report
C20	Brown Dermosol	1 (sub-dominant)	Surface looks soft, profile has not been scrapped back to see structure.	Surface site / profile witgh no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But additional informaiton will be needed to confirm ASC	UMA added for this and an adjcent GTE Site C57
C21	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface colour is brown, however no profile photos avbilablae so best ot leave as SPC Grey Vertosol
C22	Brown Dermosol	3	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Area too small to map out, between the sat imagery of the gilgai. Area is deemed to be the major gilgai SPC
C23	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface is same colour as GTE SPC UMA (Site D47). Acknowledge in report
C24	Self-Mulching Brown Vertosol	1	Minimal surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface is same colour as GTE SPC UMA (Site D47). Acknowledge in report
C25	Brown Dermosol	1 (sub-dominant)	Surface looks soft, profile has not been scrapped back to see structure.	Surface site / profile witgh no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But additional informaiton will be needed to confirm ASC	Site has been decided to fit within the SPC 21 (Grey sodosol) as a sub-dominant soil.
C26	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Site C92 conducted and UMA is observed as gilgai, surrounding by brown soils. Therefore Brown vertosol gilgai UMA included
C27	Self-Mulching Brown Vertosol	1	Surface looks soft, profile has not been scrapped back to see structure.	Surface site / profile with no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But additional informaiton will be needed to confirm ASC	Surface doesn't look flaing, likley the Brown dermosol
C28	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.

C29	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C30	Red Dermosol	2B	Cracks not wide enough. Not enough information to confirm ASC. `	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Area looks distrubed and colour isnt red. GTE assumes Site D57 <15 m away is more accurate as a grey vertosol
C31	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C32	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.
C33	Epipdeal Brown Vertosol	1	Surface does not present vertic properties Not enough information to	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Surface resembles a firm surfgace, not epipedal. Stays as Dermosol
C34	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Only surface is shown as brown. Not enough to change the GTE SPC Grey Vertosol
C35	Brown Dermosol	3	Surface likley hard, minor flake Not enough information to	Surface site / profile with no measurement tape. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	Only surface is shown as brown. Not enough to change the GTE SPC Grey Dermosol
C36	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	UMA Amended
C37	Self-Mulching Brown Vertosol	1	Surface flake present Not enough information to confirm ASC.	Surface site / No profile. SLR assessment is based on minimimal infomration	Assess as adjacent Detailed site / UMA, unless it is obvious . Site only good for Surface check	Yes - But amendment of soiil profile assessment may be needed	SPC UMA Reviewed Agree, no ASC change.

Appendix G Project Central West Region Soil Sites

Project description

Project name:	Central West Region Salinity Investigations
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	

Site characteristics

Date described:	24/06/2004	Observation type:	Relatively undisturbed soil core
Site Type:	Free survey site	Observation class:	Class IIIa (limited chemistry)
Slope (%):	1	Morphological type:	Crest
Slope type	Abney level or clinometer and tape	Landform element:	Crest
Geology:	Not recorded	Landform pattern:	Plain
Soil Name:	Not recorded	Substrate lithology:	Sandstone
Runoff:	Slow	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Moderately well drained	Microrelief type:	Zero or none
Disturbance:	Limited clearing	Proportion gilgai:	N/A
Rock outcrop:	No bedrock exposed	Vertical interval (m):	N/A
Surface condition:	Periodic cracking; Self-mulching	Horizontal interval (m):	N/A
Surface coarse fragments:	Few (2-10%), detrital sedimentary rock (unidentified), medium pebbles (6-20 mm)	Microrelief component sampled:	N/A

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-23.67881	148.85534	55	689197	7380102	Not recorded	Averaging GNSS
GDA 2020	-23.67880	148.85535	55	689198	7380103		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Endocalcareous, Self-mulching, Black Vertosol; non-gravelly, fine, medium fine, moderate.	No analytical data are available but confidence is fair.	Isbell (1996) The Australian Soil Classification (First Edition)	N/A	Brown clay	Ug5.13

Vegetation

Community name	Mid-high open woodland, Acacia harpophylla	
Stratum	Species	Common name
Tallest 6.01-12 m	*Acacia harpophylla*	brigalow
	Brachychiton rupestris	narrow-leaved bottle tree, bottle tree, Queensland bottle tree

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A11	0	0.05	Very dark greyish brown (10YR 3/2) moist	no mottles or other colour patterns mottle;	Light medium clay	Strong 5-10 mm Subangular blocky structure; Strong 2-5 mm Granular structure;	no coarse fragments;	No segregations;		clear
2	B21	0.05	0.3	Very dark greyish brown (10YR 3/2) moist	no mottles or other colour patterns mottle;	Medium clay	Strong 10-20 mm Angular blocky structure;	no coarse fragments;	No segregations;		gradual
3	B22	0.3	0.6	Dark brown (7.5YR 3/2) moist	no mottles or other colour patterns mottle;	Medium clay	Strong 10-20 mm Angular blocky structure; Strong 5-10 mm Subangular blocky structure;	no coarse fragments;	No segregations;		diffuse
4	B23	0.6	0.85	Dark brown (7.5YR 3/3) moist	no mottles or other colour patterns mottle;	Medium clay	Moderate 5-10 mm Lenticular structure;	no coarse fragments;	Very few (<2%) Fine (<2mm) Calcareous Nodules;		gradual

5	BC	0.85	1.05	Brown (7.5YR 4/4) moist	no mottles or other colour patterns mottle;		Moderate 2-5 mm Polyhedral structure;	abundant (50-90%) angular sandstone small pebbles (2-6 mm); common (10-20%) angular sandstone medium pebbles (6-20 mm);				gradual
6	C	1.05	1.2					very abundant (>90%) sandstone (size not recorded);				

Field test	
Field EC 1:5 soil/water dS/m	
Depth (m)	Value
0.01	.19
0.3	1.17
0.6	1.65
0.9	1.26

Field test	
pH by Raupach and Tucker method	
Depth (m)	Value
0.01	7.5
0.3	8.5
0.6	8.5
0.9	8.0

Notes			
Note level	Horizon name	Horizon no	Note
Observation			Disturbance data derived (in 2023) from remote sensing (aerial photography, satellite imagery). Accuracy of the disturbance value is influenced by accuracy of the site location and availability of imagery close to the date of site description.

Laboratory test results					
				Sample	1
				Upper depth (m)	0.5
				Lower depth (m)	0.6
Group	Method	Code	Units	Bulked Sample	N
Profile General	pH - 1:5 water	4A1			8.4
	EC - 1:5 water	3A1	dS/m		1.27
	Cl - 1:5 water - automated	5A2	mg/kg		1450
	Water sol NO3 - automated	7B1	mg/kg		4.40
Alcoholic Cations	Exch Ca - alcoh. NH4Cl, pH8.5, prewash	15C1_Ca	cmol_c/kg		16.60
	Exch Mg - alcoh. NH4Cl, pH8.5, prewash	15C1_Mg	cmol_c/kg		12.10
	Exch Na- alcoh. NH4Cl, pH8.5, prewash	15C1_Na	cmol_c/kg		7.40
	Exch K - alcoh. NH4Cl, pH8.5, prewash	15C1_K	cmol_c/kg		0.50
	CEC - alcoh. NH4Cl, pH8.5, prewash	15C1_CEC	cmol_c/kg		36.0
Other Cations	ESP (Exch. Na %)	15N1	%		21.0

Photo No: 140
Date: 4/04/2005
Title: S 293 Soil
Desc:



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Project SALTC Site 294 Observation 1

SALI4320

Project description

Project name:	Central West Region Salinity Investigations
Project status:	Data is from an active project and may be subject to change through additions/updates or further quality assessment processes
Location:	

Site characteristics

Date described:	24/06/2004	Observation type:	Relatively undisturbed soil core
Site Type:	Free survey site	Observation class:	Class IIIa (limited chemistry)
Slope (%):	1	Morphological type:	Simple slope
Slope type	Abney level or clinometer and tape	Landform element:	Plain
Geology:	Not recorded	Landform pattern:	Plain
Soil Name:	Not recorded	Substrate lithology:	Clay
Runoff:	Slow	Depth to free water:	Not recorded
Permeability:	Slowly permeable (5-50 mm/day)	Erosion:	Not recorded
Drainage:	Imperfectly drained	Microrelief type:	Normal gilgai
Disturbance:	Complete clearing - pasture - but never cultivated	Proportion gilgai:	Not recorded
Rock outcrop:	No bedrock exposed	Vertical interval (m):	0.15
Surface condition:	Periodic cracking; Self-mulching	Horizontal interval (m):	6
Surface coarse fragments:	Very few (<2%), silcrete, medium pebbles (6-20 mm)	Microrelief component sampled:	Not recorded

Site location

Datum	Latitude (dd)	Longitude (dd)	Zone	Easting (m)	Northing (m)	Location accuracy (m)	Location measurement method
GDA 94	-23.68673	148.85734	55	689390	7379222	Not recorded	Averaging GNSS
GDA 2020	-23.68672	148.85736	55	689391	7379223		

Soil classification

Australian Soil Classification (ASC)	Confidence	ASC Technical Reference	Buried	GSG	PPF
Endocalcareous-Endohypersodic, Self-mulching, Black Vertosol; non-gravelly, fine, medium fine, very deep.	No analytical data are available but confidence is fair.	Isbell (1996) The Australian Soil Classification (First Edition)	N/A	Brown clay	Ug5.15

Vegetation

Community name	Tall sparse shrubland, Acacia harpophylla	
Stratum	Species	Common name
Tallest 1.01-3.0 m	*Acacia harpophylla*	brigalow
Lowest	*Cenchrus ciliaris*	buffel grass

Profile morphology

No	Name	Upper depth (m)	Lower depth (m)	Colour	Mottles	Textures	Structures	Coarse fragments	Segregations	Strengths	Bounds
1	A11	0	0.05	Very dark greyish brown (2.5Y 3/2) moist	no mottles or other colour patterns mottle;	Light clay	Strong 5-10 mm Subangular blocky structure; Strong 2-5 mm Granular structure;	no coarse fragments;	No segregations;		gradual
2	B21	0.05	0.3	Very dark greyish brown (2.5Y 3/2) moist	no mottles or other colour patterns mottle;	Light medium clay	Strong 10-20 mm Angular blocky structure;	no coarse fragments;	No segregations;		diffuse
3	B22k	0.3	1	Very dark greyish brown (2.5Y 3/2) moist	no mottles or other colour patterns mottle;	Medium clay	Moderate 20-50 mm Subangular blocky structure; Moderate 5-10 mm Lenticular structure;	no coarse fragments;	Common (10-20%) Fine (<2mm) Calcareous Nodules; Few (2-10%) Medium (2-6 mm) Calcareous Nodules;		diffuse

4	B3	1	1.65	Dark brown (10YR 3/3) moist	common (10-20%) medium (5-15 mm) distinct brown mottle;	Medium clay	Moderate 5-10 mm Lenticular structure;	no coarse fragments;	Few (2-10%) Fine (<2mm) Calcareous Nodules; Few (2-10%) Medium (2-6 mm) Calcareous Soft segregations; Few (2-10%) Fine (<2mm) Manganiferous Veins;		

Field test

Field dispersion test as per LRO guideline (2012)

Depth (m)	Value
0.01	0
0.3	0
0.6	0
0.9	1
1.2	1
1.5	1

Field test

Field EC 1:5 soil/water dS/m

Depth (m)	Value
0.01	.27
0.3	2.33
0.6	2.18
0.9	2.5
1.2	2.55
1.5	2.39

Field test

pH by Raupach and Tucker method

Depth (m)	Value
0.01	7.0
0.3	8.5
0.6	8.5
0.9	8.5
1.2	8.5
1.5	8.0

Notes

Note level	Horizon name	Horizon no	Note
Observation			Disturbance data derived (in 2023) from remote sensing (aerial photography, satellite imagery). Accuracy of the disturbance value is influenced by accuracy of the site location and availability of imagery close to the date of site description.
Horizon	A11	1	B3 SODIC MEDIUM CLAY
Horizon	B3	4	B3 sodic medium clay

Laboratory test results

				Sample	1	2
				Upper depth (m)	0.2	0.8
				Lower depth (m)	0.3	0.9
Group	Method	Code	Units	Bulked Sample	N	N
Profile General	pH - 1:5 water	4A1			8.3	8.3
	EC - 1:5 water	3A1	dS/m		1.31	1.78
	Cl - 1:5 water - automated	5A2	mg/kg		1880	2330
	Water sol NO3 - automated	7B1	mg/kg		<1	<1
Alcoholic Cations	Exch Ca - alcoh. NH4Cl, pH8.5, prewash	15C1_Ca	cmol_c/kg		21.60	15.90
	Exch Mg - alcoh. NH4Cl, pH8.5, prewash	15C1_Mg	cmol_c/kg		7.85	9.18
	Exch Na- alcoh. NH4Cl, pH8.5, prewash	15C1_Na	cmol_c/kg		4.85	7.31
	Exch K - alcoh. NH4Cl, pH8.5, prewash	15C1_K	cmol_c/kg		0.46	0.38
	CEC - alcoh. NH4Cl, pH8.5, prewash	15C1_CEC	cmol_c/kg		38.0	36.0
Other Cations	ESP (Exch. Na %)	15N1	%		13.0	20.0

Photo No: 141
Date: 24/06/2004
Title: S 294 Soil
Desc: Black vertosol over clay sediments



Photo No: 142
Date: 24/06/2004
Title: S 294 Landscape
Desc: Cleared brigalow



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Appendix H Regional Frameworks SPC Assessments

Table AppJ-1: Summary of Land Suitability classes for 1Dn(Te), Representative Site D1

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppJ-2: Summary of Land Suitability classes for 2Dn(Te), Representative Site D3

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	11	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

Table AppJ-3: Summary of Land Suitability classes for 3Bl(Te), Representative Site D5

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-4: Summary of Land Suitability classes for 4Bl(Te)Representative Site D6

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppJ-5: Summary of Land Suitability classes for 5Dn(Ro), Representative Site D7

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

Table AppJ-6: Summary of Land Suitability classes for 6Bl(Pg), Representative Site D12m

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Soil Water Availability (M)[1]	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

1 – Soil water availability is based on the lowest PAWC of both the mound and depression, which is depression at 115.2 mm/100cms

Table AppJ-7: Summary of Land Suitability classes for 7Bl(Pg), Representative Site D14m

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Soil Water Availability (M) [1]	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	4	2	2	2	2	2	2	2	2	2	2	2	2	2
Wetness (W)[2]	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

1 – Soil water availability is based on the lowest PAWC of both the mound and depression, which is depression at 106.8 mm/100cms
2 – Wetness assessed on depression site location, D14d

Table AppJ-8: Summary of Land Suitability classes for 8Dn(Te), Representative Site D19

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	41	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	42	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3M	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

Table AppJ-9: Summary of Land Suitability classes for 9Dn(Ro), Representative Site D21

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-10: Summary of Land Suitability classes for 10Ct(Ro), Representative Site D22

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	33	4	4	4	4	4	4	4	4	4	4	4	4	4
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-11: Summary of Land Suitability classes for 11Bl(Ta), Representative Site D24

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	33	4	4	4	4	4	4	4	4	4	4	4	4	4
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	8	4	4	4	4	4	4	4	4	4	4	4	4	4
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4S	2	2	2	2	2	2	2	2	2	2	2	2	2
Overall Suitability Class		5	5	4	4	5	4	5	4	4	4	4	5	5

Table AppJ-12: Summary of Land Suitability classes for 12Da(Te), Representative Site D32

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	4	4	5	4	5	4	4	4	4	5	5

Table AppJ-13: Summary of Land Suitability classes for 13Bl(Ta), Representative Site D36

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	31	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	4	4	5	4	5	4	4	4	4	5	5

Table AppJ-14: Summary of Land Suitability classes for 14Bl(Ro), Representative Site D37

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-15: Summary of Land Suitability classes for 15Bl(Ro), Representative Site D39

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	~
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-16: Summary of Land Suitability classes for 16Bl(Ta), Representative Site D43

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	8	4	4	4	4	4	4	4	4	4	4	4	4	4
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	~
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppJ-17: Summary of Land Suitability classes for 17Bl(Ro), Representative Site D44

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		4	4	4	4	4	4	4	4	4	4	4	4	4

Table AppJ-18: Summary of Land Suitability classes for 18Bl(Ro), Representative Site D45

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3M	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class		4	4	3	3	4	3	4	3	3	3	3	4	4

Table AppJ-19: Summary of Land Suitability classes for 19Bl(Ro), Representative Site D52

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	4	4	5	4	5	4	4	4	4	5	5

Table AppJ-20: Summary of Land Suitability classes for 20Bl(Ro), Representative Site D58

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	4	5	5	3	4	5	4	5	4	4	4	4	5	5
Narrow Moisture Range (Pm)	2	1	1	1	1	1	1	1	1	1	1	1	1	1
Surface Condition (Ps)	5	3	3	3	3	3	3	3	3	3	3	3	3	3
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	3	4	5	4	5	4	4	4	4	5	5

Table AppJ-21: Summary of Land Suitability classes for 21Bl(Ta), Representative Site D59

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	6	3	3	3	3	3	3	3	3	3	3	3	3	3
Surface Condition (Ps)	8	4	4	4	4	4	4	4	4	4	4	4	4	4
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	3S	4	4	4	4	4	4	4	4	4	4	4	4	4
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

Table AppJ-22: Summary of Land Suitability classes for 22Bl(Wy), Representative Site D65

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	22	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	21	1	1	1	1	1	1	1	1	1	1	1	1	1
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Narrow Moisture Range (Pm)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Surface Condition (Ps)	3	2	2	2	2	2	2	2	2	2	2	2	2	2
Rockiness (R)	G2	1	1	1	1	1	1	1	1	1	1	1	1	1
Microrelief (Tm)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Wetness (W)	4M	1	1	2	1	1	1	1	1	1	1	1	1	1
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Appendix I Beef Cattle Grazing Suitability Assessment

Table AppK-1: Summary of Beef Cattle Grazing Land Suitability Classes for SPCs

SPC / Class III Site	Water Availability	Nutrient Def	Physical Factors	Salinity	Rockiness	Gilgai	pH	ESP	Wetness	Topography	Water erosion	Flooding	Beef Cattle Grazing Class
1Dn(Te) / D1	4	4	2	3	1	-	3	1	1	-	1	1	**4**
2Dn(Te) / D3	3	1	2	4	1	-	2	1	1	-	1	1	**4**
3Bl(Te) / D5	1	4	1	3	1	-	2	1	1	-	1	1	**4**
4Bl(Te) / D6	4	3	3	3	1	-	2	1	1	-	1	1	**4**
5Dn(Ro) / D7	3	4	3	3	1	-	3	1	1	-	1	1	**4**
6Bl(Pg) / D12m/d	2	3	3	5	1	1	3	1	1	-	1	1	**5**
7Bl(Pg) / d14m/d	2	1	3	5	1	1	2	1	1	-	1	1	**5**
8Dn(Te) / D19	3	3	3	4	1	-	3	1	1	-	1	1	**4**
9Dn(Ro) / D21	2	3	3	4	1	-	3	1	1	-	1	1	**4**
10Ct(Ro) / D22	2	3	3	4	1	-	3	1	1	4	1	2	**4**
11Bl(Ta) / D24	3	3	2	3	1	-	2	1	1	-	2	1	**3**
12Da(Te) / D32	3	3	1	2	1	-	2	1	2	-	1	1	**3**
13Bl(Ta) / D36	3	4	1	3	1	-	3	1	1	-	1	1	**4**
14Bl(Ro) / D37	2	4	3	2	1	-	3	1	1	-	1	1	**4**
15Bl(Ro) / D39	2	4	3	3	1	-	2	1	1	-	1	1	**4**
16Bl(Ta) / D43	4	3	2	3	1	-	2	1	1	-	2	1	**4**
17Bl(Ro) / D44	2	4	3	3	1	-	2	1	1	-	1	1	**4**
18Bl(Ro) / D45	2	3	3	3	1	-	2	1	1	-	1	1	**3**
19Bl(Ro) / D52	3	4	3	3	1	-	2	1	1	-	1	1	**4**
20Bl(Ro) / D58	3	4	3	3	1	-	3	1	1	-	1	1	**4**
21Bl(Ta) / D59	5	4	2	1	1	-	2	1	2	-	2	1	**5**
22Bl(Wy) / D65	4	3	1	1	1	-	2	1	1	-	1	1	**3**

Appendix J Regional Frameworks UMA Assessments

Table AppL-1: Land Suitability Classes, Limitation and Crop Land Assessment UMAs distinct from SPCs

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
1	1Dn(Te)	D1 (Analysed Site)[1]	1	-		
2	2Dn(Te)	D55	1	No limitation amendments to SPC UMA		
3	2Dn(Te)	D3 (Analysed Site)	1	-		
4	2Dn(Te)	B15 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
5	2Dn(Te)	B11 (SLR, 2023), C38, C39	2	Incipient gilgai reported, none present in photo or satellite imagery review. Soil profile indicates weathered substrate at 0.85 mbgl. PAWC would likely be impacted, which would reduce it slightly. The amount cannot be accurately assessed, however it is based on site D3 PAWC at 0.90 mbgl (SALFPredict, 2025), the PAWC would be below 75 mm/100cm C38 indicated soil profile depth of 0.80 mbgl C39 indicated soil profile depth of 0.80 mbgl Limitation Amendments to SPC UMA		
				Soil water availability updated in Table AppL-2	No limitation amendments to UMA	ALC updated in Table AppL-3
6	2Dn(Te)	B04 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
7	2Dn(Te)	B03 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. Soil profile indicates weathered substrate at 0.40 mbgl. PAWC would likely be impacted, which would reduce it slightly. The amount cannot be accurately assessed, however it is based on site D3 PAWC at 0.40 mbgl (SALFPredict, 2025), the PAWC would be 46 mm/100cm		
				Soil water availability updated in Table AppL-4	Water availability limitation updated in Table AppL-5	ALC updated in Table AppL-6
8	2Dn(Te)	SLR Site B27	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
9	3Bl(Te)	D5 (Analysed site)	1	-		
10	4Bl(Te)	D20	1	No limitation amendments to SPC UMA		
11	4Bl(Te)	D6 (Analysed site)	1	-		
12	8Dn(Te)	C18	1	Soil profile indicates weathered substrate at 0.85 mbgl. PAWC would likely be impacted, which would reduce it slightly. The amount cannot be accurately assessed, however it is based on site D19 PAWC at 0.50 mbgl (SALFPredict, 2025), the PAWC would be below 66.7 mm/100cm		
				Soil water availability updated as Table AppL-7	Limitation assessed in Table AppL-8, no change	ALC updated in Table AppL-9
13	5Dn(Ro)	D42	1	Soil profile indicates weathered substrate at 0.85 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D7 PAWC at 0.85 mbgl (SALFPredict, 2025), the PAWC		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
				would be above 97 mm/100cm, calculated at 0.70 mbgl. It is assumed that the PAWC would be above 100 mm100cm and has been assessed as this.		
				Soil water availability assessed in Table AppL-10, no change	Water availability limitation assessed in Table AppL-11, no change	No updates for cropping or beef cattle grazing, therefore no update to ALC
14	5Dn(Ro)	D7 (Analysed Site)	1	-		
15	17Bl(Ro)	D26	1	Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-12, no change	-	No updates for cropping therefore no update to ALC
16	5Dn(Ro)	D50	1	Soil profile indicates weathered substrate at 0.95 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D7 PAWC at 0.85 mbgl (SALFPredict, 2025), the PAWC would be above 97 mm/100cm, calculated at 0.70 mbgl. It is assumed that the PAWC would be above 100 mm100cm and has been assessed as this.		
				Soil water availability assessed in Table App-10, no change	Water availability limitation assessed in Table AppL-11, no change	No updates for cropping or beef cattle grazing, therefore no update to ALC
17	5Dn(Ro)	D33	1	Soil profile indicates weathered substrate at 0.90 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D7 PAWC at 0.85 mbgl (SALFPredict, 2025), the PAWC would be above 97 mm/100cm, calculated at 0.70 mbgl. It is assumed that the PAWC would be above 100 mm100cm and has been assessed as this.		
				Soil water availability assessed in Table App-10, no change	Water availability limitation assessed in Table AppL-11, no change	No updates for cropping or beef cattle grazing, therefore no update to ALC
18	6Bl(Pg)	D12m/d (Analysed Site)	1	-		
19	6Bl(Pg)	D9m/d	1	Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-10, no change	-	No updates for cropping therefore no update to ALC
20	6Bl(Pg)	C28	1	Boundary of UMA, no assessment undertaken		
21	6Bl(Pg)	C26	1	No limitation amendments to SPC UMA		
22	6Bl(Pg)	C3	1	No limitation amendments to SPC UMA		
23	6Bl(Pg)	C5	1	No limitation amendments to SPC UMA		
24	7Bl(Pg)	C18	2	Boundary of UMA, no assessment undertaken		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
25	7Bl(Pg)	D14m/d (Analysed site)	1	-		
26	7Bl(Pg)	D15	1	No limitation amendments to SPC UMA		
27	7Bl(Pg)	-	5	No limitation amendments to SPC UMA		
28	7Bl(Pg)	C22	1	Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-14, no change	-	No updates for cropping therefore no update to ALC
29	8Dn(Te)	C35	1	Site has no recovery of soil at 0.50 m not refusal. Based on the assessment of the field site, this isn't an indicator of refusal therefore no amendment to soil profile or PAWC will be undertaken. No limitation amendments to SPC UMA		
30	8Dn(Te)	D19 (Analysed site)	1	-		
31	8Dn(Te)	D34	1	No limitation amendments to SPC UMA		
32	16Bl(Ta)	C24	1	No limitation amendments to SPC UMA		
33	9Dn(Ro)	D21 (Analysed site)	1	-		
34	9Dn(Ro)	D28	1	No limitation amendments to SPC UMA		
35	14Bl(Ro)	D37 (Analysed site)	1	-		
36	9Dn(Ro)	B33, B34 (SLR, 2023)	2	Incipient / crabhole gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
37	9Dn(Ro)	B19, B23 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
38	9Dn(Ro)	B16 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
39	9Dn(Ro)	B14 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
40	9Dn(Ro)	B13 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
41	9Dn(Ro)	B13 (SLR, 2023)	2	Incipient linear gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
42	9Dn(Ro)	B29, B30 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review.		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
				Slope at Site B30 indicates 3%, but on review this is likely a simple, short slope within the drainage line. GTE has assessed this as not representative of the UMA as a whole, and therefore will not be assessed. No limitation amendments to SPC UMA		
43	10Ct(Ro)	D27	1	No limitation amendments to SPC UMA		
44	10Ct(Ro)	D21 (Analysed site), D22, D23, D30, D47, D48, D53, D60	1	No limitation amendments to SPC UMA		
45	10Ct(Ro)	D25, D31	1	No limitation amendments to SPC UMA		
46	10Ct(Ro)	D16	1	No limitation amendments to SPC UMA		
47	10Ct(Ro)	D17	1	No limitation amendments to SPC UMA		
48	10Ct(Ro)	D54, C69	1	Site c69 indicates one single gilgai in the area. As no other gilgai were observed, this was considered sub-dominant of the UMA and unmappable. No limitation amendments to SPC UMA		
49	11Bl(Ta)	C22	1	Site has no recovery of soil at 0.60 m not refusal. Based on the assessment of the field site, this isn't an indicator of refusal therefore no amendment to soil profile or PAWC will be undertaken. No limitation amendments to SPC UMA.		
50	11Bl(Ta)	C34	1	Soil profile indicates weathered substrate at 0.68 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D24 PAWC at 0.80 mbgl (SALFPredict, 2025), the PAWC would be 72.6 mm/100cm, calculated at 0.70 mbgl.		
				Soil water availability assessed in Table App-15	Water availability limitation assessed in Table AppL-16	ALC updated in Table AppL-17
51	11Bl(Ta)	C34	1	Soil profile indicates weathered substrate at 0.45 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D24 PAWC at 0.80 mbgl (SALFPredict, 2025), the PAWC would be 55.26 mm/100cm, calculated at 0.50 mbgl.		
				Soil water availability assessed in Table App-15	Water availability limitation assessed in Table AppL-16	ALC updated in Table AppL-17
52	11Bl(Ta)	D24 (Analysed site)	1	-		
53	11Bl(Ta)	C23	1	Soil profile indicates weathered substrate at 0.80 mbgl. PAWC would not be impacted. The PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		
54	11Bl(Ta)	C37	1	Soil profile indicates weathered substrate at 0.80 mbgl. PAWC would not be impacted. The PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
55	11Bl(Ta)	C57	2	Profile of the soil exposure presents weathered substrate. A ruler measurement is within the photo, however notes indicate approximately 0.80 of soil from surface to the weathered substrate. Soil profile indicates weathered substrate at 0.80 mbgl. PAWC would not be impacted. The PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		
56	11Bl(Ta)	C6	1	Soil profile indicates weathered substrate at 0.80 mbgl. PAWC would not be impacted. The PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		
57	12Da(Te)	D32 (Analysed site)	1	-		
58	12Da(Te)	C30	1	No limitation amendments to SPC UMA		
59	13Bl(Ta)	C4	1	No limitation amendments to SPC UMA		
60	13Bl(Ta)	C14	1	No limitation amendments to SPC UMA		
61	13Bl(Ta)	D36 (Analysed site)	1	-		
62	15Bl(Ro)	C9	1	No limitation amendments to SPC UMA		
63	15Bl(Ro)	D10, D11, D61, D66, C10, C13	1	Soil profile for site D11 indicates weathered substrate at 0.90 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D36 PAWC at 1.00 mbgl (SALFPredict, 2025), the PAWC would be 94.10 mm/100cm, calculated at 0.90 mbgl. Based on the review of the entire UMA and overall depths of the key sites, both Class I and IV(a), it is assessed that this depth is an anomaly. It is assessed the overall UMA falls within existing cropping and beef cattle grazing PAWC, No limitation amendments to SPC UMA		
64	15Bl(Ro)	D8, D13	1	No limitation amendments to SPC UMA		
65	15Bl(Ro)	D39	1	No limitation amendments to SPC UMA		
66	15Bl(Ro)	D2	1	No limitation amendments to SPC UMA		
67	16Bl(Ta)	D43 (Analysed site)	1	-		
68	16Bl(Ta)	C28	1	Soil profile indicates weathered substrate at 0.60 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed, however it is based on site D43 PAWC at 0.40 mbgl (SALFPredict, 2025), the PAWC would be above 60.3 mm/100cm, calculated at 0.40 mbgl. It is assumed that the PAWC would be above 60 and below 75 mm/100cm and has been assessed as this. The assumed PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		
69	16Bl(Ta)-	C27	1	Soil profile indicates weathered substrate at 0.50 mbgl. PAWC would likely be impacted, which would increase. The amount cannot be accurately assessed,		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
				however it is based on site D43 PAWC at 0.40 mbgl (SALFPredict, 2025), the PAWC would be above 60.3 mm/100cm, calculated at 0.40 mbgl. It is assumed that the PAWC would be above 60 and below 75 mm/100cm and has been assessed as this. The assumed PAWC falls within existing cropping and beef cattle grazing PAWC. No limitation amendments to SPC UMA		
70	17Bl(Ro)	D41	1	No limitation amendments to SPC UMA		
71	17Bl(Ro)	D29	1	Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-18, no change	-	No updates for cropping, therefore no update to ALC
72	17Bl(Ro)	C33, D38, D46 B07 (SLR, 2023)	1	Incipient gilgai reported, none present in photo or satellite imagery review. Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-18, no change	-	No updates for cropping, therefore no update to ALC
73	17Bl(Ro)	D44 (Analysed site), B01 (SLR, 2023)	1	-		
74	18Bl(Ro)	D45 (Analysed site)	1	-		
75	19Bl(Ro)	D49, D52 (Analysed site)	1	-		
76	19Bl(Ro)	B22 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. Slope is reported as 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-19, no change	-	No updates for cropping, therefore no update to ALC
77	19Bl(Ro)	D18	1	Slope is reported as 2.0 / 2.0 %. This impacts the water erosion and erosion hazard for cropping.		
				Soil water availability assessed in Table AppL-19, no change	-	No updates for cropping, therefore no update to ALC
78	19Bl(Ro)	D62, D63, D64, B35 (SLR, 2023)	1	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		
79	19Bl(Ro)	C11, C12	1	No limitation amendments to SPC UMA		
80	19Bl(Ro)	B18 (SLR, 2023)	2	Incipient gilgai reported, none present in photo or satellite imagery review. No limitation amendments to SPC UMA		

UMA	SPC	Key Site/s Reviewed	UMA Confidence Code	Cropping Land Use Limitations and Assessment	Beef Cattle Grazing Land Use Limitations and Assessment	Agricultural Land Use Classification Land Use Limitations and Assessment
81	20Bl(Ro)	D58 (Analysed site)	1	-		
82	21Bl(Ta)	D59 (Analysed site) B21 (SLR, 2023)	1	-		
83	22Bl(Wy)	D65 (Analysed site)	1	-		

1- Analysed sites are already assessed, as per Appendix X and X, therefore no further assessment is required for the UMA it occupies.

Table AppL-2: UMA 5 Re-assessment for 2Dn(Te)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppL-3: UMA 5 Re-assessment for 2Dn(Te)

ALC	UMA
C2	UMA 5

Table AppL-4: UMA 7 Re-assessment for 2Dn(Te)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Soil Water Availability (M)	6	5	5	5	5	5	5	5	5	5	5	5	5	5
Overall Suitability Class		5	5	5	5	5	5	5	5	5	5	5	5	5

Table AppL-5: UMA 7 Re-assessment for 2Dn(Te)

Water Availability[1]	Nutrient Def	Physical Factors	Salinity[2]	Rockiness	Gilgai	pH	ESP	Wetness	Topography	Water erosion	Flooding	Beef Cattle Grazing Class
5	-	-	-	-	-	-	-	-	-	-	-	**5**

Table AppL-6: UMA 7 Re-assessment for SPC 2

ALC	SPC
C3	SPC 2

Table AppL-7: UMA 12 Re-assessment for 8Dn(Te)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Overall Suitability Class		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppL-8: UMA 12 Re-assessment for 8Dn(Te)

Water Availability	Nutrient Def	Physical Factors	Salinity[2]	Rockiness	Gilgai	pH	ESP	Wetness	Topography	Water erosion	Flooding	Beef Cattle Grazing Class
4	-	-	-	-	-	-	-	-	-	-	-	**4**

Table AppL-9: UMA 12 Re-assessment for 8Dn(Te)

ALC	SPC
C2	SPC 8

Table AppL-10: UMAs 13, 16, 17 Re-assessment for 5Dn(Ro)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Soil Water Availability (M)	3	4	4	3	3	4	3	4	3	3	3	3	4	4
Overall Suitability Class[1]		4	4	4	4	4	4	4	4	4	4	4	4	4

1- Wetness limitation indicates higher overall suitability class

Table AppL-11: UMAs 13, 16, 17 Re-assessment for 5Dn(Ro)

Water Availability[1]	Nutrient Def	Physical Factors	Salinity[2]	Rockiness	Gilgai	pH	ESP	Wetness	Topography	Water erosion	Flooding	Beef Cattle Grazing Class
2	4	4	3	3	1	-	3	1	1	-	1	**4**

Table AppL-12: UMA 15 Re-assessment for 17Bl(Ro)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class[1]		4	4	3	3	4	3	4	3	3	3	3	4	4

1- Soil water availability limitation indicates higher overall suitability class

Table AppL-13: UMA 19 Re-assessment for 6Bl(Pg)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class[1]		4	4	4	4	4	4	4	4	4	4	4	4	4

1- Wetness limitation indicates higher overall suitability class

Table AppL-14: UMA 28 Re-assessment for 7Bl(Pg)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class[1]		4	4	4	4	4	4	4	4	4	4	4	4	4

1- Wetness limitation indicates higher overall suitability class

Table AppL-15: UMA 50, 51 Re-assessment for 11Bl(Ta)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Soil Water Availability (M)	5	5	5	4	5	5	5	5	5	5	5	5	5	5
Overall Suitability Class[1]		5	5	4	5	5	5	5	5	5	5	5	5	5

Table AppL-16: UMA 50, 51 Re-assessment for 11Bl(Ta)

Water Availability[1]	Nutrient Def	Physical Factors	Salinity[2]	Rockiness	Gilgai	pH	ESP	Wetness	Topography	Water erosion	Flooding	Beef Cattle Grazing Class
4	3	2	3	1	-	2	1	1	-	2	1	**4**

Table AppL-17: UMA 50, 51 Re-assessment for 11Bl(Ta)

ALC	UMA
C2	50, 51

Table AppL-18: UMAs 71, 72 Re-assessment for 17Bl(Ro)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class[1]		4	4	3	3	4	3	4	3	3	3	3	4	4

1- Soil water availability limitation indicates higher overall suitability class

Table AppL-19: UMAs 76, 77 Re-assessment for 19Bl(Ro)

Limitation Categories	Limitation Value	Suitability subclasses for different land uses												
		Barley	Chickpea	Cotton	Maize	Millet	Mung bean	Oat	Safflower	Sorghum	Soybean	Sunflower	Triticale	Wheat
Water Erosion (E)	31	2	2	2	2	2	2	2	2	2	2	2	2	2
Erosion Hazard (Es)	32	3	3	3	3	3	3	3	3	3	3	3	3	3
Overall Suitability Class[1]		5	5	4	4	5	4	5	4	4	4	4	5	5

1- Soil water availability and wetness limitations indicates higher overall suitability class

Appendix K Crop Land Use Yield Assessments

Table AppM-1: Summary of Crop Land Use Assessment against Plant Salt-Tolerance Data (DERM, 2011)

SPC	Sample ID:	Electrical Conductivity (dS/m)	ECse (dS/m) (SALFPREDICT)	Root Depth Observed (m) - Class III Site	Crops	Barley	Cotton	Maize	Oat	Safflower	Sorghum	Soybean	Sunflower	Wheat
					90% Yield (Ecse, dS/m)	10	9.6	2.5	5.5	-	7.4	5.5	5.9	7.4
					75% Yield (Ecse, dS/m)	13	12.5	3.8	6.3	-	8.4	6.3	6.5	9.5
					50% Yield (Ecse, dS/m)	18	17.3	5.9	7.5	-	9.9	7.5	7.5	13
1Dn(Te)	D1-0.00-0.10	0.17	1.0	0.40				90% Yield		-				
	D1-0.20-0.30	0.67	5.5						90% Yield	-		90% Yield		
	D1-0.50-0.60	0.71	6.5			90% Yield	90% Yield	75% Yield		-	90% Yield	75% Yield	90% Yield	90% Yield
2Dn(Te)	D3-0.00-0.10	0.04	0.7	1.00m						-				
	D3-0.20-0.30	0.09	1.4							-				
	D3-0.50-0.60	1.42	3.0					90% Yield		-				
	D3-0.70-0.80	2.71	3.5							-				
	D3-0.90-1.00	3.11	3.4			90% Yield	90% Yield		90% Yield	-	90% Yield	90% Yield	90% Yield	90% Yield
3Bl(Te)	D5-0.00-0.10	0.13	1.1	1.80m						-				
	D5-0.20-0.30	0.35	2.5							-				
	D5-0.50-0.60	0.46	2.8							-				
	D5-0.80-0.90	1.00	2.8							-				
	D5-1.00-1.10	0.97	8.1							-		50% Yield	50% Yield	90% Yield
	D5-1.40-1.50	1.00	7.9							-				
	D5-1.70-1.80	0.88	8.7			90% Yield	90% Yield	90% Yield	90% Yield	-	90% Yield			
4Bl(Te)	D6-0.00-0.10	0.07	0.6	1.00m						-				
	D6-0.20-0.30	0.39	2.7					90% Yield		-				
	D6-0.50-0.60	0.51	3.8					75% Yield		-				
	D6-0.80-0.90	0.91	7.8					50% Yield	50% Yield	-	90% Yield	50% Yield	50% Yield	90% Yield
	D6-1.00-1.10	0.91	8.1			90% Yield	90% Yield			-				
5Dn(Ro)	D7-0.00-0.10	0.16	0.8	0.60										
	D7-0.20-0.30	0.23	1.2											
	D7-0.50-0.60	0.58	4.7			90% Yield	90% Yield	75% Yield	90% Yield	-	90% Yield	75% Yield	90% Yield	90% Yield
6Bl(Pg)	D12m-0.00-0.10	0.33	2.6	1.80				90% Yield	50% Yield	-	90% Yield	90% Yield	90% Yield	90% Yield
	D12m-0.20-0.30	1.10	9.5					50% Yield		-	75% Yield	50% Yield	50% Yield	50% Yield
	D12m-0.50-0.60	1.50	11.5			90% Yield	90% Yield			-	50% Yield			
	D12m-0.80-0.90	2.00	15.2			75% Yield	75% Yield			-				
	D12m-1.10-1.20	2.10	19.0			50% Yield	50% Yield			-				
	D12m-1.40-1.50	1.90	17.1							-				
	D12m-1.70-1.80	2.30	19.9							-				
7Bl(Pg)	D14m-0.00-0.10	0.13	1.1	1.80						-				
	D14m-0.20-0.30	0.62	5.6					75% Yield	90% Yield	-	90% Yield	90% Yield	90% Yield	
	D14m-0.50-0.60	0.49	4.9							-				
	D14m-0.80-0.90	1.90	16.4			75% Yield	75% Yield	50% Yield	50% Yield	-	50% Yield	50% Yield	50% Yield	50% Yield
	D14m-1.10-1.20	1.90	15.4							-				
	D14m-1.40-1.50	1.90	15.4							-				
	D14m-1.70-1.80	2.10	17.5				50% Yield			-				
8Dn(Te)	D19-0.00-0.05	0.10	0.5	0.90						-				
	D19-0.20-0.30	0.15	0.7							-				
	D19-0.40-0.50	0.21	1.7							-				
	D19-0.50-0.60	0.76	6.9					50% Yield	75% Yield	-		75% Yield	75% Yield	
	D19-0.80-0.90	0.38	3.5			90% Yield	90% Yield			-	90% Yield			90% Yield
9Dn(Ro)	D21-0.00-0.10	0.11	-	1.80						-				
	D21-0.20-0.30	0.80	6.5					50% Yield	75% Yield	-		75% Yield	75% Yield	
	D21-0.50-0.60	1.20	10.4			90% Yield	90% Yield			-	50% Yield	50% Yield	50% Yield	75% Yield
	D21-0.80-0.90	1.10	8.5							-				
	D21-1.10-1.20	1.30	11.6							-				
	D21-1.40-1.50	1.10	9.3							-				
	D21-1.70-1.80	0.83	7.6							-				
10Ct(Ro)	D22-0.00-0.10	0.16	1.1	1.80						-				
	D22-0.20-0.30	0.26	1.1							-				
	D22-0.50-0.60	0.80	5.8					75% Yield	90% Yield	-		90% Yield		
	D22-0.80-0.90	1.06	7.6					50% Yield	75% Yield	-	90% Yield	50% Yield	50% Yield	90% Yield
	D22-1.00-1.10	0.92	9.3						50% Yield	-	75% Yield			
	D22-1.30-1.40	0.95	9.1							-				
	D22-1.60-1.70	0.92	8.9							-				

11Bl(Ta)	D24-0.00-0.10	0.06	0.5	0.90						-					
	D24-0.20-0.30	0.68	5.8					75% Yield	90% Yield	-		90% Yield			
	D24-0.50-0.60	0.68	6.1					50% Yield	75% Yield	-			90% Yield		
	D24-0.80-0.90	0.54	4.6							-					
12Da(Te)	D32-0.00-0.10	0.05	0.3	1.80						-					
	D32-0.20-0.30	0.04	0.6							-					
	D32-0.50-0.60	0.13	1.5							-					
	D32-0.80-0.90	0.50	4.0					75% Yield		-					
	D32-1.10-1.20	0.71	5.2							-					
	D32-1.40-1.50	0.89	6.5					50% Yield	90% Yield	-		90% Yield	90% Yield		
	D32-1.70-1.80	1.10	8.1						50% Yield	-	90% Yield	50% Yield	50% Yield	90% Yield	
13Bl(Ta)	D36-0.00-0.10	0.07	0.3	1.80						-					
	D36-0.20-0.30	0.20	1.0							-					
	D36-0.50-0.60	0.41	3.1					90% Yield		-					
	D36-0.80-0.90	0.56	4.9					75% Yield		-					
	D36-1.10-1.20	0.53	4.8							-					
	D36-1.40-1.50	0.49	4.7							-					
	D36-1.70-1.80	0.29	3.5							-					
14Bl(Ro)	D37-0.00-0.10	0.13	0.6	1.80						-					
	D37-0.20-0.30	0.16	1.8							-					
	D37-0.50-0.60	0.30	2.0							-					
	D37-0.80-0.90	0.69	5.1					75% Yield		-					
	D37-1.10-1.20	1.00	9.5						50% Yield	-	75% Yield	50% Yield	50% Yield	75% Yield	
	D37-1.40-1.50	0.81	6.9							-					
	D37-1.70-1.80	0.81	7.0							-					
15Bl(Ro)	D39-0.00-0.10	0.07	0.4	1.80						-					
	D39-0.20-0.30	0.20	1.1							-					
	D39-0.50-0.60	0.36	2.8					90% Yield		-					
	D39-0.80-0.90	0.86	6.9					50% Yield	75% Yield	-		75% Yield	75% Yield		
	D39-1.10-1.20	0.78	6.3							-					
16Bl(Ta)	D43-0.00-0.10	0.09	1.0	1.80						-					
	D43-0.10-0.20	0.22	1.8							-					
	D43-0.20-0.30	0.32	2.4							-					
17Bl(Ro)	D44-0.00-0.10	0.15	0.8	1.80						-					
	D44-0.10-0.20	0.13	-							-					
	D44-0.20-0.30	0.40	1.0							-					
	D44-0.50-0.60	0.61	2.9					90% Yield		-					
	D44-0.80-0.90		2.9							-					
	D44-1.10-1.20	0.68	5.2					75% Yield		-					
18Bl(Ro)	D45-0.00-0.10	0.09	0.7	1.80						-					
	D45-0.20-0.30	0.08	0.4							-					
	D45-0.50-0.60	0.31	2.3												
	D45-0.80-0.90	0.58	4.9					75% Yield		-					
	D45-1.10-1.20	0.57	4.8							-					
	D45-1.40-1.50	0.54	4.7							-					
	D45-1.70-1.80	0.47	4.0							-					
19Bl(Ro)	D52-0.00-0.10	0.04	0.2	1.80						-					
	D52-0.20-0.30	0.05	0.6							-					
	D52-0.50-0.60	0.45	3.8					75% Yield							
	D52-0.80-0.90	0.69	6.7					50% Yield	75% Yield	-		75% Yield	75% Yield		
	D52-1.10-1.20	0.85	7.2							-					
	D52-1.40-1.50	0.80	8.1						50% Yield	-	90% Yield	50% Yield	50% Yield	90% Yield	
	D52-1.70-1.80	0.74	7.0							-					
20Bl(Ro)	D58-0.00-0.10	0.10	0.5	0.80						-					
	D58-0.20-0.30	0.22	1.5							-					
	D58-0.50-0.60	0.56	4.5					75% Yield		-					
	D58-0.70-0.80	0.58	4.9							-					
21Bl(Ta)	D59-0.00-0.10	0.07	-	1.80						-					
	D59-0.20-0.30	0.05	0.2							-					
	D59-0.50-0.60	0.13	0.9							-					
	D59-0.80-0.90	0.73	3.0					90% Yield		-					
	D59-1.10-1.20	0.48	4.3					75% Yield	75% Yield	-		75% Yield	75% Yield		
	D59-1.40-1.50	0.69	6.5					50% Yield		-					
	D59-1.70-1.80	0.55	5.1							-					
22Bl(Wy)	D65-0.00-0.05	0.06	0.4	1.00						-					
	D65-0.10-0.20	0.06	-							-					
	D65-0.20-0.30	0.05	0.4							-					
	D65-0.50-0.60	0.13	1.2							-					
	D65-0.80-0.90	0.32	3.1					90% Yield		-					

Appendix L Laboratory Certificates

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Eurofins APAL Test Method Codes												
Crop	Actual Crop	SubmissionID	SamplingDate	DateReceived	BatchID	Batch Position No.	AgentName	ClientName	SampleName	Barcode	SampleDepth	Postcode
		147219		2025-11-20	46601	36	GT Environmental - Reece McCann	BWN	D3-0.00-0.10	111981004	0-0.1	4120
		147219		2025-11-20	46601	25	GT Environmental - Reece McCann	BWN	D3-0.20-0.30	111981005	0.2-0.3	4120
		147219		2025-11-20	46601	40	GT Environmental - Reece McCann	BWN	D3-0.50-0.60	111981006	0.5-0.6	4120
		147219		2025-11-20	46601	31	GT Environmental - Reece McCann	BWN	D3-0.70-0.80	111981007	0.7-0.8	4120
		147219		2025-11-20	46601	43	GT Environmental - Reece McCann	BWN	D3-0.90-1.00	111981008	0.9-1	4120
		147219		2025-11-20	46601	6	GT Environmental - Reece McCann	BWN	D22-0.00-0.10	111981064	0-0.1	4120
		147219		2025-11-20	46601	11	GT Environmental - Reece McCann	BWN	D22-0.20-0.30	111981065	0.2-0.3	4120
		147219		2025-11-20	46601	20	GT Environmental - Reece McCann	BWN	D22-0.50-0.60	111981066	0.5-0.6	4120
		147219		2025-11-20	46601	19	GT Environmental - Reece McCann	BWN	D22-0.80-0.90	111981067	0.8-0.9	4120
		147219		2025-11-20	46601	12	GT Environmental - Reece McCann	BWN	D32-0.00-0.10	111981075	0-0.1	4120
		147219		2025-11-20	46601	14	GT Environmental - Reece McCann	BWN	D32-0.20-0.30	111981076	0.2-0.3	4120
		147219		2025-11-20	46603	34	GT Environmental - Reece McCann	BWN	D32-0.50-0.60	111981077	0.5-0.6	4120
		147219		2025-11-20	46604	47	GT Environmental - Reece McCann	BWN	D32-0.80-0.90	111981078	0.8-0.9	4120
		147219		2025-11-20	46603	24	GT Environmental - Reece McCann	BWN	D37-0.00-0.10	111981089	0-0.1	4120
		147219		2025-11-20	46603	5	GT Environmental - Reece McCann	BWN	D37-0.20-0.30	111981090	0.2-0.3	4120
		147219		2025-11-20	46603	16	GT Environmental - Reece McCann	BWN	D37-0.50-0.60	111981091	0.5-0.6	4120
		147219		2025-11-20	46603	45	GT Environmental - Reece McCann	BWN	D37-0.80-0.90	111981092	0.8-0.9	4120
		147219		2025-11-20	46604	23	GT Environmental - Reece McCann	BWN	D44-0.00-0.10	111980904	0-0.1	4120
		147219		2025-11-20	46604	13	GT Environmental - Reece McCann	BWN	D44-0.10-0.20	111980905	0.1-0.2	4120
		147219		2025-11-20	46604	20	GT Environmental - Reece McCann	BWN	D44-0.20-0.30	111980906	0.2-0.3	4120
		147219		2025-11-20	46604	4	GT Environmental - Reece McCann	BWN	D44-0.50-0.60	111980907	0.5-0.6	4120
		147219		2025-11-20	46604	1	GT Environmental - Reece McCann	BWN	D44-0.80-0.90	111980908	0.8-0.9	4120
		147219		2025-11-20	46604	50	GT Environmental - Reece McCann	BWN	D59-0.00-0.10	111980929	0-0.1	4120
		147219		2025-11-20	46603	41	GT Environmental - Reece McCann	BWN	D59-0.20-0.30	111980930	0.2-0.3	4120
		147219		2025-11-20	46603	29	GT Environmental - Reece McCann	BWN	D59-0.50-0.60	111980931	0.5-0.6	4120
		147219		2025-11-20	46604	49	GT Environmental - Reece McCann	BWN	D59-0.80-0.90	111980932	0.8-0.9	4120

NOTE 1: Walkley and Black Organic Carbon % (40°C) data presented in this test report have been obtained by a combination of laboratory wet chemistry and the equivalent modelled result from Mid-Infrared Diffuse Reflectance Spectroscopy and Partial Least Squares Regression (PLSR) analysis. An explanatory

		TMs-006A	TMs-007NO3	TMs-007NH4	TMs-009B	TMs-009I2	TMs-018	TMs-010D	TMs-015G	TMs-015G
Transect GPS Start	Transect GPS Finish	Organic Carbon (W&B)	Nitrate - N (2M KCl)	Ammonium - N (2M KCl)	Colwell Phosphorus	PBI + Col P	Colwell Potassium	KCl Sulfur (S)	Exchangeable acidity	Exchangeable aluminium
		% (40°C)	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	cmol/kg	cmol/kg
N/A	N/A	3.85	3.8	4.1	18	67	1800	11	<0.02	<0.02
N/A	N/A	1.5	47	<1.0	5.5	94	1100	37	<0.02	<0.02
N/A	N/A									
N/A	N/A									
N/A	N/A									
N/A	N/A	1.33	<1.0	1.2	7.9	101	310	8.4	<0.02	<0.02
N/A	N/A	1.25	<1.0	1.1	<5.0	118	150	5.6	<0.02	<0.02
N/A	N/A									
N/A	N/A									
N/A	N/A	1.38	<1.0	5.4	8.2	38	170	5.4	<0.02	<0.02
N/A	N/A	0.55	<1.0	<1.0	6.2	53	220	13	<0.02	<0.02
N/A	N/A									
N/A	N/A									
N/A	N/A	1.31	<1.0	2.1	<5.0	119	120	4	<0.02	<0.02
N/A	N/A	1.22	<1.0	1.3	<5.0	112	110	6.8	<0.02	<0.02
N/A	N/A									
N/A	N/A									
N/A	N/A	1.89	3.7	1.6	<5.0	60	310	5.4	<0.02	<0.02
N/A	N/A	1.35	<1.0	1.2	<5.0	74	86	3.7	<0.02	<0.02
N/A	N/A									
N/A	N/A									
N/A	N/A									
N/A	N/A	0.35	<1.0	<1.0	<5.0	21	130	<2.5	<0.02	<0.02
N/A	N/A									
N/A	N/A	0.22	<1.0	<1.0	<5.0	73	180	4.8	<0.02	<0.02
N/A	N/A									

y technical note is available upon request. The exception is for quoted work that specifically required laboratory wet chemistry.

TMs-015G	TMs-028	TMs-005	TMs-012C	TMs-012A	TMs-012A	TMs-012A	TMs-012A	TMs-031	TMs-007	TMs-002A1	TMs-002A1
Exchangeable hydrogen	CaCl2 extr. Aluminium	Chloride	Boron	Iron (Fe)	Manganese (Mn)	Copper (Cu)	Zinc (Zn)	Oxalate ext. Molybdenum	Dumas Total Nitrogen	% Air-dry Moisture Content	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)
cmol/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	% dry wt	% of dry wt	g/g
<0.02	<0.1	41	2.7	8.1	11	0.9	1.1	0.59	0.38	2.9	0.0286
<0.02		380							0.14	3.5	0.0351
		1100									
		1200									
		740									
<0.02	<0.1	100	1.3	14	12	1.5	0.4	1.2	0.13	3.5	0.0345
<0.02		29							0.12	3.6	0.0361
		1500									
		1600									
<0.02	<0.1	6	0.57	12	19	0.79	0.56	0.47	0.11	1.2	0.0117
<0.02		67							0.05	1.9	0.0192
		300									
		760									
<0.02	<0.1	14	0.9	15	6.8	1.2	0.12	1.3	0.15	3.3	0.0332
<0.02		340							0.1	3.7	0.0365
		580									
		1500									
<0.02	<0.1	21	0.56	18	34	1.2	0.78	0.62	0.16	1.8	0.0183
<0.02		15							0.11	2.2	0.0215
		120									
		630									
		830									
<0.02	<0.1	<5	0.26	4.3	4.7	0.47	<0.08	<0.25	0.035	0.3	0.0032
		5									
<0.02		51							0.05	1.7	0.0169
		170									

SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D3-0.00-0.10
Barcode:	111981004	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		3.85						
	Dumas Total Nitrogen	% dry wt		0.38						
Other tests	% Air-dry Moisture Content	% of dry wt		2.9						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0286						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		3.8						
	Ammonium - N (2M KCl)	mg/kg		4.1						
	Colwell Phosphorus	mg/kg		18						
	PBI + Col P			67						
	Colwell Potassium	mg/kg		1800						
	KCl Sulfur (S)	mg/kg		11						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		2.7						
	Iron (Fe)	mg/kg		8.1						
	Manganese (Mn)	mg/kg		11						
	Copper (Cu)	mg/kg		0.90						
	Zinc (Zn)	mg/kg		1.1						
	Oxalate ext. Molybdenum	mg/kg		0.59						
Salt	Chloride	mg/kg		41						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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NOTE[2]: Walkley and Black Organic Carbon % (40°C) data presented in this test report have been obtained by a combination of laboratory wet chemistry and the equivalent modelled result from Mid-Infrared Diffuse Reflectance Spectroscopy and Partial Least Squares Regression (PLSR) analysis. An explanatory technical note is available upon request. The exception is for quoted work that specifically required laboratory wet chemistry.

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D3-0.20-0.30
Barcode:	111981005	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.2-0.3
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.50						
	Dumas Total Nitrogen	% dry wt		0.14						
Other tests	% Air-dry Moisture Content	% of dry wt		3.5						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0351						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		47						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		5.5						
Extractable N-P-K-S	PBI + Col P			94						
Extractable N-P-K-S	Colwell Potassium	mg/kg		1100						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		37						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		380						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D3-0.50-0.60
Barcode:	111981006	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.5-0.6
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		1100						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D3-0.70-0.80
Barcode:	111981007	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.7-0.8
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		1200						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D3-0.90-1.00
Barcode:	111981008	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.9-1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		740						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D22-0.00-0.10
Barcode:	111981064	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.33						
	Dumas Total Nitrogen	% dry wt		0.13						
Other tests	% Air-dry Moisture Content	% of dry wt		3.5						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0345						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
	Ammonium - N (2M KCl)	mg/kg		1.2						
	Colwell Phosphorus	mg/kg		7.9						
	PBI + Col P			101						
	Colwell Potassium	mg/kg		310						
	KCl Sulfur (S)	mg/kg		8.4						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		1.3						
	Iron (Fe)	mg/kg		14						
	Manganese (Mn)	mg/kg		12						
	Copper (Cu)	mg/kg		1.5						
	Zinc (Zn)	mg/kg		0.40						
	Oxalate ext. Molybdenum	mg/kg		1.2						
Salt	Chloride	mg/kg		100						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D22-0.20-0.30
Barcode:	111981065	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.2-0.3
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.25						
	Dumas Total Nitrogen	% dry wt		0.12						
Other tests	% Air-dry Moisture Content	% of dry wt		3.6						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0361						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		1.1						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		<5.0						
Extractable N-P-K-S	PBI + Col P			118						
Extractable N-P-K-S	Colwell Potassium	mg/kg		150						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		5.6						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		29						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D22-0.50-0.60
Barcode:	111981066	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.5-0.6
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		1500						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D22-0.80-0.90
Barcode:	111981067	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.8-0.9
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		1600						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D32-0.00-0.10
Barcode:	111981075	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.38						
	Dumas Total Nitrogen	% dry wt		0.11						
Other tests	% Air-dry Moisture Content	% of dry wt		1.2						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0117						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
	Ammonium - N (2M KCl)	mg/kg		5.4						
	Colwell Phosphorus	mg/kg		8.2						
	PBI + Col P			38						
	Colwell Potassium	mg/kg		170						
	KCl Sulfur (S)	mg/kg		5.4						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		0.57						
	Iron (Fe)	mg/kg		12						
	Manganese (Mn)	mg/kg		19						
	Copper (Cu)	mg/kg		0.79						
	Zinc (Zn)	mg/kg		0.56						
	Oxalate ext. Molybdenum	mg/kg		0.47						
Salt	Chloride	mg/kg		6						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D32-0.20-0.30
Barcode:	111981076	**Crop:**	NOT SPECIFIED
Batch Number:	46601	**Sample Depth:**	0.2-0.3
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		0.55						
	Dumas Total Nitrogen	% dry wt		0.050						
Other tests	% Air-dry Moisture Content	% of dry wt		1.9						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0192						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		6.2						
Extractable N-P-K-S	PBI + Col P			53						
Extractable N-P-K-S	Colwell Potassium	mg/kg		220						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		13						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		67						

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SOIL ANALYSIS

Agent: GT Environmental
Agent Address: 4 / 162 Juliette Street, GREENSLOPES, QLD, 4120
Client: BWN
Test Set or Quotation:
Barcode: 111981077
Batch Number: 46603
Submission ID: 147219

Report Date: 03/12/2025
Sampling Date: NA
Date Received: 20/11/2025
Sample Name: D32-0.50-0.60
Crop: NOT SPECIFIED
Sample Depth: 0.5-0.6
GPS Start: NA
GPS End: NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		300						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D32-0.80-0.90
Barcode:	111981078	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0.8-0.9
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		760						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D37-0.00-0.10
Barcode:	111981089	**Crop:**	NOT SPECIFIED
Batch Number:	46603	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.31						
	Dumas Total Nitrogen	% dry wt		0.15						
Other tests	% Air-dry Moisture Content	% of dry wt		3.3						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0332						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
	Ammonium - N (2M KCl)	mg/kg		2.1						
	Colwell Phosphorus	mg/kg		<5.0						
	PBI + Col P			119						
	Colwell Potassium	mg/kg		120						
	KCl Sulfur (S)	mg/kg		4.0						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		0.90						
	Iron (Fe)	mg/kg		15						
	Manganese (Mn)	mg/kg		6.8						
	Copper (Cu)	mg/kg		1.2						
	Zinc (Zn)	mg/kg		0.12						
	Oxalate ext. Molybdenum	mg/kg		1.3						
Salt	Chloride	mg/kg		14						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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NOTE[2]: Walkley and Black Organic Carbon % (40°C) data presented in this test report have been obtained by a combination of laboratory wet chemistry and the equivalent modelled result from Mid-Infrared Diffuse Reflectance Spectroscopy and Partial Least Squares Regression (PLSR) analysis. An explanatory technical note is available upon request. The exception is for quoted work that specifically required laboratory wet chemistry.

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D37-0.20-0.30
Barcode:	111981090	**Crop:**	NOT SPECIFIED
Batch Number:	46603	**Sample Depth:**	0.2-0.3
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.22						
	Dumas Total Nitrogen	% dry wt		0.10						
Other tests	% Air-dry Moisture Content	% of dry wt		3.7						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0365						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		1.3						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		<5.0						
Extractable N-P-K-S	PBI + Col P			112						
Extractable N-P-K-S	Colwell Potassium	mg/kg		110						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		6.8						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		340						

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SOIL ANALYSIS

Agent: GT Environmental
Agent Address: 4 / 162 Juliette Street, GREENSLOPES, QLD, 4120
Client: BWN
Test Set or Quotation:
Barcode: 111981091
Batch Number: 46603
Submission ID: 147219

Report Date: 03/12/2025
Sampling Date: NA
Date Received: 20/11/2025
Sample Name: D37-0.50-0.60
Crop: NOT SPECIFIED
Sample Depth: 0.5-0.6
GPS Start: NA
GPS End: NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		580						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D37-0.80-0.90
Barcode:	111981092	**Crop:**	NOT SPECIFIED
Batch Number:	46603	**Sample Depth:**	0.8-0.9
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		1500						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D44-0.00-0.10
Barcode:	111980904	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.89						
	Dumas Total Nitrogen	% dry wt		0.16						
Other tests	% Air-dry Moisture Content	% of dry wt		1.8						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0183						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		3.7						
	Ammonium - N (2M KCl)	mg/kg		1.6						
	Colwell Phosphorus	mg/kg		<5.0						
	PBI + Col P			60						
	Colwell Potassium	mg/kg		310						
	KCl Sulfur (S)	mg/kg		5.4						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		0.56						
	Iron (Fe)	mg/kg		18						
	Manganese (Mn)	mg/kg		34						
	Copper (Cu)	mg/kg		1.2						
	Zinc (Zn)	mg/kg		0.78						
	Oxalate ext. Molybdenum	mg/kg		0.62						
Salt	Chloride	mg/kg		21						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D44-0.10-0.20
Barcode:	111980905	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0.1-0.2
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		1.35						
	Dumas Total Nitrogen	% dry wt		0.11						
Other tests	% Air-dry Moisture Content	% of dry wt		2.2						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0215						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		1.2						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		<5.0						
Extractable N-P-K-S	PBI + Col P			74						
Extractable N-P-K-S	Colwell Potassium	mg/kg		86						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		3.7						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		15						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D44-0.20-0.30
Barcode:	111980906	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0.2-0.3
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		120						

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SOIL ANALYSIS

Agent: GT Environmental
Agent Address: 4 / 162 Juliette Street, GREENSLOPES, QLD, 4120
Client: BWN
Test Set or Quotation:
Barcode: 111980907
Batch Number: 46604
Submission ID: 147219

Report Date: 03/12/2025
Sampling Date: NA
Date Received: 20/11/2025
Sample Name: D44-0.50-0.60
Crop: NOT SPECIFIED
Sample Depth: 0.5-0.6
GPS Start: NA
GPS End: NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		630						

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SOIL ANALYSIS

Agent: GT Environmental
Agent Address: 4 / 162 Juliette Street, GREENSLOPES, QLD, 4120
Client: BWN
Test Set or Quotation:
Barcode: 111980908
Batch Number: 46604
Submission ID: 147219

Report Date: 03/12/2025
Sampling Date: NA
Date Received: 20/11/2025
Sample Name: D44-0.80-0.90
Crop: NOT SPECIFIED
Sample Depth: 0.8-0.9
GPS Start: NA
GPS End: NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		830						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D59-0.00-0.10
Barcode:	111980929	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0-0.1
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		0.35						
	Dumas Total Nitrogen	% dry wt		0.035						
Other tests	% Air-dry Moisture Content	% of dry wt		0.3						
	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0032						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
	Ammonium - N (2M KCl)	mg/kg		<1.0						
	Colwell Phosphorus	mg/kg		<5.0						
	PBI + Col P			21						
	Colwell Potassium	mg/kg		130						
	KCl Sulfur (S)	mg/kg		<2.5						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
	Exchangeable hydrogen	cmol/kg		<0.02						
Trace Elements	Boron	mg/kg		0.26						
	Iron (Fe)	mg/kg		4.3						
	Manganese (Mn)	mg/kg		4.7						
	Copper (Cu)	mg/kg		0.47						
	Zinc (Zn)	mg/kg		<0.08						
	Oxalate ext. Molybdenum	mg/kg		<0.25						
Salt	Chloride	mg/kg		<5						
Al	CaCl2 extr. Aluminium	mg/kg		<0.1						

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SOIL ANALYSIS

Agent: GT Environmental
Agent Address: 4 / 162 Juliette Street, GREENSLOPES, QLD, 4120
Client: BWN
Test Set or Quotation:
Barcode: 111980930
Batch Number: 46603
Submission ID: 147219

Report Date: 03/12/2025
Sampling Date: NA
Date Received: 20/11/2025
Sample Name: D59-0.20-0.30
Crop: NOT SPECIFIED
Sample Depth: 0.2-0.3
GPS Start: NA
GPS End: NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		5						

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:	DS1	**Sample Name:**	D59-0.50-0.60
Barcode:	111980931	**Crop:**	NOT SPECIFIED
Batch Number:	46603	**Sample Depth:**	0.5-0.6
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
	Organic Carbon (W&B) [2]	% (40°C)		0.22						
	Dumas Total Nitrogen	% dry wt		0.050						
Other tests	% Air-dry Moisture Content	% of dry wt		1.7						
Other tests	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)	g/g		0.0169						
Extractable N-P-K-S	Nitrate - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Ammonium - N (2M KCl)	mg/kg		<1.0						
Extractable N-P-K-S	Colwell Phosphorus	mg/kg		<5.0						
Extractable N-P-K-S	PBI + Col P			73						
Extractable N-P-K-S	Colwell Potassium	mg/kg		180						
Extractable N-P-K-S	KCl Sulfur (S)	mg/kg		4.8						
Exchangeable cations	Exchangeable aluminium	cmol/kg		<0.02						
Exchangeable cations	Exchangeable hydrogen	cmol/kg		<0.02						
Salt	Chloride	mg/kg		51						

NOTE[1]: Eurofins APAL will review published literature for crop desired levels, and reserves the right to make changes to this information in test reports as and when these reviews are conducted.

NOTE[2]: Walkley and Black Organic Carbon % (40°C) data presented in this test report have been obtained by a combination of laboratory wet chemistry and the equivalent modelled result from Mid-Infrared Diffuse Reflectance Spectroscopy and Partial Least Squares Regression (PLSR) analysis. An explanatory technical note is available upon request. The exception is for quoted work that specifically required laboratory wet chemistry.

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SOIL ANALYSIS

Agent:	GT Environmental	**Report Date:**	03/12/2025
Agent Address:	4 / 162 Juliette Street, GREENSLOPES, QLD, 4120	**Sampling Date:**	NA
Client:	BWN	**Date Received:**	20/11/2025
Test Set or Quotation:		**Sample Name:**	D59-0.80-0.90
Barcode:	111980932	**Crop:**	NOT SPECIFIED
Batch Number:	46604	**Sample Depth:**	0.8-0.9
Submission ID:	147219	**GPS Start:**	NA
		GPS End:	NA

	Analyte	Unit	Desired Level	Level Found	c.mol/kg	Very Low	Low	Acceptable	High	Excessive
Salt	Chloride	mg/kg		170						

NOTE[1]: Eurofins APAL will review published literature for crop desired levels, and reserves the right to make changes to this information in test reports as and when these reviews are conducted.

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Eurofins APAL Test Method Codes														
Crop	Actual Crop	SubmissionID	SamplingDate	DateReceived	BatchID	Batch Position No.	AgentName	ClientName	SampleName	Barcode	SampleDepth	Postcode	Transect GPS Start	Transect GPS Finish
		147220		2025-11-20	46603	23	GT Environmental - Reece McCann	BWN	D1-0.00-0.10	111981001	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	12	GT Environmental - Reece McCann	BWN	D1-0.20-0.30	111981002	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	24	GT Environmental - Reece McCann	BWN	D1-0.50-0.60	111981003	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	42	GT Environmental - Reece McCann	BWN	D5-0.00-0.10	111981009	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	44	GT Environmental - Reece McCann	BWN	D5-0.20-0.30	111981010	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	28	GT Environmental - Reece McCann	BWN	D5-0.50-0.60	111981011	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46603	22	GT Environmental - Reece McCann	BWN	D5-0.80-0.90	111981012	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46603	10	GT Environmental - Reece McCann	BWN	D5-1.00-1.10	111981013	1-1.1	4120	N/A	N/A
		147220		2025-11-20	46601	33	GT Environmental - Reece McCann	BWN	D5-1.40-1.50	111981014	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46601	35	GT Environmental - Reece McCann	BWN	D5-1.70-1.80	111981015	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46601	34	GT Environmental - Reece McCann	BWN	D6-0.00-0.10	111981016	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	38	GT Environmental - Reece McCann	BWN	D6-0.20-0.30	111981017	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46603	13	GT Environmental - Reece McCann	BWN	D6-0.50-0.60	111981018	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	27	GT Environmental - Reece McCann	BWN	D6-0.80-0.90	111981019	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46601	29	GT Environmental - Reece McCann	BWN	D6-1.00-1.10	111981020	1-1.1	4120	N/A	N/A
		147220		2025-11-20	46603	20	GT Environmental - Reece McCann	BWN	D7-0.00-0.10	111981021	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	3	GT Environmental - Reece McCann	BWN	D7-0.20-0.30	111981022	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	32	GT Environmental - Reece McCann	BWN	D7-0.50-0.60	111981023	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	37	GT Environmental - Reece McCann	BWN	D12m-0.00-0.10	111981024	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	45	GT Environmental - Reece McCann	BWN	D12m-0.20-0.30	111981025	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	26	GT Environmental - Reece McCann	BWN	D12m-0.50-0.60	111981026	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	30	GT Environmental - Reece McCann	BWN	D12m-0.80-0.90	111981027	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46601	41	GT Environmental - Reece McCann	BWN	D12m-1.10-1.20	111981028	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	16	GT Environmental - Reece McCann	BWN	D12m-1.40-1.50	111981029	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46601	39	GT Environmental - Reece McCann	BWN	D12m-1.70-1.80	111981030	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46604	45	GT Environmental - Reece McCann	BWN	D12d-0.00-0.10	111981031	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46604	46	GT Environmental - Reece McCann	BWN	D12d-0.20-0.30	111981032	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	41	GT Environmental - Reece McCann	BWN	D12d-0.50-0.60	111981033	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	7	GT Environmental - Reece McCann	BWN	D12d-0.80-0.90	111981034	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	27	GT Environmental - Reece McCann	BWN	D12d-1.10-1.20	111981035	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	25	GT Environmental - Reece McCann	BWN	D12d-1.40-1.50	111981036	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46601	9	GT Environmental - Reece McCann	BWN	D12d-1.70-1.80	111981037	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46604	40	GT Environmental - Reece McCann	BWN	D14d-0.00-0.10	111981038	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	10	GT Environmental - Reece McCann	BWN	D14d-0.20-0.30	111981039	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	30	GT Environmental - Reece McCann	BWN	D14d-0.50-0.60	111981040	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	28	GT Environmental - Reece McCann	BWN	D14d-0.80-0.90	111981041	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	42	GT Environmental - Reece McCann	BWN	D14d-1.10-1.20	111981042	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	31	GT Environmental - Reece McCann	BWN	D14d-1.30-1.40	111981043	1.3-1.4	4120	N/A	N/A
		147220		2025-11-20	46604	44	GT Environmental - Reece McCann	BWN	D14m-0.00-0.10	111981044	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46604	26	GT Environmental - Reece McCann	BWN	D14m-0.20-0.30	111981045	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	33	GT Environmental - Reece McCann	BWN	D14m-0.50-0.60	111981046	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	8	GT Environmental - Reece McCann	BWN	D14m-0.80-0.90	111981047	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	5	GT Environmental - Reece McCann	BWN	D14m-1.10-1.20	111871227	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	35	GT Environmental - Reece McCann	BWN	D14m-1.40-1.50	111981049	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46604	43	GT Environmental - Reece McCann	BWN	D14m-1.70-1.80	111981050	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46604	32	GT Environmental - Reece McCann	BWN	D14m-2.00-2.10	111981051	2-2.1	4120	N/A	N/A
		147220		2025-11-20	46604	38	GT Environmental - Reece McCann	BWN	D19-0.00-0.05	111981052	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46604	24	GT Environmental - Reece McCann	BWN	D19-0.20-0.30	111981053	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	6	GT Environmental - Reece McCann	BWN	D19-0.40-0.50	111981054	0.4-0.5	4120	N/A	N/A
		147220		2025-11-20	46601	1	GT Environmental - Reece McCann	BWN	D19-0.50-0.60	111981055	0.5-0.6	4120	N/A	N/A

		147220		2025-11-20	46604	37	GT Environmental - Reece McCann	BWN	D19-0.80-0.90	111981056	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46601	16	GT Environmental - Reece McCann	BWN	D21-0.00-0.10	111981057	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	17	GT Environmental - Reece McCann	BWN	D21-0.20-0.30	111981059	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	18	GT Environmental - Reece McCann	BWN	D21-0.50-0.60	111981060	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	29	GT Environmental - Reece McCann	BWN	D21-0.80-0.90	111981061	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	36	GT Environmental - Reece McCann	BWN	D21-1.10-1.20	111981062	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	34	GT Environmental - Reece McCann	BWN	D21-1.40-1.50	111981063	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46604	39	GT Environmental - Reece McCann	BWN	D21-1.70-1.80	111981058	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46601	8	GT Environmental - Reece McCann	BWN	D24-0.00-0.10	111981071	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	2	GT Environmental - Reece McCann	BWN	D24-0.20-0.30	111981072	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46601	7	GT Environmental - Reece McCann	BWN	D24-0.50-0.60	111981073	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	5	GT Environmental - Reece McCann	BWN	D24-0.80-0.90	111981074	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46601	15	GT Environmental - Reece McCann	BWN	D36-0.00-0.10	111981082	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	8	GT Environmental - Reece McCann	BWN	D36-0.20-0.30	111981083	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46603	43	GT Environmental - Reece McCann	BWN	D36-0.50-0.60	111981084	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46601	13	GT Environmental - Reece McCann	BWN	D36-0.80-0.90	111981085	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46603	25	GT Environmental - Reece McCann	BWN	D36-1.10-1.20	111981086	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46601	4	GT Environmental - Reece McCann	BWN	D36-1.40-1.50	111981087	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46603	6	GT Environmental - Reece McCann	BWN	D36-1.70-1.80	111981088	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46603	21	GT Environmental - Reece McCann	BWN	D39-0.00-0.10	111981096	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	15	GT Environmental - Reece McCann	BWN	D39-0.20-0.30	111981097	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	14	GT Environmental - Reece McCann	BWN	D39-0.50-0.60	111981098	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	21	GT Environmental - Reece McCann	BWN	D39-0.80-0.90	111981099	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46603	11	GT Environmental - Reece McCann	BWN	D39-1.10-1.20	111981100	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46603	1	GT Environmental - Reece McCann	BWN	D43-0.00-0.10	111980901	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46601	21	GT Environmental - Reece McCann	BWN	D43-0.10-0.20	111980902	0.1-0.2	4120	N/A	N/A
		147220		2025-11-20	46604	19	GT Environmental - Reece McCann	BWN	D43-0.20-0.30	111980903	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	15	GT Environmental - Reece McCann	BWN	D45-0.00-0.10	111980910	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	4	GT Environmental - Reece McCann	BWN	D45-0.20-0.30	111980911	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	9	GT Environmental - Reece McCann	BWN	D45-0.50-0.60	111980912	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	12	GT Environmental - Reece McCann	BWN	D45-0.80-0.90	111980913	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	3	GT Environmental - Reece McCann	BWN	D45-1.10-1.20	111980914	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	11	GT Environmental - Reece McCann	BWN	D45-1.40-1.50	111980915	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46604	2	GT Environmental - Reece McCann	BWN	D45-1.70-1.80	111980916	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46601	22	GT Environmental - Reece McCann	BWN	D52-0.00-0.10	111980917	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	14	GT Environmental - Reece McCann	BWN	D52-0.20-0.30	111980918	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46604	17	GT Environmental - Reece McCann	BWN	D52-0.50-0.60	111980919	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46603	19	GT Environmental - Reece McCann	BWN	D52-0.80-0.90	111980920	0.8-0.9	4120	N/A	N/A
		147220		2025-11-20	46604	10	GT Environmental - Reece McCann	BWN	D52-1.10-1.20	111980921	1.1-1.2	4120	N/A	N/A
		147220		2025-11-20	46604	18	GT Environmental - Reece McCann	BWN	D52-1.40-1.50	111980922	1.4-1.5	4120	N/A	N/A
		147220		2025-11-20	46604	22	GT Environmental - Reece McCann	BWN	D52-1.70-1.80	111980923	1.7-1.8	4120	N/A	N/A
		147220		2025-11-20	46601	23	GT Environmental - Reece McCann	BWN	D52-2.00-2.10	111980924	2-2.1	4120	N/A	N/A
		147220		2025-11-20	46603	36	GT Environmental - Reece McCann	BWN	D58-0.00-0.10	111980925	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	40	GT Environmental - Reece McCann	BWN	D58-0.20-0.30	111980926	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46603	37	GT Environmental - Reece McCann	BWN	D58-0.50-0.60	111980927	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46604	48	GT Environmental - Reece McCann	BWN	D58-0.70-0.80	111980928	0.7-0.8	4120	N/A	N/A
		147220		2025-11-20	46603	28	GT Environmental - Reece McCann	BWN	D65-0.00-0.05	111980936	0-0.1	4120	N/A	N/A
		147220		2025-11-20	46603	32	GT Environmental - Reece McCann	BWN	D65-0.10-0.20	111980937	0.1-0.2	4120	N/A	N/A
		147220		2025-11-20	46603	30	GT Environmental - Reece McCann	BWN	D65-0.20-0.30	111980938	0.2-0.3	4120	N/A	N/A
		147220		2025-11-20	46603	38	GT Environmental - Reece McCann	BWN	D65-0.50-0.60	111980939	0.5-0.6	4120	N/A	N/A
		147220		2025-11-20	46603	31	GT Environmental - Reece McCann	BWN	D65-0.80-0.90	111980940	0.8-0.9	4120	N/A	N/A

NOTE 1: Walkley and Black Organic Carbon % (40°C) data presented in this test report have been obtained by a combination of laboratory wet chemistry and the equivalent modelled result from Mid-Infrared Diffuse Reflectance Spectroscopy and Partial Least Squares Regression (PLSR) analysis. An explanatory technical note is available upon request. The exception is for quoted

TMs-004A	TMs-004B4	TMs-006A	TMs-007NO3	TMs-007NH4	TMs-009B	TMs-009I2	TMs-018	TMs-010D	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E
pH 1:5 water	pH CaCl2 (following 4A1)	Organic Carbon (W&B)	Nitrate - N (2M KCl)	Ammonium - N (2M KCl)	Colwell Phosphorus	PBI + Col P	Colwell Potassium	KCl Sulfur (S)	Calcium (Ca) - NH4Cl/BaCl2	Magnesium (Mg) - NH4Cl/BaCl2	Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Calcium (Ca) - NH4Cl/BaCl2	Magnesium (Mg) - NH4Cl/BaCl2
pH units	pH units	% (40°C)	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol/kg	cmol/kg
8.55	7.84	1.66	2.7	1.4	<5.0	100	500	5.8	4650	458	415	200	23.2	3.77
8.94	8.17	0.7	<1.0	<1.0	<5.0	92	150	6.8	3860	563	126	1320	19.3	4.63
9.2	8.35								2520	536	92	1410	12.6	4.41
7.63	6.42	1.34	<1.0	1.7	<5.0	116	97	7.5	3900	1080	115	566	19.5	8.89
8.63	7.67	1.12	<1.0	1.3	<5.0	112	80	6.3	4330	1310	109	1010	21.6	10.8
8.96	8.12								4400	1360	88	1120	22	11.2
8.13	7.52								2980	1460	110	2440	14.8	12
8.63	8.01								3450	1490	121	2110	17.2	12.3
5.21	4.6								2290	1490	100	2210	11.4	12.3
8.08	7.4								2940	1420	116	1890	14.7	11.7
7.17	6.06	1.77	1.2	2.5	7.3	68	330	4.8	2400	746	252	205	12	6.13
8.98	8.09	0.91	<1.0	1.2	<5.0	122	100	8.9	3900	1250	126	1030	19.4	10.3
9.07	8.26								3470	1260	109	1380	17.3	10.4
9.1	8.37								2110	1060	67	1680	10.6	8.69
8.95	8.14								2000	1140	64	1890	10	9.38
8.57	7.82	1.46	<1.0	1.6	<5.0	133	120	5.6	5520	796	171	227	27.6	6.55
8.96	8.01	0.78	<1.0	<1.0	<5.0	115	120	4.6	4470	1010	132	530	22.3	8.31
8.76	7.92								2990	1150	132	1510	14.9	9.43
7.75	7.11	0.75	<1.0	1.6	<5.0	100	220	20	3410	1060	195	436	17	8.75
5.67	5.22	0.42	<1.0	1.7	<5.0	94	170	56	2040	1210	173	1470	10.2	9.92
5.77	5.36								1910	1210	201	1940	9.54	9.96
5.75	5.42								1740	1210	203	2320	8.69	9.94
7.65	7.26								2150	1280	246	2480	10.7	10.5
7.22	6.76								2390	1360	257	2570	11.9	11.2
7.59	7.2								2120	1320	276	2570	10.6	10.9
8.21	7.49	0.88	<1.0	<1.0	5.9	90	230	4.2	3920	847	242	232	19.6	6.97
7.79	7.2	0.41	1	<1.0	<5.0	89	130	18	2550	1090	147	1800	12.7	8.96
8.02	7.51								2330	1150	163	2450	11.7	9.43
8.23	7.69								2250	1090	164	2310	11.2	8.98
8.08	7.57								2350	1200	197	2590	11.7	9.83
7.96	7.5								2210	1270	230	2680	11	10.5
7.19	6.7								1980	1160	179	1970	9.86	9.58
7.51	6.19	0.55	<1.0	<1.0	11	84	180	4.1	3070	894	193	263	15.3	7.35
7.55	6.36	0.64	<1.0	1.1	12	94	230	4	3040	911	231	394	15.2	7.49
7.67	7.16								3200	1270	179	1810	16	10.4
6.61	5.88								2260	1010	127	1320	11.3	8.31
8.16	7.52								2120	1220	197	1780	10.6	10.1
7.54	6.9								1820	1130	148	1720	9.1	9.34
7.18	6.34	1.77	1.2	2.2	10	82	410	5.6	3660	948	423	215	18.3	7.8
8.36	7.7	1.16	<1.0	1.3	<5.0	118	140	7.4	4240	923	164	974	21.2	7.59
8.19	7.36								2560	968	145	1070	12.8	7.96
8.03	7.57								2380	1390	287	2750	11.9	11.4
7.47	7.02								2190	1420	299	2890	10.9	11.7
7.41	7.01								2250	1460	308	3000	11.3	12
7.41	6.96								2310	1560	331	3110	11.5	12.8
7.21	6.73													
8.19	7.38	1.64	<1.0	4.8	9.3	67	470	4.2	4640	779	405	145	23.1	6.41
8.82	7.87	1.1	<1.0	<1.0	<5.0	100	170	5.7	5050	743	181	426	25.2	6.11
8.95	8.03								3170	501	88	513	15.8	4.13
7.96	7.14								1750	670	59	1750	8.73	5.51

8.88	7.99								3150	653	114	1100	15.7	5.37
8.06	7.38	2.37	2.7	2.4	9.3	99	640	7.2	5200	643	544	32.4	25.9	5.29
8.79	8.07	1.1	<1.0	1.4	<5.0	118	140	8.5	4570	863	174	1530	22.8	7.1
8.72	8.1								3990	864	174	2050	19.9	7.11
8.59	7.94								4210	942	167	2600	21	7.75
8.67	8.11								3960	937	190	2660	19.8	7.71
7.42	6.75								3180	988	165	2580	15.9	8.13
7.99	7.28								2710	817	143	2080	13.5	6.72
7.69	6.38	0.8	<1.0	1.4	6	51	300	4.4	1490	596	201	151	7.44	4.9
7.64	6.72	0.57	20	2.2	<5.0	118	89	8.7	1660	1180	85	1530	8.26	9.75
8.38	7.5								1920	1240	100	1570	9.56	10.2
9.07	8.11								1640	1090	86	1560	8.19	8.98
8	6.94	1.23	<1.0	2.1	<5.0	86	110	6.2	3210	794	115	79.9	16	6.53
8.52	7.74	0.69	<1.0	1.3	<5.0	157	72	5.2	3620	1050	92	324	18.1	8.61
9.01	8.12								2720	1170	82	778	13.6	9.65
9.06	8.31								2240	1180	86	839	11.2	9.73
9.03	8.27								2190	1090	89	879	10.9	8.97
8.7	7.91								1400	924	70	777	6.99	7.6
8.39	7.36								1010	605	53	620	5.03	4.98
7.78	6.85	1.5	1	1.5	<5.0	107	160	4.3	4270	505	171	158	21.3	4.15
8.54	7.8	1.61	8.9	<1.0	<5.0	141	130	11	5190	615	146	313	25.9	5.06
8.78	7.97								3930	610	85	684	19.6	5.02
9.3	8.4								2880	935	71	2660	14.4	7.69
9.28	8.48								2830	793	79	2230	14.1	6.52
7.4	6.16	0.68	<1.0	1.3	6.5	56	240	4.8	1750	625	148	297	8.71	5.14
8.15	6.99	0.83	<1.0	1.1	<5.0	89	140	7	2530	1110	125	700	12.6	9.11
8.72	7.76								2860	1230	143	896	14.3	10.1
7.54	6.88	1.35	1.5	<1.0	7.2	49	540	5.9	3570	496	477	16.3	17.8	4.08
8.25	7.52	1.34	<1.0	1.5	<5.0	96	210	5.5	4360	636	203	69.6	21.7	5.23
8.16	7.52								5010	868	195	480	25	7.14
7.71	7.29								4990	1020	210	681	24.9	8.37
7.28	6.75								4920	987	243	724	24.6	8.12
6.51	5.92								4550	905	251	714	22.7	7.45
6.95	6.33								3960	806	214	626	19.8	6.63
7.48	6.38	1.14	2.6	2.3	<5.0	60	260	4.4	2300	366	226	24.3	11.5	3.01
8.03	7.11	0.47	<1.0	1.2	<5.0	78	110	3.5	2330	467	121	80.9	11.6	3.84
9.23	8.21								1890	1040	99	829	9.43	8.55
9.14	8.4								1480	1040	97	1080	7.41	8.55
8.99	8.33								1710	1270	101	1310	8.52	10.5
9.02	8.29								1210	990	80	1200	6.06	8.14
9.09	8.32								1360	994	88	1210	6.78	8.18
7.91	7.1													
8.49	7.5	1.07	2.5	1.3	<5.0	92	190	5	3910	723	181	228	19.5	5.95
8.61	7.58	1.15	1.5	1.1	<5.0	78	130	10	3870	751	152	657	19.3	6.18
9.01	8.16								2980	847	111	1070	14.9	6.97
8.93	8.2								2790	878	104	1140	13.9	7.23
7.48	6.74	0.64	3.1	<1.0	5.9	20	330	2.5	616	114	259	11.1	3.07	0.94
7.85	6.99	0.49	1.1	<1.0	<5.0	19	360	<2.5	814	99	299	13	4.06	0.813
7.68	6.6								862	201	215	65.9	4.3	1.65
8.03	7.03								1490	544	167	257	7.45	4.47
9.14	8.24								1890	613	162	456	9.44	5.04

work that specifically required laboratory wet chemistry.

TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1
Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Ca:Mg ratio	K:Mg ratio	GTRI	ECR	Calcium (Ca) - prewash alc. pH 8.5 NH4Cl	Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl	Potassium (K) - prewash alc. pH 8.5 NH4Cl	Sodium (Na) - prewash alc. pH 8.5 NH4Cl	Calcium (Ca) - prewash alc. pH 8.5 NH4Cl	Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl	Potassium (K) - prewash alc. pH 8.5 NH4Cl	Sodium (Na) - prewash alc. pH 8.5 NH4Cl	Ca:Mg ratio
cmol/kg	cmol/kg				%	mg/kg	mg/kg	mg/kg	mg/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg	
1.06	0.87	6.2	0.28		6.7	4490	471	455	28.8	22.4	3.87	1.16	0.125	5.8
0.322	5.73	4.2	0.07		20	4090	563	136	274	20.4	4.63	0.347	1.19	4.4
0.234	6.15	2.9	0.05		27	2720	561	100	659	13.6	4.61	0.256	2.87	2.9
0.294	2.46	2.2	<0.05		8.9	4060	1060	144	314	20.3	8.72	0.368	1.36	2.3
0.278	4.38	2	<0.05		13	4470	1430	133	532	22.3	11.7	0.34	2.31	1.9
0.226	4.87	2	<0.05		13	4330	1530	105	446	21.6	12.6	0.269	1.94	1.7
0.281	10.6	1.2	<0.05		29	3140	1590	118	1150	15.7	13.1	0.301	4.99	1.2
0.309	9.19	1.4	<0.05		24	3570	1640	120	1020	17.8	13.5	0.306	4.43	1.3
0.255	9.6	0.9	<0.05		29	2490	1520	98.8	1200	12.4	12.5	0.253	5.24	1
0.297	8.23	1.3	<0.05		24	3260	1660	118	1050	16.3	13.7	0.302	4.55	1.2
0.644	0.892	2	0.11		7.8	2470	784	307	66.4	12.3	6.45	0.785	0.289	1.9
0.321	4.47	1.9	<0.05		14	4020	1440	137	319	20.1	11.8	0.35	1.39	1.7
0.278	6.02	1.7	<0.05		19	3940	1350	108	465	19.6	11.1	0.275	2.02	1.8
0.17	7.32	1.2	<0.05		28	2250	1140	81.8	595	11.2	9.34	0.209	2.59	1.2
0.163	8.22	1.1	<0.05		30	2050	1130	52.2	934	10.2	9.32	0.134	4.06	1.1
0.438	0.988	4.2	0.07		4	5340	813	172	48.7	26.7	6.69	0.439	0.212	4
0.338	2.3	2.7	<0.05		7.9	4800	1100	137	126	24	9.07	0.349	0.55	2.6
0.339	6.56	1.6	<0.05		22	2690	1090	139	725	13.4	8.93	0.355	3.15	1.5
0.499	1.9	1.9	0.06		8.5	3550	1110	235	101	17.7	9.13	0.602	0.44	1.9
0.441	6.4	1	<0.05		25	2110	1110	201	471	10.5	9.16	0.514	2.05	1.2
0.514	8.43	1	0.05		31	1910	1120	250	618	9.52	9.2	0.639	2.69	1
0.52	10.1	0.9	0.05		36	1640	1040	226	560	8.19	8.54	0.578	2.44	1
0.629	10.8	1	0.06		35	2310	1380	311	690	11.5	11.3	0.795	3	1
0.656	11.2	1.1	0.06		34	2290	1330	285	690	11.4	10.9	0.728	3	1
0.707	11.2	1	0.07		36	2080	1300	329	686	10.4	10.7	0.842	2.99	1
0.618	1.01	2.8	0.09		5.8	3440	800	258	52.9	17.2	6.58	0.659	0.23	2.6
0.375	7.83	1.4	<0.05		27	2390	1060	166	580	11.9	8.71	0.423	2.52	1.4
0.417	10.7	1.2	<0.05		34	2130	1070	179	643	10.6	8.84	0.458	2.8	1.2
0.418	10	1.3	<0.05		34	2240	1100	175	682	11.2	9.03	0.447	2.97	1.2
0.504	11.3	1.2	0.05		35	2140	1110	223	681	10.7	9.13	0.569	2.96	1.2
0.587	11.6	1.1	0.06		36	2060	1120	247	602	10.3	9.23	0.631	2.62	1.1
0.458	8.57	1	<0.05		32	1960	1160	223	538	9.79	9.52	0.569	2.34	1
0.495	1.14	2.1	0.07		6.7	2730	774	211	96.7	13.6	6.37	0.54	0.421	2.1
0.592	1.71	2	0.08		9.2	3290	955	297	162	16.4	7.86	0.76	0.704	2.1
0.458	7.88	1.5	<0.05		24	3210	1190	202	497	16	9.77	0.515	2.16	1.6
0.325	5.75	1.4	<0.05		24	2080	907	142	438	10.4	7.46	0.364	1.91	1.4
0.503	7.73	1.1	<0.05		29	2290	1360	247	716	11.4	11.2	0.631	3.11	1
0.379	7.48	1	<0.05		30	1680	1050	151	494	8.36	8.66	0.386	2.15	1
1.08	0.937	2.3	0.14		7.2	3100	831	471	48.2	15.5	6.84	1.2	0.21	2.3
0.42	4.24	2.8	0.06		14	3780	818	186	163	18.9	6.73	0.476	0.707	2.8
0.371	4.64	1.6	<0.05		19	2510	944	170	393	12.5	7.77	0.434	1.71	1.6
0.735	12	1	0.07		35	2240	1280	313	740	11.2	10.6	0.801	3.22	1.1
0.764	12.6	0.9	0.07		37	1690	1080	271	612	8.42	8.92	0.693	2.66	0.9
0.786	13	0.9	0.07		37	1650	1080	278	648	8.26	8.84	0.711	2.82	0.9
0.847	13.5	0.9	0.07		37	1730	1190	312	749	8.66	9.82	0.797	3.26	0.9
1.03	0.632	3.6	0.16		5.3	3890	684	453	36.1	19.4	5.62	1.16	0.157	3.5
0.464	1.85	4.1	0.08		6.9	4620	680	178	105	23	5.59	0.456	0.458	4.1
0.225	2.23	3.8	0.05		11	2770	440	77.3	162	13.8	3.62	0.198	0.705	3.8
0.151	7.61	1.6	<0.05		35	1850	667	70.2	917	9.25	5.49	0.18	3.99	1.7

0.292	4.8	2.9	0.05		19	2910	602	112	440	14.5	4.95	0.285	1.91	2.9
1.39	0.141	4.9	0.26		4.7	4790	637	690	10.6	23.9	5.24	1.76	0.046	4.6
0.445	6.67	3.2	0.06		19	4620	1020	233	528	23.1	8.41	0.596	2.3	2.7
0.445	8.9	2.8	0.06		26	4150	975	233	864	20.7	8.02	0.597	3.76	2.6
0.427	11.3	2.7	0.06		29	3520	903	190	983	17.6	7.42	0.486	4.28	2.4
0.486	11.6	2.6	0.06		31	3690	828	191	663	18.4	6.81	0.487	2.88	2.7
0.421	11.2	2	0.05		33	2360	745	124	851	11.8	6.13	0.318	3.7	1.9
0.366	9.03	2	0.05		32	2230	648	122	793	11.1	5.33	0.313	3.45	2.1
0.515	0.656	1.5	0.11		8.7	1450	593	236	44.7	7.24	4.88	0.603	0.194	1.5
0.218	6.64	0.9	<0.05		28	1590	1150	106	740	7.91	9.48	0.27	3.22	0.8
0.257	6.84	0.9	<0.05		26	1890	1310	117	860	9.41	10.8	0.3	3.74	0.9
0.22	6.8	0.9	<0.05		29	1500	1020	91.2	751	7.47	8.41	0.233	3.27	0.9
0.295	0.348	2.4	<0.05		2.8	3380	821	141	12.7	16.9	6.75	0.359	0.055	2.5
0.236	1.41	2.1	<0.05		5.8	3900	1130	90.6	58.5	19.4	9.31	0.232	0.254	2.1
0.21	3.39	1.4	<0.05		13	2830	1320	84	116	14.1	10.8	0.215	0.506	1.3
0.219	3.65	1.1	<0.05		16	2330	1320	76.5	110	11.6	10.9	0.196	0.479	1.1
0.227	3.83	1.2	<0.05		17	5740	932	163	157	28.6	7.67	0.417	0.681	3.7
0.18	3.38	0.9	<0.05		20	1560	1030	64.8	278	7.77	8.51	0.166	1.21	0.9
0.135	2.7	1	<0.05		22	998	589	42	211	4.98	4.85	0.107	0.92	1
0.437	0.686	5.1	0.11		4.2	3960	450	201	44.4	19.8	3.7	0.515	0.193	5.3
0.373	1.36	5.1	0.07		5.3	4840	616	161	57.2	24.1	5.07	0.412	0.249	4.8
0.216	2.97	3.9	<0.05		11	3510	540	73.7	84.5	17.5	4.45	0.188	0.368	3.9
0.182	11.6	1.9	<0.05		35	3080	907	57.2	836	15.4	7.46	0.146	3.64	2.1
0.202	9.72	2.2	<0.05		32	3140	803	69	892	15.7	6.61	0.176	3.88	2.4
0.377	1.29	1.7	0.07		11	1640	589	178	130	8.16	4.85	0.454	0.565	1.7
0.32	3.04	1.4	<0.05		13	2570	1130	158	378	12.8	9.3	0.405	1.64	1.4
0.366	3.9	1.4	<0.05		15	2670	1140	141	357	13.3	9.39	0.362	1.55	1.4
1.22	0.071	4.4	0.3		5.6	2820	408	421	<6.0	14.1	3.36	1.08	0.024	4.2
0.519	0.303	4.2	0.1		3	4220	611	226	17.3	21.1	5.03	0.579	0.075	4.2
0.499	2.09	3.5	0.07		7.4	4460	847	204	103	22.3	6.97	0.523	0.446	3.2
0.537	2.96	3	0.06		9.5	4570	915	214	121	22.8	7.53	0.546	0.524	3
0.62	3.15	3	0.08		10	4240	879	252	143	21.1	7.23	0.643	0.62	2.9
0.642	3.11	3	0.09		11	3650	746	257	155	18.2	6.14	0.657	0.674	3
0.546	2.72	3	0.08		11	3420	732	226	143	17.1	6.03	0.577	0.621	2.8
0.579	0.106	3.8	0.19		4.5	2130	340	263	<6.0	10.6	2.8	0.673	<0.020	3.8
0.309	0.352	3	0.08		4.1	2280	435	122	14.6	11.4	3.58	0.311	0.064	3.2
0.253	3.6	1.1	<0.05		18	1720	1030	88.7	78.1	8.59	8.44	0.227	0.34	1
0.247	4.72	0.9	<0.05		24	1470	1120	98.2	186	7.32	9.22	0.251	0.81	0.8
0.257	5.71	0.8	<0.05		24	1530	1280	85.7	256	7.62	10.5	0.219	1.11	0.7
0.205	5.21	0.7	<0.05		28	1140	1020	77.9	213	5.67	8.38	0.199	0.925	0.7
0.224	5.25	0.8	<0.05		27	1220	986	78.5	329	6.08	8.11	0.201	1.43	0.8
0.463	0.991	3.3	0.08		5.4	3930	750	218	62.4	19.6	6.17	0.557	0.271	3.2
0.388	2.86	3.1	0.06		11	3730	769	183	291	18.6	6.33	0.469	1.27	2.9
0.284	4.67	2.1	<0.05		18	3150	915	124	193	15.7	7.52	0.318	0.837	2.1
0.267	4.94	1.9	<0.05		20	2470	853	121	211	12.3	7.02	0.31	0.918	1.8
0.662	0.048	3.3	0.7		15	496	118	183	<6.0	2.47	0.97	0.468	<0.020	2.6
0.765	0.057	5	0.94		14	542	84.1	185	<6.0	2.7	0.692	0.472	<0.020	3.9
0.55	0.287	2.6	0.33		12	847	210	203	7	4.23	1.73	0.518	0.03	2.4
0.428	1.12	1.7	0.1		11	1560	600	182	62.9	7.76	4.93	0.465	0.274	1.6
0.414	1.98	1.9	0.08		14	1740	640	161	32.7	8.69	5.27	0.411	0.142	1.7

TMs-015C1	TMs-015C1	TMs-015C1	TMs-015G	TMs-015G	TMs-015G	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-028	TMs-005
K:Mg ratio	GTRI	ECR	Exchangeable acidity	Exchangeable aluminium	Exchangeable hydrogen	ECEC	Calcium	Magnesium	Potassium	Sodium	Aluminium	Hydrogen	CaCl2 extr. Aluminium	Chloride
		%	cmol/kg	cmol/kg	cmol/kg	cmol/kg	%	%	%	%	%	%	mg/kg	mg/kg
0.3		4.7	<0.02	<0.02	<0.02	27.6	81.3	14	4.2	0.5	0	0	<0.1	62
0.08		5.8	<0.02	<0.02	<0.02	26.6	76.8	17.4	1.3	4.5	0	0		700
0.06		15	<0.02	<0.02	<0.02	21.3	63.7	21.7	1.2	13	0	0		830
<0.05		5.6	<0.02	<0.02	<0.02	30.7	66	28.4	1.2	4.4	0	0	<0.1	130
<0.05		7.2	<0.02	<0.02	<0.02	36.7	60.8	32	0.9	6.3	0	0		290
<0.05		6.1	<0.02	<0.02	<0.02	36.4	59.3	34.7	0.7	5.3	0	0		350
<0.05		16	<0.02	<0.02	<0.02	34	46.1	38.4	0.9	15	0	0		1400
<0.05		13	<0.02	<0.02	<0.02	36.1	49.4	37.5	0.9	12	0	0		1100
<0.05		18	1.3	1.2	0.1	31.7	39.2	39.4	0.8	17	3.8	0.3		1500
<0.05		14	<0.02	<0.02	<0.02	34.8	46.7	39.3	0.9	13	0	0		1200
0.12		5.4	<0.02	<0.02	<0.02	19.8	62.1	32.5	4	1.5	0	0	<0.1	44
<0.05		5.2	<0.02	<0.02	<0.02	33.6	59.7	35.2	1	4.1	0	0		260
<0.05		7	<0.02	<0.02	<0.02	33	59.5	33.6	0.8	6.1	0	0		420
<0.05		12	<0.02	<0.02	<0.02	23.3	48	40	0.9	11	0	0		1100
<0.05		18	<0.02	<0.02	<0.02	23.8	43.1	39.2	0.6	17	0	0		1100
0.07		1.9	<0.02	<0.02	<0.02	34	78.4	19.7	1.3	0.6	0	0	<0.1	25
<0.05		2.6	<0.02	<0.02	<0.02	33.9	70.6	26.7	1	1.6	0	0		57
<0.05		14	<0.02	<0.02	<0.02	25.9	51.9	34.5	1.4	12	0	0		640
0.07		3.7	<0.02	<0.02	<0.02	27.9	63.5	32.8	2.2	1.6	0	0	<0.1	300
0.06		12	0.11	0.06	0.05	22.4	47.1	40.9	2.3	9.2	0.3	0.2		1500
0.07		15	0.06	<0.02	0.04	22.1	43.1	41.6	2.9	12	0.1	0.2		2200
0.07		15	0.06	0.02	0.03	19.8	41.4	43.1	2.9	12	0.1	0.2		3000
0.07		14	<0.02	<0.02	<0.02	26.7	43.2	42.6	3	11	0	0		3000
0.07		14	<0.02	<0.02	<0.02	26.1	43.8	41.9	2.8	12	0	0		2700
0.08		15	<0.02	<0.02	<0.02	24.9	41.7	42.9	3.4	12	0	0		3300
0.1		3.6	<0.02	<0.02	<0.02	24.6	69.7	26.7	2.7	0.9	0	0	<0.1	26
<0.05		13	<0.02	<0.02	<0.02	23.6	50.6	36.9	1.8	11	0	0		1500
0.05		14	<0.02	<0.02	<0.02	22.7	46.8	38.9	2	12	0	0		2200
<0.05		14	<0.02	<0.02	<0.02	23.6	47.3	38.2	1.9	13	0	0		2300
0.06		15	<0.02	<0.02	<0.02	23.3	45.8	39.1	2.4	13	0	0		2600
0.07		14	<0.02	<0.02	<0.02	22.7	45.1	40.6	2.8	12	0	0		3000
0.06		13	<0.02	<0.02	<0.02	22.2	44.1	42.9	2.6	11	0	0		2500
0.09		4.6	<0.02	<0.02	<0.02	21	65	30.4	2.6	2	0	0	<0.1	42
0.1		5.7	<0.02	<0.02	<0.02	25.7	63.8	30.5	3	2.7	0	0		150
0.05		9.4	<0.02	<0.02	<0.02	28.5	56.3	34.3	1.8	7.6	0	0		1700
<0.05		11	<0.02	<0.02	<0.02	20.1	51.5	37.2	1.8	9.5	0	0		1000
0.06		14	<0.02	<0.02	<0.02	26.4	43.3	42.5	2.4	12	0	0		1500
<0.05		13	<0.02	<0.02	<0.02	19.6	42.8	44.3	2	11	0	0		1500
0.18		6	<0.02	<0.02	<0.02	23.7	65.2	28.8	5.1	0.9	0	0	<0.1	120
0.07		4.4	<0.02	<0.02	<0.02	26.8	70.5	25.1	1.8	2.6	0	0		780
0.06		9.6	<0.02	<0.02	<0.02	22.4	55.8	34.7	1.9	7.6	0	0		670
0.08		16	<0.02	<0.02	<0.02	25.7	43.4	41	3.1	13	0	0		2900
0.08		16	<0.02	<0.02	<0.02	20.7	40.7	43.1	3.4	13	0	0		3000
0.08		17	<0.02	<0.02	<0.02	20.6	40	42.9	3.4	14	0	0		3000
0.08		18	<0.02	<0.02	<0.02	22.5	38.4	43.6	3.5	14	0	0		3200
														2400
0.21		5	<0.02	<0.02	<0.02	26.4	73.7	21.3	4.4	0.6	0	0	<0.1	21
0.08		3.1	<0.02	<0.02	<0.02	29.6	78	18.9	1.5	1.5	0	0		16
0.06		4.9	<0.02	<0.02	<0.02	18.4	75.4	19.7	1.1	3.8	0	0		120
<0.05		22	<0.02	<0.02	<0.02	18.9	48.9	29	1	21	0	0		1000

0.06		10	<0.02	<0.02	<0.02	21.7	67	22.9	1.3	8.8	0	0		370
0.34		5.8	<0.02	<0.02	<0.02	31	77.2	16.9	5.7	<0.2	0	0	<0.1	<5
0.07		8.4	<0.02	<0.02	<0.02	34.4	67.1	24.5	1.7	6.7	0	0		870
0.07		13	<0.02	<0.02	<0.02	33.1	62.6	24.2	1.8	11	0	0		1500
0.07		16	<0.02	<0.02	<0.02	29.7	59	25	1.6	14	0	0		1500
0.07		12	<0.02	<0.02	<0.02	28.6	64.4	23.8	1.7	10	0	0		1700
0.05		18	<0.02	<0.02	<0.02	21.9	53.7	27.9	1.4	17	0	0		1600
0.06		19	<0.02	<0.02	<0.02	20.2	55	26.4	1.5	17	0	0		1100
0.12		6.2	<0.02	<0.02	<0.02	12.9	56.1	37.8	4.7	1.5	0	0	<0.1	40
<0.05		17	<0.02	<0.02	<0.02	20.9	37.9	45.4	1.3	15	0	0		900
<0.05		17	<0.02	<0.02	<0.02	24.3	38.8	44.6	1.2	15	0	0		890
<0.05		18	<0.02	<0.02	<0.02	19.4	38.6	43.4	1.2	17	0	0		630
0.05		1.7	<0.02	<0.02	<0.02	24	70.2	28.1	1.5	0.2	0	0	<0.1	11
<0.05		1.7	<0.02	<0.02	<0.02	29.2	66.5	31.8	0.8	0.9	0	0		26
<0.05		2.8	<0.02	<0.02	<0.02	25.7	55	42.2	0.8	2	0	0		290
<0.05		2.9	<0.02	<0.02	<0.02	23.2	50.1	47	0.8	2.1	0	0		550
0.05		2.9	<0.02	<0.02	<0.02	37.4	76.6	20.5	1.1	1.8	0	0		490
<0.05		7.8	<0.02	<0.02	<0.02	17.7	44	48.2	0.9	6.9	0	0		570
<0.05		9.5	<0.02	<0.02	<0.02	10.9	45.9	44.7	1	8.5	0	0		360
0.14		2.9	<0.02	<0.02	<0.02	24.2	81.8	15.3	2.1	0.8	0	0	<0.1	17
0.08		2.2	<0.02	<0.02	<0.02	29.9	80.8	17	1.4	0.8	0	0		45
<0.05		2.5	<0.02	<0.02	<0.02	22.5	77.8	19.7	0.8	1.6	0	0		250
<0.05		14	<0.02	<0.02	<0.02	26.6	57.7	28	0.6	14	0	0		860
<0.05		15	<0.02	<0.02	<0.02	26.3	59.5	25.1	0.7	15	0	0		720
0.09		7.3	<0.02	<0.02	<0.02	14	58.2	34.6	3.2	4	0	0	<0.1	87
<0.05		8.5	<0.02	<0.02	<0.02	24.2	53	38.5	1.7	6.8	0	0		240
<0.05		7.8	<0.02	<0.02	<0.02	24.6	54.1	38.1	1.5	6.3	0	0		270
0.32		5.9	<0.02	<0.02	<0.02	18.5	75.9	18.1	5.8	<0.2	0	0	<0.1	40
0.12		2.4	<0.02	<0.02	<0.02	26.8	78.8	18.8	2.2	0.3	0	0		13
0.08		3.2	<0.02	<0.02	<0.02	30.2	73.7	23.1	1.7	1.5	0	0		280
0.07		3.4	<0.02	<0.02	<0.02	31.4	72.6	24	1.7	1.7	0	0		760
0.09		4.3	<0.02	<0.02	<0.02	29.6	71.3	24.4	2.2	2.1	0	0		760
0.11		5.2	<0.02	<0.02	<0.02	25.7	70.9	23.9	2.6	2.6	0	0		750
0.1		4.9	<0.02	<0.02	<0.02	24.3	70.3	24.8	2.4	2.6	0	0		630
0.24		4.8	<0.02	<0.02	<0.02	14.1	75.3	19.8	4.8	<0.2	0	0	<0.1	10
0.09		2.4	<0.02	<0.02	<0.02	15.3	74.2	23.3	2	0.4	0	0		49
<0.05		3.2	<0.02	<0.02	<0.02	17.6	48.8	48	1.3	1.9	0	0		310
<0.05		6	<0.02	<0.02	<0.02	17.6	41.6	52.4	1.4	4.6	0	0		670
<0.05		6.8	<0.02	<0.02	<0.02	19.5	39.1	54.1	1.1	5.7	0	0		760
<0.05		7.4	<0.02	<0.02	<0.02	15.2	37.4	55.2	1.3	6.1	0	0		840
<0.05		10	<0.02	<0.02	<0.02	15.8	38.4	51.3	1.3	9	0	0		710
														810
0.09		3.1	<0.02	<0.02	<0.02	26.6	73.7	23.2	2.1	1	0	0	<0.1	29
0.07		6.5	<0.02	<0.02	<0.02	26.7	69.7	23.7	1.8	4.7	0	0		140
<0.05		4.7	<0.02	<0.02	<0.02	24.4	64.4	30.9	1.3	3.4	0	0		500
<0.05		6	<0.02	<0.02	<0.02	20.6	60	34.1	1.5	4.5	0	0		540
0.48		12	<0.02	<0.02	<0.02	3.92	63.2	24.8	12	<0.2	0	0	<0.1	15
0.68		12	<0.02	<0.02	<0.02	3.87	69.7	17.9	12	0.2	0	0		<5
0.3		8.4	<0.02	<0.02	<0.02	6.5	65	26.5	8	0.5	0	0		17
0.09		5.5	<0.02	<0.02	<0.02	13.4	57.8	36.7	3.5	2	0	0		92
0.08		3.8	<0.02	<0.02	<0.02	14.5	59.9	36.3	2.8	1	0	0		270

TMs-003	TMs-012C	TMs-012A	TMs-012A	TMs-012A	TMs-012A	TMs-031	TMs-007	TMs-003	TMs-002A1	TMs-002A1
Salinity EC 1:5	Boron	Iron (Fe)	Manganese (Mn)	Copper (Cu)	Zinc (Zn)	Oxalate ext. Molybdenum	Dumas Total Nitrogen	TDS	% Air-dry Moisture Content	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)
dS/m	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	% dry wt	mg/L	% of dry wt	g/g
0.17	1.4	6.2	3.5	0.6	0.27	0.81	0.21	110	2.9	0.0288
0.67							0.12	430	3.2	0.0316
0.71								450	2.6	0.0263
0.13	1.4	27	28	2.2	0.18	1.3	0.11	83	3.5	0.0349
0.35							0.092	230	4	0.0395
0.46								290	5.3	0.0531
1								650	4.4	0.0437
0.97								620	3.5	0.0347
1								660	4	0.0404
0.88								570	4.3	0.0425
0.074	0.77	25	38	1.4	0.96	0.84	0.16	47	2.4	0.0243
0.39							0.093	250	3.4	0.0336
0.51								330	3.2	0.0323
0.91								580	3.3	0.0329
0.91								580	2.9	0.0289
0.16	1.2	11	4.6	1.1	0.19	0.92	0.15	100	2.8	0.0275
0.23							0.099	140	3.4	0.0338
0.58								370	3.6	0.036
0.33	2.9	18	7.7	1.6	0.26	1.1	0.098	210	3.3	0.033
1.1							0.031	700	3.6	0.0359
1.5								970	5	0.0498
2								1200	5.1	0.0508
2.1								1400	3.1	0.0308
1.9								1200	3.2	0.0321
2.3								1400	3.5	0.0345
0.14	0.86	15	8.2	1.8	0.25	1.1	0.095	92	2.7	0.0267
1.1							0.055	690	3	0.0297
1.5								980	2.6	0.0262
1.5								980	2.7	0.0271
1.7								1100	3.2	0.0323
2								1300	3.1	0.0305
1.6								1000	4.1	0.0408
0.06	0.53	28	24	2.2	0.46	1.1	0.044	38	2.9	0.029
0.14							0.057	87	3.8	0.0378
1.2								770	4.5	0.0448
0.72								460	3.3	0.0328
1								650	2.8	0.0284
1								640	2.2	0.0218
0.13	0.87	27	26	1.9	0.72	1.2	0.17	82	2.8	0.028
0.62							0.12	390	3	0.0296
0.49								310	2.6	0.0255
1.9								1200	3.9	0.0394
1.9								1200	4.7	0.0469
1.9								1200	4.7	0.0466
2.1								1300	4.2	0.0418
1.6								1000		
0.099	0.9	7.7	6.2	0.94	0.36	1.1	0.16	64	2.8	0.0278
0.15							0.1	99	3	0.0301
0.21								130	1.7	0.0169
0.76								490	3.1	0.0309

0.38								240	2.2	0.0218
0.11	1.1	12	13	1.4	0.67	1	0.23	72	3.1	0.0309
0.8							0.11	510	3.3	0.033
1.2								740	3.2	0.0321
1.1								720	4.7	0.0465
1.3								820	3.1	0.0305
1.1								710	4.1	0.0413
0.83								530	3	0.0297
0.057	0.49	15	26	0.9	0.46	0.64	0.09	37	1.6	0.0163
0.68							0.084	440	3.7	0.037
0.68								430	3.2	0.0319
0.54								350	3.3	0.0325
0.067	1.1	11	11	0.92	0.22	0.98	0.1	43	2.9	0.0287
0.2							0.084	130	2.6	0.0256
0.41								260	2.6	0.0262
0.56								360	2.4	0.0241
0.53								340	1.9	0.0194
0.49								310	2.3	0.0227
0.29								190	1	0.0103
0.065	1.1	11	16	1.4	0.2	1.3	0.19	42	2.7	0.0274
0.2							0.13	130	2.3	0.0233
0.36								230	2.5	0.0254
0.86								550	3.1	0.0307
0.78								500	2.8	0.0283
0.094	0.56	14	22	1.1	0.56	0.79	0.096	60	1.5	0.0149
0.22							0.11	140	4	0.0396
0.32								210	3.3	0.0328
0.092	0.79	11	7.6	0.93	0.47	0.66	0.12	59	2.1	0.0214
0.081							0.13	52	2.4	0.0241
0.31								200	4	0.0403
0.58								370	3.9	0.0386
0.57								370	3.9	0.0387
0.54								350	3.8	0.0383
0.47								300	3.9	0.0388
0.038	0.74	14	21	1.2	0.28	0.68	0.097	24	1.8	0.0178
0.054							0.077	35	1.5	0.0146
0.45								290	1.6	0.0164
0.69								440	1.5	0.015
0.85								540	2.3	0.0231
0.8								510	1.4	0.0144
0.74								470	1.7	0.0165
0.7								450		
0.1	0.81	11	6.8	1.3	0.31	1.1	0.13	66	3.5	0.0352
0.22							0.1	140	3.6	0.036
0.56								360	2.8	0.0276
0.58								370	2.6	0.0255
0.058	0.18	13	8.1	0.45	0.41	<0.25	0.075	37	0.3	0.0027
0.059							0.039	38	0.3	0.0026
0.052								33	0.5	0.0046
0.13								84	1.6	0.016
0.32								200	1.3	0.0131

eurofins | APAL

Eurofins APAL Test Method Codes											
Crop	Actual Crop	SubmissionID	SamplingDate	DateReceived	BatchID	Batch Position No.	AgentName	ClientName	SampleName	Barcode	SampleDepth
		147218		2025-11-20	46603	7	GT Environmental - Reece McCann	BWN	D22-1.00-1.10	111981068	1-1.1
		147218		2025-11-20	46601	3	GT Environmental - Reece McCann	BWN	D22-1.30-1.40	111981069	1.3-1.4
		147218		2025-11-20	46603	42	GT Environmental - Reece McCann	BWN	D22-1.60-1.70	111981070	1.6-1.7
		147218		2025-11-20	46603	44	GT Environmental - Reece McCann	BWN	D32-1.10-1.20	111981079	1.1-1.2
		147218		2025-11-20	46603	26	GT Environmental - Reece McCann	BWN	D32-1.40-1.50	111981080	1.4-1.5
		147218		2025-11-20	46603	18	GT Environmental - Reece McCann	BWN	D32-1.70-1.80	111981081	1.7-1.8
		147218		2025-11-20	46603	9	GT Environmental - Reece McCann	BWN	D37-1.10-1.20	111981093	1.1-1.2
		147218		2025-11-20	46603	35	GT Environmental - Reece McCann	BWN	D37-1.40-1.50	111981094	1.4-1.5
		147218		2025-11-20	46603	17	GT Environmental - Reece McCann	BWN	D37-1.70-1.80	111981095	1.7-1.8
		147218		2025-11-20	46603	2	GT Environmental - Reece McCann	BWN	D44-1.10-1.20	111980909	1.1-1.2
		147218		2025-11-20	46603	39	GT Environmental - Reece McCann	BWN	D59-1.10-1.20	111980933	1.1-1.2
		147218		2025-11-20	46603	33	GT Environmental - Reece McCann	BWN	D59-1.40-1.50	111980934	1.4-1.5
		147218		2025-11-20	46603	27	GT Environmental - Reece McCann	BWN	D59-1.70-1.80	111980935	1.7-1.8

			TMs-004A	TMs-004B4	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E
Postcode	Transect GPS Start	Transect GPS Finish	pH 1:5 water	pH CaCl2 (following 4A1)	Calcium (Ca) - NH4Cl/BaCl2	Magnesium (Mg) - NH4Cl/BaCl2	Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Calcium (Ca) - NH4Cl/BaCl2	Magnesium (Mg) - NH4Cl/BaCl2
			pH units	pH units	mg/kg	mg/kg	mg/kg	mg/kg	cmol/kg	cmol/kg
4120	N/A	N/A	6.01	5.26	2010	1140	103	2040	10	9.39
4120	N/A	N/A	6.08	5.27	1970	1150	100	1860	9.82	9.44
4120	N/A	N/A	5.71	5	1840	1120	109	2120	9.2	9.23
4120	N/A	N/A	8.67	8.09	2160	1010	247	797	10.8	8.28
4120	N/A	N/A	8.66	8.15	2190	1190	262	1100	10.9	9.78
4120	N/A	N/A	8.46	8.04	2090	1210	286	1140	10.4	10
4120	N/A	N/A	8.5	7.91	3360	1060	132	1630	16.8	8.7
4120	N/A	N/A	8.99	8.18	3000	992	91	1590	15	8.16
4120	N/A	N/A	8.99	8.26	2880	1030	82	1660	14.4	8.47
4120	N/A	N/A	8.54	7.72	2610	1110	103	1730	13	9.12
4120	N/A	N/A	9.32	8.36	1430	747	145	814	7.13	6.15
4120	N/A	N/A	9.3	8.31	1610	850	122	1140	8.04	6.99
4120	N/A	N/A	9.3	8.39	1490	791	142	957	7.46	6.51

TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1
Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Ca:Mg ratio	K:Mg ratio	GTRI	ECR	Calcium (Ca) - prewash alc. pH 8.5 NH4Cl	Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl	Potassium (K) - prewash alc. pH 8.5 NH4Cl	Sodium (Na) - prewash alc. pH 8.5 NH4Cl	Calcium (Ca) - prewash alc. pH 8.5 NH4Cl
cmol/kg	cmol/kg				%	mg/kg	mg/kg	mg/kg	mg/kg	cmol/kg
0.263	8.89	1.1	<0.05		32	2020	1010	101	940	10.1
0.254	8.1	1	<0.05		30	2040	1050	109	956	10.2
0.278	9.21	1	<0.05		34	1940	1080	108	981	9.66
0.632	3.47	1.3	0.08		18	1990	1130	283	91.7	9.95
0.671	4.78	1.1	0.07		21	2020	1260	298	169	10.1
0.73	4.95	1	0.07		22	1910	1280	331	137	9.53
0.337	7.11	1.9	<0.05		23	3620	1170	135	563	18
0.233	6.91	1.8	<0.05		24	3170	1110	91.4	601	15.8
0.21	7.24	1.7	<0.05		25	3050	1220	89.6	787	15.2
0.264	7.52	1.4	<0.05		26	2700	1170	98.8	834	13.5
0.37	3.54	1.2	0.06		23	1430	820	165	95.4	7.14
0.313	4.98	1.2	<0.05		26	1680	976	130	123	8.36
0.363	4.16	1.1	0.06		24	1500	826	154	95.4	7.49

TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015G	TMs-015G	TMs-015G	TMs-Cal02
Magnesium (Mg) - prewash alc. pH 8.5 NH4Cl	Potassium (K) - prewash alc. pH 8.5 NH4Cl	Sodium (Na) - prewash alc. pH 8.5 NH4Cl	Ca:Mg ratio	K:Mg ratio	GTRI	ECR	Exchangeable acidity	Exchangeable aluminium	Exchangeable hydrogen	ECEC
cmol/kg	cmol/kg	cmol/kg				%	cmol/kg	cmol/kg	cmol/kg	cmol/kg
8.28	0.258	4.09	1.2	<0.05		19	<0.02	<0.02	<0.02	22.7
8.65	0.277	4.16	1.2	<0.05		19	<0.02	<0.02	<0.02	23.2
8.86	0.276	4.27	1.1	<0.05		20	0.62	0.55	0.07	23.7
9.32	0.724	0.399	1.1	0.08		5.5	<0.02	<0.02	<0.02	20.4
10.4	0.762	0.735	1	0.07		6.8	<0.02	<0.02	<0.02	22
10.5	0.846	0.598	0.9	0.08		6.7	<0.02	<0.02	<0.02	21.5
9.62	0.346	2.45	1.9	<0.05		9.2	<0.02	<0.02	<0.02	30.5
9.09	0.234	2.61	1.7	<0.05		10	<0.02	<0.02	<0.02	27.8
10.1	0.229	3.42	1.5	<0.05		13	<0.02	<0.02	<0.02	28.9
9.66	0.253	3.63	1.4	<0.05		14	<0.02	<0.02	<0.02	27
6.74	0.423	0.415	1.1	0.06		5.7	<0.02	<0.02	<0.02	14.7
8.03	0.333	0.536	1	<0.05		5	<0.02	<0.02	<0.02	17.3
6.79	0.395	0.415	1.1	0.06		5.4	<0.02	<0.02	<0.02	15.1

TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-005	TMs-003	TMs-003	TMs-002A1	TMs-002A1
Calcium	Magnesium	Potassium	Sodium	Aluminium	Hydrogen	Chloride	Salinity EC 1:5	TDS	% Air-dry Moisture Content	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)
%	%	%	%	%	%	mg/kg	dS/m	mg/L	% of dry wt	g/g
44.4	36.5	1.1	18	0	0	1400	0.92	590	2.7	0.0265
43.7	37.2	1.2	18	0	0	1500	0.95	610	3.3	0.0334
40.8	37.4	1.2	18	2.3	0.3	1400	0.92	590	3.1	0.0312
48.8	45.7	3.6	2	0	0	740	0.71	450	1.9	0.0185
45.8	47.4	3.5	3.3	0	0	1000	0.89	570	2.3	0.0232
44.3	49	3.9	2.8	0	0	1300	1.1	700	2.2	0.0217
59.2	31.6	1.1	8	0	0	1400	1	640	2.9	0.0285
57	32.7	0.8	9.4	0	0	960	0.81	520	3.2	0.0317
52.6	34.8	0.8	12	0	0	990	0.81	520	3.3	0.0328
49.9	35.7	0.9	13	0	0	860	0.68	430	2.9	0.0287
48.5	45.8	2.9	2.8	0	0	370	0.48	300	1.5	0.0153
48.4	46.5	1.9	3.1	0	0	670	0.69	440	1.7	0.0167
49.6	45	2.6	2.7	0	0	460	0.55	350	1.5	0.0145

ESSA /EAL(NATA,ASPAC)

5 Dunphy St Sunnybank Hills
Qld 4109

Phone: 0403245560

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Reference: **25012835 ESSA25 BWNGTE**

Date Received: 19/11/2025
Date Completed: 27/11/2025

FINAL REPORT

Project: BWN

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: GTE

Contact: Dennis Baker

Sample Type: Soil

Number of samples: 138 of 140 BWN

ESSA (EAL)Pty Ltd

Soil Analysis Report

Batch Number: 25012835 ESSA237346

Date Received: 19/11/2025

Date Completed: 27/11/2025

Client: GTE BWN (25)

Report ID	E25-01-2835_EALP1_1								
Client Sample ID:			D1-0.00-0.10	D1-0.20-0.30	D1-0.50-0.60	D5-0.00-0.10	D5-0.20-0.30	D5-0.50-0.60	D6-0.00-0.10
EAL Sample ID:			E25-01-2835-0001	E25-01-2835-0002	E25-01-2835-0003	E25-01-2835-0004	E25-01-2835-0005	E25-01-2835-0006	E25-01-2835-0011
Moisture (dry basis)	%	---	3.01	3.17	2.09	3.4	4.13	3.33	1.54
Moisture 105Â°C (dry basis)	%	<0.1	10.1	12.5	8.1	11.7	15.1	13.3	3.5
Texture (ISSS Classification)	---	---	Clay	Clay	Silty Clay Loam	Clay	Clay	Clay	Clay
Gravel > 2 mm fraction	% of whole sample	<0.1	1.5	0.8	57.4	< 0.1	< 0.1	4.3	< 0.1
Sand > 20 µm fraction	% < 2 mm fraction	<0.1	40.8	30.2	43.3	38.5	30.8	31.7	48.8
Silt 2-20 µm fraction	% < 2 mm fraction	<0.1	14.8	17.9	28.5	10.2	13.5	11.9	15.2
Clay < 2 µm fraction	% < 2 mm fraction	<0.1	44.4	51.9	28.2	51.3	55.8	56.4	36
Moisture 40Â°C (dry basis)	%	<0.1	---	---	---	---	---	---	---
R1 Dispersion Ratio	---	---	0.4	0.66	0.35	0.44	0.51	0.44	0.39
Emerson Aggregate Test - Class	---	---	4	3	2	2	2	2	3

D6-0.20-0.30	D6-0.50-0.60	D6-0.80-0.90	D6-1.10-1.20	D7-0.00-0.10	D7-0.20-0.30	D7-0.50-0.60	D12m-0.00-0.10	D12m-0.20-0.30	D12m-0.50-0.60	D12m-0.80-0.90
E25-01-2835-0012	E25-01-2835-0013	E25-01-2835-001	E25-01-2835-0015	E25-01-2835-0016	E25-01-2835-001	E25-01-2835-0018	E25-01-2835-0019	E25-01-2835-0020	E25-01-2835-0021	E25-01-2835-0022
3.17	2.94	1.44	2.15	3.35	2.84	2.69	2.63	2.69	2.98	2.79
15.5	16.2	5.8	7.4	8.6	12.6	13.4	7.2	12.2	14.1	12.2
Clay	Clay	Clay	Clay Loam	Clay	Clay	Clay	Clay	Clay	Clay	Clay
0.3	1.1	47.4	0.3	2.1	9.4	20	0.8	< 0.1	0.2	9
32.2	36.2	43.8	50.3	31.9	30.2	28.2	31	24	24.1	25.2
9	10.7	15.7	18.3	16.8	14.6	16.5	13	16.6	15.7	15.8
58.8	53.1	40.5	31.4	51.3	55.2	55.3	56	59.4	60.2	59.1
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0.54	0.6	0.69	0.5	0.26	0.57	0.77	0.42	0.65	0.69	0.69
3	3	2	2	4	2	2	4	2	2	2

D12m-1.10-1.20	D12m-1.40-1.50	D12m-1.70-1.80	D12d-0.00-0.10	D12d-0.20-0.30	D12d-0.50-0.60	D12d-0.80-0.90	D12d-1.10-1.20	D12d-1.40-1.50	D12d-1.70-1.80
E25-01-2835-0023	E25-01-2835-0024	E25-01-2835-0025	E25-01-2835-0026	E25-01-2835-0027	E25-01-2835-0028	E25-01-2835-0029	E25-01-2835-0030	E25-01-2835-0031	E25-01-2835-0032
3.6	3.16	3.81	2.39	2.57	2.61	2.47	2.37	2.74	2.73
14.1	14.2	14.5	4.7	10.6	11.3	11.1	11.9	11.7	10.6
Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
18.1	17.9	2.8	7	8.9	5	0.7	0.4	1.6	3.3
25.1	23	25.2	39.7	35.7	34.4	39.5	36.8	34.1	30.2
16.7	15.8	13.9	13.1	12.3	13.4	10.3	11.4	13.6	13.7
58.2	61.2	60.9	47.3	52.1	52.2	50.2	51.8	52.3	56.1
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0.66	0.71	0.78	0.43	0.69	0.68	0.71	0.72	0.69	0.68
2	2	2	2	2	2	2	2	2	2

D14d-0.00-0.10	D14d-0.20-0.30	D14d-0.50-0.60	D14d-0.80-0.90	D14d-1.10-1.20	D14d-1.30-1.40	D14m-0.00-0.10	D14m-0.20-0.30	D14m-0.50-0.60	D14m-0.80-0.90
E25-01-2835-0033	E25-01-2835-0034	E25-01-2835-0035	E25-01-2835-0036	E25-01-2835-0037	E25-01-2835-0038	E25-01-2835-0039	E25-01-2835-0040	E25-01-2835-0041	E25-01-2835-0042
2.54	2.66	3.21	2.3	2.39	2.25	2.48	2.33	1.88	3.14
5.7	6.9	12.9	8.7	8.9	10	4.8	8.2	8.1	13.7
Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
0.3	7.6	11.8	6.9	8.7	9.5	0.3	0.9	7.2	0.2
41.5	36.1	23.9	44.2	43.2	39.8	33.6	32.3	47.7	25.4
13.8	11.7	16.2	11.4	11.6	19.5	19.9	17.5	11.4	16.2
44.7	52.3	60	44.4	45.2	40.7	46.6	50.2	41	58.4
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0.48	0.6	0.53	0.67	0.73	0.61	0.38	0.35	0.61	0.7
3	2	2	2	2	2	3	3	2	2

D14m-1.10-1.20	D14m-1.40-1.50	D14m-1.70-1.80	D19-0.00-0.05	D19-0.20-0.30	D19-0.40-0.50	D19-0.50-0.60	D19-0.80-0.90	D21-0.00-0.10	D21-0.20-0.30
E25-01-2835-0043	E25-01-2835-0044	E25-01-2835-0045	E25-01-2835-0046	E25-01-2835-0047	E25-01-2835-0048	E25-01-2835-0049	E25-01-2835-0050	E25-01-2835-0051	E25-01-2835-0052
3.25	2.97	3.23	2.3	2.49	1.82	2.04	1.68	2.69	2.74
14.7	13.1	15	5.9	7.7	6.4	8.3	6.6	3.7	11.3
Clay	Clay	Clay	Clay	Clay	Clay Loam	Clay Loam	Clay Loam	Clay	Clay
10.2	9	19.4	0.5	9.5	0.3	6.6	56.7	0.9	6.4
23.7	49.2	23	33.6	39.2	45.8	44.3	40.9	36.8	22.7
15.7	11.5	15.3	18.8	19.1	22.4	23	21.9	22.5	18.3
60.6	39.3	61.7	47.7	41.7	31.8	32.8	37.2	40.8	59
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0.76	0.99	0.79	0.43	0.44	0.44	0.52	0.51	0.37	0.63
2	2	2	3	3	2	2	2	4	3

D21-0.50-0.60	D21-0.80-0.90	D21-1.10-1.20	D21-1.40-1.50	D21-1.70-1.80	D24-0.00-0.10	D24-0.20-0.30	D24-0.50-0.60	D24-0.80-0.90	D36-0.00-0.10
E25-01-2835-0053	E25-01-2835-0054	E25-01-2835-0055	E25-01-2835-0056	E25-01-2835-0057	E25-01-2835-0058	E25-01-2835-0059	E25-01-2835-0060	E25-01-2835-0061	E25-01-2835-0062
2.66	2.86	2.73	2.52	2.61	1.1	2.37	2.14	1.9	1.83
10.7	12.6	12.6	11.8	11.1	2.8	12.8	10.7	9.4	5.8
Clay	Clay	Clay	Silty Clay	Clay	Clay Loam	Clay	Clay	Clay Loam	Clay
6.7	18.8	18	3.2	43.1	1.1	1.1	1.1	21	7.2
22.1	25.1	20.6	13.3	34.3	68.3	36.1	39.8	46.8	55.5
17	16.3	20.2	27.1	17.9	10	13.3	16.3	17.3	3.3
60.9	58.6	59.3	59.6	47.8	21.7	50.6	43.9	35.9	41.2
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0.7	0.75	0.68	0.72	0.65	0.47	0.43	0.65	0.56	0.24
2	2	2	2	2	3	2	2	2	3

D36-0.20-0.30	D36-0.50-0.60	D36-0.80-0.90	D36-1.10-1.20	D36-1.40-1.50	D36-1.70-1.80	D39-0.00-0.10	D39-0.20-0.30	D39-0.50-0.60	D39-0.80-0.90
E25-01-2835-0063	E25-01-2835-0064	E25-01-2835-0065	E25-01-2835-0066	E25-01-2835-0067	E25-01-2835-0068	E25-01-2835-0069	E25-01-2835-0070	E25-01-2835-0071	E25-01-2835-0072
2.46	2.07	1.72	1.73	1.4	1.08	2.22	2.26	1.73	2.23
9.7	8.6	7.4	7.9	6.1	5	6.4	8.3	8.1	9.4
Clay	Clay	Clay	Sandy Clay	Sandy Clay Loam	Sandy Loam	Clay	Clay	Clay	Clay
5.5	6.1	10.2	48.8	5.5	13	3.7	0.5	20.4	43.1
49.4	49.4	52.7	62.7	63.5	78.4	43.3	40.9	56.2	34.6
4.4	7.3	8.6	4	5.8	4.1	10.1	12	9.9	22.7
46.3	43.4	38.7	33.3	30.7	17.5	46.6	47.2	33.9	42.8
---	---	---	---	---	---	---	---	---	---
0.26	0.35	0.37	0.59	0.57	0.38	0.26	0.22	0.54	0.67
4	4	4	4	2	2	3	4	4	2

D39-1.10-1.20	D43-0.00-0.10	D43-0.10-0.20	D43-0.20-0.30	D45-0.00-0.10	D45-0.20-0.30	D45-0.50-0.60	D45-0.80-0.90	D45-1.10-1.20	D45-1.40-1.50	D45-1.70-1.80
E25-01-2835-0073	E25-01-2835-007	E25-01-2835-0075	E25-01-2835-0076	E25-01-2835-0077	E25-01-2835-0078	E25-01-2835-0079	E25-01-2835-0080	E25-01-2835-0081	E25-01-2835-0082	E25-01-2835-0083
2.18	1.62	2.75	2.8	1.57	2.21	2.66	2.7	2.69	2.77	2.29
9.6	5.9	10.9	11	6.4	10.4	11.5	12.1	13.6	13.6	12.3
Silty Clay Loam	Clay Loam	Clay	Clay	Clay Loam	Clay	Clay	Clay	Clay	Clay	Clay
55.5	1.9	6.8	1.3	0.8	0.2	43.6	10.1	< 0.1	4.8	1.9
31.6	57.7	34.8	36.9	52.6	35.1	29.9	23.5	26.7	26.3	32
28.7	14.8	13.9	11.6	16.4	20.3	18.2	20.3	19.4	22.4	19.4
39.7	27.5	51.3	51.5	31	44.6	51.9	56.3	53.9	51.3	48.6
---	---	---	---	---	---	---	---	---	---	---
0.64	0.59	0.63	0.65	0.49	0.33	0.31	0.35	0.53	0.56	0.61
2	2	2	2	3	4	4	4	2	2	2

D52-0.00-0.10	D52-0.20-0.30	D52-0.50-0.60	D52-0.80-0.90	D52-1.10-1.20	D52-1.40-1.50	D52-1.70-1.80	D58-0.00-0.10	D58-0.20-0.30	D58-0.50-0.60	D58-0.70-0.80
E25-01-2835-0084	E25-01-2835-0085	E25-01-2835-0086	E25-01-2835-0087	E25-01-2835-0088	E25-01-2835-0089	E25-01-2835-0090	E25-01-2835-0091	E25-01-2835-0092	E25-01-2835-0093	E25-01-2835-0094
1.34	1.49	1.31	1.68	1.92	2.07	1.58	2.35	3.08	1.78	1.68
6.5	6.4	6.4	6	7.4	7.2	6.6	10.4	10.3	8.9	8.5
Clay	Sandy Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay
2.7	1.9	4.2	16.5	18.1	19.3	3.9	1	0.5	0.7	3
61.3	62.4	54.6	54	46.6	51.7	54.7	42.2	42.1	48.3	56.1
7.1	5.6	11.5	10.9	13.5	11.5	10.3	14.7	14.7	10	7.3
31.7	32	34	35.2	39.9	36.8	35.1	43.1	43.2	41.7	36.7
---	---	---	---	---	---	---	---	---	---	---
0.32	0.39	0.62	0.66	0.72	0.72	0.63	0.35	0.55	0.51	0.62
3	4	4	2	2	2	2	3	2	3	2

D65-0.00-0.05	D65-0.10-0.20	D65-0.20-0.30	D65-0.50-0.60	D65-0.80-0.90	D3-0.00-0.10	D3-0.20-0.30	D3-0.50-0.60	D3-0.70-0.80	D3-0.90-1.00	D22-0.00-0.10
E25-01-2835-0095	E25-01-2835-0096	E25-01-2835-0097	E25-01-2835-009	E25-01-2835-0099	E25-01-2835-0100	E25-01-2835-0101	E25-01-2835-0102	E25-01-2835-0103	E25-01-2835-0104	E25-01-2835-0105
0.298	0.288	0.472	1.19	1.27	5.75	5.67	8.57	8.4	4.62	5.95
4.4	2.3	3.4	7.1	7.1	---	---	---	---	---	---
Sandy Loam	Sandy Loam	Sandy Loam	Sandy Clay	Sandy Clay Loam	Clay Loam	Clay	Clay	Clay	Clay Loam	Clay
3	2.2	10.4	2	4	2.4	1	53.7	45.7	87.1	2
85.7	86.1	78.7	64.3	68.2	51.6	47.9	24.9	31	58.7	34.4
3.9	3.6	3.9	4.4	6.8	21.4	15.2	18.1	10.7	12.4	16.9
10.4	10.3	17.4	31.3	25	27	36.9	57	58.3	29	48.8
---	---	---	---	---	2.9	5.1	7	6.3	3.3	0.3
0.32	0.43	0.49	0.61	0.59	0.31	0.31	0.27	0.37	0.57	0.35
3	3	3	2	4	---	---	---	---	---	---

D22-0.20-0.30	D22-0.50-0.60	D22-0.80-0.90	D22-1.00-1.10	D22-1.30-1.40	D22-1.60-1.70	D32-0.00-0.10	D32-0.20-0.30	D32-0.50-0.60	D32-0.80-0.90	D32-1.10-1.20
E25-01-2835-0106	E25-01-2835-0107	E25-01-2835-0108	E25-01-2835-0109	E25-01-2835-0110	E25-01-2835-0111	E25-01-2835-0112	E25-01-2835-0113	E25-01-2835-0114	E25-01-2835-0115	E25-01-2835-0116
7.12	7.25	6.23	2.56	2.23	2.11	2.65	4.36	3.97	4.18	1.57
---	---	---	9.4	9.7	8.7	---	---	---	---	9.3
Clay	Clay	Clay	Clay	Clay	Silty Clay Loam	Loam	Clay	Clay	Clay	Clay
18.2	84.1	27.3	< 0.1	49.7	0.4	< 0.1	11.2	7.5	23.6	13.2
25.6	27.9	36.3	36.5	39.7	32.8	68.6	56.5	58.5	54.9	49.1
16.4	15	19.8	22.6	18.4	28	11.6	8.4	8.5	9.8	13.2
58	57.1	43.9	41	42	39.2	19.8	35.1	33	35.3	37.7
3.4	7.6	6.6	---	---	---	1.5	5	3.6	5	---
0.37	0.61	0.59	0.51	0.59	0.42	0.38	0.64	0.48	0.57	0.59
---	---	---	2	2	2	---	---	---	---	4

D32-1.40-1.50	D32-1.70-1.80	D37-0.00-0.10	D37-0.20-0.30	D37-0.50-0.60	D37-0.80-0.90	D37-1.10-1.20	D37-1.40-1.50	D37-1.70-1.80	D44-0.00-0.10	D44-0.10-0.20
E25-01-2835-0117	E25-01-2835-0118	E25-01-2835-0119	E25-01-2835-0120	E25-01-2835-0121	E25-01-2835-0122	E25-01-2835-0123	E25-01-2835-0124	E25-01-2835-0125	E25-01-2835-0126	E25-01-2835-0127
1.86	1.8	7.97	8.2	7.92	7.77	3.6	2.73	2.53	3.77	4.78
10.2	9.4	---	---	---	---	12	8.2	9.5	---	---
Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay	Clay Loam	Clay
50.9	7.8	17.7	32.3	< 0.1	2.7	5.6	8.6	66.4	2.5	11
43.6	43.5	30.1	27.7	29.4	29.9	36.6	49.5	46.1	55.7	50.9
14.5	16.4	16.3	14.1	14.3	10.4	13.3	13.7	14.4	16.9	13.8
41.9	40.1	53.6	58.2	56.3	59.8	50.2	36.8	39.5	27.5	35.4
---	---	---	---	---	---	---	---	---	1.9	3.9
0.57	0.5	0.29	0.49	0.49	0.44	0.52	0.52	0.47	0.37	0.3
2	2	---	---	---	---	3	2	2	---	---

D44-0.20-0.30	D44-0.50-0.60	D44-0.80-0.90	D44-1.10-1.20	D59-0.00-0.10	D59-0.20-0.30	D59-0.50-0.60	D59-0.80-0.90	D59-1.10-1.20	D59-1.40-1.50	D59-1.70-1.80
E25-01-2835-0128	E25-01-2835-0129	E25-01-2835-0130	E25-01-2835-0131	E25-01-2835-0132	E25-01-2835-0133	E25-01-2835-0134	E25-01-2835-0135	E25-01-2835-0136	E25-01-2835-0137	E25-01-2835-0138
7.9	7.5	6.24	2.79	1.18	1.11	4.54	4.41	1.11	1.37	1.17
---	---	---	10.8	---	---	---	---	7.4	7.4	7.6
Clay	Clay	Clay	Clay	Sandy Loam	Sandy Loam	Sandy Clay	Clay	Sandy Clay	Clay	Clay
20.9	4.7	13.4	11.7	4.7	5.7	2	6.4	23.3	29.3	19.5
30.7	33.1	37.2	39.6	87.5	83.5	57.5	57.5	64.9	57	58.1
9.3	9.3	9.2	10.5	2	5.1	3.4	4.8	2.8	8	4.9
60	57.6	53.7	50	10.4	11.4	39.1	37.8	32.3	35	37
9.5	8.5	9.3	---	2.4	1.5	6.1	6.4	---	---	---
0.46	0.6	0.67	0.74	0.44	0.42	0.69	0.68	0.69	0.73	0.68
---	---	---	2	---	---	---	---	2	2	2

ESSA Pty Ltd/ EAL NATA ASPAC

METHOD DESCRIPTIONS

Soil

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCl extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric
OC	8B1	9.7	0.02	%	Organic Carbon	Walkley & Black, (H2SO4/K2Cr2O7), titr.
Ca (Neut)	15A1	10.3	0.10	meq/100g	Exchangeable calcium	1M NH4Cl @ pH 7.0 shake, AAS
Mg (Neut)	15A1	6.6	0.10	meq/100g	Exchangeable magnesium	1M NH4Cl @ pH 7.0 shake, AAS
Na (Neut)	15A1	7.3	0.03	meq/100g	Exchangeable sodium	1M NH4Cl @ pH 7.0 shake, AAS
K (Neut)	15A1	3.9	0.02	meq/100g	Exchangeable potassium	1M NH4Cl @ pH 7.0 shake, AAS
ECEC	15J1	5.0	1	meq/100g	Effective cation ex.capacity	Sum of exchangeable cations
ESP	15N1	5.0	3	%	Exchangeable Na%	(Exchangeable Na/sum of exch.cations)%
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric
(-) 15Bar					Moisture	Pressure Plate

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992 /2011)**

For Manager **D E Baker BSc CPSS**
Analytical Services: _____

Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
Soluble Salts included in Exchangeable Cations - Except PRE-WASHED (if EC>0.3dS/m).

Lab Accrediation for M4626
ASPAC

Director and Principal Soil Scientist – ESSA Pty Ltd



ity
Adjunct Professional Fellow Southern Cross University
Chief Soil Chemistry Trainer Soil Science Australia (National & Qld)
Hon. Life Member Soil Science Australia (National & Qld)
Certified Professional Practicing Soil Scientist CPSS

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
Ca (Alc)	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Mg (Alc)	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Na (Alc)	15C1	9.6	0.09	meq/100g	Exchangeable sodium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
K (Alc)	15C1	4.8	0.02	meq/100g	Exchangeable potassium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Al	15G1	NA	NA	meq/100g	Exchangeable Aluminium	Exch. Hydrogen and Aluminium by 1M KCl
H+	15G1	NA	NA	meq/100g	Exchangeable Acidity	Exch. Hydrogen and Aluminium by 1M KCl
15 Bar		NA	NA		15 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C
1/3 Bar		NA	NA		15 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager
Analytical Services: _____

QUALITY CONTROL DATA

Reference 25012835

Soil

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

Test Method	Units		Actual Value	Acceptance Criteria [Range]
pH	pH	r118		9.7 - 10.1
EC	dS/m	r118		.301 - .334
Cl	mg/kg	r118		28 -40
NO3-N	mg/kg	rv		3 - 8
NH4-N	mg/kg	B		80-96
Olsen P	mg/kg	rv		15 - 20
Total Kjeldahl N	%	32-13		.329 - .485
Total P	%	aspac 111		.040 - .052
Organic Carbon	%	rv		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	B		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	B		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	B		.057 - .182
K (Exch. cations)pH7	meq/100g	B		1.21 - 1.41
Exch. Acidity	meq/100g			NA
ECEC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	RD		29 -33
Fine Sand	%	RD		27 - 32
Silt	%	RD		10 - 16
Clay	%	RD		21 - 29
R1		RD		.38 - .57

Test Method	Units	Test Soil	Actual Value	Acceptance Criteria [Range]
DTPA-Cu	mg/kg	112-09		1.52 - 1.82
DTPA-Zn	mg/kg	112-09		1.25 - 1.45
DTPA-Mn	mg/kg	112-09		148 - 178
DTPA-Fe	mg/kg	112-09		7.9 - 13.2
Suflate-sulfur	mg/kg	B		5 - 12
ADMC	%			NA
15 Bar	%	G	29, 29, 30, 31	23 - 32
0.33 Bar	%	G		36 - 52
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 37.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.6 - 26.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

ESSA /DETSI(NATA)

5 Dunphy St Sunnybank Hills
Qld 4109

Phone: 0403245560

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Date Received: 19/11/2025
Date Completed: 15/01/2026

FINAL REPORT

Project: BWN (15 Bar)

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: GTE

Contact: Dennis Baker

Sample Type: Soil

Number of samples: 138 Selected of 140

ESSA (DETSI)Pty Ltd

Soil Analysis Report

Reference: DESTI 0886 **Ex 2501 2835**

Reported 15/01/2026

Client: GTE

Soil Analysis Report

Job No: 25-0886

Report ID: 25-0886-F-V1

Sample No	Customer's ID	Site ID	Project ID	S_15_BAR 15 Bar %
25-0886-0001	D1-0.00-0.10		BWNSAMPLESVIAEALLISM	20.3
25-0886-0002	D1-0.20-0.30		BWNSAMPLESVIAEALLISM	22.7
25-0886-0003	D1-0.50-0.60		BWNSAMPLESVIAEALLISM	15.1
25-0886-0004	D5-0.00-0.10		BWNSAMPLESVIAEALLISM	25.8
25-0886-0005	D5-0.20-0.30		BWNSAMPLESVIAEALLISM	28.2
25-0886-0006	D5-0.50-0.60		BWNSAMPLESVIAEALLISM	27.3
25-0886-0007	D5-0.80-0.90		BWNSAMPLESVIAEALLISM	26.8
25-0886-0008	D5-1.10-1.20		BWNSAMPLESVIAEALLISM	27.1
25-0886-0009	D5-1.40-1.50		BWNSAMPLESVIAEALLISM	28.2
25-0886-0010	D5-1.70-1.80		BWNSAMPLESVIAEALLISM	29.9
25-0886-0011	D6-0.00-0.10		BWNSAMPLESVIAEALLISM	27.2
25-0886-0012	D6-0.20-0.30		BWNSAMPLESVIAEALLISM	26.4
25-0886-0013	D6-0.50-0.60		BWNSAMPLESVIAEALLISM	24.9
25-0886-0014	D6-0.80-0.90		BWNSAMPLESVIAEALLISM	17.4
25-0886-0015	D6-1.10-1.20		BWNSAMPLESVIAEALLISM	22.9
25-0886-0016	D7-0.00-0.10		BWNSAMPLESVIAEALLISM	20.9
25-0886-0017	D7-0.20-0.30		BWNSAMPLESVIAEALLISM	21.9
25-0886-0018	D7-0.50-0.60		BWNSAMPLESVIAEALLISM	22.8
25-0886-0019	D12m-0.00-0.10		BWNSAMPLESVIAEALLISM	21.3
25-0886-0020	D12m-0.20-0.30		BWNSAMPLESVIAEALLISM	23.5
25-0886-0021	D12m-0.50-0.60		BWNSAMPLESVIAEALLISM	23.2
25-0886-0022	D12m-0.80-0.90		BWNSAMPLESVIAEALLISM	23.5
25-0886-0023	D12m-1.10-1.20		BWNSAMPLESVIAEALLISM	23.2
25-0886-0024	D12m-1.40-1.50		BWNSAMPLESVIAEALLISM	23.4
25-0886-0025	D12m-1.70-1.80		BWNSAMPLESVIAEALLISM	24.1
25-0886-0026	D12d-0.00-0.10		BWNSAMPLESVIAEALLISM	18.5
25-0886-0027	D12d-0.20-0.30		BWNSAMPLESVIAEALLISM	21
25-0886-0028	D12d-0.50-0.60		BWNSAMPLESVIAEALLISM	21.2
25-0886-0029	D12d-0.80-0.90		BWNSAMPLESVIAEALLISM	24.2
25-0886-0030	D12d-1.10-1.20		BWNSAMPLESVIAEALLISM	24.5
25-0886-0031	D12d-1.40-1.50		BWNSAMPLESVIAEALLISM	23.8
25-0886-0032	D12d-1.70-1.80		BWNSAMPLESVIAEALLISM	25.1
25-0886-0033	D14d-0.00-0.10		BWNSAMPLESVIAEALLISM	21.2
25-0886-0034	D14d-0.20-0.30		BWNSAMPLESVIAEALLISM	22.8
25-0886-0035	D14d-0.50-0.60		BWNSAMPLESVIAEALLISM	25.3
25-0886-0036	D14d-0.80-0.90		BWNSAMPLESVIAEALLISM	20.6
25-0886-0037	D14d-1.10-1.20		BWNSAMPLESVIAEALLISM	21
25-0886-0038	D14d-1.30-1.40		BWNSAMPLESVIAEALLISM	17.4
25-0886-0039	D14m-0.00-0.10		BWNSAMPLESVIAEALLISM	20.9
25-0886-0040	D14m-0.20-0.30		BWNSAMPLESVIAEALLISM	14.1
25-0886-0041	D14m-0.50-0.60		BWNSAMPLESVIAEALLISM	18.3
25-0886-0042	D14m-0.80-0.90		BWNSAMPLESVIAEALLISM	27.8
25-0886-0043	D14m-1.10-1.20		BWNSAMPLESVIAEALLISM	24.1
25-0886-0044	D14m-1.40-1.50		BWNSAMPLESVIAEALLISM	24
25-0886-0045	D14m-1.70-1.80		BWNSAMPLESVIAEALLISM	24.9
25-0886-0046	D19-0.00-0.05		BWNSAMPLESVIAEALLISM	19.3
25-0886-0047	D19-0.20-0.30		BWNSAMPLESVIAEALLISM	17.4
25-0886-0048	D19-0.40-0.50		BWNSAMPLESVIAEALLISM	13.3
25-0886-0049	D19-0.50-0.60		BWNSAMPLESVIAEALLISM	16.1

25-0886-0050	**D19-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	14
25-0886-0051	**D21-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	20.9
25-0886-0052	**D21-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	22.9
25-0886-0053	**D21-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	22.9
25-0886-0054	**D21-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	23.7
25-0886-0055	**D21-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	22.6
25-0886-0056	**D21-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	22.2
25-0886-0057	**D21-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	16.9
25-0886-0058	**D24-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	12.8
25-0886-0059	**D24-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	17.5
25-0886-0060	**D24-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	19.7
25-0886-0061	**D24-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	18.5
25-0886-0062	**D36-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	18.7
25-0886-0063	**D36-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	19.9
25-0886-0064	**D36-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	12.9
25-0886-0065	**D36-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	17.8
25-0886-0066	**D36-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	14.3
25-0886-0067	**D36-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	15.2
25-0886-0068	**D36-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	9.1
25-0886-0069	**D39-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	19.5
25-0886-0070	**D39-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	19.2
25-0886-0071	**D39-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	15.3
25-0886-0072	**D39-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	21.7
25-0886-0073	**D39-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	22.8
25-0886-0074	**D43-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	15.5
25-0886-0075	**D43-0.10-0.20**	**BWNSAMPLESVIAEALLISM**	22.7
25-0886-0076	**D43-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	21.6
25-0886-0077	**D45-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	16.9
25-0886-0078	**D45-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	20.2
25-0886-0079	**D45-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	22.8
25-0886-0080	**D45-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	23.6
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25-0886-0082	**D45-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	25.3
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25-0886-0085	**D52-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	13.6
25-0886-0086	**D52-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	15
25-0886-0087	**D52-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	15.2
25-0886-0088	**D52-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	15.4
25-0886-0089	**D52-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	14.3
25-0886-0090	**D52-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	13.7
25-0886-0091	**D58-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	20.9
25-0886-0092	**D58-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	22.7
25-0886-0093	**D58-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	18.4
25-0886-0094	**D58-0.70-0.80**	**BWNSAMPLESVIAEALLISM**	18.1
25-0886-0095	**D65-0.00-0.05**	**BWNSAMPLESVIAEALLISM**	4.7
25-0886-0096	**D65-0.10-0.20**	**BWNSAMPLESVIAEALLISM**	4.2
25-0886-0097	**D65-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	7.7
25-0886-0098	**D65-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	14
25-0886-0099	**D65-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	11.4
25-0886-0100	**D3-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	19.5
25-0886-0101	**D3-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	18.1
25-0886-0102	**D3-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	23.4
25-0886-0103	**D3-0.70-0.80**	**BWNSAMPLESVIAEALLISM**	22.4
25-0886-0104	**D3-0.90-1.00**	**BWNSAMPLESVIAEALLISM**	12.4
25-0886-0105	**D22-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	20.4
25-0886-0106	**D22-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	20.9
25-0886-0107	**D22-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	21.5
25-0886-0108	**D22-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	18.9
25-0886-0109	**D22-1.00-1.10**	**BWNSAMPLESVIAEALLISM**	18.3
25-0886-0110	**D22-1.30-1.40**	**BWNSAMPLESVIAEALLISM**	18.5
25-0886-0111	**D22-1.60-1.70**	**BWNSAMPLESVIAEALLISM**	17.8
25-0886-0112	**D32-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	8.5
25-0886-0113	**D32-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	14.5
25-0886-0114	**D32-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	12.9
25-0886-0115	**D32-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	13.3
25-0886-0116	**D32-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	15.5

25-0886-0117	**D32-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	17.9
25-0886-0118	**D32-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	15.5
25-0886-0119	**D37-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	16.2
25-0886-0120	**D37-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	23.4
25-0886-0121	**D37-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	23.5
25-0886-0122	**D37-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	20.8
25-0886-0123	**D37-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	20.1
25-0886-0124	**D37-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	14.2
25-0886-0125	**D37-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	15.9
25-0886-0126	**D44-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	11.3
25-0886-0127	**D44-0.10-0.20**	**BWNSAMPLESVIAEALLISM**	12.7
25-0886-0128	**D44-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	22.8
25-0886-0129	**D44-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	20.1
25-0886-0130	**D44-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	17.9
25-0886-0131	**D44-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	18.2
25-0886-0132	**D59-0.00-0.10**	**BWNSAMPLESVIAEALLISM**	2.7
25-0886-0133	**D59-0.20-0.30**	**BWNSAMPLESVIAEALLISM**	3.4
25-0886-0134	**D59-0.50-0.60**	**BWNSAMPLESVIAEALLISM**	13.5
25-0886-0135	**D59-0.80-0.90**	**BWNSAMPLESVIAEALLISM**	12.4
25-0886-0136	**D59-1.10-1.20**	**BWNSAMPLESVIAEALLISM**	11
25-0886-0137	**D59-1.40-1.50**	**BWNSAMPLESVIAEALLISM**	12.7
25-0886-0138	**D59-1.70-1.80**	**BWNSAMPLESVIAEALLISM**	12.1

This job has been authorized by:

Name: Fred Oudyn

Role: Principal Scientist

NATA

WORLD RECOGNISED ACCREDITATION

ESSA Pty Ltd/ DETSI

METHOD DESCRIPTIONS

Soil

Reference: Reference: DESTI 0886 **Ex 2501 2835**

Methods used to Analyse Samples

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
pH	4A1	1.1	0.1	pH	pH	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
Cl	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCl extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric
OC	8B1	9.7	0.02	%	Organic Carbon	Walkley & Black, (H2SO4/K2Cr2O7), titr.
Ca (Neut)	15A1	10.3	0.10	meq/100g	Exchangeable calcium	1M NH4Cl @ pH 7.0 shake, AAS
Mg (Neut)	15A1	6.6	0.10	meq/100g	Exchangeable magnesium	1M NH4Cl @ pH 7.0 shake, AAS
Na (Neut)	15A1	7.3	0.03	meq/100g	Exchangeable sodium	1M NH4Cl @ pH 7.0 shake, AAS
K (Neut)	15A1	3.9	0.02	meq/100g	Exchangeable potassium	1M NH4Cl @ pH 7.0 shake, AAS
ECEC	15J1	5.0	1	meq/100g	Effective cation ex.capacity	Sum of exchangeable cations
ESP	15N1	5.0	3	%	Exchangeable Na%	(Exchangeable Na/sum of exch.cations)%
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric
15 Bar					Pressure Plate	

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992 /2011)**

For Manager
Analytical Services: **D E Baker BSc MASSSI**

Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia*. CSIRO Publishing: Collingwood.
Soluble Salts included in Exchangeable Cations - Except PRE-WASHED (if EC>0.3dS/m).

Director and Principal Soil Scientist – ESSA Pty Ltd

Adjunct Professional Fellow Southern Cross University
Chief Soil Chemistry Trainer Soil Science Australia (National & Qld)
Hon. Life Member Soil Science Australia (National & Qld)
Certified Professional Practicing Soil Scientist CPSS

Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
Ca (Alc)	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Mg (Alc)	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
Na (Alc)	15C1	9.6	0.09	meq/100g	Exchangeable sodium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
K (Alc)	15C1	4.8	0.02	meq/100g	Exchangeable potassium	1M NH4Cl (alcoholic) @ pH 8.5 leach, AAS
CEC	15I3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Al	15G1	NA	NA	meq/100g	Exchangeable Aluminium	Exch. Hydrogen and Aluminium by 1M KCl
H+	15G1	NA	NA	meq/100g	Exchangeable Acidity	Exch. Hydrogen and Aluminium by 1M KCl
15 Bar		NA	NA		15 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C
1/3 Bar		NA	NA		15 Bar Analysis	Pressure Plate/Gravimetric oven dry @ 105C

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

For Manager
Analytical Services:

ESSA Pty Ltd/DETSI

QUALITY CONTROL DATA

Reference Reference: DESTI 0886 **Ex 2501 2835**

Soil

*** Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)**

Test Method	Units		Actual Value	Acceptance Criteria [Range]
pH	pH	r118		9.7 - 10.1
EC	dS/m	r118		.301 - .334
Cl	mg/kg	r118		28 -40
NO3-N	mg/kg	rv		3 - 8
NH4-N	mg/kg	B		80-96
Olsen P	mg/kg	rv		15 - 20
Total Kjeldahl N	%	32-13		.329 - .485
Total P	%	aspac 111		.040 - .052
Organic Carbon	%	rv		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	B		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	B		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	B		.057 - .182
K (Exch. cations)pH7	meq/100g	B		1.21 - 1.41
Exch. Acidity	meq/100g			NA
ECEC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	RD		29 -33
Fine Sand	%	RD		27 - 32
Silt	%	RD		10 - 16
Clay	%	RD		21 - 29
R1		RD		.38 - .57

Test Method	Units	Test Soil	Actual Value	Acceptance Criteria [Range]
DTPA-Cu	mg/kg	112-09		1.52 - 1.82
DTPA-Zn	mg/kg	112-09		1.25 - 1.45
DTPA-Mn	mg/kg	112-09		148 - 178
DTPA-Fe	mg/kg	112-09		7.9 - 13.2
Suflate-sulfur	mg/kg	B		5 - 12
ADMC	%			NA
15 Bar	%	G	29, 29, 30, 31	23 - 32
0.33 Bar	%	G		36 - 52
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 37.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.6 - 26.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

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Whitehaven

Blackwater North Extension Project

Appendix B
Surface Water Assessment



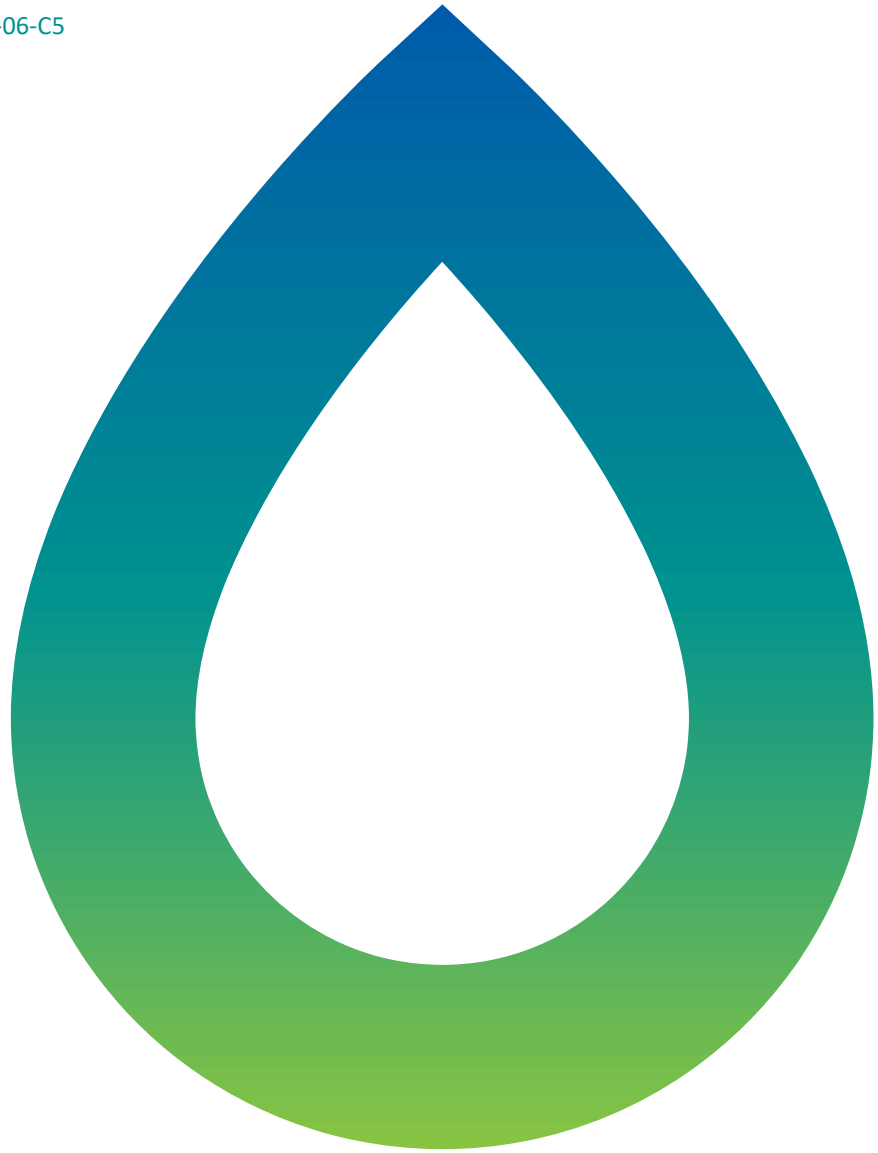
BLACKWATER NORTH EXTENSION PROJECT

Surface Water Assessment

Whitehaven Blackwater Pty Ltd

15 October 2026

1559-06-C5



DETAILS

Report Title	Blackwater North Extension Project, Surface Water Assessment
Client	Whitehaven Blackwater Pty Ltd

THIS REVISION

Report Number	1559-06-C5
Date	15 October 2026
Author	Ardianto Notodirdjo
Reviewer	Michael Batchelor

NOTE: This report has been prepared on the assumption that all information, data and reports provided to us by our client, on behalf of our client, or by third parties (e.g. government agencies) is complete and accurate and on the basis that such other assumptions we have identified (whether or not those assumptions have been identified in this advice) are correct. You must inform us if any of the assumptions are not complete or accurate. We retain ownership of all copyright in this report. Except where you obtain our prior written consent, this report may only be used by our client for the purpose for which it has been provided by us.

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1 INTRODUCTION

1.1 BACKGROUND

The Blackwater Mine (BWM) is an existing, open cut metallurgical coal mine located approximately 20 kilometres (km) south-west of Blackwater in the Bowen Basin, Queensland (refer to Figure 1.1). BWM's Mining Leases (MLs) include ML 1759, ML 1760, ML 1761, ML 1762, ML 1767, ML 1771, ML 1772, ML 1773, ML 1792, ML 1800, ML 1812, ML 1829, ML 1860, ML 1862, ML 1907, ML 70091, ML 70103, ML 70104, ML 70139, ML 70167 and ML 70329 (refer to Figure 1.1).

The BWM has been in operation since 1967 and is currently owned and operated by Whitehaven Blackwater Pty Ltd (Whitehaven Blackwater), a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven). It operates under Environmental Authority (EA) EPML00717813, granted under the Queensland *Environmental Protection Action 1994* (EP Act).

The BWM comprises a series of open cut mining pits along an approximately 80 km long strike length. The BWM extracts coal using drill and blast methods, draglines, and truck and shovel fleets for overburden removal and haulage. The BWM produces up to 17.6 million tonnes per annum (Mtpa) of product coal, predominantly high-quality coking coal for use in steelmaking as well as high energy thermal coal.

Existing infrastructure at BWM includes two rail spurs and balloon loops from the Bauhinia Railway, a coal handling and preparation plant (CHPP), thermal coal plant (TCP), product stockpiles, run-of-mine (ROM) coal stockpiles, tailings storage facility, in-pit spoil (i.e. waste rock) dumps, train-load out facilities, water management infrastructure and other supporting infrastructure (e.g. haul roads, access roads, laydown areas, electricity transmission lines, workshops and offices).

1.2 PROJECT DESCRIPTION

Whitehaven Blackwater proposes to develop the Blackwater North Extension Project (the Project), which would extend the current open cut mining development at the BWM to within Surface Area (SA) 7 on ML 1762 and SA 10 on ML 1759 (Figure 1.1). The Project is expected to optimise mining operations at BWM allowing ongoing employment and economic benefits from the BWM to the local area, region, and State of Queensland.

The Project would include the following activities:

- extension of open cut operations into SA 7 on ML 1762 and SA 10 on ML 1759 to allow mining of additional coal reserves to approximately 2055;
- extraction of an additional 200 million tonnes (Mt) (approximately) of ROM coal;
- continued extraction of up to 19 Mtpa of ROM coal;
- continued use of existing BWM infrastructure (e.g. CHPP, TCP, ROM and product coal stockpiles, train load-out, water management, tailings management and other supporting infrastructure);
- construction and operation of new water management and water storage infrastructure in support of extended mining operations;
- development of waste rock emplacement areas;
- continued co-disposal of coarse rejects with waste rock and disposal of tailings into an approved tailings storage facility or in-pit void;
- construction of semi-permanent tailings cells to be utilised for the disposal of fine rejects;
- progressive rehabilitation activities of the Project;
- ongoing exploration activities in the Project area; and

- other associated infrastructure, equipment and activities.

Figure 1.2 shows the general arrangement of the Project site, including the open cut pit extents within SA 7 on ML 1762 and SA 10 on ML 1759.

1.3 SCOPE OF WORK

This Surface Water Assessment (SWA) has been prepared to support the environmental approvals for the Project and aims to:

- Describe the existing surface water environment around the Project, including the hydrological setting, surface water quality characteristics, environmental values (EVs) and flooding behaviour.
- Describe the existing BWM Surface Water Management System (SWMS) and the proposed changes to the SWMS required as part of the Project.
- Assess potential impacts of the Project on the surface water environment, identify associated risks, and propose mitigation strategies to protect hydrological and ecological systems.

1.4 REPORT STRUCTURE

This report is structured as follows:

- Section 2 provides an overview of the regulatory framework for the Project.
- Section 3 describes the existing surface water environment, including baseline data on climate, drainage networks, and water quality.
- Section 4 provides an overview of the existing SWMS and the BWM site characteristics.
- Section 5 provides details on the water management objectives, strategies and systems, including water management infrastructure and erosion and sediment control (ESC) measures.
- Section 6 presents the results of the site water balance and evaluates the predicted behaviour of the SWMS and final voids under varying climatic conditions.
- Section 7 describes the predicted behaviour of the final voids under varying climatic conditions.
- Section 8 describes the flood behaviour under existing and future (Project) conditions and assesses the impact of the Project on flooding behaviour around BWM.
- Section 9 describes the impact of catchment loss resulting from the Project on flow regime in the waterways in the vicinity of the Project.
- Section 10 details the potential impacts of the Project and outlines mitigation and management measures to minimise adverse effects on surface water resources.
- Section 11 provides a list of references.

The report includes three appendices:

  - Appendix A describes the development and calibration of the hydrological model used to estimate design flood discharges across the Project area.
  - Appendix B describes the operational water balance model including inflows, outflows, and storage dynamics under varying climatic conditions completed by HydroBalance (2026). It was developed in coordination with groundwater modelling by SLR Consulting Australia Pty Ltd (SLR) (2026).
  - Appendix C assesses the potential for the Project to result in a surface water impact on the Great Barrier Reef World Heritage Property, National Heritage Place, and Marine Park, which are listed as Matters of National Environmental Significance (MNES) under the *Environmental Protection and Biodiversity Conservation Act 1999* (EPBC Act). The Great Barrier Reef (GBR)

surface water impact assessment was undertaken by Water and Environment Pty Ltd (WRM) (2026).

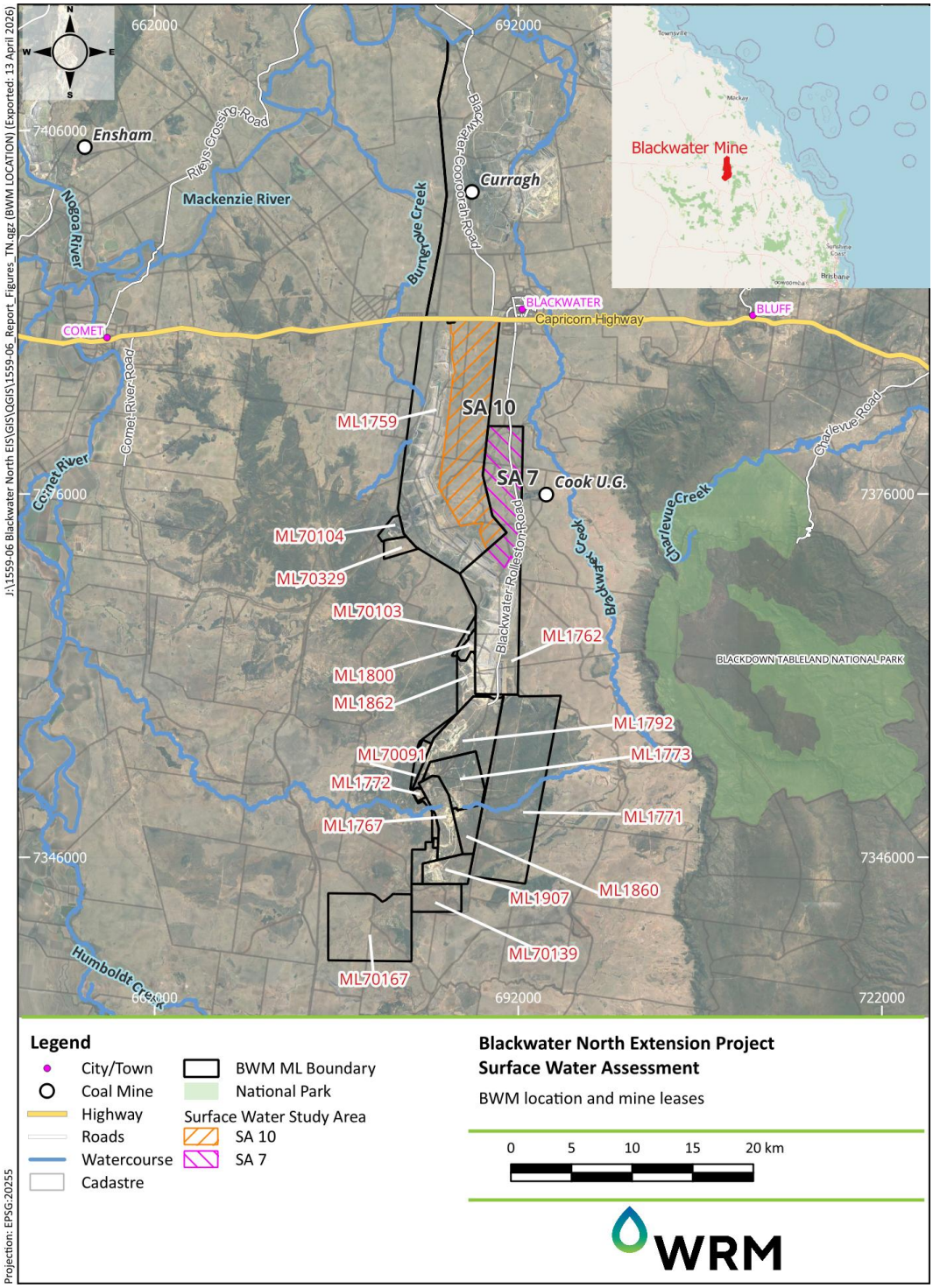


Figure 1.1 BWM Location and Mine Leases

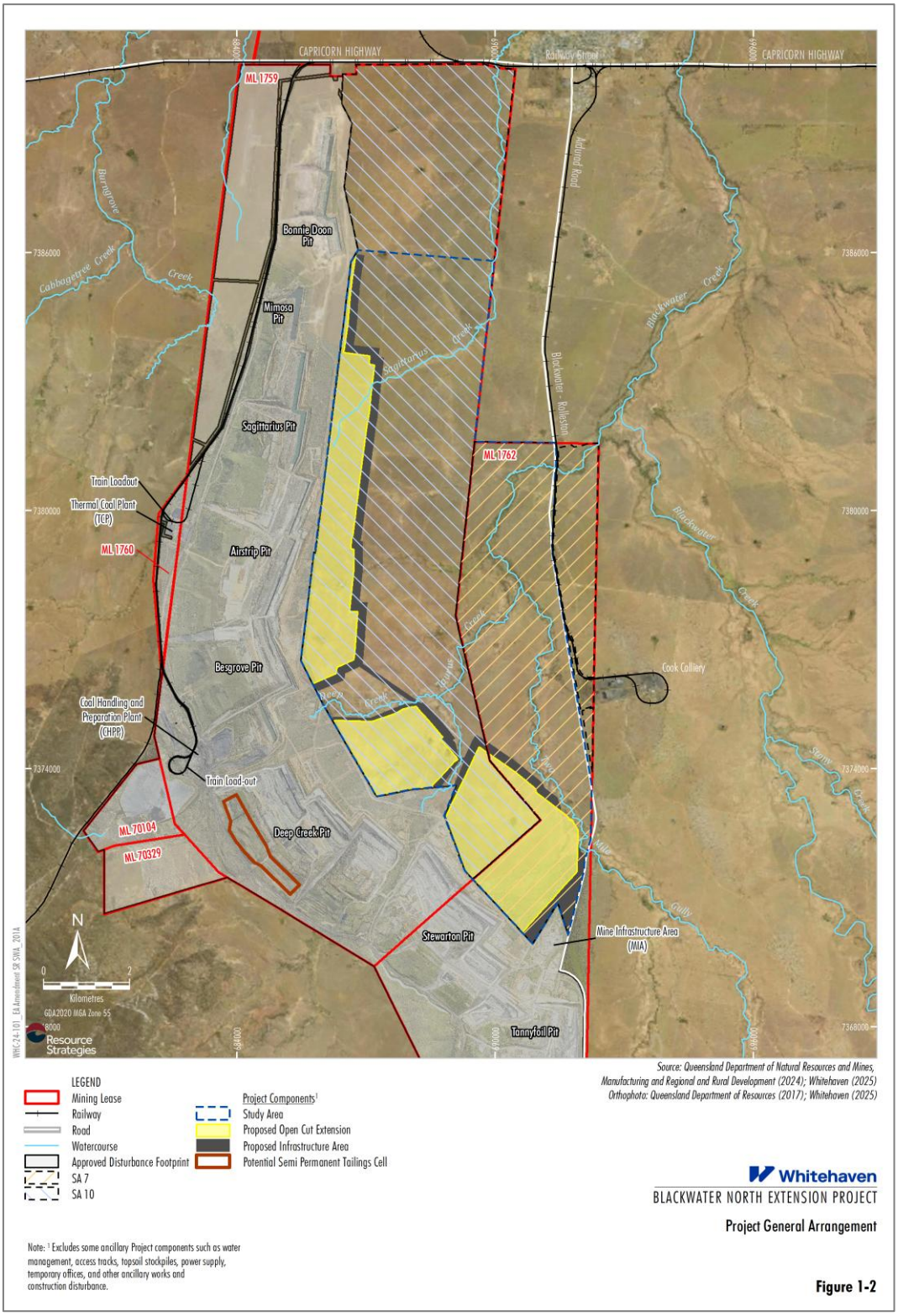


Figure 1.2 Project General Arrangement

2 REGULATORY FRAMEWORK

This section describes the regulatory framework (legislation, policies and standards) at Commonwealth and State level that would apply to surface water management for the Project.

2.1 COMMONWEALTH

2.1.1 Environment Protection and Biodiversity Conservation Act 1999

The EPBC Act outlines the requirements relating to the management and protection of MNES.

BM Alliance Coal Operations Pty Ltd (BMA) (former owners of the BWM) previously lodged a referral under the EPBC Act for the Project (EPBC 2023/09723). On 22 March 2024, the Department of Climate Change, Energy, the Environment and Water determined the Project to be a 'Controlled Action.' The controlled action includes 'a water resource, in relation to unconventional gas development and large coal mining development (sections 24D & 24E)' as the controlling provision relevant to this assessment.

Following Whitehaven Blackwater's acquisition of the BWM from BMA, the Referral was withdrawn on 6 November 2025.

2.2 QUEENSLAND

2.2.1 Environmental Protection Act 1994

2.2.1.1 Overview

Resource activities are defined as environmentally relevant activities (ERAs) under the EP Act, and as such, the development and operation of the Project are governed by the EP Act. The objective of the EP Act is to:

> *protect Queensland's environment while allowing for development that improves the total quality of life, both now and in the future, in a way that maintains the ecological processes on which life depends (**ecologically sustainable development**).*

2.2.1.2 Environmental Authority

An EA is granted in accordance with the EP Act and details the conditions that govern the ERA. In the context of surface water management, the EA will set out conditions that will be relevant to the Project, including:

- management of contained water including release;
- Water Management Plan (WMP) requirements;
- regulation of water structures including dams and levees;
- saline drainage management;
- acid rock drainage management; and
- storm water and sediment laden runoff management.

2.2.1.3 Environmental Protection (Water and Wetland Biodiversity) Policy 2019

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP Water) is the primary instrument for surface water management under the EP Act. The EPP Water governs discharge to land, surface water and groundwater, aims to protect EVs and sets water quality guidelines and objectives.

The processes to identify EVs and to determine Water Quality Guidelines (WQGs) and Water Quality Objectives (WQOs) in Queensland waters are based on the *Australian and New Zealand Guidelines for Fresh and Marine Water Quality* (ANZG (2018) guidelines).

2.2.1.4 Mackenzie Sub-basin Environmental Values and Water Quality Objectives 2011

The relevant document, pursuant to the EPP Water, for the Project is the *Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin, September 2011* (Department of Environment and Heritage Protection [DEHP], 2013). The document is made pursuant to the provisions of the EPP Water. It contains EVs and WQOs for waters in the Mackenzie River Sub-basin, and they are listed under Schedule 1 of EPP Water. Refer to Section 3.3 for further details.

2.2.1.5 Guideline – Application Requirements for Activities with Impacts to Water

The EP Act and the *Environmental Protection Regulation 2019* (EP Regulation) specify the regulatory requirements for prescribed ERAs. The *Guideline – Application requirements for activities with impacts to water* (Department of the Environment, Tourism, Science and Innovation [DETSI], 2026) focuses on the types of impacts that ERAs can have on water and outlines the information to be provided to the department as part of the ERA application process.

Section 4 of the guideline requires the applicant to provides details on a number of surface water-related issues, including:

- discharges and releases;
- unplanned and uncontrolled releases;
- water infrastructure;
- wetlands;
- hydrology of receiving waters; and
- mixing zones.

The guideline also refers to the department's technical guideline, *Wastewater release to Queensland waters* (DETSI, 2025a), which is discussed in Section 2.2.1.8.

2.2.1.6 Reef discharge standards for industrial activities

The *Reef discharge standards for industrial activities* (Department of Environment, Science and Innovation [DESI], 2024a) guideline (the Reef Discharge Standards) outlines the additional requirements to address section 41AA of the EP Regulation, regarding the potential impacts to the GBR catchment waters (GBR catchments) from the release of fine sediments (FS) and dissolved inorganic nitrogen (DIN). Section 41AA of the EP Regulation states:

> 3. *The administering authority must refuse to grant the application if the authority considers that –*
>
> *(a) the relevant activity will, or may, have a residual impact; and*
>
> *(b) having regard to the matters mentioned in the water quality offset policy, the residual impact will not be adequately counterbalanced by offset measures for the relevant activity.*
>
> 4. *A residual impact of a relevant activity is the presence of fine sediment, or dissolved inorganic nitrogen, in Great Barrier Reef catchment waters, or waters mentioned in subsection (1)(b), that –*
>
> *(a) was released to the water because of the relevant activity; and*

(b) remains, or is likely to remain in the water despite mitigation measures for the relevant activity.

The intent of section 41AA of the EP Regulation is to achieve a 'no net decline' in water quality from the release of waters into the GBR catchment waters as outlined in the *Reef discharge standards for industrial activities* (DESI, 2024a).

2.2.1.7 Manual for Assessing Consequence Categories and Hydraulic Performance of Structures

The *Manual for assessing consequence categories and hydraulic performance of structures* (the Manual) (DETSI, 2025b) defines the methodology and assessment criteria to determine if a structure associated with an ERA should be regulated under the EP Act. The manual details the hydraulic design requirements for regulated structures and this document has been used as a reference in the preliminary design of the SWMS and preliminary sizing of dams associated with the Project.

2.2.1.8 Technical Guideline – Wastewater Release to Queensland Waters

The technical guideline, *Wastewater Release to Queensland Waters* (DETSI, 2025a) is provided to support a risk-based assessment approach to licensing releases of wastewater to surface water and applies the philosophy of the ANZG (2018) guidelines and the intent of the *Environmental Protection (Water) Policy 2009*.

2.2.2 Water Act 2000

2.2.2.1 Overview

In Queensland, the *Water Act 2000* (Water Act) is the primary statutory document that establishes a framework for the planning, allocation and use of non-tidal water. The Water Act is primarily administered by the Department of Local Government, Water and Volunteers (DLGWV).

The main purpose of the Water Act is to provide a framework for the following:

- The sustainable management of Queensland's water resources and quarry material by establishing a system for:
  - the planning, allocation and use of water; and
  - the allocation of quarry material and riverine protection.
- The sustainable and secure water supply for the south-east Queensland region and other designated regions.
- The management of impacts on underground water caused by the exercise of underground water rights by the resource sector.
- The effective operation of water authorities.

A watercourse is defined by the Water Act as a river, creek or stream in which water flows permanently or intermittently and includes the bed and banks and any other element of a river, creek or stream confining or containing water. The DLGWV have published a watercourse identification map of the state that shows: watercourses (other than their lateral limits); the downstream limit of watercourses; drainage features; lakes; and springs.

2.2.2.2 Water Plan (Fitzroy Basin) 2011

The *Water Plan (Fitzroy Basin) 2011* was developed under the Water Act to:

- define the availability of water in the Fitzroy Basin;
- provide a framework for sustainably managing water and the taking of water;
- identify priorities and mechanisms for dealing with future water requirements;
- provide a framework for establishing water allocations;
- provide a framework for reversing, where practicable, degradation in natural ecosystems;
- regulate the taking of overland flow water; and
- regulate the taking of groundwater.

2.2.2.3 Water Regulation 2016

Water Regulation 2016 is subordinate legislation to the Water Act and provides details, protocol and instruction for the following:

- Water rights and planning.
- Statutory authorisations to take or interfere with water.
- Matters relating to water licenses.
- Water allocations.
- Water supply and demand management.
- Declarations about watercourses.

2.2.3 Water Supply (Safety and Reliability) Act 2008

The Water Supply (Safety and Reliability) Act 2008 provides for the safety and reliability of water supply in Queensland. The purpose is achieved primarily by:

- providing a regulatory framework for providing water and sewerage services in the State;
- providing a regulatory framework for providing recycled water and drinking water quality, primarily for protecting public health;
- the regulation of referable dams; and
- stating flood mitigation responsibilities.

3 EXISTING SURFACE WATER ENVIRONMENT

3.1 DRAINAGE NETWORK

3.1.1 Overview

There are seven waterways within the vicinity of the Project. These waterways have been defined from the Ordered Drainage 100K mapping layer from the Queensland Government Qspatial website, which identifies riverine systems, watercourses, waterways or drainage lines (here referred to collectively as waterways) for the Project area. The drainage layer classifies the hierarchy of streams using the Strahler (1957) stream ordering system. A first order stream starts at the top of a catchment and has no other streams flowing into it. Second-order streams form when two first-order streams join. They are bigger in size due to the water from both first-order streams combining. Third-order streams form when two or more second-order streams join, and so on.

In the vicinity of the Study area, there are:

- two waterways of Strahler stream order five, which include Blackwater Creek and Taurus Creek (downstream of Two Mile Gully confluence);
- two waterways of stream order four, which include Two Mile Gully and Taurus Creek (upstream of Two Mile Gully confluence);
- three waterways of stream order three, which include Emu Creek, Deep Creek and Sagittarius Creek; and
- there are also several waterways of stream order one, which are minor drainage features that drain the Project area directly to Two Mile Gully and/or Taurus Creek.

Descriptions of these waterways are given below.

3.1.2 Regional drainage features

Figure 3.2 show the regional drainage characteristics in the vicinity of the Study area. The Project is located within the Mackenzie subcatchment of the greater Fitzroy Basin. Blackwater Creek, a tributary of the Mackenzie River, is the main watercourse in the vicinity of the Project area and flows in a northerly direction to the east of the Project. Figure 3.2 shows Blackwater Creek catchment to the Mackenzie River.

The Blackwater Creek catchment originates at its headwaters from the west of BWM and drains in an easterly direction across the BWM ML. Blackwater Creek drains north and joins the Mackenzie River approximately 33 km north of BWM.

Ultimately, the Mackenzie River joins the Fitzroy River, which flows initially north and then east towards the east coast of Queensland, discharging into the Coral Sea south-east of Rockhampton, near Port Alma. The total Fitzroy River catchment is 142,665 square kilometres (km²).

The catchment area of Blackwater Creek, encompassing the Project area, is approximately 1,100 km². This represents around 0.8 percent (%) of the overall Fitzroy River catchment. The Project disturbance footprint is approximately 23 km² and represents 2% of the Blackwater Creek catchment and 0.016% of the overall Fitzroy River catchment area.

3.1.3 Local drainage features

3.1.3.1 Overview

Figure 3.3 shows the local drainage features in the vicinity of the Study area, which comprise of several waterways of stream order two to three that are tributaries of Blackwater Creek. Descriptions of these local waterways are given in the below subsections.

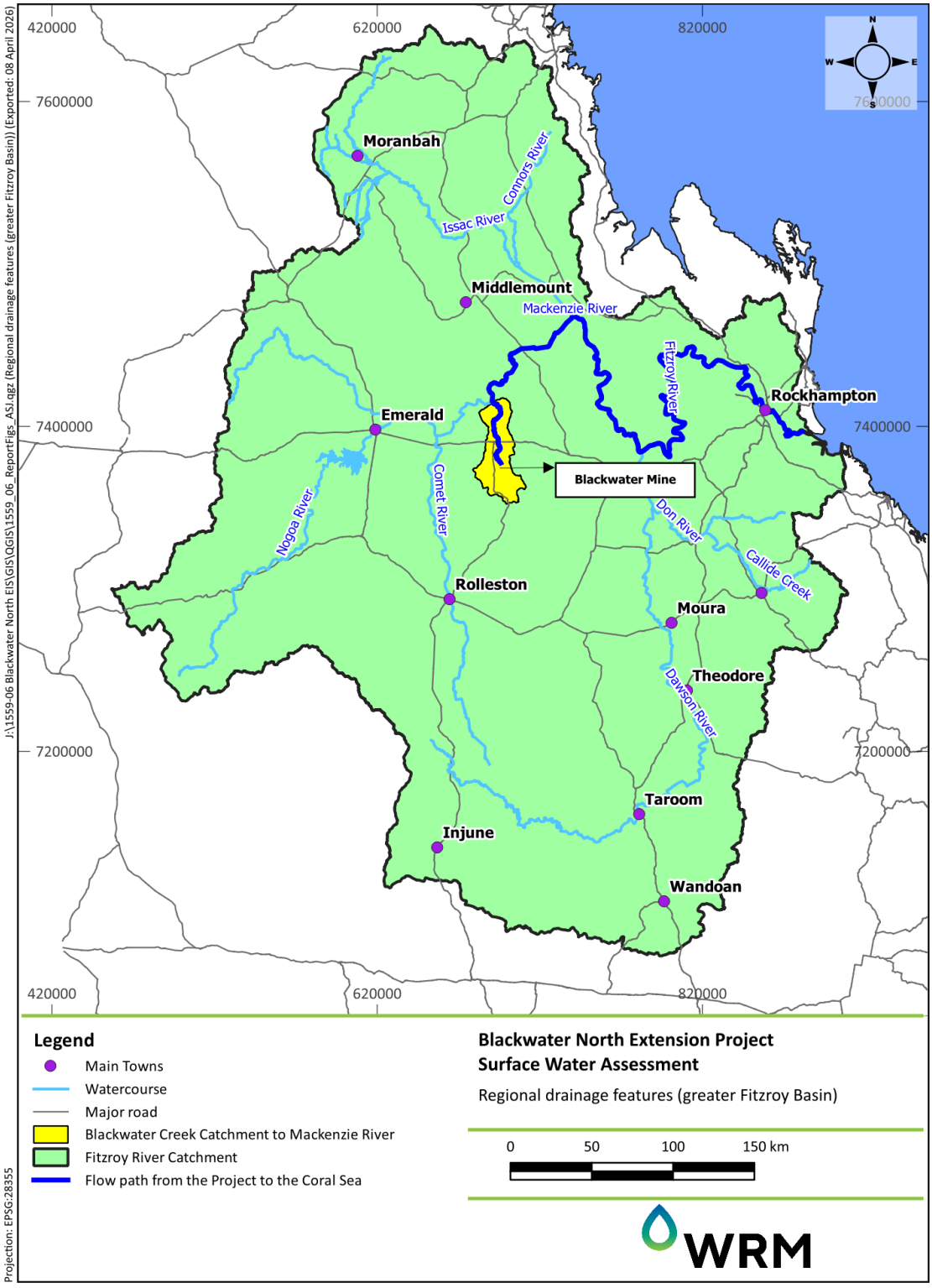


Figure 3.1 Regional drainage features (greater Fitzroy Basin)

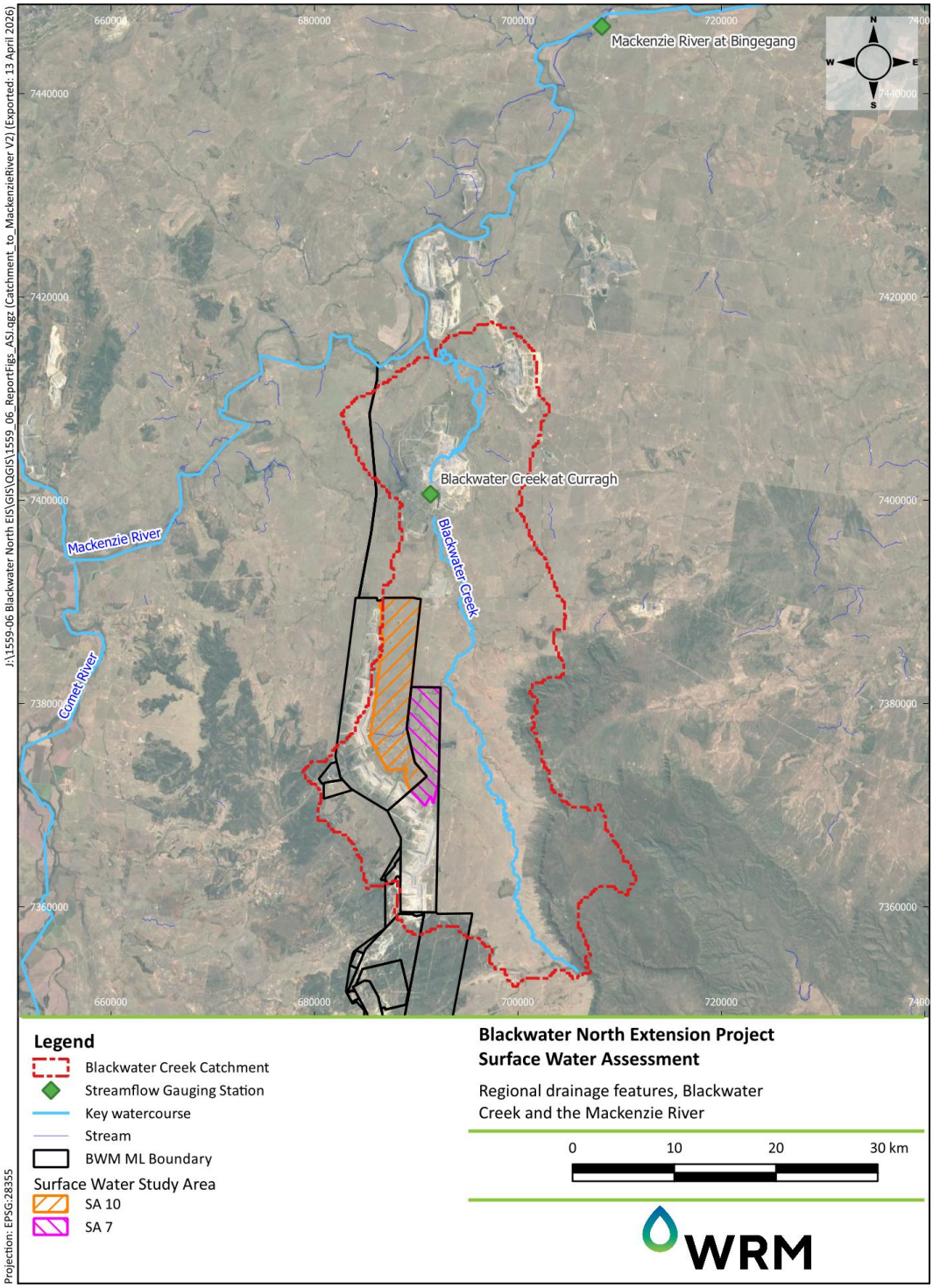


Figure 3.2 Regional drainage features, Blackwater Creek and the Mackenzie River

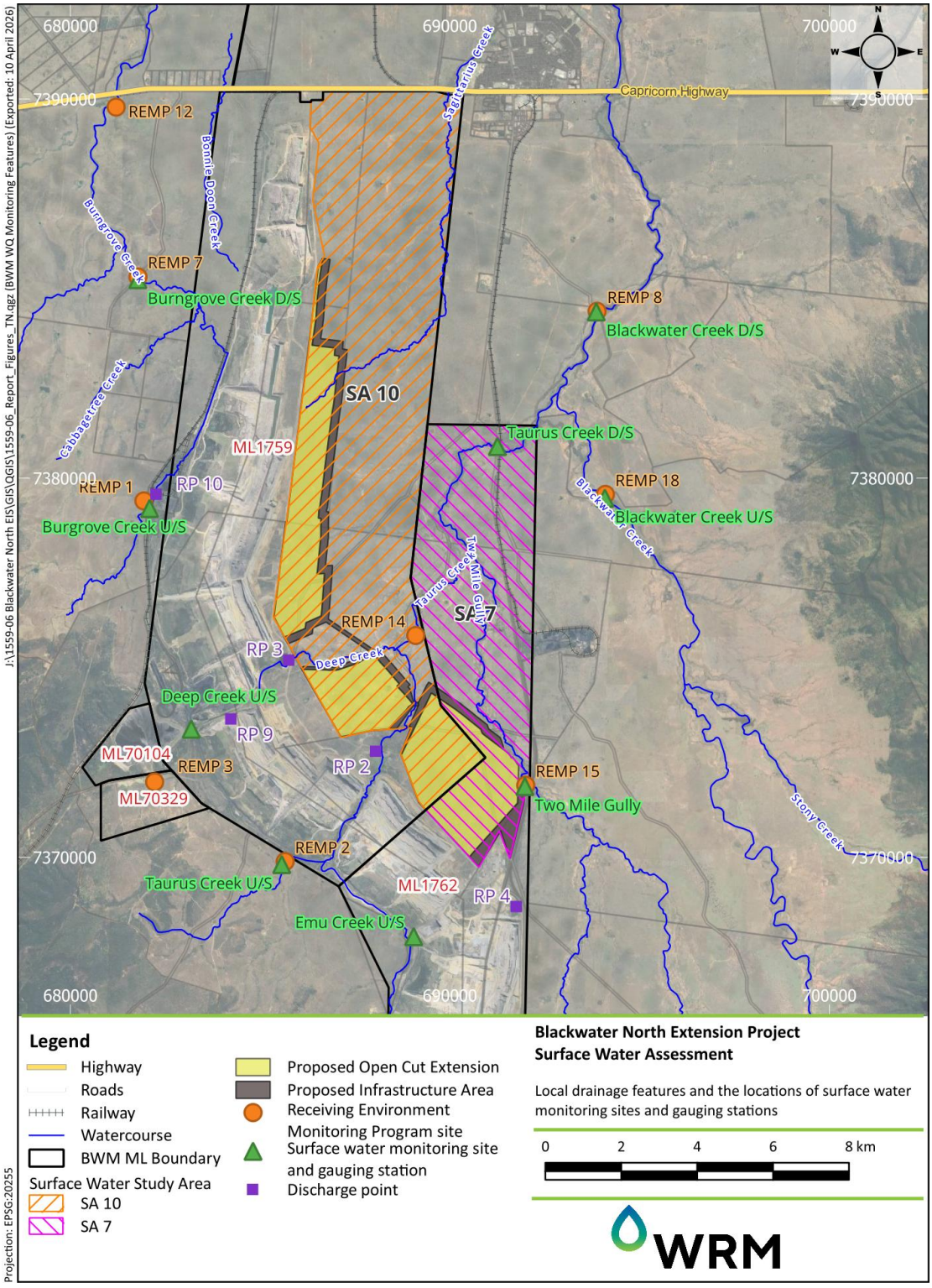


Figure 3.3 **Local drainage features and the locations of surface water monitoring sites and gauging stations**

3.1.3.2 Taurus Creek

Taurus Creek, a major tributary of Blackwater Creek, originates from the east of BWM and drains in a north-easterly direction across BWM. It drains as a stream order three waterway between existing overburden dumps, then between the Deep Creek and Stewarton open cut pits and into the New Taurus Creek Dam. New Taurus Creek Dam is an online water storage dam that forms a key part of the SWMS. Downstream of New Taurus Creek Dam, Taurus Creek continues to drain in a north-easterly direction and becomes a stream order four waterway as it joins Deep Creek immediately downstream of the Project area. Taurus Creek drains to Blackwater Creek approximately 5 km east of the Project area.

3.1.3.3 Emu Creek

Emu Creek, a tributary of Taurus Creek, originates from the west (upstream) of BWM and flows in a north-easterly direction towards BWM. Within the BWM ML, the natural Emu Creek channel has been largely consumed by mining activities. The downstream reaches of Emu Creek have been replaced by the non-regulated Emu Creek Diversion, which diverts the Emu Creek catchment to the north-west into Taurus Creek on the western side of BWM. The Emu Creek diversion is not located on a watercourse as defined under the Water Act. However, it was designed and constructed to be a permanent feature in line with applicable guidelines. Emu Creek, including the Emu Creek Diversion, drains as a stream order two waterway within the BWM ML until it joins Taurus Creek.

3.1.3.4 Deep Creek

Deep Creek, a tributary of Taurus Creek, originates from the west of BWM and drains in a north-easterly direction towards BWM. It drains as a stream order three waterway between existing overburden dumps, then between the Besgrove and Deep Creek open cut pits and into the New Deep Creek Dam. New Deep Creek Dam is an online water storage dam that forms a key part of the SWMS. Downstream of New Deep Creek Dam, Deep Creek continues to drain in a north-easterly direction and then joins Taurus Creek immediately downstream of the Project area.

3.1.3.5 Two Mile Gully

Two Mile Gully, tributary of Taurus Creek, flows in a northerly direction to the east of BWM. It drains as a stream order four waterway adjacent to and along the south-eastern portion of the Project area and then joints Taurus Creek about 5 km east of BWM.

The upper (and western) headwaters of the Two Mile Gully catchment has been consumed by mining activities at BWM. However, the central and lower sections of Two Mile Gully adjacent to the Project area are relatively undisturbed.

3.1.3.6 Sagittarius Creek

Sagittarius Creek, a tributary of Blackwater Creek, flows in a northerly direction along the eastern side of BWM. It drains as a stream order three waterway across the northern BWM ML boundary, passing the western side of Blackwater township and then join Blackwater Creek just downstream of Blackwater township.

The upper headwater of the Sagittarius Creek catchment, comprising several minor streams of order one or two, have been consumed by mining activities. However, the central and lower portions of the Sagittarius Creek catchment are relatively undisturbed.

3.2 STREAMFLOW

Historical flow and water level (river height) monitoring data was assessed to provide an indication of local flow regime in the vicinity of the Project and regional flow regime in the Mackenzie River. Table 3.1 shows the available water level data from two gauges owned by Whitehaven and three gauges owned by the DLGWV in the vicinity of the Project.

Table 3.1 Stream gauging stations

Gauge No.	Gauge name	Catchment area (km²)	Owner	Period of record	Easting (m) (GDA 94)	Northing (m) (GDA 94)
330124	Two Mile Gully	98	Whitehaven	2016 – 2025	692,093	7,372,042
330121	Taurus Creek D/S[a]	246	Whitehaven	2016 – 2025	691,367	7,381,013
130108A	Blackwater Creek at Curragh[b]	777	DLGWV	1972 – 1989	691,299	7,400,395
130108B	Blackwater Creek at Curragh[b]	776	DLGWV	1990 – 2009	691,299	7,400,395
130106A	Mackenzie River at Bingegang	50,860	DLGWV	1971 – present	708,267	7,446,599

[a] D/S = downstream, m = metres

[b] The two Blackwater Creek gauges (130108A and 130108B) are at the same location

Figure 3.4, Figure 3.5, Figure 3.6 and Figure 3.7 present daily discharge exceedance curves of flows (in megalitres per day [ML/d]) in Two Mile Gully, Taurus Creek, Blackwater Creek and the Mackenzie River, respectively, as recorded at the above stream gauging stations.

Figure 3.8, Figure 3.9, Figure 3.10 and Figure 3.11 present monthly box and whisker plots of stream flows (in megalitres per month [ML/month]) in Two Mile Gully, Taurus Creek, Blackwater Creek and the Mackenzie River, respectively, as recorded at the above stream gauging stations. The box and whisker plots show:

- The lower and upper extents of the 'whiskers' show the 10th and 90th percentile recorded monthly flows.
- The box represents the range within which 50% of recorded monthly flows fall. The lower bound of the box is the 25th percentile monthly flow (i.e. 25% of flows are equal to or smaller, 75% of flows are larger) while the upper bound of the box is the 75th percentile flow (i.e. 75% of flows are equal to or smaller, only 25% of flows are larger).
- The middle line in the box represents the median or 50th percentile recorded monthly flow (i.e. 50% of flows are equal to or smaller, 50% of flows are larger).

The data indicates the following:

- At all four watercourses, flows are most likely to occur during the summer months. Stream flows are highly variable, especially during the summer months.

- Two Mile Gully, Taurus Creek and Blackwater Creek are ephemeral streams, where flows occur during the summer months often in short durations, but generally drying out during winter and early spring. Stream flows greater than 10 ML/d occur less than (<) 3% of the time in Two Mile Gully, <6% of the time in Taurus Creek, and <14% of the time in Blackwater Creek. The higher frequency of low flows above 0.1 ML/d in Blackwater Creek at Curragh is likely due to releases from the Blackwater Sewage Treatment Plant, but it could also be due to mine releases.
- The Mackenzie River, around the confluence with Blackwater Creek, exhibits the characteristics of an ephemeral stream. Flows occur more regularly during the summer months and in longer durations, compared to the local creeks in the vicinity of the BWM. However, the river generally dries out during the winter months.

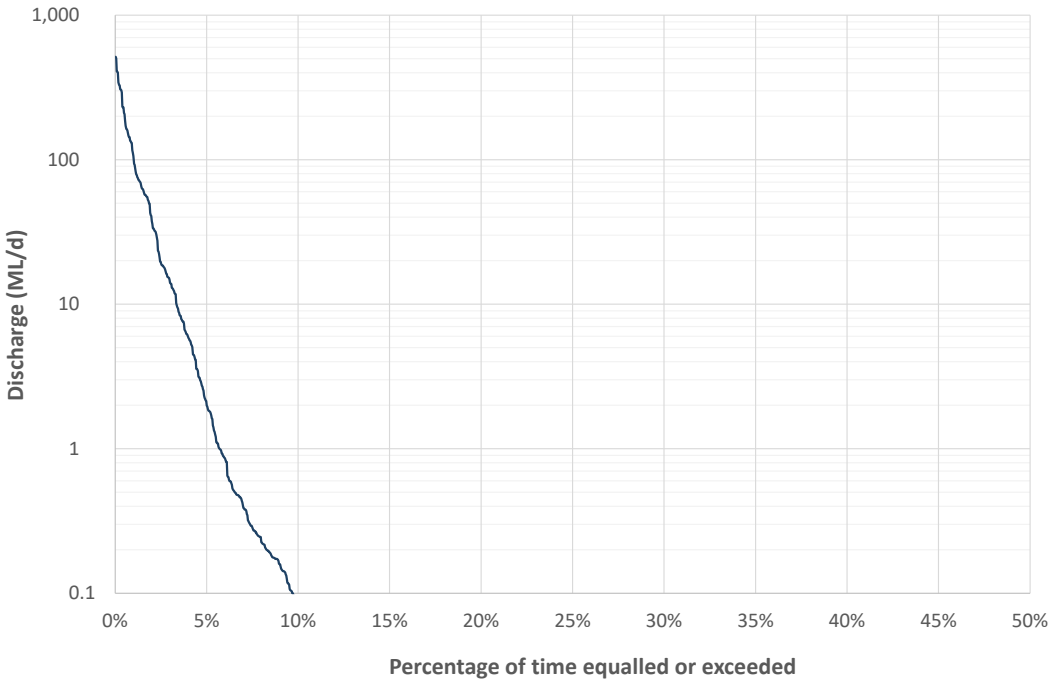


Figure 3.4 Daily discharge exceedance curve (2016 – 2025) at Two Mile Gully (Station No. 330124)

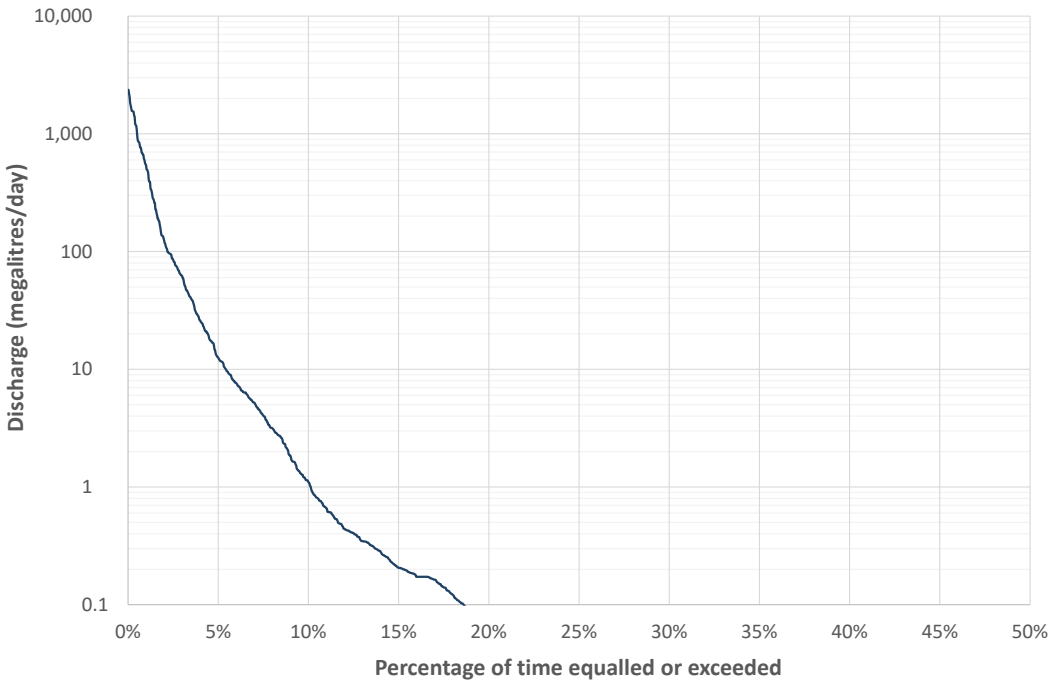


Figure 3.5 **Daily discharge exceedance curve (2016 – 2025) for Taurus Creek at Taurus Creek D/S (Station No. 330121)**

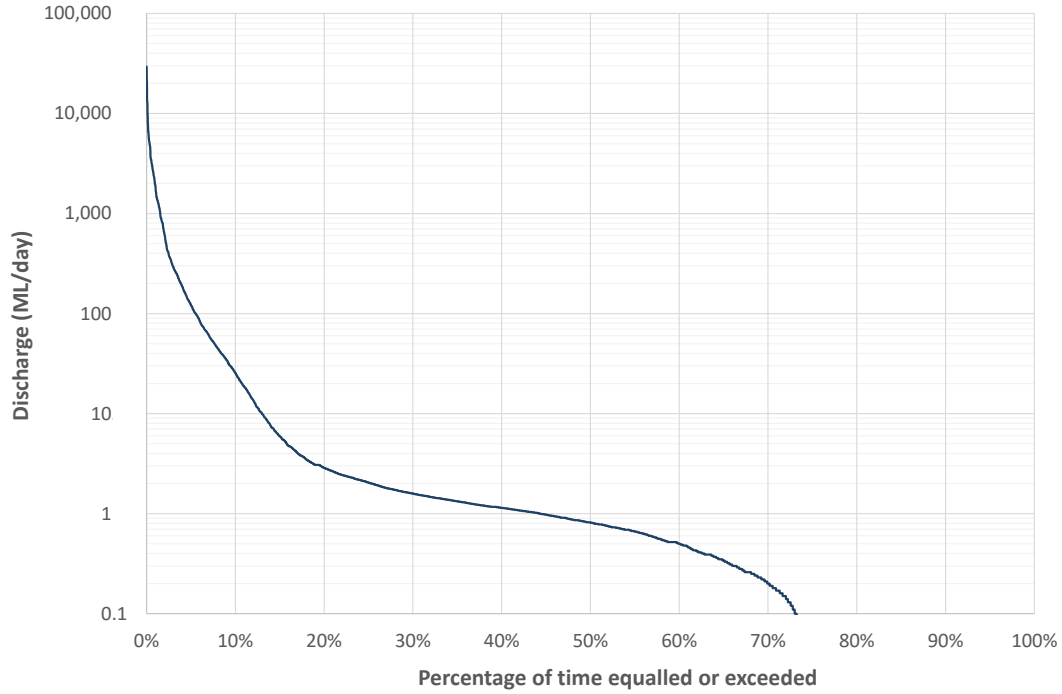


Figure 3.6 **Daily discharge exceedance curve (1971-2023) for Blackwater Creek at Curragh (Station No. 130108A and 130108B)**

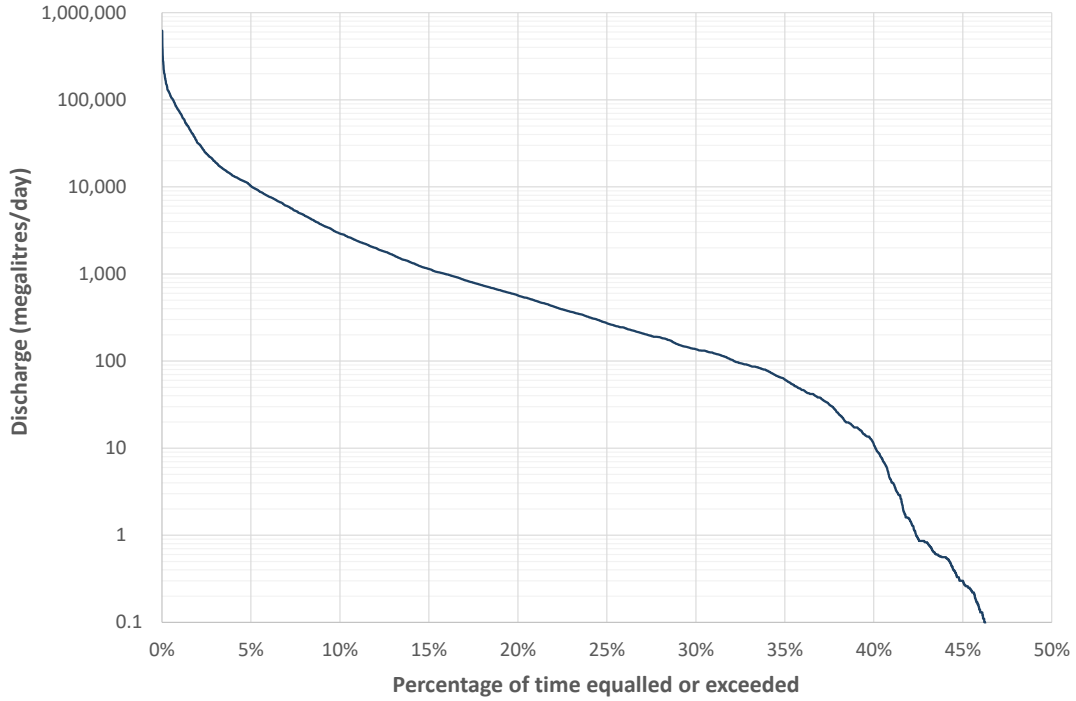


Figure 3.7 **Daily discharge exceedance curve (1971-2023) for the Mackenzie River at Bingegang (Station No. 130106A)**

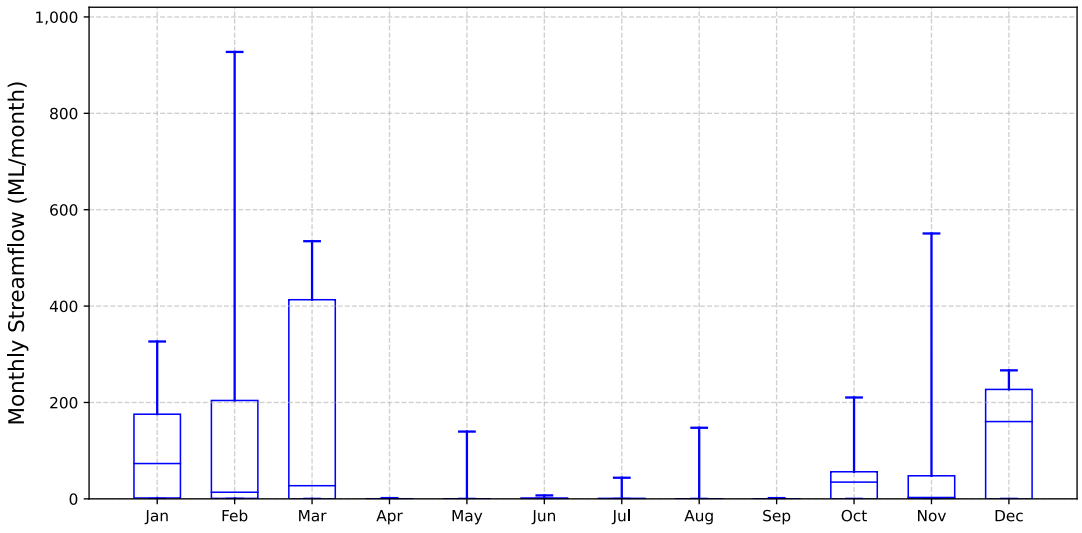


Figure 3.8 **Monthly box and whisker plot of flow volume at Two Mile Gully (Station No. 330124)**

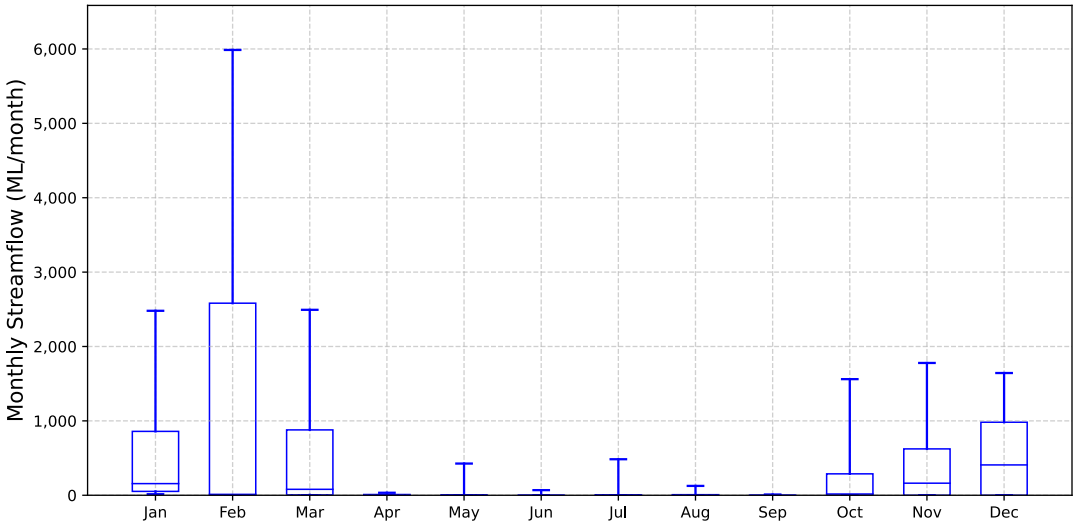


Figure 3.9 **Monthly box and whisker plot of flow volume for Taurus Creek at Taurus Creek D/S (Station No. 330121)**

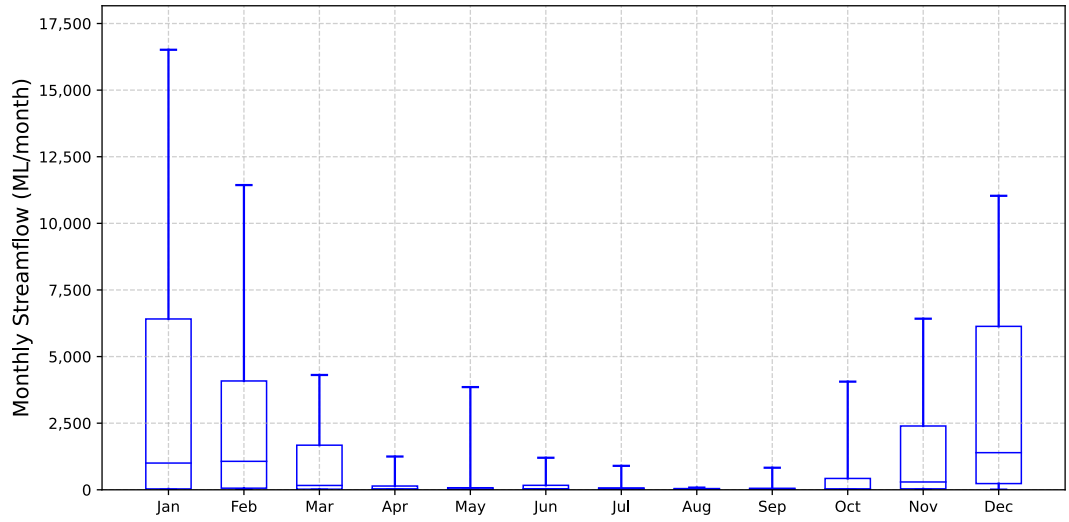


Figure 3.10 **Monthly box and whisker plot of flow volume for Blackwater Creek at Curragh (Station No. 130108A and 130108B)**

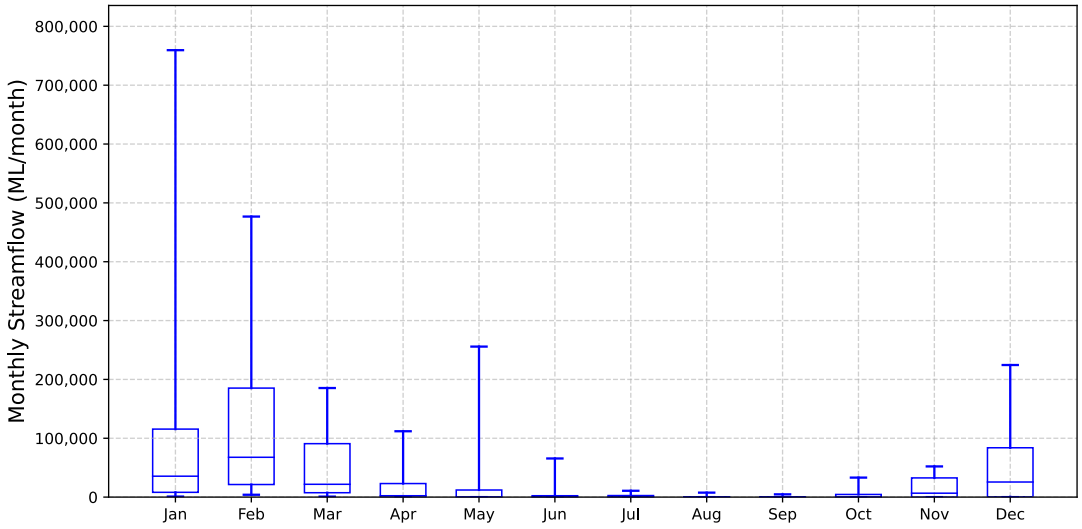


Figure 3.11 Monthly box and whisker plot of flow volume for the Mackenzie River at Bingegang (Station No. 130106A)

3.3 ENVIRONMENTAL VALUES OF RECEIVING WATERS

3.3.1 Overview of environmental values

The EPP Water, which is subordinate legislation to the EP Act, provides a framework for identifying EVs for a waterway and deciding WQOs to protect or enhance those EVs. EVs for water are the qualities of water that make it suitable for supporting aquatic ecosystems and human water uses. These EVs need to be protected from the effects of habitat alteration, contaminated runoff and releases and changed flow to ensure healthy aquatic ecosystems and waterways that are safe for community use.

The waterways in the vicinity of the Project (Blackwater Creek, Taurus Creek, Two Mile Gully, Deep Creek and Emu Creek) are located within the Mackenzie southern tributaries region of the Mackenzie River Sub-basin (WQ1304).

The EVs selected for protection include:

- aquatic ecosystem protection (slightly to moderately disturbed ecosystems [DEHP, 2009]);
- farm use and stock watering;
- human consumption;
- primary, secondary and visual recreation;
- drinking water;
- industrial use; and
- cultural and spiritual values.

In summary, the key EVs for water that are to be protected are:

- physical, chemical and biological integrity of the watercourses within the catchment and their amenity as potential water sources for human use and to support aquatic ecosystems;
- the qualitive and quantitative integrity of local groundwater as a potential water source for agriculture or other suitable uses; and

- the integrity of raw water supplies and associated infrastructure in the region.

3.3.2 Water quality objectives

The indicators and WQGs relevant to the above EVs are listed in the Queensland Water Quality (QWQ) Guidelines (DEHP, 2009), ANZG (2018) guidelines and the Mackenzie River Sub-basin Environmental Values and Water Quality Objectives (DEHP, 2013) guidelines. The conditions of waterways located in the vicinity of the Project are classified as 'moderately disturbed' ecosystems under DEHP (2013).

Table 3.2 compares the Mackenzie River WQOs (WQ 1304) nominated in the QWQ Guidelines, the Default Guideline Values (DGVs) nominated in ANZG (2018) based on 95% level of protection as well as the release and receiving waters contaminant trigger levels (trigger values) nominated in the EA (EPML00717813). Table 3.2 also shows the adopted WQOs, which were adopted based on the rationale described in sections 3.3.3 and 3.3.4.

WQOs and DGVs are displayed only for water quality parameters that are nominated in the EA (EPML00717813). The parameters for fine sediments and nutrients, including turbidity, total suspended solids (TSS), total nitrogen (TN) and total phosphorous (TP), have been included as they are the relevant water quality indicators for the GBR.

Table 3.2 Default Guideline Values, EA trigger levels and the adopted water quality objectives

Parameter	Unit [a]	Mackenzie River WQOs (WQ 1304)	Toxicant DGVs [b]	EA Trigger Level	Adopted WQO
pH	-	6.5 - 8.5	6.5 – 8.5	6.5 - 8.5	6.5 - 8.5
EC	µS/cm	310 (baseflow) 210 (high flow)	-	2,000	2,000
Turbidity	NTU	50	-	-	50
TSS	mg/L	110	-	-	110
Sulphate	mg/L	10	-	To be correlated with EC	545 [c]
Fluoride	µg/L	2,000	1,700	2,000	1,700
Nutrients					
Ammonia	µg/L	20	720	1,000 [f]	720
Nitrate	µg/L	-	2,600 – 29,000 [d]	7,600	7,600
TN	µg/L	775	-	-	775
TP	µg/L	160	-	-	160
Dissolved Metals					
Aluminium	µg/L	55	55	1,014 [g]	1,014
Cadmium	µg/L	0.2	0.2	5.6 [h]	0.2
Iron	µg/L	300	280 [e]	1,200 [i]	280
Zinc	µg/L	8	8	17 [f]	8
Boron	µg/L	370	940	370 [f]	940
Molybdenum	µg/L	34	34	34 [i]	34
Selenium	µg/L	5	11 [e]	10 [h]	10
Uranium	µg/L	0.5	0.5	1 [h]	1
Vanadium	µg/L	6	6	10 [h]	10
Hydrocarbons					
Petroleum hydrocarbons (C6-C9)	µg/L	-	-	20	20
Petroleum hydrocarbons (C10-C36)	µg/L	-	-	100	100

a – µS/cm = microSiemens per centimetre, mg/L = milligrams per litre, EC = electrical conductivity, NTU = Nephelometric Turbidity Unit and µg/L = micrograms per litre.

b – ANZG (2018) DGVs for slightly to moderately disturbed freshwater systems, based on protection of 95% of species.

c – Obtained from Dunlop et al (2016) based on protection of 95% of species.

d – Ranges from 2,600 µg/L in moderately hard water (<30 mg/L CaCO3) to 29,000 µg/L for hard water (<30 mg/L CaCO3).

e – Based on total concentration, not dissolved concentration.

f – Based on ANZECC/ARMCANZ (2000) trigger value, which is now superseded by the ANZG (2018) trigger value.

g – Based on 80th percentile of background data.

h – Based on limit of reporting (LOR) for Inductively Coupled Plasma Mass Spectrometry (ICPMS).

i – Noted in the EA as based on low reliability guideline.

3.3.3 Discussion on electrical conductivity (EC) objectives

The following sections describe the outcomes of previous toxicology studies undertaken to assess the tolerances of aquatic organisms to salinity (measured in EC) within the Fitzroy River basin.

3.3.3.1 Prasad et al (2012)

It is understood that the receiving environment EC trigger level of 2,000 µS/cm adopted in the EA was based on the 2012 toxicology study undertaken by Prasad et al (2012). This study assessed the tolerances of aquatic macroinvertebrates collected from Nebo Creek (located in the Fitzroy River catchment, some 200 km north of the Project) to saline solution representative of mine waters. A species sensitivity distribution (SSD) for salinity was derived, which has been reproduced in Figure 3.12. Prasad et al (2012) concluded that the ECs that would be protective of 95% of species was estimated to be 2,010 µS/cm, which is consistent with the EA trigger level for EC.

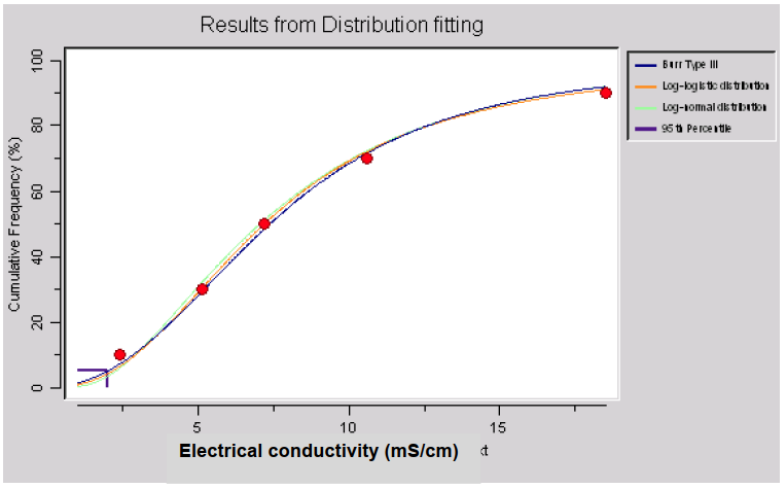


Figure 3.12 SSD for salinity (measured as EC) (Prasad et al, 2012)

3.3.3.2 Hydrobiology (2011)

Prior to the Prasad et al (2012) study, Hydrobiology undertook a site-specific ecotoxicity assessment of mine water discharges for the Caval Ridge Project (Hydrobiology, 2011). The Caval Ridge Project is located within the Fitzroy River catchment, some 175 km northwest of the Project. The objective of this study was to develop and undertake ecotoxicity testing to develop a locally relevant SSD that could be used to predict ECs that would protect a specified percentage of the receiving ecosystem.

Tests were undertaken using commercially available, but locally relevant test species. Test waters were developed to mimic that found in MAW stored at the Peak Downs Mine (adjacent to Caval Ridge), and the diluent water was formulated to approximate Cherwell Creek water.

Hydrobiology (2011) derived an SSD for salinity, which has been reproduced in Figure 3.13. Hydrobiology (2011) concluded that the ECs that would be protective of 95% of species was estimated to be 2,433 µS/cm, which is slightly higher, but generally consistent with the EA trigger level for EC and the DSITIA (2012) study outcomes.

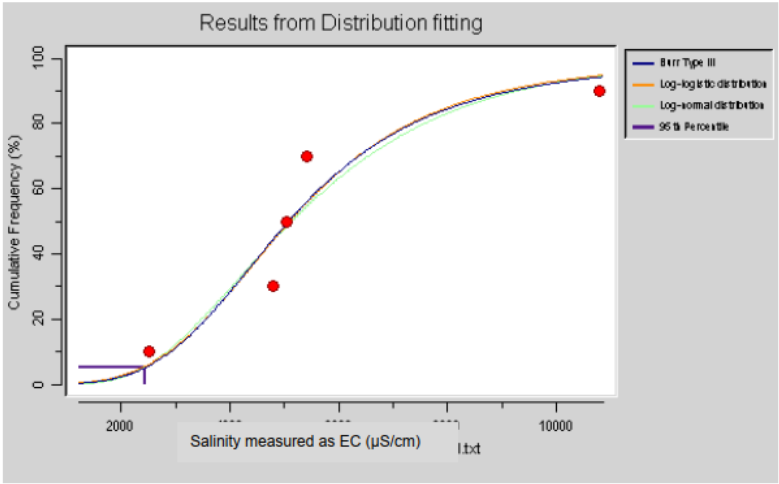


Figure 3.13 SSD for salinity (measured as EC) (Hydrobiology, 2011)

3.3.3.3 Mann (2014)

A study by Mann (2014) investigated the toxicity of mine water with different ionic compositions on specific test species. Two test waters representing coal-mine pit-water (referred to as AMW1 and AMW2) were formulated with chemical salts and differing in the proportions of various ions. Mann (2014) noted that the use of formulated waters permitted the comparison of salinity profiles representing different coal mining areas in Queensland on an equal footing, without the confounding effects of other contaminants that would be found in natural waters.

SSDs were developed for test species exposed to artificial mine waters AMW1 and AMW2, which has been reproduced in Figure 3.14. Mann (2014) noted that based on the trigger values for the protection of 80% to 99% of species, the results suggest that AMW1 was less toxic than AMW2. However, despite substantial differences in ionic composition, and despite individual differences in sensitivity among different test species, the resulting SSDs are of similar shape and position when salinity was measured as EC. More importantly, Mann (2014) noted that ECs that would be protective of 95% of species was estimated to be 3,300 µS/cm for AMW1 and 2,100 µS/cm for AMW2, which are higher than the EA trigger value of 2,000 µS/cm for EC.

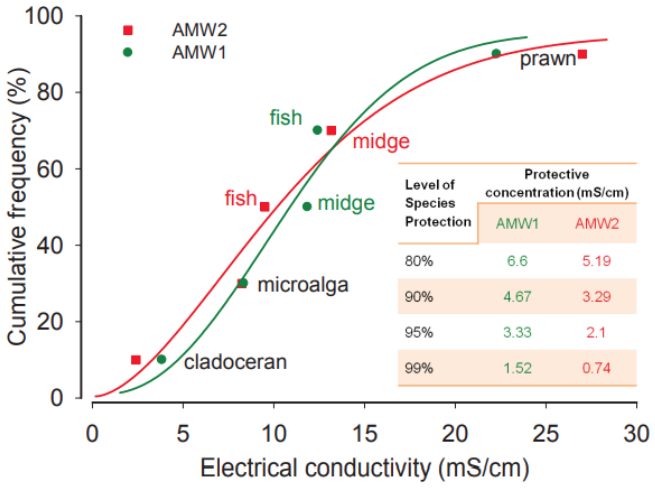


Figure 3.14 SSDs for test species exposed to artificial mine waters AMW1 and AMW2 (Mann, 2014)

3.3.3.4 Dunlop et al (2015)

Dunlop et al (2015) undertook a similar study to Mann (2014). Dunlop et al (2015) defined a test exposure for salinity based on observed ionic composition at the river basin scale and evaluated the 96-hour acute response of 10 macroinvertebrate families. Test organisms were collected from seven sites, four in the Fitzroy River basin, and three within Southeast Queensland. The salt solution used in toxicity testing was representative of an ionic composition typical for the Fitzroy River basin. The final ionic composition used in toxicity testing is subsequently referred to in Dunlop et al (2015) as the Fitzroy Composition (FC).

Dunlop et al (2015) analysed the 96-hour lethal concentration 50% (96-h LC50) for EC of the various test species, and the results have been reproduced in Figure 3.15. It shows that LC50 values for the various test species are generally greater than 6,000 µS/cm, indicating that more than 50% of the test species are tolerant to ECs equal to or higher than 6,000 µS/cm. This provides confidence that the EA trigger value of 2,000 µS/cm for EC is protective of the local aquatic ecosystem.

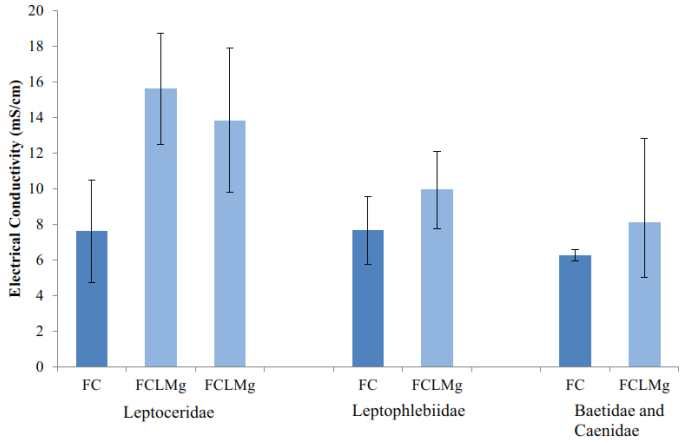


Figure 3.15 Comparison of LC50 results for the FC and Fitzroy Composition with Low Magnesium (FCLMg) with error bars showing the upper 95th and lower 5th confidence limits of LC50 estimates (Dunlop et al, 2015)

3.3.3.5 Adopted WQO for EC

Based on the outcomes of the various toxicity studies described above, the trigger value of 2,000 µS/cm for EC would be protective of local environmental values and was therefore adopted. The evidence from previous studies presented in Sections 3.3.3.1 to 3.3.3.4 suggests that the majority of local aquatic species in the vicinity of the Project would tolerate EC values of up to 2,000 µS/cm.

3.3.4 Discussion on WQOs for parameters other than EC

The WQOs for parameters other than EC were selected based on the rationale presented below.

3.3.4.1 Sulphate

Dunlop et al (2016) evaluated the toxicity of sulphate and then developed preliminary toxicant guidelines for sulphate for the Fitzroy River Basin. Dunlop et al (2016) found that based on a water hardness of 550 mg/L (as $CaCO_3$), the sulphate concentration (as NA_2SO_4) estimated to be protective of 95% of species is 545 mg/L. The Dunlop et al (2016) guideline value has been adopted.

3.3.4.2 Fluoride

The ANZG (2018) DGV for fluoride (based on 95% level of protection) is 1,700 µg/L, which is lower than the EA trigger level of 2,000 µg/L (noted in the EA as being based on guidelines for the protection of livestock and short-term irrigation). The ANZG (2018) DGV has been adopted.

3.3.4.3 Ammonia

The ANZG (2018) DGV for ammonia (based on 95% level of protection) is 720 µg/L, which is lower than the EA trigger level of 1,000 µg/L. The ANZG (2018) DGV has been adopted.

3.3.4.4 Nitrate

ANZG (2018) have published three sets of DGVs for nitrate as its toxicity depends on water hardness. The DGV for nitrate (based on 95% level of protection) is 2,600 µg/L in moderately hard water (30-150 mg/L $CaCO_3$) and 29,000 µg/L for hard water (>150 mg/L $CaCO_3$) (ANZG, 2018). The EA trigger level of 7,600 µg/L is within the range of DGVs for moderately hard to hard water and has been retained as the WQO.

3.3.4.5 Aluminium

The EA trigger level for aluminium (1,014 µg/L) is noted in the EA as being based on 80th percentile of background data. This is consistent with the monitoring data shown in Table 3.4 and therefore, the EA trigger level has been retained as the WQO.

3.3.4.6 Cadmium

The ANZG (2018) DGV for cadmium (based on 95% level of protection) is 0.2 µg/L, which is lower than the EA trigger level (5.6 µg/L). The ANZG (2018) DGV has been adopted.

3.3.4.7 Iron

The ANZG (2018) DGV for iron (based on 95% level of protection) is 280 µg/L, which is lower than the EA trigger level (1,200 µg/L). The ANZG (2018) DGV has been adopted.

3.3.4.8 Zinc

The ANZG (2018) DGV for zinc (based on 95% level of protection) is 8 µg/L**,** which is lower than the EA trigger level (17 µg/L). The ANZG (2018) DGV has been adopted**.**

3.3.4.9 Boron

The ANZG (2018) DGV for boron (based on 95% level of protection) is 940 µg/L, which is higher than the EA trigger level (370 µg/L). The EA trigger level of 370 µg/L is based on the ANZECC/ARMCANZ (2000) DGV, which is now superseded by the ANZG (2018) trigger value. The more contemporary ANZG (2018) DGV has been adopted.

3.3.4.10 Molybdenum

The EA trigger level of 34 µg/L for molybdenum is consistent with the ANZG (2018) DGVs and Mackenzie River WQOs. Therefore, the EA trigger level has been retained as the WQO.

3.3.4.11 Selenium, Uranium and Vanadium

The EA (Table F3) notes that the contaminant investigation levels for selenium, uranium and vanadium are based on the LOR for ICPMS. The EA contaminant investigation levels for selenium, uranium and vanadium are very similar to the respective DGVs, are considered protective of environmental values and have been retained as the WQOs.

3.4 SURFACE WATER QUALITY

3.4.1 Monitoring network and data sources

Figure 3.3 shows the locations of monitoring sites along the local creeks in the vicinity of the Project. Figure 3.2 shows the monitoring site in the Mackenzie River at Bingegang, which is located closest to the Project. Descriptions of these monitoring sites are given in Table 3.3.

Existing surface water quality have been characterised for parameters listed in Table F2 of the EA only, based on water quality monitoring results described in the following reports:

- Receiving Environment Monitoring Program (REMP) Annual Report, July 2021 – June 2022 (BMA, 2023);
- Fitzroy Regional Receiving Environment Monitoring Program (FRREMP) Annual Report, July 2022 – June 2023 (Riethmuller et al., 2023); and
- FRREMP Annual Report, July 2023 – June 2024 (Riethmuller et al., 2025).

It should be noted that after June 2022, Whitehaven Blackwater became a participant in the FRREMP and as such, FRREMP reports were not available for the period before June 2022.

Local monitoring stations at BWM that still contribute data to the FRREMP include the Sirius Creek D/S and the Rockland Creek upstream (U/S) gauges, which are not located within the Project area.

Table 3.3 Description of monitoring sites

Name	Reference	Easting (m) (GDA 94)	Northing (m) (GDA 94)	Description
Upstream monitoring sites				
Emu Creek U/S	EM US	689,049	7,367,899	Upstream end of the Emu Creek clean water drain.
Deep Creek U/S	DP US	681,340	7,371,998	Deep Creek upstream of the haul road.
Taurus Creek U/S	TR US	685,570	7,369,801	Taurus Creek upstream of the haul road.
Two Mile Gully	TM DS	692,093	7,372,042	Two Mile Gully downstream of Blackwater Rolleston Road.
Blackwater Creek U/S	BW US	694,201	7,379,648	Blackwater Creek approximately 2.7 km upstream of the Taurus Creek confluence.
Downstream monitoring sites				
Taurus Creek D/S	TR DS	691,367	7,381,013	Taurus Creek upstream of the railway.
Blackwater Creek D/S	BW DS	693,953	7,384,565	Blackwater Creek at Tantallon Road and downstream of the Taurus Creek confluence.
Mackenzie River at Bingegang	130106A / MAC106	708,267	7,446,600	Mackenzie River just upstream of the Bingegang Weir.

3.4.2 Water quality in local creeks

Table 3.4 shows the water quality monitoring results for the five local monitoring sites upstream of the Project. Table 3.4 also shows the adopted WQOs. It should be noted that whilst the Blackwater U/S monitoring point is geographically located 'downstream' (east) of BWM, this location is upstream of the Taurus Creek confluence and is therefore unaffected by mining activities. The water quality monitoring results shown in Table 3.4 reflect existing site conditions excluding the Project. The data indicates that, upstream of the Project area:

- Median (50th percentile) physiochemical properties such as EC, TSS, turbidity and fluoride in Taurus Creek and Deep Creek are below the WQOs. In Emu Creek, median EC is below the WQOs, but turbidity and TSS exceed the WQOs.
- For nutrients, median concentrations of ammonia and nitrate are below the WQOs. Based on two samples, TN and TP generally exceed the WQOs at Taurus Creek U/S. Based on one sample, TN exceeds the WQOs while TP is below the WQOs at Deep Creek U/S.
- Median concentrations of metalloids upstream of BWM are generally below the WQOs.

Table 3.5 shows the water quality monitoring results for the two local monitoring sites downstream of the Project. Table 3.5 also shows the adopted WQOs. The water quality monitoring results shown in Table 3.5 reflect existing site conditions excluding the Project. The data indicates that, downstream of the Project area:

- For physiochemical properties, median EC and fluoride are below the WQOs. Median TSS and turbidity generally exceed the WQOs and those observed from upstream monitoring sites.
- For nutrients, median concentrations of ammonia and nitrate at Taurus Creek D/S and Blackwater Creek D/S are below the WQOs. Based on one sample, TN and TP in Taurus Creek D/S and Blackwater Creek D/S generally exceed the WQOs and those observed from upstream monitoring sites.
- Median to 80th percentile concentrations of metalloids downstream of BWM are generally below the WQOs.
- Exceedances compared to the WQOs and/or upstream monitoring sites may be due to existing mining activities (excluding the Project) but is also likely due to the larger catchments contributing runoff to these downstream sites.

3.4.3 Regional water quality

Table 3.6 shows the water quality monitoring results for the Mackenzie River at Bingegang (130106A/MAC106). Table 3.6 also shows the local creek WQOs and the Sub-basin WQOs for the Mackenzie River Sub-basin (WQ 1304) (DEHP, 2013). The water quality monitoring results shown in Table 3.6 reflect existing site conditions excluding the Project. The data indicates that, in the Mackenzie River:

- Median physiochemical parameters including EC, turbidity and TSS are below the adopted local creek WQOs and the Sub-Basin WQOs (WQ 1304).
- Median nutrient concentrations including ammonia, nitrate, TP and TN are below the adopted local creek WQOs and the Sub-Basin WQOs (WQ 1304).
- Median metalloid concentrations are below the adopted local creek WQOs and the Sub-Basin WQOs (WQ 1304).

Physicochemical properties, nutrient concentrations and metalloid concentrations in the Mackenzie River are significantly lower than those recorded at the local monitoring sites closer to BWM. This is

due to significantly higher flows, and hence a much higher level of dilution in the Mackenzie River compared to the local creeks in the vicinity of BWM.

Table 3.4 Local waterways surface water quality monitoring results from monitoring sites upstream of the Project

Parameter	Unit	Adopted WQO	Taurus Creek U/S [a]				Deep Creek U/S [a]				Emu Creek U/S [a]				Blackwater Creek U/S [a]				Two Mile Gully [a]			
			Total Samples	20%ile	Median	80%ile	Total Samples	20%ile	Median	80%ile	Total Samples	20%ile	Median	80%ile	Total Samples	20%ile	Median	80%ile	Total Samples	20%ile	Median	80%ile
pH	-	6.5 - 8.5	39	7.37	7.78	7.99	17	6.95	7.83	7.99	3	7.65	7.88	7.89	13	7.12	7.82	8.04	18	6.75	7.24	7.82
EC	µS/cm	2,000	39	154.4	306	389.4	17	149.4	176.5	283.8	3	121.8	132	151.2	13	113.9	144	174.4	18	128.4	164	212.6
Turbidity	NTU	50	37	112	200	364	14	95.2	240	424	5	418	863	1.968	7	142	250	300	15	222	423	860
TSS	mg/L	110	38	37.8	75	311	13	28.8	75	181.2	6	290	471	950	12	65.2	142	696	21	236	444	1,280
Sulphate	mg/L	545	41	2	6	26	14	2	3	6.8	6	0.5	3	132	12	0.6	2	2.8	24	2	4.5	23.6
Fluoride	µg/L	1,700	33	100	200	300	14	50	100	200	6	100	200	300	12	50	100	200	22	50	100	300
Nutrients																						
Ammonia	µg/L	720	30	10	30	50	11	20	60	90	6	20	35	40	11	20	40	40	17	8	40	50
Nitrate	µg/L	7,600	39	28	80	288	14	8	40	144	6	70	130	330	12	12	40	68	22	52	95	210
TN	µg/L	775	2	1,380 [b]	-	1,620 [b]	1	-	1.700 [c]	-	-	-	-	-	1	-	100 [c]	-	1	-	600 [c]	-
TP	µg/L	160	2	116 [b]	-	224 [b]	1	-	130 [c]	-	-	-	-	-	1	-	20 [c]	-	1	-	120 [c]	-
Dissolved Metals																						
Aluminium	µg/L	1,014	34	102	365	1,100	11	90	340	1.050	6	130	200	290	11	120	180	800	18	84	165	296
Cadmium	µg/L	0.2	33	0.05	0.05	0.05	9	0.05	0.05	0.05	6	0.05	0.08	0.25	11	0.05	0.05	0.05	17	0.05	0.05	0.05
Iron	µg/L	280	34	104	345	748	11	140	320	490	6	150	250	280	11	140	240	510	18	104	175	354
Zinc	µg/L	8	34	<2.5	<2.5	7.4	11	<2.5	<2.5	<2.5	6	<2.5	4.75	12.5	11	<2.5 [d]	<2.5 [d]	<2.5 [d]	18	<2.5 [d]	<2.5 [d]	4.6 [d]
Boron	µg/L	940	30	<25 [c]	60	74	11	<25 [d]	<25 [d]	25 [d]	6	<25 [d]	50	60	11	<25 [d]	<25 [d]	<25 [d]	18	<25 [d]	<25 [d]	52 [d]
Molybdenum	µg/L	34	34	<0.5 [d]	<0.5 [d]	2	11	<0.5 [d]	<0.5 [d]	2	6	<0.5 [d]	<0.5 [d]	2.5	11	<0.5 [d]	<0.5 [d]	<0.5 [d]	18	<0.5 [d]	<0.5 [d]	<0.5 [d]
Selenium	µg/L	10	30	<5 [d]	<5 [d]	<5 [d]	11	<5 [d]	<5 [d]	<5 [d]	6	<5 [d]	<5 [d]	25	11	<5 [d]	<5 [d]	<5 [d]	19	<5 [d]	<5 [d]	<5 [d]
Uranium	µg/L	1	29	<0.5 [d]	<0.5 [d]	<0.5 [d]	11	<0.5 [d]	<0.5 [d]	<0.5 [d]	6	<0.5 [d]	<0.5 [d]	<0.5 [d]	11	<0.5 [d]	<0.5 [d]	<0.5 [d]	18	<0.5 [d]	<0.5 [d]	<0.5 [d]
Vanadium	µg/L	10	29	<5 [d]	<5 [d]	<5 [d]	10	<5 [d]	<5 [d]	<5 [d]	6	<5 [d]	<5 [d]	25	11	<5 [d]	<5 [d]	<5 [d]	18	<5 [d]	<5 [d]	<5 [d]

[a] – Values preceded by the symbol '<' represent concentrations below the LOR.

[b] – Only two samples were analysed. The values shown in the 20th percentile (20%ile) and 80th percentile (80%ile) columns are the minimum and maximum values, respectively.

[c] – Only one sample was analysed, with the value shown in the median column.

[d] – Below the limit of detection.

Table 3.5 Local waterways surface water quality monitoring results from monitoring sites downstream of the Project

Parameter	Unit	Adopted WQO	Blackwater Creek D/S [a]				Taurus Creek D/S [a]			
			Total Samples	20%ile	Median	80%ile	Total Samples	20%ile	Median	80%ile
pH	-	6.5 - 8.5	88	7.1	7.7	7.96	16	6.88	7.3	7.7
EC	µS/cm	2,000	88	168.88	224.5	373.8	16	151	185.65	265
Turbidity	NTU	50	61	190	450	1,000	8	254	532	2,172
TSS	mg/L	110	72	136.6	269.5	1,041.6	13	164.8	462	1,400
Sulphate	mg/L	545	85	4	11	34.4	15	0.5	6	14.2
Fluoride	µg/L	1,700	84	100	200	300	14	100	200	340
Nutrients										
Ammonia	µg/L	720	67	20	40	60	11	20	50	80
Nitrate	µg/L	7,600	80	60	130	322	13	40	130	230
TN	µg/L	775	3	1,360	2,200	4,240	1	-	4,400 [b]	-
TP	µg/L	160	3	312	660	1,332	1	-	1,300 [b]	-
Dissolved Metals										
Aluminium	µg/L	1,014	68	48	150	418	11	120	180	320
Cadmium	µg/L	0.2	60	0.05	0.05	0.05	9	0.05	0.05	0.05
Iron	µg/L	280	68	94	170	378	11	120	210	300
Zinc	µg/L	8	68	<2.5 [c]	<2.5 [c]	<2.5 [c]	11	<2.5 [c]	<2.5 [c]	<2.5 [c]
Boron	µg/L	940	68	<25 [c]	<25 [c]	60	11	<25 [c]	<25 [c]	<25 [c]
Molybdenum	µg/L	34	68	<0.5 [c]	<0.5 [c]	1	11	<0.5 [c]	<0.5 [c]	<0.5 [c]
Selenium	µg/L	10	68	<5 [c]	<5 [c]	<5 [c]	11	<5 [c]	<5 [c]	<5 [c]
Uranium	µg/L	1	68	<0.5 [c]	<0.5 [c]	<0.5 [c]	11	<0.5 [c]	<0.5 [c]	<0.5 [c]
Vanadium	µg/L	10	66	<5 [c]	<5 [c]	<5 [c]	11	<5 [c]	<5 [c]	<5 [c]

[a] – Values preceded by the symbol '<' represent concentrations below the LOR.

[b] – Only one sample was analysed, with the value shown in the median column.

[c] – Below the limit of detection.

Table 3.6 Regional surface water quality sampling results

Parameter	Unit	Adopted WQO	Mackenzie WQ1304 WQO	Mackenzie River at Bingegang (MAC106)			
				Total Samples	20%ile	Median	80%ile
pH	-	6.5 - 8.5	6.5 - 8.5	6	7.3	7.5	7.7
EC	µS/cm	2,000	310	6	163.3	364.7	386.9
Turbidity	NTU	50	50	6	25.7	47.7	208.4
TSS	mg/L	110	110	6	18	21.5	38
Sulphate	mg/L	545	10	6	2	9	9
Fluoride	µg/L	1,700	-	-	-	-	-
Nutrients							
Ammonia	µg/L	720	20	6	5	17.5	30
Nitrate	µg/L	7,600	-	6	10	17.5	170
TN	µg/L	775	775	6	500	750	1200
TP	µg/L	160	160	6	60	125	400
Dissolved Metals							
Aluminium	µg/L	1,014	55	6	10	5	5
Cadmium	µg/L	0.2	0.2	6	0.05	0.05	0
Iron	µg/L	280	300	6	30	25	25
Zinc	µg/L	8	8	6	3	2.5	2.5
Boron	µg/L	940	370	6	25	37.5	60
Molybdenum	µg/L	34	34	6	0.5	0.5	1
Selenium	µg/L	10	5	6	5	5	5
Uranium	µg/L	1	0.5	6	0.5	0.5	1
Vanadium	µg/L	10	6	6	5	5	5

3.5 CLIMATE

3.5.1 Overview

BWM is in a subtropical climate zone, characterised by hot, humid summers and moderately dry winters. Average minimum daily temperatures range from 11.4 degrees Celsius (°C) in July to 22.0°C in January, and average maximum daily temperatures range from 20.7°C in July to 43.7°C in January.

3.5.2 Rainfall

Climate data for the site (latitude 23.74°S, longitude 148.83°E) (easting 686,524, northing 7,373,359 in GDA94) was sourced from the Department of Science, Information Technology and Innovation's (DSITI's) SILO Data Drill (SILO). This dataset provides continuous, gap-free daily records interpolated from the Bureau of Meteorology's (Bureau's) observations.

The historic average annual rainfall from 1957 to 2024 is 536.5 millimetres (mm) (see Figure 3.16). The minimum recorded rainfall during this period was 279 mm in 2019, while the maximum reached 1,403 mm in 2010. The distribution of monthly SILO rainfall is shown in Figure 3.12.

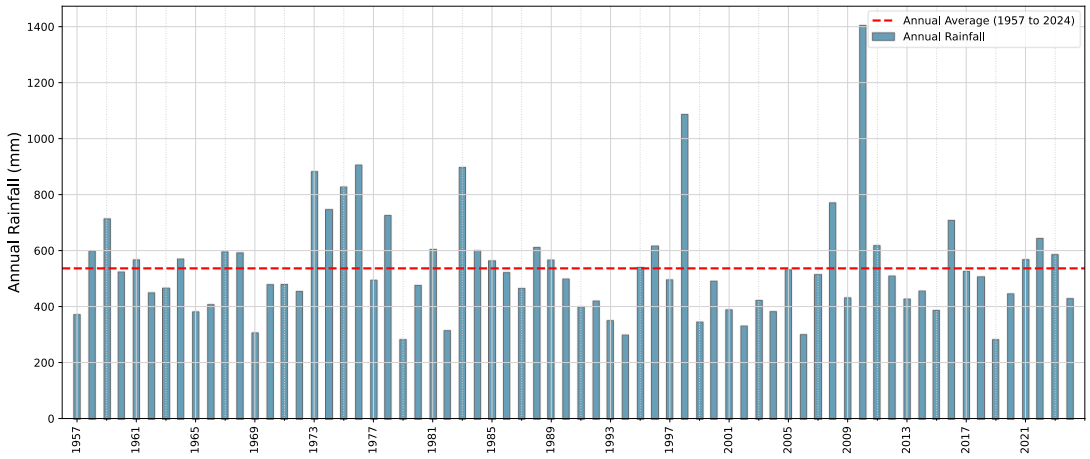


Figure 3.16 Annual rainfall (1957-2024)

Figure 3.17 shows the distribution of monthly rainfalls at the site based on SILO data between 1957 and 2024. Rainfalls predominantly fall during the warmer months from November to March with significantly lower rainfalls recorded during the cooler months.

3.5.3 Evaporation

Figure 3.17 shows the median monthly Class A pan evaporation and rainfall based on SILO data between 1957 and 2024. Evaporation data for the site has been compiled using a combination of synthetic estimates before 1970 and Class A pan evaporation measurements from 1970 onwards. The SILO evaporation estimates were derived using climatological modelling techniques to fill gaps in historical records. Of note:

- Average Annual Pan Evaporation: 2,034 mm.
- Evaporation peaks between October and January, aligning with the warmer months.
- Median monthly evaporation exceeds median monthly rainfall for all months.

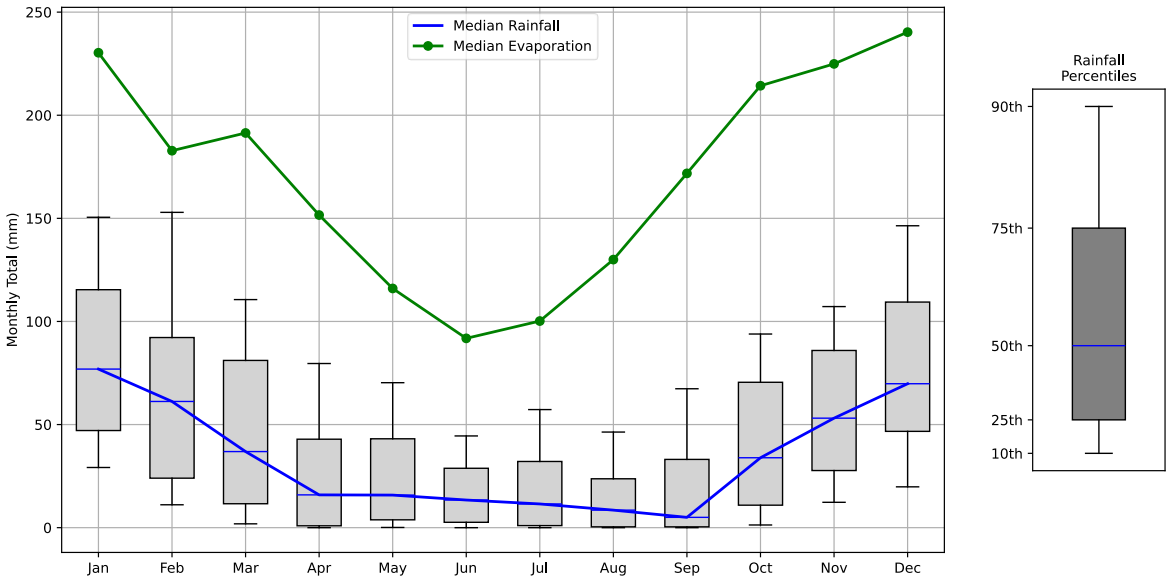


Figure 3.17 Monthly SILO rainfall and evaporation distributions summary

3.5.4 Comparative climate data

Table 3.7 shows long term rainfall, evaporation and temperatures at three nearby Bureau-owned stations and at two on-site weather stations owned by Whitehaven Blackwater, where data is available. The data shows that:

- Silo rainfall and evaporation monthly data is consistent with recorded data at the nearby stations.
- Average annual rainfalls at the two site weather stations are consistent with those recorded at the Bureau's Blackwater Airport station (located adjacent to BWM), but generally lower than those recorded at the Bureau's Springsure and Comet Post Office stations, which are located further away from BWM.

Table 3.7 Rainfall and evaporation monthly averages, minimum and maximum monthly temperature

	Mean monthly rainfall at Bureau rainfall stations (mm)			SILO Data Drill mean monthly rainfall	Mean monthly rainfall at on-site rainfall stations (mm)		Mean Monthly Evaporation (mm)		Average Daily Temperature (°C)	
	Blackwater Airport (35134)	Springsure Creek Junction AL (35276)	Comet Post Office (35021)		Northern Weather Station (330122)	Central Industrial Area Weather Station (330107)	Springsure Comet St (35065)	SILO Data Drill	Blackwater Airport (35134)	
									Min.	Max.
Distance and direction from BWM	1 km	38 km	28 km	-	-	-	85 km	-	1 km	
Period of record	2013 - 2025	2010 - 2025	1895 – 2025	1957 - 2025	2016 - 2025	2016 - 2025	1957 - 2025	1957 - 2025	2013 - 2025	
January	92.3	90.4	99.3	85.5	83.0	81.4	235.5	229.1	21.9	34.7
February	73.1	69.0	88.8	71.8	75.9	82.1	188.9	185.3	21.7	34.3
March	65.6	101.0	59.3	50.4	75.3	72.8	191.0	188.8	21.0	33.3
April	19.7	25.9	32.3	29.3	17.2	12.6	146.3	148.1	16.9	30.3
May	21.0	31.3	29.1	30.6	25.9	29.2	109.8	114.1	13.4	26.8
June	19.0	21.9	27.6	21.1	24.1	23.4	84.5	90.0	10.2	24.2
July	29.9	29.9	25.8	21.7	38.3	31.8	93.4	98.7	9.3	24.0
August	18.4	14.1	17.2	17.5	22.2	16.0	126.5	129.5	10.0	26.2
September	17.5	25.0	21.3	21.8	17.0	16.9	170.8	170.9	13.4	29.5
October	50.3	53.8	36.6	43.6	68.5	58.2	216.0	213.1	17.2	32.4
November	52.4	60.5	54.8	60.4	69.1	72.7	228.8	224.6	19.2	33.8
December	71.3	88.1	81.8	84.2	62.0	67.7	246.4	240.1	21.0	34.8
Annual Average	**534.5**	**572.1**	**578.9**	**536.5**	**529.4**	**516.8**	**2,039.6**	**2,033.8**	-	-

4 EXISTING SITE CHARACTERISTICS

4.1 OVERVIEW

This section describes the objectives and principles of the SWMS for the existing operations at BWM, including a description of the infrastructure and systems that have been designed to achieve the objectives and principles.

4.2 EXISTING SITE OPERATING ACTIVITIES

HydroBalance (2026) describes the existing SWMS in Appendix B. Figure 4.1 to Figure 4.3 show the locations of the existing water storages at BWM. Table 4.1 shows a summary of the existing water storages at BWM including the Operating Capacity (OC) for each of the storages. The OC represents the maximum allowable volume that can be stored in the dam/pit (taking into account factors such as base of weathering). Figure 4.4 to Figure 4.6 shows the existing SWMS schematic.

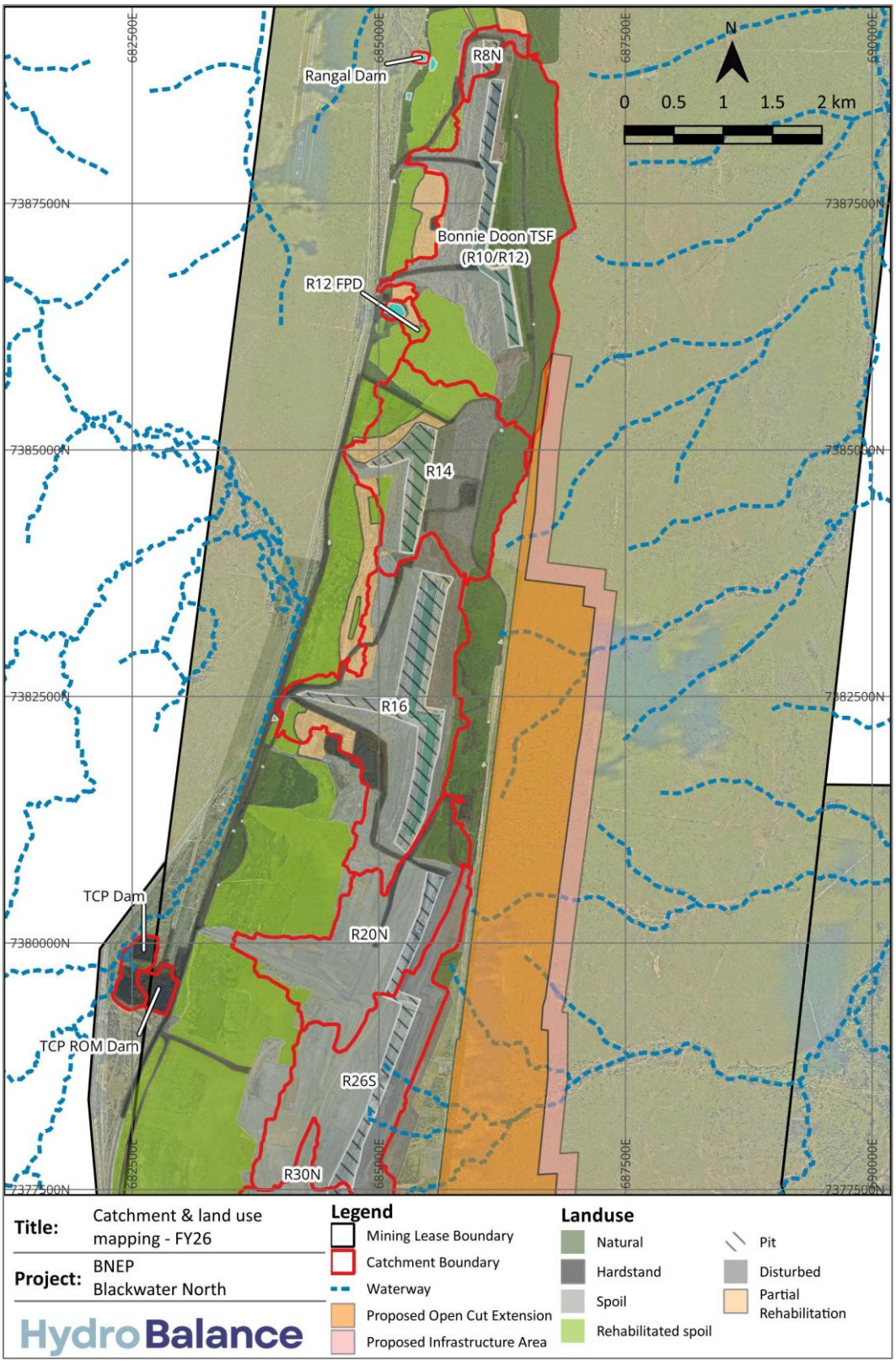


Figure 4.1 **Existing water storages, catchments and land use characteristics – Blackwater North (HydroBalance, 2026)**

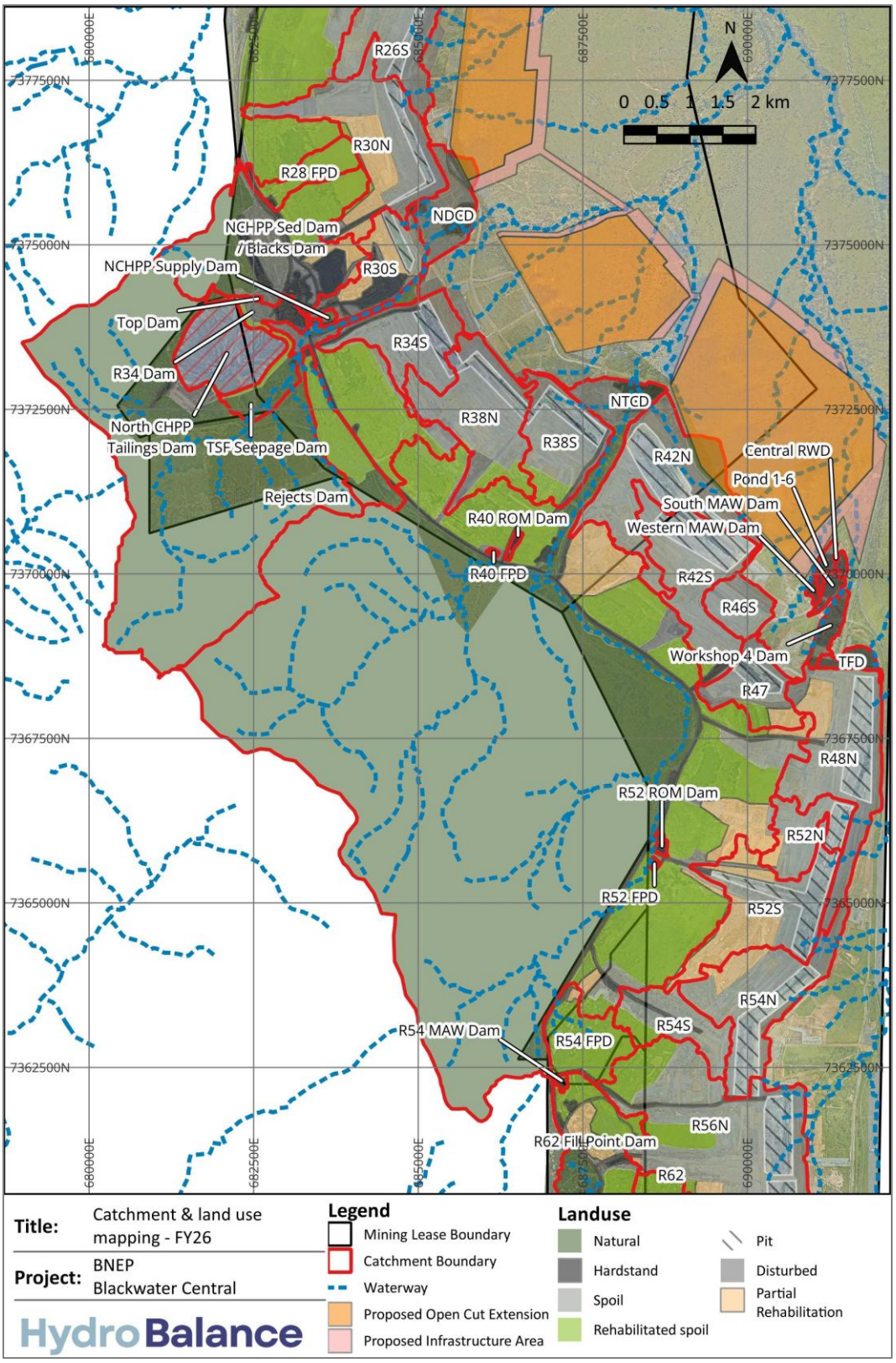


Figure 4.2 **Existing water storages, catchments and land use characteristics – Blackwater Central (HydroBalance, 2026)**

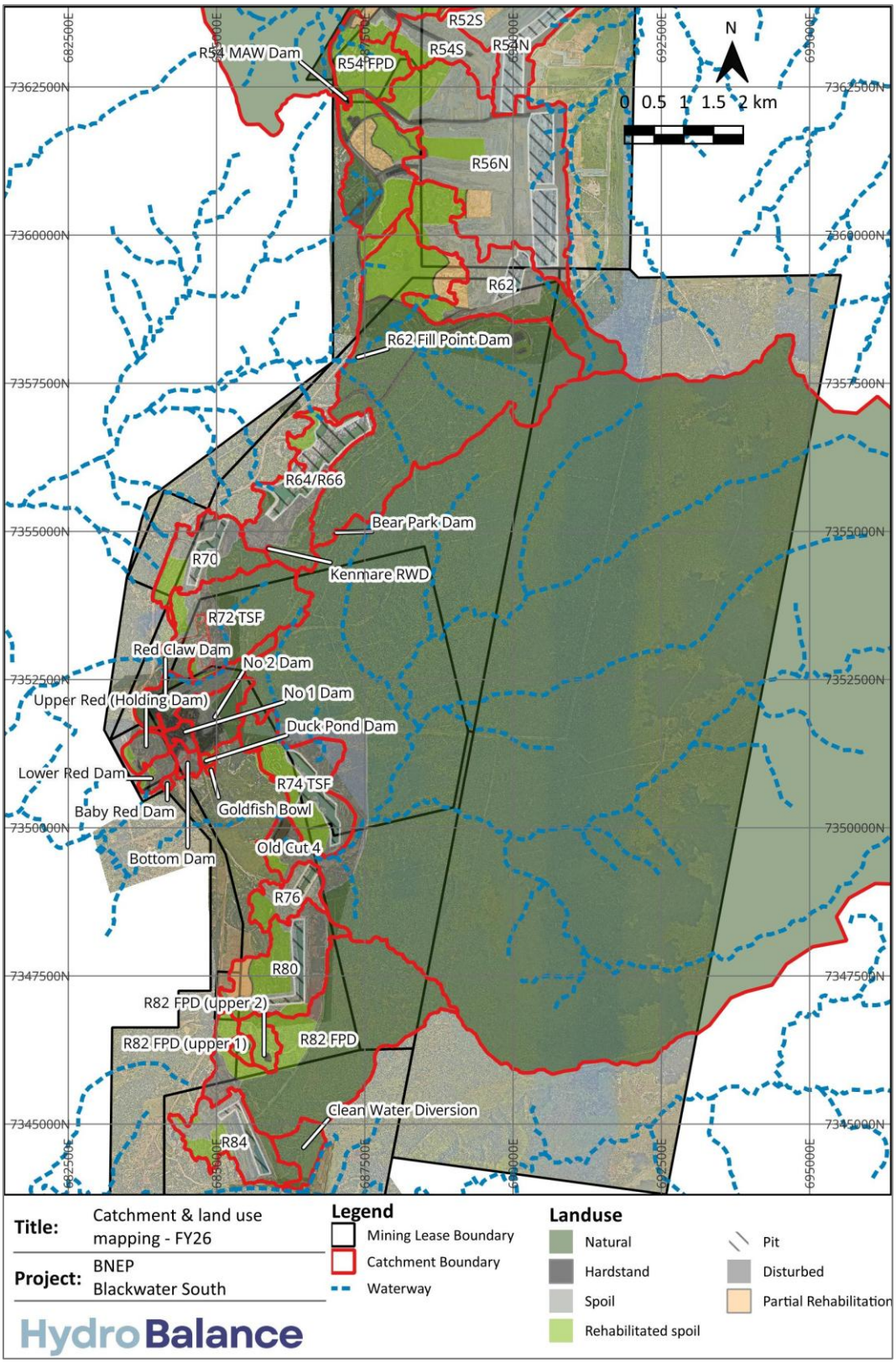


Figure 4.3 **Existing water storages, catchments and land use characteristics – Blackwater South (HydroBalance, 2026)**

Table 4.1 Mine water storage inventory and capacity (HydroBalance, 2026)

Storage name	Operating Capacity (ML)	Overflows to
Dam storages		
BWM North MAW Dams		
R12 FPD	241.8	Offsite
TCP Dam	68	Offsite
TCP ROM Dam	15.5	Offsite
R28 FPD	7.5	Offsite
Top Dam	100	Offsite
NCHPP Sed Dam/Blacks Dam	39.3	Deep Creek
NCHPP Supply Dam	48.7	Offsite
R34 Dam	11.8	-
TSF Seepage Dam	41.3	Offsite
Rejects Dam	16	Offsite
South MAW Dam	13.4	Offsite
Pond 1-6	25.9	Offsite
Western MAW Dam	3.0	Pond 1-6
Workshop 4 Dam	51.3	Offsite
TFD	97.5	Two Mile Gully
Old R40 FPD	-	NTCD
R40 FPD	13.1	NTCD
R40 ROM Dam	12.3	NTCD
R48 FPD	29.8	Offsite
R52 ROM Dam	12.0	Offsite
R52 FPD	20.1	Offsite
R54 FPD	12.0	Offsite
R54 MAW Dam	26.6	Offsite
BWM South MAW Dams		
Upper Red Dam (Holding Dam)	113	Lower Red Dam
Lower Red Dam	80	Offsite
Baby Red Dam	0.5	Offsite
No 1 Dam	7.2	Bottom Dam
No 2 Dam	156	Duck Pond
Bottom Dam TSF	0.45	Duck Pond
Duck Pond	61.9	Goldfish Bowl
Goldfish Bowl	15	Sirius Creek
R56 FPD	157.2	Speculation Creek

Storage name	Operating Capacity (ML)	Overflows to
R62 FPD	15.3	Speculation Creek
R82 FPD	110.3	Rockland Creek
On-stream storages		
NDCD	268.9	Deep Creek
NTCD	533.9	Taurus Creek
Old Cut 4	447.5	Sirius Creek
Rockland Basin	13,800	Rockland Creek
Pit storages		
R14	8,191	R16
R16	11,999	R20
R30S	860	R30N
R64/R66	4,963	Offsite
R70	2,170	Offsite
R76	2,149	Offsite
R80	7,879	Offsite
R84	7,563	Rockland Creek
Tailings dams		
R10/R12 WSP (Bonnie Doon)	5,527	Offsite
North CHPP Tailings Dam	738	Offsite
R72 TSF	487	Offsite
R74 TSF	3,949 (FSV) 3,453 (MOV)	Offsite
Pits		
R8N	<200	Offsite
R20/R26	30,644	Offsite
R30N	5,815	R20
R34	2,773	R38
R38	13,264	Offsite
R42	2,000	Offsite
R46N	1,500	R42
R46S	1,500	R46N
R47	1,500	R46S
R48	2,000	Offsite
R52N	569	Offsite
R52S	2,000	Offsite
R54	5,217	Offsite

Storage name	Operating Capacity (ML)	Overflows to
R56	5,217	Offsite
R62	2,000	R56
Raw Water Dams		
Rangal Dam	5	Offsite
Central RWD	5	Offsite
Kenmare RWD	22	Offsite
Bear Park Dam	22	Offsite
Red Claw Dam	113	Offsite

Notes:

MAW = Mine Affected Water

TSF = Tailings Storage Facility

NCHPP = North CHPP, WSD = water storage dam, MAW = mine-affected water, RWD = raw water dam, TSF = tailings storage facility, TFD = Tannyfoil dam, FPD = fill point dam, NDCD = New Deep Creek Dam, NTCD = New Taurus Creek Dam, WSP = water storage pit, TSD = tailings storage dam

ML = megalitres

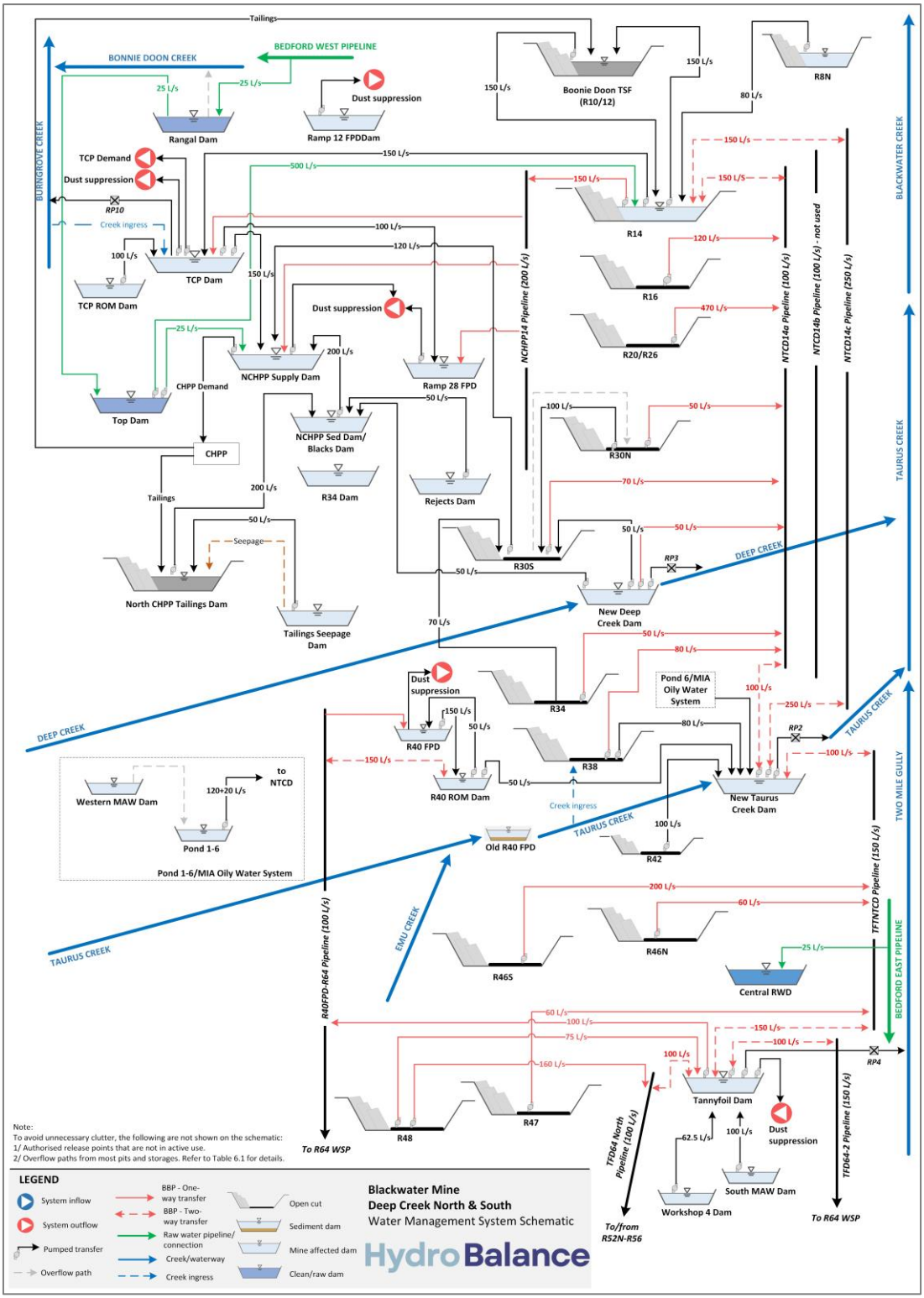


Figure 4.4 Existing SWMS schematic – Deep Creek North and South (HydroBalance, 2026)

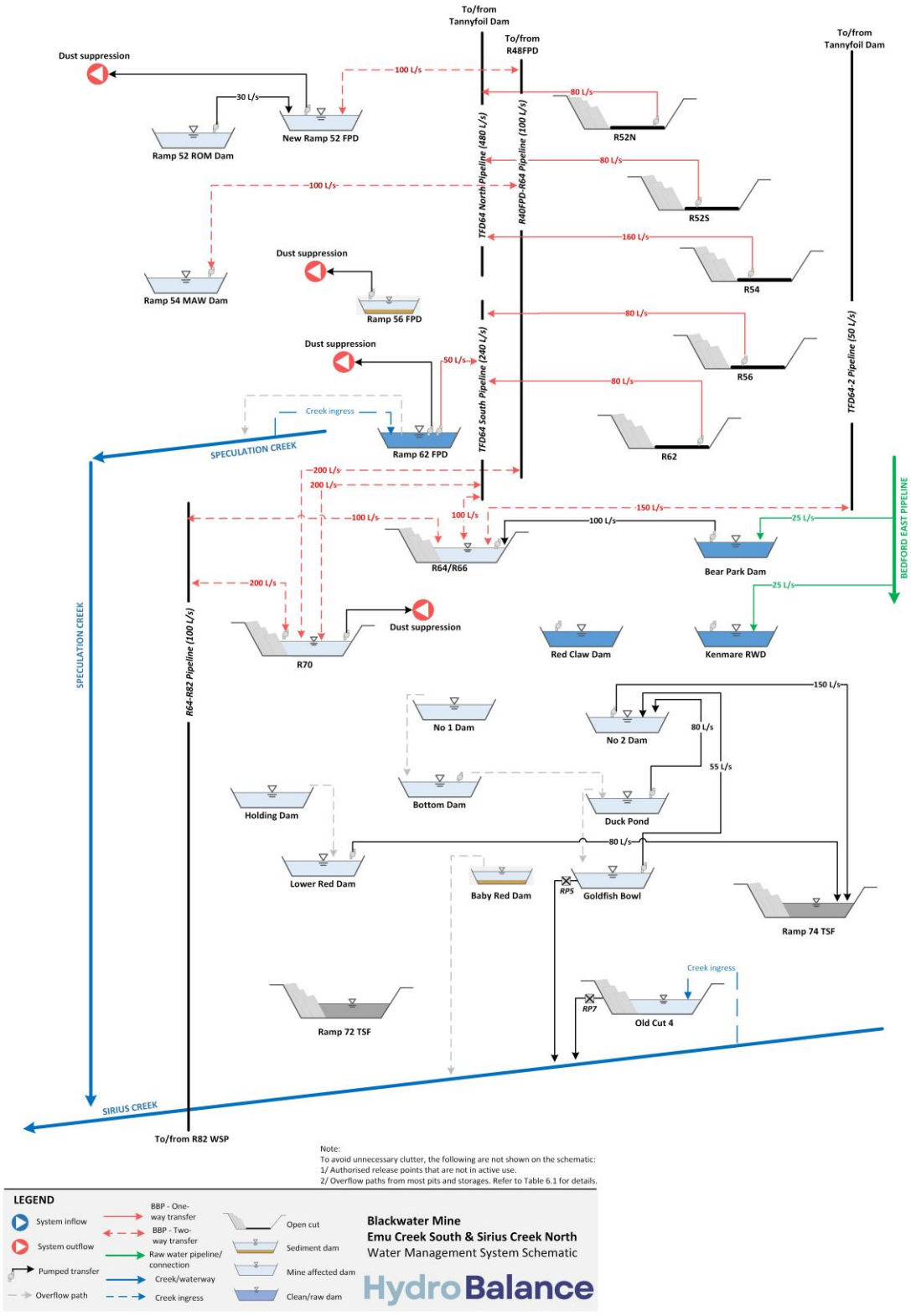


Figure 4.5 Existing SWMS schematic – Emu Creek and Sirius Creek North (HydroBalance, 2026)

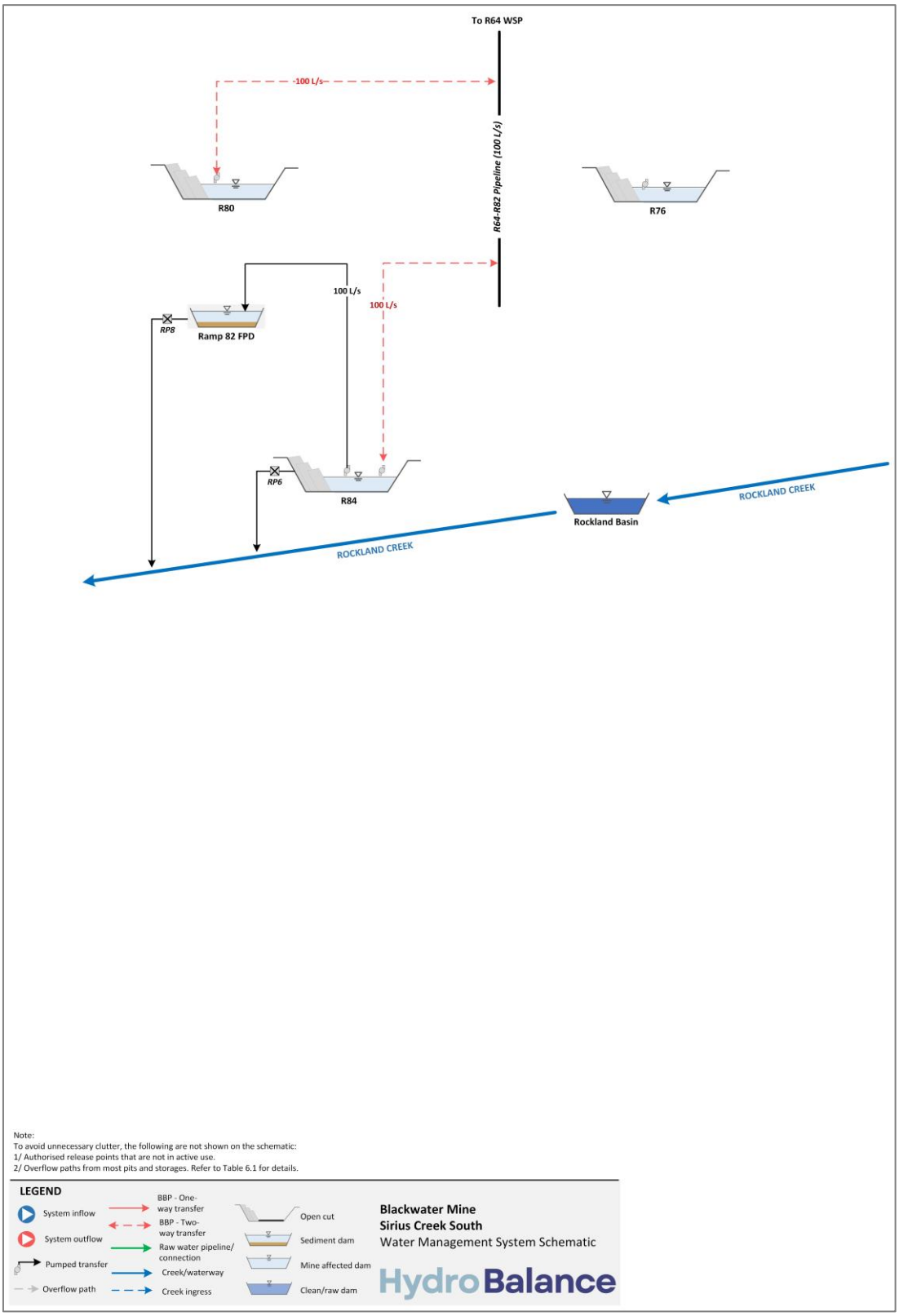


Figure 4.6 Existing SWMS schematic – Sirius Creek South (HydroBalance, 2026)

4.3 TYPES OF WATER GENERATED ON SITE

Land disturbance associated with mining has the potential to adversely affect the quality of surface runoff in downstream receiving waters through increased sediment loads. In addition, runoff from active mining areas (including coal stockpiles, etc.) may have increased concentrations of salts and other pollutants when compared to natural runoff. The existing and proposed strategy for the management of surface water at the Project is based on the separation of water from different sources based on anticipated water quality.

Potential sources of contamination include runoff from disturbed and rehabilitated land, release of recycled waters from sewage treatment plants and industrial areas, and release of waters from pits, water storages and dams. Contaminants may include suspended solids, dissolved solids (e.g. sodium, chloride, sulphate), altered pH and metals (Whitehaven, 2025).

Definitions of the types of water generated within the Project are shown in Table 4.2.

Table 4.2 Types of water generated on site

Water type	Definition
MAW	In accordance with the DESI's *Model Mining Conditions (*2024b*)*, MAW means the following types of water: *i) pit water, tailings dam water, processing plant water* *ii) water contaminated by a mining activity which would have been an environmentally relevant activity under Schedule 2 of the Environmental Protection Regulation 2008 if it had not formed part of the mining activity* *iii) rainfall runoff which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated, excluding rainfall runoff discharging through release points associated with erosion and sediment control structures that have been installed in accordance with the standards and requirements of an Erosion and Sediment Control Plan to manage such runoff, provided that this water has not been mixed with pit water, tailings dam water, processing plant water or workshop water* *iv) groundwater which has been in contact with any areas disturbed by mining activities which have not yet been rehabilitated* *v) groundwater from the mine dewatering activities* vi) *a mix of mine-affected water (under any of paragraphs i) - v)) and other water.*
Sediment water	Surface water runoff from areas that are disturbed by mining operations (including out-of-pit waste rock emplacements). This runoff does not come into contact with coal or other carbonaceous material and may contain high sediment loads but does not contain elevated level of other water quality parameters (e.g. EC, pH, metals, metalloids, non-metals). This runoff must be managed to ensure adequate sediment removal prior to release to receiving waters.
Clean catchment water	Surface runoff from areas unaffected by mining operations. Clean catchment water includes runoff from undisturbed areas and fully rehabilitated areas.
Raw water	Untreated water, generally from an external water supply, particularly the Burdekin pipeline.

Water type	Definition
Contaminated water	Contaminated water includes runoff from areas containing explosives, hazardous chemicals, corrosive substances, toxic substances, gases and dangerous goods, as well as flammable and combustible liquids (including petroleum products).
Potable water	Treated water suitable for human consumption.

4.4 SOURCES OF CONTAMINATION

The following are the primary sources of contamination at BWM, along with their potential contaminants and mechanisms (Whitehaven, 2025):

- Spoil areas - large areas of exposed spoil can be a substantial source of salt and sediment during runoff events and also potential seepage.
- Open pits - a large quantity of saline alkaline water collects in operational pits during intense wet periods. This water must be pumped to other storages to enable mining operations to continue.
- Haul roads and Industrial areas - very high runoff coefficient associated with the heavily compacted road surface can exacerbate sediment loads.
- Tailings Dams and Disposal Areas - dams with insufficient freeboard or structural faults can allow coal wastes to escape an impoundment.
- Topsoil stripped areas - subsoils in the area are often saline, hence topsoil stripped areas can generate saline surface runoff as well as high turbidity colloidal suspensions.
- MAW Management System (storage dams, piping and drainage infrastructure) - collection and transfer of MAW from other contaminant sources, providing risk of release to environment via dam spillways and piping infrastructure.
- Coal stockpiles - storm events can generate saline runoff and coal fines and leachate from stockpiles of coal.
- Reject stockpiles - storm events can generate saline runoff and coal fines and leachate from reject areas.
- Rejects disposal areas - drainage from these areas has potential for acid leachate generation.
- Rehabilitation areas - newly developed rehabilitation – e.g. top-soiled and seeded carries high erosion risk until vegetation cover is satisfactory. Potential for significant sediment yield as well as some saline water.

4.5 STORED WATER QUALITY

Whitehaven Blackwater have been recording pH and EC on a subdaily basis (telemetry) at key storages within BWM. Figure 4.7 and Figure 4.8 are box and whisker plots (box plots), which illustrate a statistical summary of pH and EC, respectively, at the following six BWM storages, for the period between January 2016 and April 2025:

- TFD – location of licensed discharge point RP4;
- NTCD – location of licensed discharge point RP2;
- TCP Dam;
- Rejects Drainage Sump; and
- Ramp 34 Storage Dam.

The box plots represent the following:

- the upper and lower 'whiskers' represent the 5th and 95th percentile range of values;
- the upper and lower extents of the green box represent the 25th and 75th percentile of values; and
- the black line in the green box represents the median (50th percentile value).

The monitoring results show that:

- Stored water quality in all six storages is generally alkaline, with median pH ranging between 8.5 and 9.5, which is above the upper threshold of the adopted WQOs.
- Median EC are above the adopted WQOs at all storages except for the Ramp 34 Storage Dam. However, EC at all six storages has mostly remained below 10,000 µS/cm, which is EA's upper limit for controlled releases (discussed in Section 5.6.7).

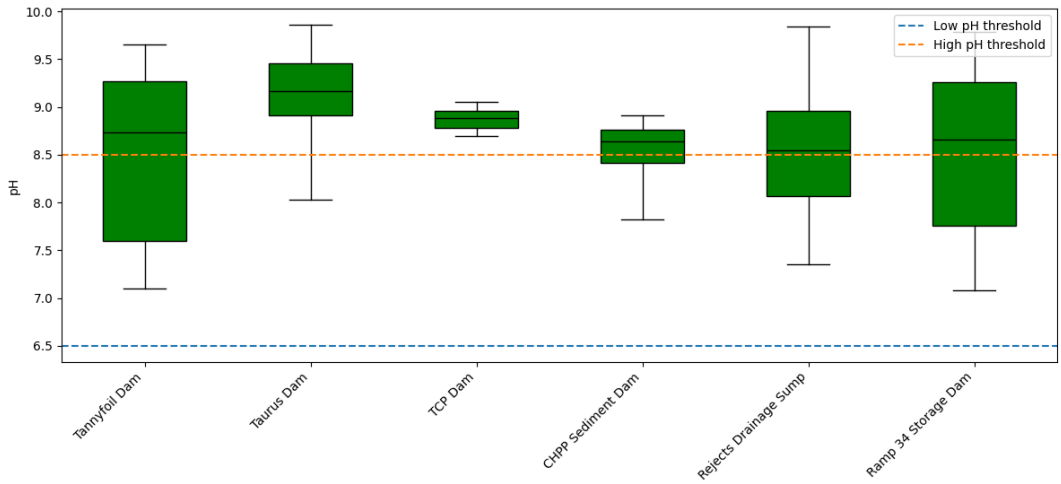


Figure 4.7 Monitoring results for pH at existing BWM storages, 2016 to 2025

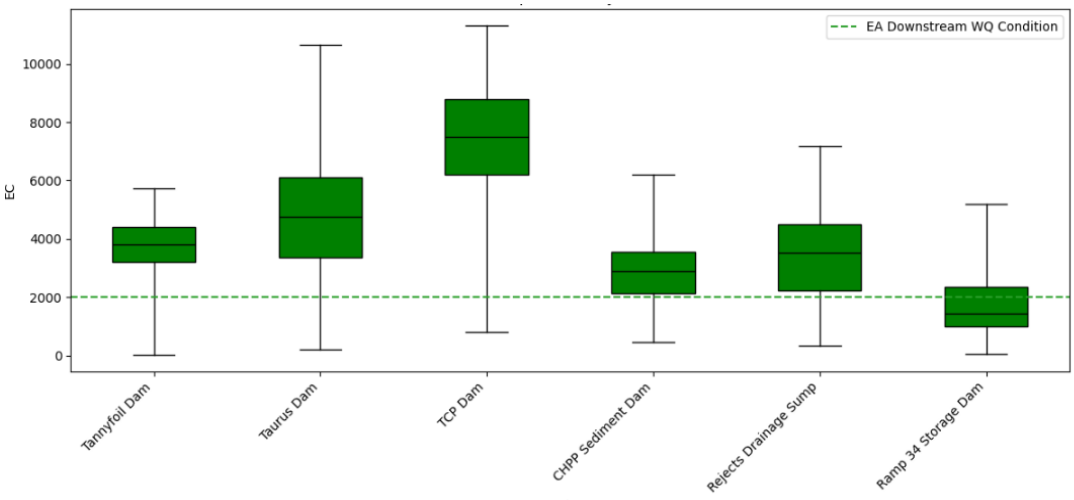


Figure 4.8 Monitoring results for EC (µS/cm) at existing BWM storages, 2016 to 2025

5 SURFACE WATER MANAGEMENT SYSTEM

5.1 OVERVIEW

The SWMS at BWM is designed to manage water resources efficiently while reducing environmental impacts. The system is designed to handle the diverse water sources generated by mining activities, including MAW, tailings runoff, sediment-laden water, and clean catchment water.

The SWMS consists of a network of storage facilities, pipelines, and controlled-release mechanisms. These components work together to ensure compliance with environmental regulations, maintain operational efficiency, and protect local waterways. The SWMS consist of:

- Storage Facilities: The SWMS includes a variety of dams and pits with specific operating capacities. These include dam storages, on-stream storages, tailings dams as well as active and inactive pit storages (refer to Table 4.1). There are no additional storages proposed as part of the Project.
- Pipeline Network: The site has 10 backbone pipelines connecting water storage facilities across the mine (refer to Table 6.2 in Appendix B). There are no additional trunk pipelines proposed as part of the Project.
- Controlled Releases: Controlled releases are permitted under specific conditions. Releases are regulated to ensure minimal impact on downstream water quality. There are no proposed changes to the currently approved controlled release strategy as part of the Project.
- Erosion and Sediment Control:
  - The SWMS includes sediment basins to capture sediment laden runoff from the disturbed areas and provide an area where settlement of suspended sediment in runoff can occur (Whitehaven, 2024).
  - No specific requirements for additional sediment basins have been identified. However, there is potential additional sediment basins may be required for the Project associated with disturbance in advance (to the east) of mining operations including infrastructure corridors, pre-stripping and topsoil stockpiles. The requirement for, and location and sizing of, any new sediment basins would be confirmed during detailed design, having regard to the final disturbance footprint, catchment configuration, drainage design and anticipated sediment-generation risk.

5.2 SURFACE WATER MANAGEMENT DOCUMENTATION

Surface water at BWM is managed in accordance with key guiding documents, including:

- BWM WMP (Whitehaven, 2026a): This plan is developed in compliance with the EA EPML00717813 and serves as the primary framework for site water management. It provides comprehensive guidance on operational principles, design considerations, and management strategies to ensure effective and environmentally responsible water handling.
- Erosion and Sediment Control Plan (ESCP) (Whitehaven, 2026b): This plan outlines specific measures to prevent erosion and manage sediment-laden water.

The WMP includes detailed strategies for water storage, controlled releases, ESC, and tailings management. It is designed to address the unique hydrological challenges of the BWM site, ensuring that water resources are managed sustainably and in line with regulatory requirements.

5.3 SURFACE WATER MANAGEMENT OBJECTIVES

The SWMS at BWM, including the Project, is designed to ensure operational efficiency while safeguarding EVs. The key objectives of the SWMS, as outlined in the WMP (Whitehaven, 2023), are:

- Prevent uncontrolled discharges: Ensure that MAW is effectively managed to prevent uncontrolled discharges into local waterways, thereby protecting aquatic ecosystems and maintaining water quality.
- Ensure regulatory compliance: Adhere to all EA conditions, including those specified under EPML00717813, to meet statutory requirements and uphold environmental standards.
- Optimise water reuse and recycling: Maximise water reuse and recycling on the mine site to reduce reliance on external water sources and promote sustainable water management practices.
- Minimise downstream impacts: Mitigate the effects of mining activities on downstream water quality and hydrology, ensuring that local waterways remain healthy and functional.
- Implement ESC measures: Deploy effective strategies, such as sediment basins and silt fences, to reduce sedimentation and protect the integrity of local waterways.

5.4 CONTAMINATED WATER MANAGEMENT

5.4.1 Chemical storage

Chemical storage facilities at BWM are designed to prevent contamination of surface water resources. These facilities are equipped with secondary containment systems, such as bunds and spill trays, to capture any accidental spills or leaks. Regular inspections and maintenance are conducted to ensure the integrity of storage tanks and associated infrastructure, as outlined in the WMP (Whitehaven, 2023). Additionally, the EA requires compliance with strict guidelines for chemical storage and handling to minimise environmental risks.

5.4.2 Fuel storage

Fuel storage areas are managed to prevent spills and leaks that could contaminate surface water. These areas are equipped with bunding and spill containment systems to capture any accidental releases. Regular inspections and maintenance are carried out to ensure the structural integrity of storage tanks and associated infrastructure. The EA mandates that all fuel storage facilities meet specific standards to prevent environmental harm (Whitehaven, 2025).

5.4.3 Sewage

Sewage generated at BWM is treated in accordance with environmental regulations to prevent contamination of surface water resources. The mine operates and maintains three Sewage Treatment Plants (STPs): the Central STP, the Southern Coal Preparation Plant STP, and the Northern Coal Preparation Plant STP. Treated sewage effluent is released only under strict conditions outlined in the EA. Monitoring of treated effluent quality is conducted by a National Association of Testing Authorities registered laboratory, and all data is stored in the PI Vision system for compliance and reporting purposes (Whitehaven, 2025).

5.5 SEDIMENT WATER MANAGEMENT

5.5.1 Objectives

The sediment water management system at BWM is designed to reduce sediment transport into local waterways, thereby protecting water quality and preserving aquatic ecosystems. This system is a critical component of the SWMS and is implemented in compliance with the EA EPML00717813 (Whitehaven, 2025a).

5.5.2 Operational principles

The sediment water management system employs a range of control measures to capture and treat sediment-laden water before releasing it into the environment. These measures include:

- Sediment Basins: Strategically located basins collect and settle sediment from runoff before discharging into local waterways.
- Silt Fences: Temporary barriers are installed to trap sediment and prevent it from entering watercourses during construction and operational activities.
- Diversion Drains: Clean water is diverted away from disturbed areas to reduce the risk of sediment contamination.
- Vegetative Cover: Rehabilitation of disturbed areas with vegetation helps stabilise soil and reduce erosion, further minimising sediment transport.

5.5.3 Design and planning considerations

Where required, new sediment basins would be designed, constructed, operated and maintained in accordance with *BWM Plan - Erosion and Sediment Control Plan* (Whitehaven, 2022) and relevant contemporary guidance, including the Best Practice Erosion and Sediment Control guideline published by the International Erosion Control Association (Australasia) (IECA, 2008). The erosion and sediment control system would apply a treatment-train approach, incorporating measures such as clean-water diversion, runoff conveyance, erosion controls, sediment controls and appropriately sized sediment basins.

The design and planning of sediment water management measures at BWM consider several factors to ensure their effectiveness:

- Size and Location of Sediment Basins: Basins are designed based on the expected volume of sediment-laden water and are placed in areas with high runoff potential.
- Type of Control Measures: The selection of control measures, such as silt fences or sediment traps, is based on site-specific conditions, including soil type, slope, and rainfall patterns.
- Catchment Characteristics: Detailed catchment mapping is used to identify areas with high erosion risk and to plan appropriate sediment control measures (HydroBalance, 2026).
- Monitoring and Maintenance: Regular inspections and maintenance of sediment control structures are conducted to ensure their continued effectiveness, particularly before and after wet seasons (Whitehaven, 2025a).

5.6 MINE WATER MANAGEMENT SYSTEM

5.6.1 Overview of water management system configuration

The SWMS is designed to manage water generated by mining activities and natural processes, including rainfall, catchment runoff, groundwater inflows and external water supplies. The SWMS ensures that water is safely collected, stored, treated, reused and released in a controlled manner.

The SWMS consists of a connected network of storage facilities, pipelines and pumping systems that manage water across the site. The system services a total catchment area of approximately 10,914 hectares (ha), including natural catchments, spoil areas, rehabilitated land, tailings facilities, pits and other disturbed areas.

Water is stored in a combination of dams and pits before reuse or release. Key storage facilities are fitted with infrastructure that allows water to be released in a controlled manner during extreme wet conditions. The SWMS includes 10 main pipelines that transfer water between storage facilities and operational areas across the site.

5.6.2 Site water demands

Operational demands at BWM include haul road dust suppression and coal washing demand. Details for each demand and loss is provided in the following sections below, which, in the absence of

metered data, was estimated based on daily rainfall and evaporation data sourced from the SILO (HydroBalance, 2026).

5.6.2.1 Dust suppression

The estimated future annual dust suppression demand is 3,000 megalitres per year (ML/year) with adjustments to the model rules as follows:

- Watered haul road length increased to 40 km.
- Watered haul road width = 55 m.
- Summer application factor = 0.85.
- Winter application factor = 0.9.

Figure 5.1 shows the average monthly forecast dust suppression demand.

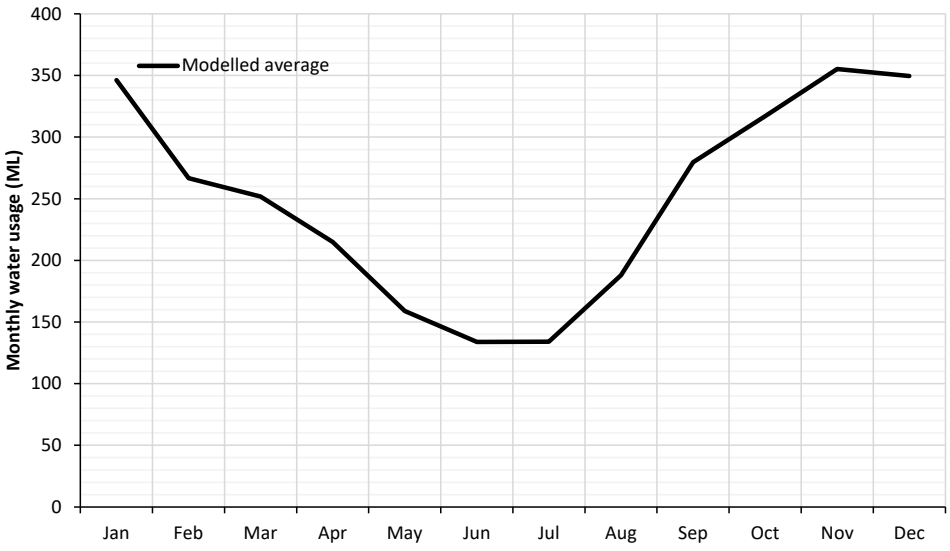


Figure 5.1 Forecast average monthly dust suppression demand (HydroBalance, 2026)

Dust suppression water is sourced from the following storages:

- R14 WSP;
- TCP Dam;
- Top Dam;
- NCHPP WSD;
- R28 FPD;
- R40 FPD;
- TFD;
- R52 FPD;
- R56 FPD;
- R62 FPD; and
- R70 WSP.

5.6.2.2 Coal Handling and Preparation Plant production and demand

CHPP coal processing water demand is generally related to the annual coal production tonnages (HydroBalance, 2026). The estimated net CHPP consumption rate is 188 litres per run-of-mine tonne (L/ROM t) for the coal washed through the BWM CHPP. For bypass coal, the estimated usage is 10 L/ROM t.

The forecast annual production profile for washed and bypass coal between Financial Year (FY)26 and FY55, and the annual net consumption, are summarised in Table 5.1.

The net CHPP process makeup demand is primarily sourced from the MAW system and has minimal raw water demand. MAW continuously supplies CHPP makeup water from NCHPP WSD.

Table 5.1 BWM forecast production profile – washed coal (HydroBalance, 2026)

Period	Washed coal - Annual tonnage (Mtpa)	Washed coal - Annual net CHPP consumption (ML/year)	Bypass coal - Annual tonnage (Mtpa)	Bypass coal - Annual net consumption (ML/year)
FY27	12.6	2,378	2.6	26.1
FY28	13.8	2,603	2.8	27.6
FY29	13.0	2,442	2.0	20.4
FY30	14.1	2,659	1.4	13.9
FY31	15.2	2,858	1.8	18.0
FY32	15.2	2,866	3.8	37.6
FY33	15.2	2,858	3.7	37.2
FY34	15.2	2,858	2.9	29.4
FY35	15.2	2,858	3.8	38.0
FY36	15.2	2,866	3.8	37.6
FY37	15.2	2,858	2.3	23.1
FY38	15.2	2,858	3.8	38.0
FY39	15.2	2,858	3.6	36.2
FY40	15.2	2,866	3.6	35.9
FY41	15.2	2,858	2.1	20.6
FY42	15.2	2,858	3.0	29.8
FY43	15.2	2,858	2.8	28.4
FY44	15.2	2,866	1.9	19.4
FY45	15.2	2,858	2.2	22.3
FY46	15.2	2,866	1.9	19.5
FY47	15.2	2,858	3.6	36.2
FY48	15.2	2,866	0.8	8.0
FY49	15.2	2,858	3.0	30.4
FY50	15.2	2,858	2.7	27.4
FY51	15.2	2,858	2.4	23.7
FY52	15.2	2,866	1.3	12.6

Period	Washed coal - Annual tonnage (Mtpa)	Washed coal - Annual net CHPP consumption (ML/year)	Bypass coal - Annual tonnage (Mtpa)	Bypass coal - Annual net consumption (ML/year)
FY53	12.3	2,317	3.3	32.5
FY54	10.0	1,882	3.5	34.7
FY55	11.1	2,081	3.9	39.4

The following CHPP water and solids assumptions have been made:

- ROM coal moisture content: 6.4% weight per weight (w/w).
- Product coal moisture content: 10.7% w/w.
- Product yield (wet): 77.5%.
- Product yield (dry): 69.7%.
- Coarse rejects moisture content: 10.1% w/w.
- Fine tailings moisture content: 71.8% w/w.
- Waste stream split:
  - Coarse rejects fraction (dry): 85.7%.
  - Fine tailings fraction (dry): 14.3%.
- CHPP makeup water requirement: 188 L/ROM t – note this does not account for any decant return water, it is the water needed to balance the adopted tonnages and moisture contents.

5.6.2.3 Thermal Coal Plant demand

The TCP water demand is not metered. As per the previous modelling, a constant demand of 100 ML/year has been adopted for the TCP (HydroBalance, 2026).

5.6.3 External water supply

The raw water for BWM is supplied from the Bedford West and Bedford East pipelines, with annual available allocations of 1,603 ML and 678 ML, respectively (HydroBalance, 2026). Pipeline water is drawn into the site when the site-wide water storage inventory falls below 14,701 ML (Green Trigger Action Response Plan [TARP]).

A minimum raw water import volume was applied to the model as follows, based on Whitehaven's advice:

- Bedford East supply: 27 ML/month (based on March to August 2025 usage).
- Bedford West supply: 11 ML/month (based on August 2025 usage) – this excludes 6 ML/month that is supplied to Pastoral Agreements (based on March to August 2025 usage).

Maximum daily supply rates of 2.5 ML/d (Bedford East) and 10 ML/d (Bedford West) were allocated based on the rate currently achievable at the site, including an allowance for 85% availability.

5.6.4 Tailings management

The BWM Water Balance Model models the tailings waste stream as follows (HydroBalance, 2026):

- All tailings moisture is sent to R10/12 WSP (Bonnie Doon).

- Water is actively dewatered from R10/12 WSP back to the SWMS. The model accounts for losses such as tailings matrix retention, beach and decant pond evaporation, and seepage.

The tailings and reject runoff management system at BWM is designed to manage water generated during coal processing activities. This system operates in conjunction with the SWMS, allowing water to be recovered, reused and managed in a controlled manner and assumes the following:

- All moisture associated with tailings is directed to the R10/12 WSP (also known as Bonnie Doon), which stores and manages water generated from the tailings stream.
- Water is actively dewatered from the R10/12 WSP and returned to the SWMS. Recovered water is reused in site operations, including coal washing and dust suppression.
- For modelling purposes, HydroBalance (2026) adopted tailings decant return of 40%, which also accounts for losses from beach evaporation, decant pond evaporation, and seepage.
- Coarse rejects are transported from the CHPP to approved disposal locations, such as in-pit voids. These areas are progressively capped with topsoil and rehabilitated to reduce long-term environmental impacts.
- Fine tailings consist of fine coal particles and clay materials suspended in water. These materials are stored in semi-permanent tailings cells or approved tailings storage facilities.
- The management of fine tailings is designed to minimise the risk of acid metalliferous drainage and saline drainage, protecting surrounding surface water and groundwater resources.

5.6.5 Inflows from local waterways

A few creeks that flow past or through BWM interact with the site's storages either as direct catchment inflows or as overflows from the creek. These interactions are as follows:

- TCP Dam – receives direct water ingress from Burngrove Creek.
- R40 FPD – receives direct water ingress from Taurus Creek.
- R38 – receives indirect water ingress from Taurus Creek, via R40 FPD overflows.
- R62 FPD – receives direct water ingress from Speculation Creek.
- Old Cut 4 – receives direct water ingress from Sirius Creek.
- Rockland Basin – receives direct water ingress from Rockland Creek.

5.6.6 Groundwater

Groundwater inflow rates to the mine pits have been estimated based on a groundwater model developed by SLR (2026). The groundwater inflows have been adjusted to account for pit face evaporation losses and losses from in-situ coal extraction during mining (HydroBalance, 2026).

Figure 5.2 and Table 5.2 summarise the annual groundwater estimates for the Project over the simulation period between 2026 and 2055. The inflows have been distributed among the open cut pits in accordance with the provided groundwater data.

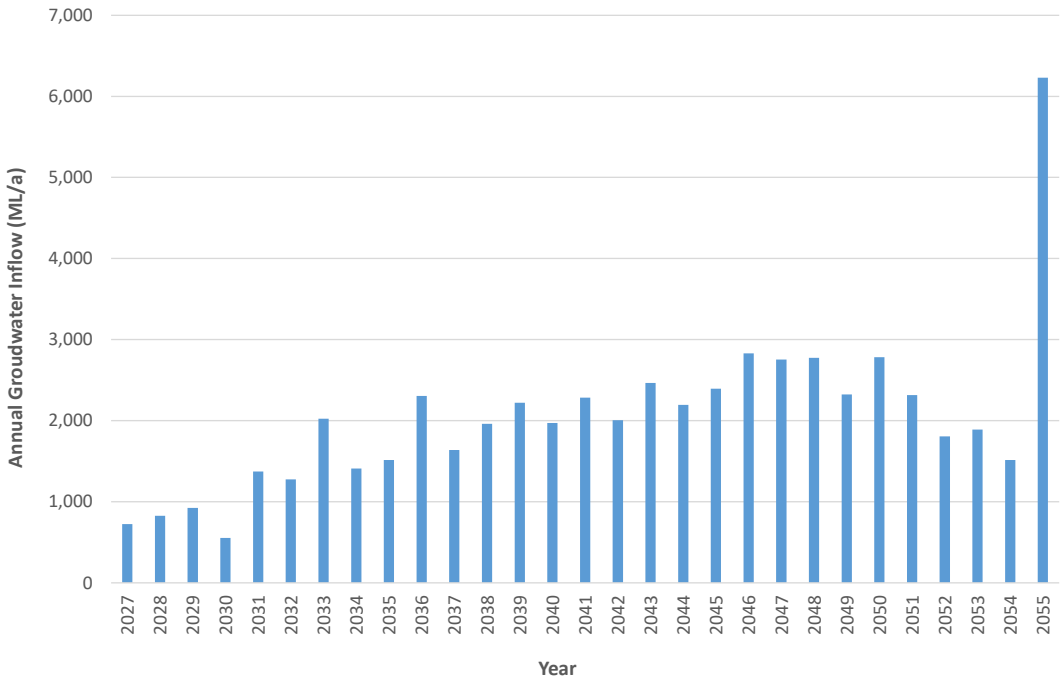


Figure 5.2 **Forecast annual groundwater inflow rate (HydroBalance, 2026)**

Table 5.2 **Adopted groundwater inflow rates (HydroBalance, 2026)**

Calendar year	Annual groundwater inflow (ML/year)
2027	725
2028	828
2029	924
2030	553
2031	1,373
2032	1,275
2033	2,025
2034	1,410
2035	1,514
2036	2,306
2037	1,639
2038	1,962
2039	2,220
2040	1,972
2041	2,285
2042	2,006
2043	2,465

Calendar year	Annual groundwater inflow (ML/year)
2044	2,196
2045	2,395
2046	2,830
2047	2,754
2048	2,774
2049	2,323
2050	2,782
2051	2,316
2052	1,805
2053	1,892
2054	1,515
2055	6,231

5.6.7 Controlled release

Controlled releases are permitted from RP2 via NTCD, RP3 via NDCD and RP4 via TFD. Controlled releases may be undertaken when the following conditions are met per Condition F4 and Conditions F9 to F11 of the current EA :

- For RP2 and RP3:
  - the flow in Blackwater Creek (at Gauging Station 2) is greater than or equal to (≥) 1 cubic metre per second (m^3/s);
  - the EC in the release dam is <10,000 µS/cm;
  - the 80th percentile of the mixed downstream Blackwater Creek EC values (at MP8) is <2,000 µS/cm; and
  - Blackwater Creek mixed downstream EC can exceed greater than (>) 2,000 µS/cm during a release if the upstream monitoring point is equal or higher than downstream (i.e. the mine release does not have a measurable impact on downstream water quality during the release).
- For RP4:
  - the flow in Two Mile Gully (at Gauging Station 3) is ≥1 m^3/s;
  - the EC in the release dam is <10,000 µS/cm; and
  - the 80th percentile of the mixed downstream Blackwater Creek EC values (at MP8) is <2,000 µS/cm.

The BWM EA also authorises releases from the following storages, which were not modelled as controlled releases:

- RP5 - Goldfish Pond;
- RP6 - Marshmead Pit;
- RP7 - Old Cut 4;
- RP8 - R82 FPD;

- RP10 - TCP Dam;
- RP11 - NCHPP Sediment Dam[1];
- RP12 - Rejects Stockpile Dam[1]; and
- RP13 - R34[1].

5.7 TRIGGER ACTION RESPONSE PLAN

The site-wide water security and containment risks at BWM are managed using a TARP. The TARP has been developed by Whitehaven personnel, based on the acceptable risk profiles and the measures available to manage water onsite. The site-wide BWM TARP is summarised in Table 5.3.

Table 5.3 BWM site-wide water management TARP (HydroBalance, 2026)

Trigger	Action / Response
Red - Dry	• Import water from Bedford pipelines at full allocation. • Minimise dust suppression usage. • Investigate use of dust binders.
Yellow - Dry	• Import water from Bedford pipelines at full allocation. • Minimise dust suppression usage. • Investigate use of dust binders.
Green	• Import water from Bedford pipelines at 50% allocation.
Yellow - Wet	• Cease importing water from Bedford pipelines. • Maximise dust suppression usage. • Consider controlled release.
Red - Wet	• Cease importing water from Bedford pipelines. • Maximise dust suppression usage. • Consider controlled release. • Allocate emergency storage in pits.

[1] In accordance with Table F1 of the EA, "RP11, RP12 and RP13 are not 'active' until the completion of Deep Creek Diversion Stage 2."

6 SITE WATER BALANCE ASSESSMENT

6.1 OVERVIEW

6.1.1 Water balance assessment methodology

The site water balance assessment for Project (HydroBalance, 2026) provides a detailed evaluation of the water management system's performance under different climatic conditions. This assessment is essential for ensuring the mine's water management system operates effectively and sustainably, even during extreme weather events.

A computer-based operational simulation model was used to assess the dynamics of the BWM water balance under varying rainfall and catchment conditions throughout the duration of the Project. The water balance model developed for this assessment covers the period of July 2025 to June 2055 (30 years in total). The Project commences in 2030, and mining in the Project area ceases in 2055.

The assessment uses the GoldSim model, a dynamic simulation tool, to analyse water inflows and outflows across the site. The model accounts for various water sources and losses, including:

- Inflows: Rainfall, catchment runoff, groundwater inflows, and external water supplies.
- Outflows: Evaporation, seepage, controlled releases, and water usage for operational activities such as coal processing and dust suppression.

6.1.2 Modelled scenarios

The site water balance assessment was undertaken for the following two scenarios:

- Proposed (Project) conditions – This scenario simulates the performance of the BWM SWMS including the increased disturbance footprint by the Project up to June 2055. For this scenario, the performance of the SWMS was assessed in terms of predicted inventory, external water supply requirements, controlled and uncontrolled releases.
- Approved conditions – This scenario represents the Approved BWM operations up to June 2055 excluding the increased disturbance by the Project. This scenario was simulated to compare the predicted volumes of controlled releases from BWM between the proposed (Project) conditions and the Approved operations up to 2055.

6.2 WATER BALANCE MODELLING RESULTS

6.2.1 Overview

Water balance modelling was completed for BWM (incorporating the Project) to assess how the SWMS performs under different climatic conditions. The modelling was undertaken using the GoldSim model and considered system performance over a 30-year simulation period.

The purpose of the modelling was to confirm that water inflows, storage and releases can be managed effectively, while reducing the risk of uncontrolled discharges and environmental impacts.

6.2.2 Water management system inventory

The modelling shows that the combined water inventory, which includes all dam and pit storages, is expected to operate within its available capacity under most climatic conditions.

Figure 6.1 shows the forecast total inventory, which includes all dam and pit storages onsite and is compared to the available SWMS capacity over time. Table 6.1 gives the total SWMS capacity.

The model results show the following:

- For the 5th percentile results (very wet climatic conditions), the peak combined water inventory volume is around 32,000 ML during the first few years of the simulation and around 39,500 ML by the end of the simulation.
- For the 10th percentile results (wet climatic conditions), the peak combined water inventory volume is around 28,000 ML during the first few years of the simulation and around 35,000 ML by the end of the simulation.
- For the 50th percentile results (median climatic conditions), the peak combined water inventory reaches around 17,500 ML during the first few years of the simulation and around 19,000 ML by the end of the simulation.
- The combined water inventory is maintained below the combined water capacity for almost all climatic conditions. There is between a 1% and 5% probability that the combined water inventory will exceed the combined water storage capacity in the first two years of the simulation, and any excess MAW would be temporarily stored in an active pit.

Overall, the results indicate that the SWMS has sufficient storage capacity to manage water over the life of the mine.

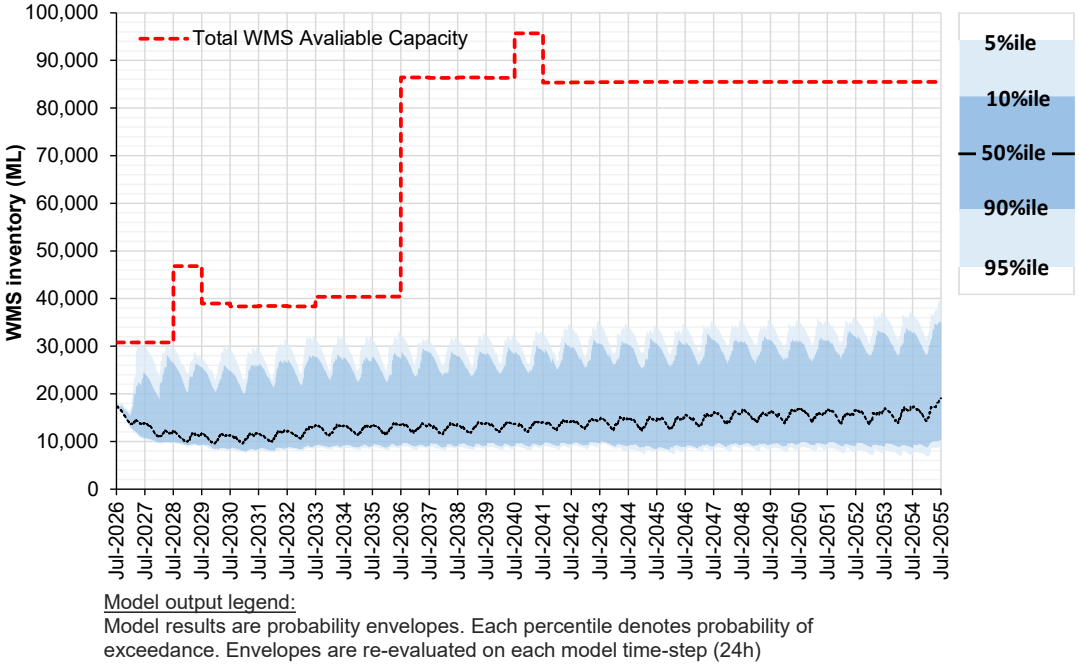


Figure 6.1 Forecast SWMS inventory (HydroBalance, 2026)

Table 6.1 Available storage capacity at BWM (HydroBalance, 2026)

Year/s (inclusive)	Available SWMS storage capacity (ML)
FY27	30,766
FY28	30,766
FY29	30,766
FY30	46,801
FY31	38,972
FY32	38,374
FY33	38,424
FY34	38,374
FY35	40,350
FY36	40,350
FY37	40,400
FY38	86,400
FY39	86,350
FY40	86,400
FY41	86,350
FY42	95,695
FY43	85,334
FY44	85,384
FY45	85,434
FY46	85,471
FY47	85,471
FY48	85,471
FY49	85,471
FY50	85,471
FY51	85,471
FY52	85,471
FY53	85,471
FY54	85,471
FY55	85,471

6.2.3 External water supply

Water imports from the Bedford East and Bedford West pipelines was included in the water balance model to assess operational water demands.

External water supply volumes vary depending on climatic conditions and site water availability. Higher import volumes are generally required during drier conditions, while lower volumes are needed during wetter periods. Figure 6.2 and Figure 6.3 show the forecast annual pipeline import volumes for Bedford East and Bedford West. The following is of note regarding the external water demand:

- The pipelines supply the minimum raw water demands to the site for all climatic conditions (as outlined in Section 3.5).
- For Bedford East pipeline:
  - External water is only imported under median (50th percentile), dry (90th percentile) and very dry (95th percentile) climatic conditions, in addition to the minimum raw water demands.
  - The annual Bedford East external water demands do not exceed the raw water allocation under any climatic conditions.
- For Bedford West pipeline:
  - External water is only imported under median (50th percentile), dry (90th percentile) and very dry (95th percentile) climatic conditions, in addition to the minimum raw water demands.
  - The annual Bedford West external water demands do not exceed the raw water allocation under any climatic conditions.

The existing Bedford West and Bedford East pipeline allocations are sufficient for maintaining operations at BWM. Additional external water supply allocation is not required as a result of the Project.

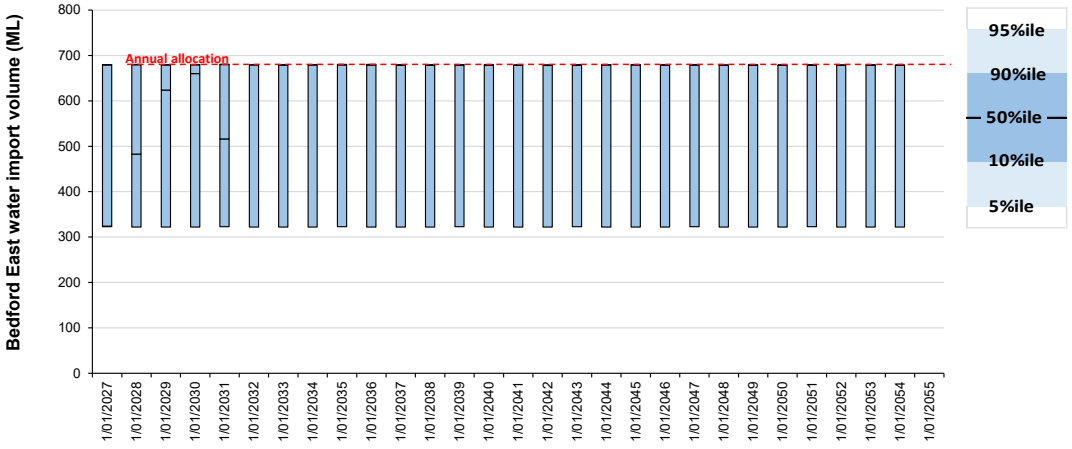


Figure 6.2 Forecast Bedford East pipeline demand (HydroBalance, 2026)

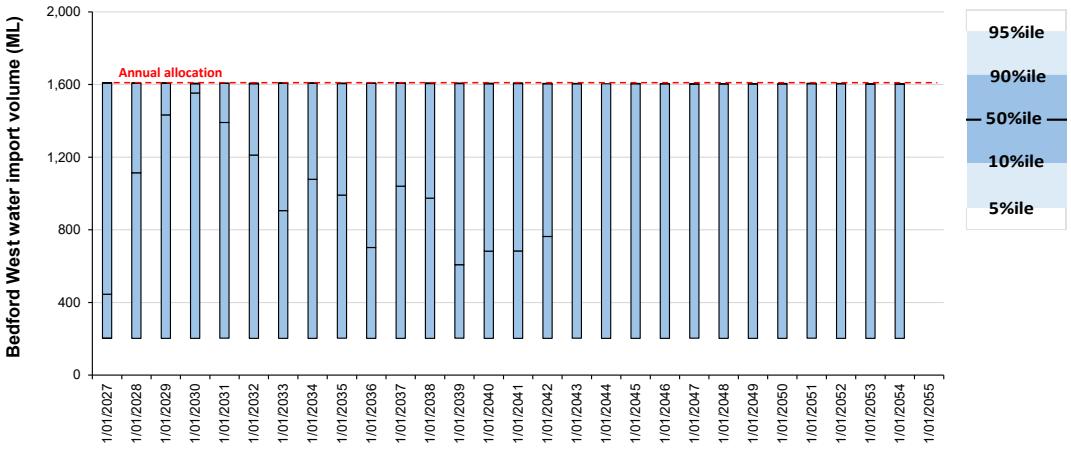


Figure 6.3 Forecast Bedford West pipeline demand (HydroBalance, 2026)

6.2.4 Controlled releases

6.2.4.1 Proposed Project conditions

The forecast annual controlled release volumes, in accordance with EA conditions, are shown in Figure 6.4. The following points are noted in relation to the controlled releases (HydroBalance, 2026):

- Controlled releases are expected to be required in very wet (5th percentile), wet (10th percentile) and median climatic conditions, as well as dry (90th percentile) climatic conditions in some years.
- During very wet climatic conditions (5th percentile), the annual releases volumes range from 2,950 ML to 5,130 ML.
- During wet climatic conditions (10th percentile), the annual releases volumes range from 2,350 ML to 2,930 ML.
- During median climatic conditions (50th percentile), the annual releases volumes range from 760 ML to 1,120 ML.

There are no proposed changes to the currently approved controlled release strategy as a result of the Project. In addition, there are no proposed changes to release infrastructure (release dams and pipelines).

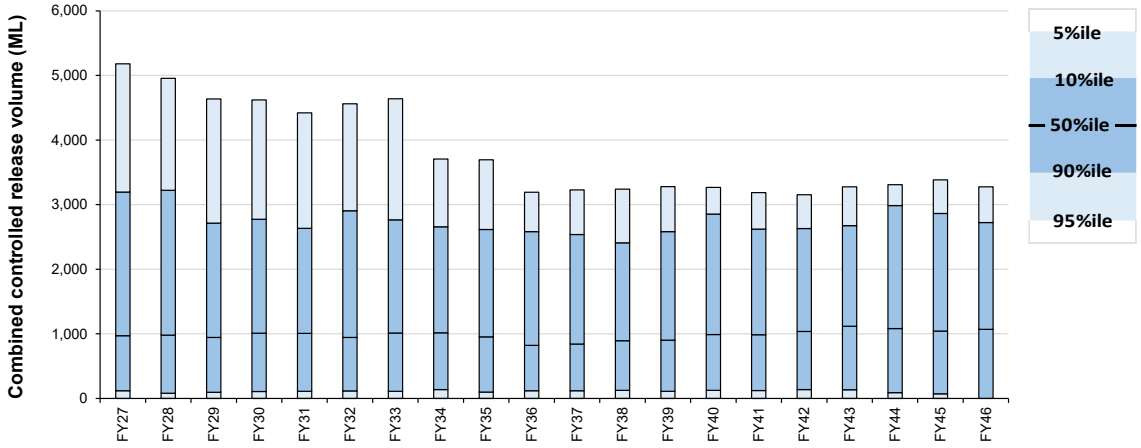


Figure 6.4 Forecast controlled release volumes (HydroBalance, 2026)

6.2.4.2 Comparison against Approved case

The Project results in the following key changes to water inflows within the water management system:

- Estimated 60% increase in groundwater inflows up to Year 2055.
- Minor changes in captured catchment areas.

An assessment of the impact of the Project on controlled release volumes has been undertaken by comparing Project results against an Approved case. The outcomes of this assessment have identified the following changes to controlled releases due to the Project:

- During very wet climatic conditions (5th percentile), the annual releases volumes for the Approved case range from 2,880 ML to 4,940 ML. That is, under very wet climatic conditions (5th percentile), annual controlled release volumes for the Project are predicted to increase by around 2-4% (70-190 ML) compared with the Approved Case.
- During wet climatic conditions (10th percentile), the annual releases volumes for the Approved case range from 2,200 ML to 3,100 ML. That is, under wet climatic conditions (10th percentile), annual controlled release volumes for the Project are predicted to increase by up to 7% (150 ML) compared with the Approved Case.
- During median climatic conditions (50th percentile), the annual releases volumes for the Approved case range from 630 ML to 1,010 ML. That is, under median climatic conditions (50th percentile), annual controlled release volumes for the Project are predicted to increase by around 11-20% (110-130 ML) compared with the Approved Case.

This assessment indicates that the Project would result in relatively small volumetric changes to annual release volumes. The release water quality is not expected to change as a result of the Project.

6.2.4.3 Controlled release rates and dilution requirement

An assessment of potential controlled-release rates and dilution requirements has been undertaken for:

- RP2 and RP3, discharging to Blackwater Creek; and
- RP4, discharging to Two Mile Gully.

For the purposes of this assessment, a downstream mixed EC value of 2,000 µS/cm has been adopted, as per Table F5 of the EA (80th percentile receiving water contaminant trigger level for EC). The adopted value is an assessment assumption only and does not necessarily represent the operational trigger or target applied by BWM Operations during an actual controlled release. Operational releases would continue to be managed in accordance with the EA and site procedures, which include:

- Assess stream flow conditions and applicable release limits in accordance with the EA.
- Check release water quality for compliance with the EA Release Contaminant Limits.
- Check receiving water quality for compliance with the EA Receiving Waters Contaminant Limits.
- Use the BWM Release Contaminant Model to assess opportunities to commence an EA compliant MAW release.
- Continue monitoring water quality and release conditions and model outputs.
- Inform the HSE Superintendent prior to commencing a release.

Typical upstream EC concentrations were estimated from relationships developed using recorded streamflow and EC data for the Blackwater Creek and Two Mile Gully gauges over the period 2016–2025. The assessment considers receiving flows of:

- 1 to 100 m^3/s in Blackwater Creek; and
- 1 to 10 m^3/s in Two Mile Creek.

The indicative release rates and dilution requirements are summarised in Table 6.2.

Table 6.2 Indicative release rates and dilution requirements

Release-water EC	Indicative dilution ratio [1]	Indicative release rate
2,500 µS/cm	Approximately 0.27–0.28	Approximately 3.5–3.7 times the receiving-stream flow
5.000 µS/cm	Approximately 1.63–1.69	Approximately 0.5-0.62 times the receiving-stream flow
10,000 µS/cm	Approximately 4.34–4.52	Approximately 0.22–0.23 times the receiving-stream flow

[1] Dilution ratio is defined as receiving-stream flow divided by release flow.

These results demonstrate that the allowable release rate reduces as the EC of the release water increases. For example, at the minimum assessed receiving flow of 1 m^3/s:

- release water with an EC of approximately 2,500 µS/cm could theoretically be released at approximately 3.5–3.6 m^3/s;
- release water with an EC of approximately 5,000 µS/cm could theoretically be released at approximately 0.6 m^3/s; and
- release water with an EC of approximately 10,000 µS/cm could theoretically be released at approximately 0.2 m^3/s.

For RP2 and RP3, the calculated release rate represents the combined allowable discharge from the two release points, rather than a separate allowable rate for each release point.

At higher receiving-stream flows, the achievable discharge rate would be constrained by the capacity of the release infrastructure rather than the calculated receiving-stream dilution capacity. Consequently, the dilution achieved under these conditions would generally be greater than the minimum values presented in the assessment.

The assessment demonstrates that controlled releases can be managed by adjusting the combined release rate in response to:

- the measured receiving-stream flow;
- the receiving-stream EC;
- the EC of the water proposed for release;
- the applicable downstream EC limit; and
- the hydraulic capacity of the release infrastructure.

The calculations are indicative desktop estimates and assume complete and instantaneous mixing of release water with the receiving stream. Actual releases would continue to be undertaken in accordance with the approved Environmental Authority (EA), including all applicable minimum-flow, water-quality, monitoring and release-point requirements.

6.2.4.4 Implications of dilution requirements on the controlled-release strategy

The assessment demonstrates that controlled releases can be managed by adjusting the combined release rate in response to:

- the measured receiving-stream flow;
- the receiving-stream EC;
- the EC of the water proposed for release;
- the applicable downstream EC limit; and
- the hydraulic capacity of the release infrastructure.

The calculations are indicative desktop estimates and assume complete and instantaneous mixing of release water with the receiving stream. Actual releases would continue to be undertaken in accordance with the approved EA, including all applicable minimum-flow, water-quality, monitoring and release-point requirements.

6.2.5 Uncontrolled releases

The Whitehaven documents *WHC QLD Standard – Erosion & Sediment Control and Mine Affected Water* (Whitehaven, 2024), *BWM Plan – Water Management* (Whitehaven, 2026a) and *BWM Plan – Erosion and Sediment Control Plan* (Whitehaven, 2026b) outline the strategies and design objectives currently implemented at BWM to manage legacy risks associated with uncontrolled discharges from MAW storages and sediment dams. The management strategies described in this standard will continue to apply to the Project.

The Project is not expected to increase the risk of uncontrolled discharges from site storages to receiving waterways for the following reasons (HydroBalance, 2026):

- The proposed changes to the Project footprint are limited to the eastward expansion of existing pits. Resulting catchment changes are confined to the expanding pits, which drain internally.
- The Project does not alter the contributing catchments or drainage arrangements of existing MAW storages or sediment dams that have been identified as having a higher potential for uncontrolled discharge.
- The Project does not modify the catchments of NTCD or NDCD, which have a higher potential for uncontrolled discharges due to their on-stream configuration.

7 FINAL VOID WATER BALANCE ASSESSMENT

7.1 OVERVIEW

Water levels in the final voids will vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff, and groundwater. A final void GoldSim model (separate to the GoldSim model used for the operational modelling) was used to assess the likely long-term water level behaviour of the final voids.

Condition E10 of the EA stipulates that "residual voids must not cause any serious environmental harm to land, surfaces waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself".

The BWM residual voids would be operated as non-use management areas (NUMAs) as part of the Progressive Rehabilitation and Closure Plan (PRCP).

A final void water balance assessment has been undertaken to evaluate the long-term hydrological behaviour of the residual voids. The GoldSim software platform was used to simulate the long-term water level behaviour for the Project voids. Details of the methodology and results of the final void water balance assessment are provided in the HydroBalance (2026) report (Appendix B). The key outcomes from the HydroBalance (2026) report have been reproduced in the following sections.

The assessment considers how water levels and water quality within the voids may change over time following mine closure. The long-term final void hydrology and water quality behaviour of the proposed final voids has been modelled over a 1,000-year post-closure period to assess whether the final voids would be safe and non-polluting.

7.2 FINAL VOID GEOMETRY

The proposed final landform layout relevant to the Project is presented in Figure 7.1 and Figure 7.2, and includes five residual voids:

- Mimosa/Besgrove;
- Ramp 30;
- Deep Creek;
- Stewarton North; and
- Stewarton South.

These residual voids would remain following the completion of mining and rehabilitation activities and would be managed as follows:

The residual voids would be managed as NUMAs under the PRCP, and the voids would not be used for ongoing water supply or operational purposes after mine closure.

Management of the voids is intended to minimise potential risks to surface water and groundwater, while supporting the long-term safety and stability of the final landform.

The final landform forms during mining, incorporating in-pit backfilled spoil within the mining works. A digital elevation model (DEM) of the final landform (i.e. the final surface expected at the end of the mine life) was provided by Whitehaven.

A summary of the residual void geometries is provided in Table 7.1

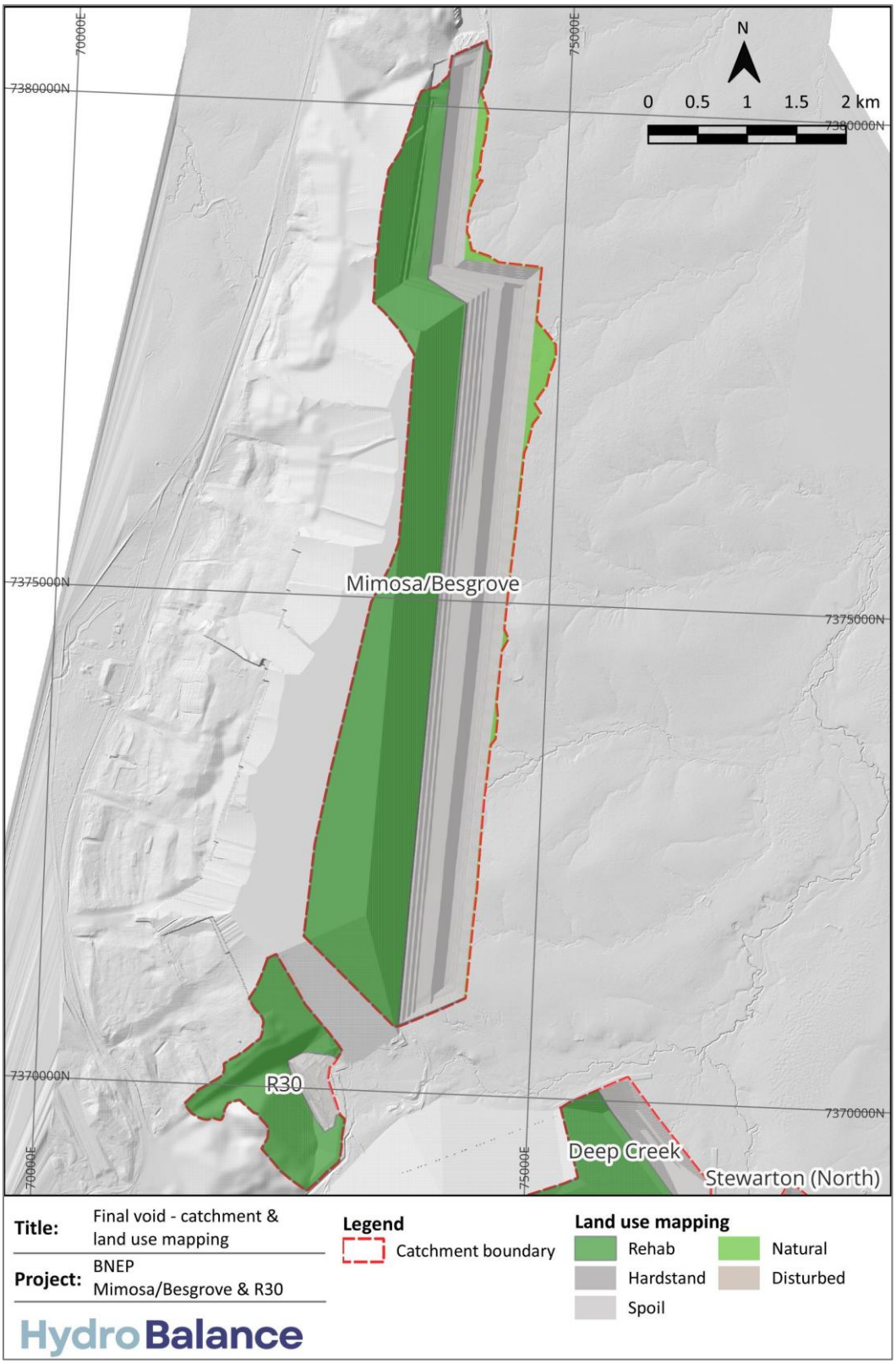


Figure 7.1 Final void configuration – Mimosa/Besgrove & Ramp 30 (HydroBalance, 2026)



Figure 7.2 **Final void configuration – Deep Creek, Stewarton North & South (HydroBalance, 2026)**

Table 7.1 Final void geometries

Void	Floor level (metres Australian Height Datum [mAHD])	Crest level (mAHD)	Depth (m)	Volume to crest (ML)	Surface area at crest (ha)
Mimosa/Besgrove	24	200	176	374,878	597.2
Ramp 30	139	217	78	16,316	59.7
Deep Creek	52	202	150	54,895	109.4
Stewarton North	-4	204	208	302,582	380.1
Stewarton South	92	232	140	42,632	82.5

7.3 CLIMATE DATA

The final void water balance assessment incorporates climate data sourced from the Australian Government Consistent Climate Scenarios (CCS) project. This project provides climate change-adjusted rainfall and evaporation data, transforming historical climate data from 1960 to 2024 into future projections. The CCS project offers daily climate projections across Australia on a 0.05-degree grid, with the grid point closest to the centre of BWM used for this assessment.

The assessment uses the Shared Socioeconomic Pathway (SSP)2-4.5 as the emission pathway, based on the Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) (IPCC, 2014). This pathway assumes moderate global development and environmental policies, leading to moderate greenhouse gas emissions and radiative forcing of 4.5 watts per square metre (W/m^2) by 2100. The year 2070 was selected as the base case for global warming sensitivity, representing a midpoint for the varying void commencement dates (HydroBalance, 2026).

The climate data was adjusted using the following parameters:

- Climate Warming Sensitivity: Assumed to fall within the medium category.
- Future Climate Cluster: High global warming (HP) was selected to represent a high level of warming.
- Long-Term Climate Sequence: Historical climate data was adjusted and looped to create a 1,000-year climate sequence, ensuring robust predictions of rainfall and evaporation patterns. Figure 7.3 shows the long-term monthly averages for the rainfall data and pan evaporation.

The CCS data were used to generate long-term monthly averages for rainfall and pan evaporation. Evaporation data were converted to Morton's Lake (mLake) and Morton's Wet (mWet) evapotranspiration to account for water losses from the pit lake and catchment areas:

- Pan evaporation to mLake factor: 0.883, applied to evaporation on the pit lake surface.
- Pan evaporation to mWet factor: 0.845, applied to evaporation losses from the catchment.

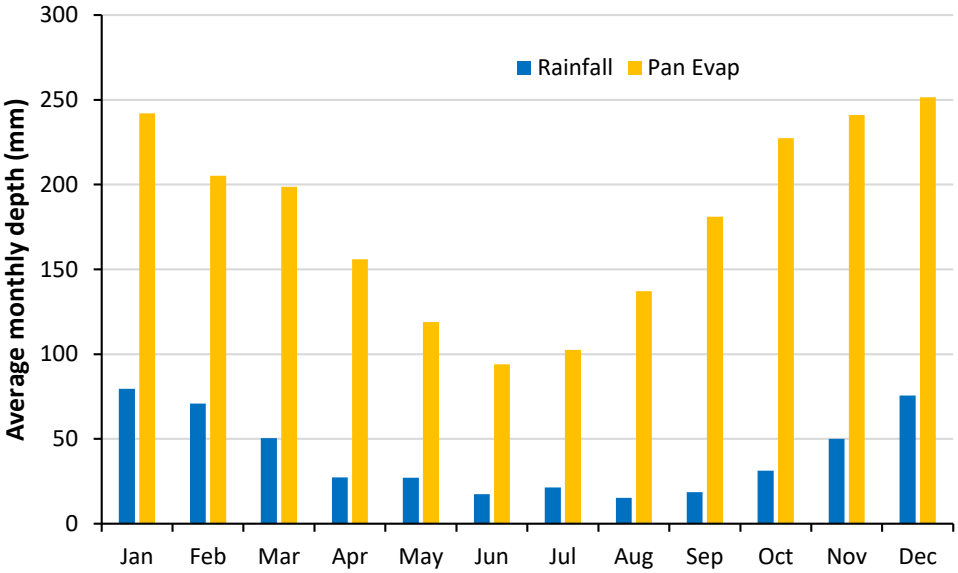


Figure 7.3 **Distribution of monthly rainfall and pan evaporation (CCS 1960 - 2024) (HydroBalance, 2026)**

7.4 CATCHMENT AREAS AND LAND USE MAPPING

Catchment areas and land use maps have been developed for the final voids to predict water inflows and outflows for each void. Each residual void has a specific catchment area that contributes water through rainfall, surface runoff, and groundwater inflows (HydroBalance, 2026). The final landform catchment area was delineated from the final landform surface provided by Whitehaven. The land use of the void floor has been characterised as spoil.

Figure 7.1 to Figure 7.2 show the catchment boundary and land uses adopted for the final void water balance. The catchment and land use values used in the GoldSim model are shown in Table 7.2.

At the completion of mining, surface runoff from rehabilitated in-pit and out of pit waste rock emplacement areas would flow to the receiving environment, with the exception of approximately 2,726 ha (27.3 km^2) which would report to residual voids associated with the Project.

Table 7.2 Final void catchment and land use areas (HydroBalance, 2026)

Void	Area (ha)			
	Undisturbed	Spoil	Rehabilitated spoil	Total
Mimosa/ Besgrove	39.1	596.5	622.4	1,258.0
Ramp 30	0.0	24.1	149.2	173.3
Deep Creek	0.0	52.9	167.3	220.2
Stewarton North	0.0	195.2	678.1	873.3
Stewarton South	0.0	50.9	150.3	201.2

The mapping includes various land use types that influence water flow and quality (HydroBalance, 2026):

- Natural Areas: Undisturbed regions that contribute clean water to the voids.
- Spoil Areas: Disturbed zones where mining waste is stored, which may contribute sediment-laden water.
- Rehabilitated Zones: Areas that have been restored with vegetation to stabilise soil and reduce erosion.
- Tailings Areas: Fine waste material from coal processing is stored, which may contribute water with higher levels of dissolved solids.
- Pit Voids: Active and inactive mining pits that can act as temporary water storage areas.
- Disturbed Areas: Zones affected by mining activities, which may generate sediment-laden runoff.

7.5 GROUNDWATER INFLOWS

Groundwater inflows into the five voids have been provided by the Project groundwater consultants (SLR, 2026). The inflows were provided as a time series over the 1,000 year simulation. Details on the groundwater inflows to the voids are provided in SLR (2026).

7.6 FINAL VOID WATER BALANCE MODELLING RESULTS

7.6.1 Overview

The final void water balance modelling results for Project final landform (HydroBalance, 2026) provide a detailed analysis of the long-term hydrological behaviour of the residual voids. The modelling was conducted using the GoldSim software platform, simulating water levels and salinity over a 1,000-year post-closure period.

The final water levels for the five voids are presented in Figure 7.4 to Figure 7.8. Of the five voids, three are expected by SLR (2026) to become long-term sinks, and the other two are predicted to become flow-through systems reporting to these long-term sinks.

7.6.2 Mimosa/Besgrove void water level

The Mimosa/Besgrove void is expected to reach equilibrium within 100 years post-closure, with a median water level of approximately 83 mAHD. The maximum water level is predicted to be 88.1 mAHD, which is about 112 metres (m) below the pit crest level of 200 mAHD. There is no risk of overtopping or significant water quality impacts during the simulation period (HydroBalance, 2026).

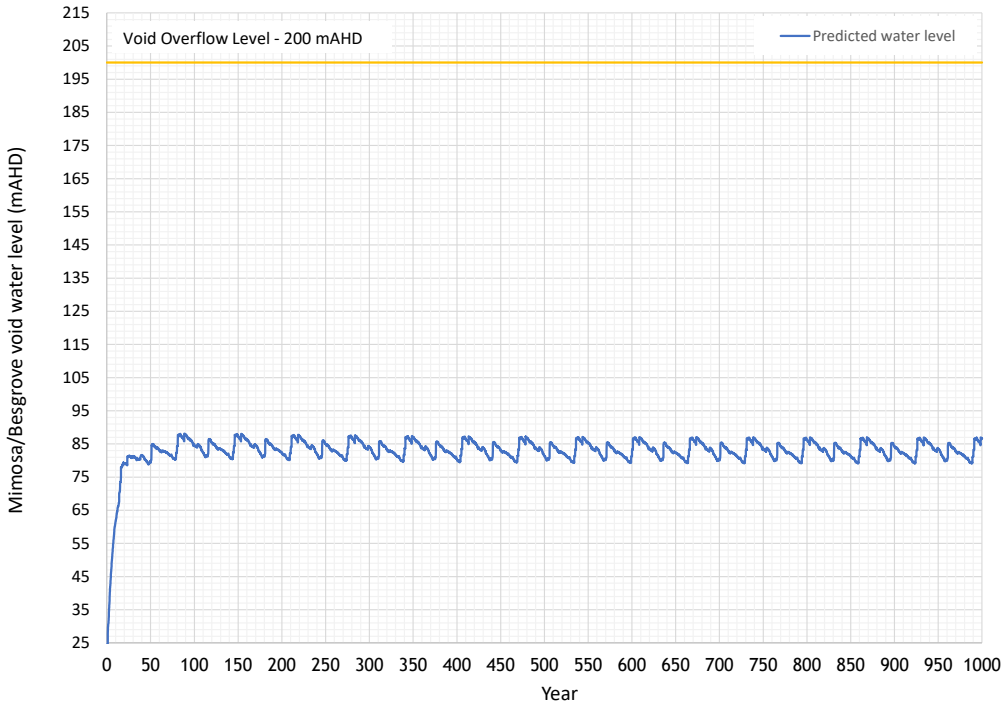


Figure 7.4 Mimosa/Besgrove void – long-term predicted final void water level (HydroBalance, 2026)

7.6.3 Ramp 30 void water level

The Ramp 30 void is expected to achieve equilibrium within 100 years post-closure, with water levels fluctuating between empty (during extended dry periods) and a maximum of around 160 mAHD during wet periods. The maximum water level is 57 m below the pit crest level of 217 mAHD, ensuring no overtopping occurs (HydroBalance, 2026).

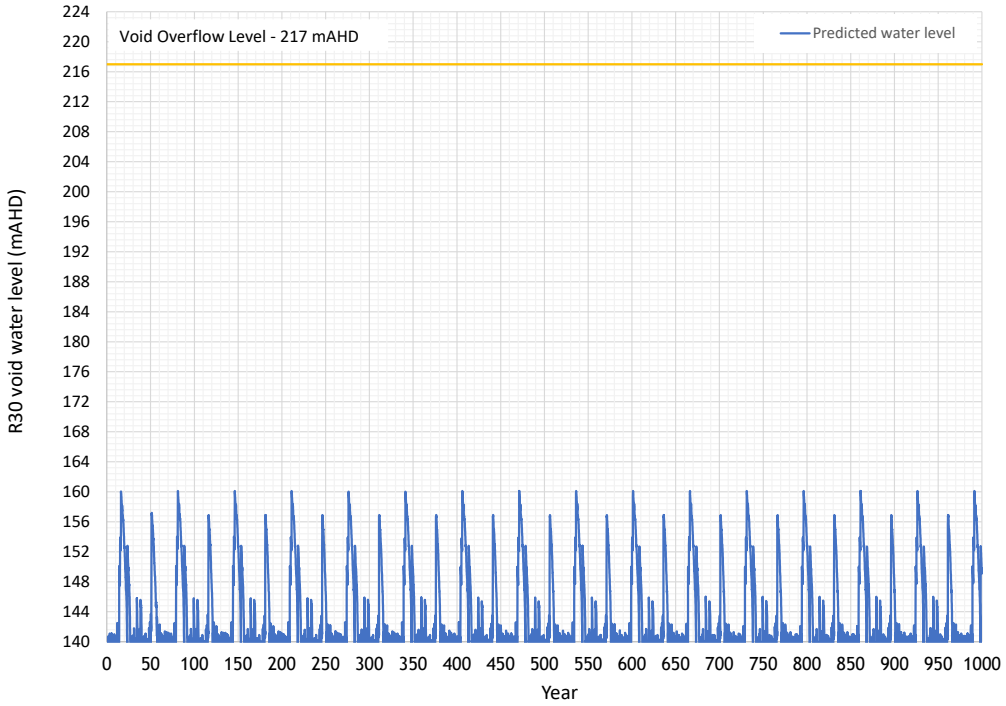


Figure 7.5 Ramp 30 void – long-term predicted final void water level (HydroBalance, 2026)

7.6.4 Deep Creek void water level

The Deep Creek void is anticipated to reach equilibrium within 150 years post-closure, with a median water level of approximately 138 mAHD. The maximum water level is predicted to be 149.8 mAHD, which is 52 m below the pit crest level of 202 mAHD. Water quality parameters are expected to remain within acceptable limits throughout the simulation period (HydroBalance, 2026).

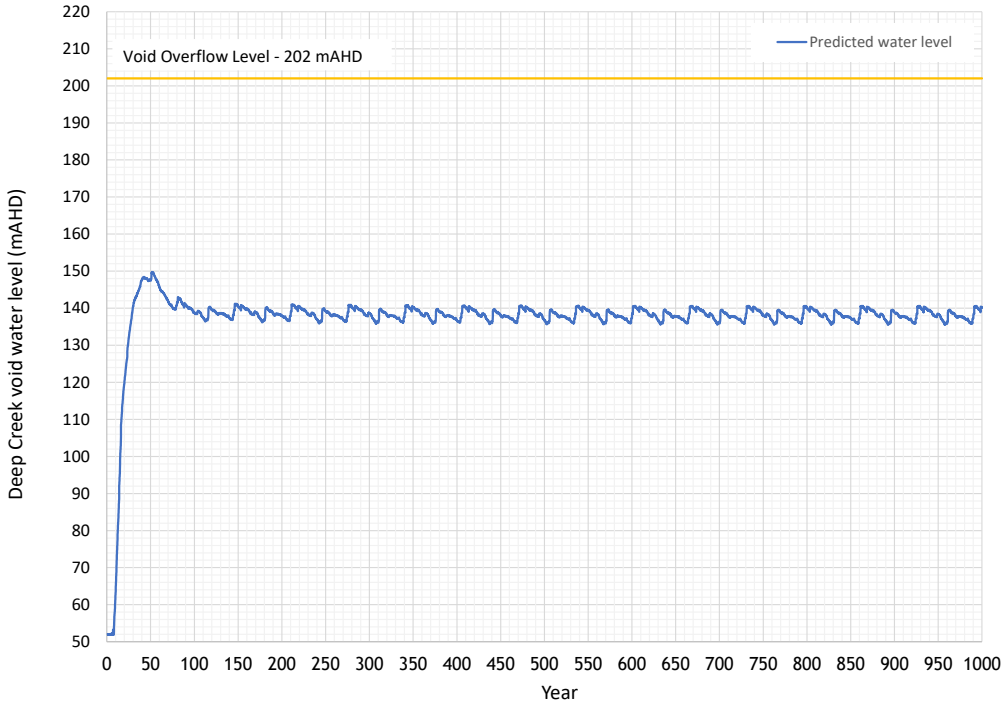


Figure 7.6 Deep Creek void – long-term predicted final void water level (HydroBalance, 2026)

7.6.5 Stewarton North void water level

The Stewarton North void is expected to stabilise within 100 years post-closure, with a median water level of approximately 73 mAHD. The maximum water level is predicted to be 79.4 mAHD, which is 124 m below the pit crest level of 204 mAHD. No significant environmental impacts are anticipated (HydroBalance, 2026).

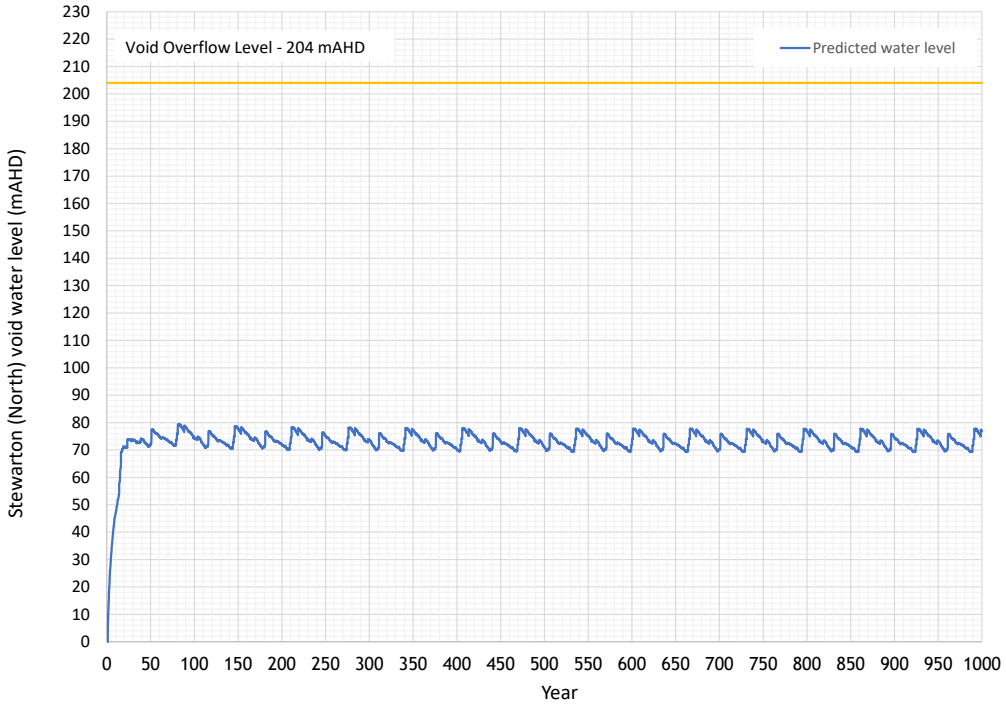


Figure 7.7 Stewarton North void – long-term predicted final void water level (HydroBalance, 2026)

7.6.6 Stewarton South void water level

The Stewarton South void is projected to achieve equilibrium within 100 years post-closure, with a median water level of approximately 104 mAHD. The maximum water level is predicted to be 118.5 mAHD, which is 113 m below the pit crest level of 232 mAHD. Water quality parameters are expected to meet environmental standards throughout the simulation period (HydroBalance, 2026).

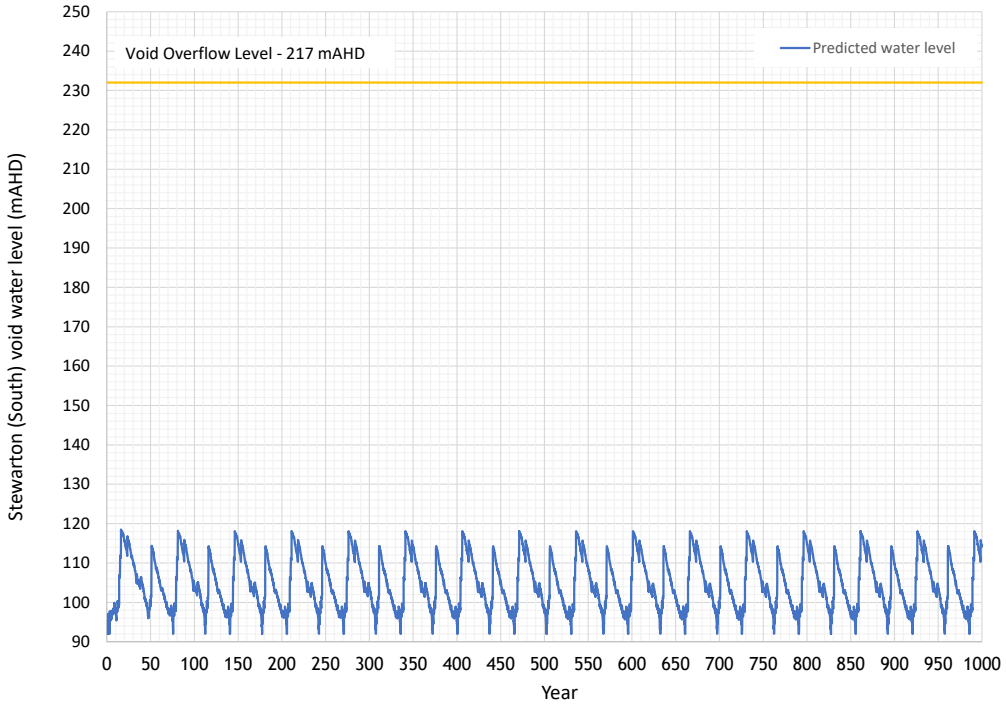


Figure 7.8 Stewarton South void – long-term predicted final void water level (HydroBalance, 2026)

7.6.7 Extreme storm event behaviour

An assessment of the impact of extreme storm events on the water levels in the final voids has been undertaken (HydroBalance, 2026). The potential for discharge of void water during a large storm was assessed for the 1 in 1,000 Annual Exceedance Probability (AEP) (or 0.1% AEP) 72-hour (3 day) design storm. For conservatism, it has been assumed that the extreme storm would occur coincident with the peak modelled long-term water levels.

The results of the storm event analysis are presented in Table 7.3. These results show that, even during extreme short duration storm events, the pit crest would not be overtopped for any of the final voids (HydroBalance, 2026).

Table 7.3 Storm event modelling results

Void	Runoff Volume (ML)	Water level increase (m)	Final Volume (ML)	Final Level (mAHD)	Pit crest level (mAHD)	Freeboard (m)
Mimosa/Besgrove	3,585	3.4	29,316	91.5	200	108.5
Ramp 30	494	6.3	1,124	166.1	217	50.9
Deep Creek	628	2.6	7,884	129.9	202	72.1
Stewarton North	2,489	1.5	59,120	115.0	204	89.0
Stewarton South	573	3.6	4,992	150.0	232	82.0

7.6.8 Salinity

The final void modelled salinity levels for the five voids are presented in Figure 7.9 to Figure 7.13. The long-term salinity generally increases over time, which is expected for closed-loop systems with no mechanism for salt removal. HydroBalance (2026) noted that this assessment is considered conservative, as it:

- Assumes an unlimited source of salt within the catchment and does not include any allowance for potential reduction in the leaching of salts from the catchment over time.
- Does not take into account the potential precipitation of dissolved salts as mineral compounds.

The following is of note regarding these results (HydroBalance, 2026):

- For Mimosa/Besgrove void, the salinity of the pit lake progressively increases, rising to 250,000 µS/cm over the 1,000-year simulation.
- For Ramp 30 void, the salinity of the pit lake fluctuates over time as the void empties in cycles. The peak salinity during these cycles is around 5,000 µS/cm.
- For Deep Creek void, the salinity of the pit lake progressively increases, rising to 180,000 µS/cm over the 1,000-year simulation.
- For Stewarton North void, the salinity of the pit lake progressively increases, rising to 195,000 µS/cm over the 1,000-year simulation.
- For Stewarton South void, the salinity of the pit lake fluctuates over time as the void empties in cycles. The peak salinity during these cycles is around 10,000 µS/cm.

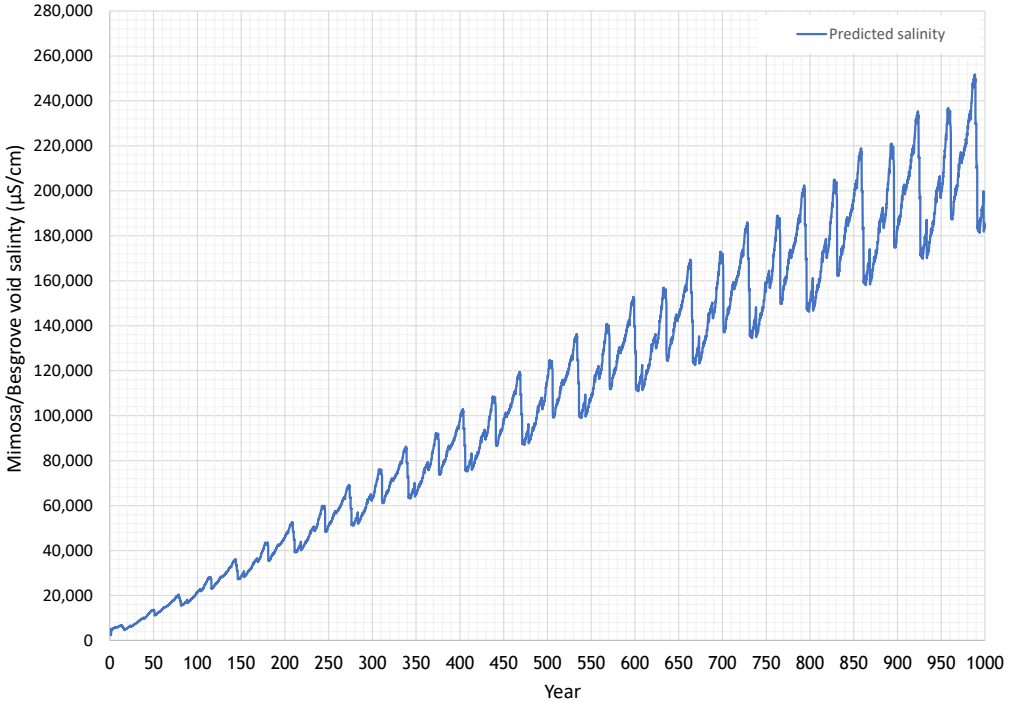


Figure 7.9 Mimosa/Besgrove void – long-term predicted void water salinity (HydroBalance, 2026)

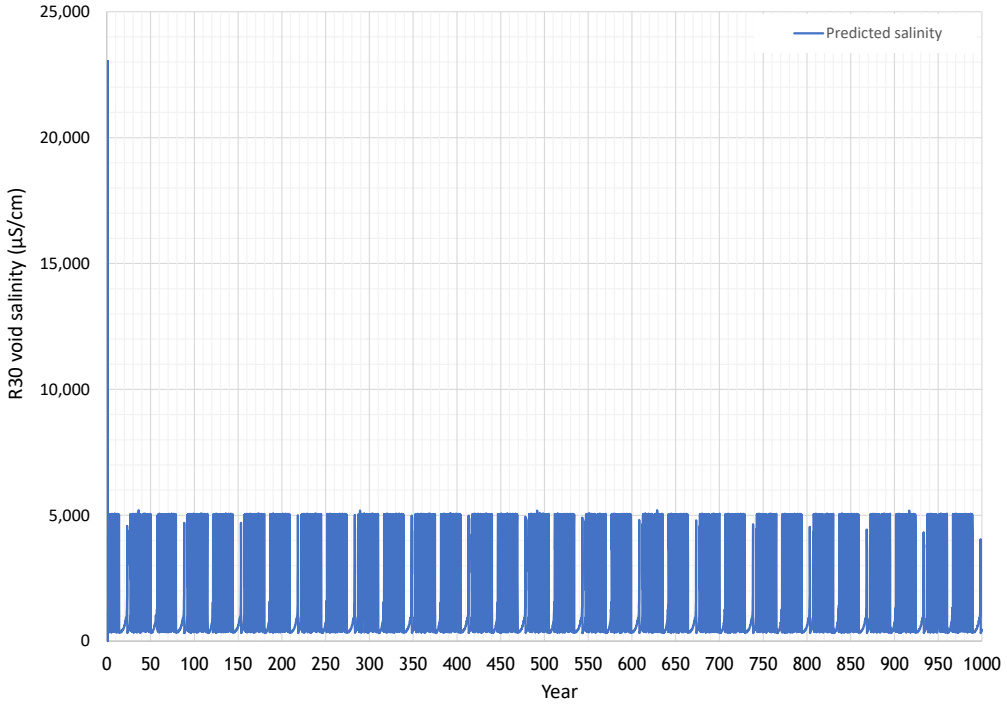


Figure 7.10 Ramp 30 void – long-term predicted final void water salinity (HydroBalance, 2026)

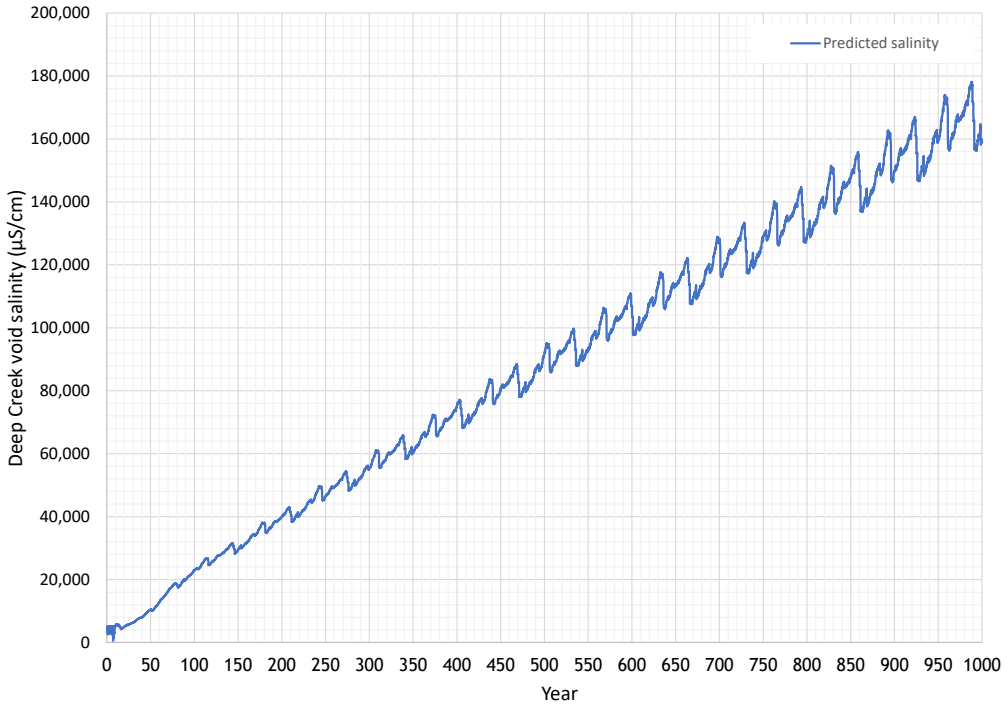


Figure 7.11 Deep Creek void – long-term predicted final void water salinity (HydroBalance, 2026)

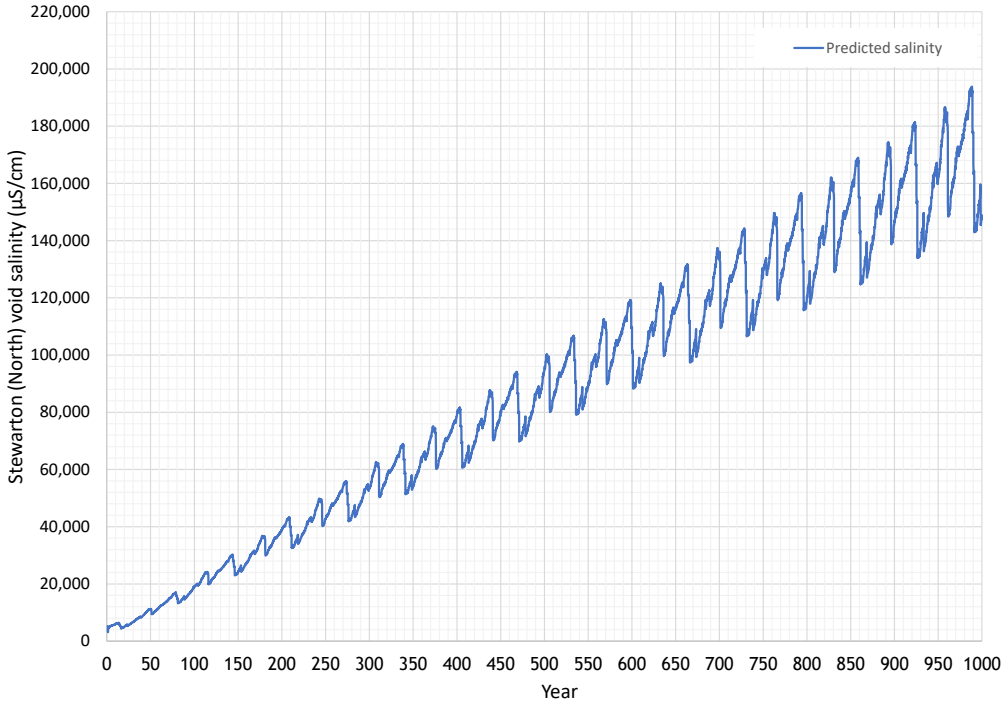


Figure 7.12 Stewarton North void – long-term predicted final void water salinity (HydroBalance, 2026)

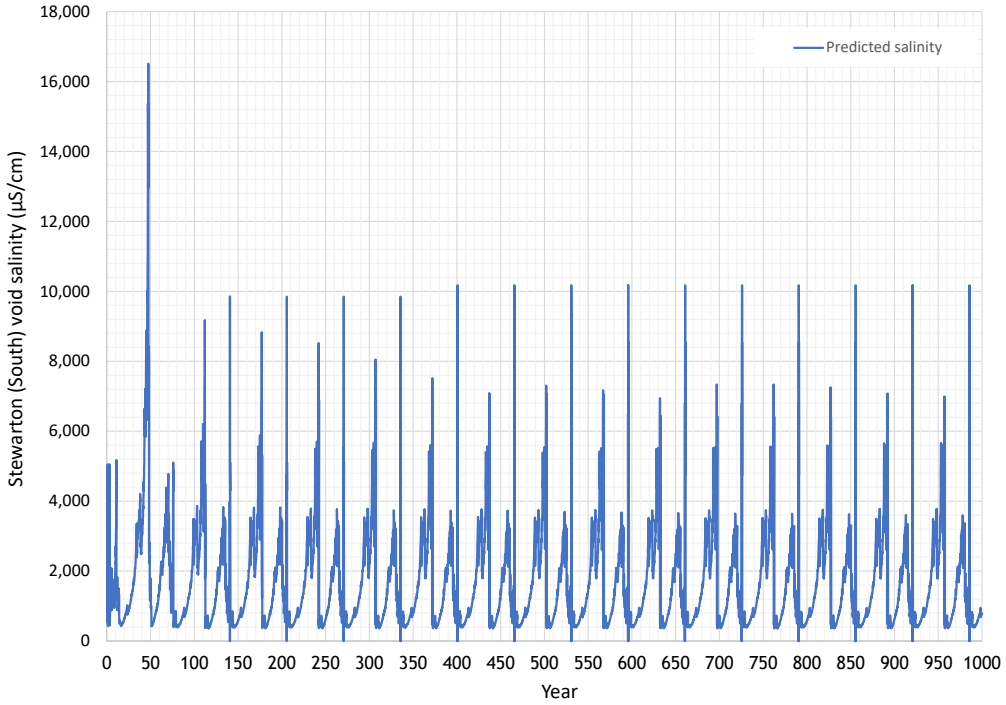


Figure 7.13 Stewarton South void – long-term predicted final void water salinity (HydroBalance, 2026)

8 FLOOD IMPACT ASSESSMENT

8.1 OVERVIEW

8.1.1 Previous studies

Hydrologic models were developed using the Unified River Basin Simulator (URBS) (Carroll, 2024) runoff-routing software to estimate design flood discharges in the vicinity Project for various scenarios. Hydraulic models were developed using the Two-dimensional Unsteady FLOW (TUFLOW) hydrodynamic modelling software (BMT Pty Ltd, 2018) to estimate design flood levels, depths, extents and velocities in the vicinity of the Project for various scenarios.

Whitehaven Blackwater provided the XP-RAFTS hydrologic and TUFLOW hydraulic models used for the *Blackwater Mine Flood Study* (GHD Group Pty Ltd [GHD], 2021) and the *Blackwater Mine Progressive Rehabilitation and Closure Plan – Rehabilitation Flood Assessments* (SLR, 2024). Upon review, the SLR (2024) flood models appear to have been developed based on the GHD (2021) flood models.

8.1.2 Hydrologic and hydraulic modelling approach

8.1.2.1 Overview

The URBS models were calibrated to recorded rainfall and water level data for the March 2017 and January 2020 events where suitable data is available. Design event hydrologic modelling was undertaken in accordance with Australian Rainfall and Runoff (ARR) 2019 Version 4.2 (Ball et al., 2019) and includes the latest guidance on climate change considerations.

The SLR (2024) hydraulic models were modified to incorporate the most recent Light Detection and Ranging (LiDAR) topographic data (obtained after the GHD [2021] and SLR [2024] studies), as well as updated design inflows from the new URBS hydrologic models described in Section 8.2 and Appendix A.

8.1.2.2 Modelled scenarios

The URBS hydrologic and TUFLOW hydraulic models were developed to simulate riverine flooding in the vicinity of the Project for the following three scenarios:

- 'Existing conditions' – This scenario represents the existing BWM configuration and was adopted as the baseline conditions.
- 'Proposed (Project) conditions' – This scenario represents the proposed BWM configuration incorporating the maximum disturbance area associated with the Project and associated flood protection levees. However, areas outside of the Project area are assumed unchanged from existing conditions.
- 'Final landform conditions' – This scenario represents the BWM configuration pot-closure, incorporating the final landform including the final voids.

8.1.3 Flood impact assessment approach

The hydrologic and hydraulic models were used to estimate design flood discharges, levels, depths, extents and velocities for a range of events from 50% (1 in 2) to 0.1% (1 in 1,000) AEP as well as the Probable Maximum Flood (PMF) event. AEP is a standard measure in floodplain management to define the likelihood of flooding. For instance, a 1% AEP flood has a 1% chance of occurring in any one year, which can also be described as having a 1 in 100 chance in any one year.

Table 8.1 provides a summary of the design flood event AEPs, and scenarios modelled in this SWA.

Table 8.1 Summary of modelled design flood event AEPs and scenarios

AEP % (1 in X)	Existing conditions (baseline) (year 2030 climate)	Proposed (Project) conditions (year 2030 climate)	Final landform conditions (year 2100 climate)
50% (1 in 2)	✓	✓	X
5% (1 in 20)	✓	✓	X
2% (1 in 50)	✓	✓	X
1% (1 in 100)	✓	✓	✓
0.1% (1 in 1,000)	✓	✓	✓
PMF	X	X	✓

The existing conditions flood model results was used to establish the baseline conditions at BWM without the Project, for the 50% to 0.1% AEP events (refer to Section 8.4). The proposed (Project) conditions flood model results was used to assess the flood immunity of the extended open cut pits for all events up to 0.1% AEP.

The impacts of the Project on flood levels and velocities were assessed by comparing design flood levels and velocities between existing and proposed (Project) conditions for the 50% AEP to 0.1% AEP events. The flood impact of the Project was not assessed for the PMF event.

The impact of the Project on waterway stability (geomorphology), including a hydraulic assessment of the proposed clean water drain adjacent to the Stewarton Pit expansion area, was assessed for the 50% AEP and 2% AEP events.

The final landform conditions model results for the 1% AEP, 0.1% AEP and PMF events were used to assess the flood immunity of the final voids and the stability of the rehabilitated dump landforms under extreme flooding conditions.

8.2 ESTIMATION OF DISCHARGES

8.2.1 Overview

URBS hydrologic models were developed to estimate design discharges within the Blackwater Creek catchment (including Taurus Creek and Two Mile Gully) and the Sagittarius Creek catchment.

The Blackwater Creek URBS model was calibrated to recorded data for the March 2017 and January 2020 flood events. The Sagittarius Creek URBS model could not be calibrated due to the absence of any stream gauges within the catchment. Design peak discharges from both models were validated against estimates derived using the Rational Method, the Quantile Regression Technique (Palmen and Weeks, 2015) and the Regional Flood Frequency Estimation method.

Details of the URBS model development, calibration and validation are provided in Appendix A.

The URBS hydrologic models were then used to estimate design discharges for the following design flood events:

- 50% (1 in 2) AEP;
- 5% (1 in 20) AEP;
- 2% (1 in 50) AEP;

- 1% (1 in 100) AEP;
- 0.1% (1 in 1,000) AEP; and
- Probable Maximum Precipitation.

8.2.2 Climate change considerations

In August 2024, ARR was updated to include additional guidance on the incorporation of the impacts on climate change on flood estimates. The guidance has been developed from the latest IPCC temperature projections based on SSPs that cover a broad range of potential future development options. The SSPs are designated low (SSP1-2.6), medium (SSP2-4.5), high (SSP3-7.0) and very high (SSP5-8.5) emissions pathways and have been projected out to 2100.

The IPCC guidance is that temperatures have already risen by one degree since the development of the 2016 intensity frequency-duration (IFD) data. As a result, design rainfall IFDs for existing conditions were scaled up using uplift factors obtained from ARR datahub[2], corresponding to the near-term SSP5-8.5 (year 2030) climate scenario. The associated pre-burst rainfalls were also scaled up accordingly. Similarly, design rainfall IFDs and associated pre-burst rainfalls for the final landform conditions were scaled up to the long-term SSP2-4.5 (year 2100) climate scenario.

The SSP5-8.5 climate adjustments account for approximately 1.3°C of predicted global warming for the current and near-term (2021-2040) since the historical baseline period of 1961-1990. The SSP2-4.5 climate adjustments account for approximately 2.4°C of predicted global warming for the current and near-term (2081-2100) for the same historical baseline period.

Table 8.2 shows the corresponding design rainfall uplift factors for various storm durations (as percentage increases compared to the baseline IFD data [Bureau, 2016]).

Table 8.2 Adopted design rainfall uplift factors

Storm duration	Rainfall uplift factor	
	SSP5-8.5 year 2030	SSP2-4.5 year 2100
<1 Hour	20%	41%
1.5 Hours	18%	37%
2 Hours	17%	35%
3 Hours	16%	32%
4.5 Hours	14%	29%
6 Hours	13%	27%
9 Hours	13%	25%
12 Hours	12%	24%
18 Hours	11%	22%
>24 Hours	11%	21%

[2] https://data.arr-software.org/

8.2.3 Design discharges

Table 8.3 and Table 8.4 show the URBS modelled peak design discharges at Taurus Creek (BWC_03) and Two Mile Gully (TMG) (as shown in Figure 8.1). Table 8.4 and Table 8.6 show the corresponding critical storm durations at BWC_03 and TMG, respectively.

Table 8.3 Design discharge estimates at location BWC_03

AEP (%)	Existing conditions (m^3/s) (SSP5-8.5 year 2030)	Post-mining conditions (m^3/s) (SSP2-4.5 year 2100)
50% (1 in 2)	166	n/a
5% (1 in 20)	398	n/a
2% (1 in 50)	488	n/a
1% (1 in 100)	562	863
0.1% (1 in 1,000)	901	1,361
PMF	4,006	6,219

Table 8.4 Adopted critical duration design storms at location BWC_03

AEP (%) (1 in X)	Existing conditions (m^3/s) (SSP5-8.5 year 2030)		Post-mining conditions (m^3/s) (SSP2-4.5 year 2100)	
	Critical duration (hours)	Representative temporal pattern	Critical duration (hours)	Representative temporal pattern
50% (1 in 2)	3	5	n/a	n/a
5% (1 in 20)	3	8	n/a	n/a
2% (1 in 50)	3	1	n/a	n/a
1% (1 in 100)	3	1	2	1
0.1% (1 in 1,000)	3	4	2	4
PMF	2	4	2	2

Table 8.5 Design discharge estimates at location TMG

AEP (%)	Existing conditions (m^3/s) (SSP5-8.5 year 2030)	Post-mining conditions (m^3/s) (SSP2-4.5 year 2100)
50% (1 in 2)	146	n/a
5% (1 in 20)	361	n/a
2% (1 in 50)	440	n/a
1% (1 in 100)	517	625
0.1% (1 in 1,000)	887	1,025
PMF	4,945	5,718

Table 8.6 Adopted critical duration design storms at location TMG

AEP (%)	Existing conditions (m^3/s) (SSP5-8.5 year 2030)		Post-mining conditions (m^3/s) (SSP2-4.5 year 2100)	
	Critical duration (hours)	Representative temporal pattern	Critical duration (hours)	Representative temporal pattern
50% (1 in 2)	3	3	n/a	n/a
5% (1 in 20)	3	8	n/a	n/a
2% (1 in 50)	4.5	9	n/a	n/a
1% (1 in 100)	6	10	3	1
0.1% (1 in 1,000)	6	4	4.5	4
PMF	3	9	2	9

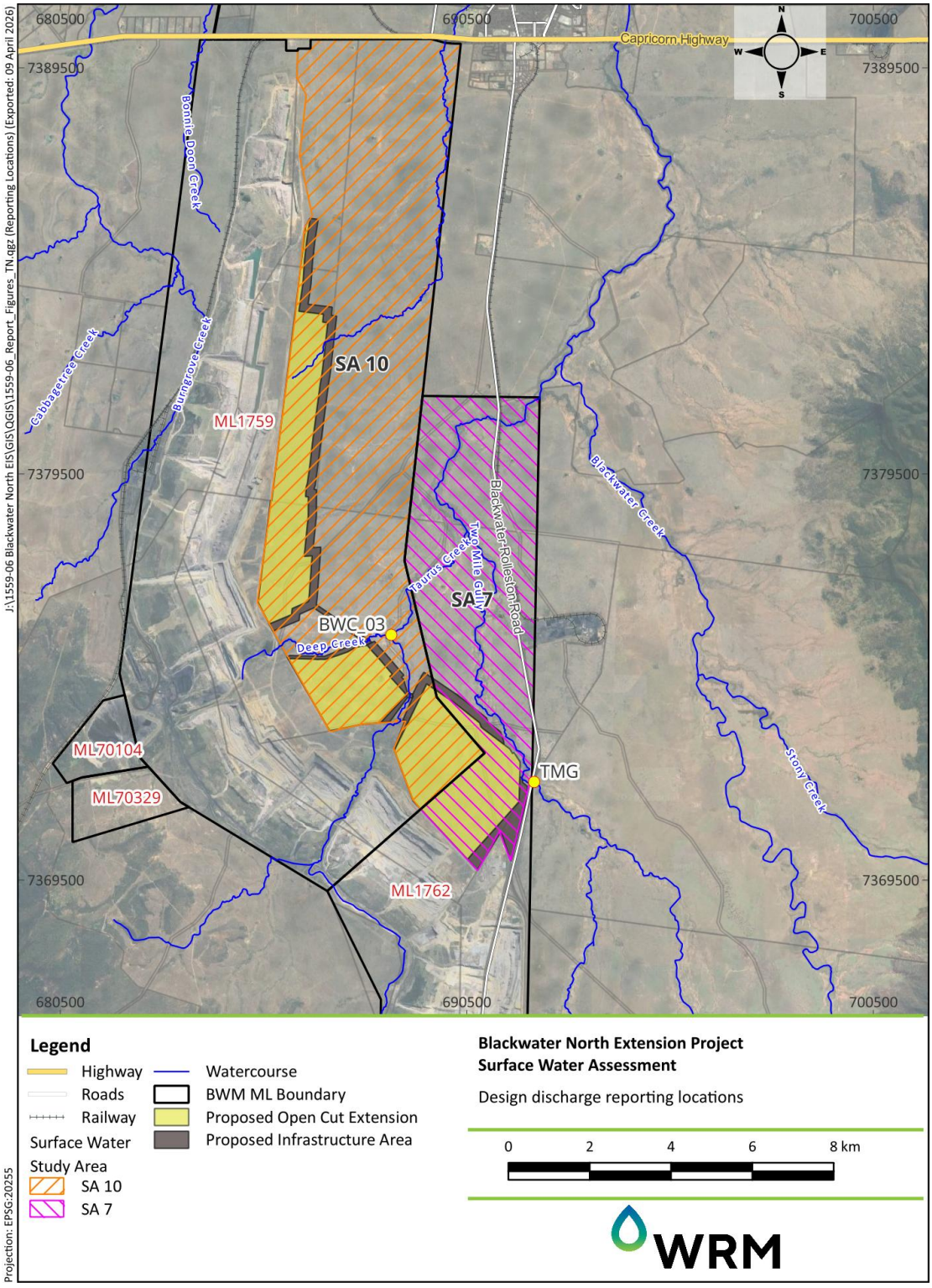


Figure 8.1 Design discharge reporting locations

8.3 HYDRAULIC MODEL DEVELOPMENT

8.3.1 Overview

TUFLOW hydraulic models for Blackwater Creek (including Taurus Creek, Deep Creek and Two Mile Gully) and Sagittarius Creek previously developed by SLR (2024) as part of the BWM PRCP flood assessment, was updated and used for this assessment. Design discharges from the URBS hydrologic models described in Section 8.2 and Appendix A, were applied as inflows to the TUFLOW hydraulic models.

TUFLOW hydraulic models were developed for the following three scenarios:

- 'Existing conditions' – This scenario represents the existing BWM configuration and was adopted as the baseline conditions.
- 'Proposed (Project) conditions' – This scenario represents the proposed BWM configuration incorporating the maximum disturbance area associated with the Project. However, areas outside of the Project area are assumed unchanged from existing conditions.
- 'Final landform conditions' – This scenario represents the BWM configuration post-closure, incorporating the final landform including the final voids within the Project area.

8.3.2 TUFLOW model configuration

8.3.2.1 Extent and topography

The configuration and extent of the TUFLOW hydraulic models developed for this SWA are shown in the following figures:

- For Blackwater Creek (including Taurus Creek and Two Mile Gully):
  - Figure 8.2 for existing conditions;
  - Figure 8.3 for proposed (Project) conditions; and
  - Figure 8.4 for the final landform;
- For Sagittarius Creek:
  - Figure 8.5 for existing conditions; and
  - Figure 8.6 for proposed (Project) conditions.

The TUFLOW models were configured with a grid cell size resolution of 5 m. The base model topography in the models was configured using the following data:

- a 1 m resolution LiDAR data flown in 2024 (the 2024 LiDAR) for the majority of the TUFLOW model extent;
- a 1 m resolution LiDAR data flown in 2025 (the 2025 LiDAR) for areas in the vicinity of the active mining areas, including recent updates to the NTCD;
- a 1 m resolution DEM embedded in previous SLR (2024) hydraulic models provided by Whitehaven Blackwater, for areas not covered by the 2024 and 2025 LiDAR;
- a 30 m resolution Copernicus DEM sourced from the Copernicus Open Access Hub, for areas not covered by the available 1 m LiDAR data; and
- flood protection levees proposed around the proposed Project voids.

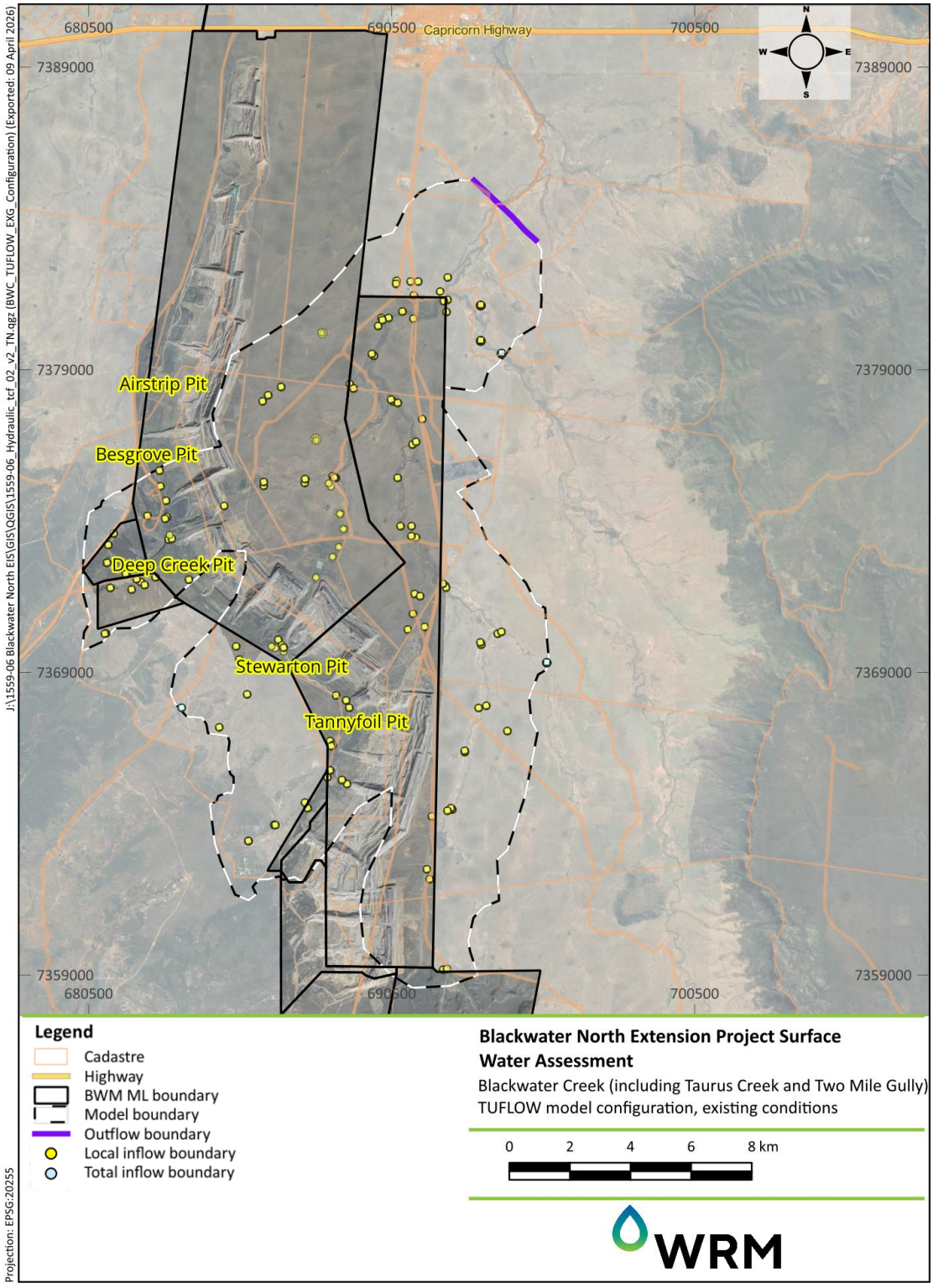


Figure 8.2 **Blackwater Creek (including Taurus Creek and Two Mile Gully) TUFLOW model configuration, existing conditions**

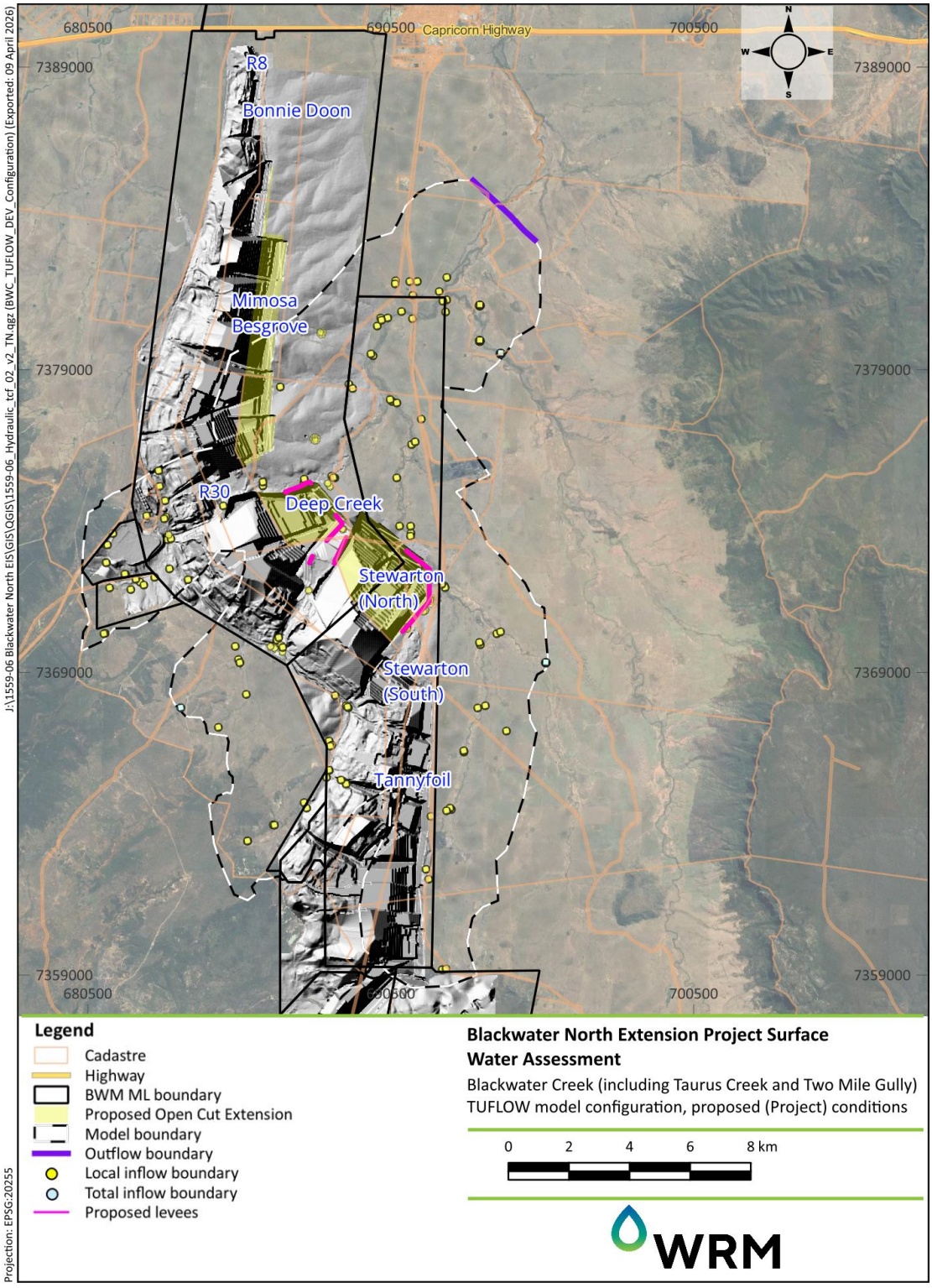


Figure 8.3 **Blackwater Creek (including Taurus Creek and Two Mile Gully) TUFLOW model configuration, proposed (Project) conditions**

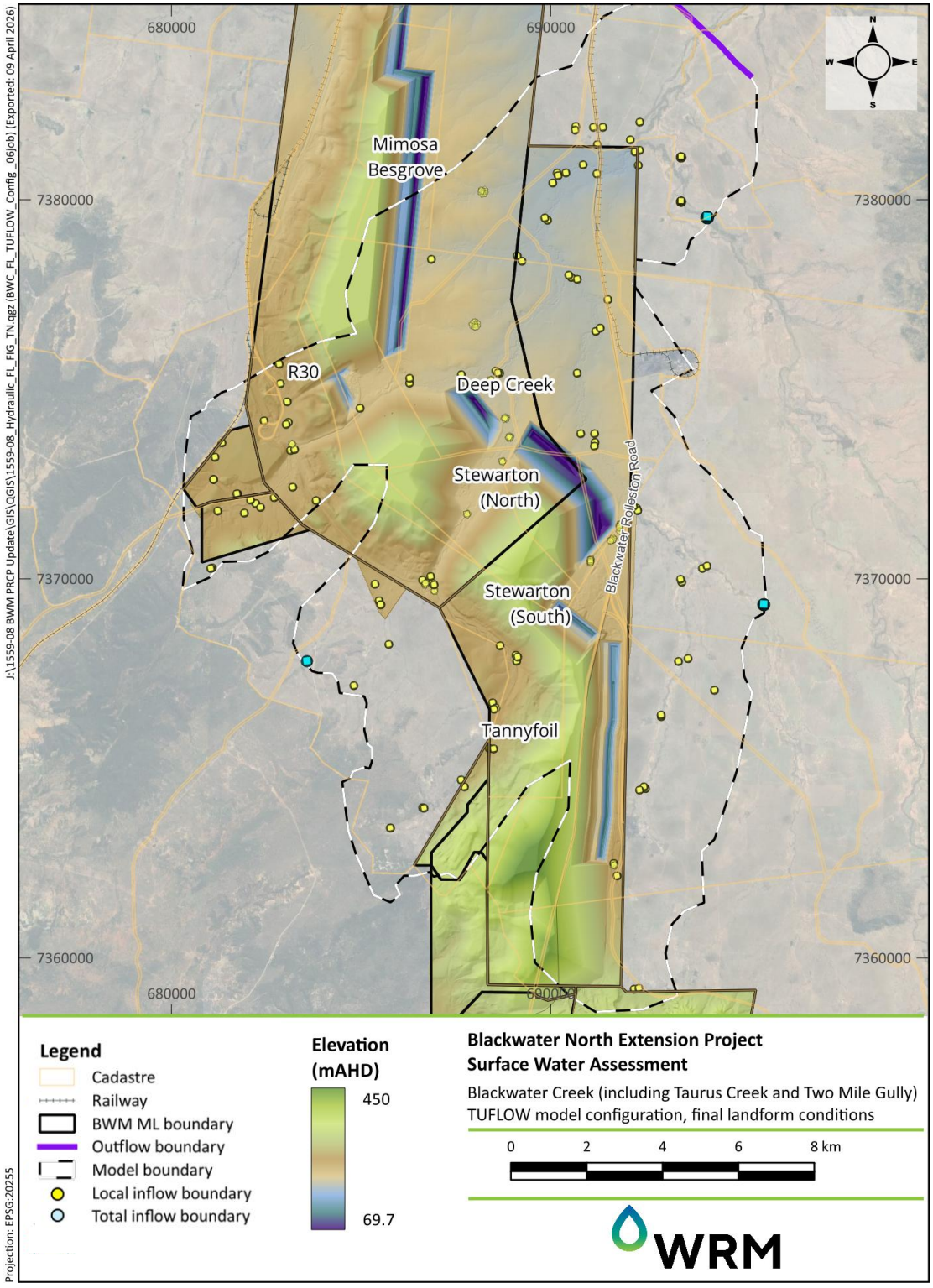


Figure 8.4 Blackwater Creek (including Taurus Creek and Two Mile Gully) TUFLOW model configuration, final landform conditions

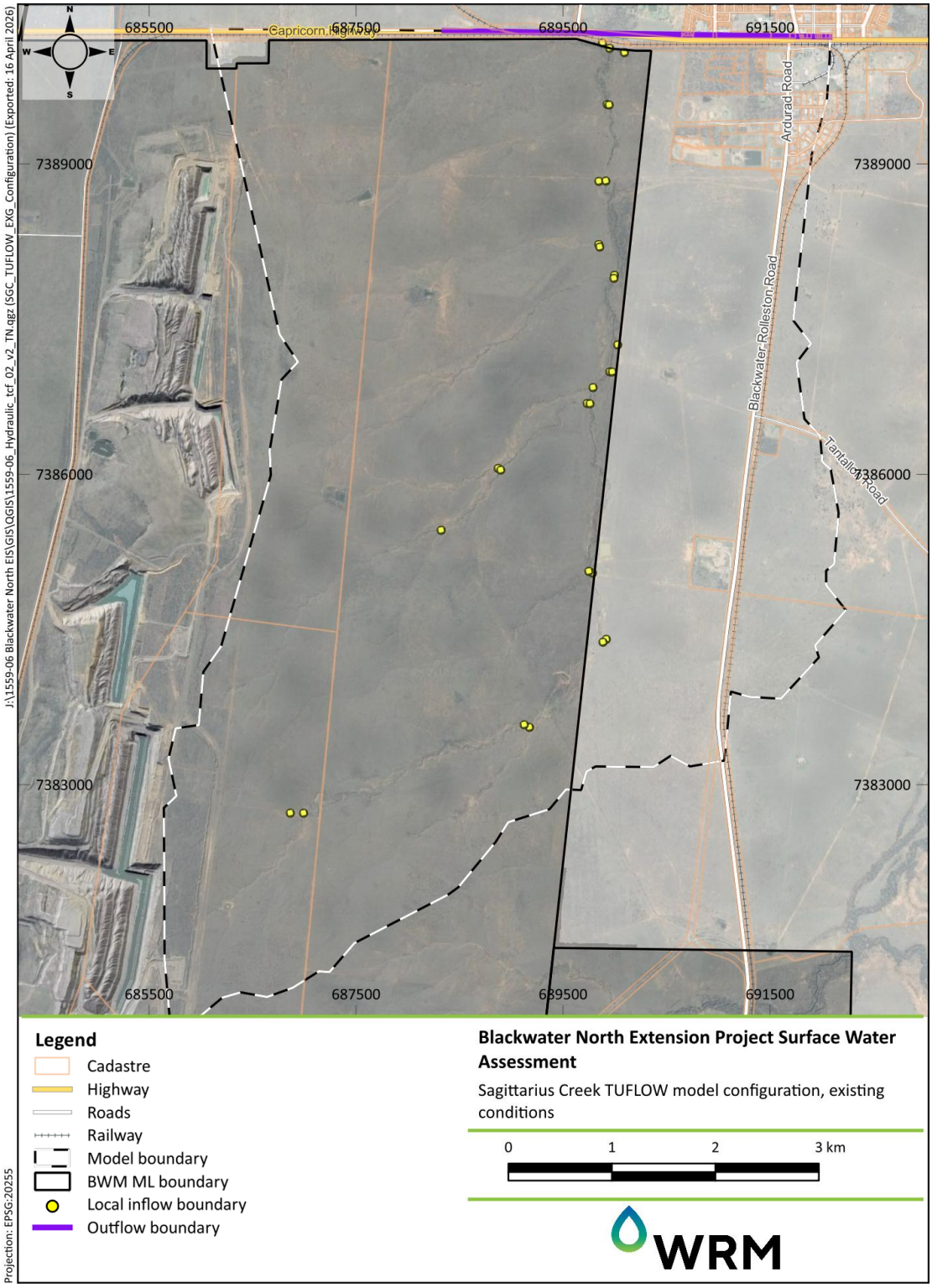


Figure 8.5 **Sagittarius Creek TUFLOW model configuration, existing conditions**

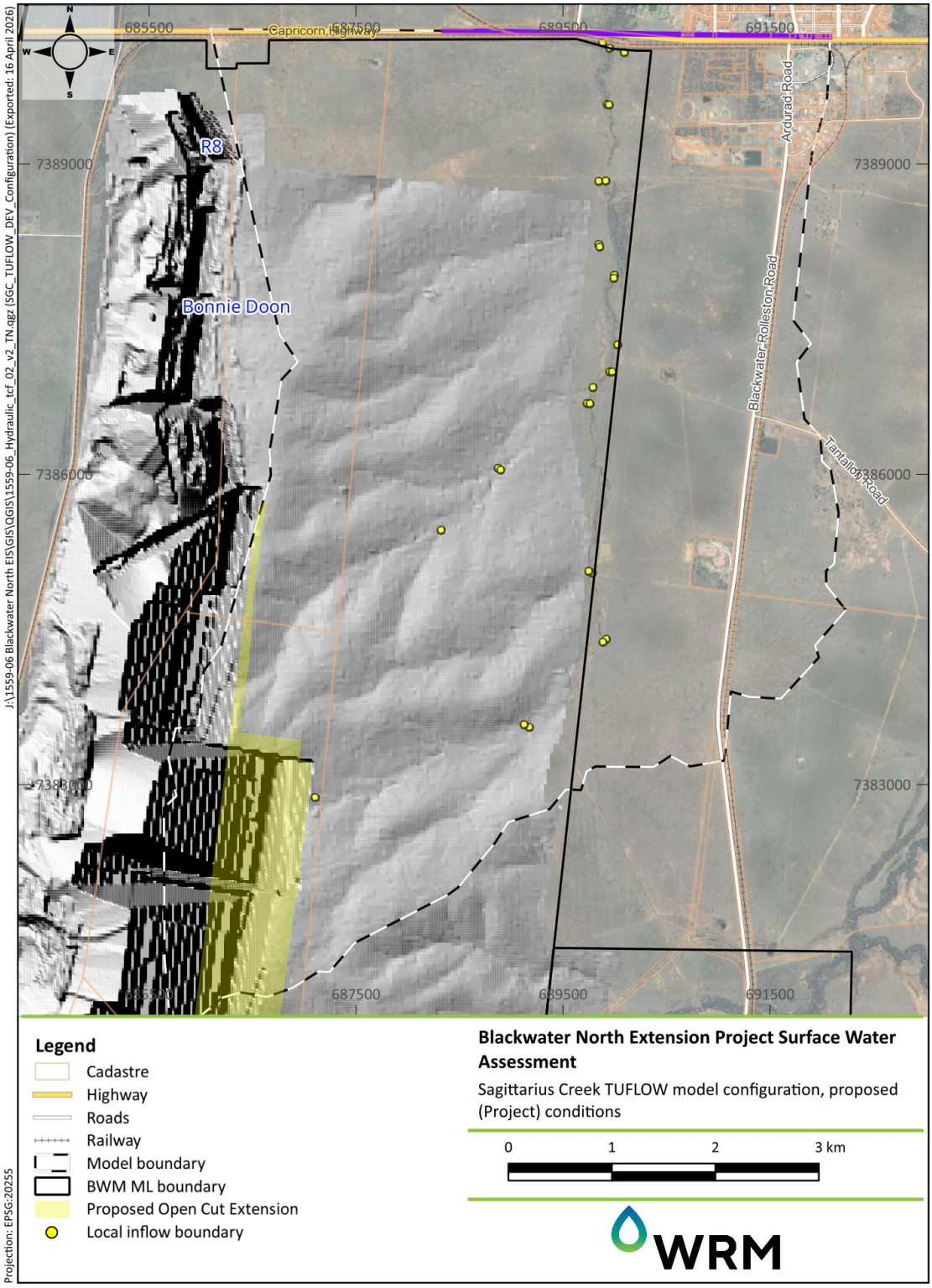


Figure 8.6 **Sagittarius Creek TUFLOW model configuration, proposed (Project) conditions**

8.3.2.2 Inflow and outflow boundaries

Design discharge hydrographs from the URBS hydrologic models (described in Section 8.2 and Appendix A) were applied as inflows to the TUFLOW hydraulic models.

The flow boundaries included in the models are as follows:

1. Blackwater Creek (including Taurus Creek, Deep Creek and Two Mile Gully) (BWC):
    - a total of 129 local inflow boundaries representing inflows from the URBS subcatchments within the hydraulic model boundary;
    - three total inflow boundary representing total inflows from URBS subcatchments outside of hydraulic model boundary; and
    - one 'stage-discharge' downstream outflow boundary, with a fixed downstream flood slope of 0.13%.
2. Sagittarius Creek (SGC):
    - a total of 27 local inflow boundaries representing inflows from the URBS subcatchments within the hydraulic model boundary; and
    - one 'stage-discharge' (HQ) type downstream outflow boundary, with a fixed downstream flood slope of 0.12%.

8.3.2.3 Hydraulic structures

Hydraulic structures including culverts were incorporated into the hydraulic model as one-dimensional network objects embedded within the two-dimensional domain. The hydraulic structures included in the SLR (2024) hydraulic models were maintained in the updated model.

8.3.2.4 Hydraulic roughness

The TUFLOW model uses Manning's 'n' values to represent hydraulic resistance. Table 8.7 shows the adopted Manning's 'n' values in the models.

Table 8.7 Adopted hydraulic roughness coefficients

Land use	Adopted Mannings 'n'
Short grass	0.04
Bare land	0.03
Sparse trees	0.06
Dense trees	0.08
Tailings	0.03
Creeks	0.05
Hardstand	0.02
Access Haul Roads	0.03
Paved Roads	0.02
Rail embankment	0.03
Concrete	0.02
Rehabilitated landform	0.04

8.4 EXISTING CONDITIONS FLOODING

Figure 8.7 to Figure 8.11 are flood maps showing TUFLOW model predicted existing conditions flood extents, levels and depth along Emu Creek, Deep Creek, Taurus Creek, Two Mile Gully, and Blackwater Creek for the 50% (1 in 2) AEP to 0.1% (1 in 1,000) AEP design events. Figure 8.12 to Figure 8.16 show the corresponding peak velocities (in metres per second [m/s]).

Figure 8.17 shows the TUFLOW model predicted existing conditions peak flood extents, levels and depths along Sagittarius Creek for the 1% AEP design event. Figure 8.17 shows the corresponding 1% AEP peak velocities.

The model results show that, within the Project area (downstream of the existing mining pits):

- The waterway channels generally have less than 50% AEP flow capacity and overflows from the channel would occur for all modelled events. A significant portion of flood flows would be conveyed along the floodplain for all events ≥50% AEP.
- Peak flood depths along Deep Creek and Tarus Creek (upstream of the Two Mile Gully confluence) are generally less than 1 m along the flood plains and >1 m along the channels for all events up to 1% AEP. Flood depths along Two Mile Gully and Tarus Creek (downstream of the Two Mile Gully confluence) are generally deeper, with larger areas affected by flood depths >1 m for all events up to 1% AEP.
- The existing BWM mining operations are located outside of the Sagittarius Creek flood extent for all modelled events.

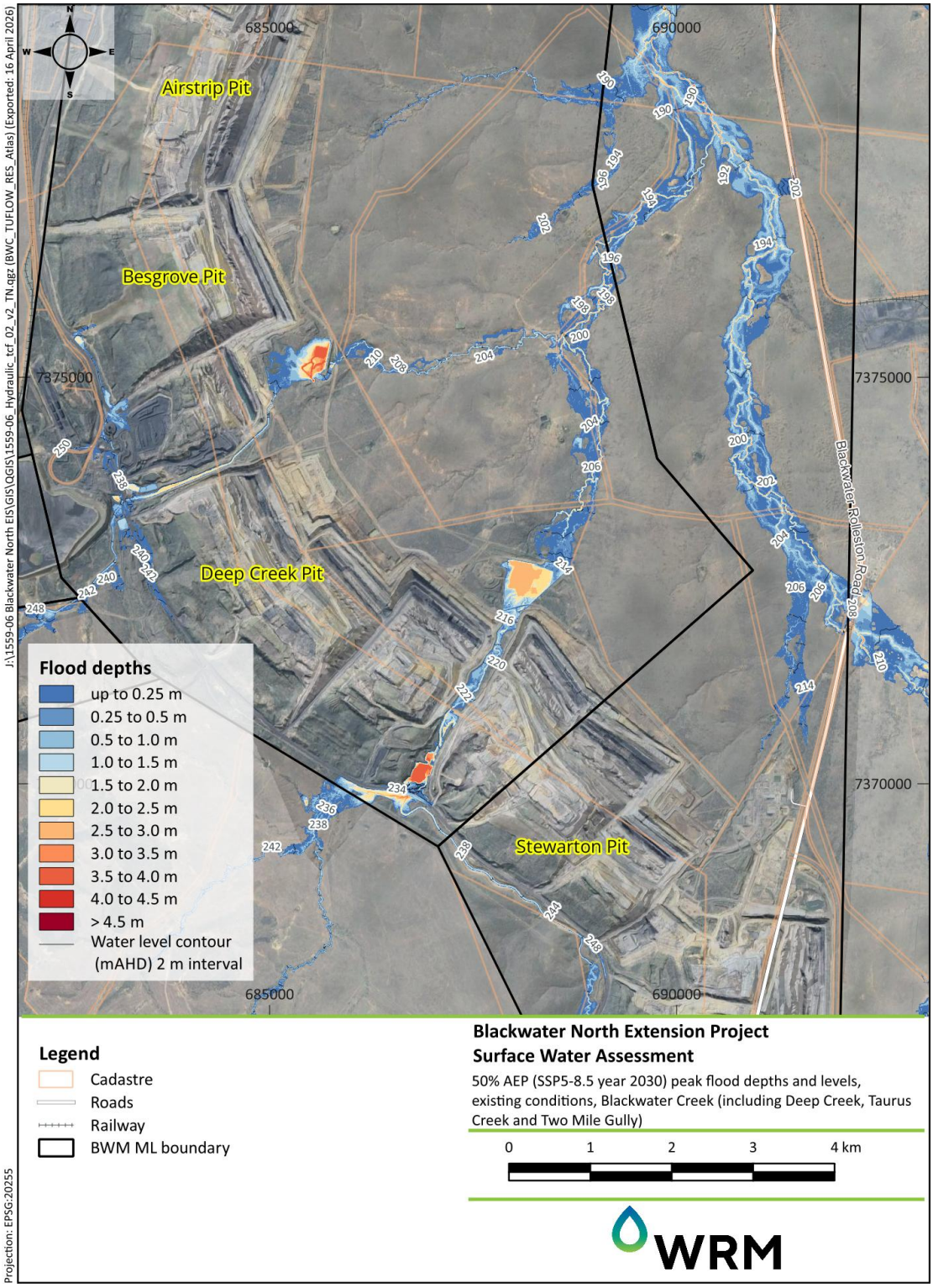


Figure 8.7 **50% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

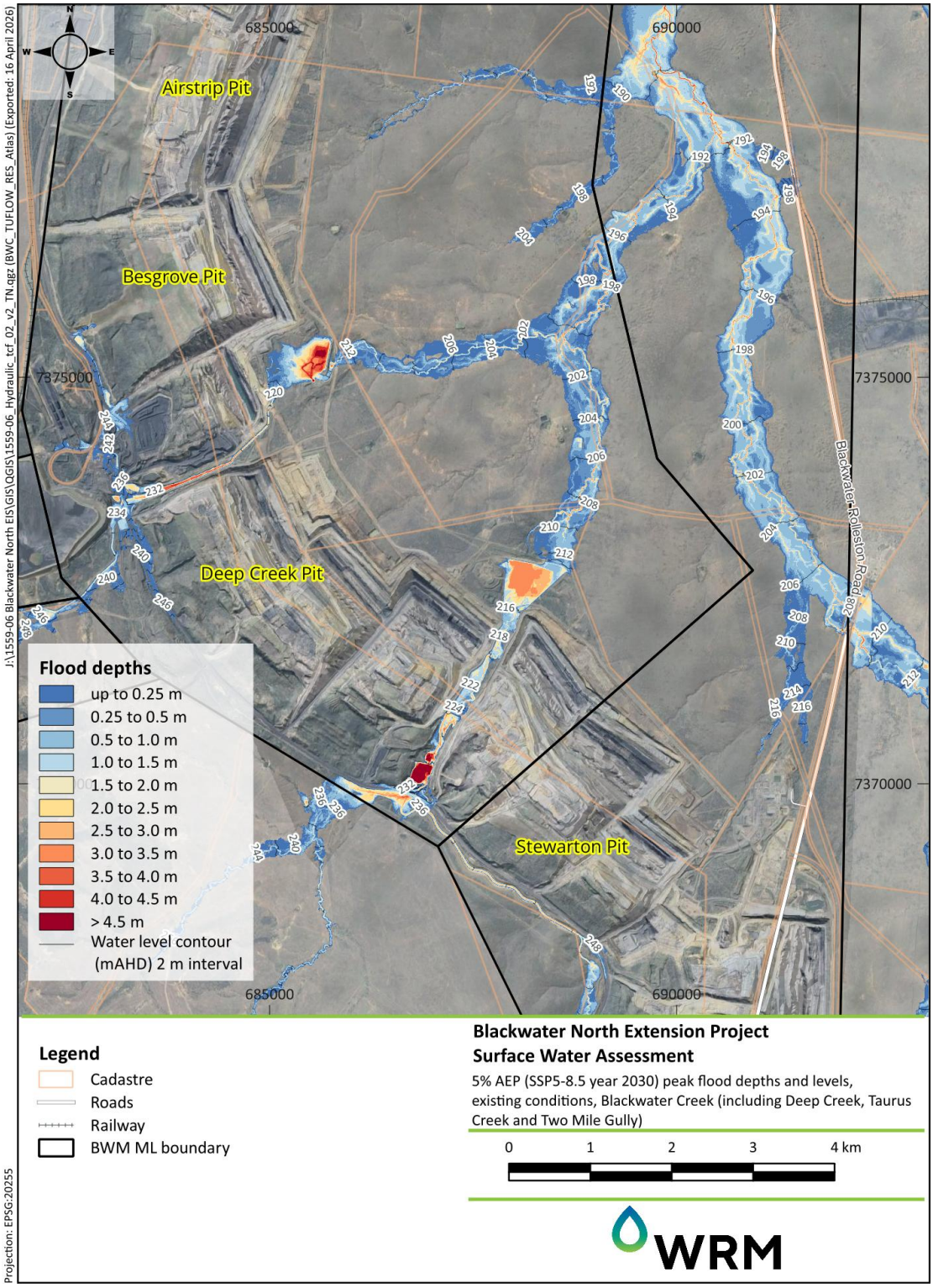


Figure 8.8 **5% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

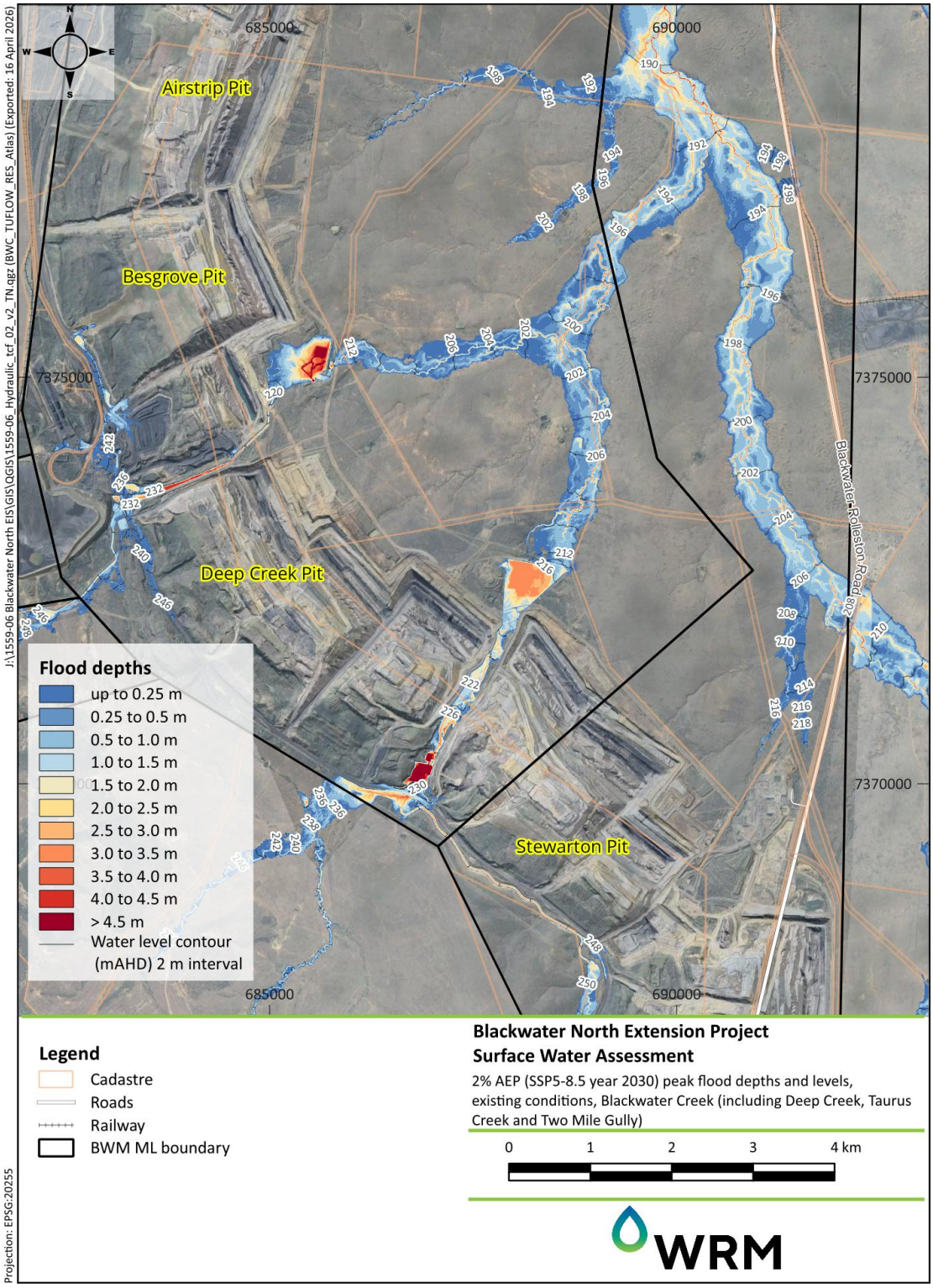


Figure 8.9 **2% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

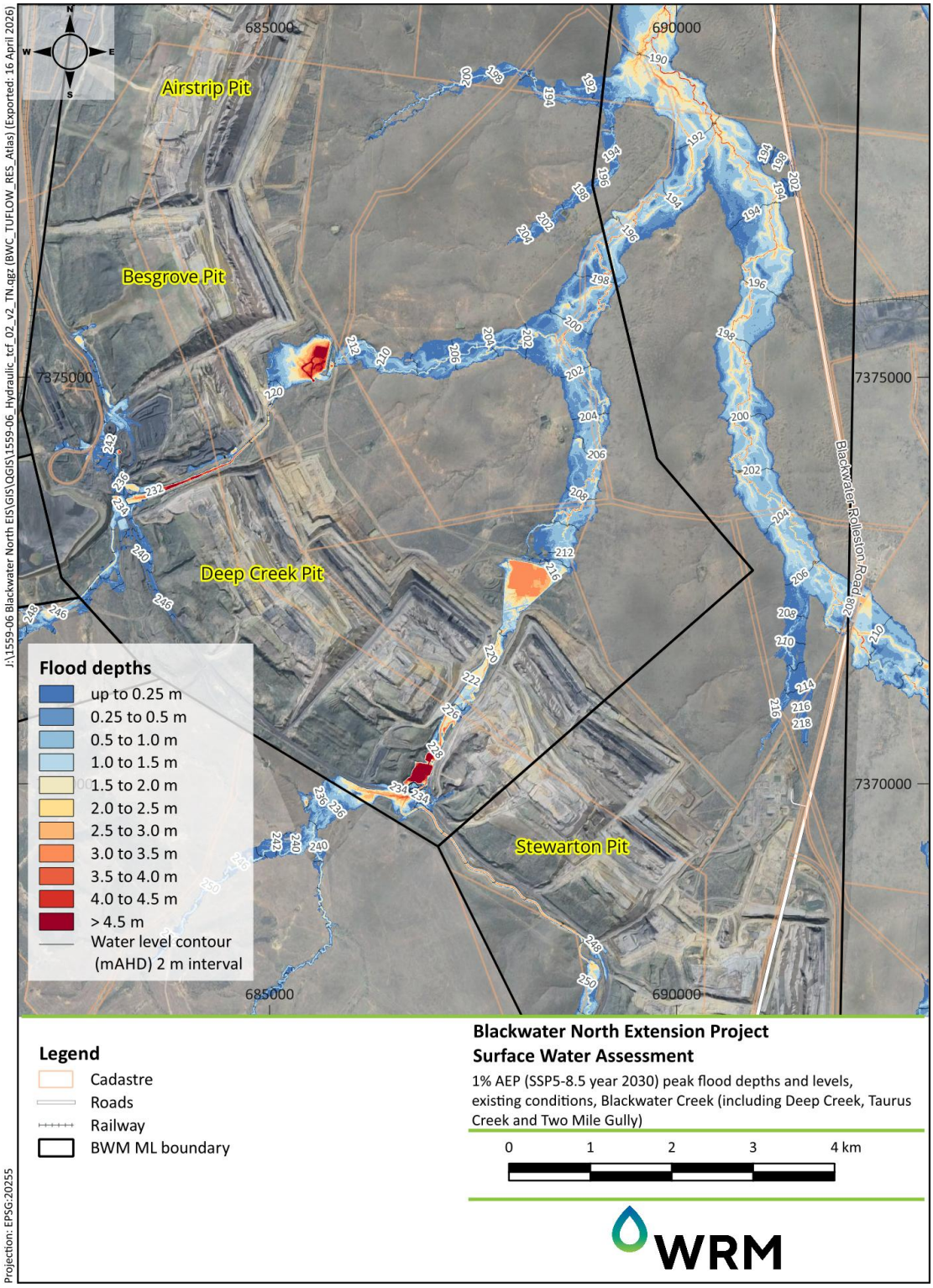


Figure 8.10 **1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

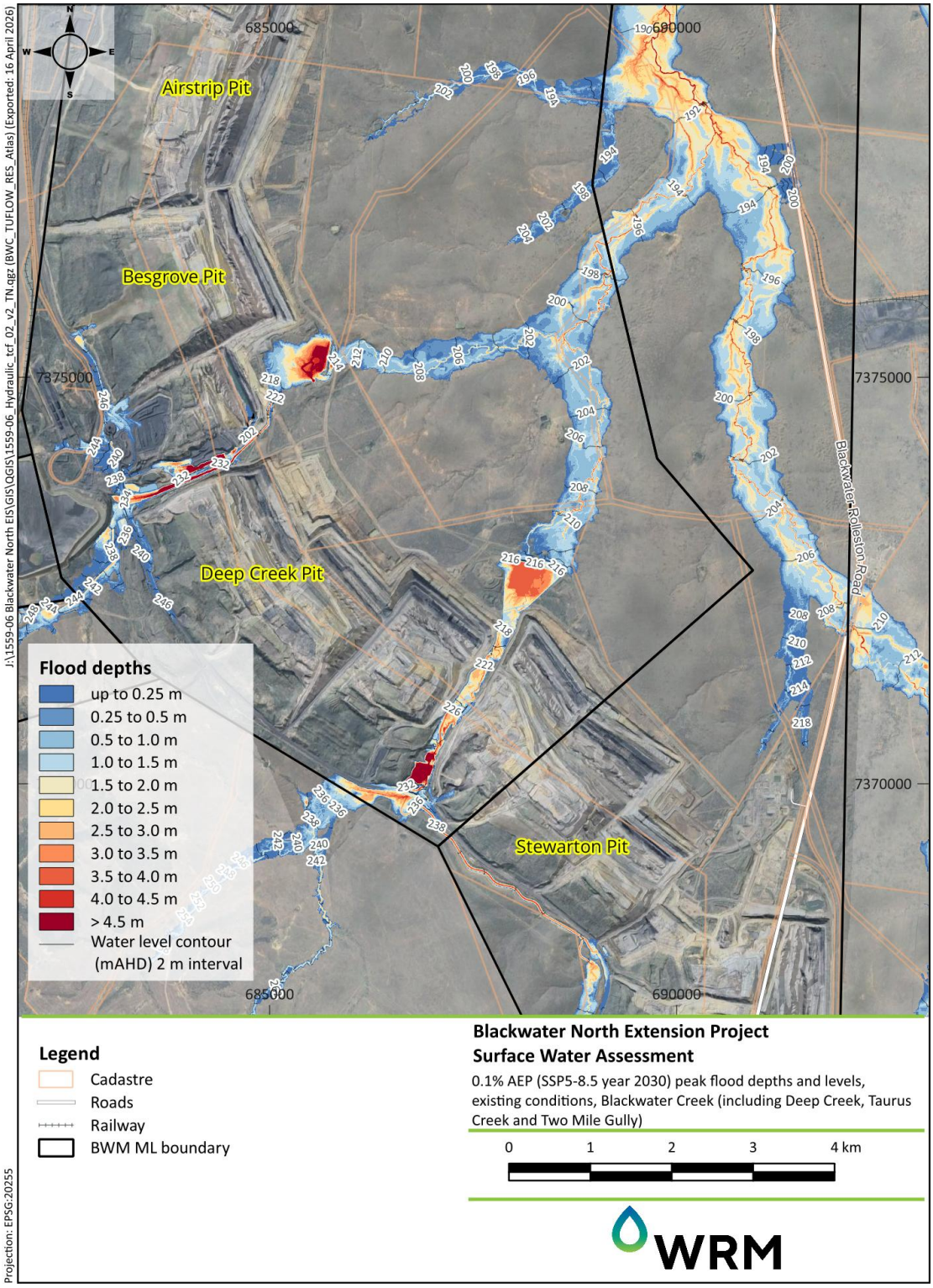


Figure 8.11 **0.1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

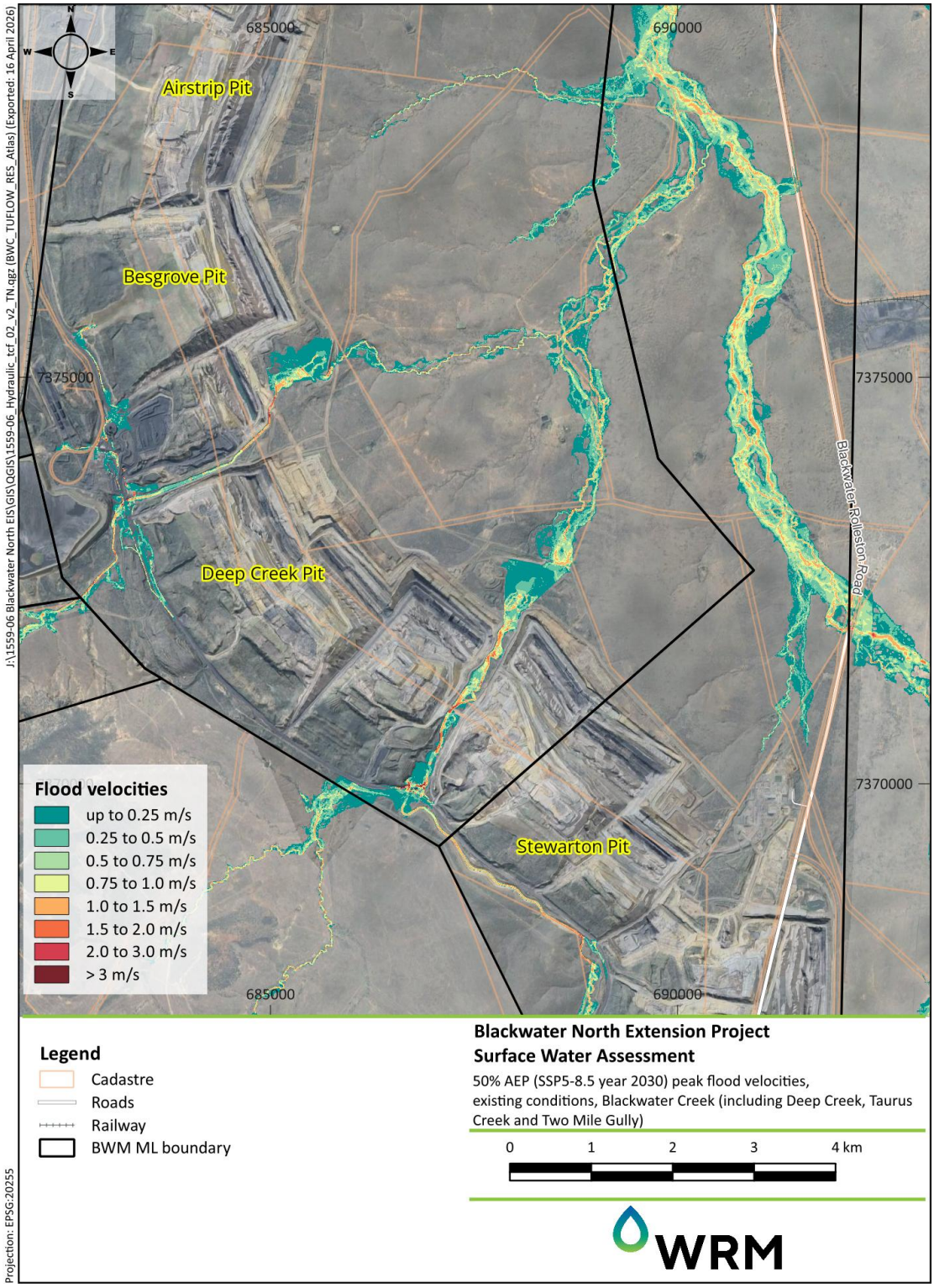


Figure 8.12 **50% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

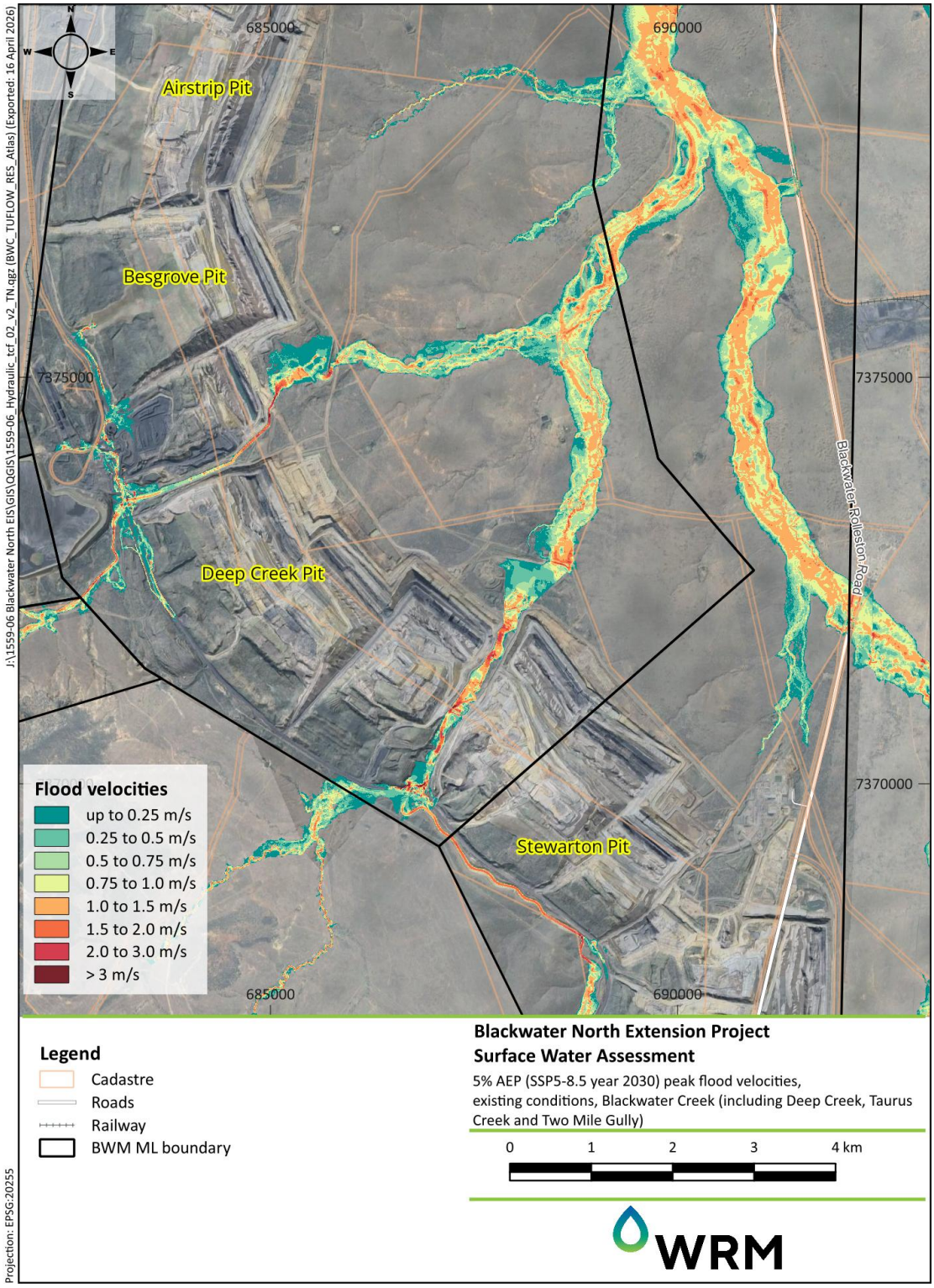


Figure 8.13 **5% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

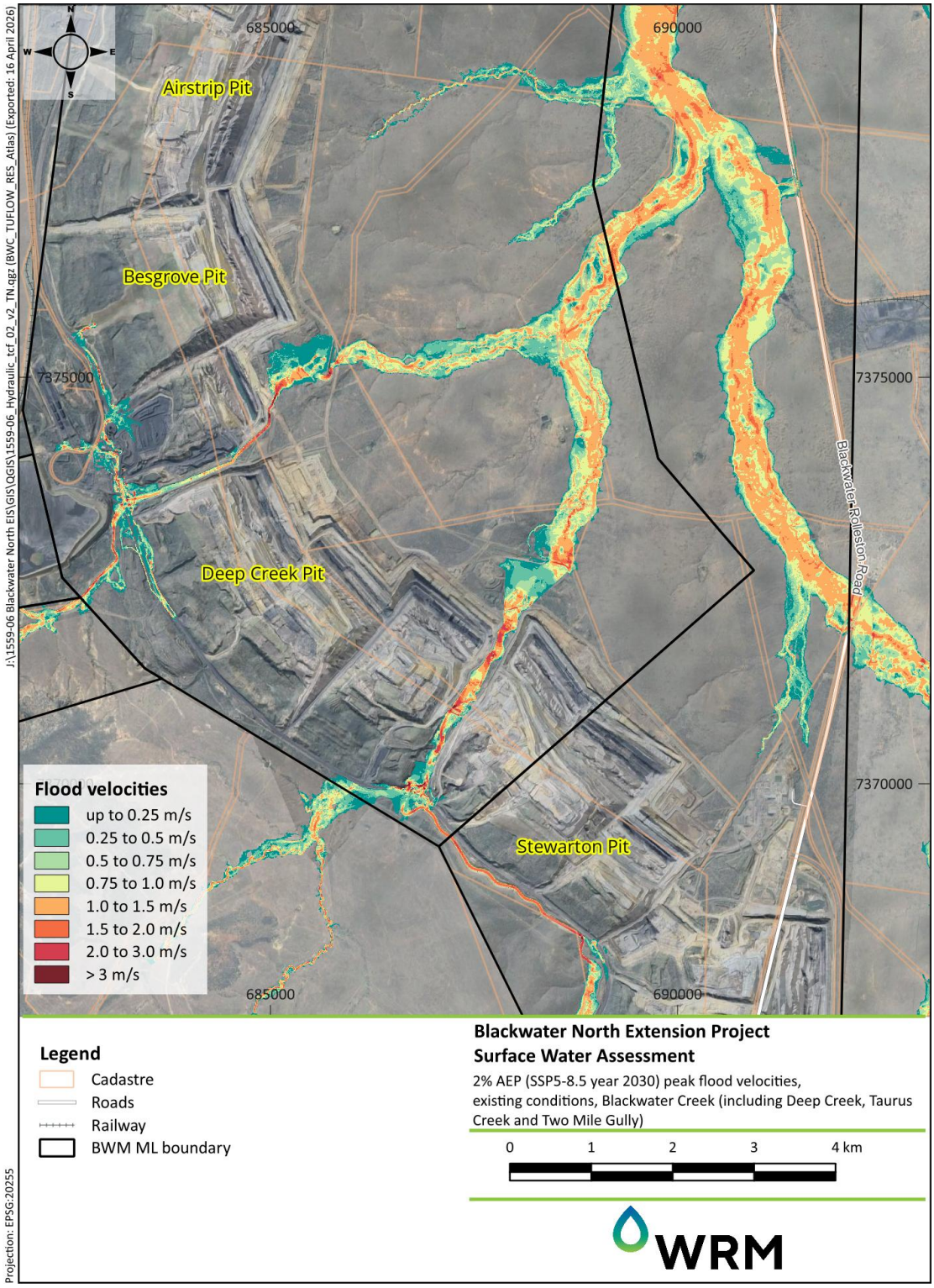


Figure 8.14 **2% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

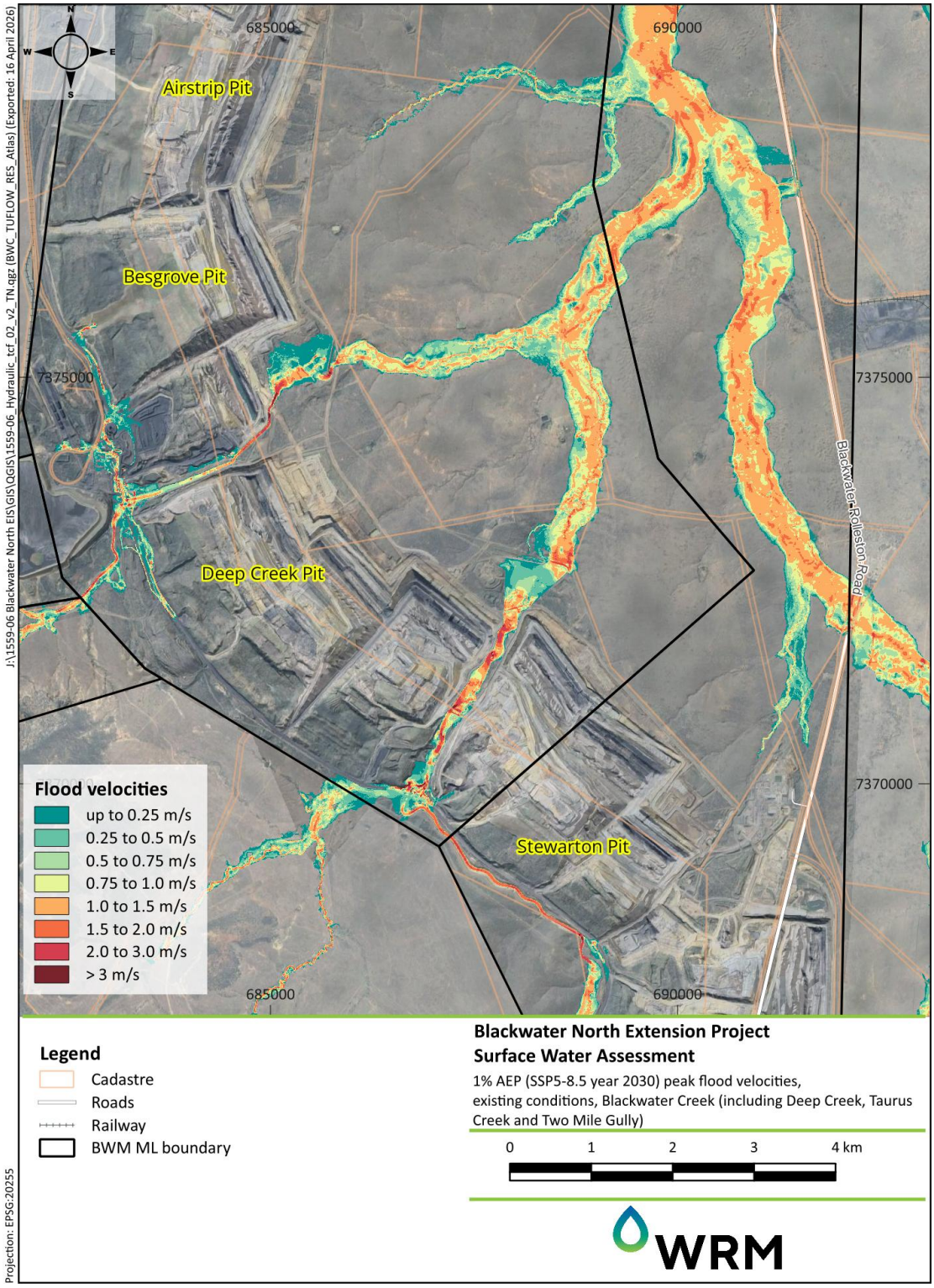


Figure 8.15 **1% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

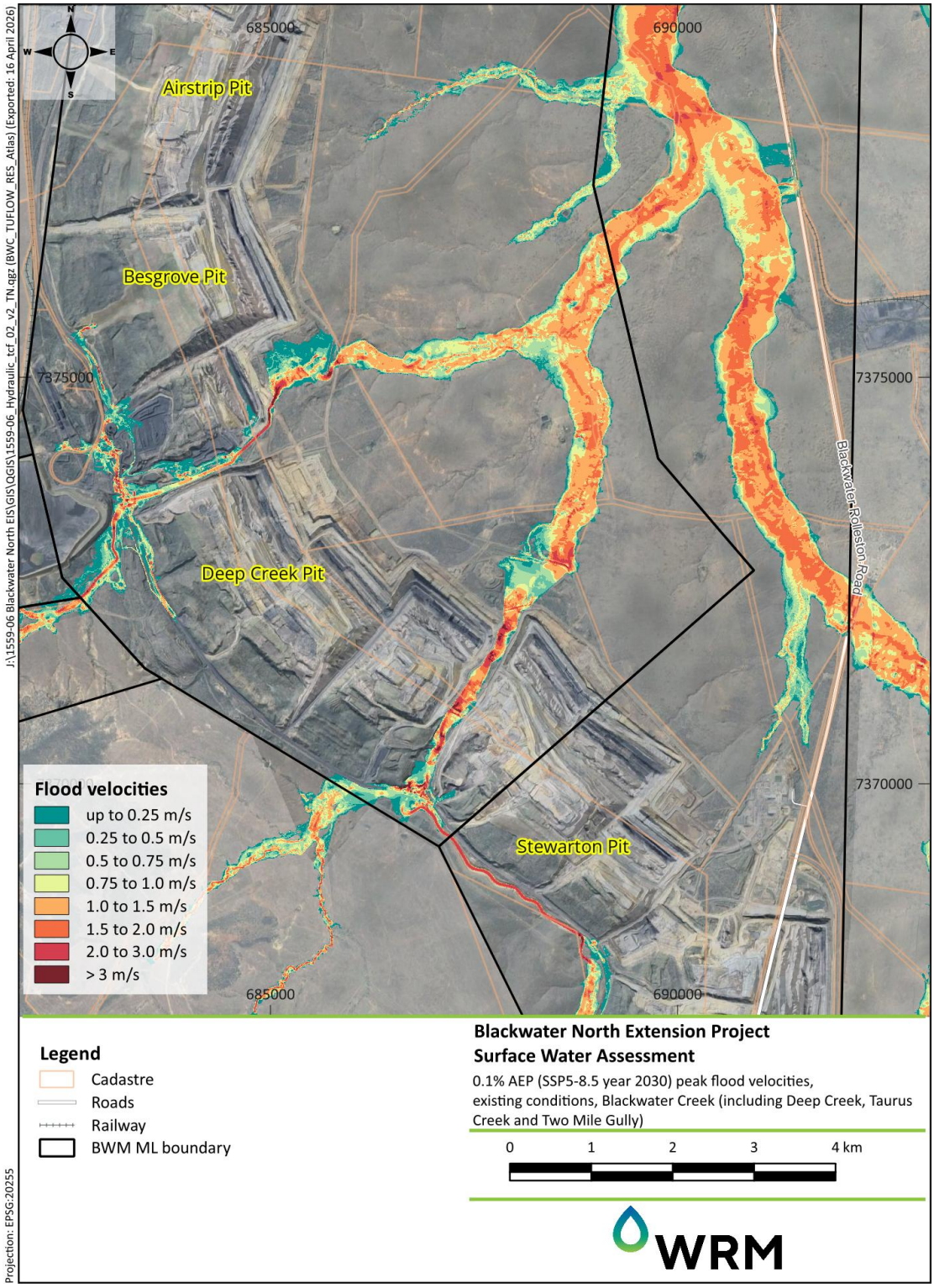


Figure 8.16 **0.1% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

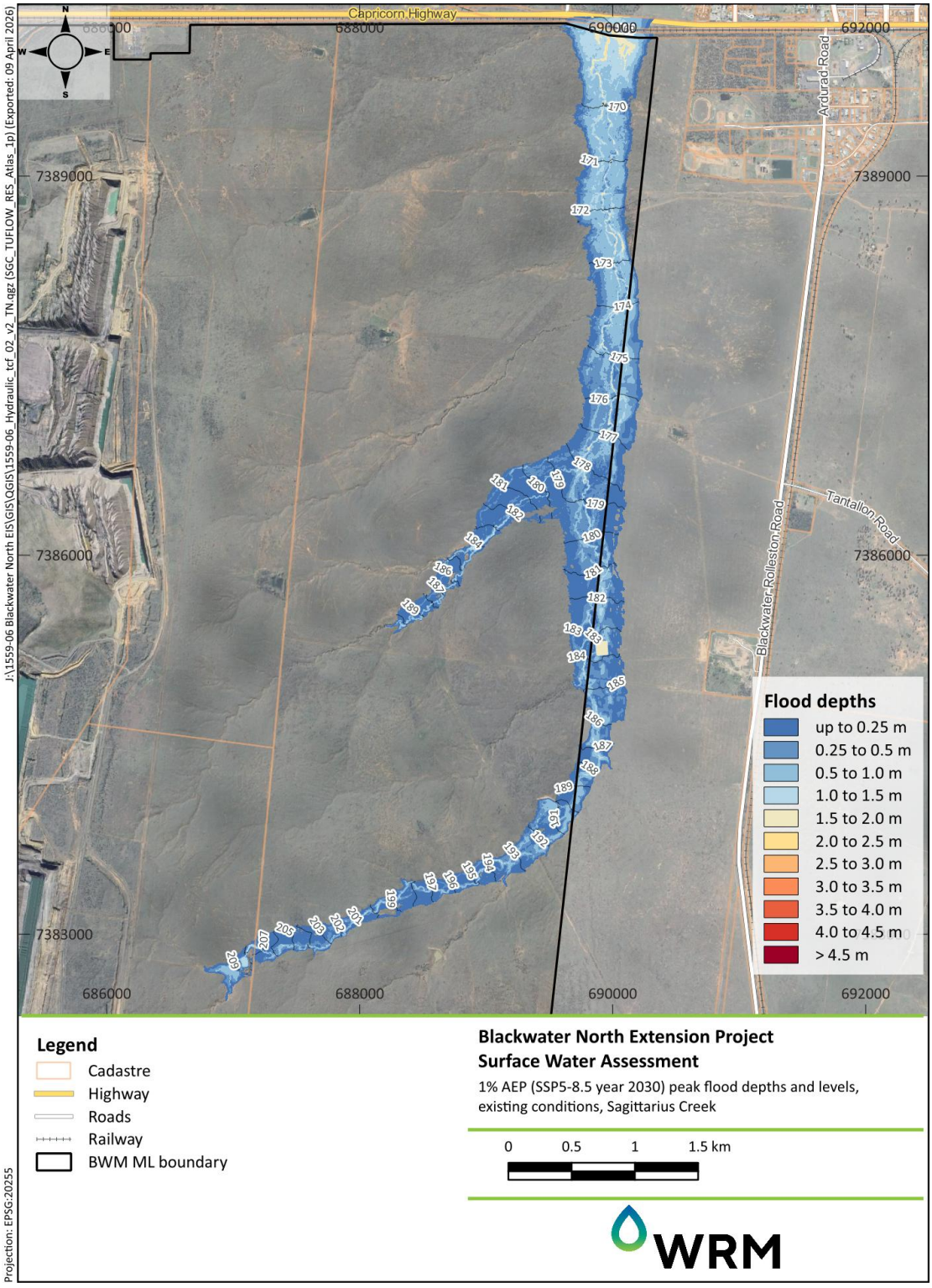


Figure 8.17 **1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, existing conditions, Sagittarius Creek**

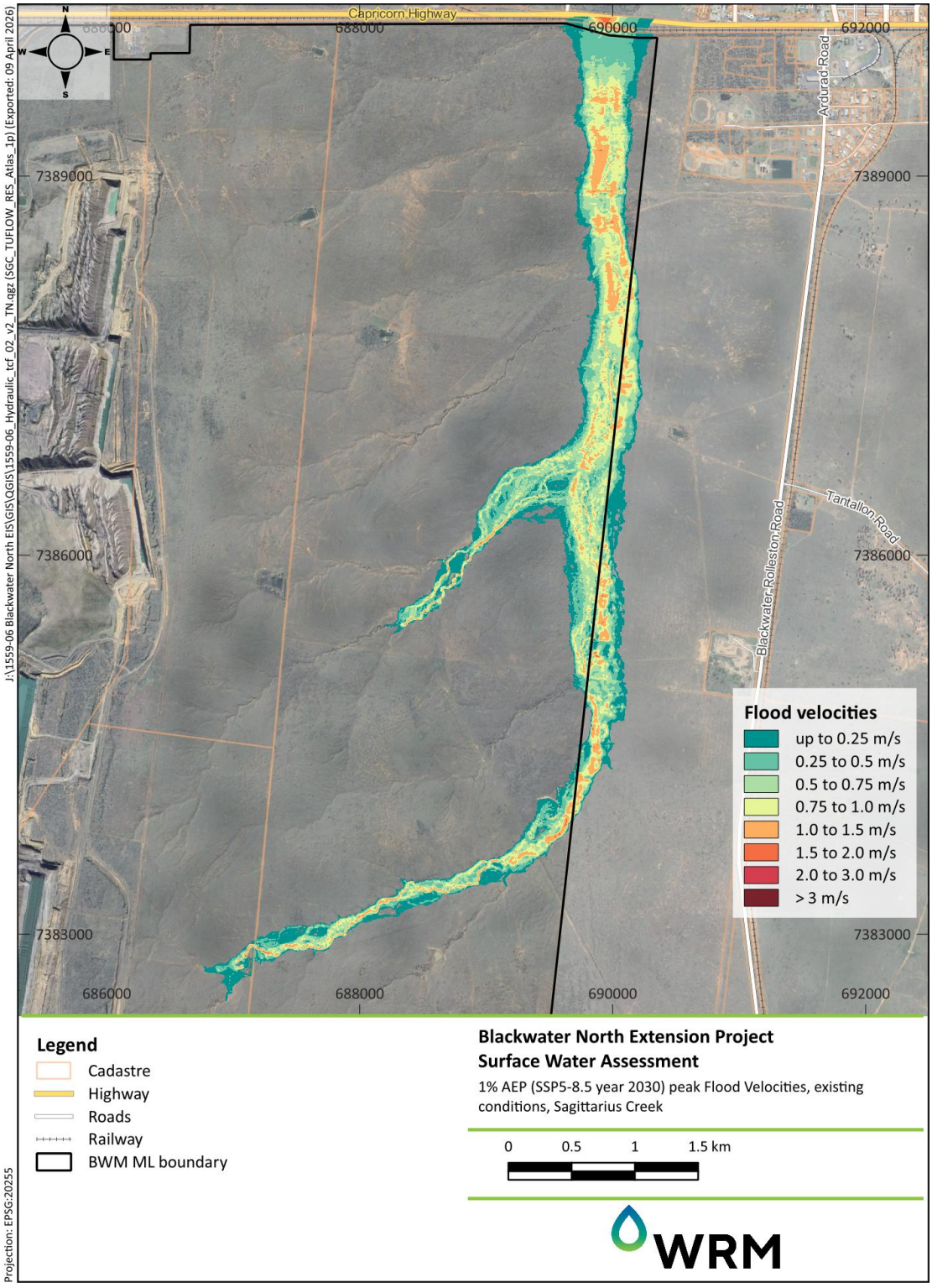


Figure 8.18 **1% AEP (SSP5-8.5 year 2030) peak flood velocities, existing conditions, Sagittarius Creek**

8.5 PROPOSED (PROJECT) CONDITIONS FLOODING

Figure 8.19 to Figure 8.23 are flood maps showing TUFLOW model predicted proposed (Project) conditions flood extents, levels and depth along Emu Creek, Deep Creek, Taurus Creek, Two Mile Gully, and Blackwater Creek for the 50% to 0.1% AEP design events. Figure 8.24 to Figure 8.28 show the corresponding peak velocities.

Figure 8.19 to Figure 8.28 shows the locations of the following proposed infrastructure:

- proposed temporary flood protection levees that would be in place during the maximum operational disturbance stage of the Project (year 2055). It was assumed that the proposed temporary levees would be constructed with crest levels at least 1 m above the adjacent 0.1% AEP peak flood level; and
- the proposed clean water drain along the southeastern side of the future Stewarton Pit extent, which would be in place during the operational stage of the Project and would also form part of the final landform post-closure.

Figure 8.29 shows the TUFLOW model predicted proposed (Project) conditions peak flood extents, levels and depths along Sagittarius Creek for the 1% AEP design event. Figure 8.30 shows the corresponding 1% AEP peak velocities.

The model results show that, within the Project area:

- The proposed levees would provide the future mining pits with immunity from flooding for all events up to 0.1% (1 in 1,000) AEP.
- The proposed clean water drain would have capacity to convey flood flows from the unnamed Two Mile Gully tributary catchment, for all events up to and including 0.1% AEP.
- The Project maximum disturbance area is located outside of the Sagittarius Creek flood extent for all modelled events.

An assessment of impacts on peak flood levels, velocities and waterway stability due to the Project is provided in Section 8.6. A hydraulic assessment of the proposed clean water drain is provided in Section 8.7.3.

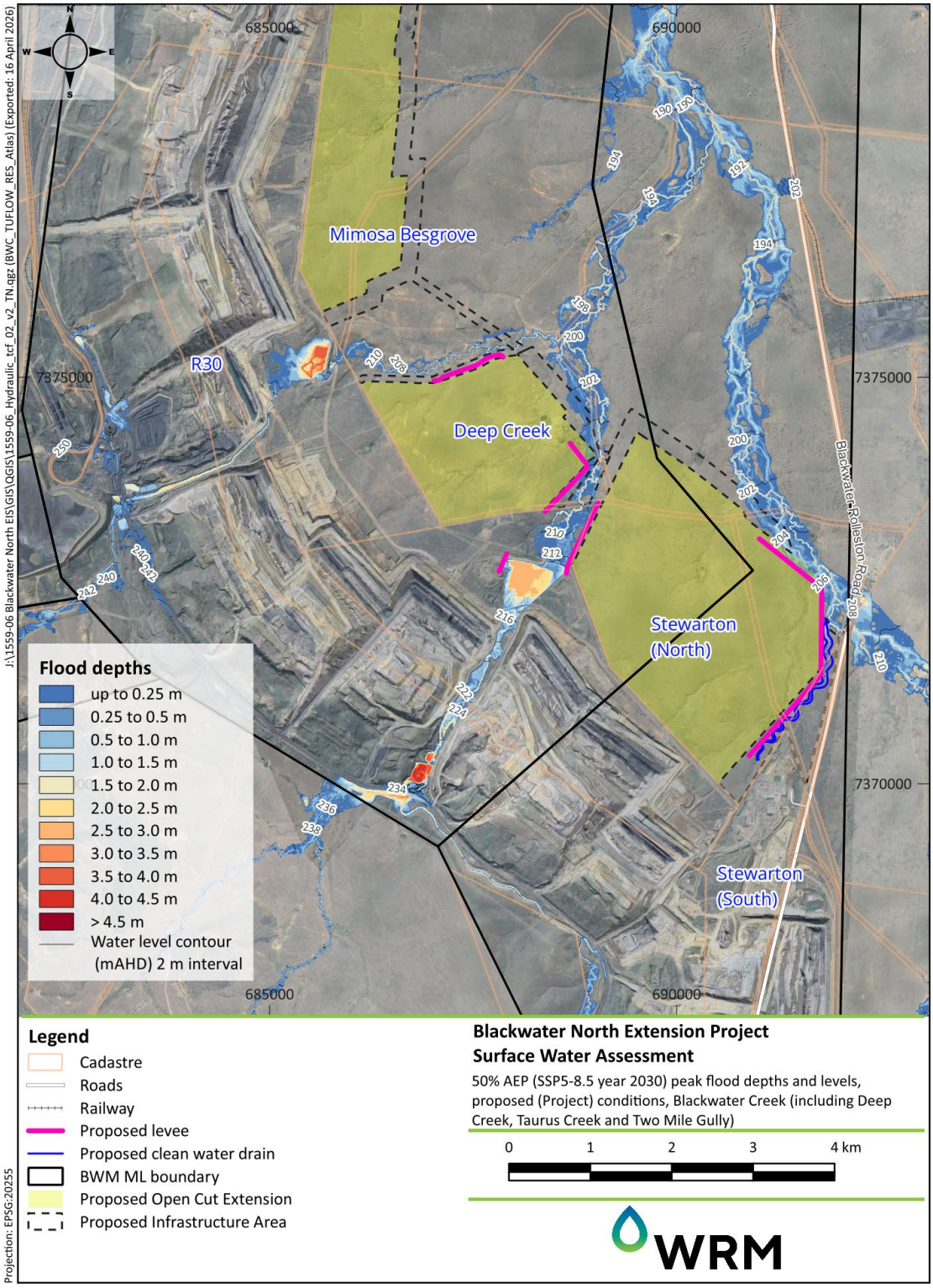


Figure 8.19 **50% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

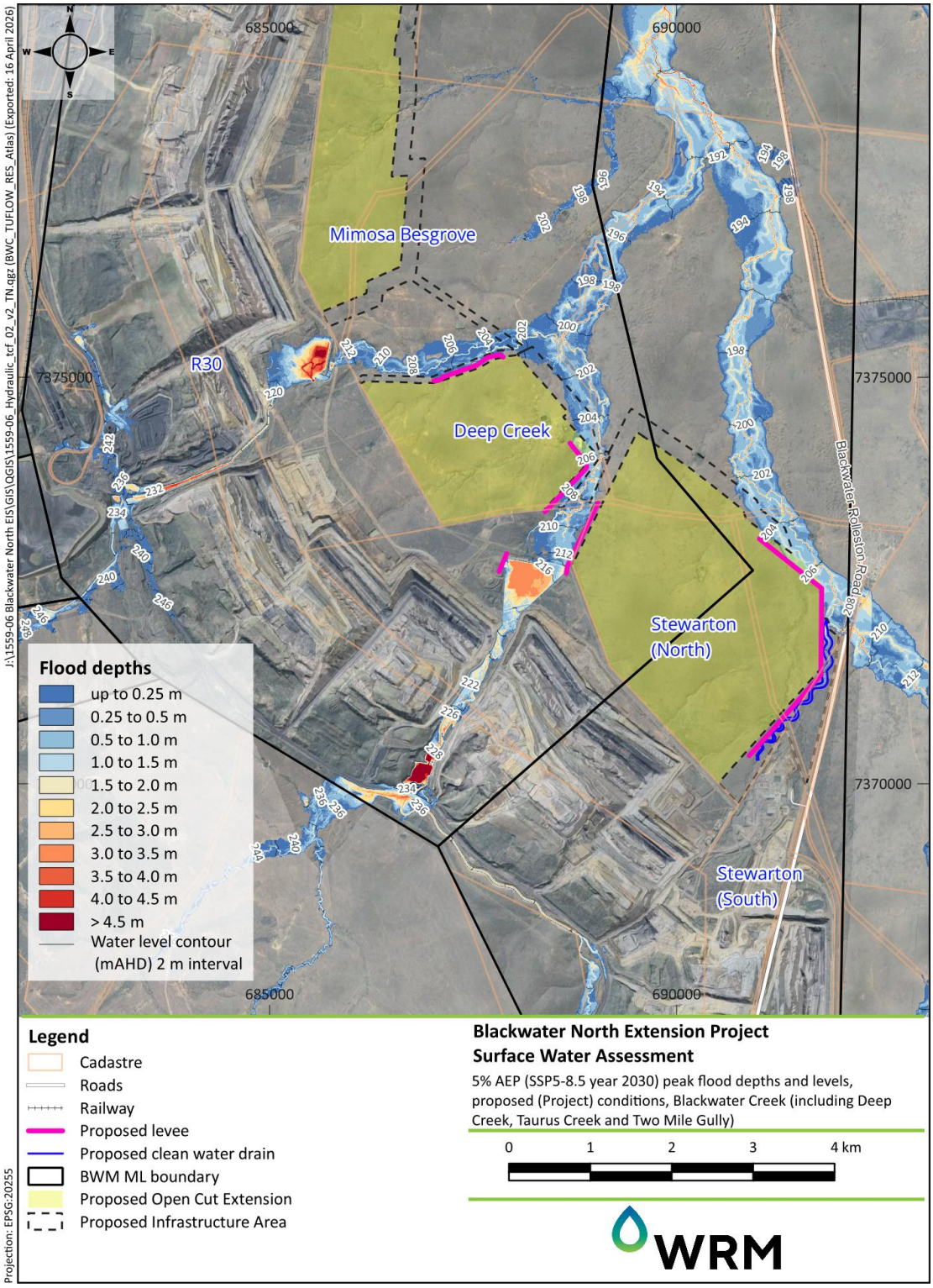


Figure 8.20 **5% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

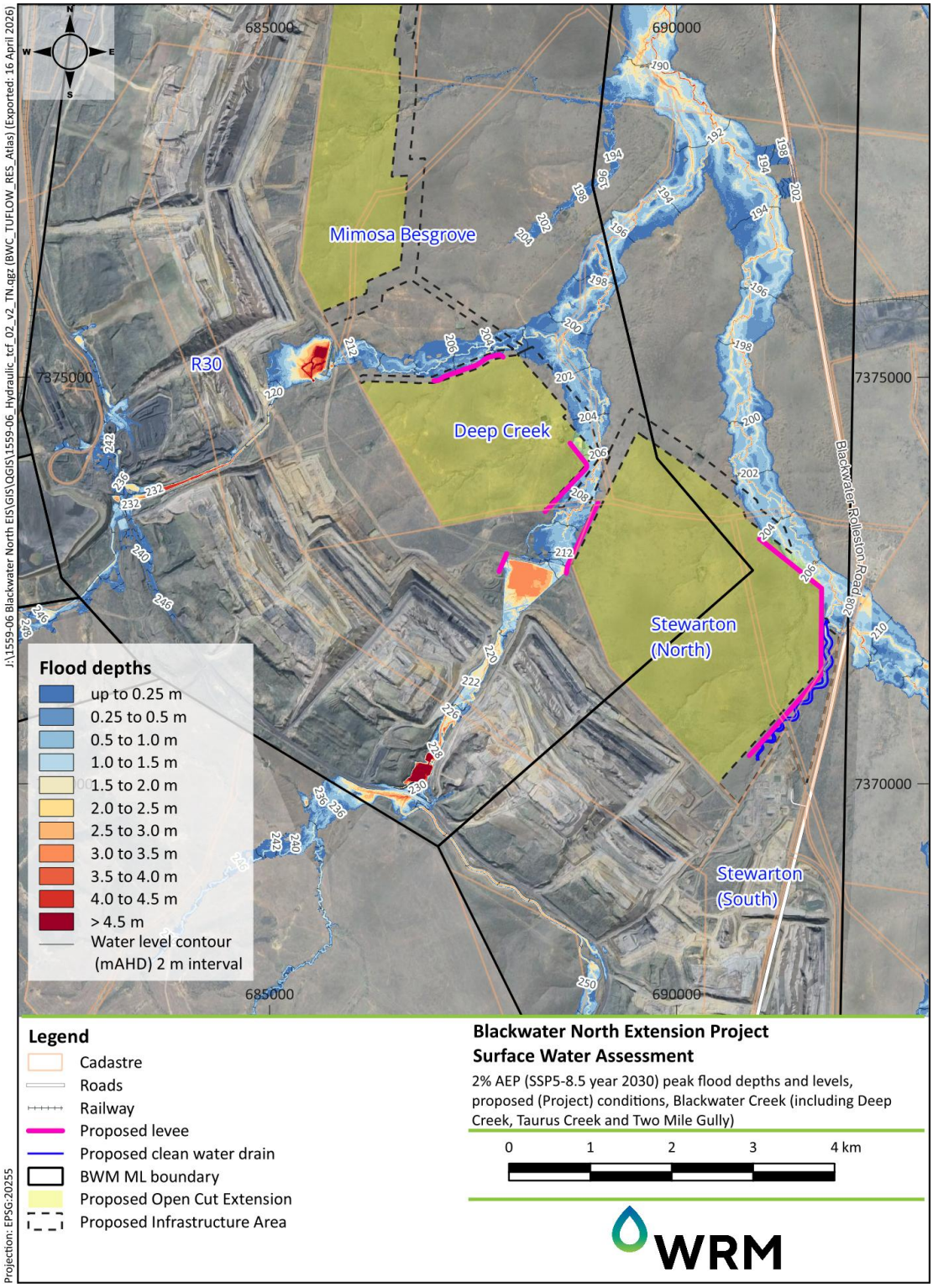


Figure 8.21 **2% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

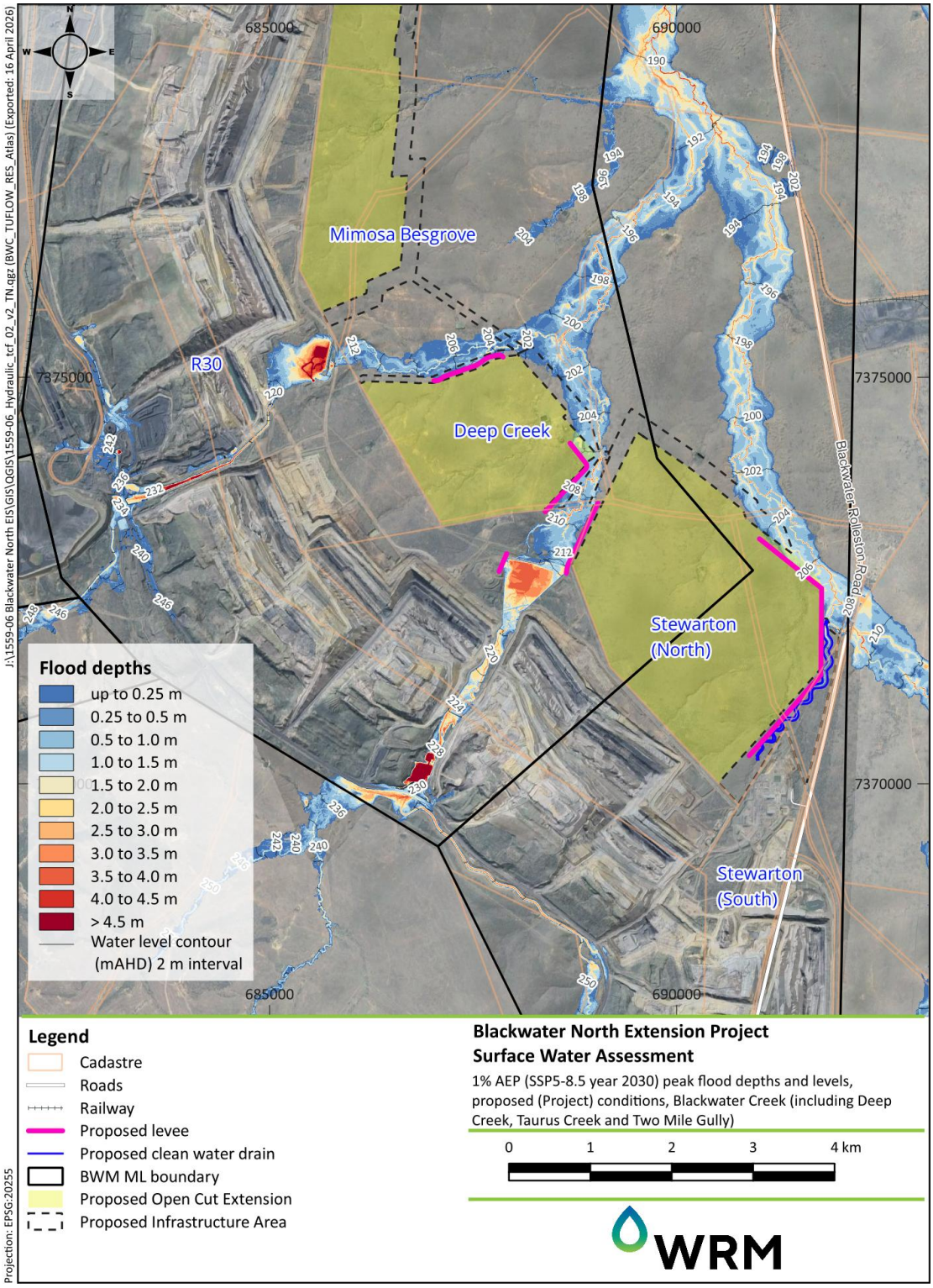


Figure 8.22 **1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

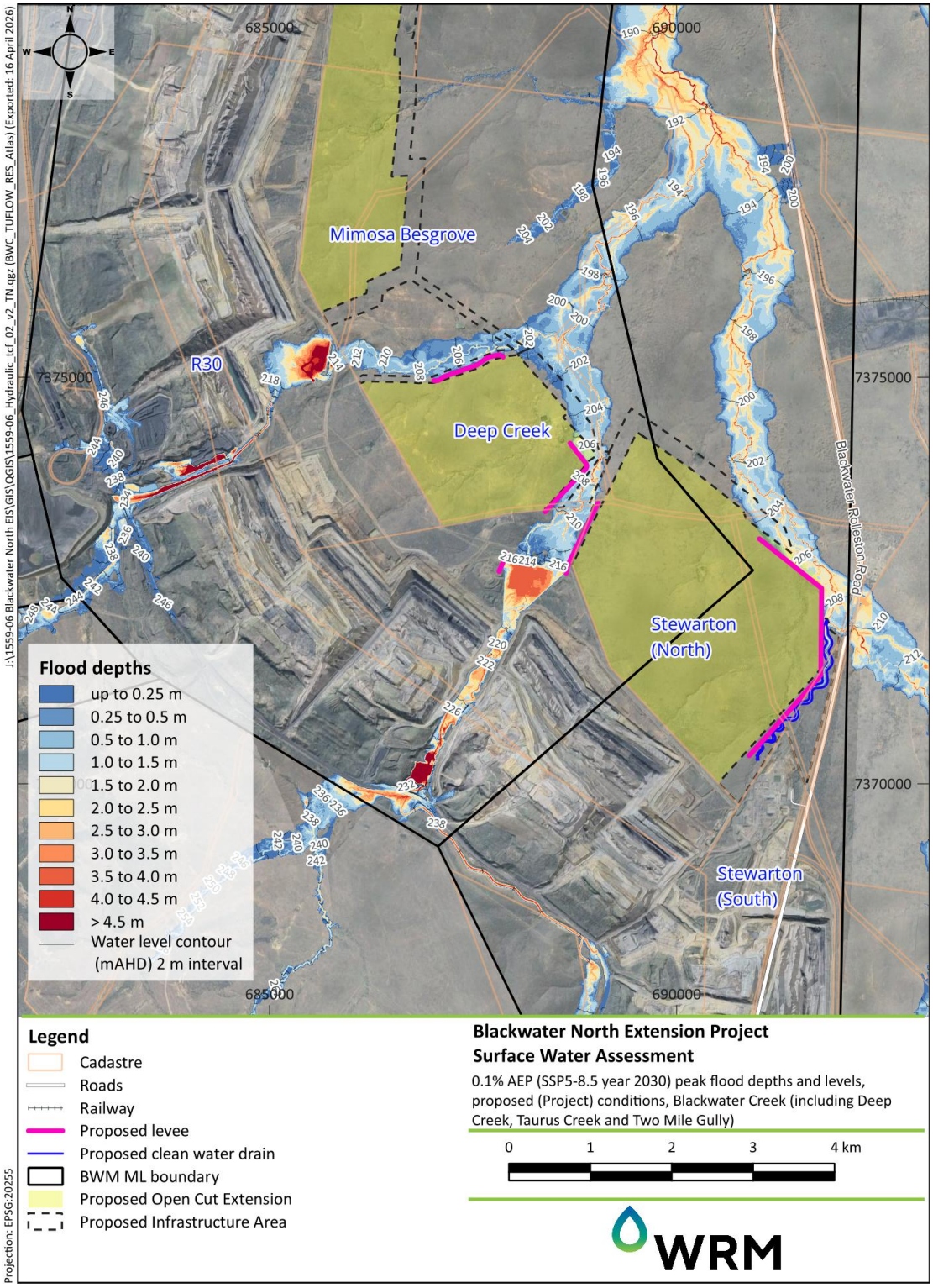


Figure 8.23 **0.1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

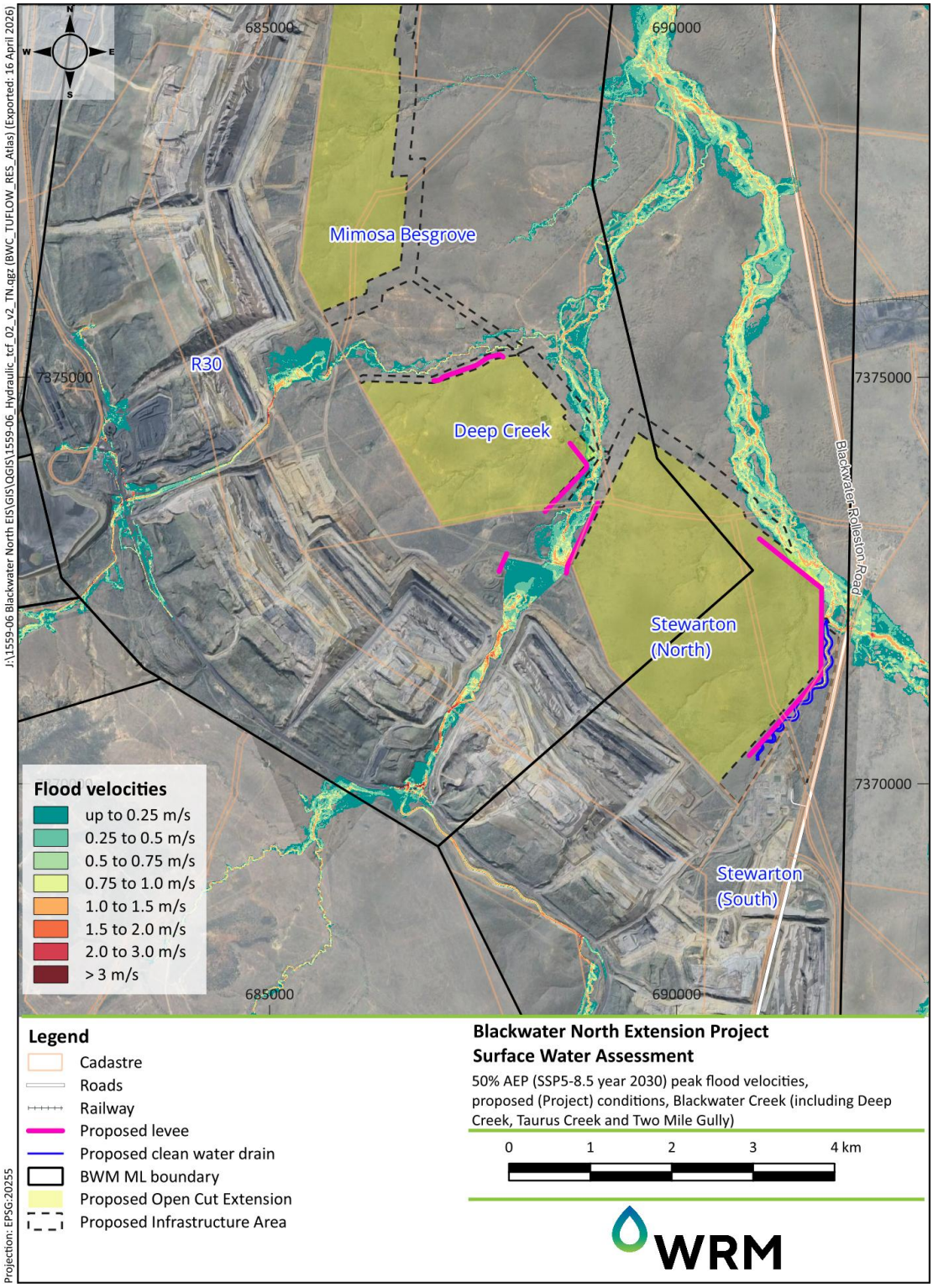


Figure 8.24 **50% AEP (SSP5-8.5 year 2030) peak flood velocities, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

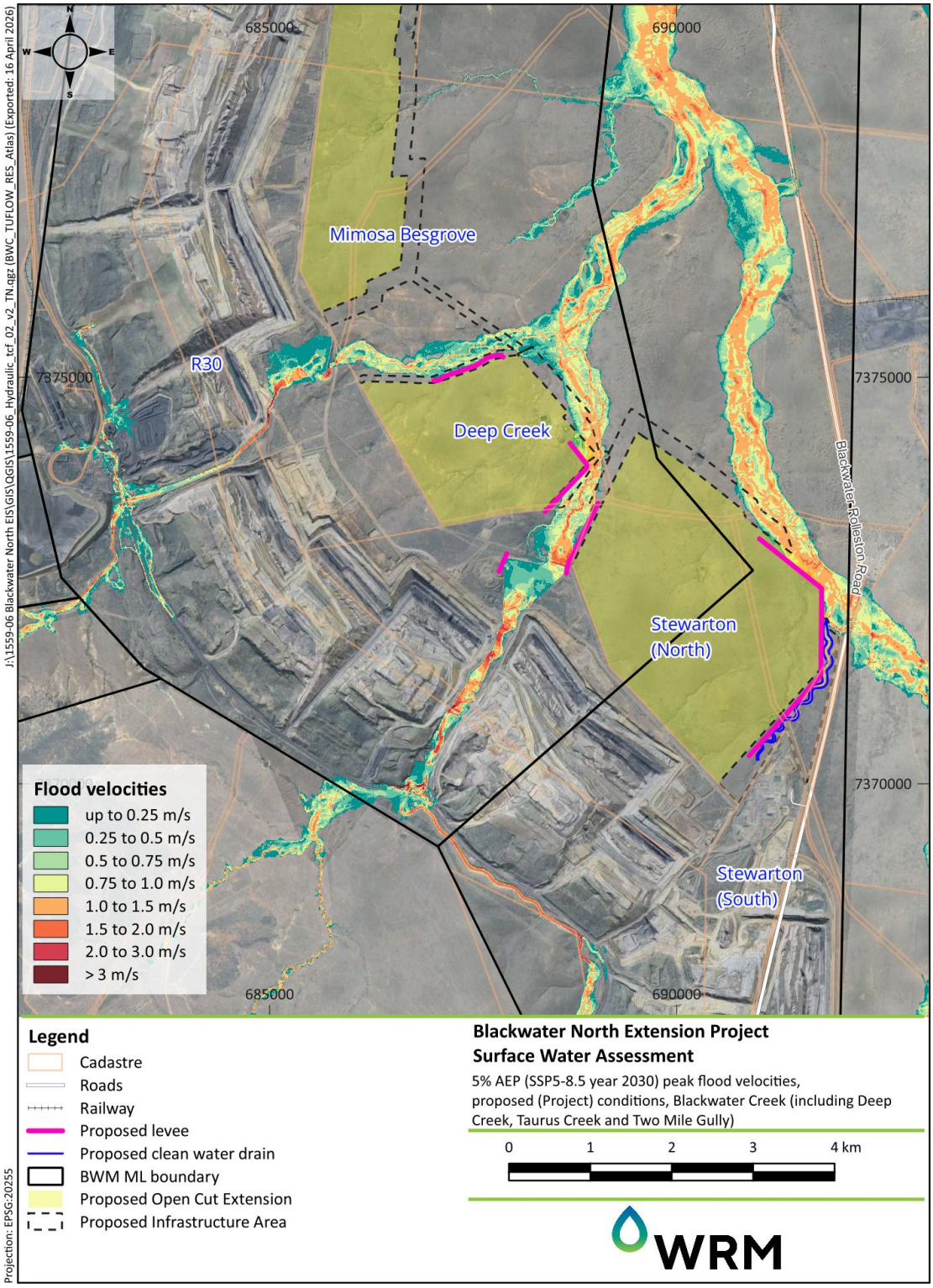


Figure 8.25 **5% AEP (SSP5-8.5 year 2030) peak flood velocities, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

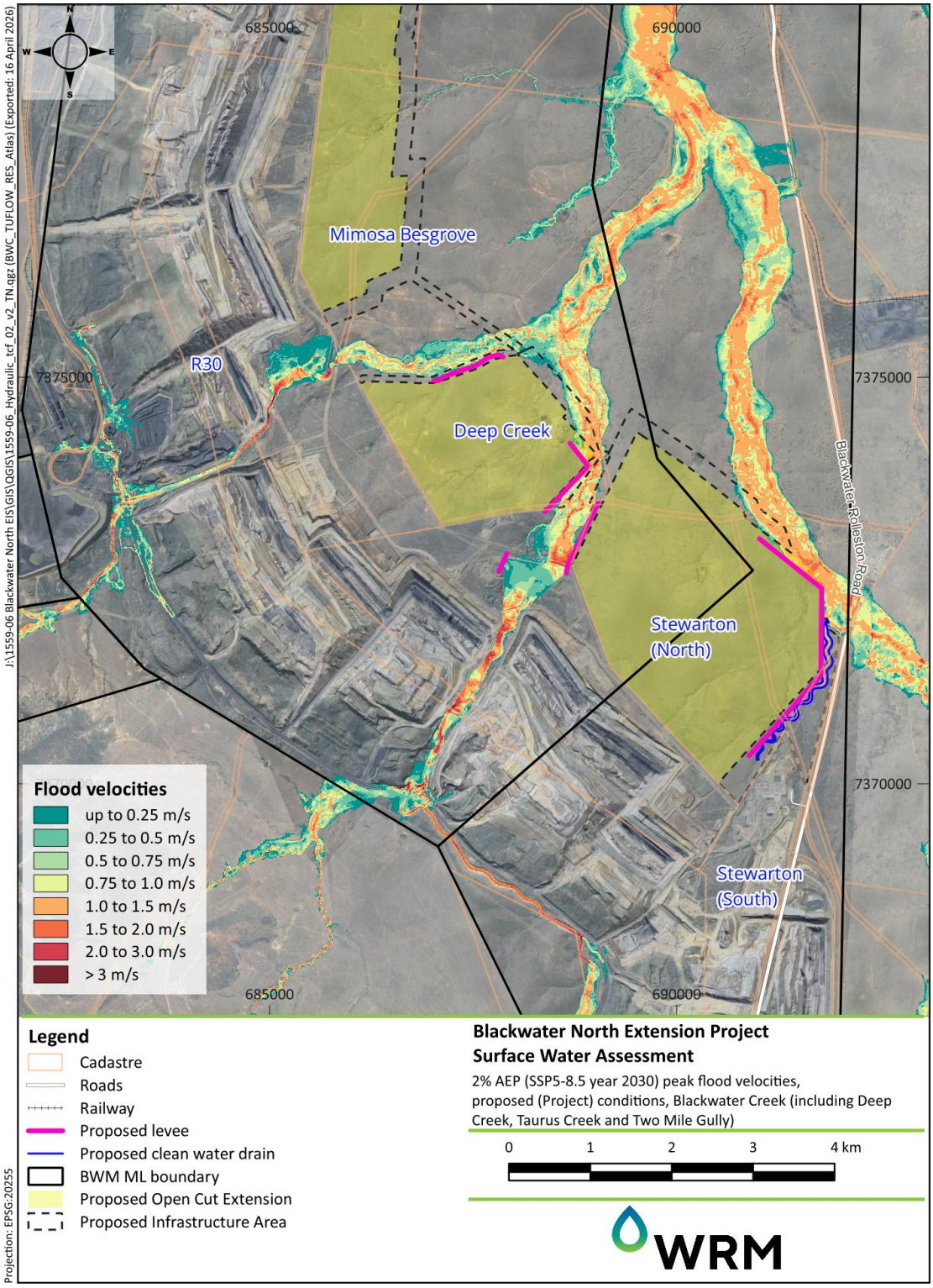


Figure 8.26 **2% AEP (SSP5-8.5 year 2030) peak flood velocities, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

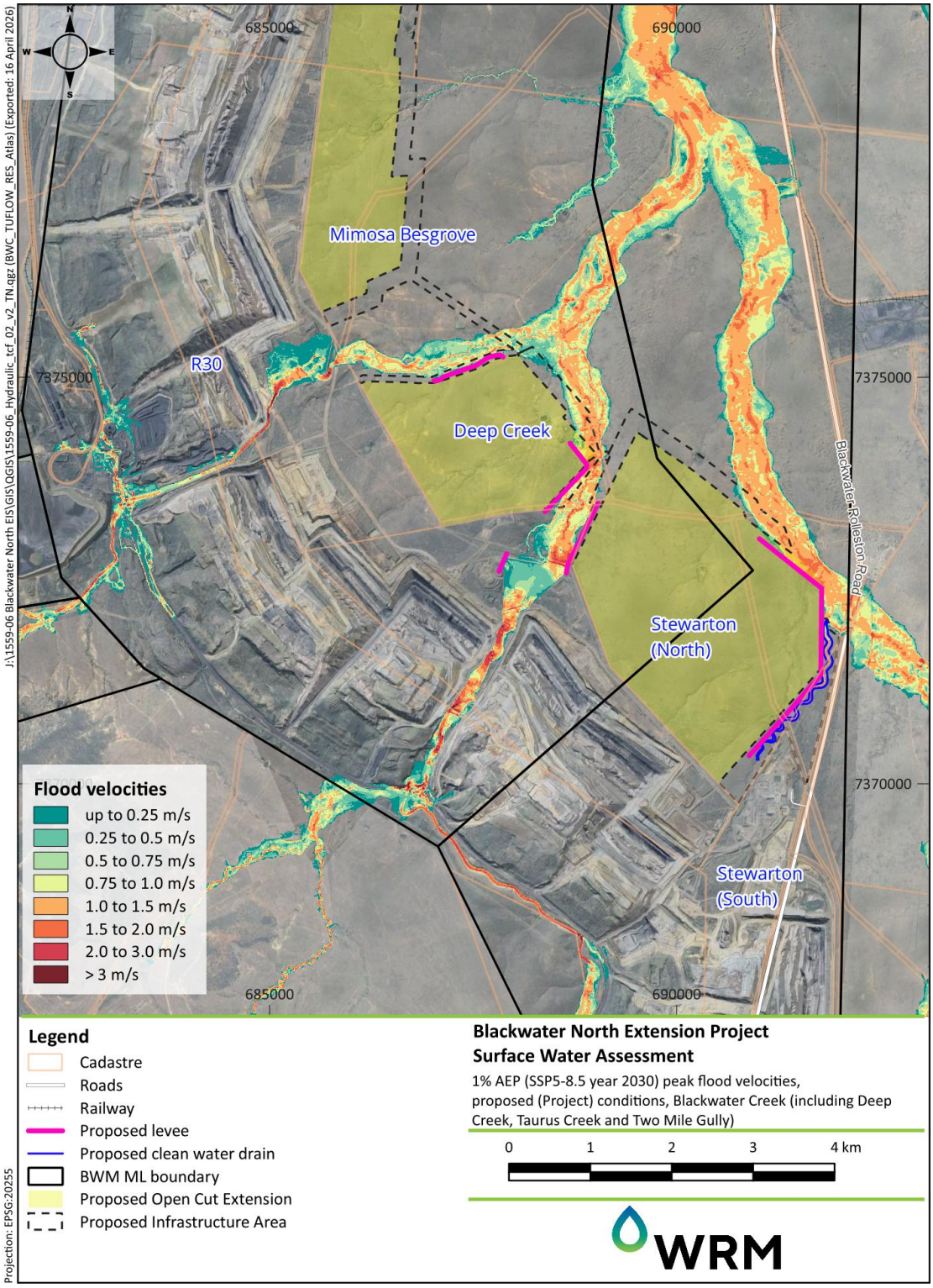


Figure 8.27 **1% AEP (SSP5-8.5 year 2030) peak flood velocities, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

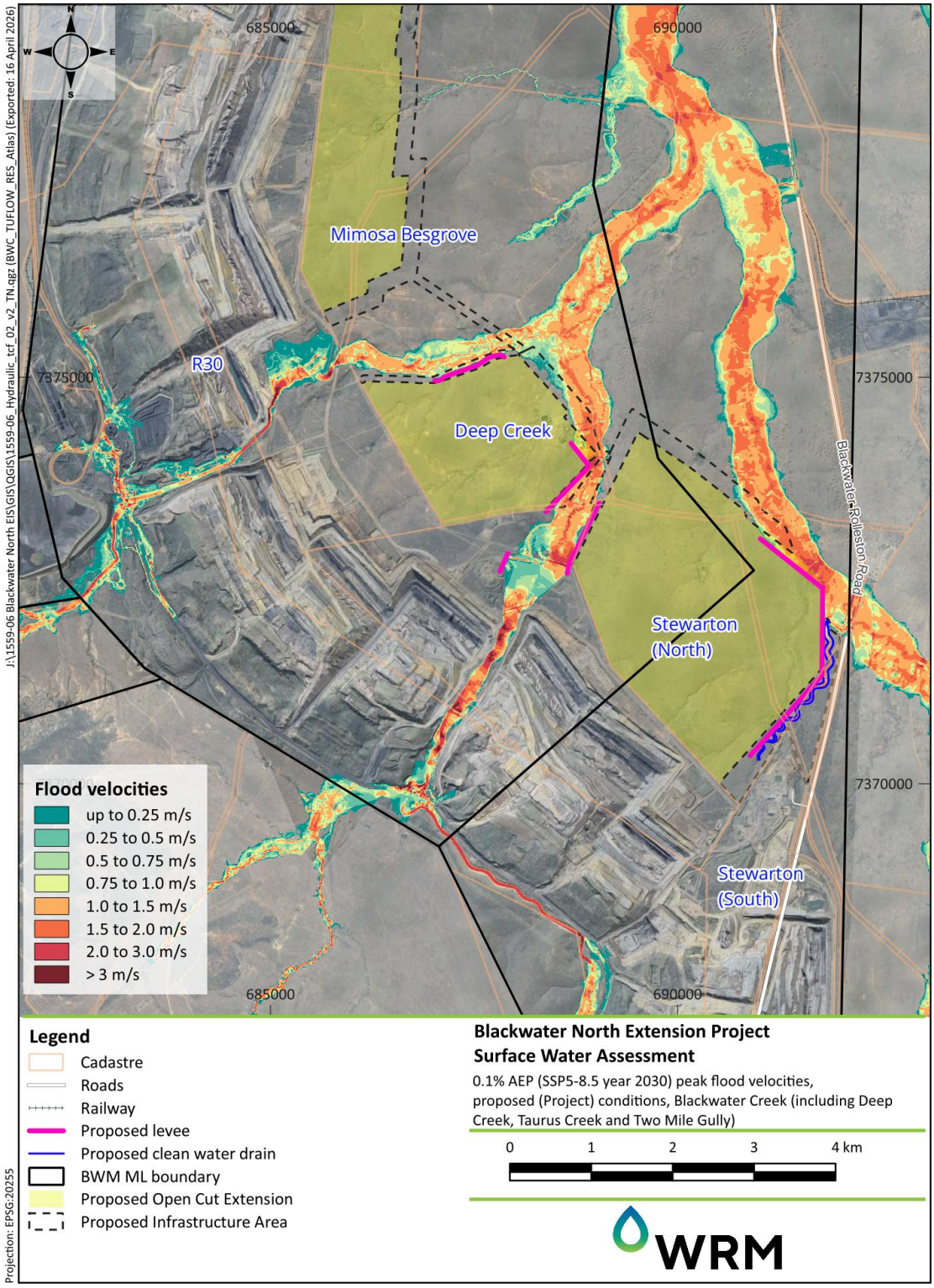


Figure 8.28 **0.1% AEP (SSP5-8.5 year 2030) peak flood velocities, proposed (Project) conditions, Blackwater Creek (including Deep Creek, Taurus Creek and Two Mile Gully)**

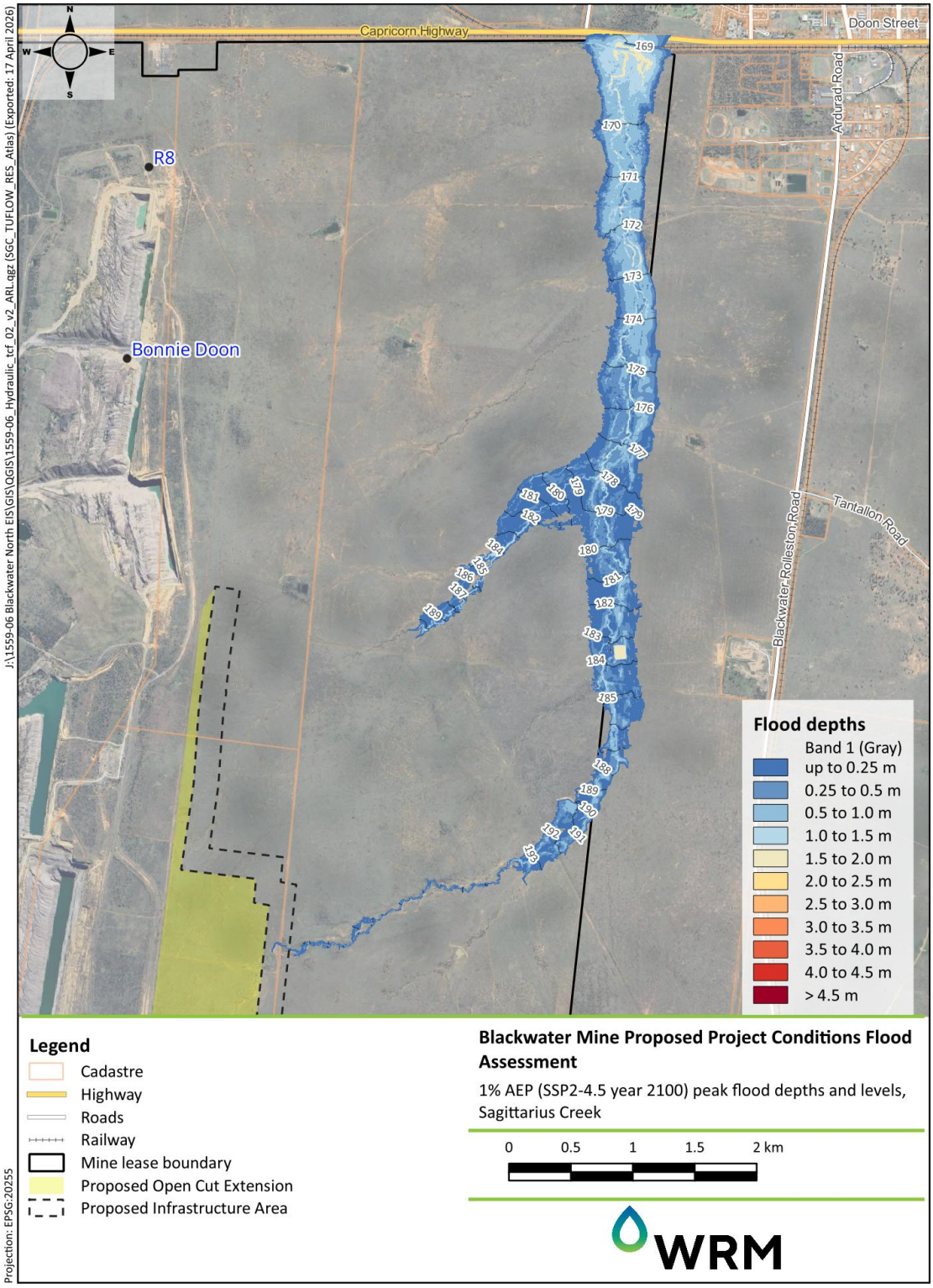


Figure 8.29 **1% AEP (SSP5-8.5 year 2030) peak flood depths and levels, proposed (Project) conditions, Sagittarius Creek**

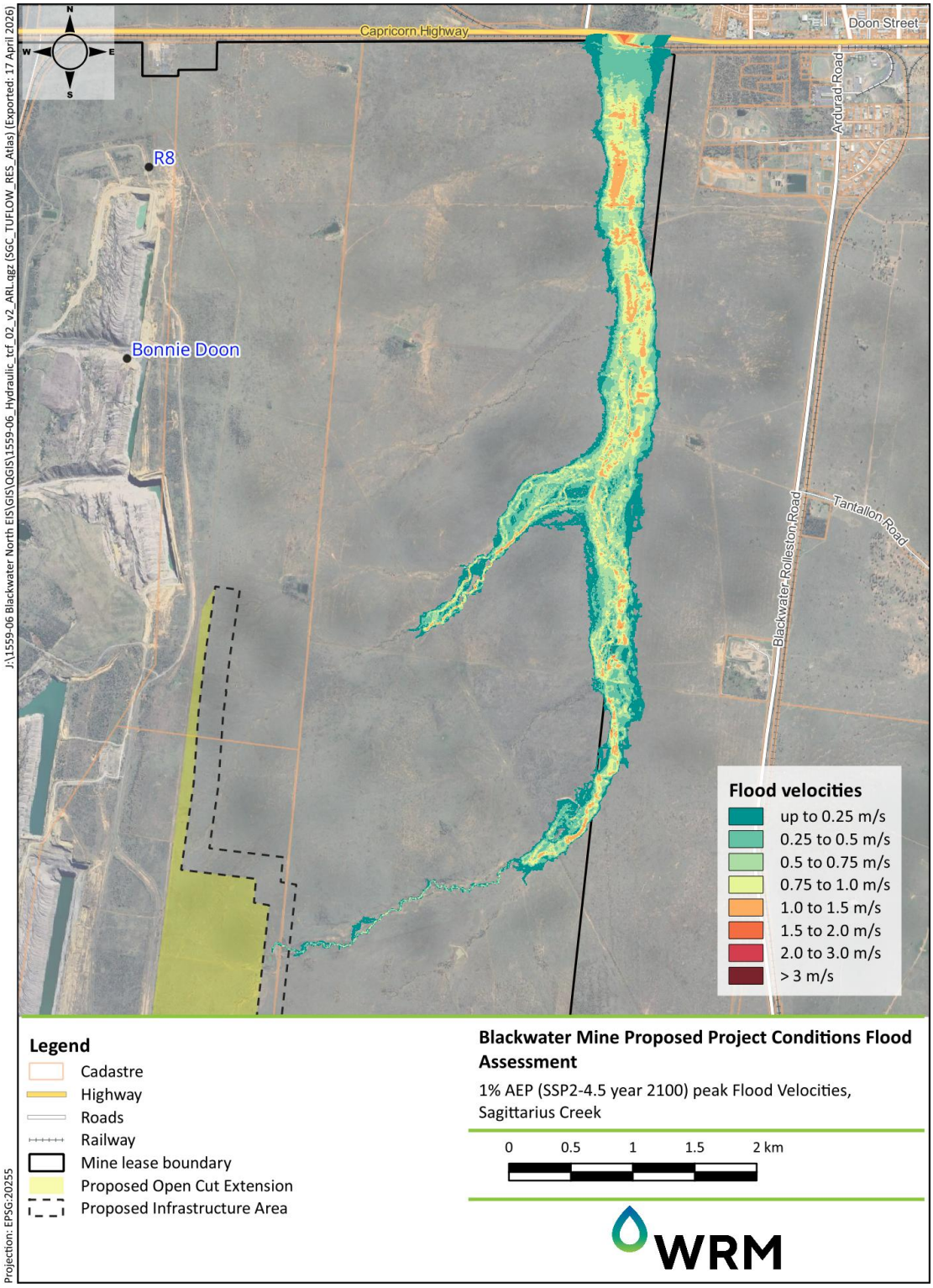


Figure 8.30 **1% AEP (SSP5-8.5 year 2030) peak velocities, proposed (Project) conditions, Sagittarius Creek**

8.6 IMPACTS ON PEAK FLOOD LEVELS AND VELOCITIES

Figure 8.31 to Figure 8.35 are flood maps showing the predicted impacts on peak flood levels (afflux) along Emu Creek, Deep Creek, Taurus Creek, Two Mile Gully, and Blackwater Creek for the 50% to 0.1% AEP design events. Figure 8.36 to Figure 8.40 show the corresponding impacts on peak velocities.

Figure 8.41 shows the TUFLOW model predicted proposed (Project) conditions peak flood extents, levels and depths along Sagittarius Creek for the 1% AEP design event. Figure 8.42 shows the corresponding 1% AEP peak velocities.

The model results show that:

- Predicted increases in peak flood levels are generally minor and contained on-lease for all events up to 0.1% AEP. There are minor off-lease impacts upstream of the confluence between the existing Taurus Creek temporary diversion and the existing Emu Creek diversion. There are no predicted increases in peak flood levels and events at existing dwellings/homesteads in the vicinity of the Project area.
- Downstream of the Project area, peak flood levels are predicted to reduce due to the reduction in design discharges as a result of additional catchment excision from expansion of the mining pits. The predicted reduction in peak flood levels is greatest within a short section in the upper headwaters of Sagittarius Creek as a result of the open cut pit extension.
- Flood level increases are predicted to occur adjacent to the proposed levees due to constriction of the floodplain by these levees. Flood level impacts are also predicted to occur along the Deep Creek and Taurus Creek temporary diversions, due to increased runoff from additional areas of rehabilitation dump landform upstream of mining pits.
- Any predicted increases in peak flood levels are generally <0.1 m along the floodplains within the Project area. Given that existing conditions flood depths are between 0.5 m and 1.5 m for events up to 1% AEP, these predicted flood level increases are not considered significant.
- Increases in flood levels >0.1 m are generally localised to areas adjacent to the proposed levees, and along the Taurus Creek temporary diversion.
- Predicted increases in peak velocities along the floodplains within the Project area generally <0.1 m/s for all events up to 1% AEP. Existing conditions peak velocities along the floodplain typically range between up to 0.5 m/s for the 50% AEP event and up to existing conditions velocities are up to 1 m/s for the 1% AEP event. Hence the predicted velocity impacts are not significant.
- Localised increases in peak velocities of up to 0.5 m/s are predicted adjacent to the proposed levees. The impact of these flood velocity increases on erosion potential and stream stability was assessed and are described in Section 8.7.
- The Project would reduce peak flood levels along the Sagittarius Creek floodplain for all events, due to the reduction in catchment area and flood discharges. Flood impacts along Sagittarius Creek were assessed for the 1% AEP event only. As the Project disturbance area is outside of the Sagittarius Creek flood extent, flood impacts for other events were not assessed.

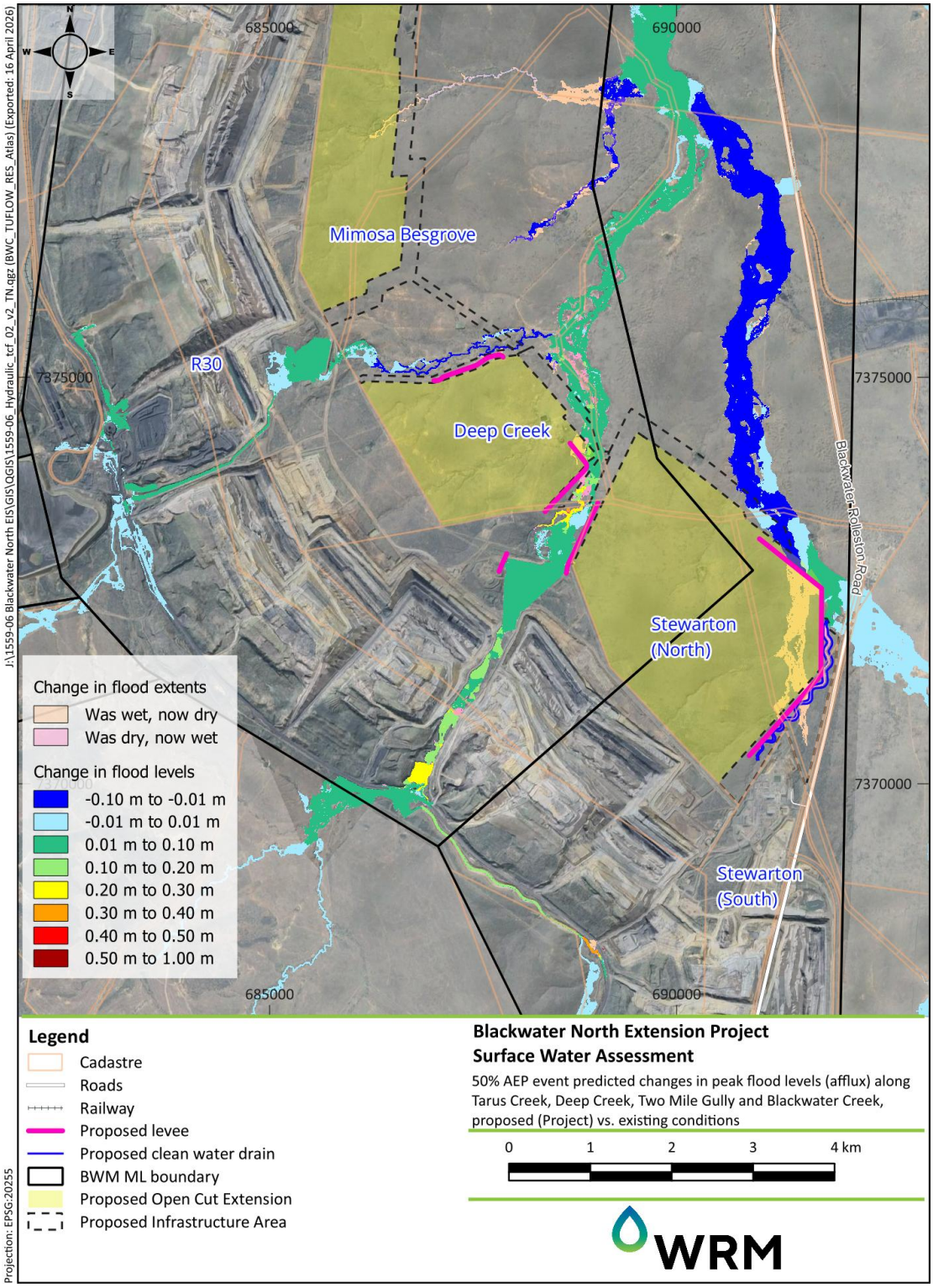


Figure 8.31 **50% AEP event predicted changes in peak flood levels (afflux) along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

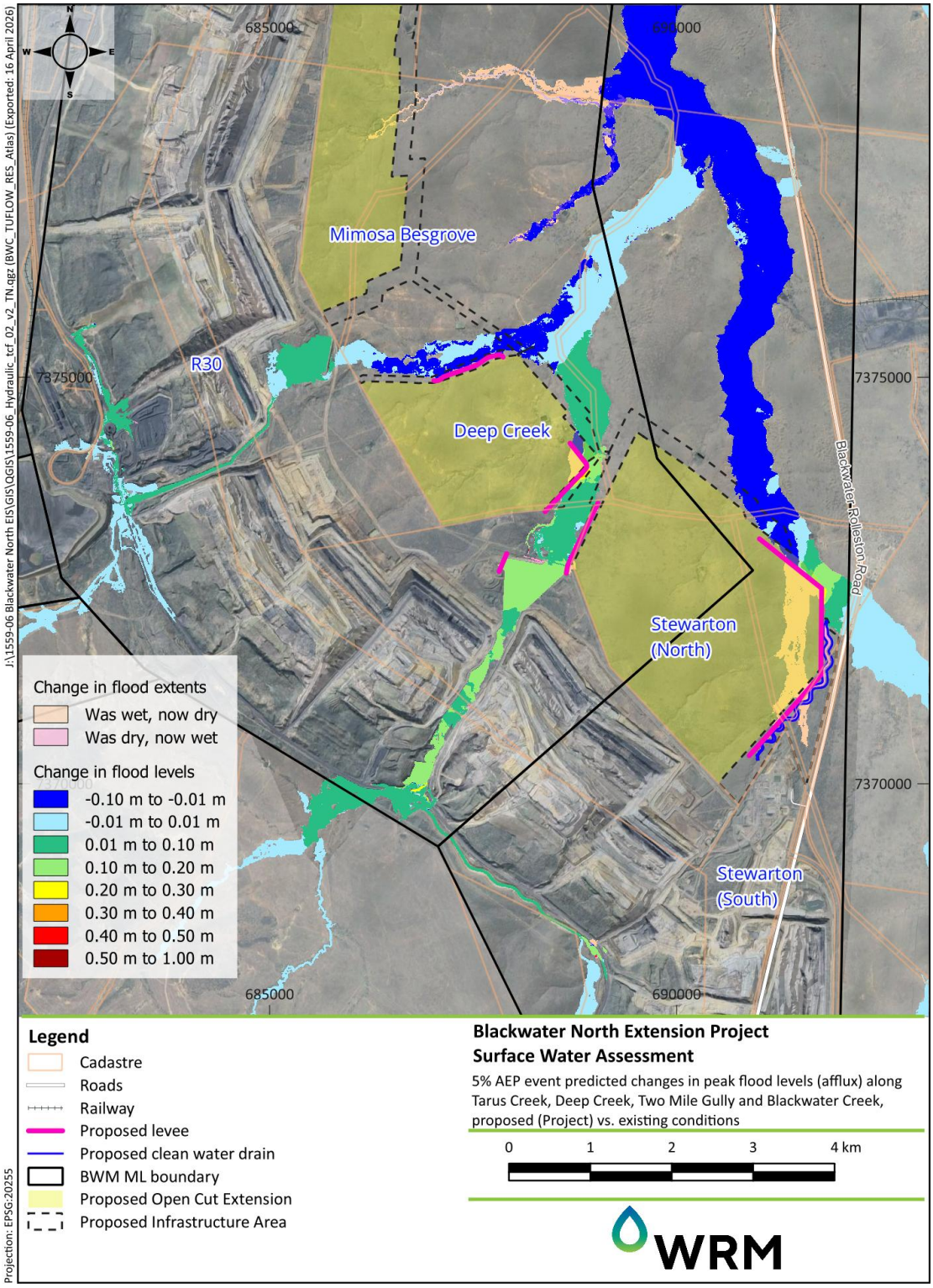


Figure 8.32 **5% AEP event predicted changes in peak flood levels (afflux) along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

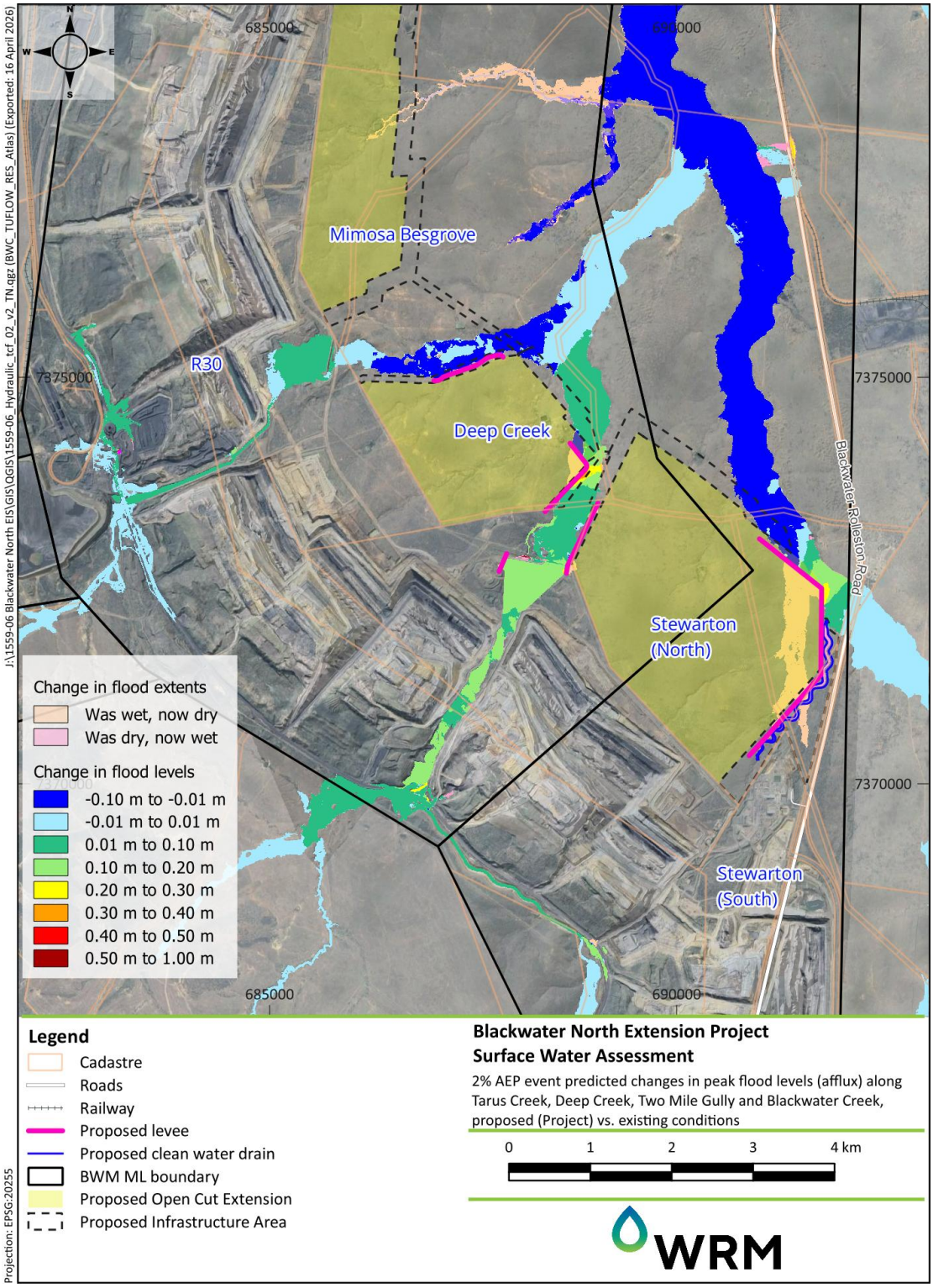


Figure 8.33 **2% AEP event predicted changes in peak flood levels (afflux) along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

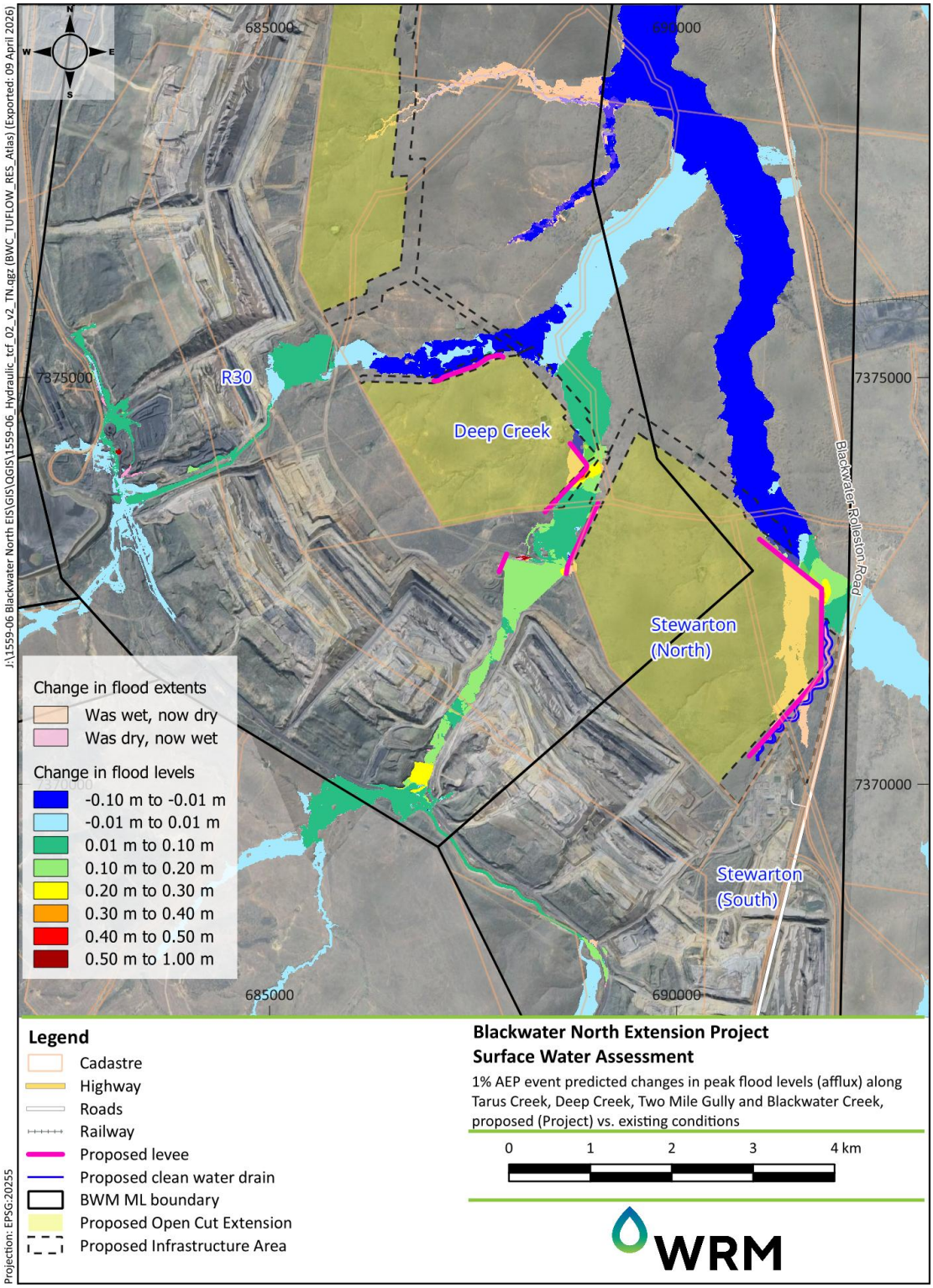


Figure 8.34 **1% AEP event predicted changes in peak flood levels (afflux) along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

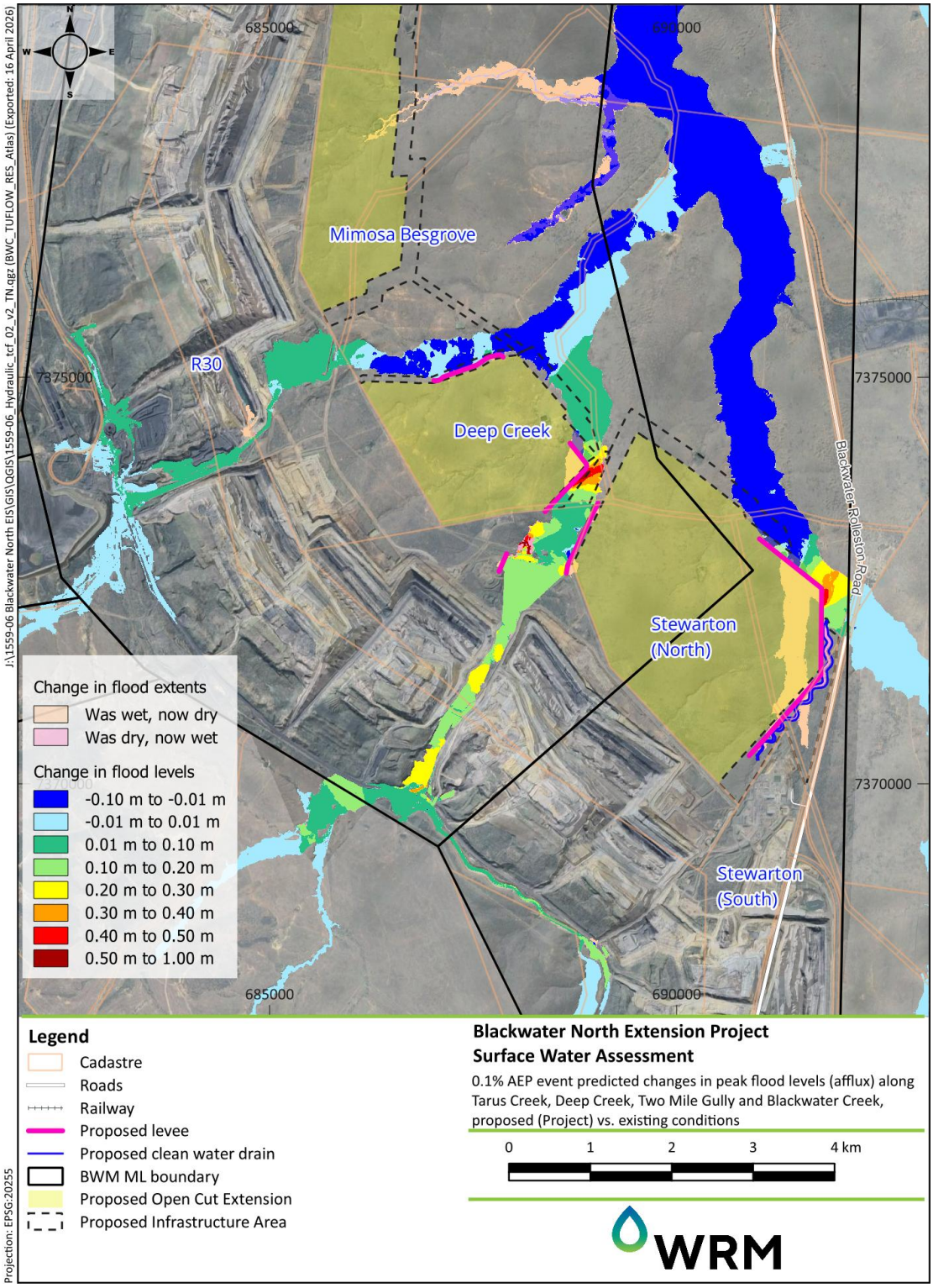


Figure 8.35 **0.1% AEP event predicted changes in peak flood levels (afflux) along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

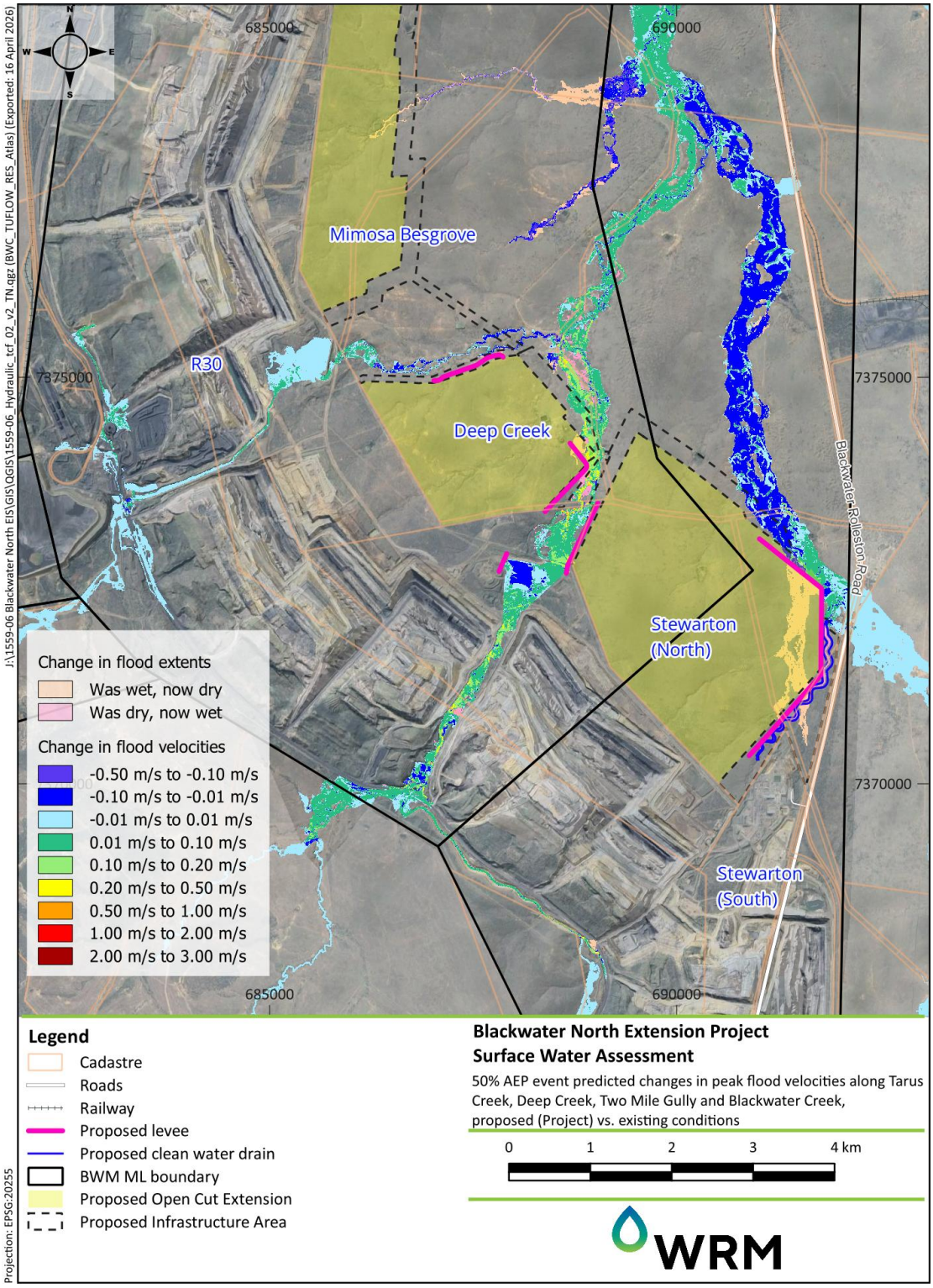


Figure 8.36 **50% AEP event predicted changes in peak flood velocities along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

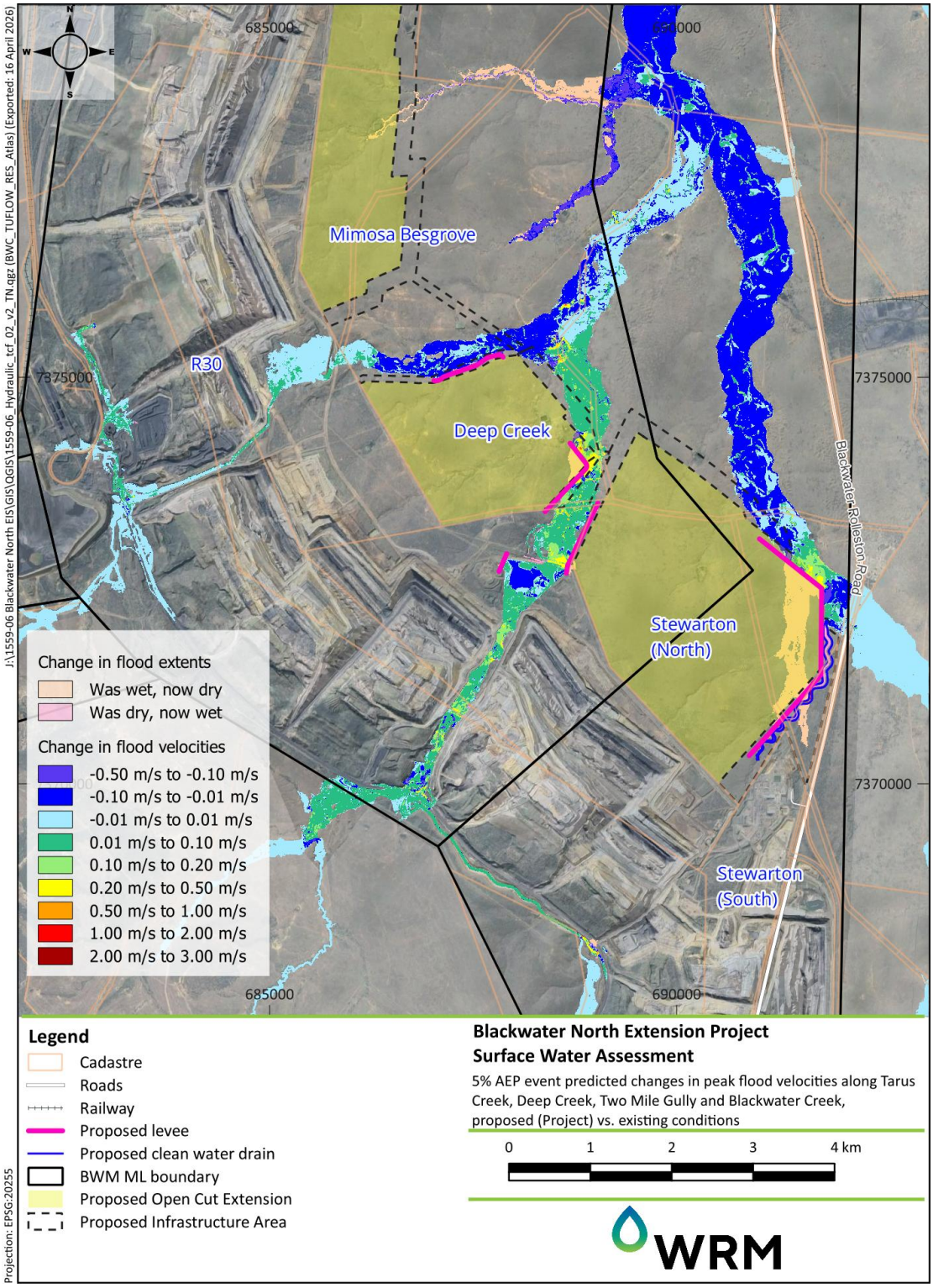


Figure 8.37 **5% AEP event predicted changes in peak flood velocities along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

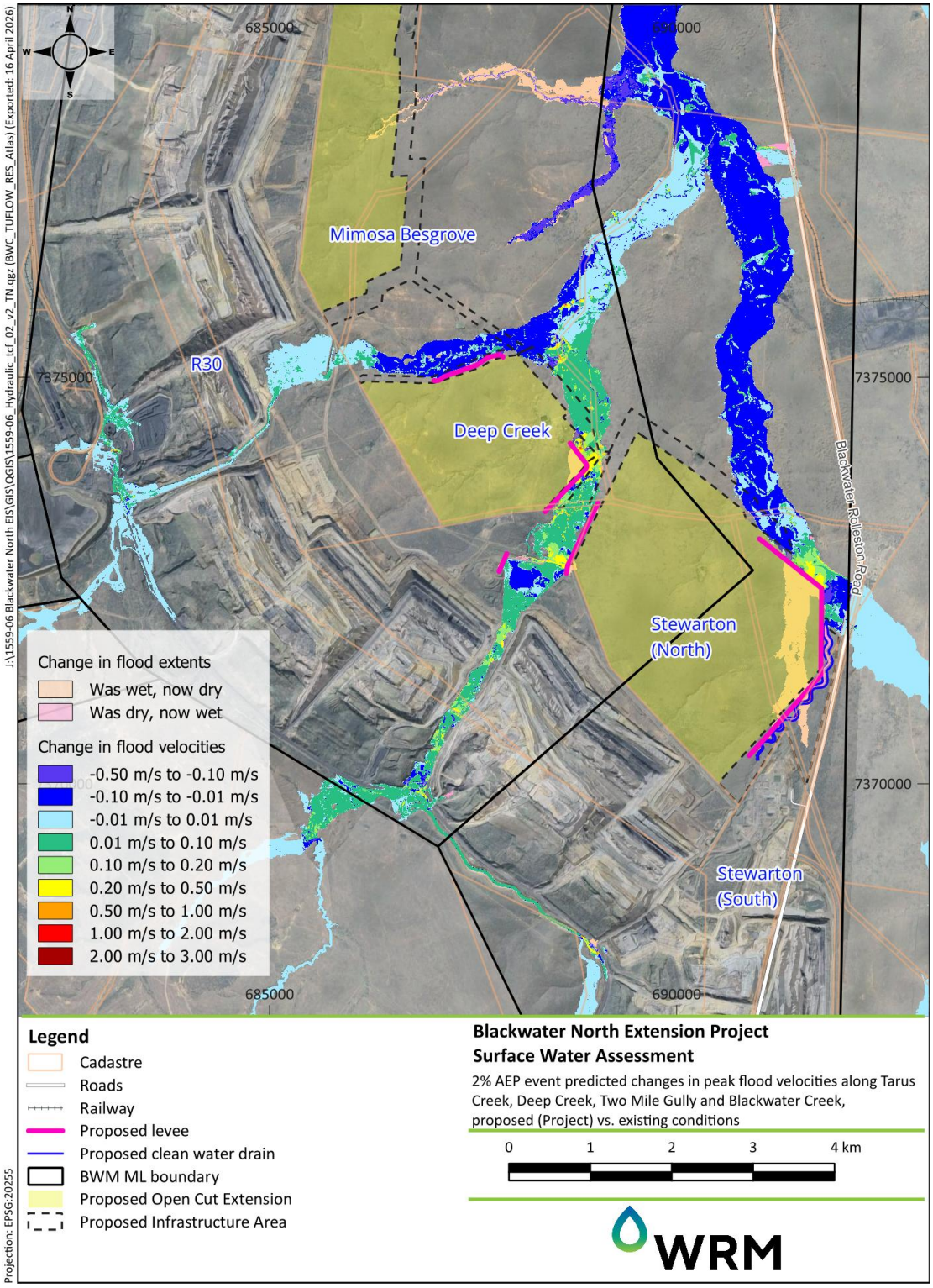


Figure 8.38 **2% AEP event predicted changes in peak flood velocities along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

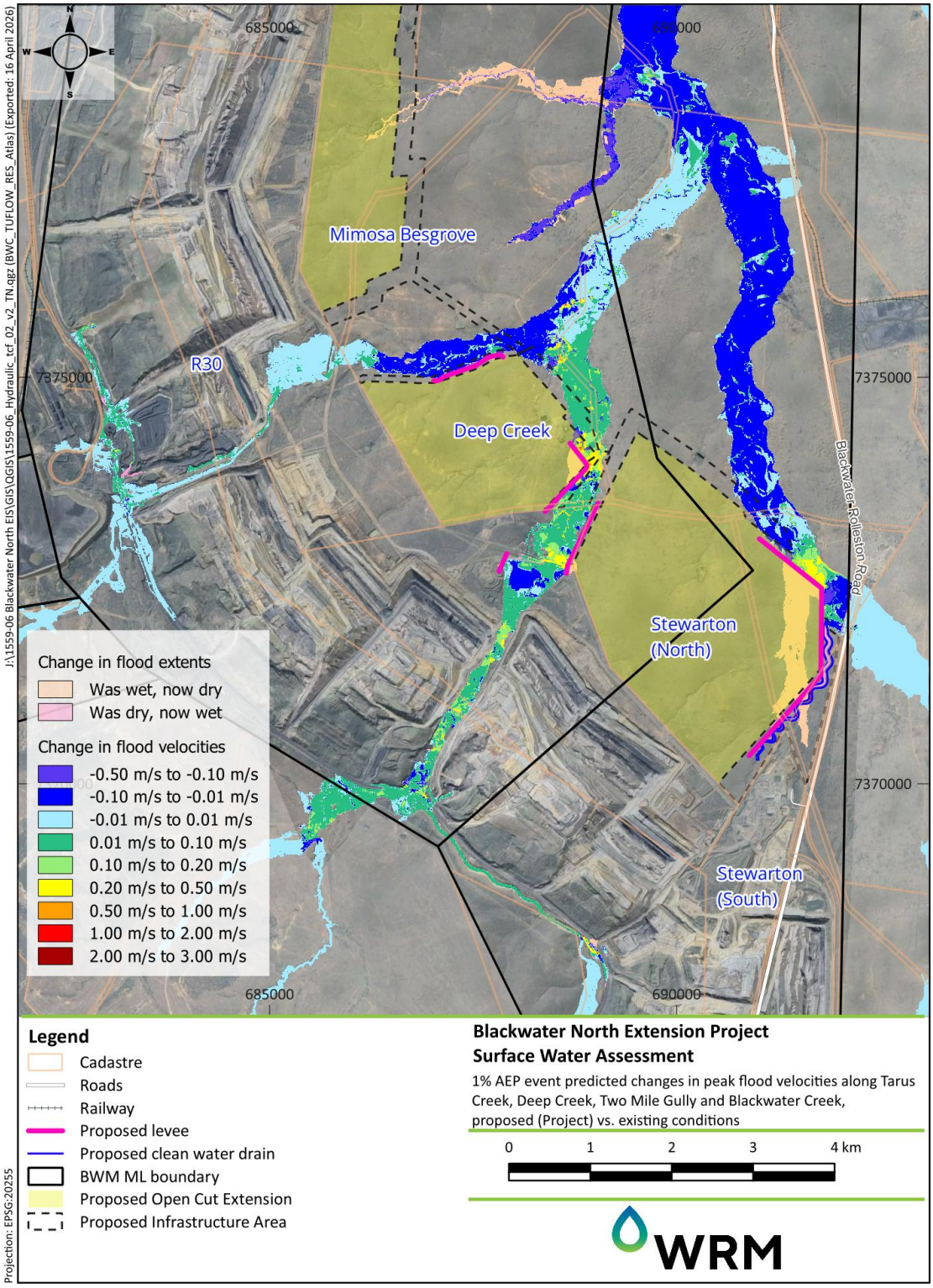


Figure 8.39 **1% AEP event predicted changes in peak flood velocities along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

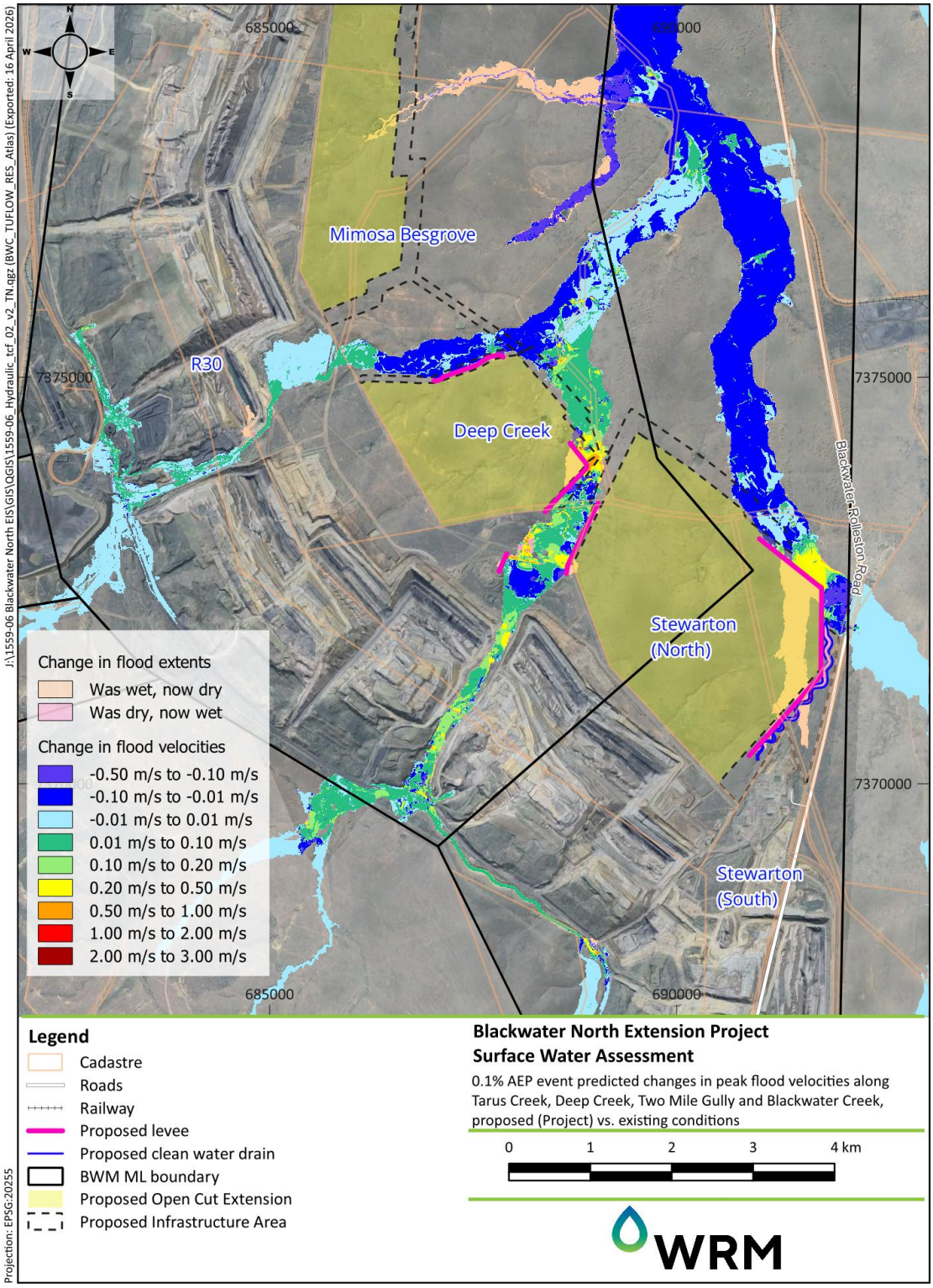


Figure 8.40 **0.1% AEP event predicted changes in peak flood velocities along Taurus Creek, Deep Creek, Two Mile Gully and Blackwater Creek, proposed (Project) vs. existing conditions**

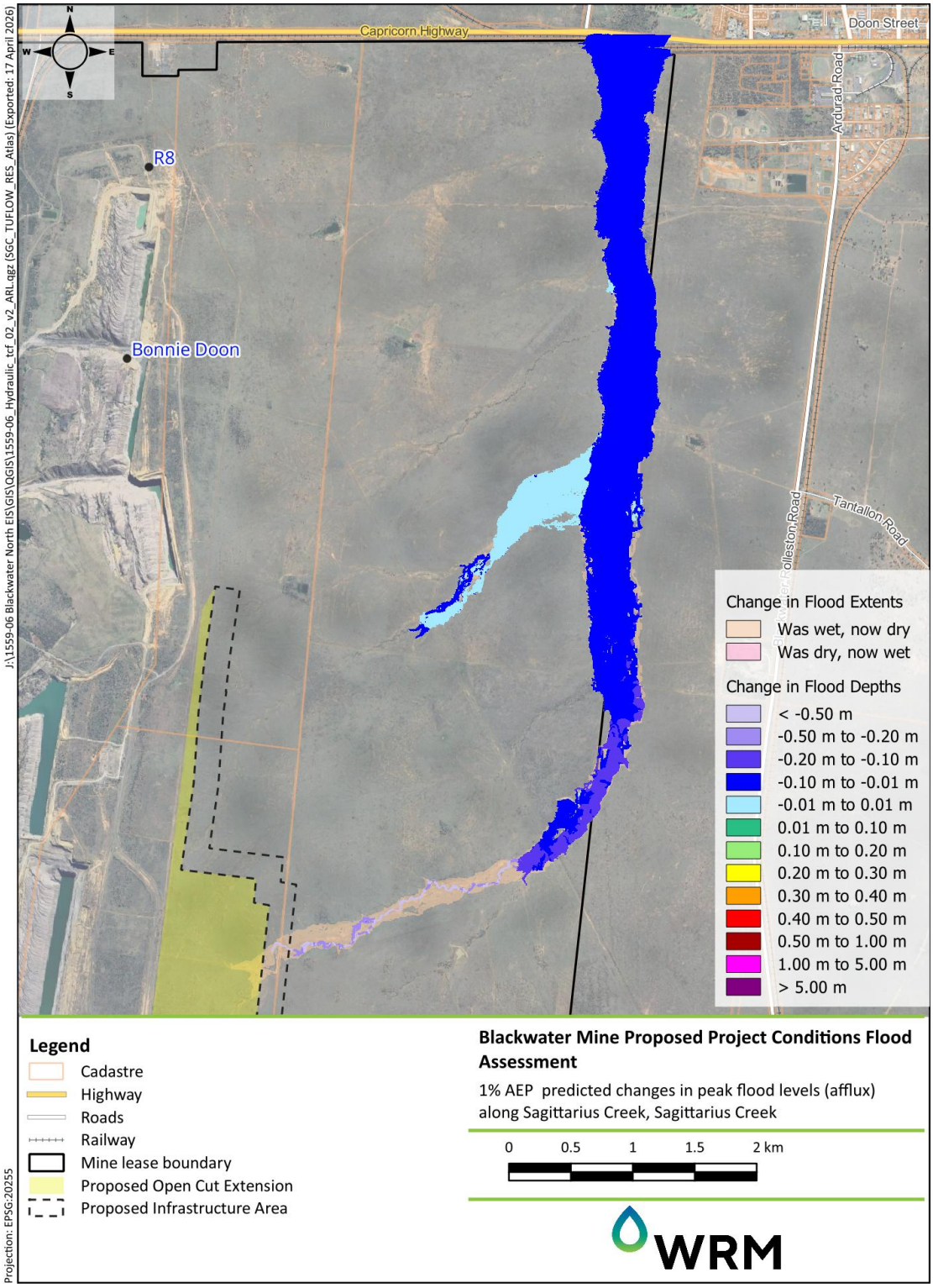


Figure 8.41 **1% AEP event predicted changes in peak flood levels (afflux), proposed (Project) vs. existing conditions, Sagittarius Creek**

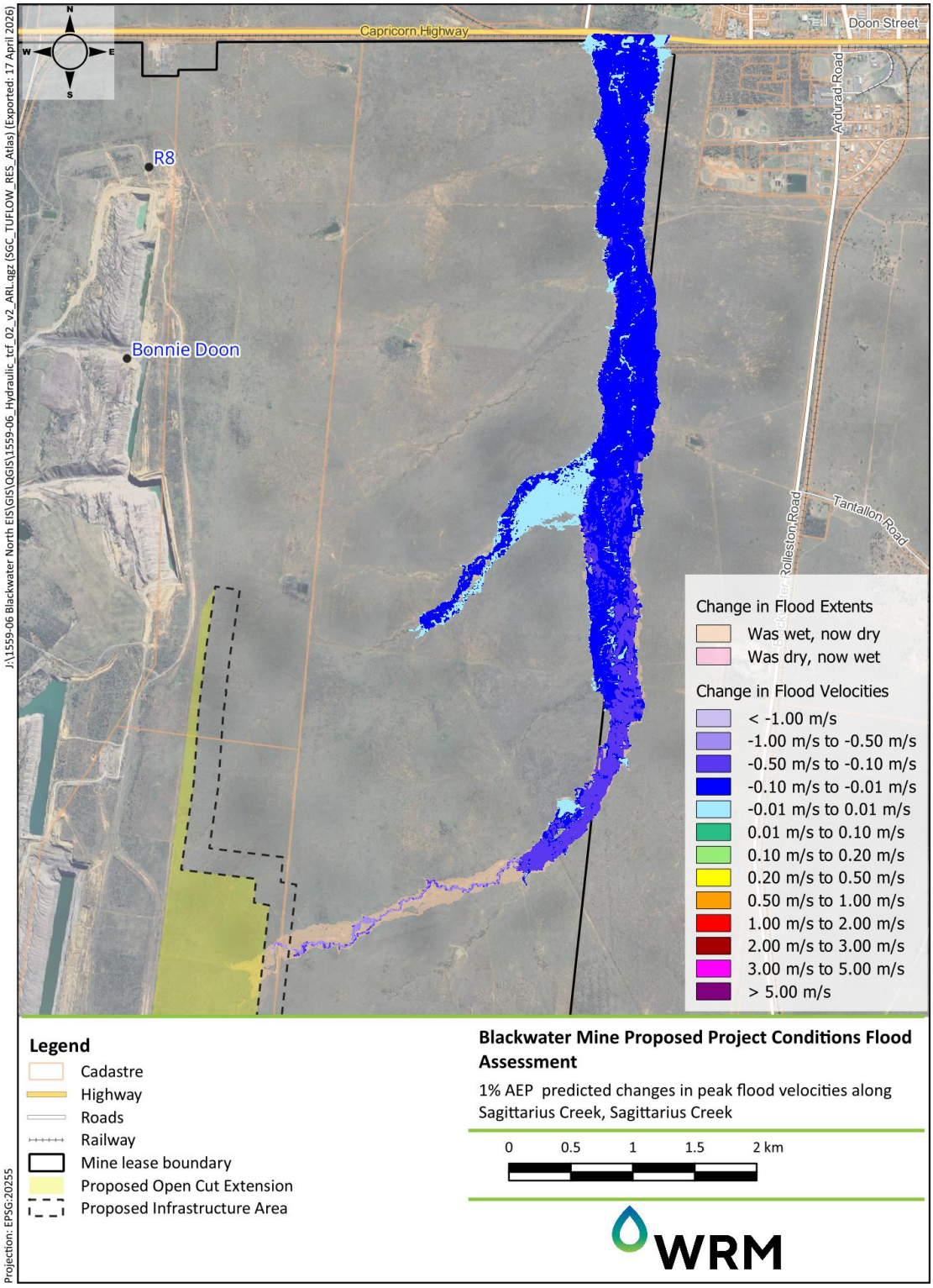


Figure 8.42 **1% AEP event predicted changes in peak flood velocities, proposed (Project) vs. existing conditions, Sagittarius Creek**

8.7 WATERWAY STABILITY ASSESSMENT

8.7.1 Overview

The TUFLOW hydraulic model results were analysed in more detail to assess:

- the potential impacts of increased flood velocities due to the Project (described in Section 8.6) on the channel stability including sediment transport characteristics of the existing creek channels in the vicinity of the Project; and
- the hydraulic characteristics of the proposed clean water drain (adjacent to and southeast of the Stewarton Pit expansion area).

The hydraulic assessment was undertaken based on guidance in *Criteria for Functioning River Landscape Units in Mining and Post Mining Landscapes* (Alluvium Consulting Australia Pty Ltd [Alluvium], 2014). The Alluvium (2014) guideline was developed for the design and assessment of watercourse diversions in the Bowen Basin region of Central Queensland.

The metrics used to assess channel hydraulic characteristics are velocities (in m/s) and stream power (in W/m^2). Stream power is defined in Alluvium (2014) as the rate of energy dissipation against the bed and banks of a river or stream and is used as a surrogate for sediment transport characteristics.

In line with the Alluvium (2014) guideline, channel hydraulic characteristics were assessed for the 50% AEP event (a representative small flow event) and the 2% AEP event (a representative large flow event), for existing and proposed (Project) conditions.

8.7.2 Hydraulic impact assessment of existing creek channels

Figure 8.43 shows locations of six representative creek sections (reaches) where channel hydraulic characteristics were assessed. Figure 8.43 also shows the predicted flood velocity impacts for the 2% AEP event. The six representative sections are described as follows:

- Section 1 – the existing Emu Creek Diversion;
- Section 2 – the Taurus Creek temporary diversion;
- Section 3 – Taurus Creek between the Deep Creek Pit and Stewarton North Pit;
- Section 4 – Taurus Creek downstream of the Deep Creek confluence;
- Section 5 – Two Mile Gully downstream of the Project area; and
- Section 6 – Two Mile Gully east of the Stewarton North pit.

Table 8.8 to Table 8.13 compare the statistical summaries of velocities and stream power along representative Sections 1 to 6 under existing and proposed (Project) conditions, for the 50% and 2% AEP design events. It should be noted that the velocities and stream power shown in Table 8.8 to Table 8.13 are section-averaged values along the six representative reaches.

The model results show that the 25^{th} to 75^{th} percentile range of velocities and stream power along all six representative sections would not be changed significantly as a result of the Project. The 25^{th} to 75^{th} percentile range of channel velocities and stream power would generally be increased by less than 5% and 10%, respectively, for the 39% AEP and 2% AEP events. Therefore, the erosion potential and sediment transport characteristics of the existing waterway channels under proposed (Project) conditions would be similar to existing conditions.

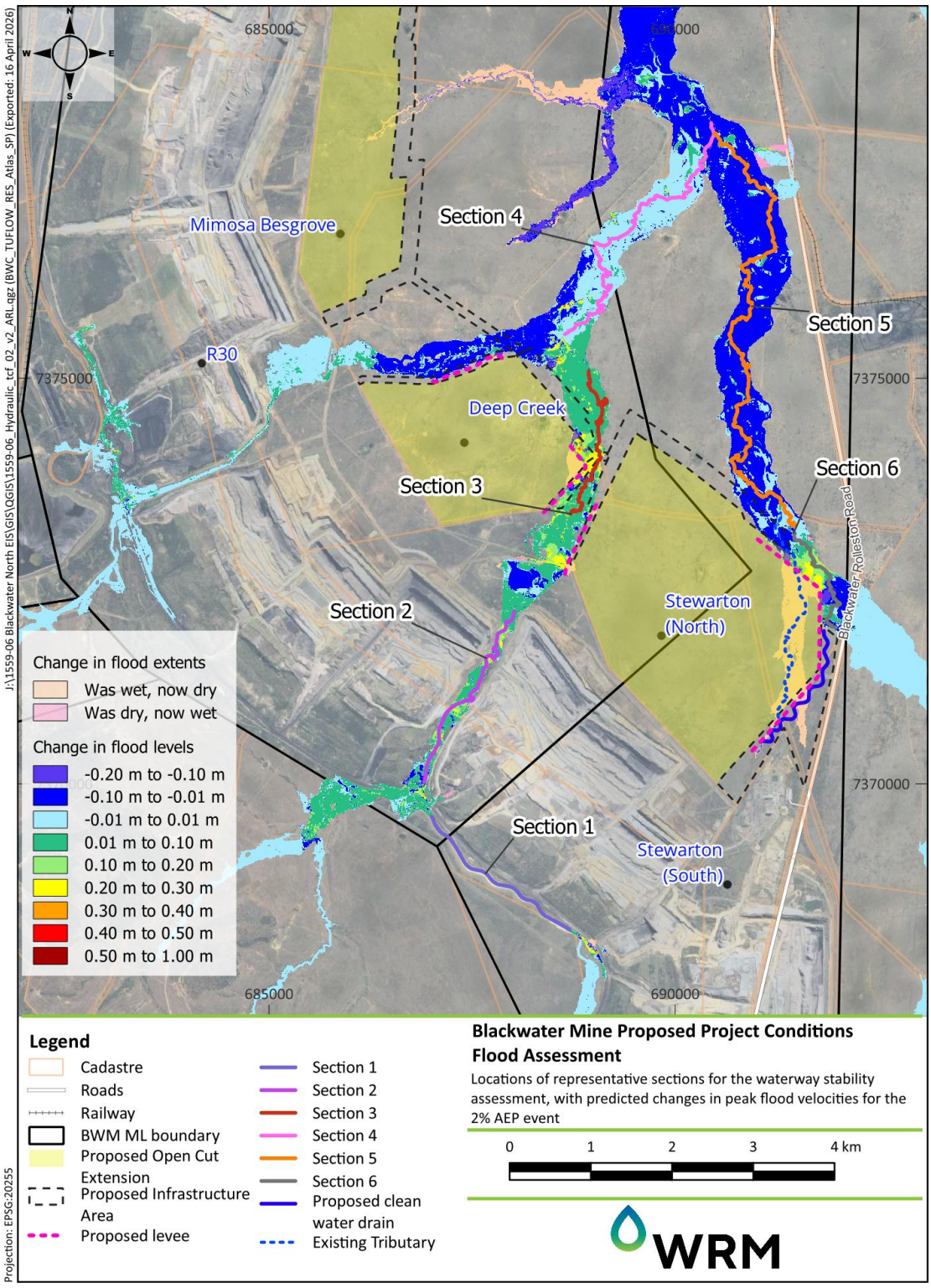


Figure 8.43 **Locations of representative sections for the waterway stability assessment, with predicted changes in peak flood velocities for the 2% AEP event**

Table 8.8 Comparison of velocities and stream power along Section 1 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 1			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	1.4	1.4	38.8	39.9
	50%ile	1.3	1.3	56.4	62.9
	75%ile	1.3	1.4	70.8	76.9
2% AEP	25%ile	2.1	2.1	115.1	118.6
	50%ile	1.9	1.9	150.2	154.6
	75%ile	2.0	2.1	193.2	198.6

Table 8.9 Comparison of velocities and stream power along Section 2 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 1			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	0.9	0.8	9.6	9.8
	50%ile	1.1	1.1	29.3	30.2
	75%ile	1.4	1.5	64.4	72.3
2% AEP	25%ile	0.9	0.9	14.8	16.4
	50%ile	1.4	1.4	53.0	57.5
	75%ile	1.9	2.0	139.5	156.8

Table 8.10 Comparison of velocities and stream power along Section 3 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 3			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	1.0	0.9	15.9	17.9
	50%ile	0.9	0.9	24.4	26.1
	75%ile	0.8	0.8	29.8	31.1
2% AEP	25%ile	0.9	1.0	19.5	20.4
	50%ile	0.8	0.8	31.9	32.3
	75%ile	0.7	0.7	39.7	39.7

Table 8.11 Comparison of velocities and stream power along Section 4 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 4			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	0.7	0.7	8.0	8.0
	50%ile	1.0	1.0	16.0	16.3
	75%ile	1.1	1.1	27.6	28.2
2% AEP	25%ile	0.7	0.7	7.0	7.0
	50%ile	1.0	1.0	19.3	19.3
	75%ile	1.2	1.2	35.7	35.7

Table 8.12 Comparison of velocities and stream power along Section 5 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 5			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	0.7	0.7	7.3	7.4
	50%ile	0.9	0.9	15.0	14.8
	75%ile	1.0	1.0	24.4	24.1
2% AEP	25%ile	0.8	0.8	9.1	9.1
	50%ile	1.1	1.1	21.2	20.9
	75%ile	1.3	1.3	38.1	37.5

Table 8.13 Comparison of velocities and stream power along Section 6 between existing and proposed (Project) conditions, 50% and 2% AEP design events

Event	Statistic	Section 6			
		Velocity (m/s)		Stream power (W/m²)	
		Existing conditions	Proposed (Project) conditions	Existing conditions	Proposed (Project) conditions
50% AEP	25%ile	0.9	0.9	12.8	13.1
	50%ile	1.0	1.0	19.2	20.0
	75%ile	1.2	1.2	27.6	27.9
2% AEP	25%ile	0.8	0.9	8.5	9.4
	50%ile	1.1	1.1	24.2	23.2
	75%ile	1.3	1.4	39.5	43.0

8.7.3 Hydraulic assessment of the proposed clean water drain

8.7.3.1 Overview

The proposed clean water drain would realign an unnamed tributary of Two Mile Gully (referred to as the existing tributary), which is mapped as a second order stream. The existing tributary is not mapped as a watercourse per the Water Act. As such, a functional design assessment and report in accordance with the *Guideline: Works that interfere with water in a watercourse for a resource activity* (Department of Natural Resources, Mines and Energy, 2019) would not be required. Notwithstanding this, a hydraulic assessment was undertaken to assess the stability of the proposed clean water drain due to the following reasons:

- the proposed clean water drain potentially impacts flood flows to Two Mile Gully, which is a fourth order stream and considered a watercourse under the Water Act; and
- the proposed clean water drain would form a permanent feature of the final landform.

The concept design for the proposed clean water drain has been developed to support the environmental approvals for the Project. It is anticipated the design would be further optimised during Preliminary and Detailed Design prior to construction.

Figure 8.44 shows the proposed clean water drain channel extent configuration. Figure 8.45 shows a longitudinal section plot along the proposed clean water drain alignment. Figure 8.46 and Figure 8.47 show cross section plots along representative cross sections A-A and B-B, respectively (cross section locations are shown in Figure 8.44).

The proposed clean water drain will be a trapezoidal channel with base width of 5 m, a maximum top width of 65 m, 1V:5H (vertical rise to horizontal run) internal batter slopes and a longitudinal slope of 0.7%.

In comparison, the existing tributary (that the proposed clean water drain would replace), has a longitudinal slope of 0.35% to 0.61%. The existing tributary channel has a base width between <2 m and up to 5 m, with bank slopes of between 1V:5H to 1V:10H.

In summary, the proposed clean water drain is slightly steeper than the steepest section of the existing tributary that it would replace. The clean water drain channel shape generally would not replicate the existing tributary channel, which is due to the constraints of the site.

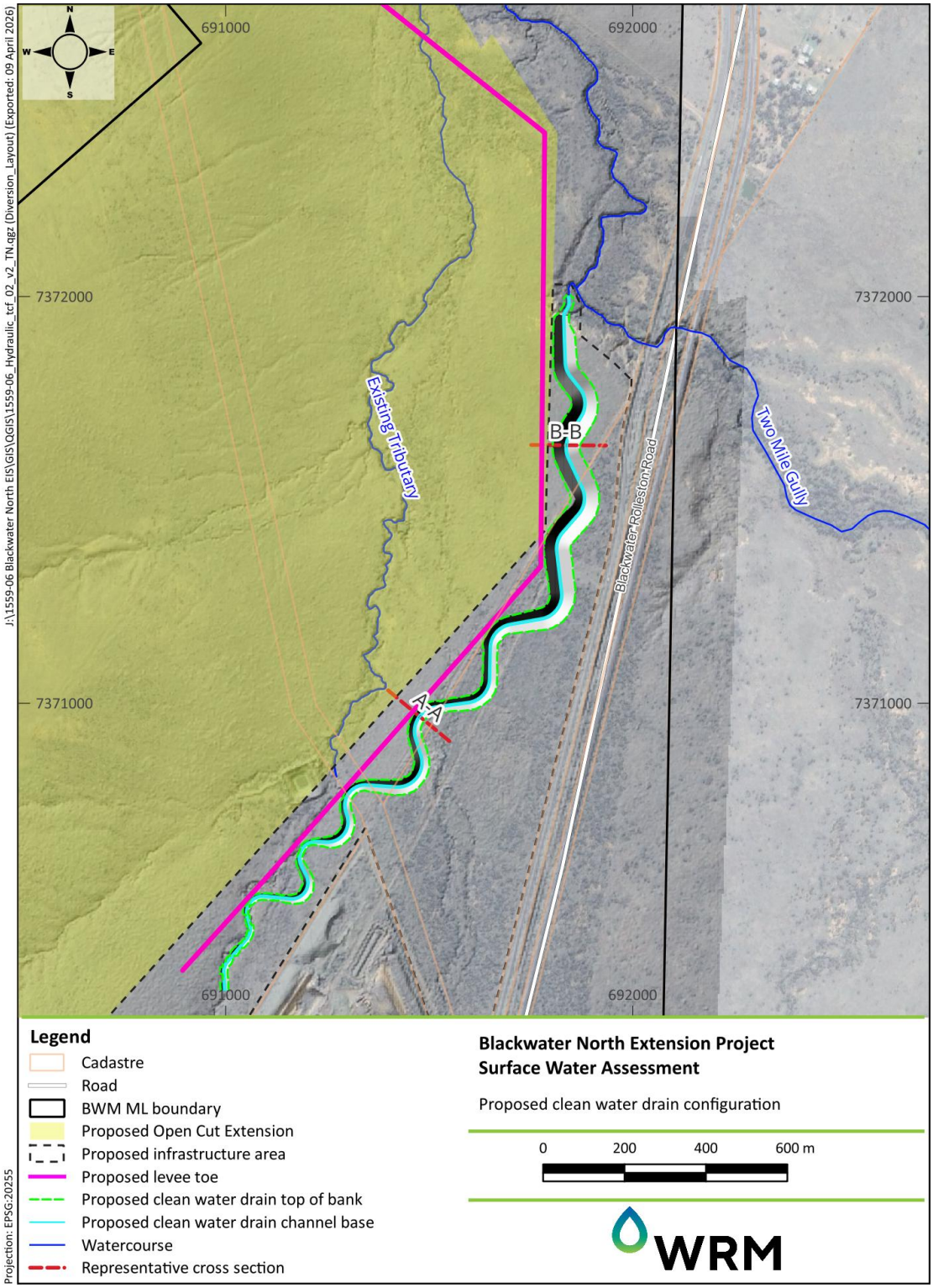


Figure 8.44 Proposed clean water drain configuration

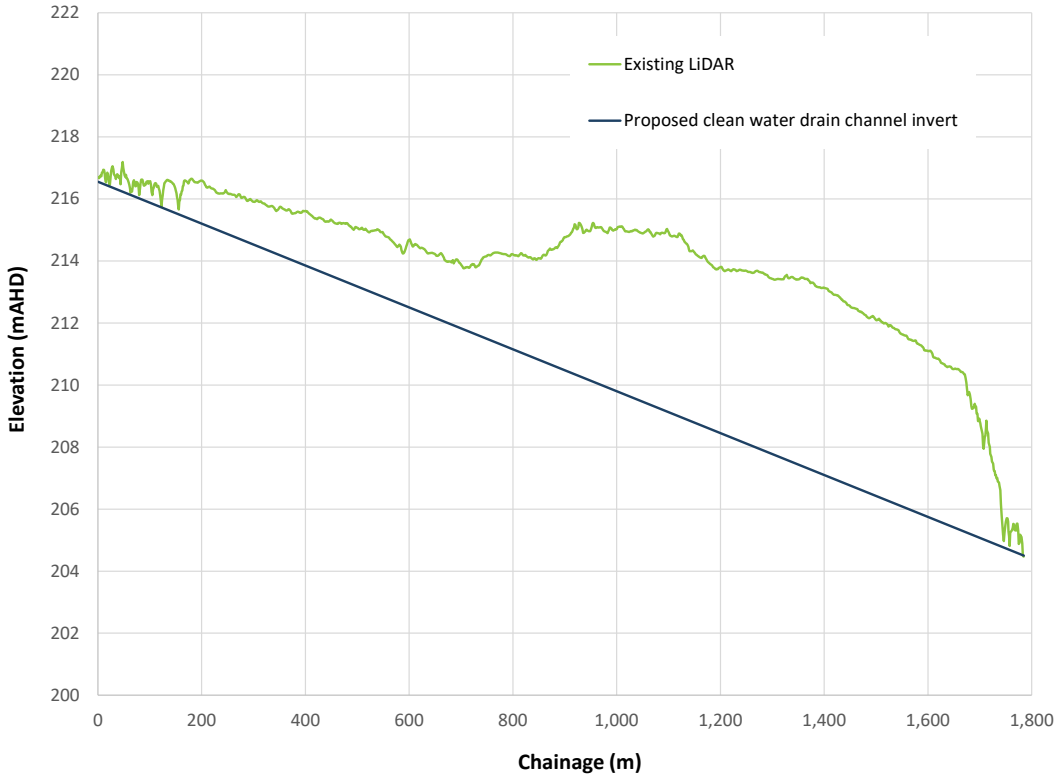


Figure 8.45 Longitudinal section plot along the proposed clean water drain alignment

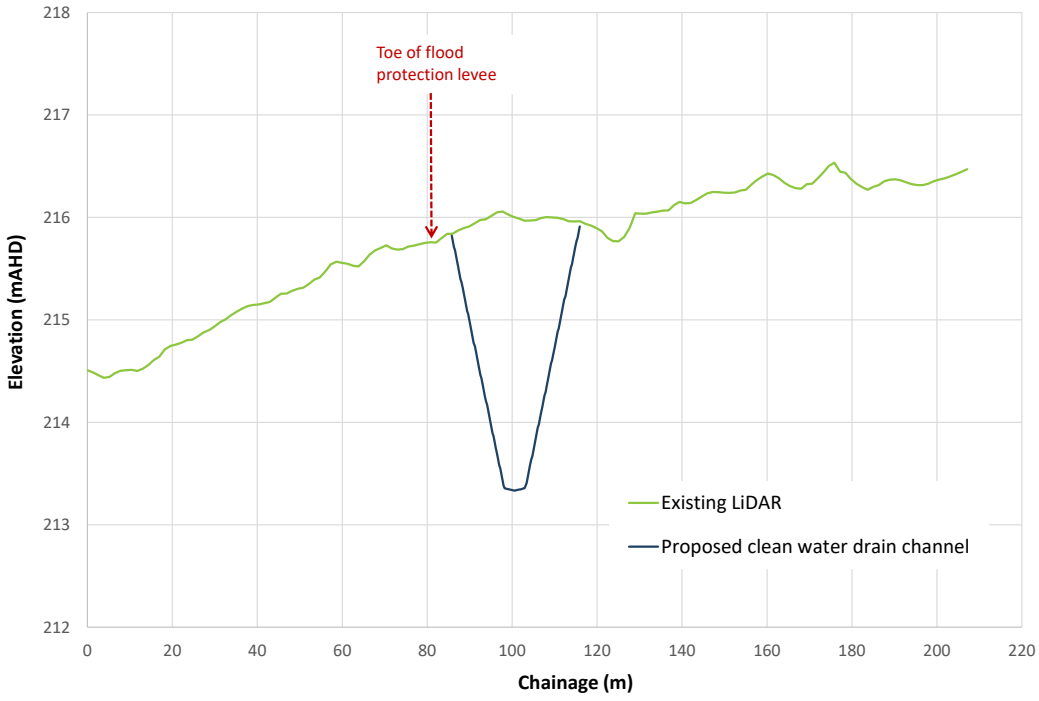


Figure 8.46 Proposed clean water drain cross section A-A (left to right in the direction of flow)

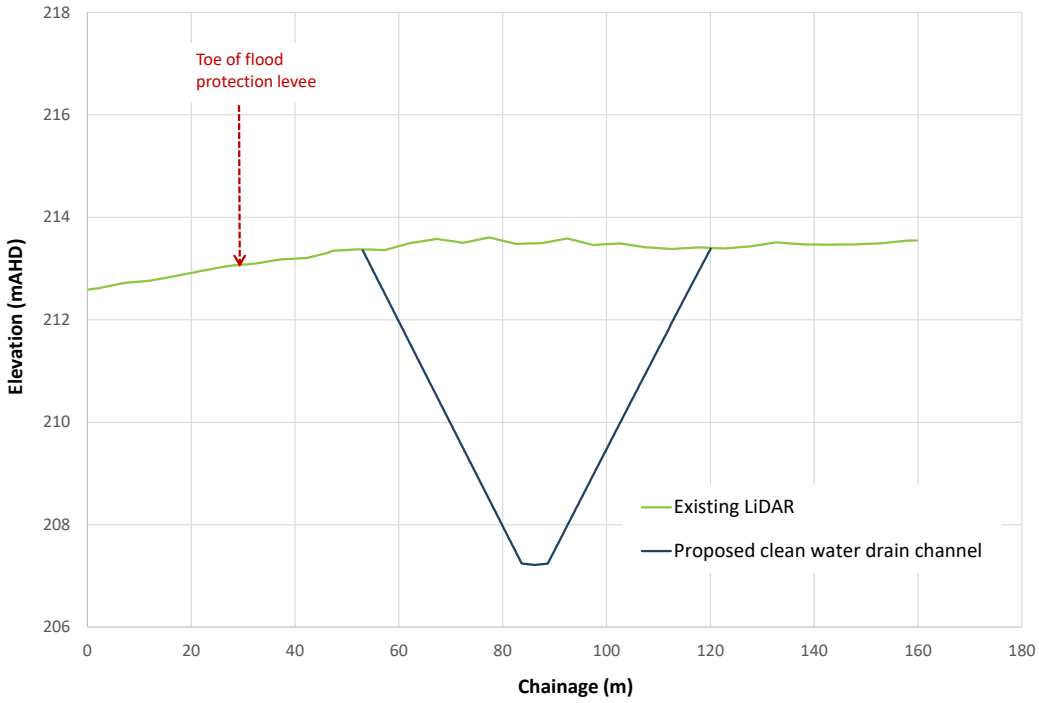


Figure 8.47 Proposed clean water drain cross section B-B (left to right in the direction of flow)

8.7.3.2 Hydraulic design criteria

Alluvium (2014) noted that sediment supply and bed load transport was found to be a critical factor in the performance of diversions. The volume of bed load sediment transported by a watercourse system is controlled by both the amount of sediment delivered to the watercourse and the capacity of the watercourse to transport sediment. Bed load transport in a watercourse can be broadly described as being either supply limited (can transport more sediment than is available) or transport limited (sediment supply exceeds transport capacity) (Alluvium, 2014).

For the purpose of constructed waterway diversion design, Alluvium (2014) recommends that mean reach stream power within a constructed waterway diversion lie within the ranges provided in Table 8.14. Further, Alluvium (2014) recommends that no cross section within a constructed waterway diversion exceed the adopted reach mean stream power by more than 50%.

Alluvium (2014) noted that a large proportion of natural watercourses in the Bowen Basin can be classified as transport limited with elevated and excess sediment supply available within the channel extent. Therefore, the mean reach stream power upper limits for transport limited alluvial streams given in Table 8.14, are applicable to the proposed clean water drain.

The proposed clean water drain would replace a section of the existing tributary during the operational phase of the Project and for the final landform. Therefore, velocities and stream power along the proposed clean water drain (under proposed [Project] conditions) were also compared against those within the existing tributary channel (under existing conditions).

Table 8.14 Mean reach stream power identified for sample stream reaches (Alluvium, 2014)

Stream type	Sediment transport group	Stream power (W/m²)	
		2-year Average Recurrence Interval (ARI) (1 in 1.44 AEP)	50-year ARI (1 in 50 AEP)
Alluvial	Supply limited (low sediment supply)	15 – 35	50 – 100
	Transport limited (high sediment supply)	35 – 60	80 – 150
Prevalent bedrock controls	n/a	50 – 100	100 – 350

8.7.3.3 Hydraulic assessment

Table 8.15 compares the statistical summaries of velocities and stream power along the existing tributary (under existing conditions) and the proposed clean water drain (under proposed [Project] conditions), for the 50% and 2% AEP design events. In the absence of hydraulic modelling for the 2 year ARI (1 in 1.44 AEP) event, the 50% (1 in 2) AEP hydraulic model results were assessed against the 2 year ARI (1 in 1.44 AEP) design criteria in the Alluvium (2014) guideline.

The model results show that the mean and maximum stream power along the proposed clean water drain are within the Alluvium (2014) design criteria for the 2 year ARI (1 in 1.44 AEP) event (35 - 60 W/m^2) and the 50 year ARI (1 in 50 AEP) event (80 – 150 W/m^2), based on transport limited alluvial streams. Therefore, the proposed clean water drain would satisfy the Alluvium (2014) design criteria.

Compared to the hydraulic characteristics of the existing tributary, predicted velocities and stream power in the proposed clean water drain would be higher. This is due to the significant constriction of the floodplain compared to existing conditions. As shown in Figure 8.43, a large proportion of flood flows along the existing tributary would be conveyed along the floodplain, with only a small proportion being conveyed within the existing tributary channel. The design of the clean water drain may be revised during Detailed Design, so that the hydraulic characteristics of the proposed clean water drain can better replicate the existing tributary's hydraulic behaviour.

Whilst the proposed clean water drain cannot replicate the hydraulic characteristics of the existing tributary, predicted velocities and stream power along the proposed clean water drain are well below the Alluvium (2014) upper limits of velocities and stream power for transport limited streams. Therefore, the proposed clean water drain is expected to be a stable and self-sustaining structure during the operational phase of the Project and post-closure. The design of the clean water drain would be improved during Detailed Design.

Table 8.15 Comparison of velocities and stream power along the existing tributary and the proposed clean water drain, 50% and 2% AEP design events

Event	Statistic	Velocity and stream power along the existing tributary and proposed clean water drain				Alluvium (2014) stream power thresholds (W/m²)	
		Velocity (m/s)		Stream power (W/m²)			
		Existing tributary	Proposed clean water drain	Existing tributary	Proposed clean water drain	Supply limited alluvial stream (low sediment supply)	Transport limited alluvial stream (high sediment supply)
50% AEP	25%ile	0.5	1.0	3.0	25.2	15 – 35 [a]	35 – 60 [a]
	50%ile	0.6	1.1	6.2	35.3		
	75%ile	0.8	1.2	11.9	44.9		
	Mean	0.8	1.1	9.3	34.1		
	Max.	1.2	1.3	42.9	75.7		
2% AEP	25%ile	0.7	1.3	8.1	44.4	50 – 100	80 – 160
	50%ile	0.8	1.4	14.9	56.4		
	75%ile	1.1	1.6	26.8	75.5		
	Mean	1.0	1.4	20.5	56.2		
	Max.	1.7	1.7	91.2	107.1		

[a] – Alluvium (2014) provides stream power thresholds for the 2 year ARI event (equivalent to a 39% AEP event). The 50% AEP event hydraulic model results were used as a proxy for the 2 year ARI (39% AEP) event.

8.8 FINAL LANDFORM FLOOD ASSESSMENT

8.8.1 Final landform configuration

Figure 8.48 to Figure 8.50 show the proposed final landform configuration and the extent of flooding for the 1% AEP, 0.1% AEP and PMF design flood events, respectively. The final landform for the Project would include five residual voids as previously described in Section 7.1.

- The final landform around the final voids would be constructed to prevent floodwater from entering. The temporary flood protection levees (in place during mining) adjacent to the Ramp 30, Deep Creek and Stewarton North pits would be removed such that the rehabilitated out-of-pit overburden areas would prevent floodwater from entering the voids.
- The landform features around the proposed voids would be constructed to be at least 60 m wide at the crest.
  - For the Ramp 30 void, the landform feature would have a crest height above the adjacent 0.1% AEP peak flood level in Deep Creek.
  - For the Mimosa/Besgrove, Deep Creek, and Stewarton North and Stewarton South voids, the landform feature would have a crest height above the adjacent PMF peak flood level.
- At the end of mining, the south-eastern corner of the Deep Creek void would be backfilled. As a result, the toe of the landform at this location would be located further away from Deep Creek compared to the maximum Deep Creek Pit extent during operations. This approach provides additional floodplain conveyance for the final landform compared to mining stage.
- Similarly, the south-eastern corner of the Stewarton North pit would be backfilled and as a result, the toe of the landform at this location would be located further away from Taurus Creek

compared to the maximum Stewarton North Pit extent during operations. In addition, the proposed clean water drain described in Section 8.7.3 would be retained for the final landform.

- It is assumed that the final landform, including the out-of-pit overburden dumps, would be rehabilitated to achieve at least 70% vegetal cover (in line with Whitehaven Blackwater's rehabilitation schedule), using erosion resistant materials at the toe of the landform that would be in contact with floodwater.

8.8.2 Assessment methodology

Hydraulic modelling was undertaken for the 1% AEP, 0.1% AEP and PMF design flood events under proposed final landform conditions, and for the SSP2-4.5 (year 2100) future climate scenario.

A summary of the model results is presented in the following sections, focusing on the flood immunity of the proposed voids and the risk of erosion and scour in the vicinity of the proposed final voids and sections of rehabilitated dump landform in contact with floodwater.

8.8.3 Peak flood levels, depths, extents and velocities

Figure 8.48 to Figure 8.50 show the predicted peak flood extents, levels and depths along Taurus Creek, Two Mile Gully, Emu Creek and Deep Creek in the vicinity of the final landform, for the 1% AEP, 0.1% AEP and PMF events. Figure 8.51, Figure 8.52 and Figure 8.53 show the corresponding peak velocities.

The model results indicate that:

- The Mimosa/Besgrove void would be located outside of the riverine flood extents in Sagittarius Creek for all flood events up to the PMF.
- The Deep Creek, Stewarton North and Stewarton South voids would have immunity from flooding for all events up to and including the PMF.
- The Ramp 30 void would have immunity from flooding for all events up to and including the 0.1% AEP event. Floodwater ingress into the Ramp 30 voids is predicted to occur during the PMF event. The predicted depths of overtopping during the PMF event vary at approximately 0.25 m on average up to a maximum of 1 m above the crest of the landform.
- The model predicted flood velocities along the toe of the proposed flood protection landform adjacent to the voids for all events up to 0.1% AEP are as follows:
  - Adjacent to the Ramp 30 void, flood velocities are generally <1 m/s, with higher velocities contained within creek channel further away from the landform.
  - Adjacent to the Deep Creek void, flood velocities are generally <0.5 m/s, with velocities of up to 1.6 m in some sections.
  - Adjacent to the Stewarton void, flood velocities along the Two Mile Gully floodplain range between <0.4 m/s and up to 1.3 m/s.
- Flood velocities along the toe of rehabilitated dumps (adjacent to Deep Creek, Taurus Creek and Emu Creek) are generally <2 m/s for events up to 0.1% AEP.

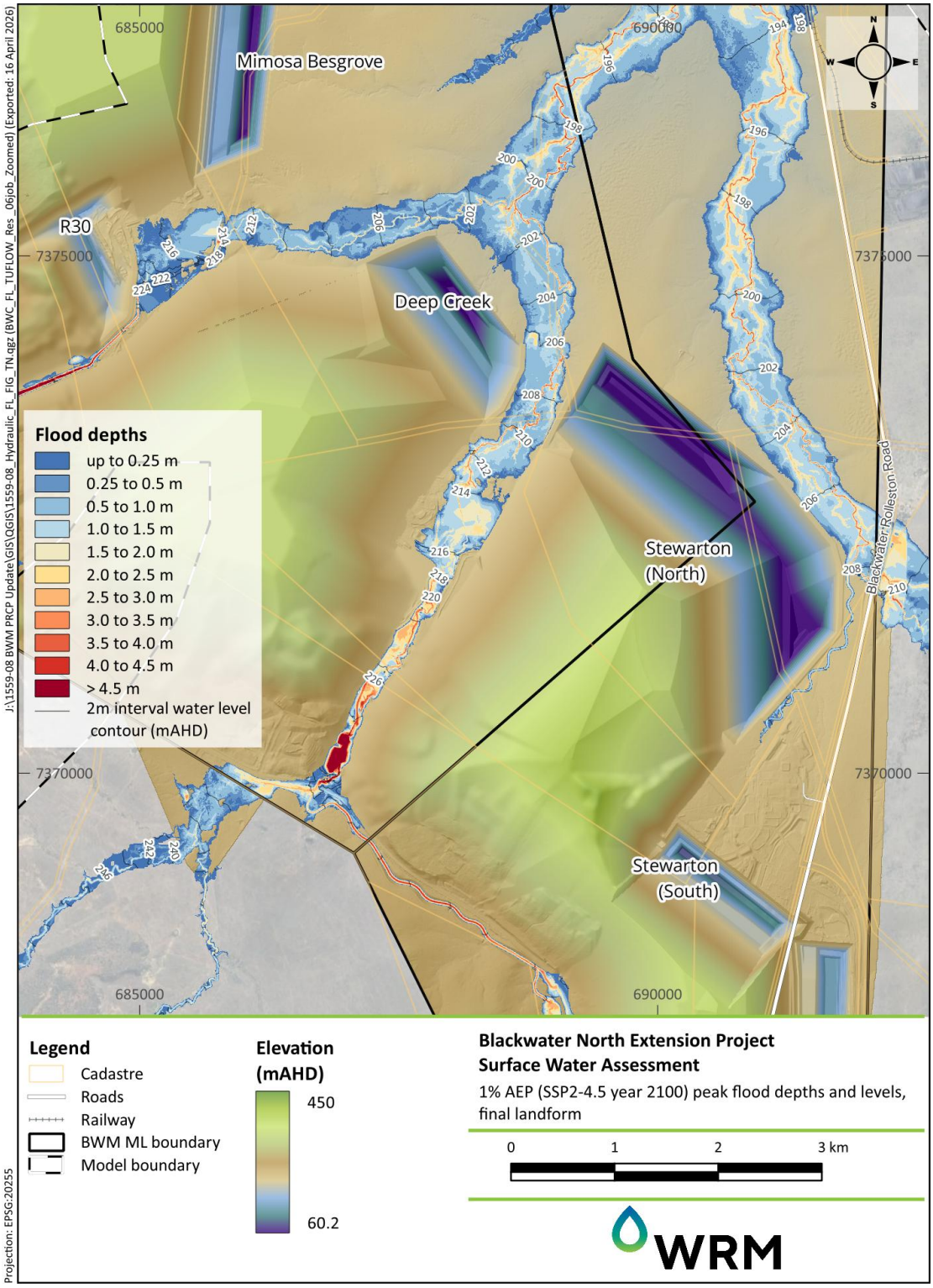


Figure 8.48 1% AEP (SSP2-4.5 year 2100) peak flood depths and levels, final landform

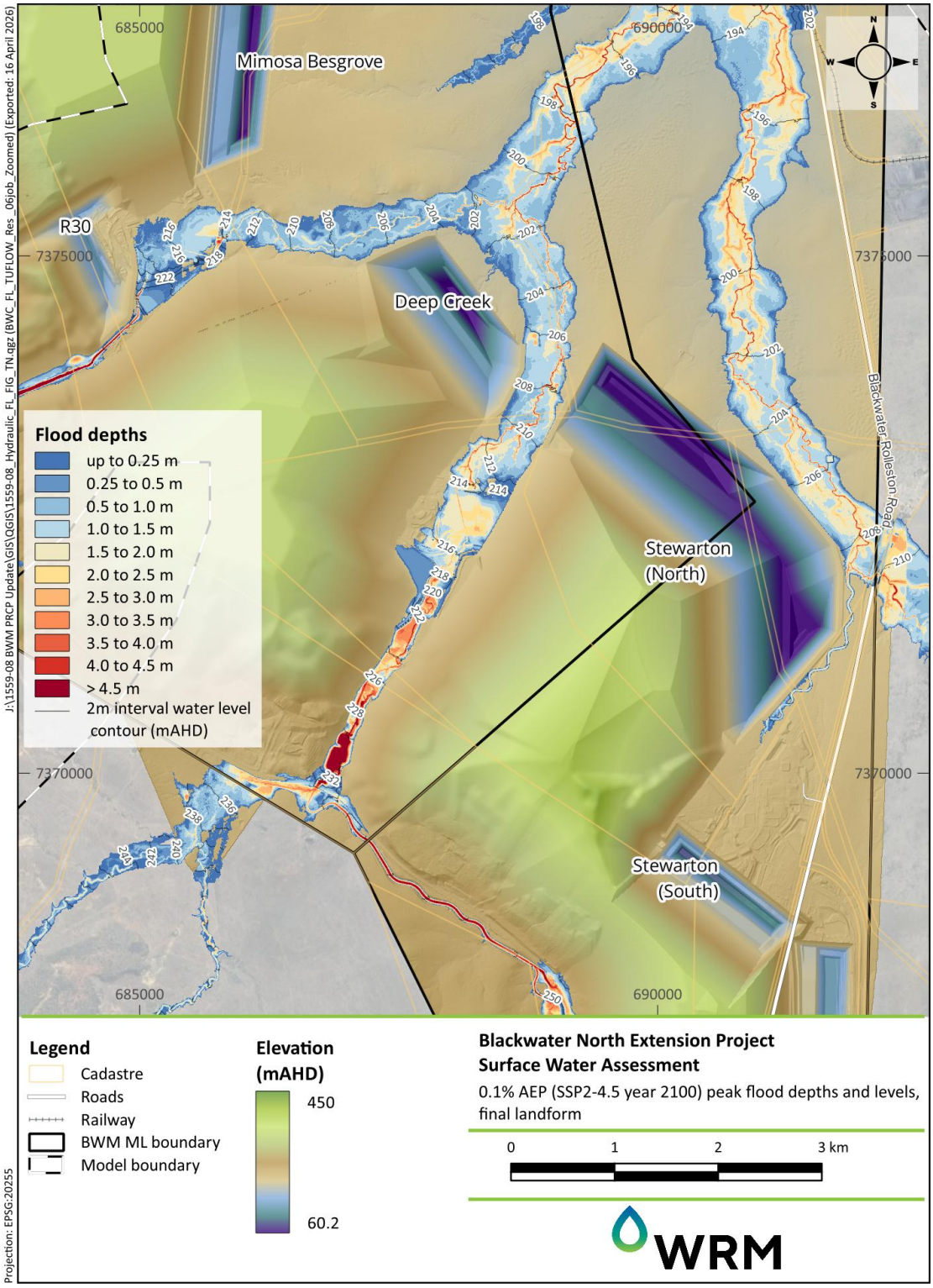


Figure 8.49 0.1% AEP (SSP2-4.5 year 2100) peak flood depths and levels, final landform

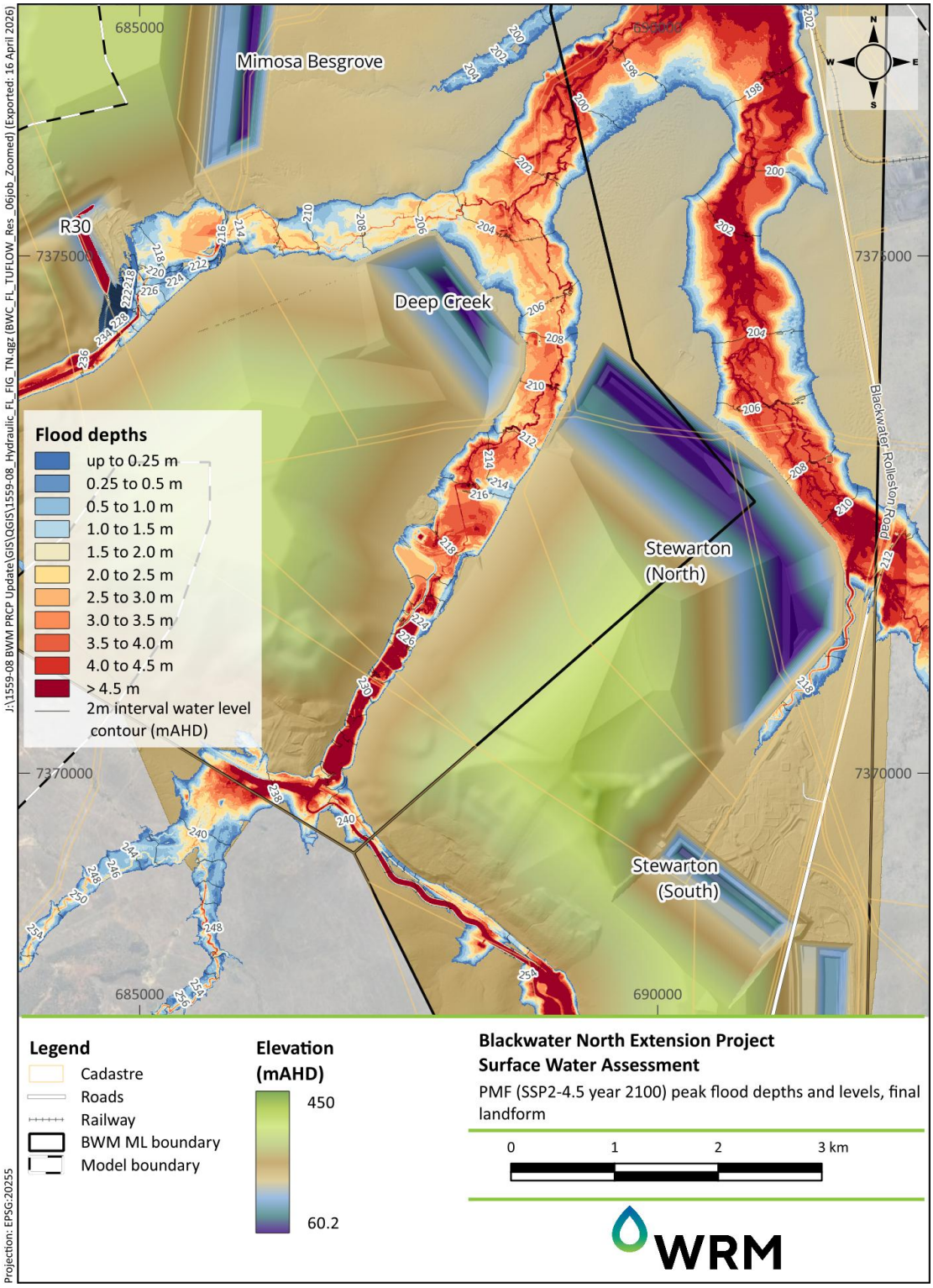


Figure 8.50 PMF (SSP2-4.5 year 2100) peak flood depths and levels, final landform

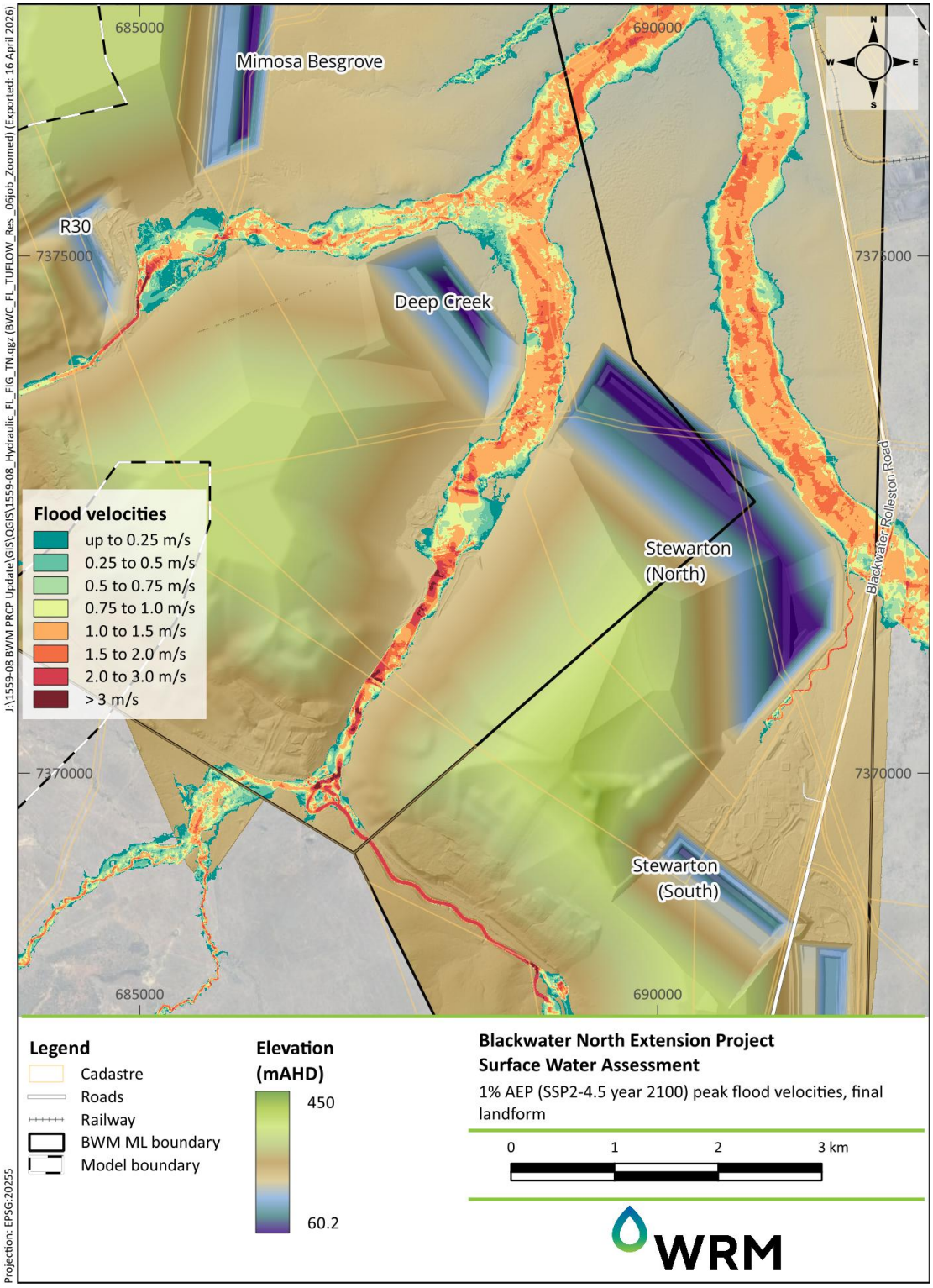


Figure 8.51 1% AEP (SSP2-4.5 year 2100) peak flood velocities, final landform

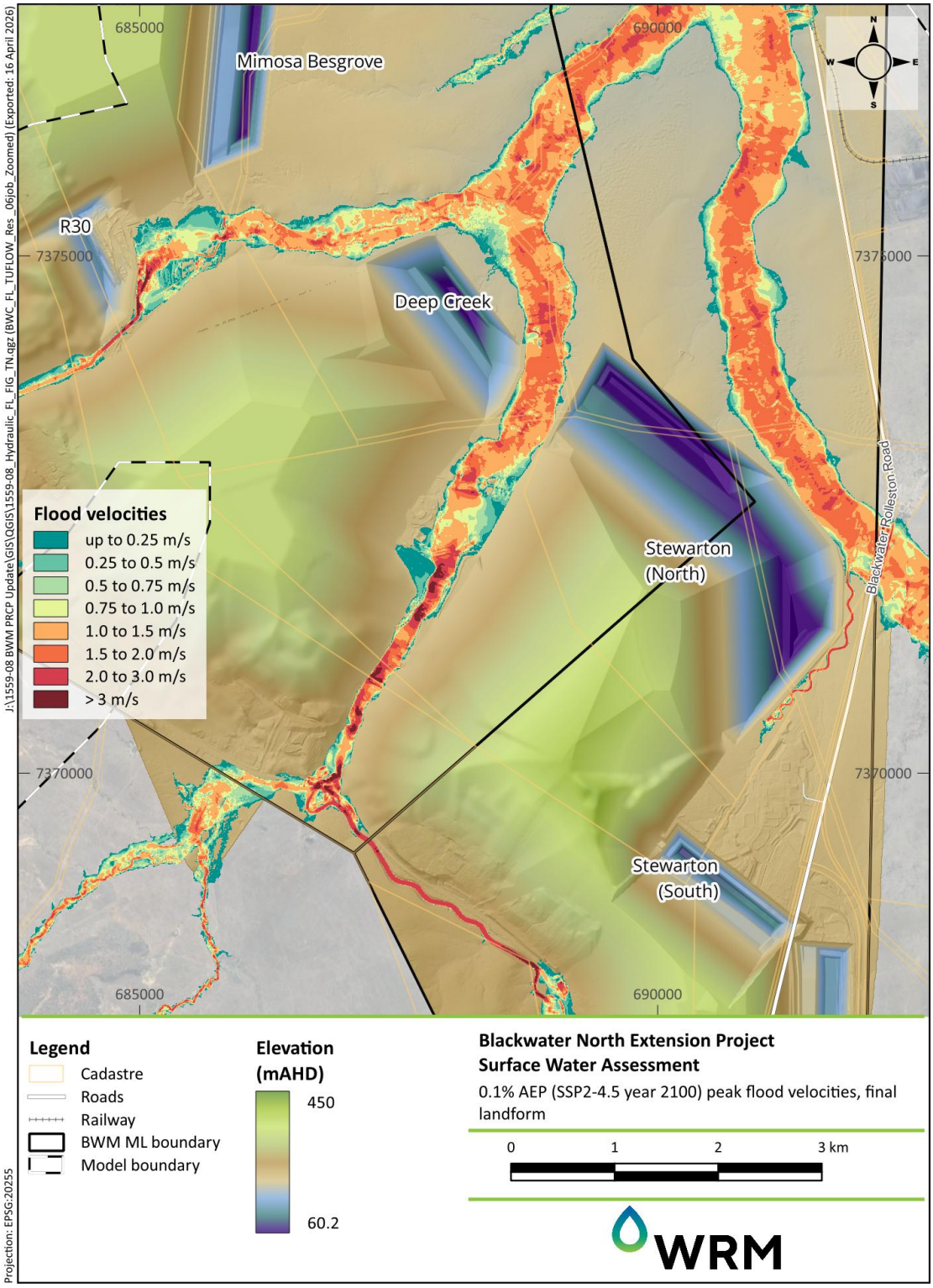


Figure 8.52 0.1% AEP (SSP2-4.5 year 2100) peak flood velocities, final landform

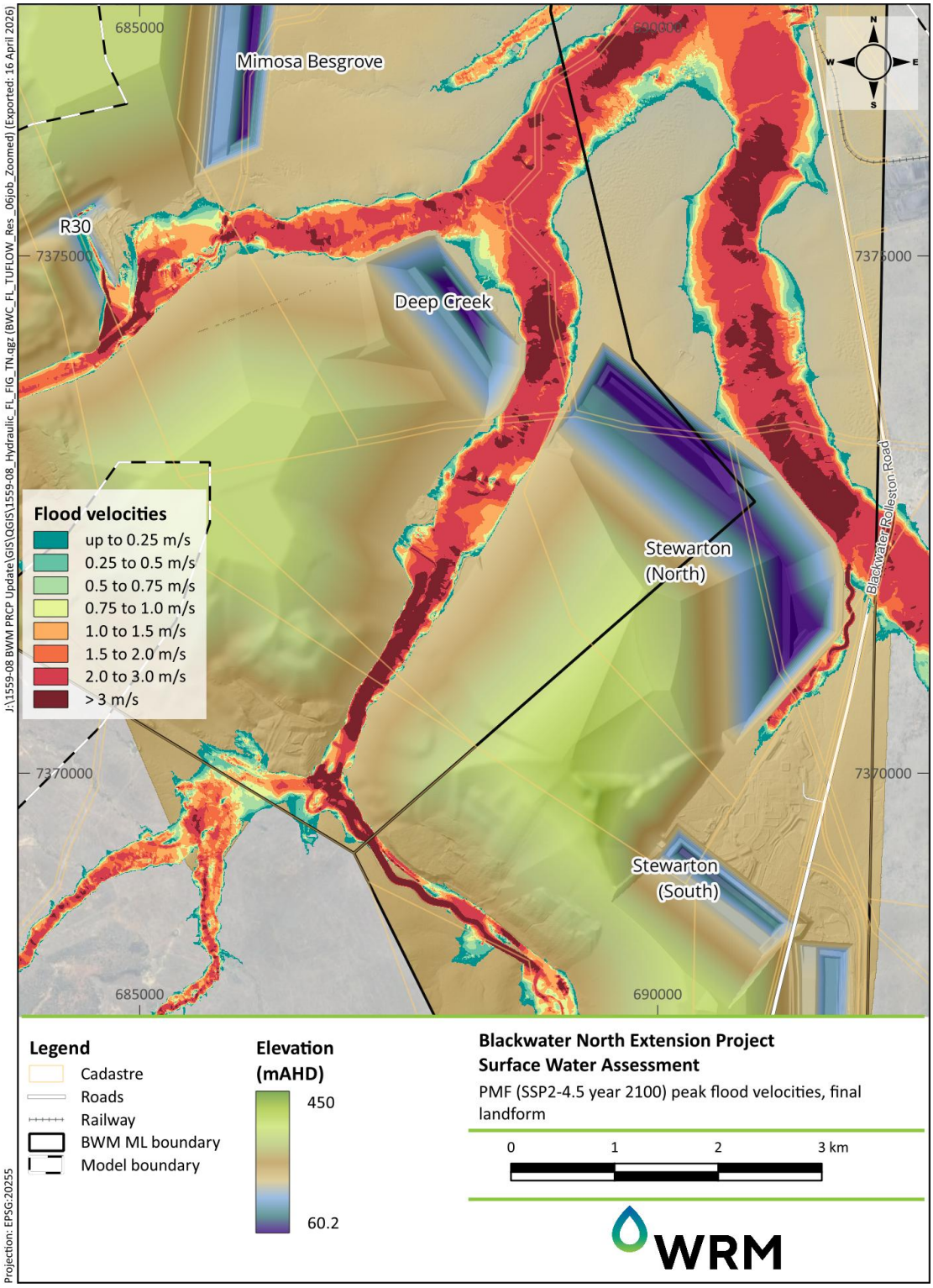


Figure 8.53 PMF (SSP2-4.5 year 2100) peak flood velocities, final landform

8.8.4 Risk of erosion and scour

The risk of erosion on the post-mining rehabilitated landform was assessed by comparing the model-predicted flood velocities adjacent to the final landform against the maximum allowable velocity threshold given in *Book 4 – Best Practice Erosion and Sediment Control* guideline (International Erosion Control Association [IECA], 2008).

Table 8.16 shows the maximum allowable velocities for bare earth and grassed channels obtained from IECA (2008), which are considered applicable to rehabilitated landform surfaces subjected to flooding.

Table 8.16 Adopted criteria for maximum allowable velocities adjacent to rehabilitated landform in contact with floodwater, adopted from IECA (2008)

Channel gradient (%)	Percentage of stable vegetal cover			
	0%	50%	70%	100%
Erosion resistant soils:				
1	0.7	1.6	2.1	2.8
2	0.6	1.4	1.8	2.5
3	0.5	1.3	1.7	2.4
4		1.3	1.6	2.3
5		1.2	1.6	2.2
6			1.5	2.1
8			1.5	2.0
10			1.4	1.9
15			1.3	1.8
20			1.3	1.7
Easily eroded soils:				
1	0.5	1.2	1.5	2.1
2	0.5	1.1	1.4	1.9
3	0.4	1.0	1.3	1.8
4		1.0	1.2	1.7
5		0.9	1.2	1.6
6			1.1	1.6
8			1.1	1.5
10			1.1	1.5
15			1.0	1.4
20			0.9	1.3

2.1 – Adopted velocity threshold above which flood-induced erosion would likely occur

It is assumed that the final landform achieves at least 70% vegetative cover, combined with the use of erosion resistant materials at the toe of the landform, that would be in contact with floodwater during flooding. The topographic gradient along the toe of the landform, in the direct flow, would be <1% in general.

On this basis of the above, the risk of flooding-induced erosion of the rehabilitated landform is expected to be low for velocities up to 2.1 m/s at the toe of the landform in contact with floodwater. Flood velocities towards the centre of the floodplain are generally higher than at the toe of the rehabilitated landform, but these higher velocities would not trigger erosion of the landform itself.

As described in Section 8.8.3, velocities adjacent to the final voids and rehabilitated dump landform are lower than the adopted maximum allowable velocity (2.1 m/s) from IECA (2008). Therefore, the final landform is expected to be stable during flood events up to the 0.1% AEP event.

9 CATCHMENT EXCISION ANALYSIS

9.1 OVERVIEW

The Project would involve an expansion of the mining pits, which would result in the loss of undisturbed catchment reporting to Taurus Creek and Sagittarius Creek. The following sections describe impact of the predicted catchment loss on:

- flow regime in the waterways in the vicinity of the Project; and
- fine sediment and nutrient loads to the GBR catchment waters.

9.2 CATCHMENT LOSS

Figure 9.1 shows the existing Taurus Creek catchment (to Taurus Creek D/S gauge), the existing Sagittarius Creek catchment (to the northern ML boundary) and the existing Two Mile Gully catchment to the Blackwater-Rolleston Road. Figure 9.1 also shows the portions of the existing Taurus Creek and Sagittarius Creek catchments that would be lost as a result of the Project during mining. The changes in catchment areas between existing and proposed (Project) conditions are tabulated in Table 9.1.

The Project would involve an extension of the open cut pit footprint towards the east, which would reduce the Taurus Creek and Sagittarius Creek catchments during mining, as a greater portion of undisturbed land would drain to the open cut pits.

The Project, during mining, would result in an 8.9% reduction of the Taurus Creek catchment and a 7.9% reduction in the Sagittarius Creek catchment compared to existing conditions.

Table 9.1 Analysis of catchment loss due to the Project

Catchment	Catchment area (km^2)		Difference (%)
	Existing conditions	Project conditions	
Taurus Creek to Taurus Creek D/S gauge	250.4	228.2	-8.9
Sagittarius Creek to northern ML boundary	42.7	39.3	-7.9

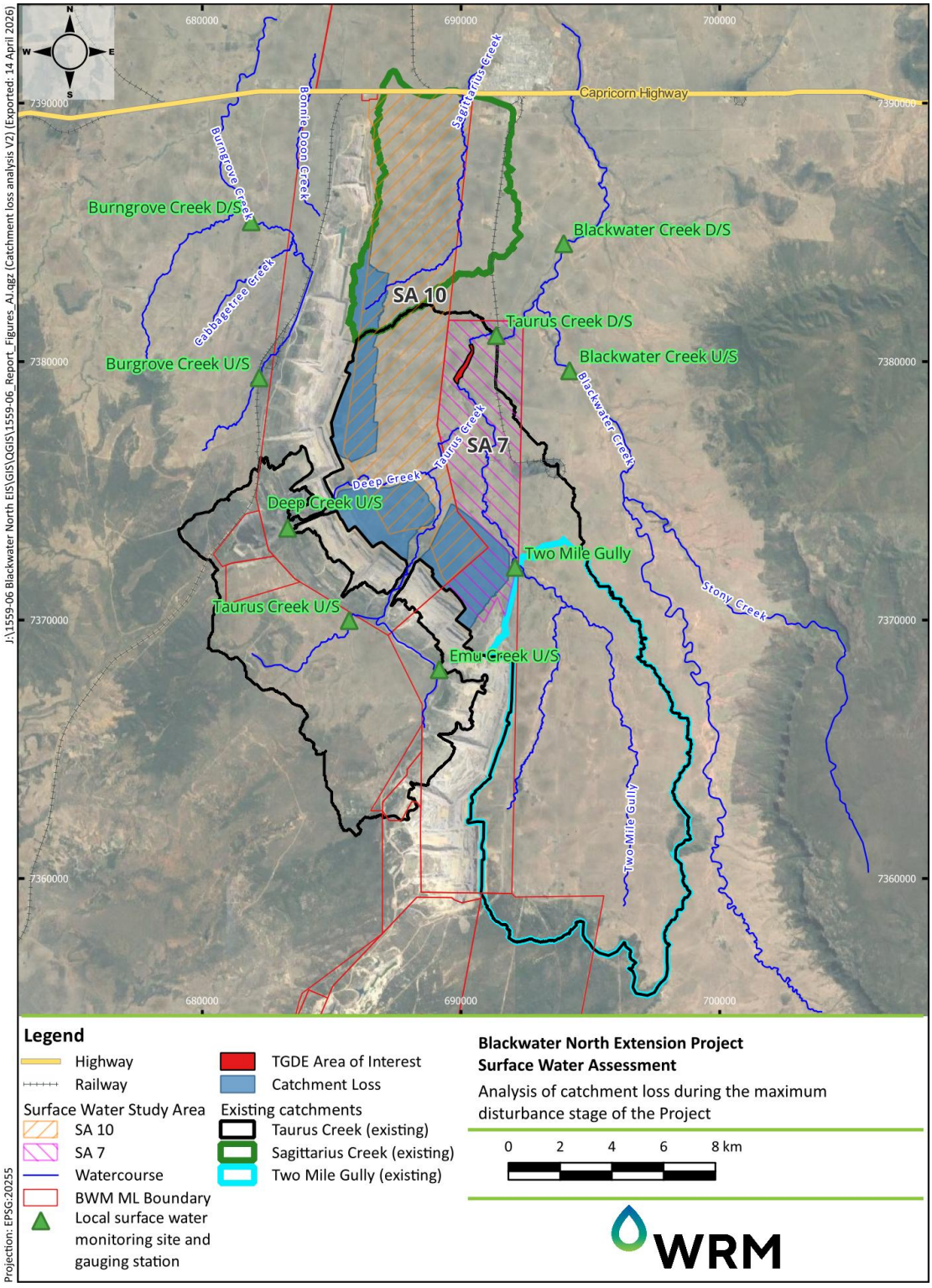


Figure 9.1 Analysis of catchment loss during the maximum disturbance stage of the Project

9.3 IMPACTS ON FLOW REGIME

9.3.1 Taurus Creek

Figure 9.2 shows the derived existing conditions flow-duration relationship for Taurus Creek at the Taurus Creek D/S gauge, based on recorded stream flow data at this gauge. Figure 9.2 also shows the Project conditions flow-duration relationship, which was derived by factoring the recorded flows based on the loss of catchment to the Taurus Creek D/S gauge.

Figure 9.2 shows that Taurus Creek is ephemeral, with flows <0.1 ML/d occurring <19% of the time and flows >1 ML/d occurring <10% of the time. Figure 9.2 also shows the impact of the Project on the magnitude of flows in Taurus Creek is insignificant.

Figure 9.2 also shows the location of an identified Terrestrial Groundwater Dependent Ecosystems (TGDE). The Taurus Creek D/S gauge is located just downstream of the TGDE area of interest and as such, the flow-duration relationship at this gauge is representative of flow characteristics at the TGDE area of interest. The *Aquatic Ecology and Groundwater-Dependent Ecosystems Assessment* (DPM Enviroscences Pty Ltd, 2026) noted that based on the insignificant impact on Taurus Creek flow regime predicted in this surface water assessment, the TGDEs of the Study area are unlikely to be affected by the Project.

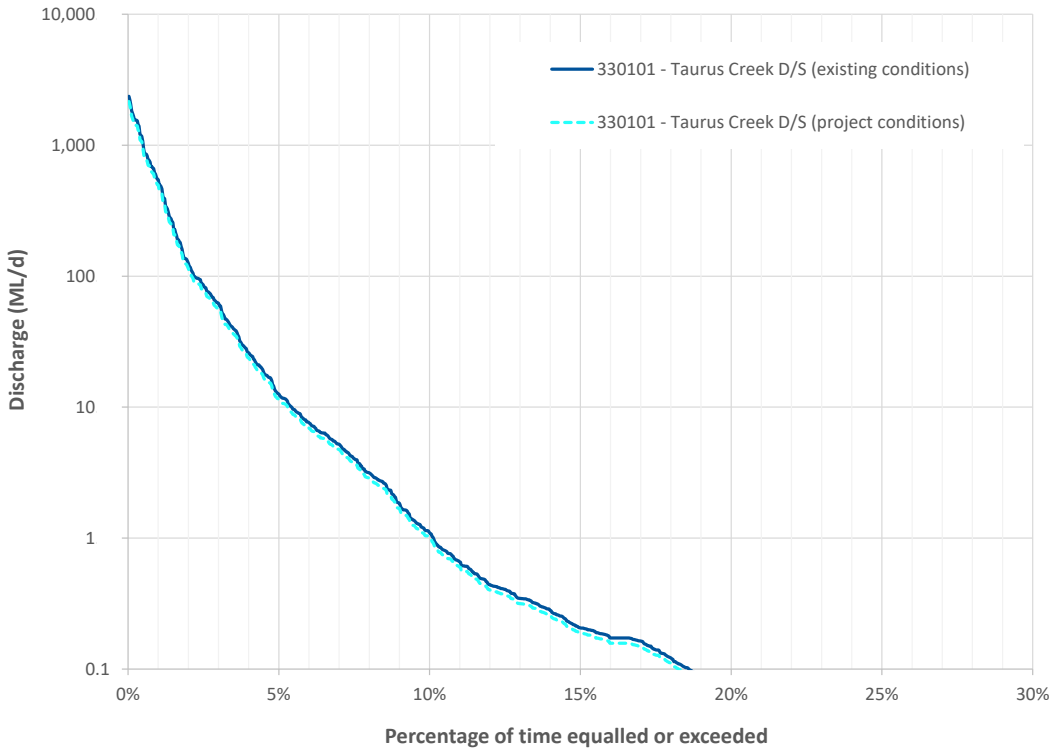


Figure 9.2 Derived flow-duration relationship for Taurus Creek at the Taurus Creek D/S gauge (existing vs. Project conditions)

9.3.2 Two Mile Gully

Figure 9.3 shows the derived existing conditions flow-duration relationship for Two Mile Gully at the Two Mile Gully gauge, based on recorded stream flow data at this gauge.

Figure 9.3 shows that Two Mile Gully is ephemeral, with flows >0.1 ML/d occurring less than 10% of the time and flows >1 ML/d occurring less than 6% of the time. The Two Mile Gully catchment to this gauge would not be changed as a result of the Project, hence the flow regime in Two Mile Gully would be unaffected by the Project.

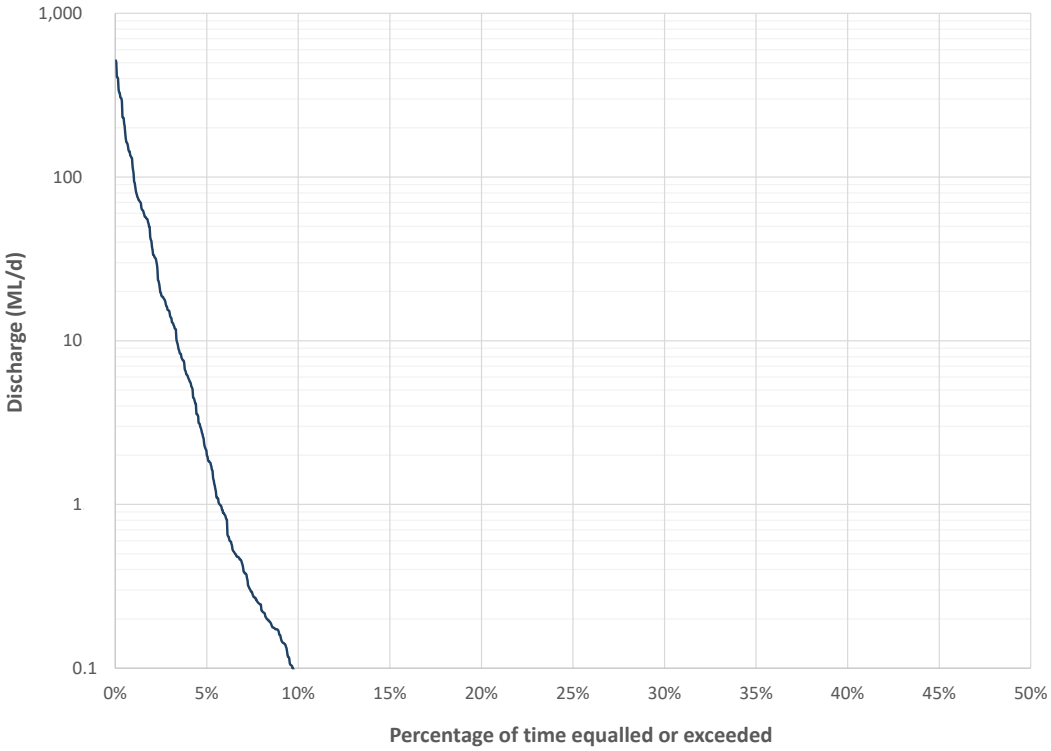


Figure 9.3 Derived flow-duration relationship for Two Mile Gully

9.3.3 Sagittarius Creek

Recorded stream flow data in Sagittarius Creek is not available to generate a data-based flow-duration relationship. Sagittarius Creek is likely to be ephemeral, behaving similarly to Taurus Creek and Two Mile Gully and would only flow after significant rain events.

The predicted percentage loss of Sagittarius Creek catchment due to the Project is similar to, and slightly smaller than, the predicted loss of Taurus Creek catchment (refer to Table 9.1). On this basis, the impact on flow regime in Sagittarius Creek due to the Project is expected to be similar to those predicted in Taurus Creek and is likely to be insignificant.

10 ASSESSMENT OF SURFACE WATER IMPACTS, MITIGATION AND MANAGEMENT MEASURES

The following sections describe the key potential water management risk and mitigation measures.

10.1 IMPACT ON FLOW REGIME

The Project would result in minor alterations to flow regimes in the local creeks, primarily due to the loss of catchment area draining to Taurus Creek and Sagittarius Creek resulting from the expansion of the mining pits.

The impacts on flow regime in Taurus Creek and Sagittarius Creek are insignificant, and the Project would not impact on flow regime in Two Mile Gully.

The loss of catchment area due to the Project would occur in the middle reaches of Taurus Creek, while the headwaters of the Taurus Creek catchment would be unaffected by the Project. As a result, the duration and frequency of flows would not be materially changed.

10.2 IMPACT ON WATER QUALITY

The Project would continue to operate within an established and regulated surface water management framework that prioritises the capture, reuse and controlled release of MAW. Surface water management measures include separation of clean and contaminated water, ESC structures, operational water balance controls, and TARPs to prevent uncontrolled releases.

10.2.1 Impact of controlled releases

There are no proposed changes to the currently approved controlled release strategy as a result of the Project. In addition, there are no proposed changes to release infrastructure (release dams and pipelines).

The controlled release of MAW is restricted by the EA release conditions (Schedule F) and relevant WQOs. Water balance modelling results indicate that:

- The approved controlled release strategy is sufficient for maintaining excess MAW volumes at BWM during the operational phase of the Project.
- Compared to the Approved operations, the water balance modelling results indicate that the Project would result in relatively small volumetric changes to annual release volumes. The release water quality is not expected to change as a result of the Project.

Controlled releases under Schedule F of the EA would only occur when receiving waterways have recorded a natural flow event in excess of the minimum flow trigger in response to rainfall-generated catchment runoff. At these times, local creeks would be exhibiting elevated, event-driven flows characterised by increased water levels, higher velocities and short-duration runoff pulses which would likely include natural turbidity and sediment transport reflecting storm conditions.

An assessment of potential controlled-release rates and dilution requirements has been undertaken for RP2 and RP3 (discharging to Blackwater Creek) and RP4 (discharging to Two Mile Gully). The assessment results demonstrate that the allowable release rate reduces as the EC of the release water increases. At higher receiving-stream flows, the achievable discharge rate would be constrained by the capacity of the release infrastructure rather than the calculated receiving-stream dilution capacity. Consequently, the dilution achieved under these conditions would generally be greater than the minimum values presented in the assessment.

The assessment demonstrates that controlled releases can be managed by adjusting the combined release rate in response to:

- the measured receiving-stream flow;
- the receiving-stream EC;
- the EC of the water proposed for release;
- the applicable downstream EC limit; and
- the hydraulic capacity of the release infrastructure.

BWM's current and proposed controlled-release strategy is to monitor receiving-stream flow, EC and pH at the relevant stream gauges and manage the release rate accordingly. The release flow rates are adjusted based on predictions from a RCM that BWM maintain onsite.

During a controlled release, downstream flow, EC and pH are monitored against compliance limits using automated remote telemetry stations which record data in near-real time. The release rate is reduced, or the release is ceased, based on a combination of RCM predictions and real time monitoring results where monitoring indicates that the applicable flow or water-quality trigger is being approached or exceeded.

10.2.2 Impact of uncontrolled releases

The Project is not expected to increase the risk of uncontrolled discharges from site storages to receiving waterways. The proposed eastward expansion of existing pits would result in catchment changes that are confined to the expanding pits, which drain internally. The Project does not alter the contributing catchments or drainage arrangements of existing MAW storages or sediment dams that have a higher potential for uncontrolled discharge. Additionally, the Project does not modify the catchments of NTCD or NDCD, which have a higher potential for uncontrolled discharges due to their on-stream configuration.

In conclusion, the Project is unlikely to substantially affect the quality of surface waters in receiving environments compared to current conditions and the Approved operations.

10.3 IMPACT ON DOWNSTREAM WATER USERS

Given the ephemeral nature of the local waterways in the vicinity of the Project as well as the insignificant impacts on flow regime and water quality in these waterways compared to the approved operations, there would not be any downstream water users that would be impacted by the Project.

10.4 IMPACT ON FLOODING

10.4.1 Flood impacts during mining

Flooding impacts from the Project during mining were assessed for events up to 0.1% AEP. The results show that:

- There would no ingress of floodwater into the mining pits for all events up to the 0.1% AEP design event with the construction of the proposed temporary flood protection levees.
- Predicted increases in peak flood levels are generally minor and mostly contained to the lease area for all events up to 0.1% AEP. There are minor localised off lease impacts upstream of BWM. There are no predicted increases in peak flood levels and events at existing dwellings/homesteads in the vicinity of the Project area.
- Predicted peak velocities on the floodplain remain within acceptable limits.
- The Project is not expected to result in a material change to flood behaviour downstream of the Project.

10.4.2 Waterway stability

Hydraulic modelling results show that the erosion potential and sediment transport characteristics of the existing waterway channels under proposed (Project) conditions would be similar to existing conditions.

The hydraulic characteristics of the proposed clean water drain were analysed, and the results are as follows:

- Compared to the hydraulic characteristics of the existing tributary, predicted velocities and stream power in the proposed clean water drain would be higher. This is due to the significant constriction of the floodplain compared to existing conditions.
- The predicted velocities and stream power along the proposed clean water drain are well below the Alluvium (2014) upper thresholds of velocities and stream power for transport limited streams. Therefore, the proposed clean water drain is expected to be a stable and self-sustaining structure during the operational phase of the Project and post-closure. The design of the clean water drain would be refined during Detailed Design, prior to construction.

10.4.3 Flooding for the final landform

Flooding for the final landform was assessed for a range of events up to the PMF. The results show that:

- There would be no ingress of floodwater into the Mimosa/Besgrove, Deep Creek, Stewarton North and Stewarton South voids for all events up to and including the PMF.
- There would no ingress of floodwater into the Ramp 30 void for all events up to and including the 0.1% AEP event.
- Predicted peak velocities adjacent to the final landform are non-erosive. Therefore, the final landform is expected to be stable and self-sustaining post-closure from a flood perspective.

10.5 IMPACT ON GREAT BARRIER REEF CATCHMENT WATERS

10.5.1 Overview

A separate SWA memorandum has been prepared to support a Referral for the Project under the EPBC Act (WRM, 2026). This memorandum (provided in Appendix C) specifically addresses the potential for the Project to result in surface water impacts on the GBR. The key findings of the WRM (2026) have been summarised below.

10.5.2 Contribution of sediments to the GBR due to specific land uses

The 2022 Scientific Consensus Statement (Prosser, 2024) investigated how much anthropogenic sediment and particulate nutrients are exported from GBR catchments, the most important characteristics of anthropogenic sediments and particulate nutrients and the primary sources. The findings in Posser (2024) are summarised below.

Concentrations of sediment and particulate nutrients have been measured in subcatchments dominated by particular land uses. The findings from Packett et al (2009) found a strong correlation in the Fitzroy River between the concentration of suspended sediment and the proportion of cropland in the contributing catchment, suggesting that cropland is the more significant sediment source. Prosser (2024) noted that in the Fitzroy River, mines make up a very small proportion of the basin and located much further inland.

Bartley et al (2017) quantified the contributions of suspended sediment by land use by region. Bartley et al (2017) fond that in the Fitzroy River catchment, the estimated proportion of total fine sediment loads exported to the GBR from each land use are approximately 40% from grazing, approximately

40% from streambank erosion, approximately 10% from dryland cropping, approximately 5% from nature conservation and the remainder of approximately 5% from forestry, irrigated cropping, dairy, horticulture, sugarcane, urban and other land uses.

10.5.3 Project impacts

The Project would result in a reduction in undisturbed catchment runoff volumes. This in turn, is expected to reduce the TSS, TN and TP loads generated from undisturbed land to the greater Fitzroy basin and ultimately to the GBR.

There are no proposed changes to the currently approved controlled release strategy as a result of the Project and as such, controlled releases would continue to be undertaken in accordance with the EA release conditions. Additionally, the Project is not expected to increase the risk of uncontrolled discharges from site storages to receiving waterways.

The site water balance assessment (HydroBalance, 2026) predicted that the Project would increase controlled releases by around 11% - 20% (110 - 130 ML) under median climate conditions compared to the Approved operations. However, the potential increase in controlled releases is primarily due to the groundwater modelling outputs that predict an increase in groundwater inflows during the operation of the Project. Groundwater inflows are not anticipated to result in a significant increase in the TSS load to the mine water management system. Potential releases of fine sediments from controlled releases will be partially offset by the loss of undisturbed catchment that would otherwise contribute to sediment loads to the GBR.

Bartley et al (2017) estimated that approximately 1,805 kilotonnes (kt) of suspended sediment is released annually to the GBR from the Fitzroy River catchment. Assuming that controlled releases discharge an additional 130 ML per year at a TSS concentration of 462 mg/L (the median TSS at Taurus Creek D/S), this equates to approximately 0.06 kt of sediments annually. This represents less than 0.01% of the estimated total sediment load to the GBR from the Fitzroy River catchment. The BWM mine water storages including NTCD (RP2), NDCD (RP3) and TFD (RP4) provide extended detention and settling opportunities that promote sediment deposition. Therefore, the above estimate of sediment loads from controlled releases may be conservative and would need to be reviewed with additional monitoring for TSS. Surface water monitoring of the receiving environment (which already includes TSS) would continue in accordance with the FRREMP.

The water balance assessment (HydroBalance, 2026) indicates that the Project can be managed within the existing water management system and existing controlled release framework, with releases continuing to occur only in accordance with the approved EA (Schedule F) release conditions. Accordingly, the Project is not expected to result in a material residual impact to GBR catchment waters.

10.6 CUMULATIVE IMPACTS

The proposed release strategy to Blackwater Creek and the Mackenzie River is informed by existing release conditions applied to nearby operating coal mines. These conditions are embedded within a broader strategic framework designed to manage the cumulative impacts of water releases and mining activities. As such, the cumulative effects on surface water quality and associated EVs are expected to be negligible.

The site's water management system has been designed to minimise the need for controlled releases. When releases are required, they are conducted under strict release conditions, ensuring minimal impact on receiving water quality. With the implementation of the proposed mitigation measures, including sediment control, any potential contribution to salinity in the Mackenzie River from sediment dam discharges is expected to be minimal.

Given that the incremental impacts associated with the Project are not expected to be material, these impacts would not compound into significant cumulative impacts and a detailed cumulative impact

assessment, including sediment and water releases from other mining operations in the Blackwater Creek catchment, is not considered necessary.

Releases from coal mines typically occur during high-flow conditions, which help dilute discharge concentrations and reduce environmental risks. During the 2023–24 reporting period, 27% of coal mines in the Fitzroy Basin participated in the FRREMP program, with 25 authorised releases recorded. During the 2023–24 reporting period, 27% of coal mines in the Fitzroy Basin participated in the FRREMP program, with 25 authorised releases recorded. The total salinity load discharged in the Mackenzie sub-basin was approximately 1,292 tonnes, primarily during high-flow events. When considering potential discharges from these operations under current release rules, the overall reduction in catchment area and associated streamflow is relatively minor.

Receiving water quality was analysed for the Mackenzie River at Bingegang (refer to Section 3.4.3), which is located downstream of all active mining operations within the Blackwater Creek catchment. The water quality monitoring data indicates that physiochemical parameters and the concentration of nutrients and metalloids in the Mackenzie River at Bingegang have stayed below the adopted local creek WQOs and the Sub-Basin WQOs (WQ 1304).

10.7 FINAL VOID CHARACTERISTICS

The final landform for the Project would include five residual voids. Water balance modelling results for the final landform show that:

- Void water levels would be influenced by groundwater inflow, rainfall, runoff, and evaporation, with equilibrium levels expected below overflow levels at all five residual voids, even after extreme long-duration storm events.
- The salinity of the pit lake in the Mimosa/Besgrove, Deep Creek and Stewarton North voids would increase over time due to evapoconcentration.
- The salinity of the pit lake in the Ramp 30 and Stewarton South voids fluctuates over time as the void empties in cycles.
- The modelling confirms that the residual voids would comply with EA EPML00717813, which requires that voids must not cause serious environmental harm to land, surface waters, or recognised groundwater aquifers, other than the harm constituted by the existence of the void itself.

10.8 MONITORING

The existing water management and monitoring regime for the approved EA would be continued for the Project with ESC as appropriate. Key elements of surface water management and monitoring include:

- The WMP would be updated as mine plans are refined, and new water management infrastructure is designed and constructed.
- Management of erosion and sediment control through implementation of the ESCP.
- Surface water monitoring would continue in accordance with the WMP. Current monitoring locations are sufficient to cover any additional disturbance due to the Project.
- Regular inspections and maintenance of dams, pipelines, and sediment control structures ensure system reliability.
- Real-time monitoring of water inventory, sediment dam overflow, and controlled release volumes ensures timely responses to changing conditions.

10.9 SUMMARY OF MITIGATION MEASURES

The proposed mitigation measures are summarised as follows:

- The controlled release of MAW would continue to be restricted by the existing EA release conditions for the duration of the Project.
- The Project would not alter the contributing catchments or drainage arrangements of existing MAW storages or sediment dams that have a higher potential for uncontrolled discharge.
- Temporary flood protection levees would be constructed for the operational stage of the Project to provide flood immunity to the open cut pits for flood events up to and including the 0.1% AEP design event. These temporary flood protection levees would be removed post-closure, and the final landform would be configured such that the rehabilitated out-of-pit overburden areas would prevent floodwater from entering the residual voids.
- A proposed clean water drain along the southeastern side of the future Stewarton Pit expansion area would be in place during the operational stage of the Project and would also form part of the final landform post-closure. The proposed clean water drain has been designed to be geomorphically stable and self-sustaining.
- Whitehaven Blackwater will continue to be a participant in the FRREMP.
- Surface water quality monitoring of receiving waters would continue to be undertaken in accordance with the requirements of EA EPML00717813. Current monitoring locations are sufficient to cover the any additional disturbance because of the Project.
- The existing *BWM Water Management Plan* would be updated, as required as mine plans are refined, to reflect any changes to the site water management system and surface water monitoring locations resulting from the Project.

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APPENDIX A HYDROLOGIC MODEL DEVELOPMENT

A.1 OVERVIEW

Hydrologic models were developed using the Unified River Basin Simulator (URBS) software package (Carroll, 2024), for the Blackwater Creek catchment (including Deep Creek, Emu Creek, Two Mile Gully and Taurus Creek) and the Sagittarius Creek catchment. The URBS models incorporate the latest climate change guidance from Australian Rainfall and Runoff (ARR) 2019 Version 4.2 (Ball et al., 2019). The following sections describe the development, calibration and validation of the Blackwater Creek and Sagittarius Creek URBS hydrologic models.

A.2 EXISTING DRAINAGE CHARACTERISTICS

The existing drainage characteristics in the vicinity of the Blackwater North Extension Project (the Project) area are described in Section 3.1 and shown in Figure 3.3.

A.3 AVAILABLE DATA

A.3.1 Overview

The following data was provided by Whitehaven Coal Limited (Whitehaven) for this study:

- previous hydrologic and hydraulic studies;
- recorded rainfall and water level data; and
- Light Detection and Ranging (LiDAR) topographic data.

A.3.2 Previous studies

A.3.2.1 Blackwater Mine Flood Study (2021)

The Blackwater Mine (BWM) Flood Study, undertaken by GHD Group Pty Ltd (GHD) (2021), assessed existing flood risks across BWM. XP-RAFTS hydrologic and Two-Dimensional Unsteady FLOW (TUFLOW) hydraulic models were developed for this study. The GHD (2021) study report was provided for this study, but the XP-RAFTS and TUFLOW models were not available.

A.3.2.2 Blackwater Mine Progressive Rehabilitation and Closure Plan (2024)

The XP-RAFTS hydrologic and TUFLOW hydraulic models used by SLR Consulting Australia Pty Ltd for the previous *Progressive Rehabilitation and Closure Plan Rehabilitation flood assessment* (SLR, 2024) were provided for this study. These models appear to have been developed based on the GHD (2021) hydrologic and hydraulic models. Separate models were provided for the Sagittarius Creek and Blackwater Creek catchments.

A.3.3 Rainfall and water level data

Figure A.1 shows the location of three subdaily rainfall (pluviograph) stations and six stream gauging stations across BWM. Table A.1 and Table A.2 show details of these stations.

Within the Project area, the Two Mile Gully (Station Number – 330124) and Taurus Creek downstream (D/S) (Station Number – 330101) stream gauging stations are located within the Blackwater Creek catchment. There are no stream gauging stations within the Sagittarius Creek catchment.

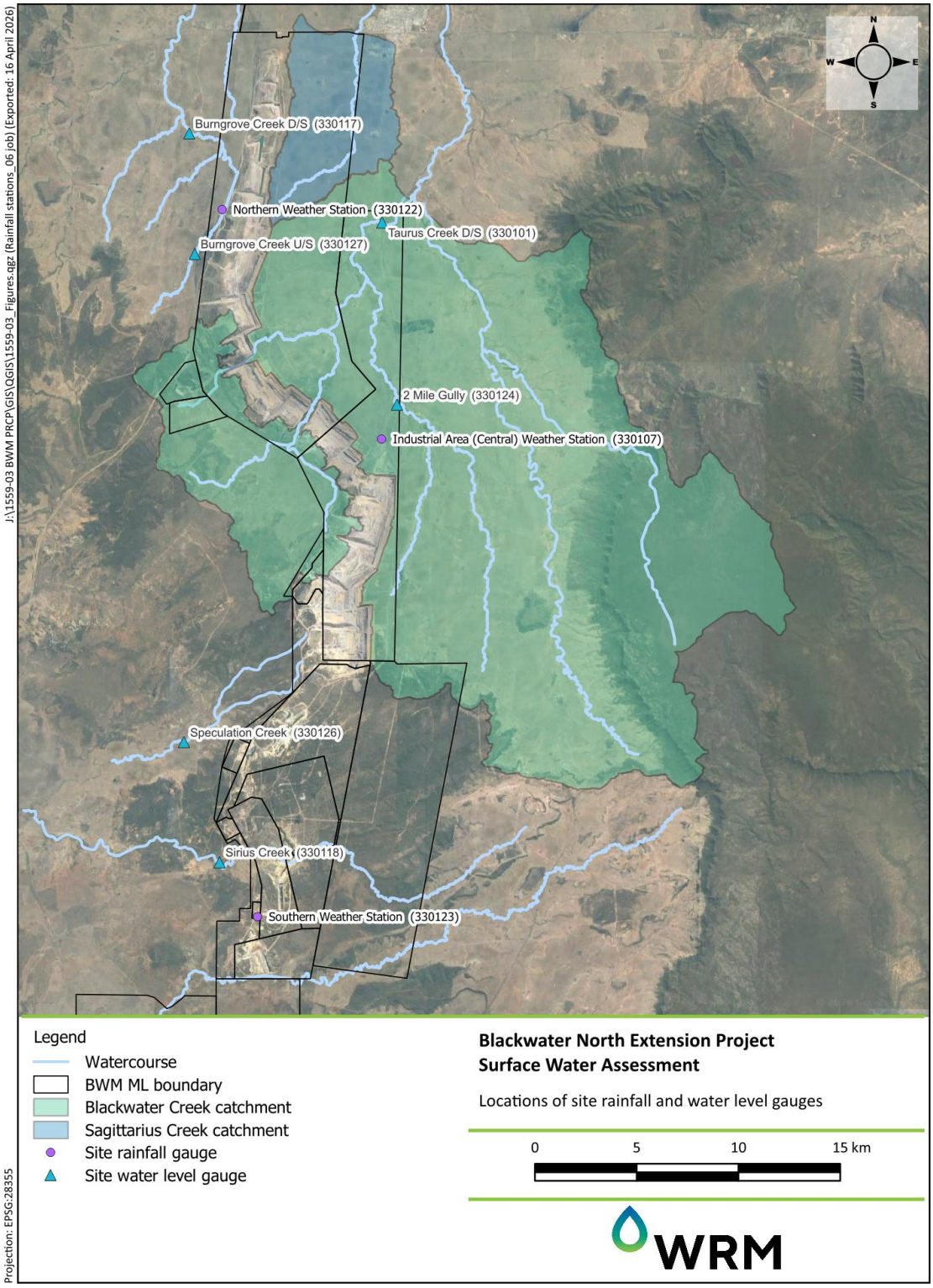


Figure A.1 Locations of site rainfall and water level gauges

Table A.1 Details of available sub-daily rainfall (pluviograph) stations

Station Number	Station Name
330122	Northern Weather Station
330107	Industrial Areal (Central) Weather Station
330123	Southern Weather Station

Table A.2 Details of available stream gauging stations

Station Number	Station Name	Supplied data period
330101	Taurus Creek D/S	January 2016 – January 2025
330118	Sirius Creek D/S	January 2016 – January 2025
330124	Two Mile Gully	January 2016 – January 2025
330126	Speculation Creek	January 2016 – January 2025
330127	Burngrove Creek U/S[a]	January 2016 – January 2025
330117	Burngrove Creek D/S	January 2016 – January 2025

[a] – U/S = upstream

A.3.4 Rating curves

Whitehaven provided rating curves for the Taurus Creek D/S and Two Mile Gully gauges relevant to the Project area (referred to in this report as the Whitehaven rating curves). It was uncertain if the Whitehaven rating curves were derived from actual gaugings or from hydraulic modelling. For this study, the rating curves were verified and then modified and/or extended if necessary, using hydraulic modelling where detailed LiDAR data is available.

Figure A.2 and Figure A.3 compare the Whitehaven rating curves, the TUFLOW model generated rating curves and the final adopted rating curves for the Taurus Creek D/S and Two Mile Gully gauges, respectively. For these four gauges, the “adopted” rating curves were used to convert recorded water levels (in metres AHD [mAHD]) into discharges (in cubic metres per second [m^3/s]) for the hydrologic model calibration.

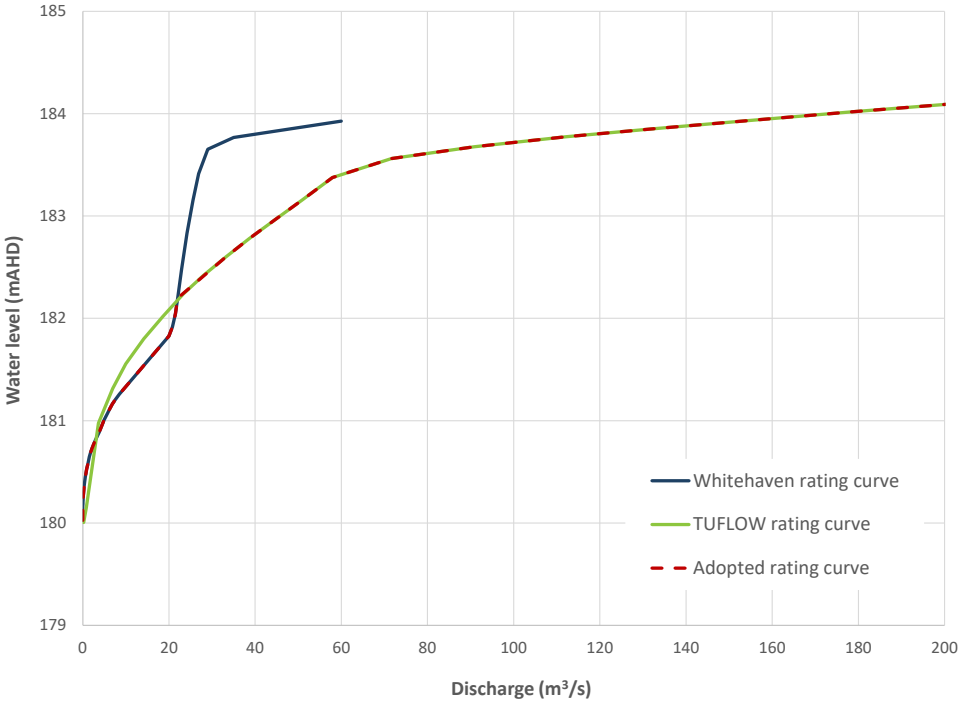


Figure A.2 **Comparison of Whitehaven-supplied, TUFLOW and adopted rating curves, Taurus Creek D/S gauging station**

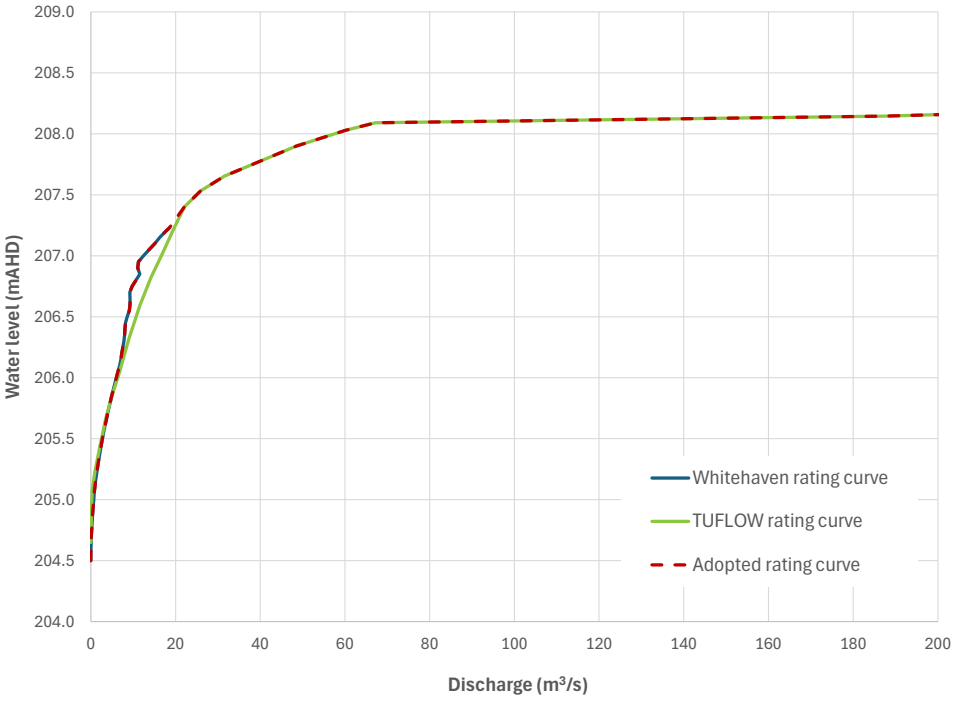


Figure A.3 **Comparison of Whitehaven-supplied, TUFLOW and adopted rating curves, Two Mile Gully gauging station**

A.3.5 Topographic data

The available topographic data used for this study is described as follows:

- A 1 metre (m) resolution LiDAR covering the BWM mining lease area captured in February 2024 (referred to as the 2024 LiDAR data);
- A 1 m resolution LiDAR captured in February 2025, covering the active mining pits of BWM and the recent upgrade to the New Taurus Creek Dam (referred to as the 2025 LiDAR data); and
- A 30 m resolution Copernicus Digital Surface Model (DSM) satellite ground level observation data obtained from the European Space Programme on 31 January 2025 (referred to as the Copernicus DSM data).

A.4 HYDROLOGIC MODEL DEVELOPMENT

A.4.1 Overview

URBS hydrologic models were developed for the Blackwater Creek catchment (including Taurus Creek and Two Mile Gully) and the Sagittarius Creek catchment.

URBS is a runoff-routing computer model that uses a network of conceptual storages to represent the routing of rainfall excess through a catchment. The URBS model was used in the "split mode" which enables the separate simulation of catchment and channel routing.

The URBS split model approach, which separates the channel and catchment storage components of each subcatchment for routing purposes, was adopted. Subcatchment routing was computed using the Aitken's equation, allowing the URBS model to provide higher resolution local subcatchment inflow hydrographs for the TUFLOW hydraulic model.

Routing was undertaken using Laurenson's (1964) procedure based on isochrones. Channel routing link lengths were estimated for each subcatchment in a boundary-boundary approach, and the inflow from the sub-catchment into the channel was assumed to occur at the boundary rather than at the centroid of the subcatchments.

The initial and continuing loss method was adopted for this study. This model assumes that there is an initial loss (IL) in millimetres (mm) before any rainfall becomes runoff. After this, a continuing loss (CL) rate in millimetres per hour (mm/h) is applied to the rainfall.

Full details of the URBS model and its features are given in the URBS User Manual (Carroll, 2024).

The Blackwater Creek URBS model was calibrated to recorded data for the March 2017 and January 2020 flood events. The Sagittarius Creek URBS model could not be calibrated due to the absence of any stream gauges within the catchment.

URBS models were developed for the following scenarios:

- 'Existing conditions' – This scenario was simulated based on year 2030 near-term climate conditions, for the current configuration of BWM (excluding the Project).
- 'Operational (2055) conditions' – This scenario was simulated based on year 2030 near-term climate conditions, for the year 2055 BWM configuration where the Project is it its maximum disturbance footprint.
- 'Final landform conditions' – This scenario was simulated based on year 2100 long-term climate conditions, for the final landform stage of BWM.
- The 'existing conditions' and 'operational (2055) conditions' URBS models were simulated for the following design flood events:
  - 50% (1 in 2) annual exceedance probability (AEP);

- 5% (1 in 20) AEP;
- 2% (1 in 50) AEP;
- 1% (1 in 100) AEP; and
- 0.01% (1 in 1,000) AEP.

- The 'final landform conditions' URBS models were simulated for the following design flood events:
  - 1% (1 in 100) AEP;
  - 0.01% (1 in 1,000) AEP; and
  - Probable Maximum Precipitation (PMP).

The 50% to 1% AEP design discharge estimates (2030 climate conditions) were validated against estimates derived using the Rational Method (RM), the Quantile Regression Technique (QRT) (Palmen and Weeks, 2015) and the Regional Flood Frequency Estimation (RFFE) method.

A.4.2 Model configuration

A.4.2.1 Subcatchment parameters

The URBS model subcatchments were assigned with area, slope, imperviousness, and Pervious Area Manning's 'n' (PERN) parameters. Subcatchment slopes were calculated based on the available topographic data.

Figure A.4 shows the existing conditions URBS model subcatchments adopted for the Sagittarius Creek. The model covers an area of 42.7 square kilometres (km^2) and consists of 28 subcatchments, ranging in size from 0.02 km^2 to 3.34 km^2. Table A.3 shows the subcatchment parameters adopted in the model under existing land use conditions.

Figure A.5 shows the existing conditions URBS model subcatchments adopted for the Blackwater Creek model. The model covers an area of 509.8 km^2 and consists of 226 subcatchments, ranging in size from 0.02 km^2 to 17.8 km^2. Table A.4 shows the subcatchment parameters adopted in the model under existing land use conditions.

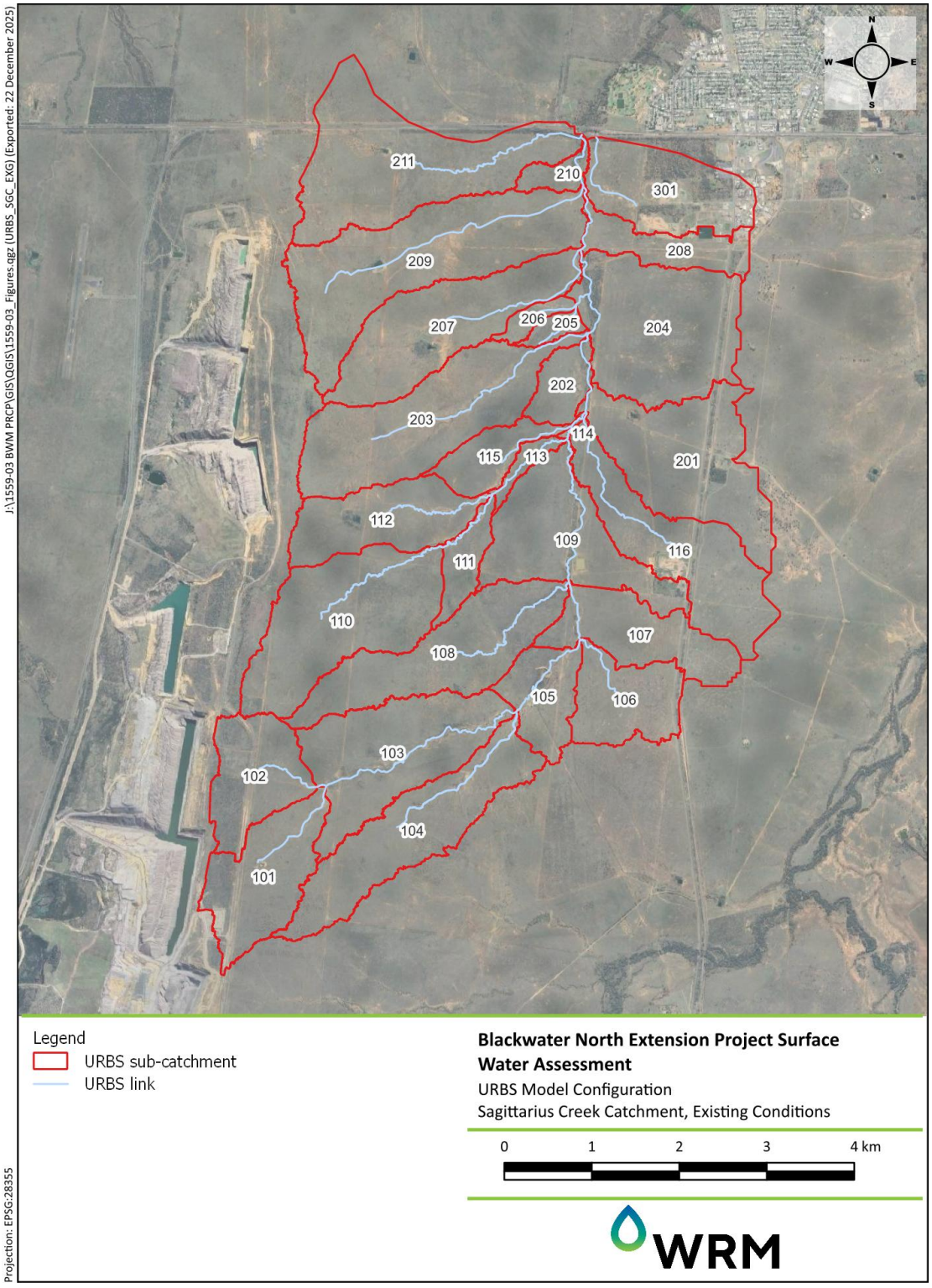


Figure A.4 URBS model configuration, Sagittarius Creek catchment, existing conditions

Table A.3 URBS model subcatchment parameters for the Sagittarius Creek catchment

ID	Area (km^2)	Percentage Impervious (percent [%])	PERN	Catchment Slope (metres per metre [m/m])
101	1.58	0	0.07	0.009
102	1.29	0	0.07	0.008
103	2.37	0	0.07	0.007
104	2.19	0	0.07	0.007
105	0.87	0	0.07	0.007
106	1.14	0	0.07	0.008
107	1.37	0	0.07	0.009
108	2.20	0	0.07	0.008
109	2.02	0	0.07	0.007
110	2.69	0	0.07	0.008
111	0.46	0	0.07	0.009
112	1.46	0	0.07	0.009
113	0.19	0	0.07	0.007
114	0.02	0	0.07	0.005
115	0.63	0	0.07	0.007
116	2.12	0	0.07	0.007
201	2.44	0	0.07	0.010
202	0.51	0	0.07	0.004
203	2.72	0	0.07	0.007
204	2.69	0	0.07	0.010
205	0.17	0	0.07	0.007
206	0.20	0	0.07	0.007
207	2.22	0	0.07	0.008
208	0.81	0	0.07	0.008
209	3.34	0	0.07	0.007
210	0.27	0	0.07	0.003
211	3.14	0	0.07	0.005
301	1.58	0	0.07	0.008

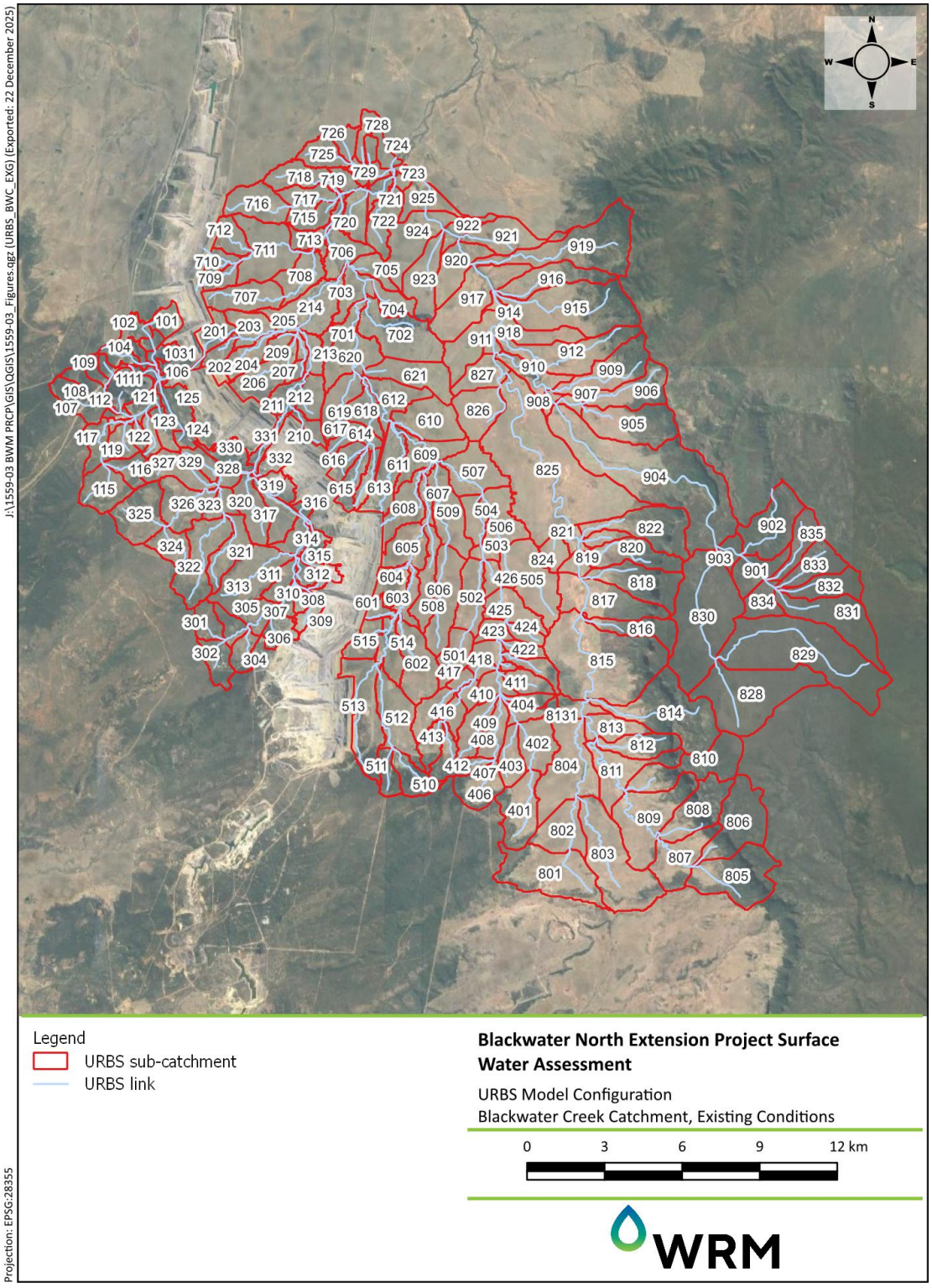


Figure A.5 URBS model configuration, Blackwater Creek catchment, existing conditions

Table A.4 URBS catchment parameters of the Blackwater Creek catchment model

ID	Area (km^2)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
101	1.11	0	0.07	0.019
102	0.88	0	0.07	0.009
103	0.47	0	0.07	0.022
104	0.97	0	0.07	0.028
105	0.51	0	0.07	0.021
106	0.37	0	0.07	0.004
107	2.02	0	0.07	0.030
108	1.10	0	0.04	0.070
109	0.65	0	0.07	0.028
110	0.42	0	0.07	0.044
111	0.02	0	0.07	0.006
112	0.10	0	0.07	0.009
113	1.94	0	0.07	0.005
114	0.33	0	0.07	0.020
115	2.55	0	0.07	0.017
116	1.21	0	0.07	0.015
117	1.61	0	0.07	0.012
118	0.28	0	0.07	0.010
119	1.14	0	0.07	0.036
120	0.50	0	0.07	0.029
121	0.95	0	0.07	0.009
122	0.79	0	0.07	0.023
123	1.05	0	0.07	0.018
124	0.60	0	0.07	0.027
125	1.72	0	0.07	0.013
201	1.45	0	0.07	0.006
202	1.26	0	0.07	0.012
203	1.77	0	0.07	0.007
204	1.65	0	0.07	0.008
205	0.32	0	0.07	0.002
206	2.94	0	0.07	0.008
207	0.46	0	0.07	0.007
208	0.39	0	0.07	0.003
209	0.67	0	0.07	0.008

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
210	0.83	0	0.07	0.010
211	1.36	0	0.07	0.006
212	1.54	0	0.07	0.011
213	1.04	0	0.07	0.004
214	3.78	0	0.07	0.004
301	1.34	0	0.07	0.033
302	1.71	0	0.07	0.018
303	1.05	0	0.07	0.026
304	1.20	0	0.07	0.026
305	1.23	0	0.07	0.009
306	1.29	0	0.07	0.019
307	0.62	0	0.07	0.019
308	0.56	0	0.07	0.037
309	0.83	0	0.07	0.044
310	0.10	0	0.07	0.016
311	1.08	0	0.07	0.015
312	0.69	0	0.07	0.030
313	4.53	0	0.07	0.017
314	1.21	0	0.07	0.004
315	1.44	0	0.07	0.007
316	0.39	0	0.07	0.074
317	1.80	0	0.07	0.009
318	0.78	0	0.07	0.053
319	0.35	0	0.07	0.085
320	2.47	0	0.07	0.013
321	2.35	0	0.07	0.017
322	4.18	0	0.07	0.016
323	1.05	0	0.07	0.013
324	1.70	0	0.07	0.019
325	3.44	0	0.07	0.023
326	3.05	0	0.07	0.013
327	2.58	0	0.07	0.013
328	0.66	0	0.07	0.004
329	1.04	0	0.07	0.015
330	1.44	0	0.07	0.018

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
331	0.80	0	0.07	0.006
332	0.57	0	0.07	0.029
401	3.50	0	0.07	0.015
402	2.59	0	0.07	0.011
403	1.73	0	0.07	0.012
404	0.92	0	0.07	0.017
405	0.74	0	0.07	0.032
406	2.38	0	0.07	0.018
407	0.62	0	0.07	0.027
408	1.72	0	0.07	0.012
409	2.13	0	0.07	0.015
410	1.21	0	0.07	0.007
411	1.35	0	0.07	0.030
412	1.33	0	0.07	0.022
413	1.28	0	0.07	0.024
414	0.97	0	0.07	0.016
415	0.66	0	0.07	0.015
416	1.65	0	0.07	0.013
417	0.55	0	0.07	0.011
418	0.57	0	0.07	0.011
419	0.21	0	0.07	0.018
420	1.00	0	0.07	0.015
421	1.25	0	0.07	0.026
422	0.87	0	0.07	0.015
423	1.00	0	0.07	0.008
424	0.79	0	0.07	0.016
425	2.31	0	0.07	0.009
426	1.00	0	0.07	0.005
501	2.03	0	0.07	0.01
502	2.62	0	0.07	0.006
503	0.56	0	0.07	0.005
504	1.46	0	0.07	0.005
505	4.78	0	0.07	0.007
506	2.93	0	0.07	0.006
507	3.35	0	0.07	0.004

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
508	3.88	0	0.07	0.006
509	3.46	0	0.07	0.006
510	1.80	0	0.07	0.032
511	1.23	0	0.07	0.031
512	3.76	0	0.07	0.015
513	4.77	0	0.07	0.013
514	1.85	0	0.07	0.007
515	1.57	0	0.07	0.012
601	0.63	0	0.07	0.012
602	3.63	0	0.07	0.008
603	1.13	0	0.07	0.005
604	1.69	0	0.07	0.011
605	2.43	0	0.07	0.006
606	2.29	0	0.07	0.007
607	0.69	0	0.07	0.004
608	2.44	0	0.07	0.005
609	2.66	0	0.07	0.006
610	3.38	0	0.07	0.006
611	2.97	0	0.07	0.007
612	2.44	0	0.07	0.006
613	1.09	0	0.07	0.009
614	0.38	0	0.07	0.006
615	1.36	0	0.07	0.007
616	1.19	0	0.07	0.010
617	1.02	0	0.07	0.013
618	1.58	0	0.07	0.003
619	2.57	0	0.07	0.009
620	3.14	0	0.07	0.008
621	3.18	0	0.07	0.009
701	1.23	0	0.07	0.005
702	4.86	0	0.07	0.007
703	1.79	0	0.07	0.005
704	1.35	0	0.07	0.006
705	1.22	0	0.07	0.012
706	2.13	0	0.07	0.005

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
707	2.90	0	0.07	0.008
708	2.27	0	0.07	0.007
709	0.93	0	0.07	0.010
710	0.89	0	0.07	0.012
711	4.49	0	0.07	0.008
712	1.47	0	0.07	0.012
713	1.27	0	0.07	0.004
714	0.55	0	0.07	0.002
715	1.15	0	0.07	0.006
716	2.84	0	0.07	0.011
717	1.89	0	0.07	0.009
718	2.25	0	0.07	0.008
719	0.73	0	0.07	0.007
720	1.69	0	0.07	0.005
721	0.77	0	0.07	0.004
722	2.29	0	0.07	0.009
723	0.36	0	0.07	0.002
724	0.88	0	0.07	0.008
725	1.67	0	0.07	0.007
726	1.07	0	0.07	0.007
727	0.61	0	0.07	0.008
728	0.92	0	0.07	0.012
729	0.52	0	0.07	0.004
730	0.46	0	0.07	0.012
801	6.29	0	0.07	0.011
802	3.02	0	0.07	0.013
803	7.28	0	0.07	0.009
804	6.31	0	0.07	0.009
805	5.39	0	0.07	0.075
806	4.86	0	0.07	0.108
807	3.45	0	0.07	0.040
808	3.68	0	0.07	0.107
809	5.80	0	0.07	0.044
810	4.62	0	0.07	0.106
811	3.55	0	0.07	0.008

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
812	2.30	0	0.07	0.059
813	1.92	0	0.07	0.021
814	7.10	0	0.07	0.074
815	11.57	0	0.07	0.015
816	2.31	0	0.07	0.104
817	4.75	0	0.07	0.072
818	3.83	0	0.07	0.076
819	0.74	0	0.07	0.010
820	3.15	0	0.07	0.039
821	0.75	0	0.07	0.005
822	4.47	0	0.07	0.062
824	1.24	0	0.07	0.010
825	17.8	0	0.07	0.004
826	2.94	0	0.07	0.014
827	2.01	0	0.07	0.008
828	8.08	0	0.07	0.019
829	12.06	0	0.07	0.015
830	10.24	0	0.07	0.009
831	4.87	0	0.07	0.030
832	2.36	0	0.07	0.039
833	2.38	0	0.07	0.070
834	1.62	0	0.07	0.034
835	2.01	0	0.07	0.045
901	2.16	0	0.07	0.037
902	4.27	0	0.07	0.034
903	0.86	0	0.07	0.031
904	15.68	0	0.07	0.028
905	4.65	0	0.07	0.041
906	3.15	0	0.07	0.034
907	0.56	0	0.07	0.006
908	0.42	0	0.07	0.010
909	3.92	0	0.07	0.027
910	2.02	0	0.07	0.005
911	0.34	0	0.07	0.005
912	4.87	0	0.07	0.022

ID	Area (km²)	Percentage Impervious (%)	PERN 'n'	Catchment Slope (m/m)
914	0.39	0	0.07	0.004
915	8.00	0	0.07	0.022
916	3.12	0	0.07	0.022
917	5.05	0	0.07	0.006
918	5.11	0	0.07	0.005
919	7.07	0	0.07	0.030
920	2.75	0	0.07	0.007
921	3.07	0	0.07	0.011
922	0.80	0	0.07	0.002
923	3.09	0	0.07	0.007
924	4.33	0	0.07	0.005
925	2.19	0	0.07	0.002
1031	0.72	0	0.07	0.012
1111	0.44	0	0.07	0.021
3091	0.20	0	0.07	0.036
8131	1.06	0	0.07	0.021
8211	0.76	0	0.07	0.026

A.4.2.2 Adopted global Unified River Basin Simulator model parameters

The global URBS model parameters included channel lag parameter (alpha [α]), catchment storage parameter (beta [β]), catchment non-linearity (M) and channel routing exponent (N). The following global URBS parameters were adopted for all seven models:

- Channel routing α = 0.1
- Catchment routing β = 1.0
- Catchment routing exponent M = 0.715
- Channel routing exponent N = 1.0

Sub-catchment routing was computed using the Aitken's equation, allowing the URBS model to provide local subcatchment inflow hydrographs of reasonable resolution. The non-linear routing parameter 'M' was set to 0.715, as recommended in URBS user manual for when the Aitken's equation is used.

A.4.2.3 Initial and continuing losses

The IL and CL method of accounting for rainfall losses was adopted for this study. For the calibration events, different initial and continuing losses were derived for each calibration event to reflect different antecedent catchment conditions (refer to Section A.5.4). Design event ILs and CLs were derived during the model validation process (refer to Section A.6.2).

A.5 HYDROLOGIC MODEL CALIBRATION

A.5.1 Methodology

The URBS models for the Blackwater Creek catchment was calibrated for the March 2017 and January 2020 flood events. The purpose of the model calibration was to achieve the best possible match between URBS-modelled discharge hydrographs against the recorded discharge hydrographs, using a common set of model parameters between flood events.

A.5.2 Selection of calibration events

A.5.2.1 Overview

The March 2017 and January 2020 flood events were selected for calibration due to the availability of data and because the rainfalls during these events triggered similar responses at adjacent catchments for which data is available. The March 2017 and January 2020 events were also the selected calibration events in the GHD (2021) study.

Table A.5 shows the adopted historical event simulation periods for the calibration events in the URBS model. Table A.6 shows the recorded rainfall depths at each station for the calibration events. Table A.7 shows the recorded peak discharges at each gauging station for the calibration events.

Table A.5 Calibration event simulation periods

Calibration Event	Simulation period
March 2017	28 March (0000 hours) – 1 April (0000 hours) - 4 days
January 2020	24 January (0000 hours) – 27 January (0000 hours) - 3 days

Table A.6 Total rainfall depths recorded during the 2017 and 2020 events

Station Number	Station Name	Rainfall depth (mm)	
		March 2017	January 2020
330107	Central Weather Station	119.0	148.0
330122	Northern Weather Station	139.5	78.5
330123	Southern Weather Station	142.5	49.5

Table A.7 Peak discharges recorded during calibration events

Station Number	Station Name	Peak discharge (m^3/s)	
		March 2017	January 2020
330101	Taurus Creek D/S	117	156.8
330124	Two Mile Gully	16.2	50.4

A.5.2.2 March 2017 event

Figure A.6 and Figure A.7 show the recorded rainfall intensities (in mm/h) at the Northern Weather Station and Central Weather Station site pluviograph stations, respectively, for the March 2017 event. Figure A.8 and Figure A.9 show the recorded water levels (in metres Reduced Level [m]) at the Two Mile Gully and Taurus Creek D/S gauges, respectively, for the March 2017 event.

A.5.2.3 January 2020 event

Figure A.10 and Figure A.11 show the recorded rainfall intensities at the Northern Weather Station and Central Weather Station site pluviograph stations, respectively, for the January 2020 event. Figure A.12 and Figure A.13 show the recorded water levels at the Two Mile Gully and Taurus Creek D/S gauges, respectively, for the January 2020 event.

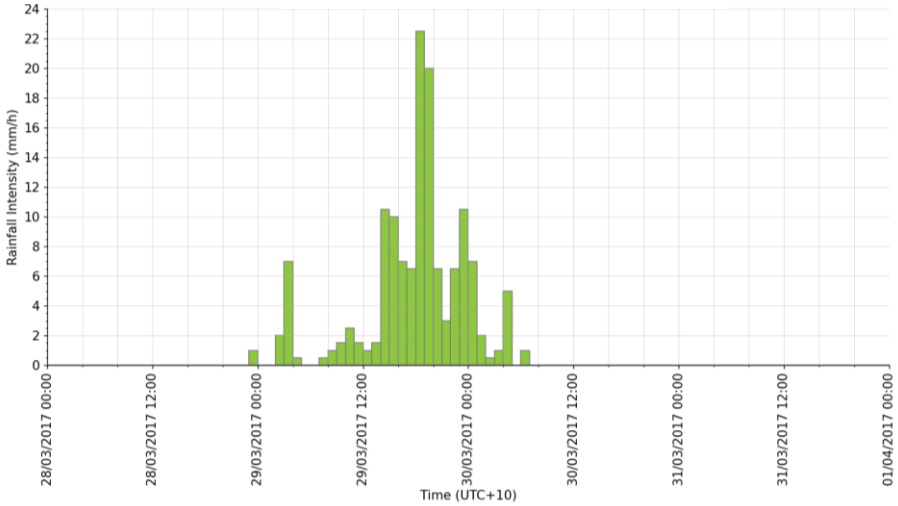


Figure A.6 Recorded rainfall at Northern Weather Station (330122), 2017 event

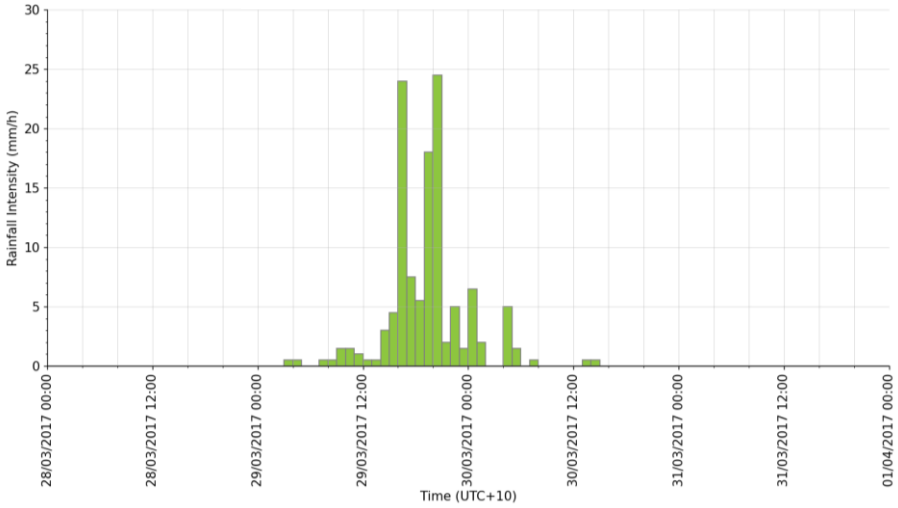


Figure A.7 Recorded rainfall at Central Weather Station (330107), 2017 event

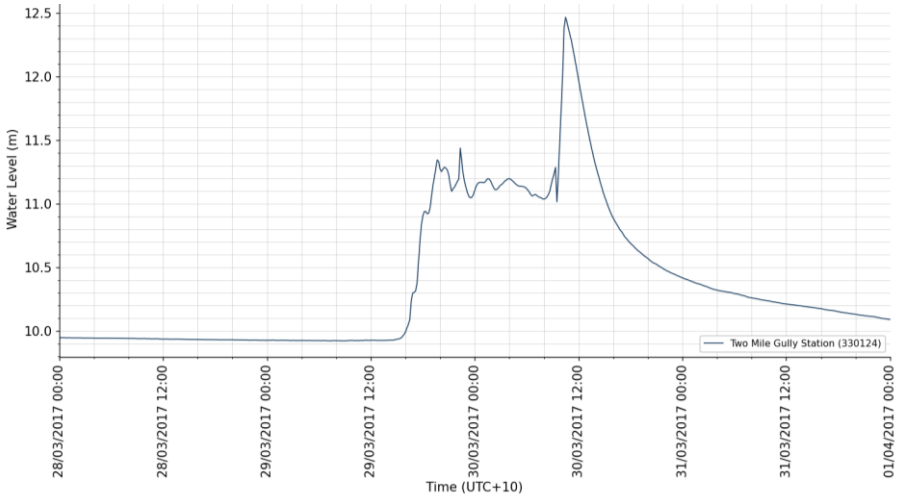


Figure A.8 Recorded water level at Two Mile Gully Station (330124), 2017 event

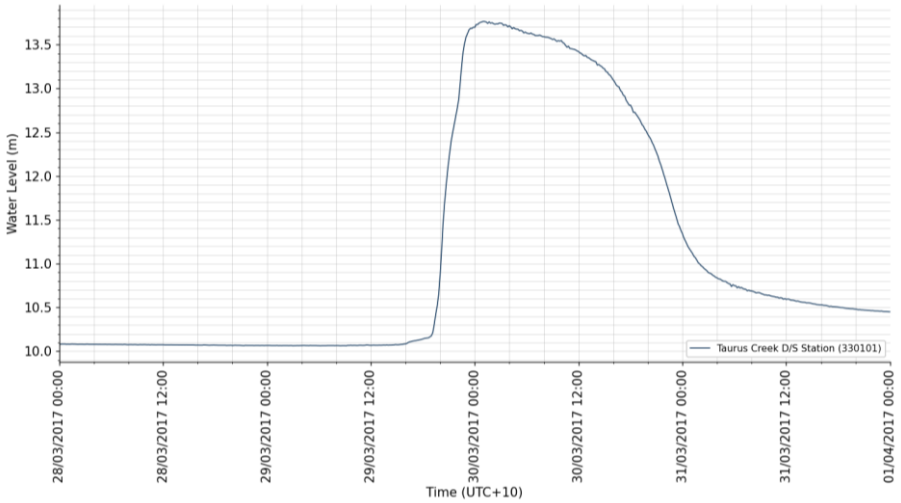


Figure A.9 Recorded water level at Taurus Creek D/S Station (330101), 2017 event

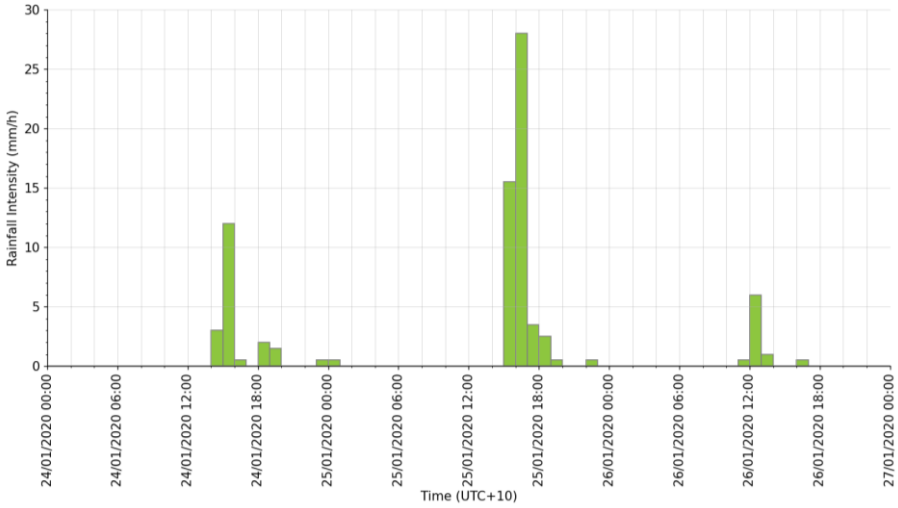


Figure A.10 Recorded rainfall at Northern Weather Station (330122), 2020 event

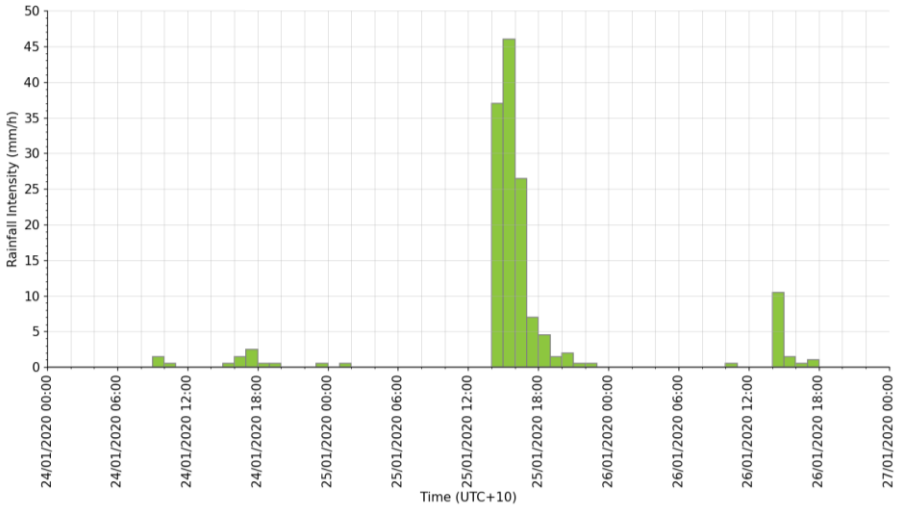


Figure A.11 Recorded rainfall at Central Weather Station (330107), 2020 event

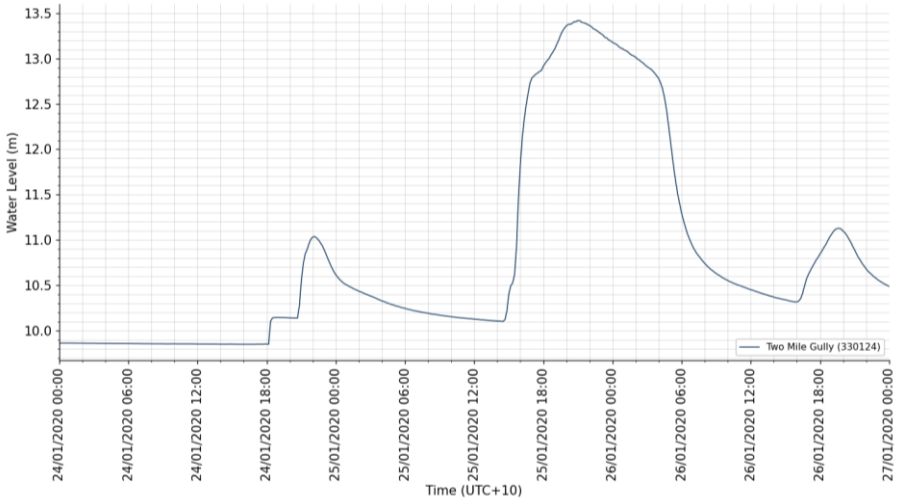


Figure A.12 Recorded water level at Two Mile Gully Station (330124), 2020 event

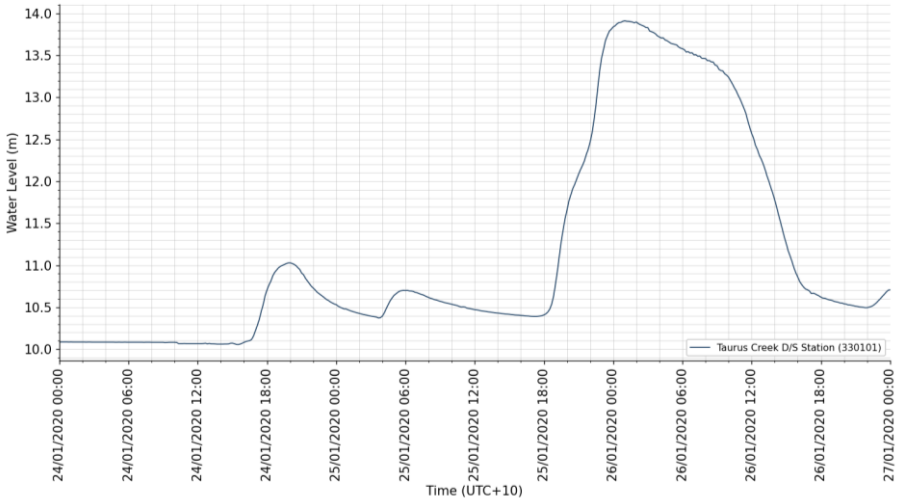


Figure A.13 Recorded water level at Two Mile Gully Station (330124), 2020 event

A.5.3 Assignment of subcatchment rainfalls

Each URBS subcatchment was assigned a rainfall hyetograph based on the three nearest pluviograph stations, using the URBS SUBRAIN utility. The SUBRAIN utility calculates the weighted average rainfall depth for each subcatchment using an inverse distance squared method based on the relative distance between the rainfall station location and the subcatchment centroid.

A.5.4 Initial and continuing losses

Table A.8 shows the IL and CL adopted for the Blackwater Creek catchment for the two calibration events. A CL of 3.5 mm/h was for both events. Different ILs were adopted for each event which reflect the different antecedent conditions prior to each event.

Table A.8 Adopted calibration event initial and continuing losses

March 2017		January 2020	
IL (mm)	CL (mm/h)	IL (mm)	CL (mm/h)
82	3.5	75	3.5

A.5.5 Model calibration results

Table A.9 shows the comparison of the calculated and recorded peak discharges at the two gauging stations within the Blackwater Creek catchment for the 2017 and 2020 events.

Table A.9 Summary of calibration results

Station Number	Station Name	Peak discharge (m^3/s)					
		March 2017			January 2020		
		Calculated	Recorded	Difference (%)	Calculated	Recorded	Difference (%)
330101	Taurus Creek D/S	116.6	117.0	-0.3%	155.6	156.8	-1%
330124	Two Mile Gully	46.9	16.2	189.4%	79.1	50.4	57%

A.5.5.1 March 2017 event calibration results

Figure A.14 and to Figure A.15 compare the modelled/calculated (C – orange) and recorded (R – blue) discharge hydrographs for the March 2017 event.

The modelled (calculated) hydrograph matches well with the recorded hydrograph peak and shape at the Taurus Creek D/S gauge. However, the URBS model could not reproduce the recorded hydrograph shape, peak or timing further upstream at the Two Mile Gully gauge.

The recorded data suggests that the Two Mile Gully gauge appears to have malfunctioned during the event, as indicated by the following:

- The recorded water level hydrograph shape and timing at the Two Mile Gully gauge is inconsistent with the recorded water levels at the Taurus Creek D/S gauge (refer to Figure A.8 and Figure A.9).
- The catchment area to Two Mile Gully is around 27% of the catchment area to the Taurus Creek D/S gauge. Despite this, the recorded peak discharge at Two Mile Gully D/S is only 14% of the recorded peak discharge at Taurus Creek D/S. This indicates that the Two Mile Gully gauge likely did not capture the peak water level (and hence the peak discharge) during this event.

In consideration of the above, the calibration in Two Mile Gully and Taurus Creek is considered acceptable.

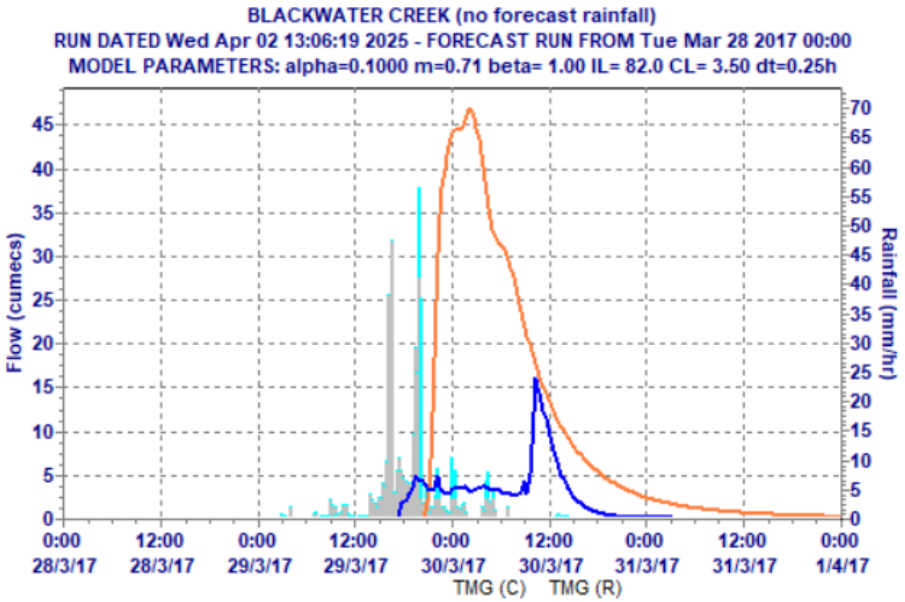


Figure A.14 Calculated (C – orange) and recorded (R – blue) discharge hydrographs for March 2017 event at the Two Mile Gully gauge

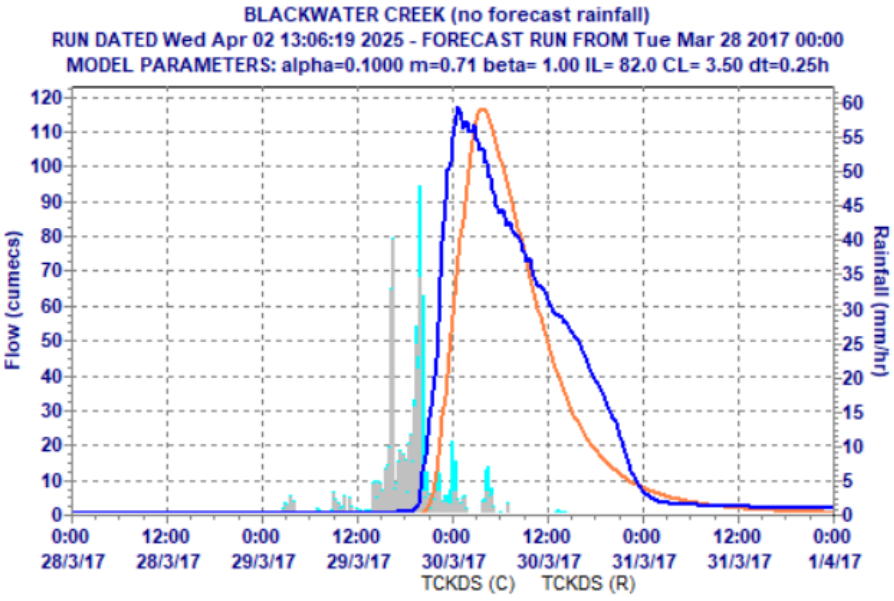


Figure A.15 Calculated (C – orange) and recorded (R – blue) discharge hydrographs for March 2017 event at the Taurus Creek D/S gauge

A.5.5.2 January 2020 event calibration results

Figure A.16 and Figure A.17 compare the modelled/calculated (C – orange) and recorded (R – blue) discharge hydrographs for the January 2020 event.

The modelled (calculated) hydrograph matches well with the recorded hydrograph peak and shape at the Taurus Creek D/S gauge. However, the URBS model could not reproduce the recorded hydrograph shape, peak or timing further upstream at the Two Mile Gully gauge.

Compared to the March 2017 event, there are similar discrepancies observed between the recorded water level hydrographs at Two Mile Gully and Taurus Creek D/S for the January 2020 event. This suggests that the Two Mile Gully gauge may not have accurately captured the peak flood level (and hence the peak discharge) during the January 2020 event, due to similar reasons described in Section A.5.5.1 for the March 2017 event.

In consideration of the above, the calibration in Two Mile Gully and Taurus Creek is considered acceptable.

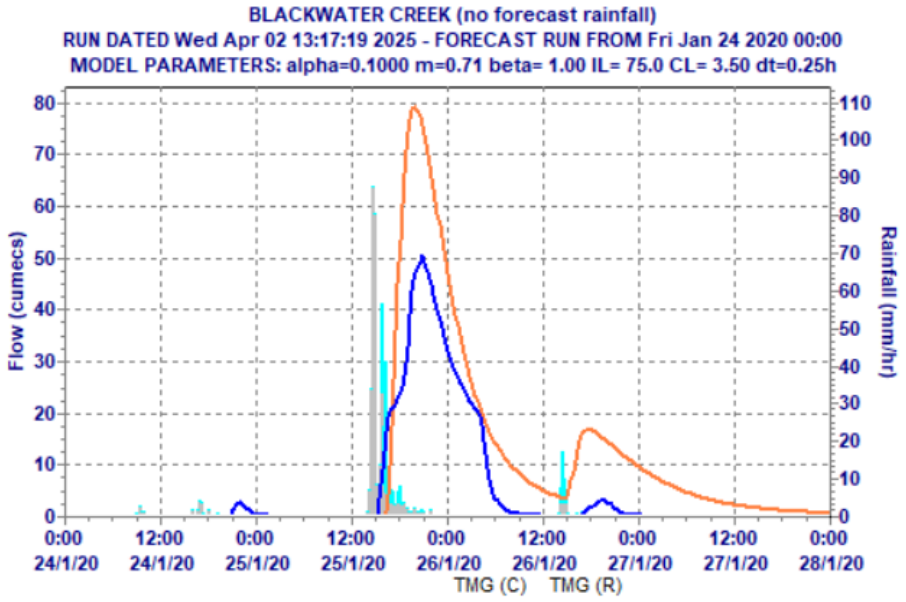


Figure A.16 Calculated (C – orange) and recorded (R – blue) discharge hydrographs for the January 2020 event at the Two Mile Gully gauge

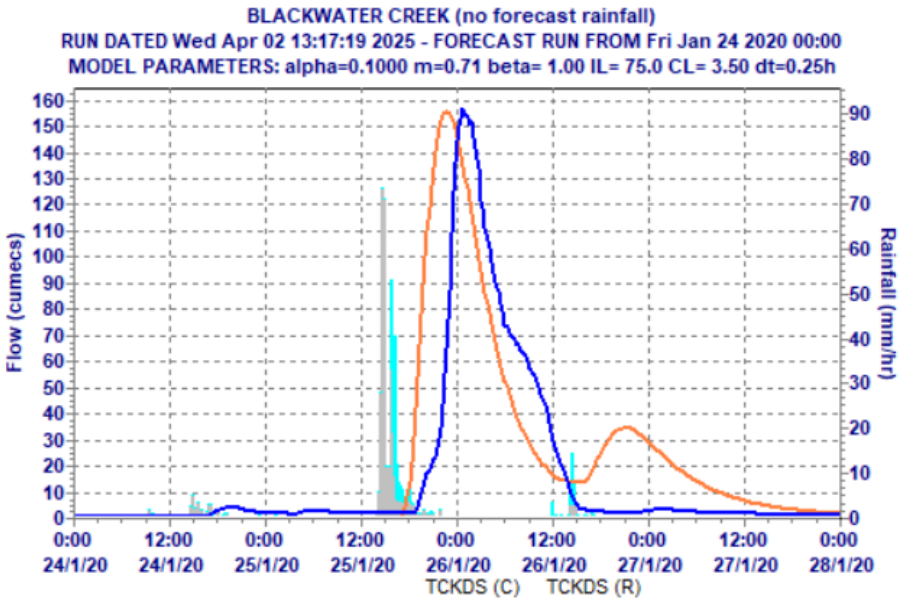


Figure A.17 Calculated (C – orange) and recorded (R – blue) discharge hydrographs for the January 2020 event at the Taurus Creek D/S gauge

A.6 DESIGN DISCHARGE ESTIMATION

A.6.1 Methodology

The URBS models for the Blackwater Creek and Sagittarius Creek catchments were used to estimate design discharges for the 50% (1 in 2) AEP, 5% (1 in 20) AEP, 2% (1 in 50) AEP, 1% (1 in 100) AEP, 0.01% (1 in 1,000) AEP and PMP design flood events. Design event hydrology was undertaken in accordance with ARR 2019 version 4.2 (Ball et al, 2019).

URBS model design discharge estimates were validated against discharge estimates derived using the RM, the QRT and the RFFE methods. Design peak discharges were validated for the 50%, 5%, 2% and 1% AEP events at key validation locations shown in Figure A.18.

The RM is no longer supported in the latest by ARR update as it has been updated by the RFFE method. However, it remains a useful methodology for catchments that are smaller than the dataset that has been used to define the design discharges in the RFFE methodology.

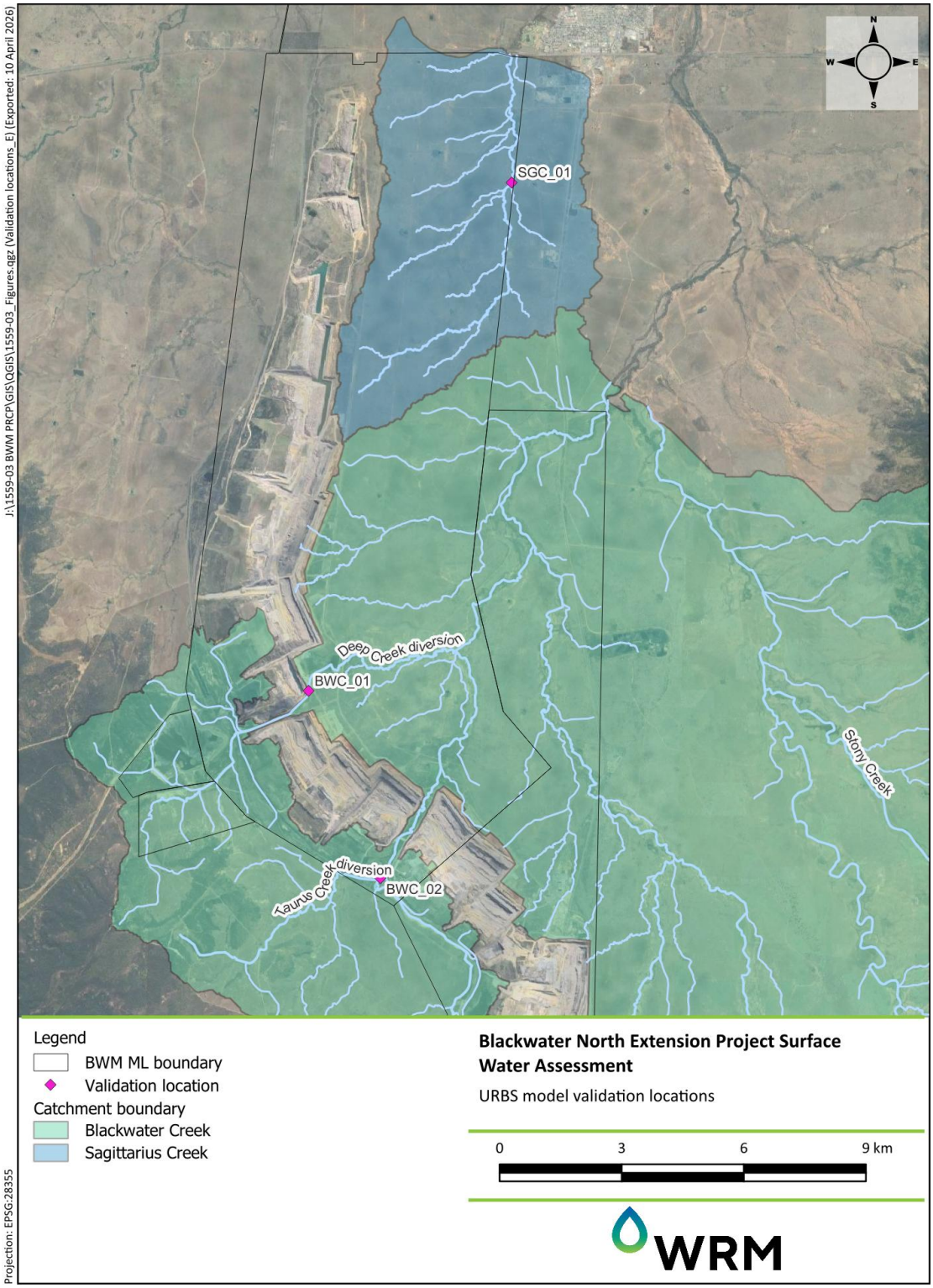


Figure A.18 URBS model validation locations

A.6.2 URBS model parameters

A.6.2.1 Global model parameters

The global URBS model parameters (α, β, M and N) given in Section A.4.2.2 were adopted for design event modelling for all models.

A.6.2.2 Design rainfalls

Desing rainfall depths was obtained from the Bureau of Meteorology (Bureau) for all events up to 0.1% AEP.

PMP rainfall depths for durations up to 6 hours were estimated using the methodology given in *The Estimation of Probable Maximum Precipitation in Australia: Generalised Short-Duration Method* (Bureau, 2003).

PMP rainfall depths for durations 24 hours and longer were estimated using the standard methodology given in the *Generalised Tropical Storm Method – Revised Edition* (Bureau, 2005).

A.6.2.3 Initial and continuing losses

The adopted ILs and CLs adopted for the design event modelling are shown in Table A.10.

For the Blackwater Creek catchment, a CL of 3.5 mm/h was used which is consistent with the adopted CL for the March 2017 and January 2020 calibration events.

The Sagittarius Creek URBS model was not calibrated due the lack of data. A CL of 2.0 mm/h was adopted based on the model validation outcomes (refer to Section C.6.3).

For the extreme events rarer than 1% AEP, minimal losses (IL = 0.0 mm and CL = 1.0 mm/h) were adopted as recommended in ARR.

Table A.10 Adopted design event initial (IL) and continuing (CL) losses

Event	Blackwater Creek URBS model		Sagittarius Creek URBS model	
	IL (mm)	CL (mm/h)	IL (mm)	CL (mm/h)
50% (1 in 2) AEP to 1% (1 in 100) AEP	0.0	3.5	0.0	2.0
0.1% (1 in 1,000) AEP to PMP	0.0	1.0	0.0	1.0

A.6.3 Model validation

Table A.11, Table A.12 and Table A.13 compare the URBS model predicted peak discharges against RM, QRT and RFFE estimates for the 50% (1 in 2) AEP to 1% (1 in 100) AEP events at validation locations BWC_01, BWC_02 and SGC_01, respectively (refer to Figure A.18 for these locations).

The URBS model predicted peak discharges are similar to the RM and QRT peak discharges for the 5% to 1% AEP events. Compared to the RFFE peak discharges, the URBS model predicted peak discharges for the 5% to 1% AEP events are lower but are within the 90% confidence bounds of the RFFE estimates. For the 50% AEP event, the URBS model peak discharges are similar to the RM but are significantly higher than the QRT and RFFE peak discharges, despite adopting minimal losses.

Given the similarities in design peak discharge between URBS, the RM and QRT and the significant uncertainties in the RFFE peak discharges, the validation is considered adequate for the purpose of this flood impact assessment. Therefore, the URBS model would produce reasonable estimates of design discharges within the Blackwater Creek and Sagittarius Creek catchments.

Table A.11 Comparison of URBS model predicted design discharges against RM, QRT and RFFE estimates at location BWC_01

AEP % (1 in X)	Design peak discharge (m³/s)					
	URBS	RM	QRT	RFFE (2021)		
				Expected	5%ile	95%ile
50% (1 in 2)	45	52	11	10	4	24
5% (1 in 20)	117	122	88	167	70	359
2% (1 in 50)	147	161	133	315	105	863
1% (1 in 100)	172	191	174	471	130	1,596

Table A.12 Comparison of URBS model predicted design discharges against RM, QRT and RFFE estimates at location BWC_02

AEP	Design peak discharge (m³/s)					
	URBS	RM	QRT	RFFE (2021)		
				Expected	5%ile	95%ile
50% (1 in 2)	58	47	12	9	4	24
5% (1 in 20)	135	113	95	179	75	385
2% (1 in 50)	165	149	145	343	113	948
1% (1 in 100)	190	177	189	520	140	1,796

Table A.13 Comparison of URBS model predicted design discharges against RM, QRT and RFFE estimates at location SGC_01

AEP	Design peak discharge (m³/s)					
	URBS	RM	QRT	RFFE (2021)		
				Expected	5%ile	95%ile
50% (1 in 2)	40	44	12	9	3	22
5% (1 in 20)	99	107	92	169	70	367
2% (1 in 50)	125	141	140	339	110	953
1% (1 in 100)	147	168	182	535	141	1,868

A.6.4 Design discharges

The URBS models were used to estimate design discharges for the following scenarios:

- 'Existing conditions' – Design discharge hydrographs were produced as input to the existing conditions TUFLOW hydraulic model (described in Section 8.3) to establish the baseline flooding characteristics in the vicinity of the Project.
- 'Operational (2055) conditions' – Design discharge hydrographs were produced for the local catchments in the vicinity of the Project, reflecting the changes to local catchments due to expansion of the mining pits.
- 'Final landform conditions' – Design discharge hydrographs were produced as input to the final landform conditions TUFLOW hydraulic model (described in Section 8.3) to simulate flooding characteristics in the vicinity of the Project post-closure.

The URBS model predicted design discharges are provided in Section 8.2.

APPENDIX B WATER BALANCE ASSESSMENT REPORT

Blackwater North Extension Project

Water Balance Assessment Report

Whitehaven Blackwater Pty Ltd

Doc. Ref.: WHC-037-C11

Date: 2 October 2026

Rev. No.	Doc Ref.	Report Date	Report Author	Reviewer
11	WHC-037-C11	2 October 2026	MGB	AH

For and on behalf of **HydroBalance**
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1 Introduction

HydroBalance was engaged by Whitehaven Blackwater Pty Ltd (Whitehaven Blackwater) to undertake a water balance assessment for the Blackwater North Extension Project (the Project), for incorporation into an application for an Environmental Authority (EA) Amendment and an application for an *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) Approval. Whitehaven Blackwater is a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven).

The Project is an extension of mining into Surface Area (SA) 10 on Mining Lease (ML) 1759 and SA7 on ML1762 utilising existing Blackwater Mine (BWM) mining methods, mining fleet, mine infrastructure and facilities.

2 Site water balance assessment overview

A computer-based operational simulation model was used to assess the dynamics of the BWM water balance under conditions of varying rainfall and catchment conditions throughout the development of the Project duration. The water balance model developed for this assessment covers the period of July 2025 to June 2055 (30 years in total). The Project commences in 2030, and mining in the Project area ceases in 2055. GoldSim was selected to represent the operational water balance, enabling dynamic simulation of the site water management system over the assessment period.

The GoldSim model dynamically simulates the operation of the water management system and keeps a complete account of all site water volumes and representative water quality on a daily time step. The model has been configured to simulate the operations of all major components of the water management system. The simulated inflows and outflows included in the model are given in Table 2.1.

Table 2.1 – Simulated inflows and outflows to the water management system

Inflows	Outflow
Direct rainfall on the water surface of storages	Evaporation from the water surface of storages
Catchment runoff	Net Coal Handling and Preparation Plant (CHPP) losses
External water supply (Bedford East and Bedford West pipelines)	Haul road dust suppression losses
Groundwater inflows to pits	Controlled releases
	Dam overflows
	Seepage from storages

Details of the development of the GoldSim model, including a description of the inflows and outflows to the water management system, are provided in the following sections.

3 Mine plan stages

The BWM water balance model includes ten representative stages to represent the progression of mining over the 30-year simulation, as shown in Table 2.1. Stage 0 was used to calibrate the water balance model against data recorded between July 2024 and June 2025. Stage 1 is an interim stage that covers the 1-year period between the end of the calibration and the start of the Project forecast simulation. Stages 2 to 9 have been set up to provide a forecast of the BWM Water Management System (WMS) performance over the simulation period.

The forecast model was run for 107 climatic realisations developed using 136 years of stochastic rainfall data in order to assess a wide range of climatic scenarios.

Table 3.1 – Modelled Life-of-Mine forecast stages

Representative stage	Description	Applied date range	Duration
Stage 0	Calibration	1 July 2024 – 30 June 2025	1 year
Stage 1 (financial year [FY]26)	Interim period	1 July 2025 – 30 June 2026	1 years
Stage 2 (FY27)	Forecast	1 July 2026 – 30 June 2027	1 year
Stage 3 (FY28)	Forecast	1 July 2027 – 30 June 2028	1 year
Stage 4 (FY29)	Forecast	1 July 2028 – 30 June 2029	1 year
Stage 5 (FY30-FY34)	Forecast	1 July 2029 – 30 June 2034	5 years
Stage 6 (FY35-FY40)	Forecast	1 July 2034 – 30 June 2040	6 years
Stage 7 (FY41-FY45)	Forecast	1 July 2040 – 30 June 2045	5 years
Stage 8 (FY46-FY50)	Forecast	1 July 2045 – 30 June 2050	5 years
Stage 9 (FY51-FY55)	Forecast	1 July 2050 – 30 June 2055	5 years

4 Catchment mapping

4.1 Existing conditions mapping

Figure 4.1 to Figure 4.3 show the catchment areas and land use types at BWM for current condition (FY26). A breakdown of catchment land use types and areas reporting to each of the water storages is shown in Table 3.1.

Table 4.1 – Catchment areas by storage for the BWM WMS

Storage	Catchment area per landuse type (hectare [ha])						Total (ha)
	Natural	Spoil	Rehab	Tailings	Hardstand/ pit	Disturbed	
R8N	0.0	0.0	6.8	0.0	9.2	7.3	**23.3**
Rangal Dam	0.6	0.0	0.0	0.0	1.0	0.0	**1.6**
R10	190.7	104.1	61.3	41.4	17.5	24.2	**493.1**
R12 FPD	1.0	0.0	7.1	0.0	2.7	0.0	**10.8**
R14	48.4	22.4	65.1	0.0	50.4	81.3	**267.6**
R16	23.8	113.4	29.2	0.0	135.5	47.2	**349.1**
R20	23.2	154.1	6.2	0.0	29.8	52.2	**265.5**
R26	0.0	134.8	1.1	0.0	32.4	85.0	**253.2**
Thermal Coal Plant (TCP) Dam	3.8	0.0	0.0	0.0	14.0	1.7	**19.6**
R28 FPD	1.3	0.0	60.0	0.0	4.6	0.0	**65.9**
R30N	0.0	126.9	102.1	0.0	41.5	59.0	**329.5**
R30S	0.9	10.3	44.6	0.0	53.3	29.9	**139.0**
R34	0.0	128.9	1.7	0.0	53.2	45.1	**228.9**
R34 Dam	3.7	0.0	8.4	0.0	16.1	0.0	**45.8**
New Deep Creek Dam (NDCD)	1444.7	24.2	255.1	0.0	65.4	122.9	**1,912.4**
Top Dam	0.0	0.0	0.0	0.0	0.6	0.8	**1.4**
NCHPP Supply Dam	1.9	0.0	0.0	0.0	1.4	2.6	**5.9**
NCHPP Sed Dam/ Blacks Dam	0.0	0.3	0.0	0.0	0.1	1.6	**2.0**
Rejects Dam	27.4	58.3	0.0	0.0	16.0	8.2	**110.0**
North CHPP Tailings Dam	0.0	0.0	0.0	156.7	0.0	0.0	**156.7**
TSF Seepage Dam	2.1	0.0	0.0	14.6	37.0	6.0	**59.8**
New Taurus Creek Dam (NTCD)	3,834.2	74.8	1,106.6	0.0	117.7	77.0	**5,210.3**
R38	0.0	128.7	29.4	0.0	24.1	51.1	**233.4**
R40 FPD	0.0	0.0	0.0	0.0	0.8	0.6	**1.4**
R42	37.8	128.3	0.0	0.0	84.5	84.4	**335.0**
R46N/S	0.0	22.1	0.0	0.0	28.1	40.1	**90.3**

Storage	Catchment area per landuse type (hectare [ha])						Total (ha)
	Natural	Spoil	Rehab	Tailings	Hardstand/ pit	Disturbed	
R47	0.0	25.2	30.4	0.0	26.8	55.5	**137.9**
R48	0.0	115.3	32.7	0.0	76.4	77.8	**302.1**
South MAW Dam	1.6	0.0	0.0	0.0	11.9	0.9	**14.4**
Pond 1-6	0.0	0.0	0.0	0.0	10.4	2.6	**13.0**
Western MAW Dam	0.0	0.0	0.0	0.0	5.8	0.0	**5.8**
Workshop 4 Dam	0.0	0.0	0.0	0.0	24.9	3.9	**28.8**
Tannyfoil Dam (TFD)	0.0	0.0	0.0	0.0	18.7	3.6	**22.3**
Central RWD	0.0	0.0	0.0	0.0	0.5	0.0	**0.5**
R52N	0.0	78.4	9.7	0.0	23.1	13.8	**125.0**
R52S	0.0	45.7	122.2	0.0	82.1	75.9	**325.9**
R52 FPD	0.0	0.0	0.0	0.0	2.0	0.0	**2.0**
R52 ROM Dam	0.0	0.0	0.0	0.0	5.1	0.0	**5.1**
R54 FPD	0.0	0.0	114.0	0.0	9.6	0.7	**124.3**
R54 MAW Dam	0.0	0.0	1.1	0.0	2.7	0.0	**3.8**
R54	0.0	102.9	31.7	0.0	78.2	46.1	**258.8**
R56	2.7	350.7	123.9	0.0	127.3	72.4	**677.0**
R62	119.8	93.9	95.1	0.0	32.4	38.1	**379.3**
R62 FPD	936.3	3.5	297.4	0.0	61.2	10.9	**1,309.3**
R64/66	3.6	0.7	18.8	0.0	62.7	8.0	**93.8**
Kenmare RWD	0.0	0.0	0.0	0.0	0.5	0.0	**0.5**
Red Claw Dam	44.5	0.0	0.0	0.0	22.3	32.0	**98.7**
Bear Park Dam	0.0	0.0	0.0	0.0	0.6	0.0	**0.6**
R70 WSP	40.8	34.4	30.2	0.0	30.2	25.4	**161.0**
Upper Red Dam (Holding Dam)	2.0	0.0	6.7	0.0	2.0	26.1	**36.7**
Lower Red Dam	0.0	0.0	4.6	0.0	1.3	20.2	**26.1**
Baby Red Dam	0.0	0.0	0.0	0.0	0.1	3.6	**3.7**
No 1 Dam	0.2	0.0	0.0	0.0	13.2	4.4	**17.7**
No 2 Dam	37.1	0.0	1.6	0.0	26.4	24.8	**90.0**
Bottom Dam	0.0	0.0	0.0	0.0	10.9	9.6	**20.4**
Duck Pond	0.0	0.0	2.6	0.0	0.4	1.1	**4.2**
Goldfish Bowl	0.0	0.0	2.2	0.0	0.3	0.0	**2.5**
Old Cut 4	10,841.8	0.0	9.6	0.0	8.9	192.8	**11,052.7**
R72 TSF	168.0	21.9	24.2	27.4	0.0	45.0	**286.5**
R74 TSF	45.2	0.0	75.9	51.5	0.0	63.9	**236.6**
R76	0.0	47.0	20.8	0.0	14.9	0.0	**82.6**

Storage	Catchment area per landuse type (hectare [ha])						Total (ha)
	Natural	Spoil	Rehab	Tailings	Hardstand/ pit	Disturbed	
R80	8.5	21.9	102.3	0.0	41.9	58.5	**233.1**
R82 FPD	524.7	0.0	90.3	0.0	1.1	37.3	**653.5**
R84	23.8	68.9	35.3	0.0	25.2	13.2	**166.3**
TOTAL	**18,441**	**2,442**	**3,059**	**292**	**1,623**	**1,789**	**27,445**

Notes: WSP = Water Storage Pit
FPD = Fill Point Dam
RWD = Raw Water Dam
TSD = Tailings Storage Dam

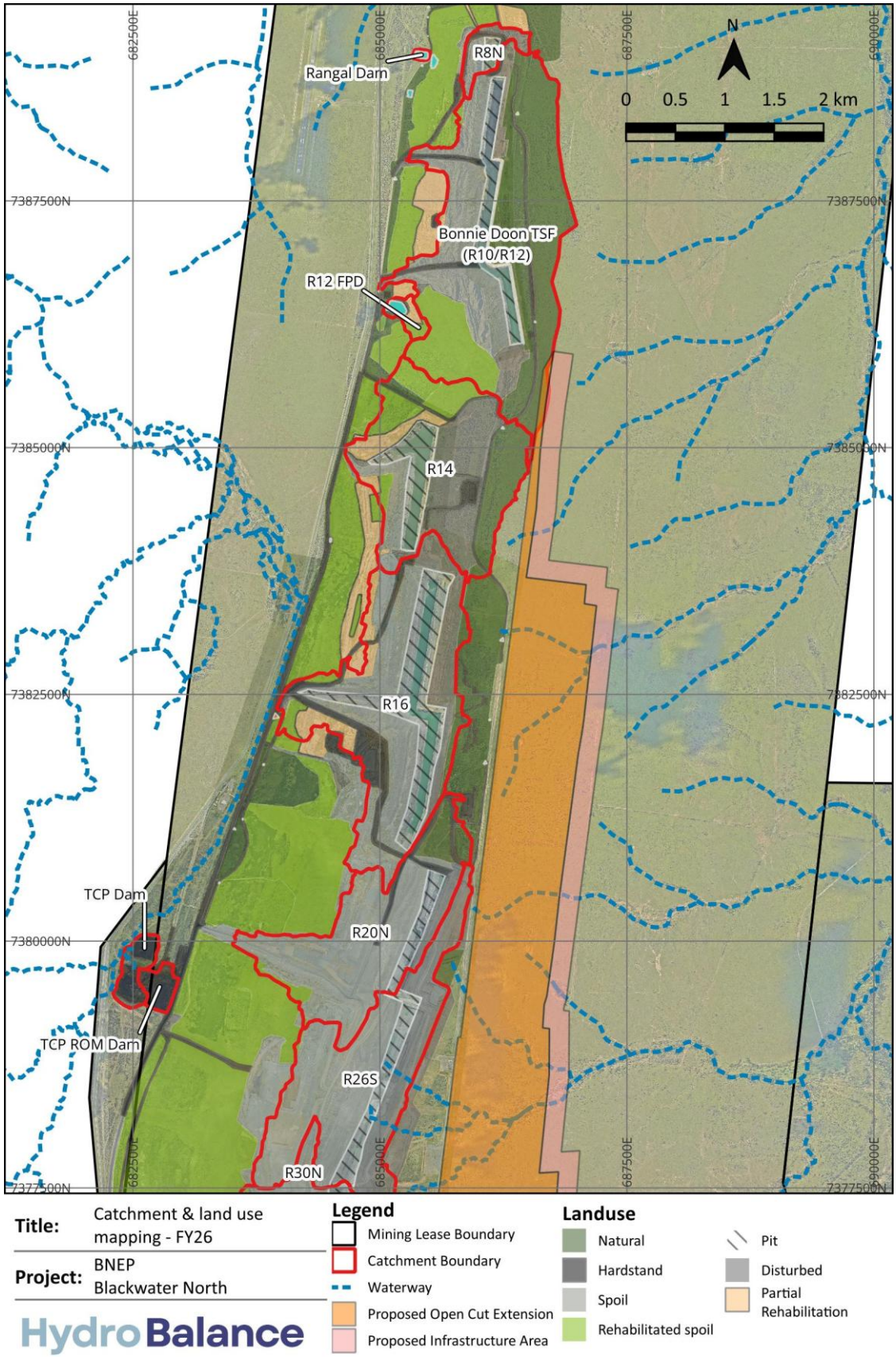


Figure 4.1 – Catchment and land use mapping – Blackwater North (FY26)

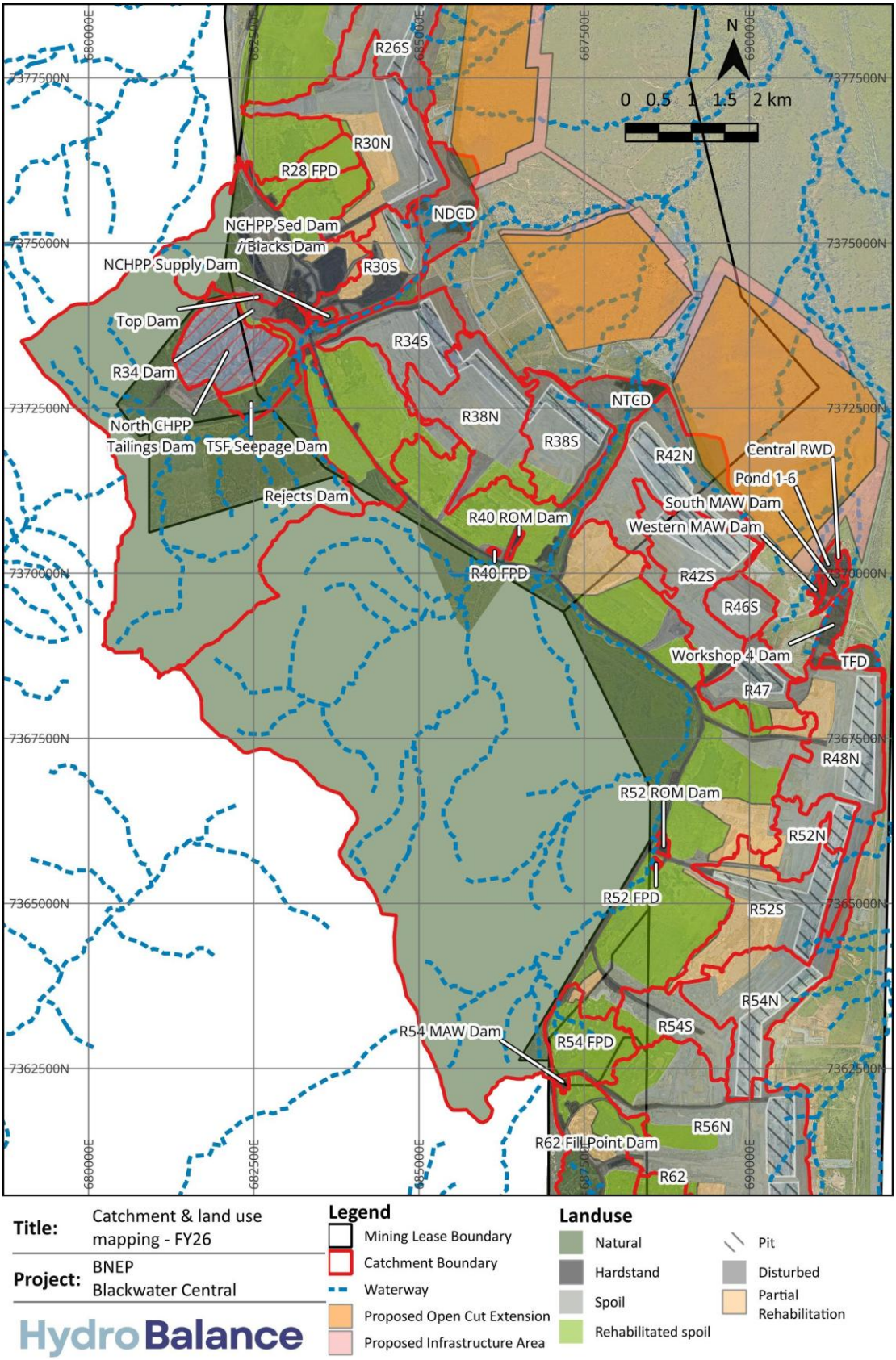


Figure 4.2 – Catchment and land use mapping – Blackwater Central (FY26)

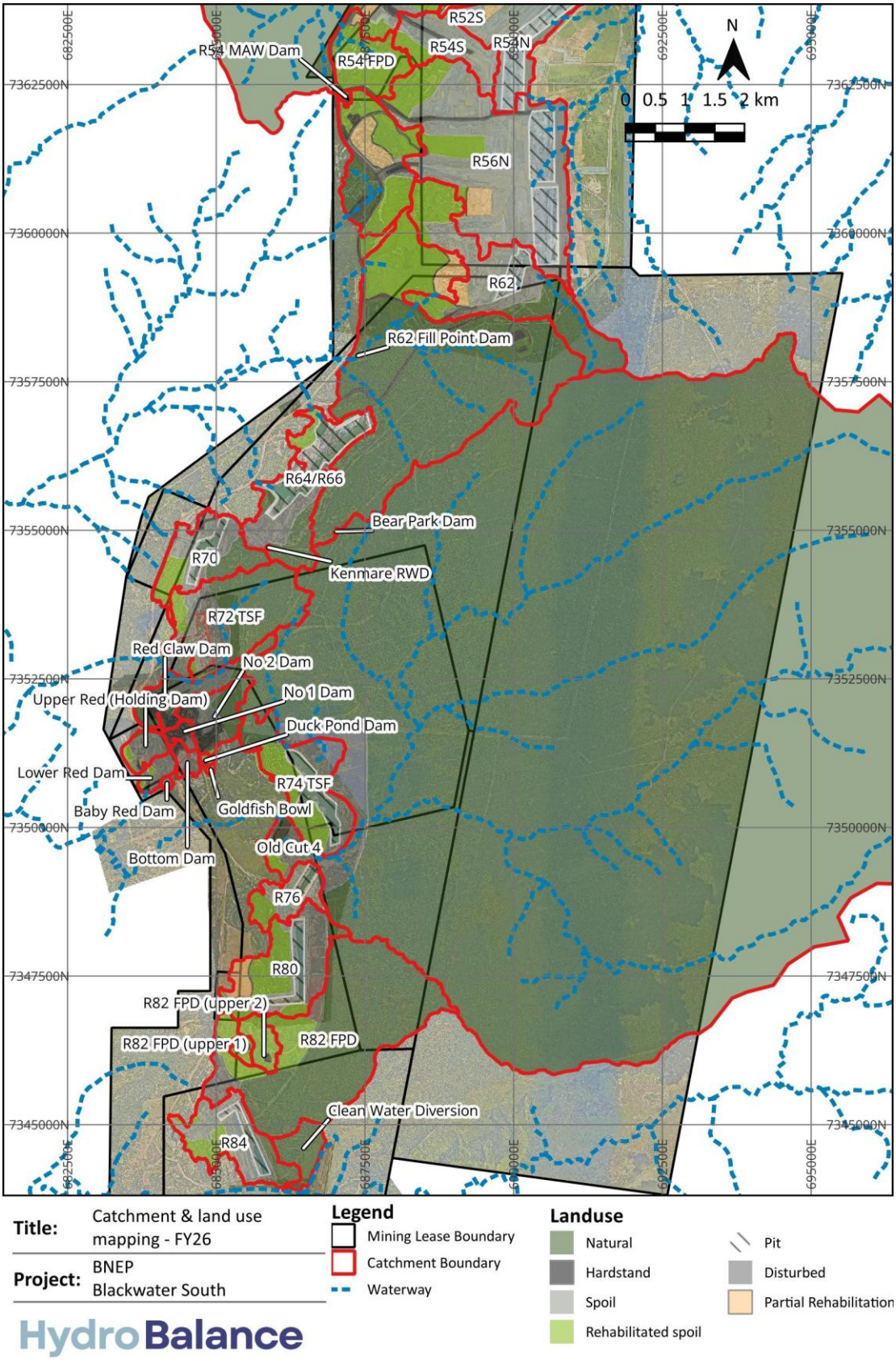


Figure 4.3 - Catchment and land use mapping - South (FY26)

4.2 Forecast catchment mapping

A set of catchment maps have been developed for selected snapshots between FY27 and FY55, in line with the model stages shown in Table 3.1. These maps have been based on staged mine plans provided by Whitehaven.

The catchment mapping for each of the eight future model stages is presented in Figure 4.4 to Figure 4.30.

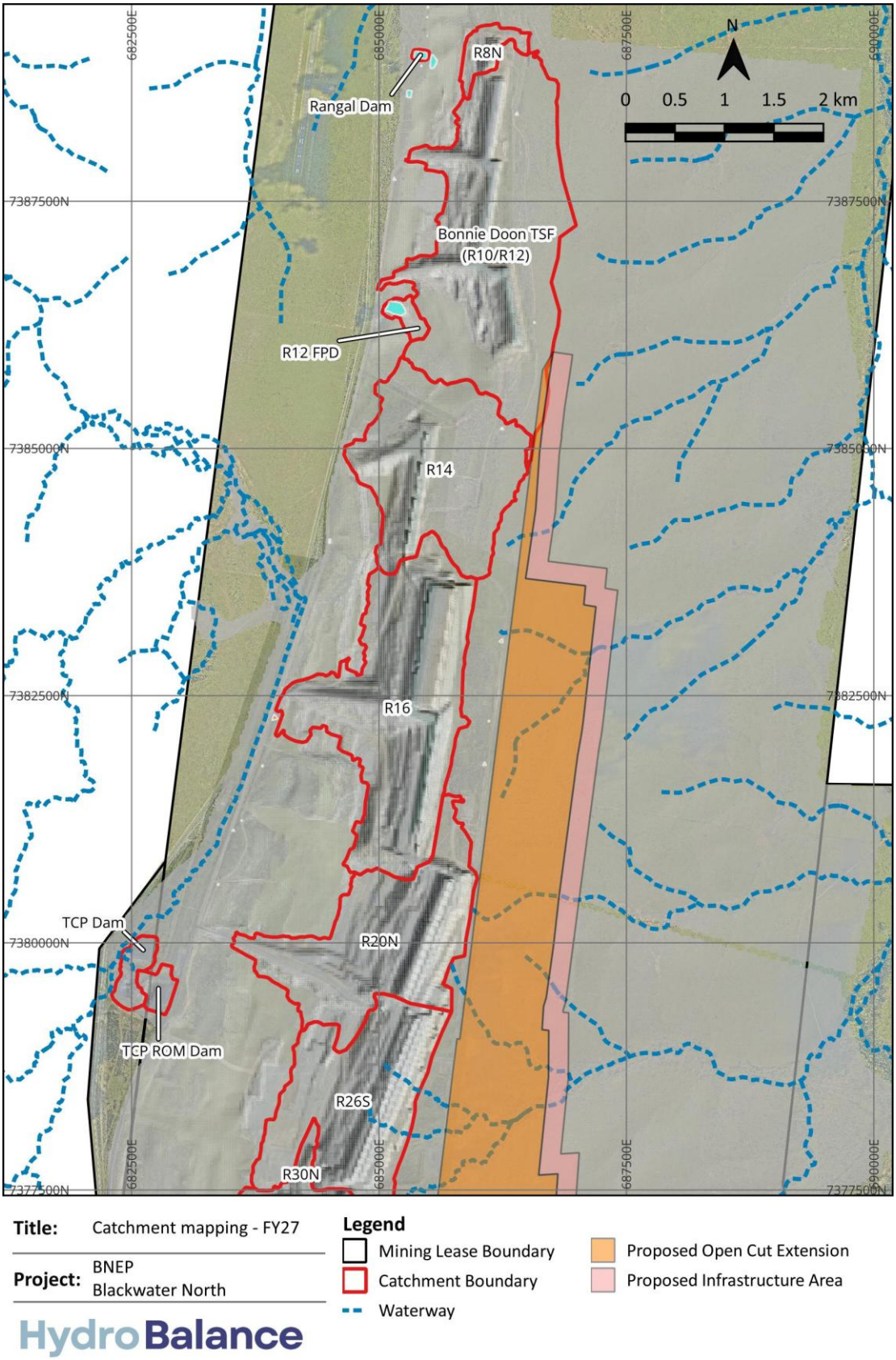


Figure 4.4 - Catchment mapping - Blackwater North - FY27

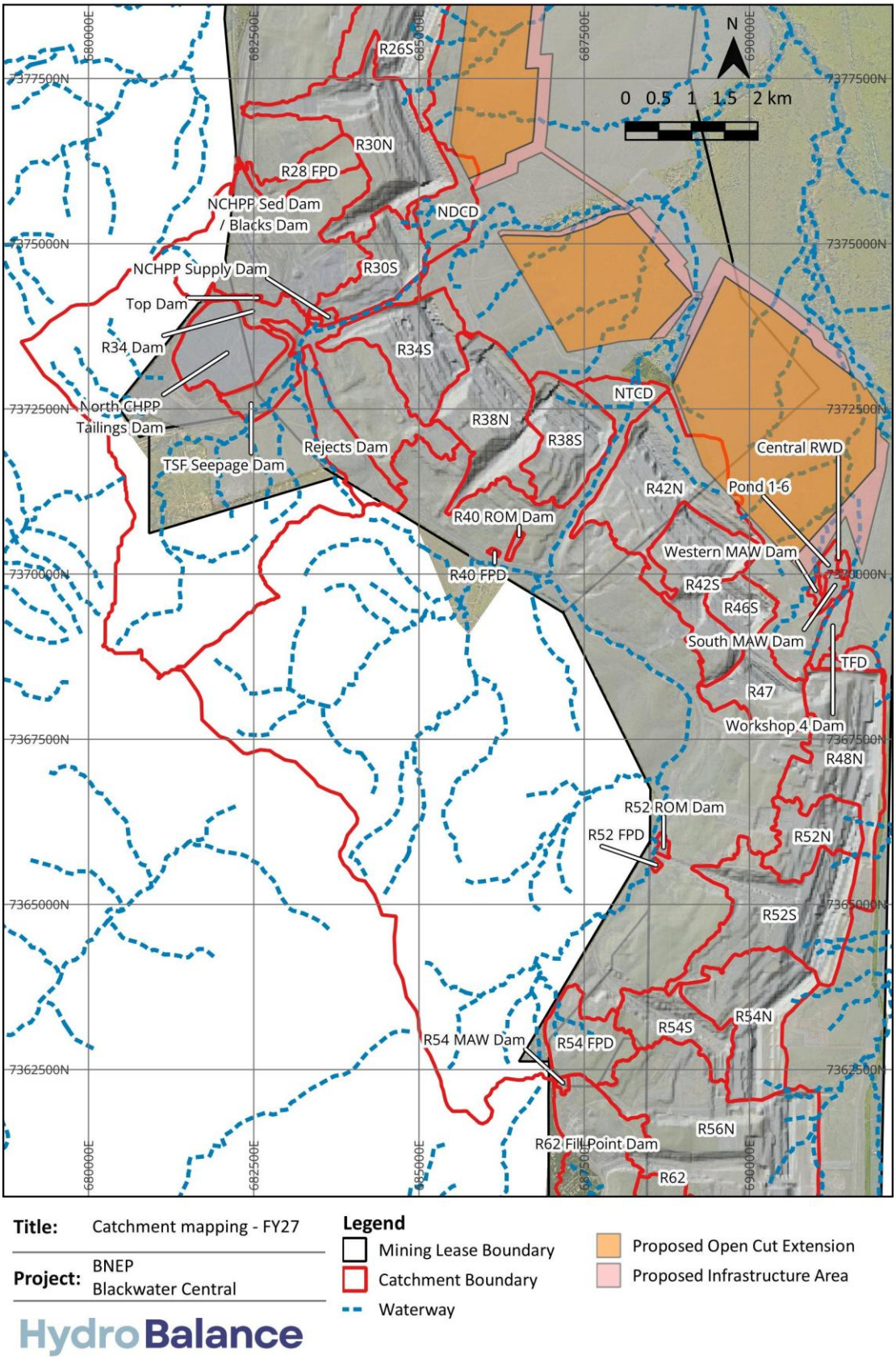
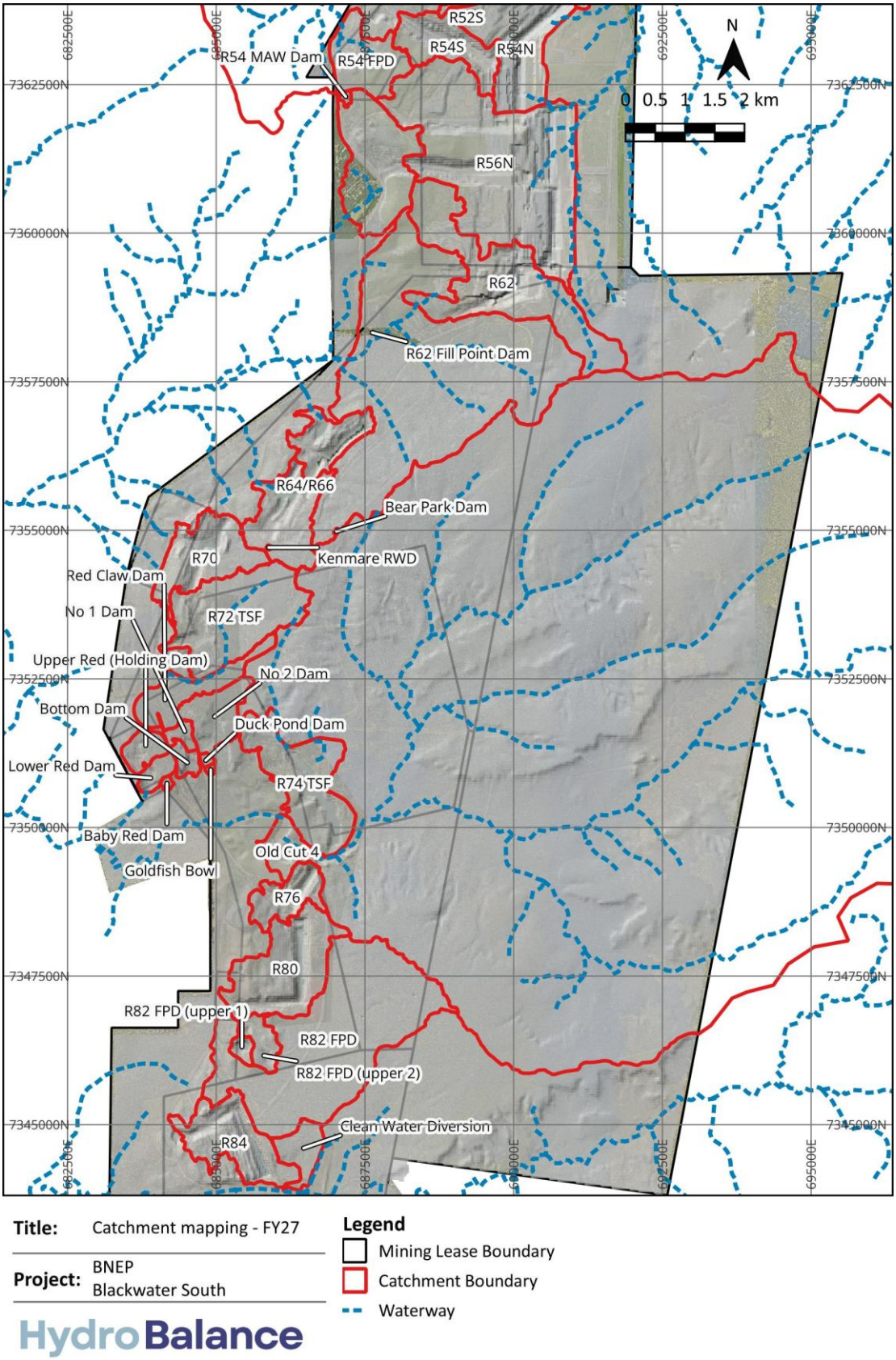


Figure 4.5 - Catchment mapping - Blackwater Central - FY27



Title: Catchment mapping - FY27

Project: BNEP Blackwater South

HydroBalance

Legend

- Mining Lease Boundary
- Catchment Boundary
- Waterway

Figure 4.6 - Catchment mapping - Blackwater South - FY27

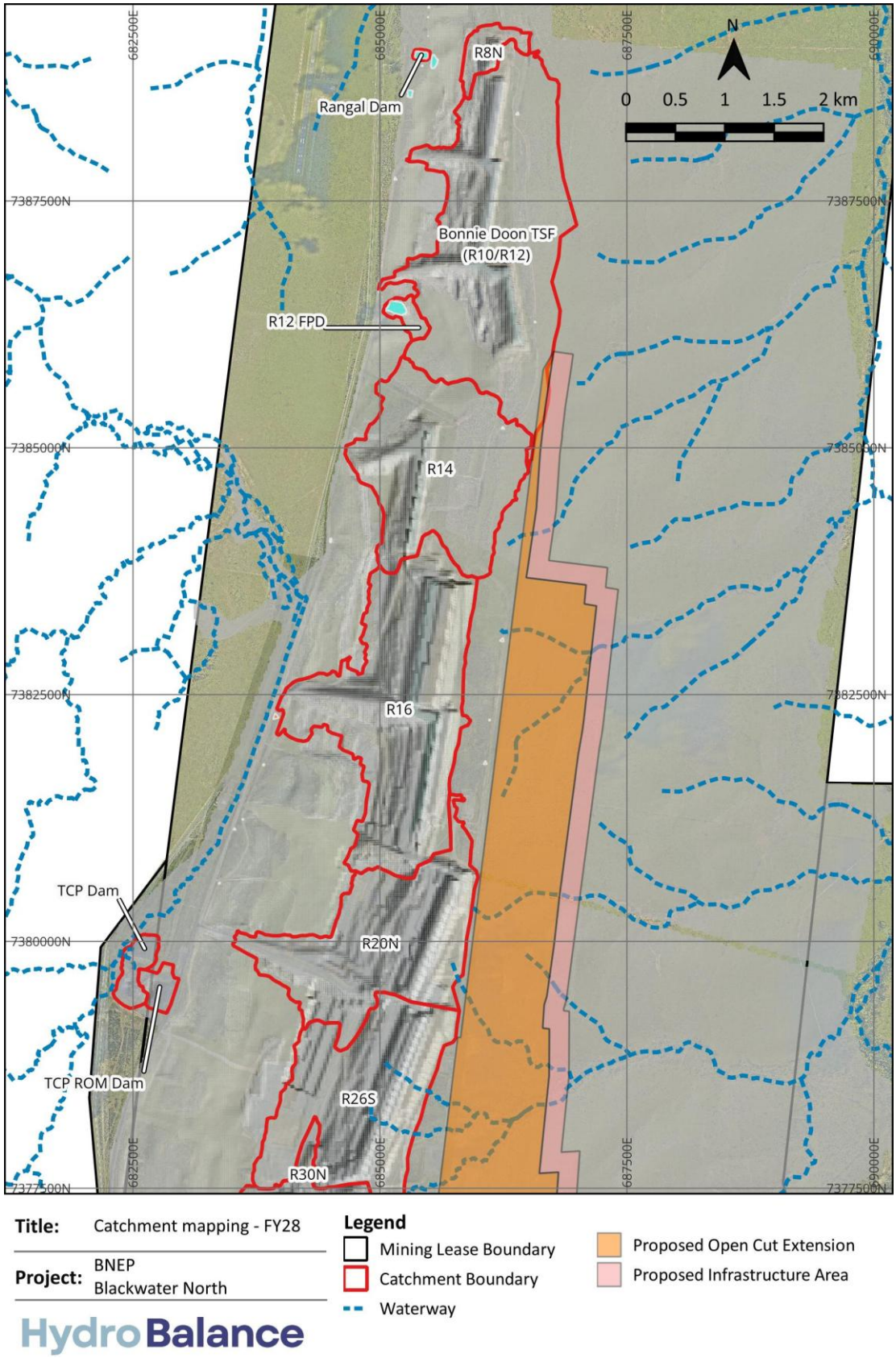
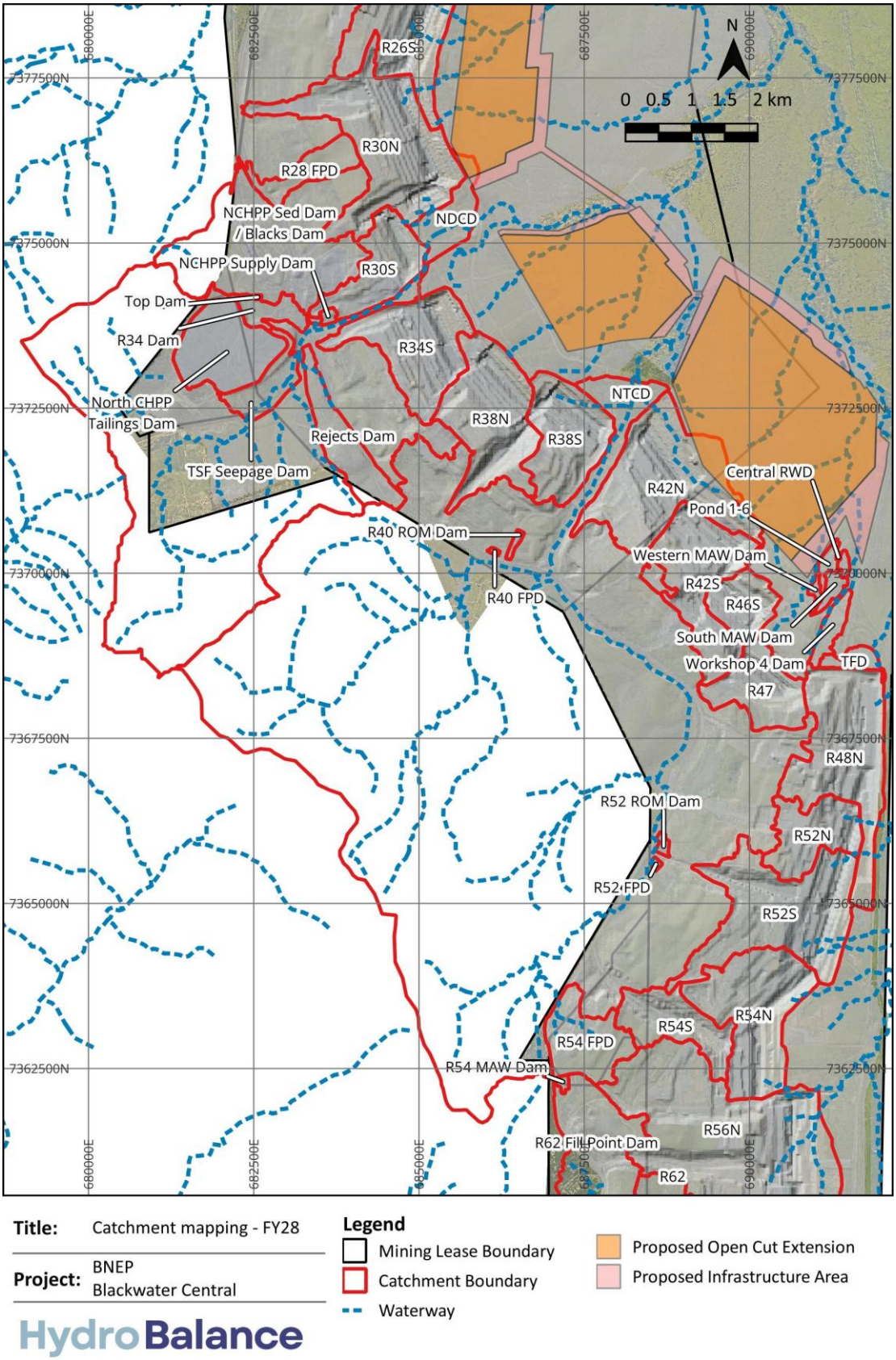


Figure 4.7 - Catchment mapping - Blackwater North - FY28



Title: Catchment mapping - FY28

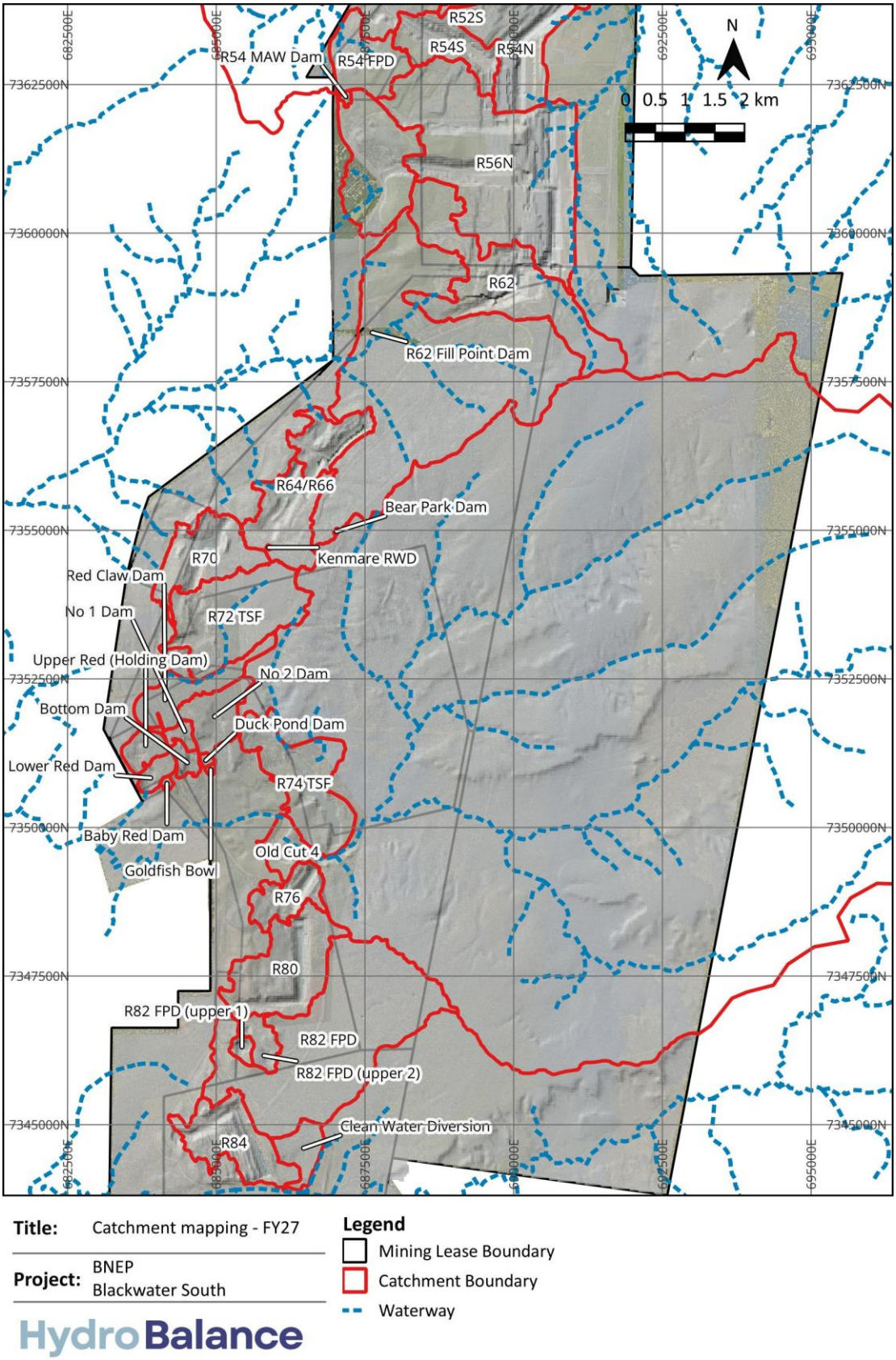
Project: BNEP Blackwater Central

HydroBalance

Legend

- Mining Lease Boundary
- Catchment Boundary
- Waterway
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Figure 4.8 - Catchment mapping - Blackwater Central - FY28



Title: Catchment mapping - FY27

Project: BNEP Blackwater South

HydroBalance

Legend

- Mining Lease Boundary
- Catchment Boundary
- Waterway

Figure 4.9 - Catchment mapping - Blackwater South - FY28

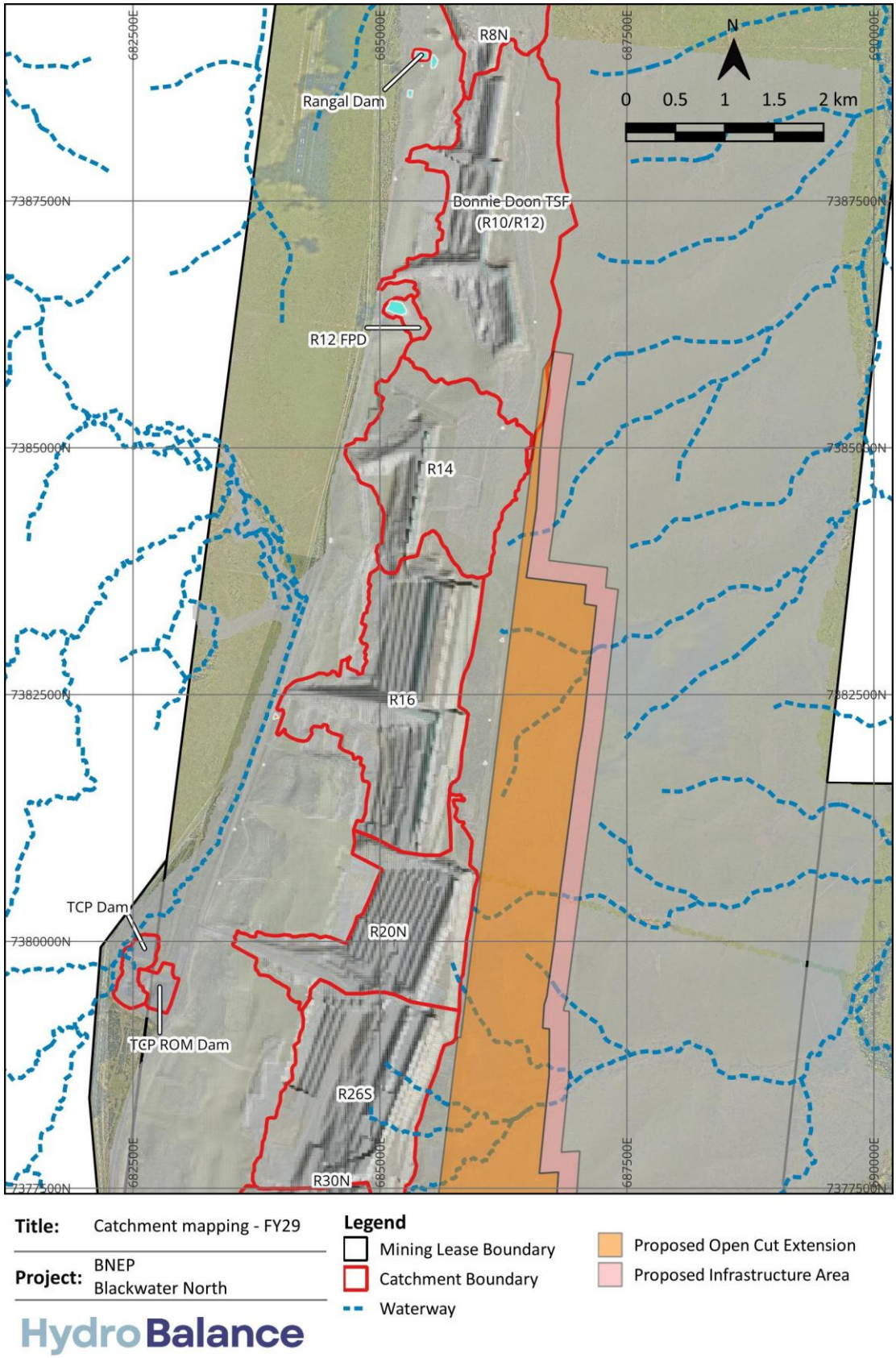


Figure 4.10 - Catchment mapping - Blackwater North - FY29

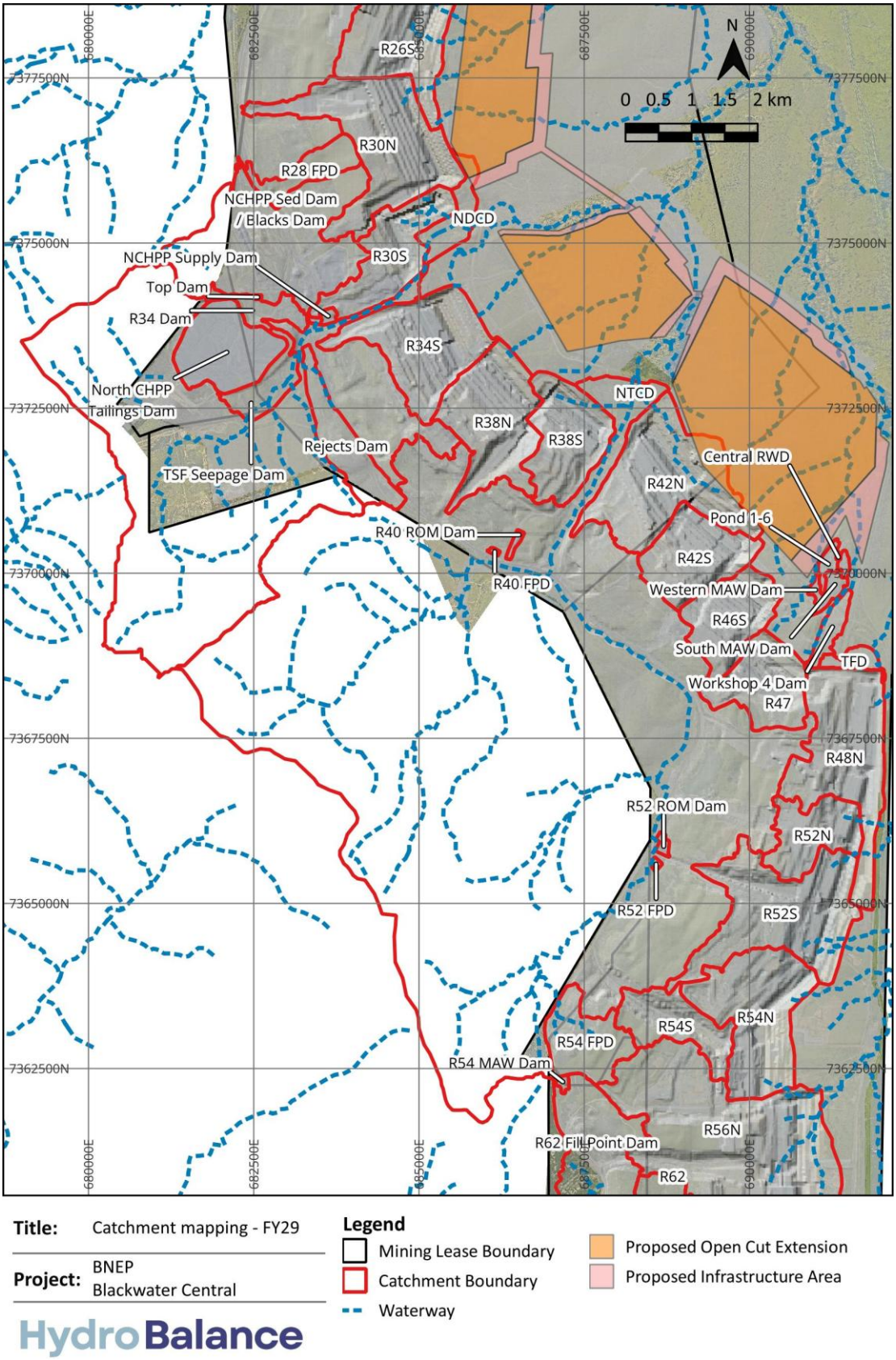


Figure 4.11 - Catchment mapping - Blackwater Central - FY29

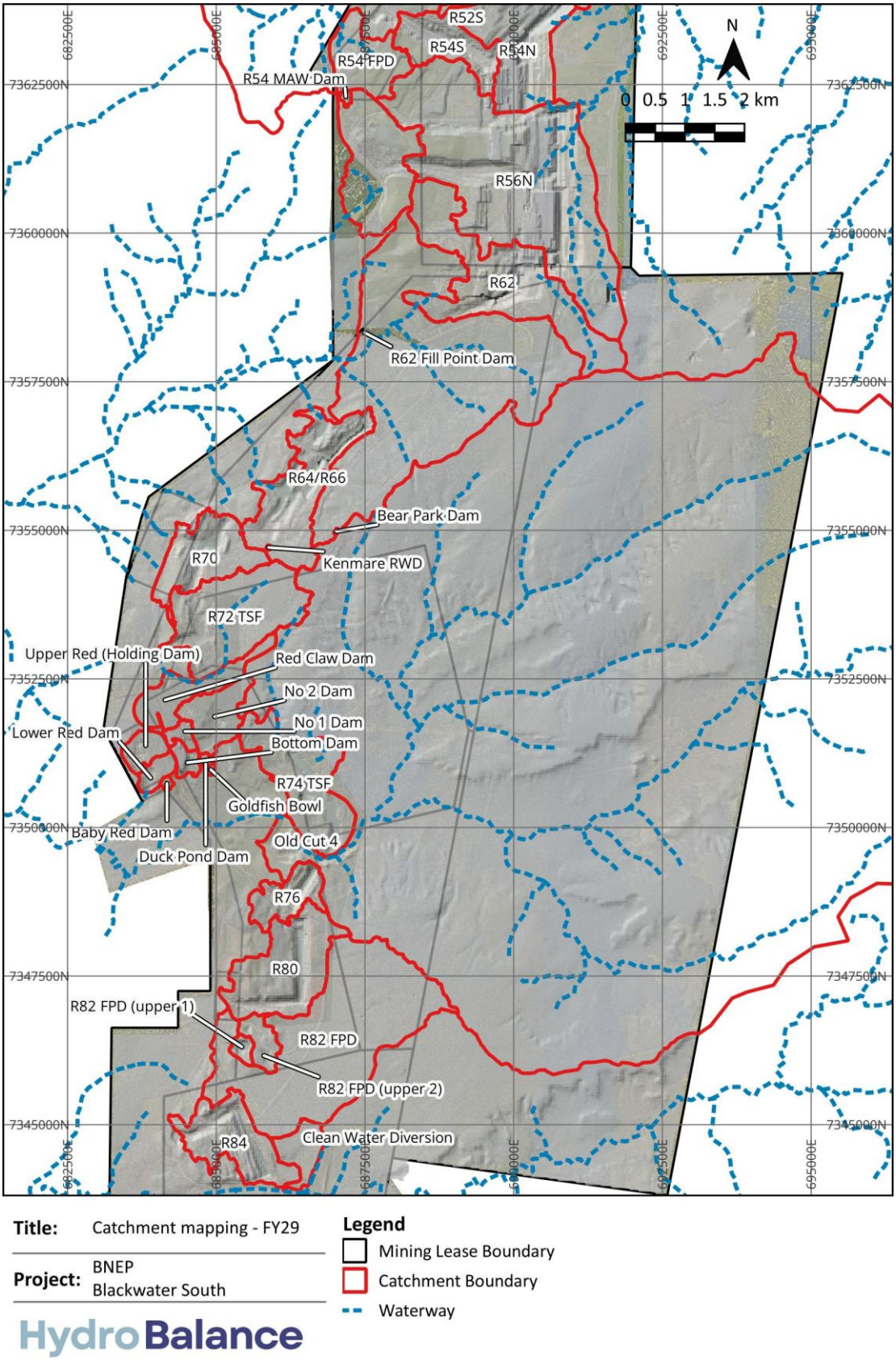


Figure 4.12 - Catchment mapping - Blackwater South - FY29

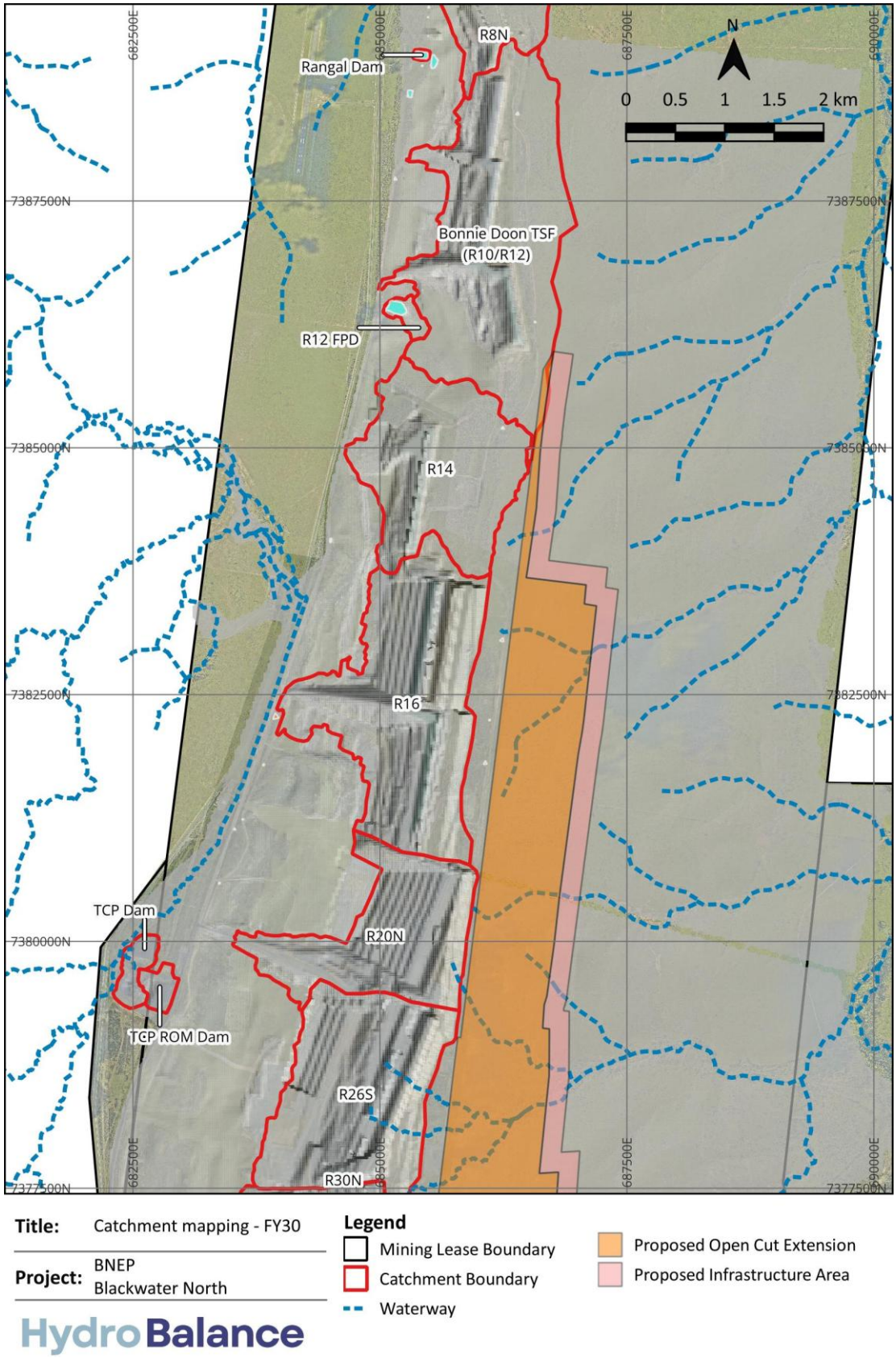


Figure 4.13 - Catchment mapping - Blackwater North - FY30

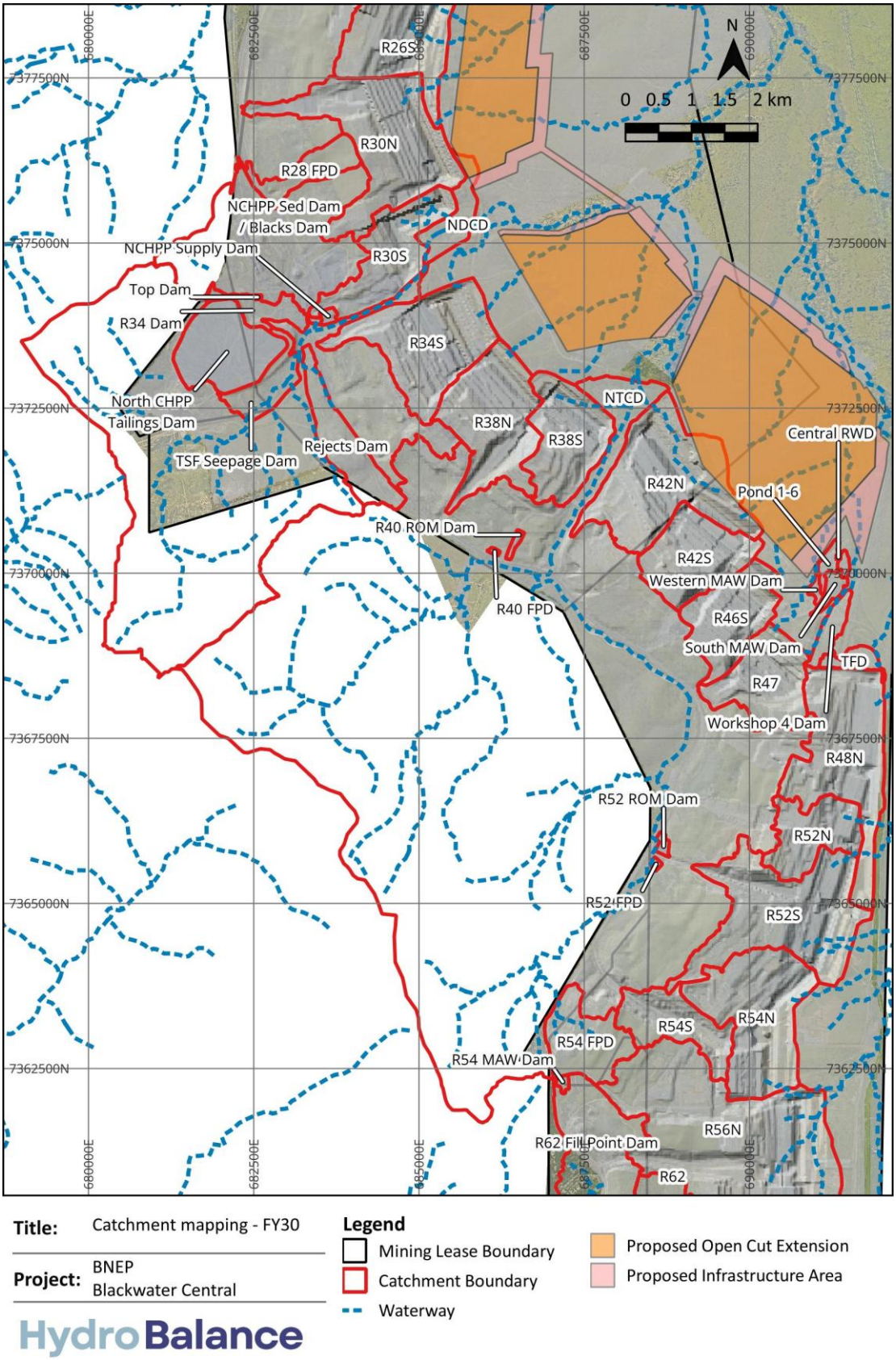
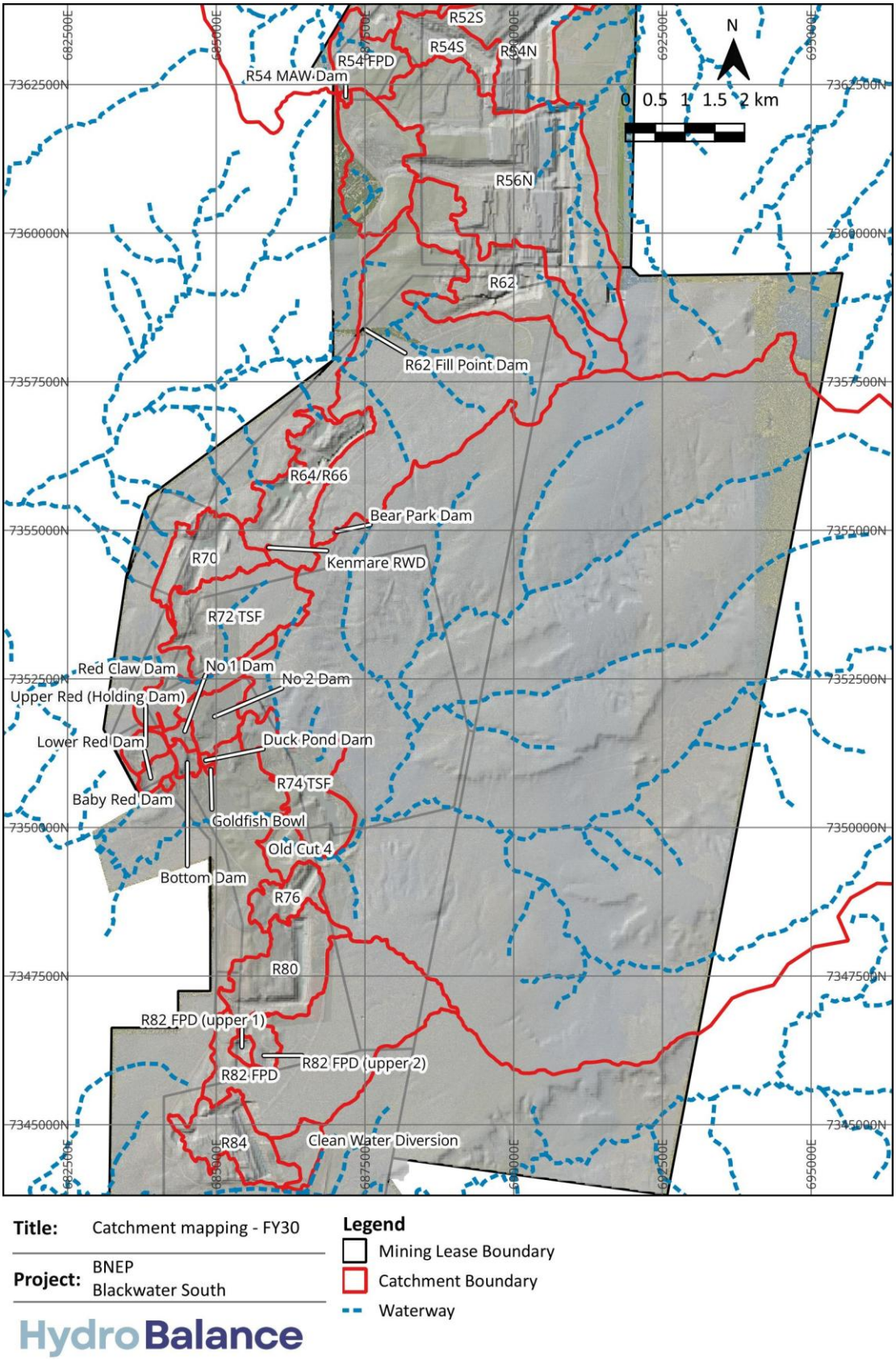


Figure 4.14 - Catchment mapping - Blackwater Central - FY30



Title: Catchment mapping - FY30

Project: BNEP Blackwater South

Legend
- Mining Lease Boundary
- Catchment Boundary
- Waterway

HydroBalance

Figure 4.15 - Catchment mapping - Blackwater South - FY30

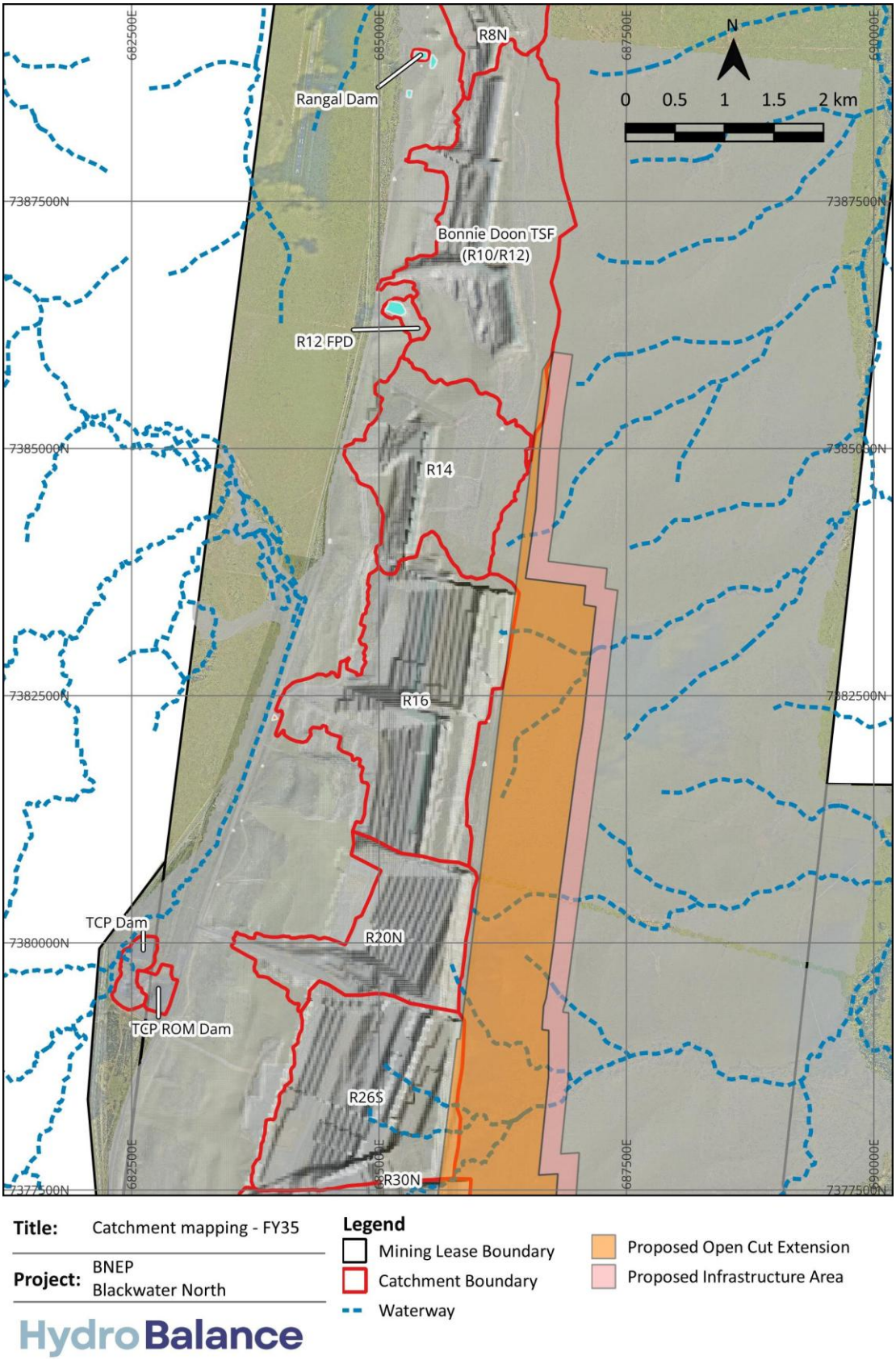


Figure 4.16 - Catchment mapping - Blackwater North - FY35

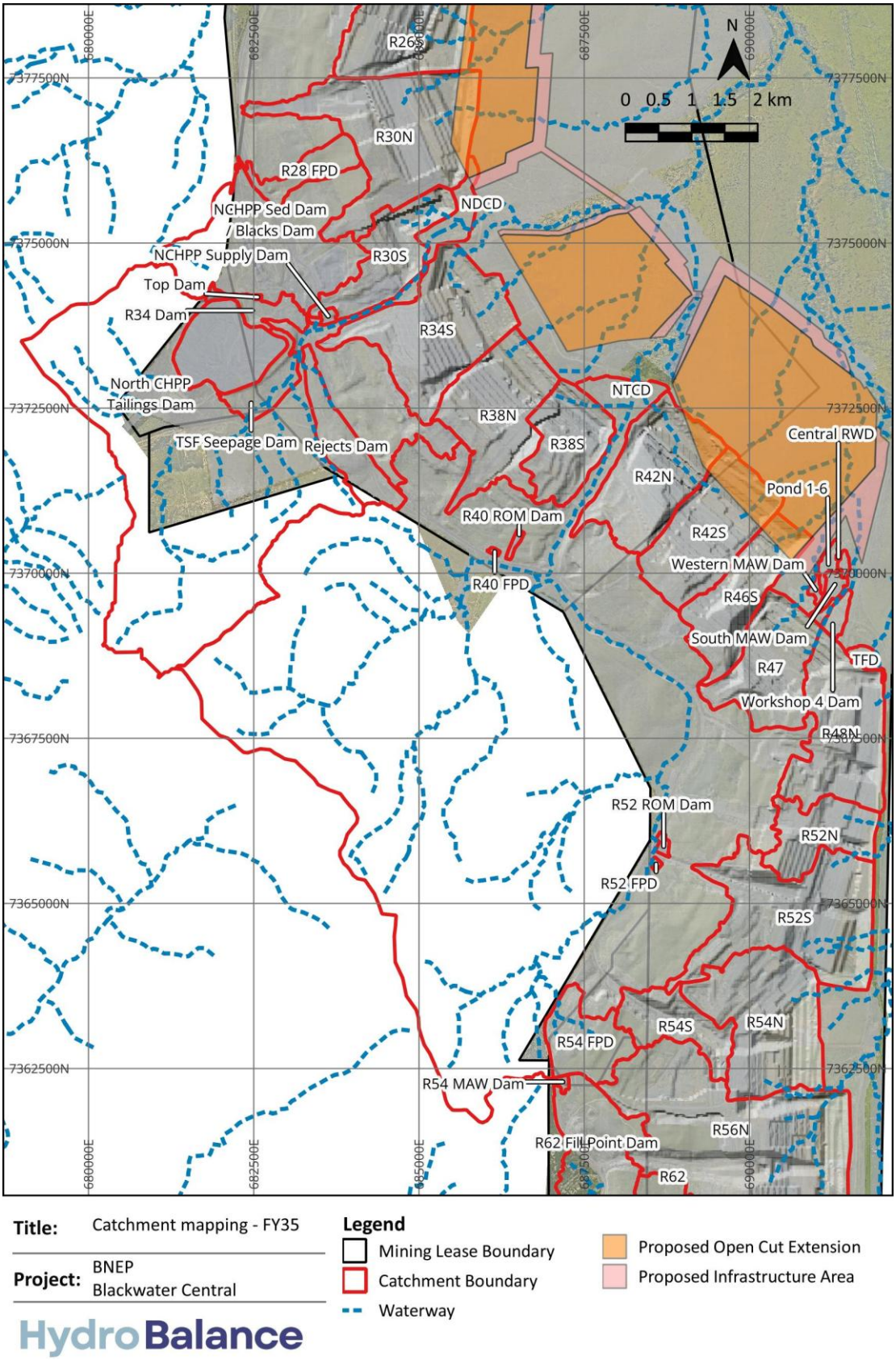
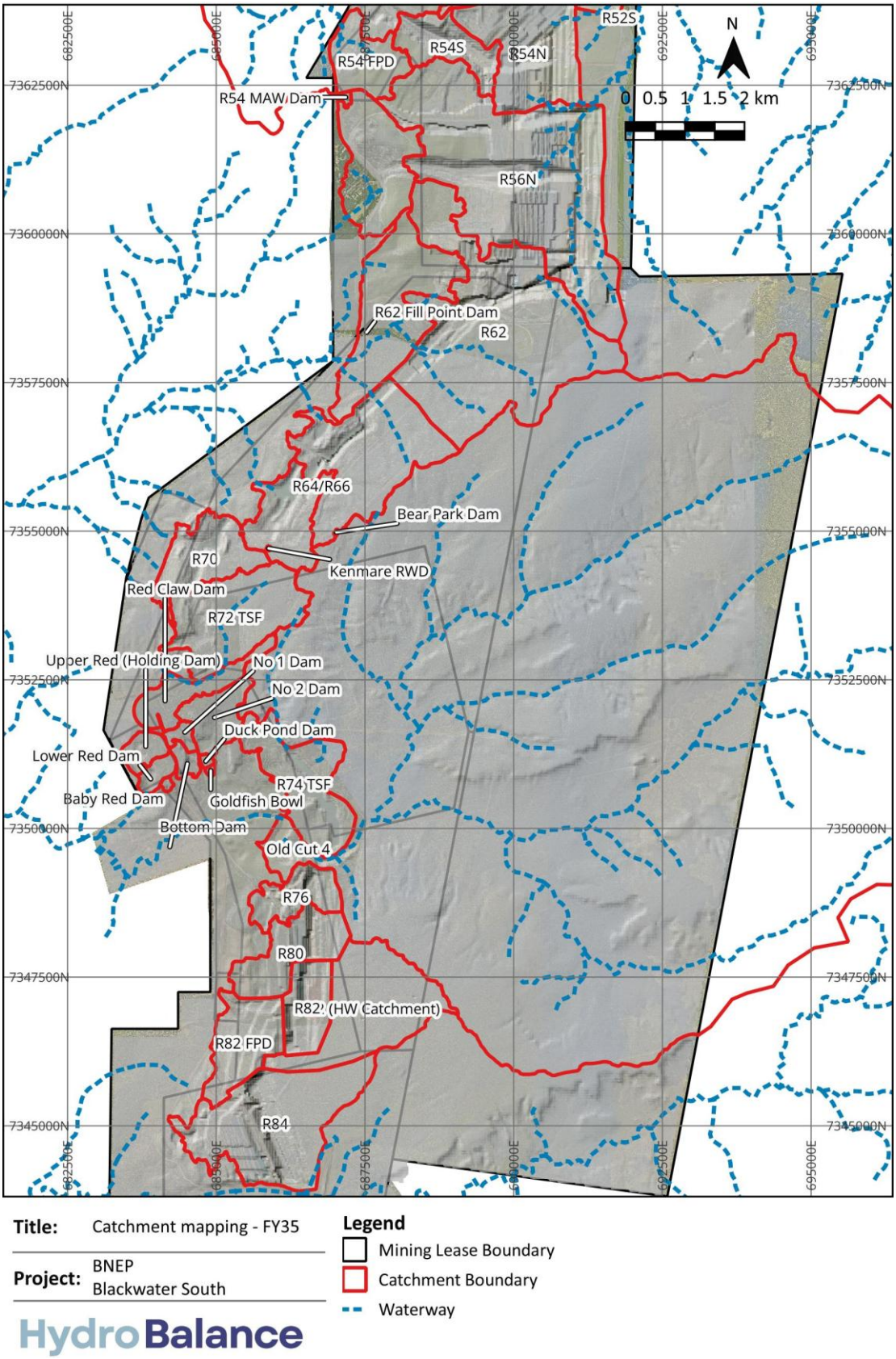


Figure 4.17 - Catchment mapping - Blackwater Central - FY35



Title: Catchment mapping - FY35

Project: BNEP Blackwater South

HydroBalance

Legend

- Mining Lease Boundary
- Catchment Boundary
- Waterway

Figure 4.18 - Catchment mapping - Blackwater South - FY35

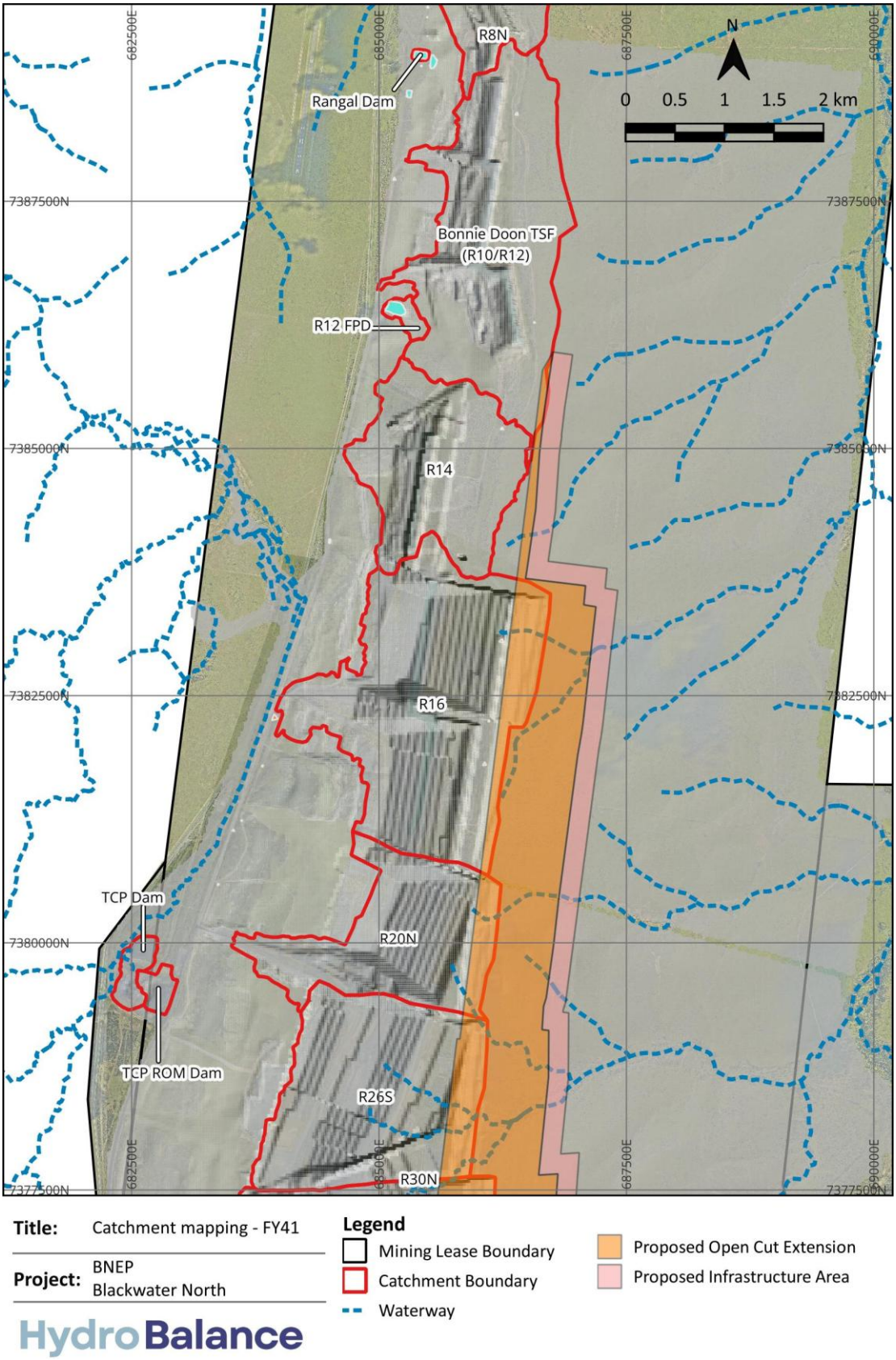


Figure 4.19 - Catchment mapping - Blackwater North - FY41

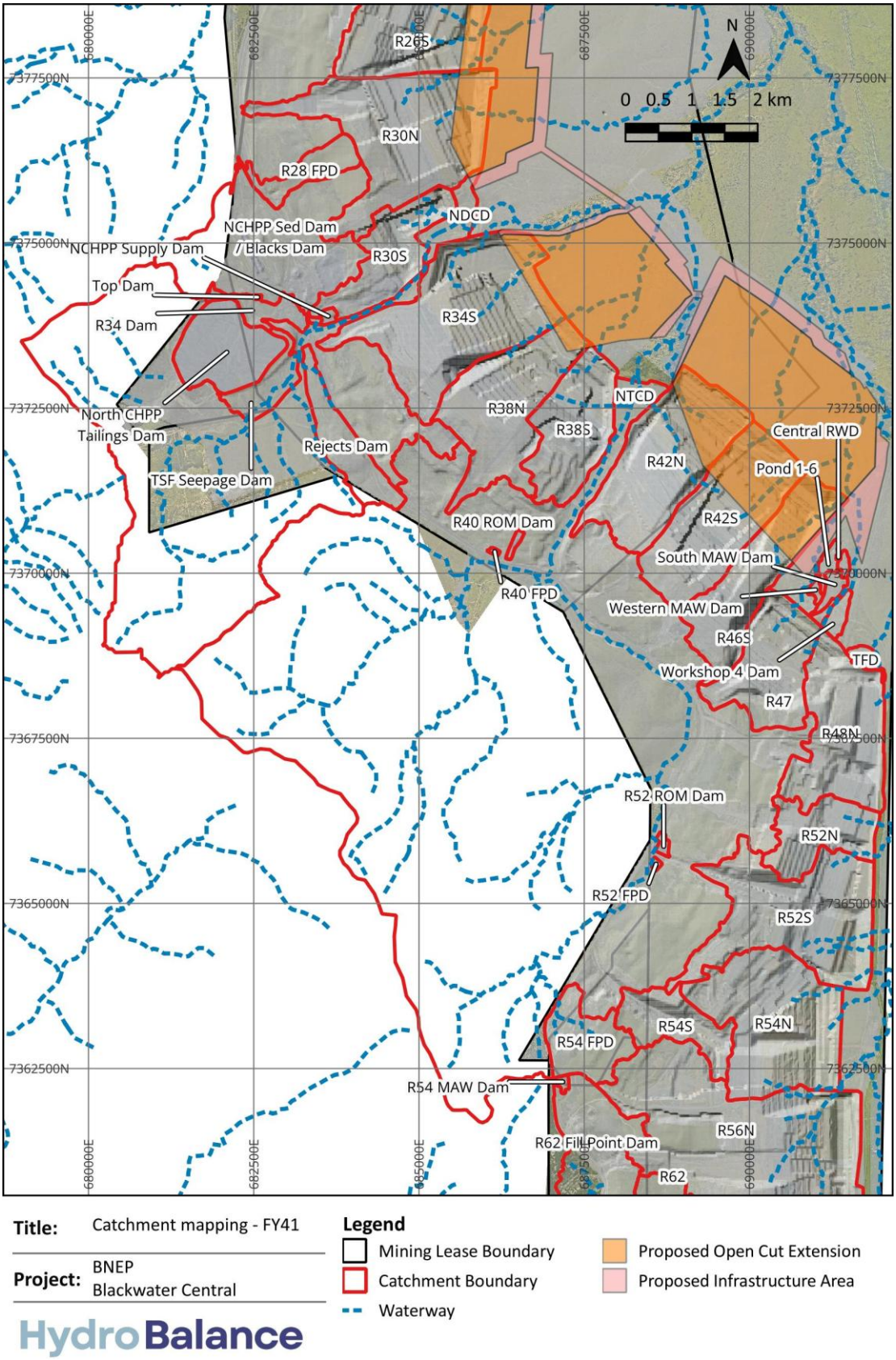


Figure 4.20 - Catchment mapping - Blackwater Central - FY41

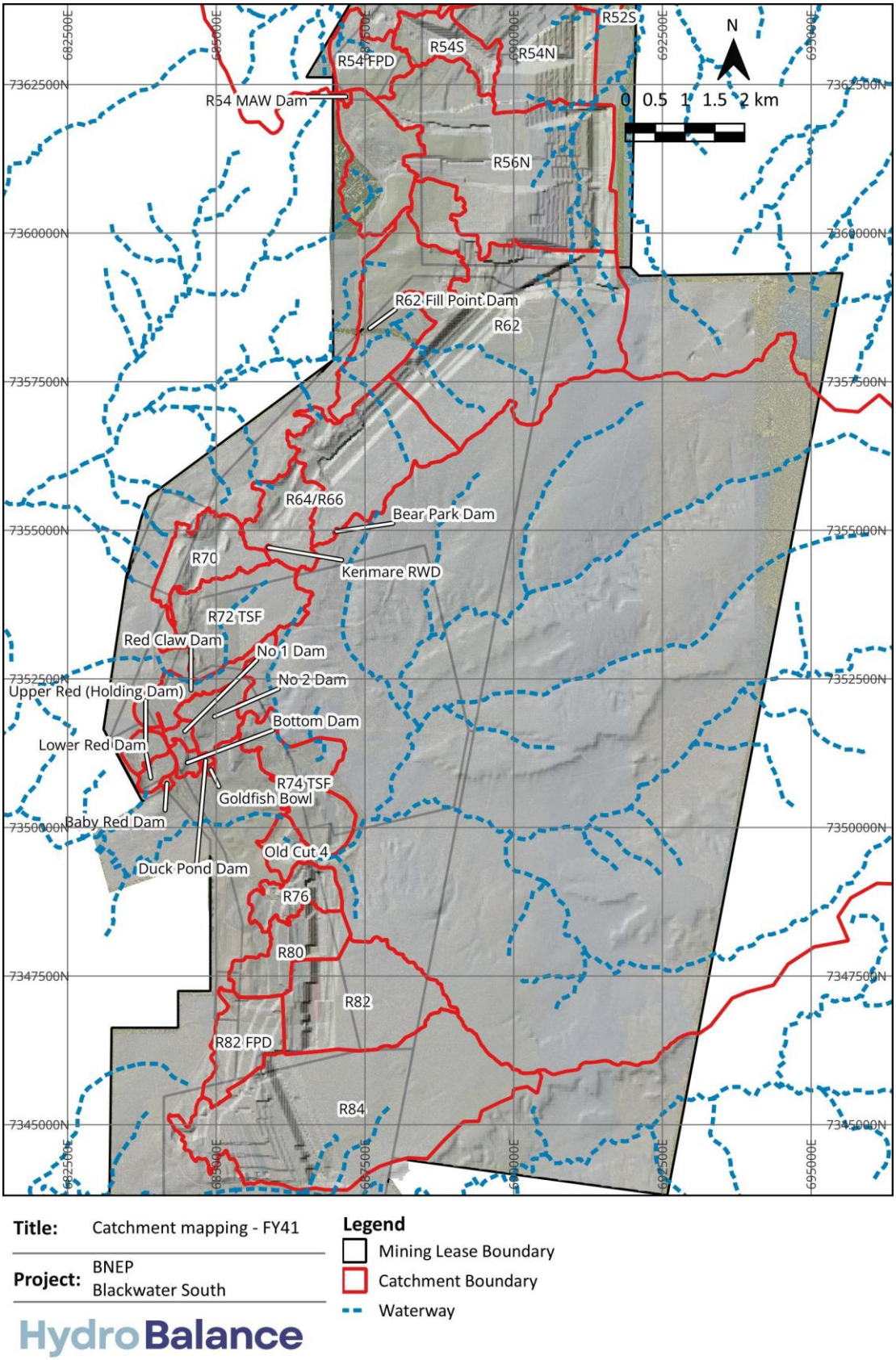


Figure 4.21 - Catchment mapping - Blackwater South - FY41

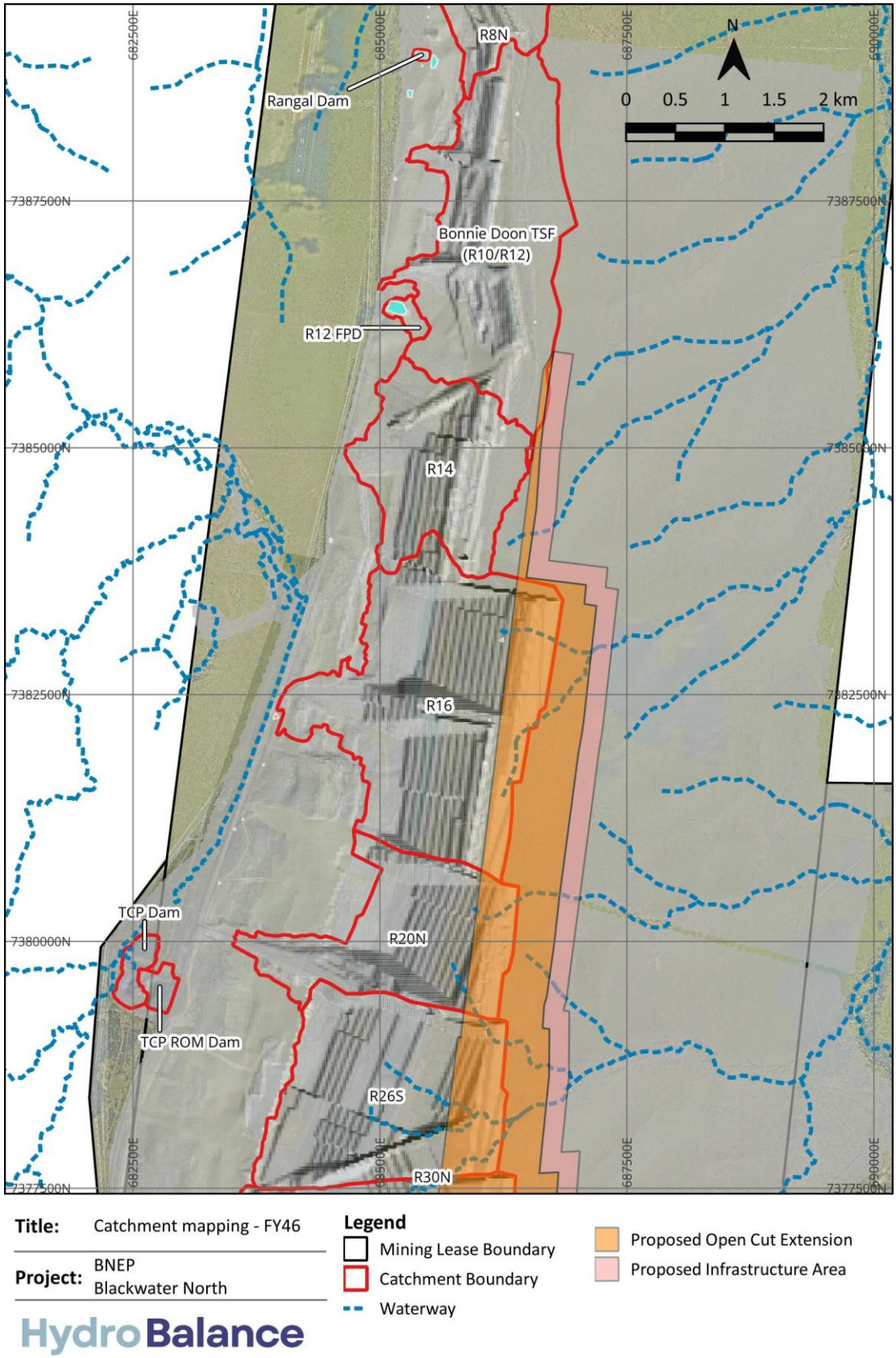


Figure 4.22 - Catchment mapping - Blackwater North - FY46

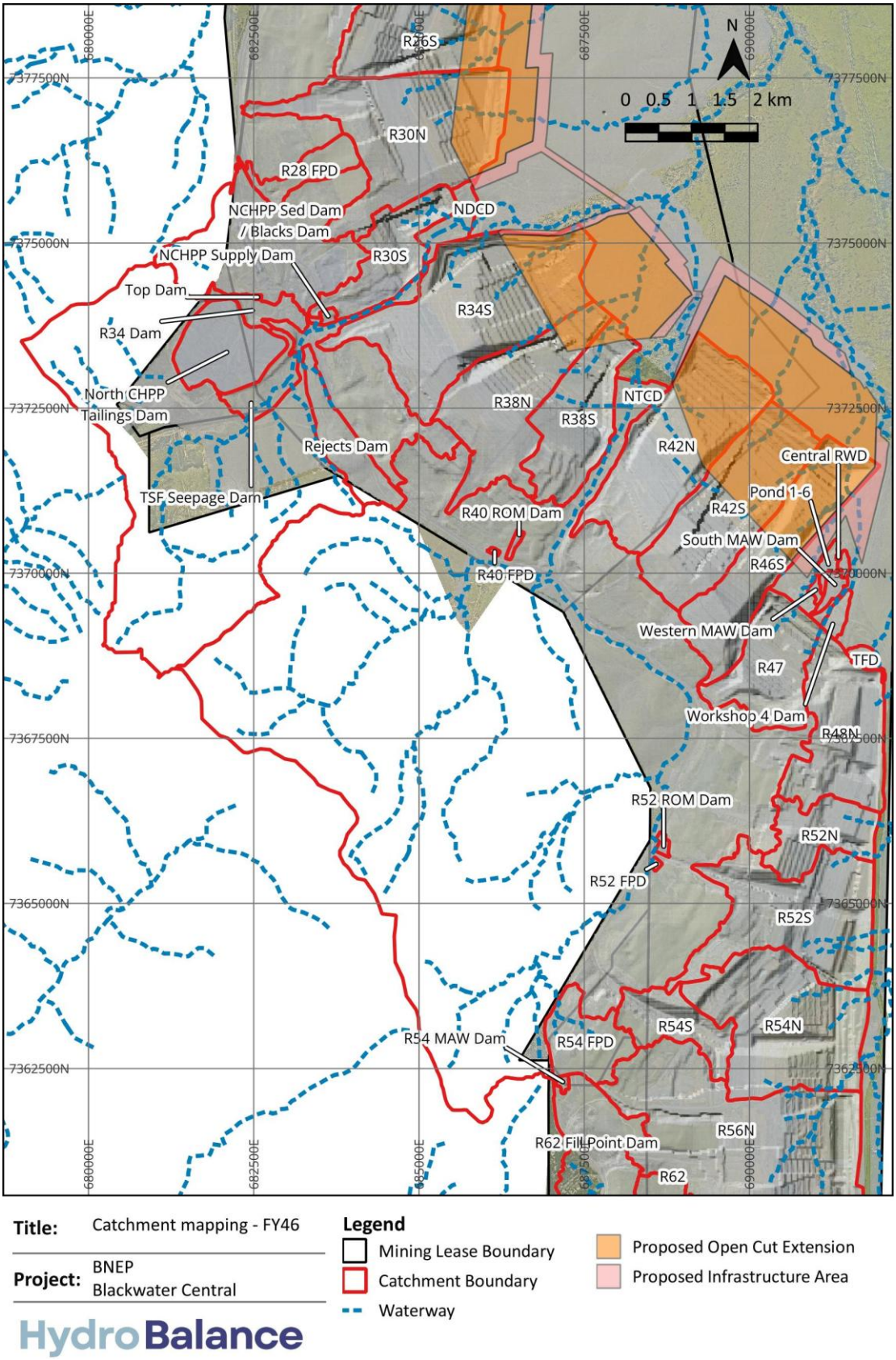


Figure 4.23 - Catchment mapping - Blackwater Central - FY46

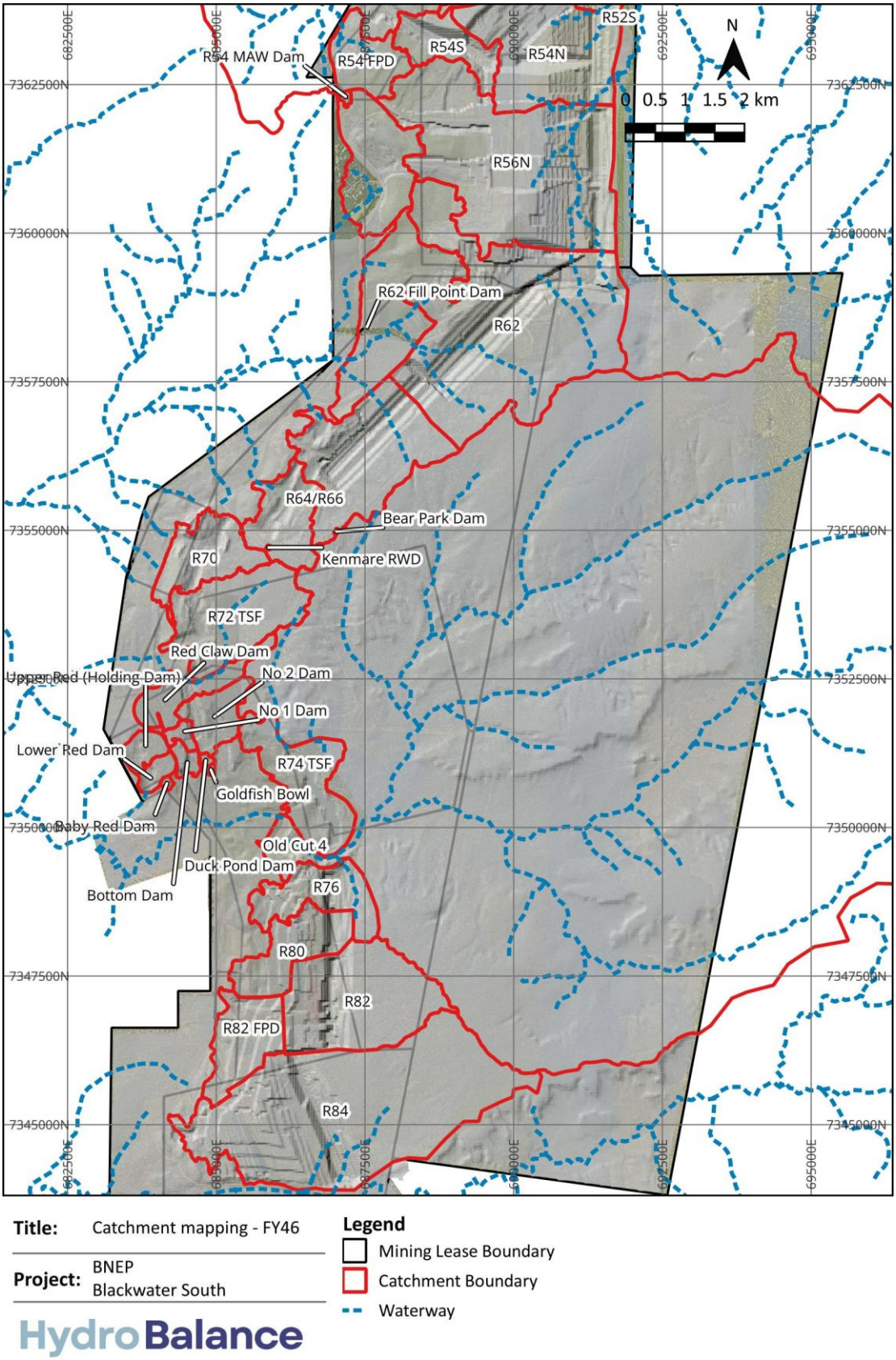


Figure 4.24 - Catchment mapping - Blackwater South - FY46

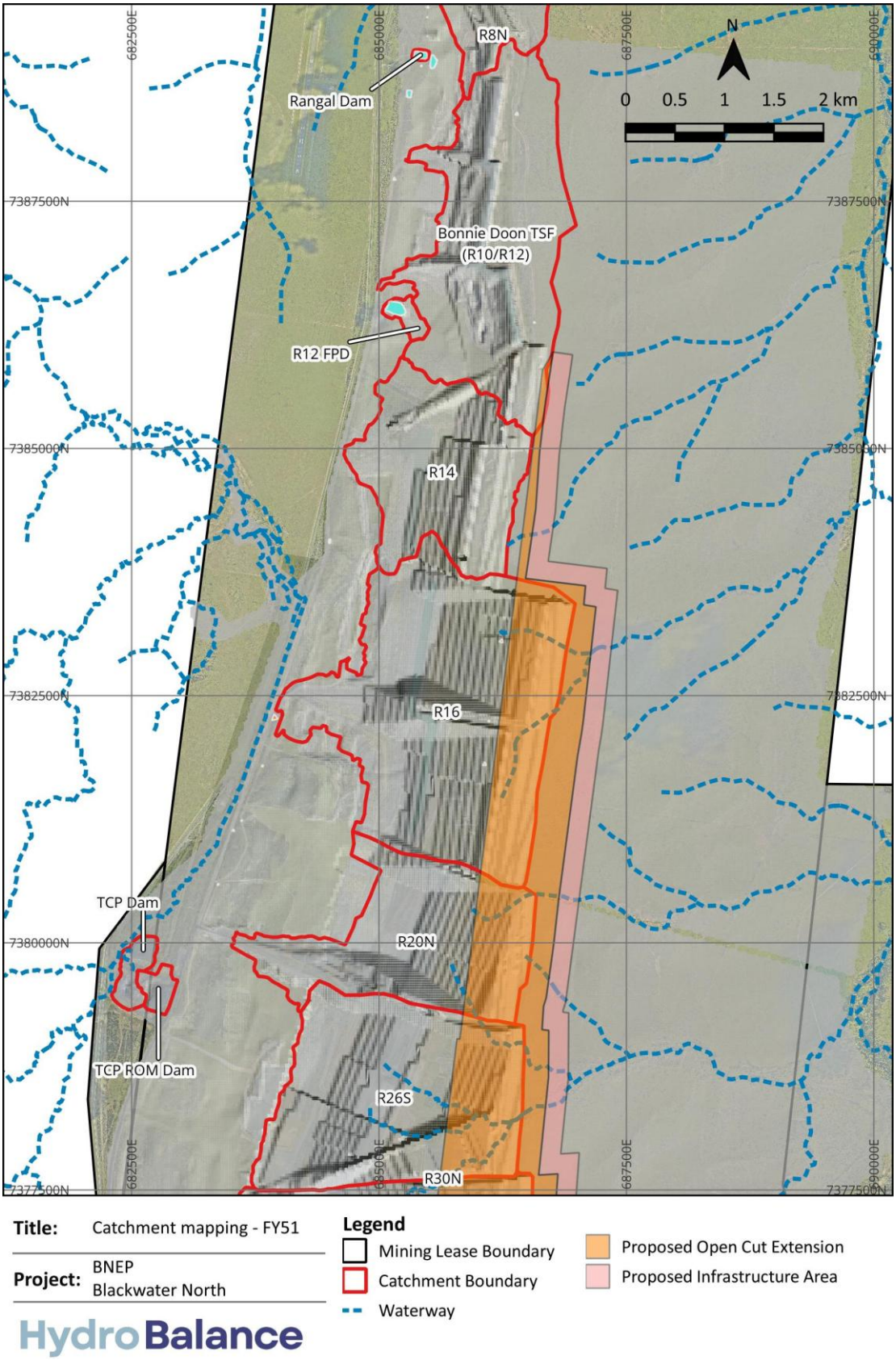


Figure 4.25 - Catchment mapping - Blackwater North - FY51

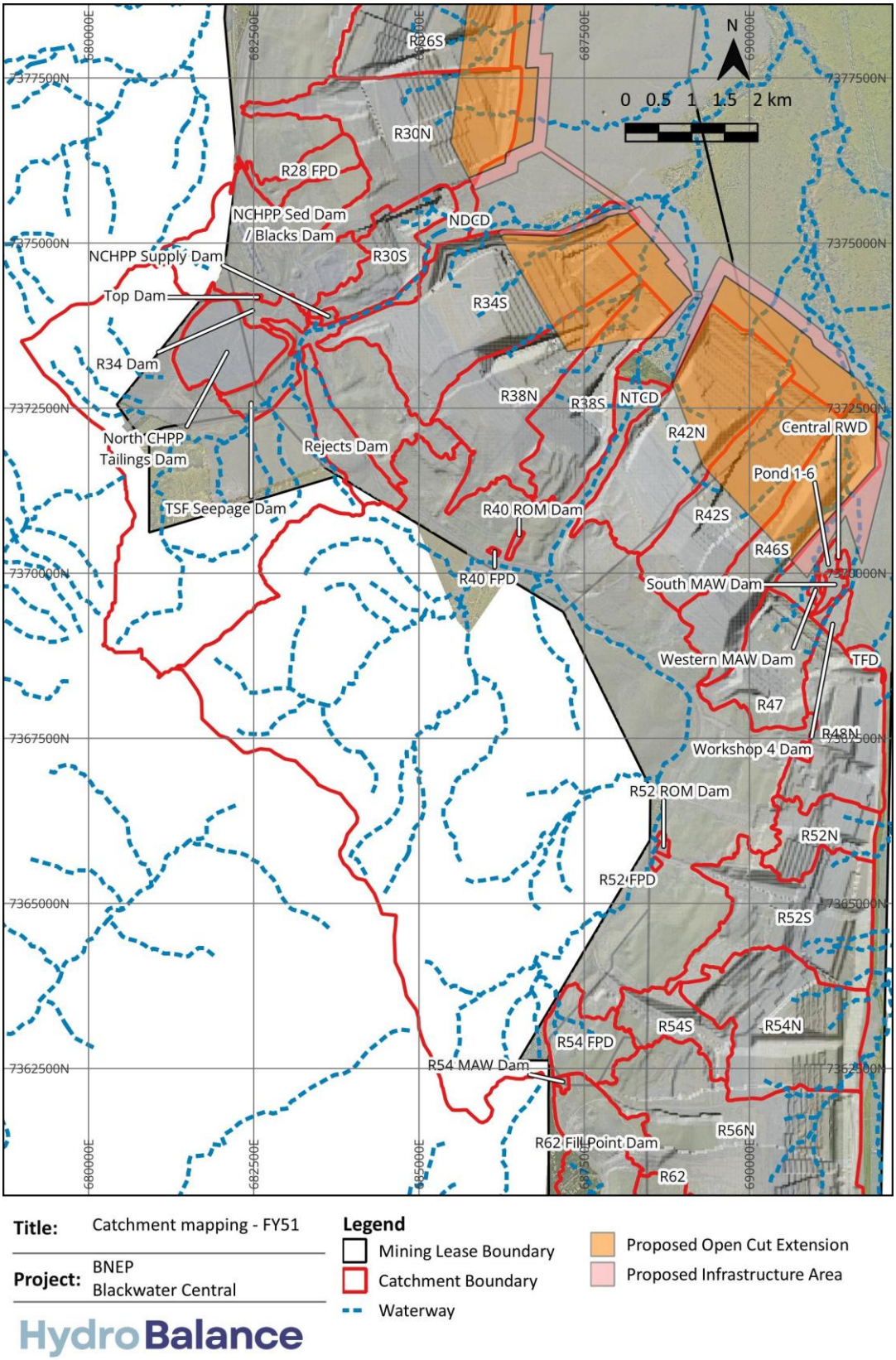
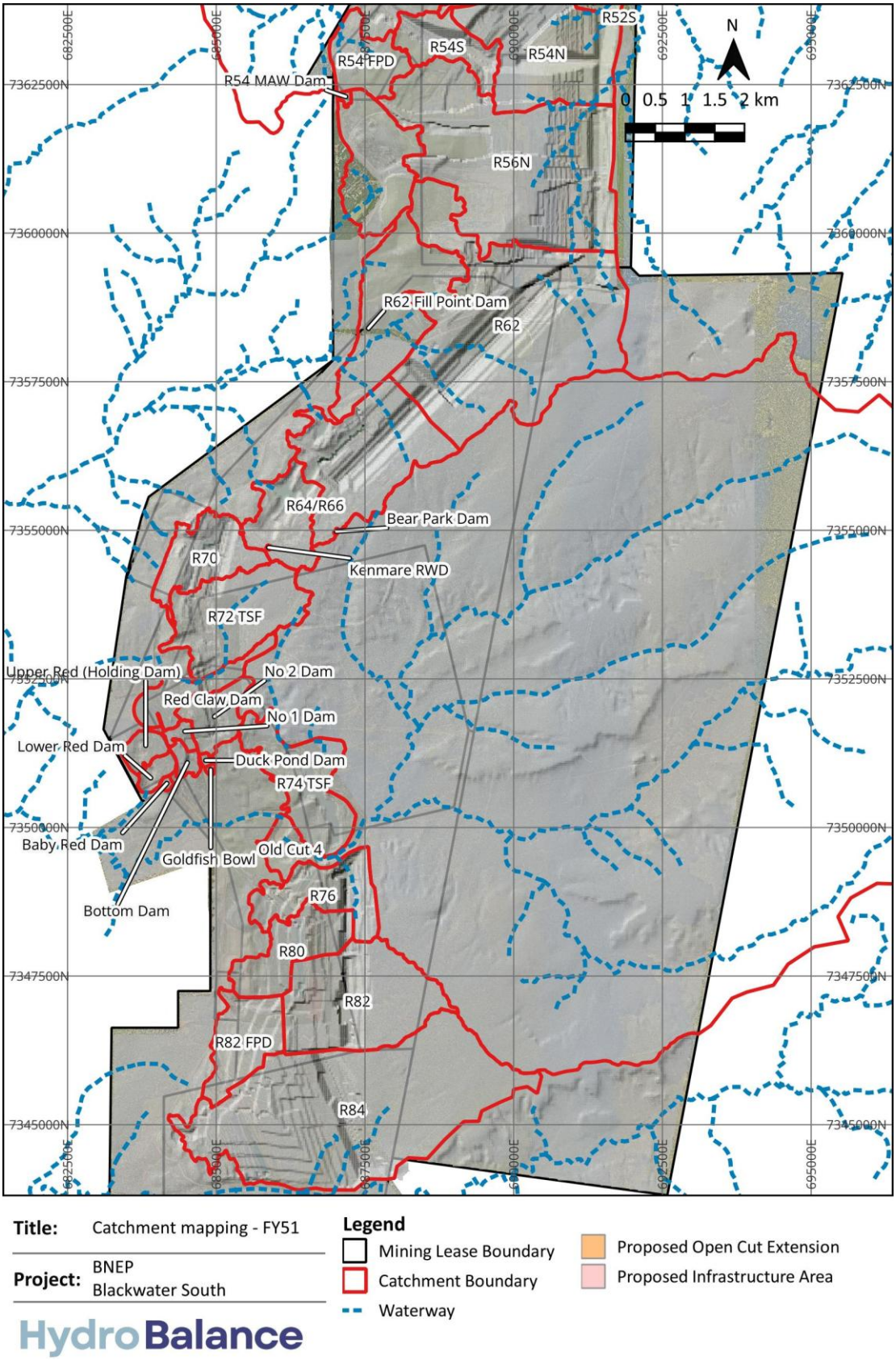


Figure 4.26 – Catchment mapping – Blackwater Central – FY51



Title: Catchment mapping - FY51

Project: BNEP Blackwater South

HydroBalance

Legend

- Mining Lease Boundary
- Catchment Boundary
- Waterway
- Proposed Open Cut Extension
- Proposed Infrastructure Area

Figure 4.27 - Catchment mapping - Blackwater South - FY51

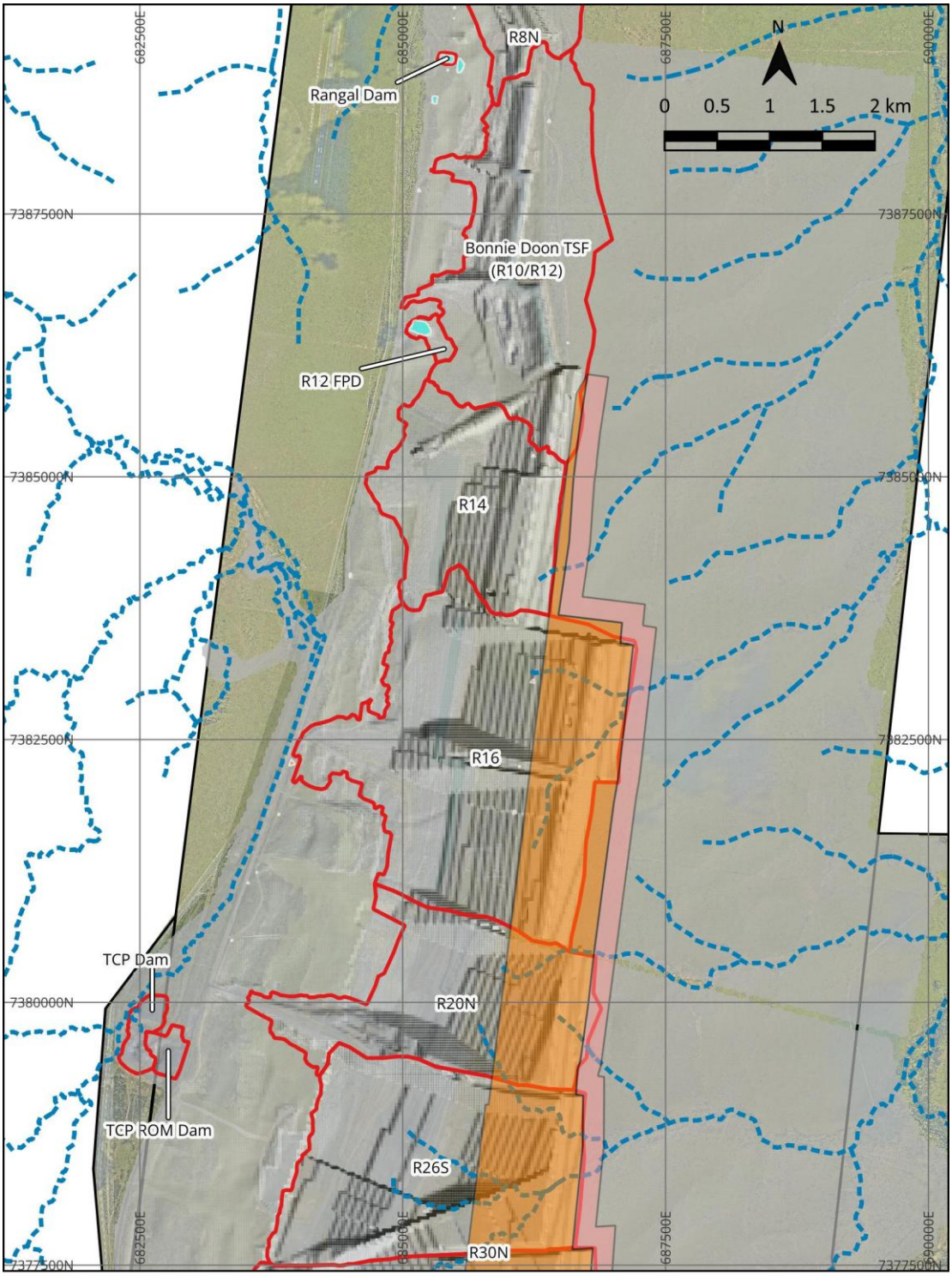


Figure 4.28 - Catchment mapping - Blackwater North - FY55

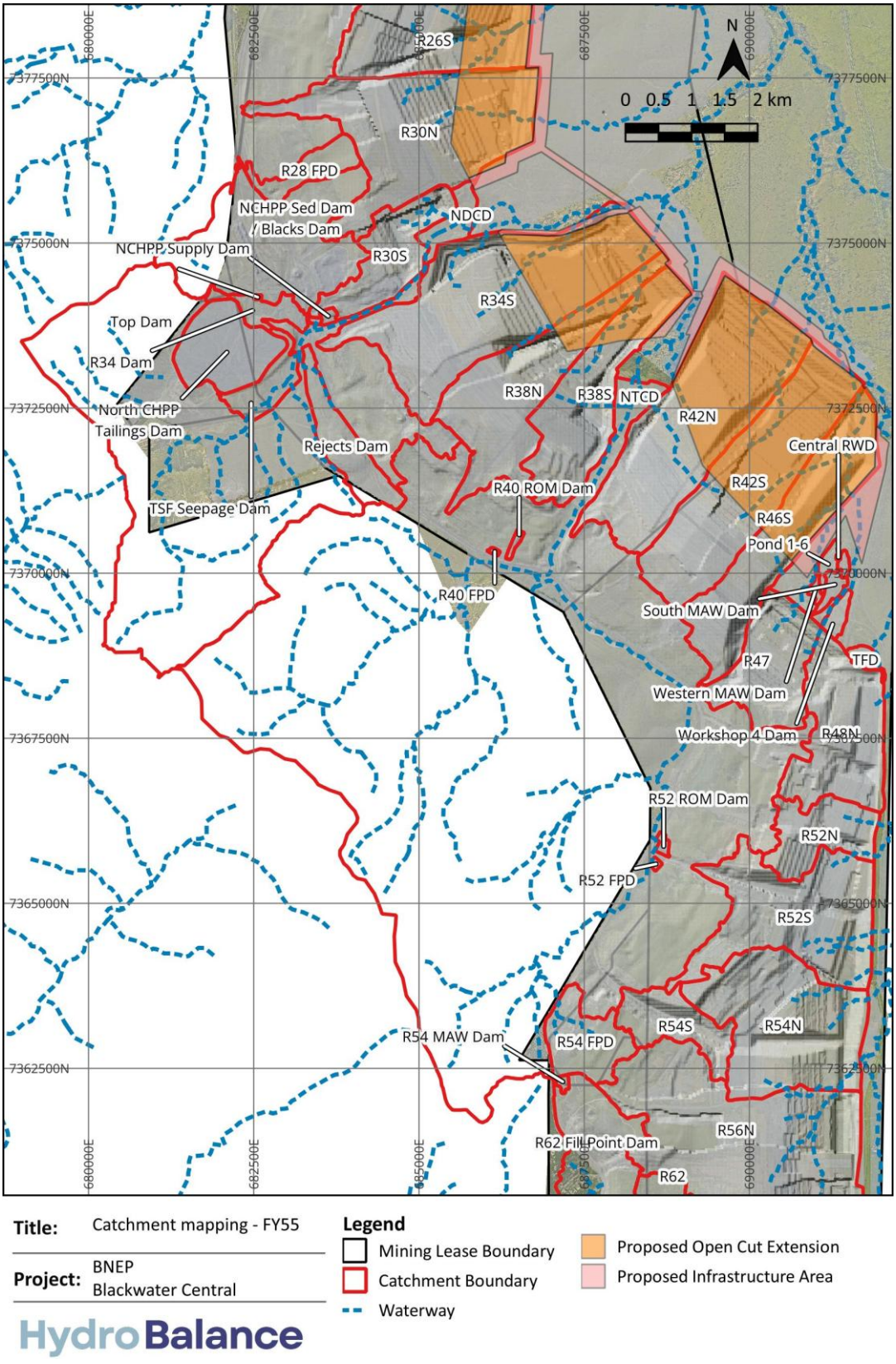
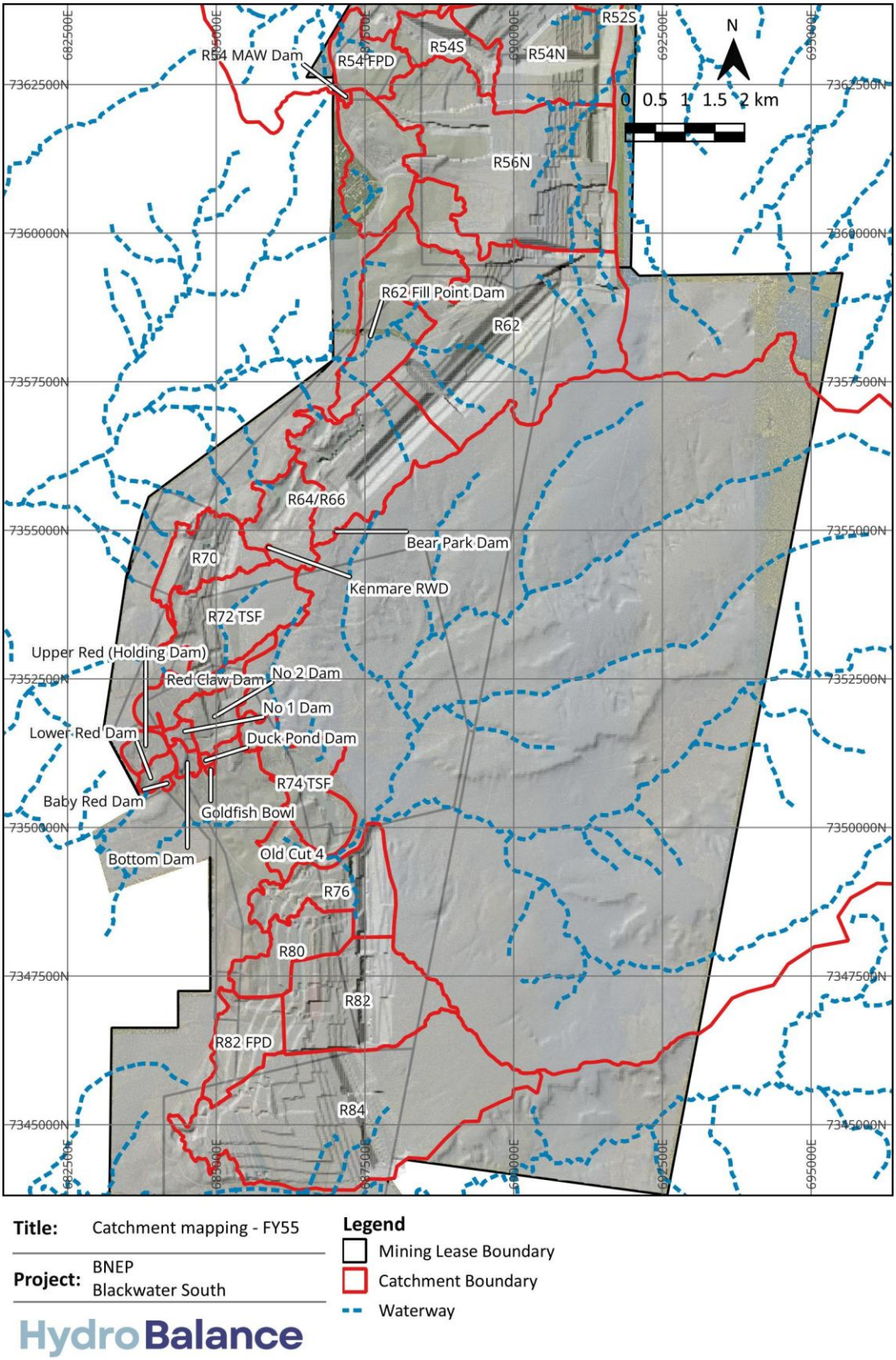


Figure 4.29 – Catchment mapping - Blackwater Central - FY55



Title: Catchment mapping - FY55

Project: BNEP Blackwater South

Legend
- Mining Lease Boundary
- Catchment Boundary
- Waterway

HydroBalance

Figure 4.30 - Catchment mapping - Blackwater South - FY55

5 Model calibration

5.1 Overview

The water balance model was calibrated for the period between July 2024 and June 2025 using site rainfall data, with the water balance model results compared to the recorded site inventories over the calibration period. The calibration was undertaken to improve the confidence of the model predictions for the forecast conditions and the sensitivity of the model parameters.

5.2 Results

Figure 5.1 shows the model calibration results, comparing the observed and modelled total site inventory. The following model parameters were adjusted to achieve this calibration result:

- Net groundwater inflow of 2.25 megalitres per day (ML/d) (821 megalitres [ML] over the calibration period). This was based on Engeny Australia Pty Ltd's (2025) estimate of the BWM 2025 associated water take, which utilised inflow data from the BWM groundwater model developed by SLR Consulting Australia Pty Ltd [SLR].
- An annual haul road dust suppression demand of 1,360 ML over the calibration period. This value was adjusted to better reflect the observed drawdown during dry periods (e.g. August to October 2025).
- A net CHPP consumption of 2,282 ML over the calibration period. This was based on a CHPP water/solids balance using CHPP run-of-mine (ROM) and production data provided by Whitehaven.

The model calibration is satisfactory and represents the performance of the BWM WMS (in terms of total inventory) over the FY25 calibration period. It simulates the drawdown during dry periods and increases during wet periods relatively well.

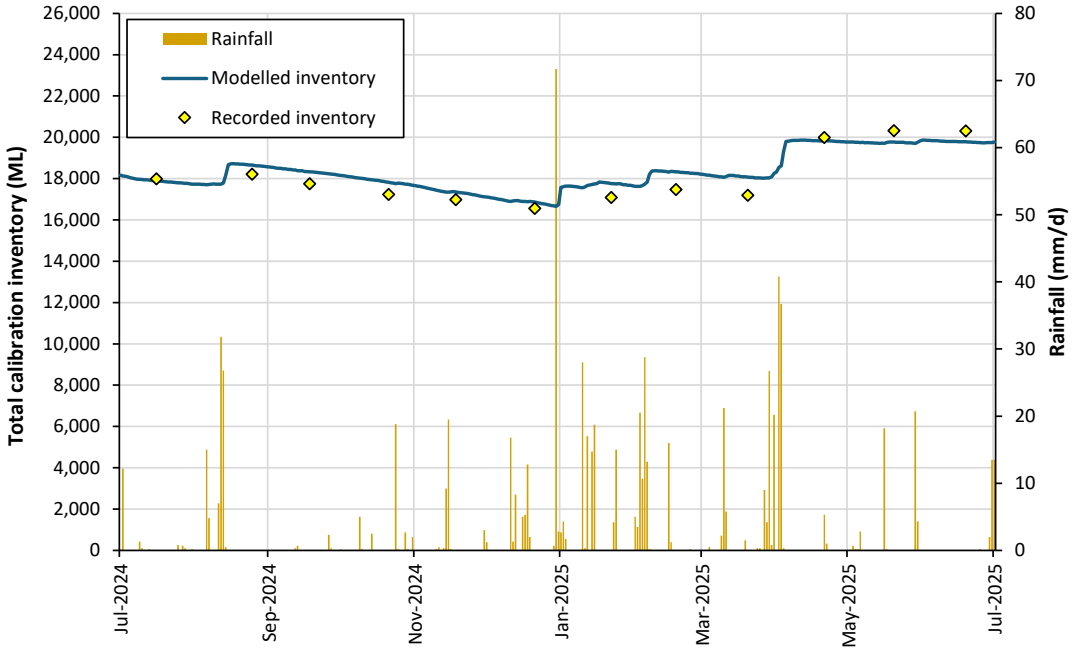


Figure 5.1 - Modelled vs recorded inventory over the calibration period (July 2024 to June 2025)

6 Water management system

6.1 Existing site storages

A summary of the existing storages within the BWM WMS is provided in Table 6.1, including the Operating Capacity (OC) for each of the storages. The OC represents the maximum allowable volume that can be stored in the dam/pit (taking into account factors such as base of weathering).

There are no additional storages proposed as part of the Project.

Table 6.1 – BWM storage details

Storage name	Operating Capacity (ML)	Overflows to
Dam storages		
BWM North MAW Dams		
R12 FPD	241.8	Offsite
TCP Dam	68	Offsite
TCP ROM Dam	15.5	Offsite
R28 FPD	7.5	Offsite
Top Dam	100	Offsite
NCHPP Sed Dam/Blacks Dam	39.3	Deep Creek
NCHPP Supply Dam	48.7	Offsite
R34 Dam	11.8	-
TSF Seepage Dam	41.3	Offsite
Rejects Dam	16	Offsite
South MAW Dam	13.4	Offsite
Pond 1-6	25.9	Offsite
Western MAW Dam	3.0	Pond 1-6
Workshop 4 Dam	51.3	Offsite
TFD	97.5	Two Mile Gully
Old R40 FPD	-	NTCD
R40 FPD	13.1	NTCD
R40 ROM Dam	12.3	NTCD
R48 FPD	29.8	Offsite
R52 ROM Dam	12.0	Offsite
R52 FPD	20.1	Offsite
R54 FPD	12.0	Offsite
R54 MAW Dam	26.6	Offsite
BWM South MAW Dams		
Upper Red Dam (Holding Dam)	113	Lower Red Dam
Lower Red Dam	80	Offsite
Baby Red Dam	0.5	Offsite
No 1 Dam	7.2	Bottom Dam
No 2 Dam	156	Duck Pond
Bottom Dam TSF	0.45	Duck Pond
Duck Pond	61.9	Goldfish Bowl

Storage name	Operating Capacity (ML)	Overflows to
Goldfish Bowl	15	Sirius Creek
R56 FPD	157.2	Speculation Creek
R62 FPD	15.3	Speculation Creek
R82 FPD	110.3	Rockland Creek
On-stream storages		
NDCD	268.9	Deep Creek
NTCD	533.9	Taurus Creek
Old Cut 4	447.5	Sirius Creek
Rockland Basin	13,800	Rockland Creek
Pit storages		
R14	8,191	R16
R16	11,999	R20
R30S	860	R30N
R64/R66	4,963	Offsite
R70	2,170	Offsite
R76	2,149	Offsite
R80	7,879	Offsite
R84	7,563	Rockland Creek
Tailings dams		
R10/R12 WSP (Bonnie Doon)	5,527	Offsite
North CHPP Tailings Dam	738	Offsite
R72 TSF	487	Offsite
R74 TSF	3,949 (FSV) 3,453 (MOV)	Offsite
Pits		
R8N	<200	Offsite
R20/R26	30,644	Offsite
R30N	5,815	R20
R34	2,773	R38
R38	13,264	Offsite
R42	2,000	Offsite
R46N	1,500	R42
R46S	1,500	R46N
R47	1,500	R46S
R48	2,000	Offsite
R52N	569	Offsite
R52S	2,000	Offsite
R54	5,217	Offsite
R56	5,217	Offsite
R62	2,000	R56
Raw Water Dams		
Rangal Dam	5	Offsite
Central RWD	5	Offsite
Kenmare RWD	22	Offsite

Storage name	Operating Capacity (ML)	Overflows to
Bear Park Dam	22	Offsite
Red Claw Dam	113	Offsite

Notes: MAW = Mine Affected Water
TSF = Tailings Storage Facility

6.2 Water management system configuration

Figure 6.1 to Figure 6.3 show a conceptual water circuit schematic of the existing BWM WMS. In addition to the linkages shown in these figures, storages will also receive inflows from direct rainfall and losses from evaporation.

There are ten backbone pipelines onsite, connecting a number of storages across the site (from north to south):

- NTCD14a pipeline;
- NTCD14b pipeline;
- NTCD14c pipeline;
- NCHPP14 pipeline;
- TFD NTCD pipeline;
- R40FPD_R64 pipeline;
- TFD64_North pipeline;
- TFD64_South pipeline;
- TFD64_2 pipeline; and
- R64_R82 pipeline.

The backbone pipeline operation rules, source/destination dams and pumping priorities are summarised in Table 6.2.

Table 6.2 – Backbone pipeline operation

Source			Destination		
Storage	Priority	Pump rate (litres per second [L/s])	Storage	Priority	Pump rate (L/s)
NTCD14a pipeline – 100 L/s maximum capacity					
R16	3	120	NTCD	1 (if conditions allow)	100
R20/R26	6	470	Pits	Reverse order of source priority	
R30N	4	50			
R30S	4	70			
R34S	5	50			
R38	2	80			
R14 WSP	1	150			
NTCD14b pipeline – not used					
NTCD14c pipeline – 250 L/s maximum capacity					
R14 WSP	1	150	NTCD	1 (if conditions allow)	250
NCHPP14 pipeline – 200 L/s maximum capacity					

Source			Destination		
Storage	Priority	Pump rate (litres per second [L/s])	Storage	Priority	Pump rate (L/s)
R14 WSP	1	150	NCHPP WSD	1 (if conditions allow)	200
			R28 FPD	1 (if conditions allow)	200
			TCP Dam	1 (if conditions allow)	200
TFDNTCD pipeline - 150 L/s maximum capacity					
NTCD	1	100	TFD	1 (if conditions allow)	150
R46N	2	60			
R46S	2	200			
R47	2	60			
R40FPD_R64 pipeline - 100 L/s maximum capacity					
R40 ROM Dam	1	150	NCHPP WSD	1 (if conditions allow)	100
R64 WSP	1	200	R52 FPD	2 (if conditions allow)	100
TFD	1	100	R54 FPD	3 (if conditions allow)	100
TFD64 North pipeline - 480 L/s maximum capacity					
R48	1	160	TFD	1 (if conditions allow)	480
R52N	1	80			
R52S	1	80			
R54	1	160			
TFD64 South pipeline - 240 L/s maximum capacity					
R56	1	80	R64 WSP	1 (if conditions allow)	240
R62	1	80			
R62_FPD	1	50			
TFD64_2 pipeline - 150 L/s maximum capacity					
TFD	1	100	R64 WSP	1 (if conditions allow)	150
R64-R82 pipeline - 100 L/s maximum capacity					
R64 WSP	1	100	R80 WSP	1 (if conditions allow)	100
R70 WSP	1	200	R82 WSP	1 (if conditions allow)	100

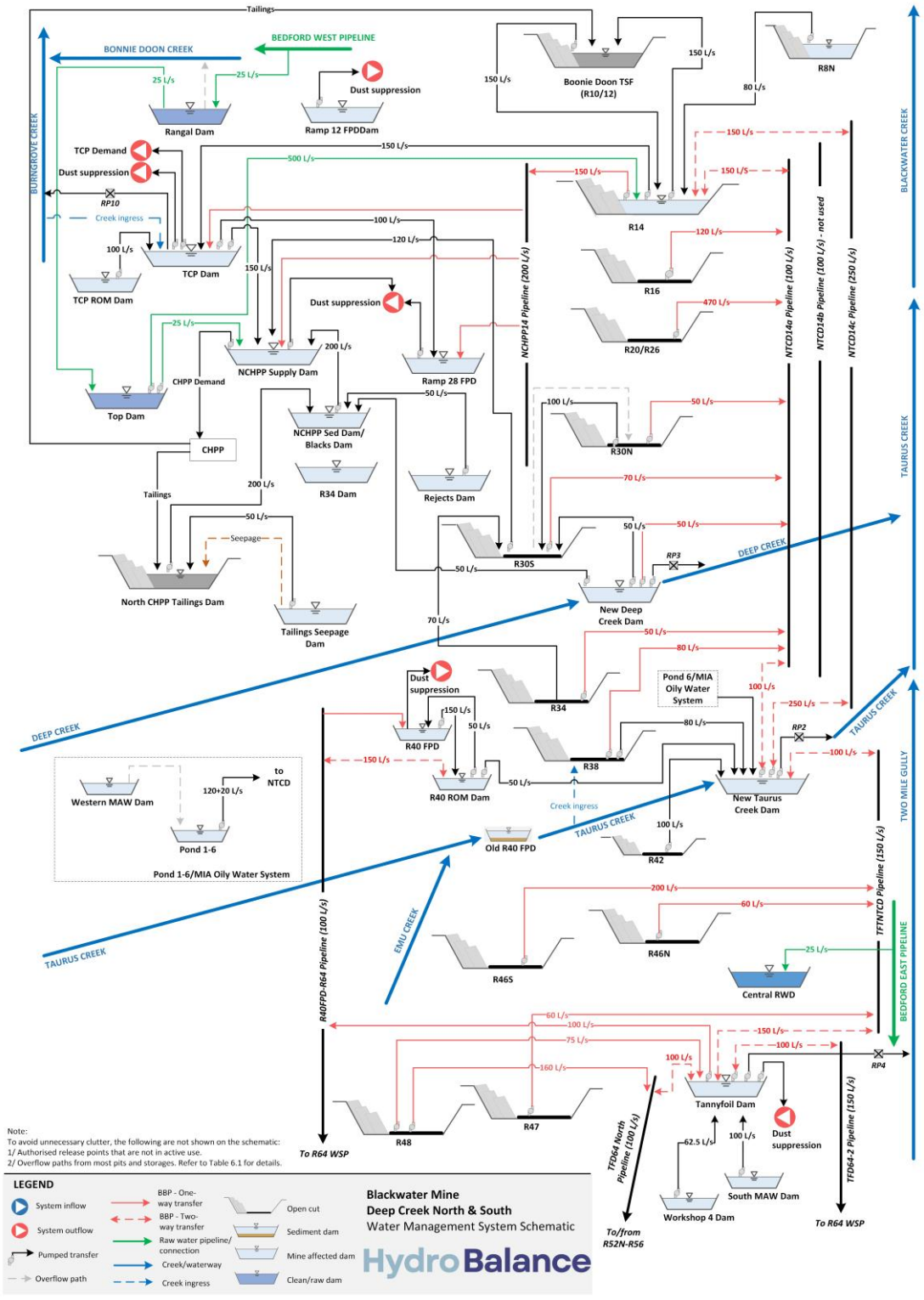


Figure 6.1 – Schematic of BWM WMS – Deep Creek North and South

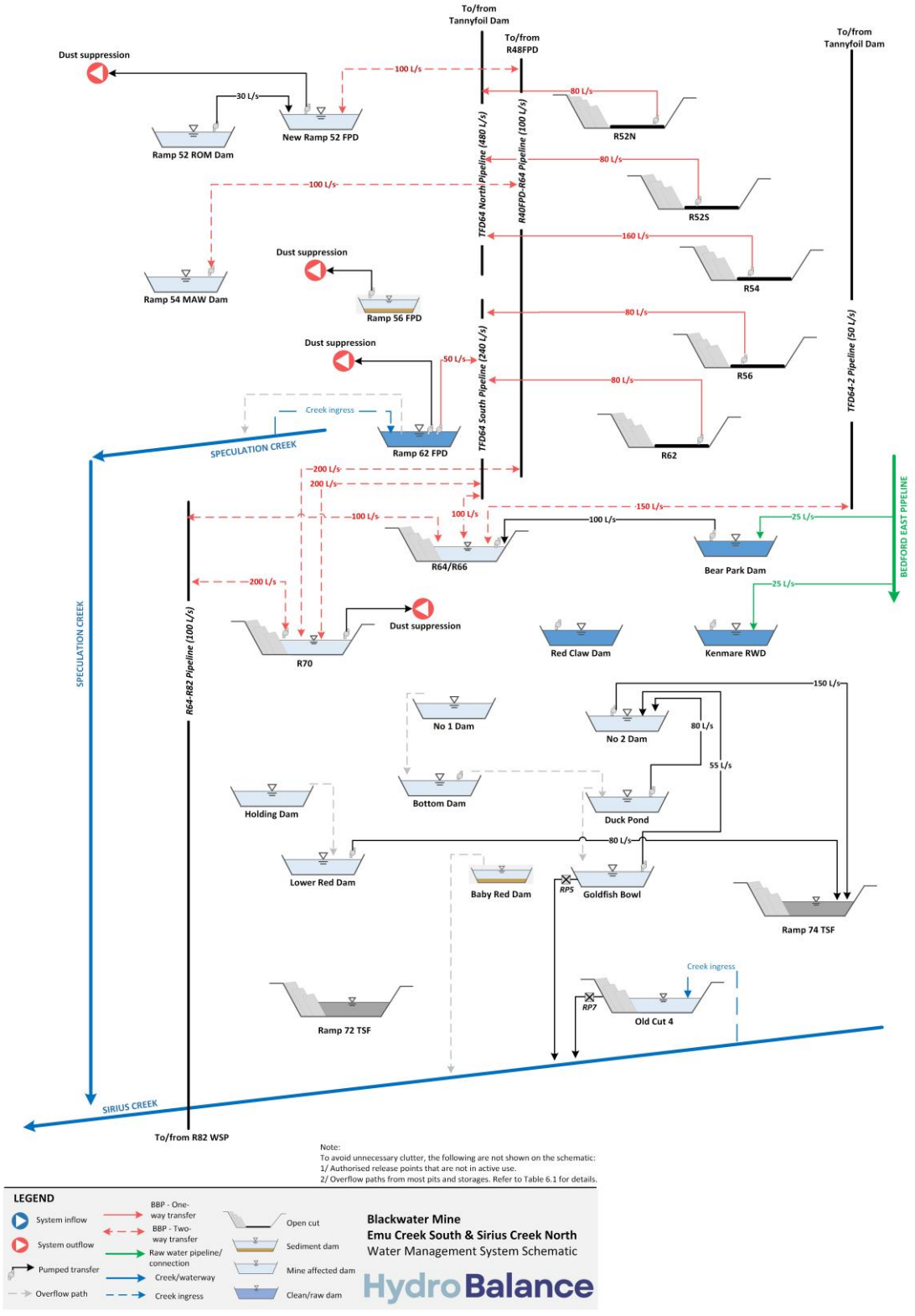
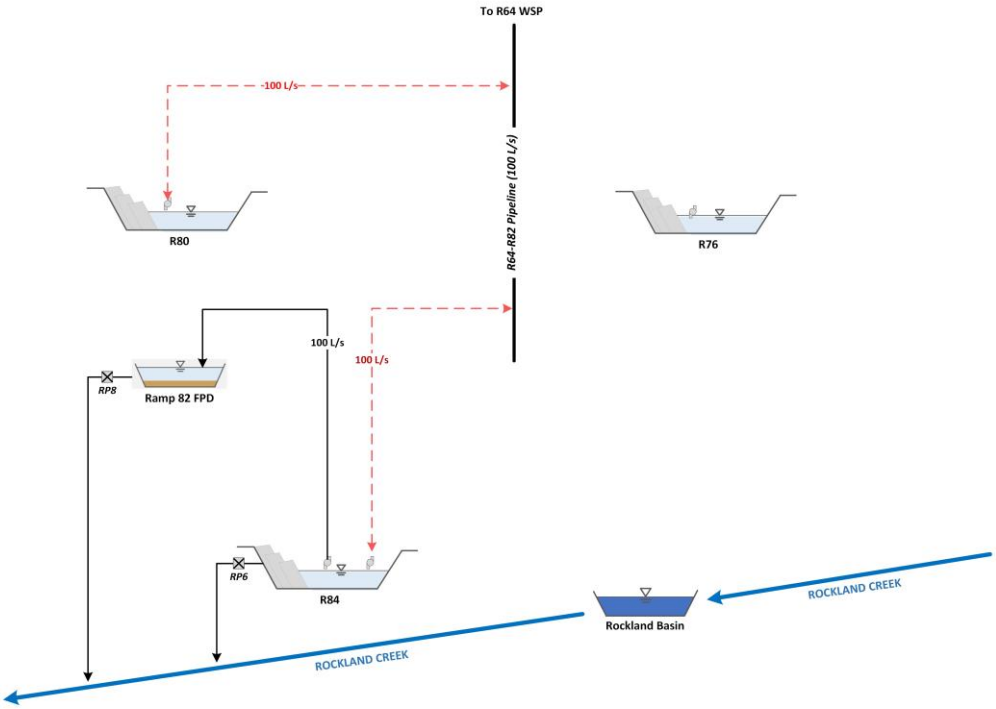


Figure 6.2 – Schematic of BWM WMS – Emu Creek South and Sirius Creek North



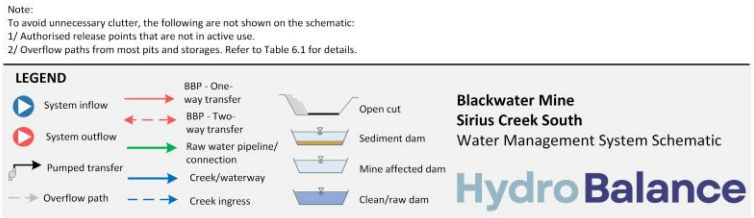


Figure 6.3 – Schematic of BWM WMS – Sirius Creek South

6.3 AWBM rainfall runoff modelling

Table 6.3 shows the adopted rainfall runoff parameters for each catchment land use. Catchment runoff was modelled using the Australian Water Balance Model (AWBM).

Table 6.3 – Adopted AWBM rainfall runoff parameters

Parameter	Natural	Spoil	Rehab (& partial rehab)	Tailings	Hardstand/ pit	Disturbed
C1 (millimetres [mm])	30	100	20	5	10	10
C2 (mm)	180	200	120	15	40	60
C3 (mm)	250	300	180	25	50	100
A1	0.134	0.134	0.134	0.134	0.3	0.3
A2	0.433	0.433	0.433	0.433	0.4	0.4
A3	0.433	0.433	0.433	0.433	0.3	0.3
C_{av}	190.2	229.9	132.6	18.0	34.0	57.0
BFI	-	0.8	0.35	-	-	-
K_{base}	-	0.98	0.98	-	-	-
K_{surf}	-	0.1	0.1	-	-	-
Cv (percent [%])	4.2	1.6	6.5	32.2	23.3	18.2

Notes: C1/C2/C3 – Surface storage capacities
A1/A2/A3 – Partial area fraction
C_{av} – Catchment averaged surface storage capacity
BFI – Baseflow index
K_{base} – Baseflow recession constant
K_{surf} – Surface flow recession constant
C_v – Long-term coefficient of runoff

6.4 Site water demands

Operational demands at BWM include haul road dust suppression and coal washing demand. Details for each demand and loss is provided in the following sections below.

6.4.1 Dust suppression

In the absence of metered data, haul road dust suppression rates have been estimated using daily rainfall and evaporation data sourced from the SILO database (Jeffrey et al., 2001).

The following rules are used to determine the applied dust suppression rate on any given day:

- For a dry day (zero rainfall), the haul road watering rate is equal to the daily evaporation rate.
- For a rain day when rainfall is less than the daily evaporation rate, the watering rate is reduced and is only required to make up the remaining depth to the daily evaporation rate.
- For a rain day when rainfall exceeds the daily evaporation rate, no haul road watering is required.

The estimated future annual dust suppression demand is 3,000 megalitres per year (ML/year). Adjustments to the model rules for the forecast simulation are as follows:

- Watered haul road length increased to 40 kilometres.

- Watered haul road width = 55 metres.
- Summer application factor = 0.85.
- Winter application factor = 0.9.

The average monthly forecast dust suppression demand is shown in Figure 6.4.

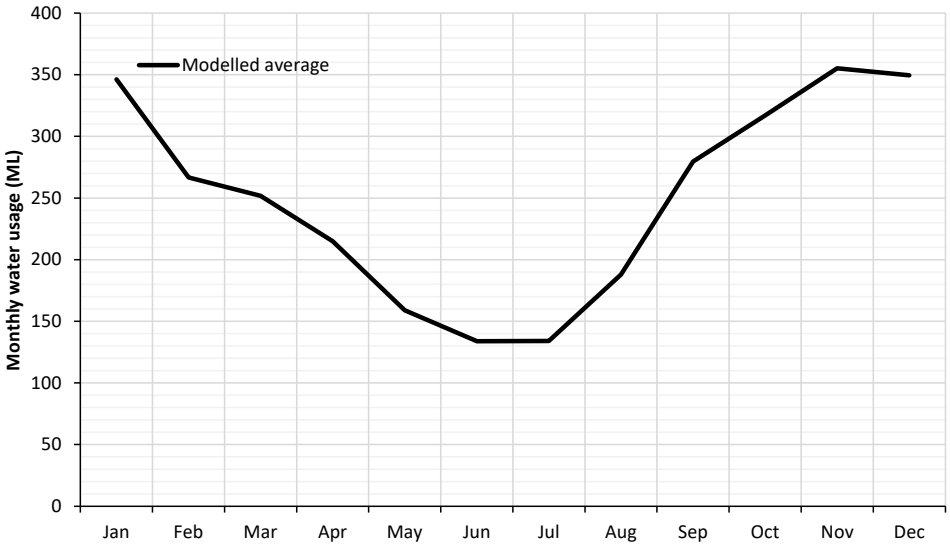


Figure 6.4 – Forecast average monthly dust suppression demand

Dust suppression water is sourced from the following storages:

- R14 WSP;
- TCP Dam;
- Top Dam;
- NCHPP WSD;
- R28 FPD;
- R40 FPD;
- TFD;
- R52 FPD;
- R56 FPD;
- R62 FPD; and
- R70 WSP.

6.4.2 CHPP production and demand

Water is required at the BWM CHPP for coal processing, wash down and other associated uses. The volume of water required for CHPP makeup is generally related to the annual coal production tonnages.

The estimated net CHPP consumption rate is 188 litres per run-of-mine tonne (L/ROM t) for the coal washed through the BWM CHPP. For bypass coal, the estimated usage is 10 L/ROM t.

The forecast annual production profile for washed and bypass coal between FY27 and FY55 and annual net consumption is summarised in Table 6.4.

Table 6.4 - BWM forecast production profile - washed coal

Period	Washed coal		Bypass coal	
	Annual tonnage (Million tonnes per annum [Mt/a])	Annual net CHPP consumption (ML/a)	Annual tonnage (Mt/a)	Annual net consumption (ML/a)
FY27	12.6	2,378	2.6	26.1
FY28	13.8	2,603	2.8	27.6
FY29	13.0	2,442	2.0	20.4
FY30	14.1	2,659	1.4	13.9
FY31	15.2	2,858	1.8	18.0
FY32	15.2	2,866	3.8	37.6
FY33	15.2	2,858	3.7	37.2
FY34	15.2	2,858	2.9	29.4
FY35	15.2	2,858	3.8	38.0
FY36	15.2	2,866	3.8	37.6
FY37	15.2	2,858	2.3	23.1
FY38	15.2	2,858	3.8	38.0
FY39	15.2	2,858	3.6	36.2
FY40	15.2	2,866	3.6	35.9
FY41	15.2	2,858	2.1	20.6
FY42	15.2	2,858	3.0	29.8
FY43	15.2	2,858	2.8	28.4
FY44	15.2	2,866	1.9	19.4
FY45	15.2	2,858	2.2	22.3
FY46	15.2	2,858	1.9	19.5
FY47	15.2	2,858	3.6	36.2
FY48	15.2	2,866	0.8	8.0
FY49	15.2	2,858	3.0	30.4
FY50	15.2	2,858	2.7	27.4
FY51	15.2	2,858	2.4	23.7
FY52	15.2	2,866	1.3	12.6
FY53	12.3	2,317	3.3	32.5
FY54	10.0	1,882	3.5	34.7
FY55	11.1	2,081	3.9	39.4

The net CHPP process makeup demand is primarily sourced from the MAW system and has a minimal raw water demand (see Section 6.5). CHPP MAW make up water is supplied continuously by NCHPP WSD.

6.4.3 Thermal Coal Plant demand

The TCP demand is not metered. As per the previous modelling, we have adopted a constant demand of 100 ML/year for the TCP water demand.

6.5 External water source

The raw water for BWM comes from the Bedford West and Bedford East pipelines, with an annual available allocation of 1,603 ML and 678 ML, respectively. Pipeline water is drawn into the site when the site-wide water storage inventory falls below 14,701 ML (Green Trigger Action Response Plan [TARP]).

A minimum raw water import volume will be applied to the model as follows, based on Whitehaven's advice:

- Bedford East supply: 27 megalitres per month (ML/month) (based on March to August 2025 usage).
- Bedford West supply: 11 ML/month (based on August 2025 usage) – this excludes 6 ML/month that is supplied to Pastoral Agreements (based on March to August 2025 usage).

A maximum daily supply rate of 10 ML/d (Bedford West) and 2.5 ML/d (Bedford East) has been allocated, which is currently what rate is achievable to site including an allowance for 85% availability.

6.6 Tailings management

The BWM Water Balance Model models the tailings waste stream as follows:

- All tailings moisture is sent to R10/12 WSP (Bonnie Doon).
- Water is actively dewatering from R10/12 WSP back to the WMS. The model accounts for loss such as tailings matrix retention, beach and decant pond evaporation, and seepage. The remaining water is then available for decant to the WMS.

The following CHPP water and solids assumptions have been made:

- ROM coal moisture content: 6.4% weight per weight (w/w).
- Product coal moisture content: 10.7% w/w.
- Product yield (wet): 77.5%.
- Product yield (dry): 69.7%.
- Coarse rejects moisture content: 10.1% w/w.
- Fine tailings moisture content: 71.8% w/w.
- Waste stream split:
  - Coarse rejects fraction (dry): 85.7%.
  - Fine tailings fraction (dry): 14.3%.
- CHPP makeup water requirement: 188 L/ROM t – note this does not account for any decant return water, it is the water needed to balance the adopted tonnages and moisture contents.

For tailings decant return, Whitehaven advise that between 30 to 50% of the water sent to Bonnie Doon in the tailings stream is decanted back to the WMS. We have adopted a return rate of 40%, which includes loss associated with beach evaporation, decant pond evaporation and seepage.

6.7 Sediment management

No specific requirements for additional sediment basins have been identified. However, there is potential additional sediment basins may be required for the Project associated with disturbance in advance (to the east) of mining operations including infrastructure corridors, pre-stripping and topsoil stockpiles.

The requirement for, and location and sizing of, any new sediment basins would be confirmed during detailed design, having regard to the final disturbance footprint, catchment configuration, drainage design and anticipated sediment-generation risk.

Where required, new sediment basins would be designed, constructed, operated and maintained in accordance with *BWM Plan - Erosion and Sediment Control Plan* (Whitehaven, 2026) and relevant contemporary guidance, including the Best Practice Erosion and Sediment Control guideline published by the International Erosion Control Association (Australasia). The erosion and sediment control system would apply a treatment-train approach, incorporating measures

such as clean-water diversion, runoff conveyance, erosion controls, sediment controls and appropriately sized sediment basins.

In areas with a high potential for sediment generation, sediment-laden runoff would be captured and directed to suitable sediment control infrastructure prior to discharge or reuse. Controls would be selected and implemented based on the nature, extent and duration of disturbance and may include measures such as progressive stabilisation, diversion drains, contour banks, check dams, sediment fences, sediment traps and sediment basins. These measures would be subject to routine inspection, maintenance and adaptive management to confirm their ongoing effectiveness.

6.8 Interactions with local waterways

A number of creeks that flow past or through BWM interact with the site's storages. These interactions are included in the model either as direct catchment inflows, or as creek ingress rating curves. These interactions are as follows:

- TCP Dam – receives creek ingress from Burngrove Creek.
- NDCD – receives direct catchment inflows from Deep Creek.
- NTCD – receives direct catchment inflows from Taurus Creek.
- R38 – receives creek ingress from Taurus Creek.
- R62 FPD - receives creek ingress from Speculation Creek.
- Old Cut 4 - receives creek ingress from Sirius Creek.
- Rockland Basin - receives direct catchment inflows from Rockland Creek.

6.9 Groundwater

The adopted total groundwater inflow rates to the mine pits are based on estimates provided from the groundwater model developed by SLR (2026), covering the simulation period. The groundwater inflows have been adjusted to account for pit face evaporation losses, and losses due to moisture within the in-situ coal being extracted during mining.

Figure 6.5 and Table 6.5 provide a summary of the groundwater estimates that have been provided for the Project over the simulation period as annual inflows between 2026 and 2055. The inflows have been distributed between the open cut pits in accordance with the provided groundwater data.

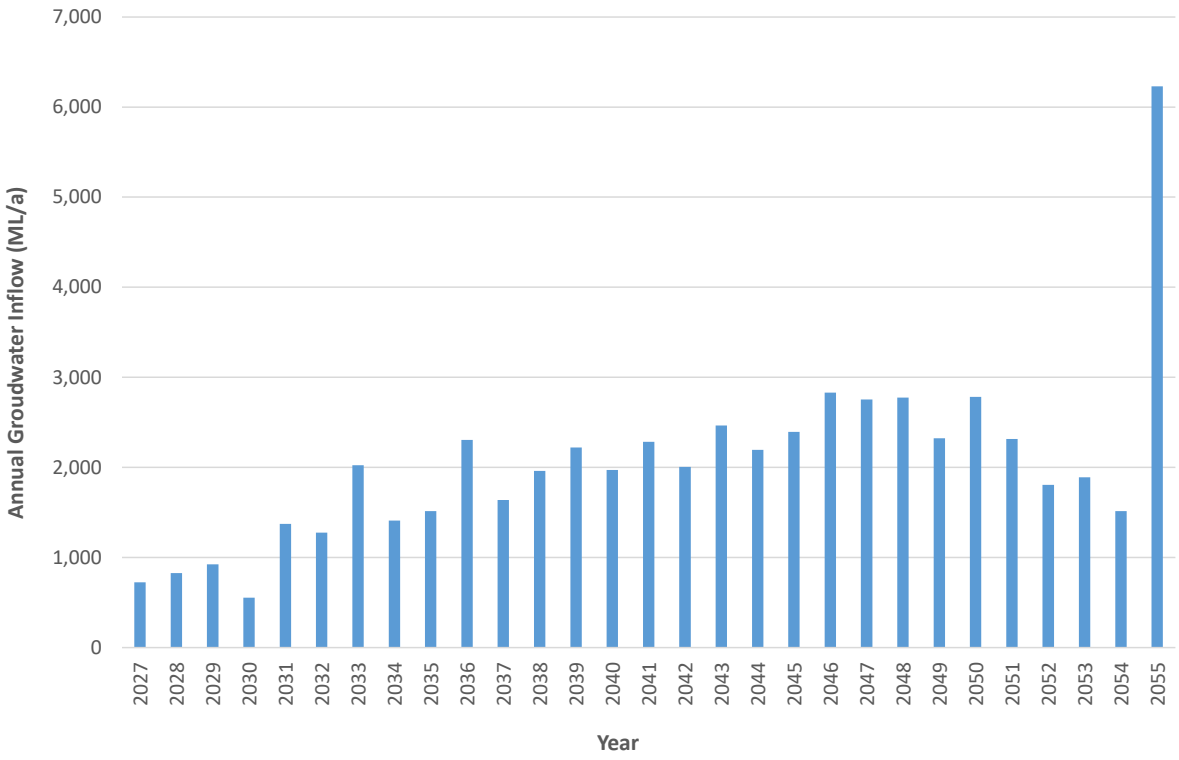


Figure 6.5 - Forecast annual groundwater inflow rate

Table 6.5 - Adopted groundwater inflow rates

Calendar year	Annual groundwater inflow (ML/a)
2027	725
2028	828
2029	924
2030	553
2031	1,373
2032	1,275
2033	2,025
2034	1,410
2035	1,514
2036	2,306
2037	1,639
2038	1,962
2039	2,220
2040	1,972
2041	2,285
2042	2,006

Calendar year	Annual groundwater inflow (ML/a)
2043	2,465
2044	2,196
2045	2,395
2046	2,830
2047	2,754
2048	2,774
2049	2,323
2050	2,782
2051	2,316
2052	1,805
2053	1,892
2054	1,515
2055	6,231

6.10 Controlled releases

Controlled releases are permitted from RP2 via NTCD, RP3 via NDCD and RP4 via TFD. Controlled releases may be undertaken when the following conditions are met per Condition F4 and Conditions F9 to F11 of the current EA (EPML00717813) (the EA):

- For RP2 and RP3:
  - the flow in Blackwater Creek (at Gauging Station 2) is greater than or equal to (≥) 1 cubic metres per second (m^3/s);
  - the electrical conductivity (EC) in the release dam is less than (<) 10,000 microSiemens per centimetre (µS/cm);
  - the 80th percentile of the mixed downstream Blackwater Creek EC values (at MP8) is <2,000 µS/cm; and
  - Blackwater Creek mixed downstream EC can exceed greater than (>) 2,000 µS/cm during a release if the upstream monitoring point is similar or higher than downstream (i.e. the mine release is not having a measurable impact on downstream water quality during the release).
- For RP4:
  - the flow in Two Mile Creek (at Gauging Station 3) is ≥1 m^3/s;
  - the EC in the release dam is <10,000 µS/cm; and
  - the 80th percentile of the mixed downstream Blackwater Creek EC values (at MP8) is <2,000 µS/cm.

The EA also authorises releases from the following storages, however these are not modelled as controlled releases:

- RP5 - Goldfish Pond;
- RP6 - Marshmead Pit;
- RP7 - Old Cut 4;
- RP8 - R82 FPD;
- RP10 – TCP Dam;
- RP11 - NCHPP Sediment Dam[1];
- RP12 - Rejects Stockpile Dam[1]; and
- RP13 - R34[1].

[1] In accordance with Table F1 of the EA, "RP11, RP12 and RP13 are not 'active' until the completion of Deep Creek Diversion Stage 2."

6.11 Trigger Action Response Plan

The site-wide water security and containment risks at BWM are managed using a TARP. The TARP has been developed by Whitehaven personnel, based on the acceptable risk profiles and the measures available to manage water onsite. The site-wide BWM TARP is summarised in Table 6.6.

Table 6.6 - BWM site-wide water management TARP

Trigger	Action / Response
Red [Dry]	• Import water from Bedford pipelines at full allocation. • Minimise dust suppression usage. • Investigate use of dust binders.
Yellow [Dry]	• Import water from Bedford pipelines at full allocation. • Minimise dust suppression usage. • Investigate use of dust binders.
Green	• Import water from Bedford pipelines at 50% allocation.
Yellow [Wet]	• Cease importing water from Bedford pipelines. • Maximise dust suppression usage. • Consider controlled release.
Red [Wet]	• Cease importing water from Bedford pipelines. • Maximise dust suppression usage. • Consider controlled release. • Allocate emergency storage in pits.

7 Water balance modelling results

7.1 Overview

An assessment of the BWM water management system has been undertaken using the water balance model with the adopted rainfall runoff parameters. Investigation outcomes depend on the accuracy of input assumptions. There is inherent uncertainty with respect to some key site characteristics (e.g. catchment yield/rainfall runoff, groundwater inflows). To manage this uncertainty, a large number of climate sequences are used, reflecting the full range of historical climatic conditions, indicates how system performance may vary under wet, dry and average climatic conditions.

7.2 Interpretation of results

The modelling methodology of a forecast simulation is described in Section 2. The results provide a statistical analysis of the water management system's performance over the next year based on 107 different climatic realisations.

The 50th percentile probability envelope represents the median results; the 10th percentile represents 10% exceedance (i.e. wet conditions) and the 90th percentile represent 90% exceedance (i.e. dry conditions). There is an 80% chance that the result will fall within the 10th and 90th percentiles, and a 98% chance that the result will fall between the 1st and 99th percentiles. Importantly, note that a percentile envelope shows the percentage chance of exceeding particular value on any specific day, and does not represent continuous results from a single model realisation (e.g. the 90th percentile trace does not represent a single continuous 90th percentile climate scenario, rather it shows the volume/rate exceeded by 90% of the 107 realisations on each day of the simulation).

7.3 Water management system inventory

Figure 7.1 shows the forecast total WMS inventory, which includes all dam and pit storages onsite and is compared to the available WMS capacity over time. The total WMS capacity is provided in Table 7.1.

The model results show the following:

- For the 5%ile results (very wet climatic conditions), the peak inventory for the combined WMS inventory reaches a volume of around 32,000 ML during the first few years of the simulation and reaching around 39,500 ML by the end of the simulation.
- For the 10%ile results (wet climatic conditions), the peak inventory for the combined WMS inventory reaches a volume of around 28,000 ML during the first few years of the simulation and reaching around 35,000 ML by the end of the simulation.
- For the 50%ile results (median climatic conditions), the peak inventory for the combined WMS inventory reaches a volume of around 17,500 ML during the first few years of the simulation and reaching around 19,000 ML by the end of the simulation.
- The combined WMS inventory is maintained below the combined WMS capacity for almost all climatic conditions. There is between a 1% and 5% probability that the combined WMS inventory will exceed the combined WMS capacity in the first two years of the simulation. This means there is a low (1-5% AEP) probability that excess MAW would need to be temporarily stored within an active pit or contingency pit storage for a short period of time

Table 7.1 – Available storage capacity at BWM

Year/s (inclusive)	Available WMS storage capacity (ML)
FY27	30,766
FY28	30,766
FY29	30,766
FY30	46,801
FY31	38,972
FY32	38,374
FY33	38,424
FY34	38,374
FY35	40,350
FY36	40,350
FY37	40,400
FY38	86,400
FY39	86,350
FY40	86,400
FY41	86,350
FY42	95,695
FY43	85,334
FY44	85,384
FY45	85,434
FY46	85,471
FY47	85,471
FY48	85,471
FY49	85,471
FY50	85,471
FY51	85,471
FY52	85,471
FY53	85,471
FY54	85,471
FY55	85,471

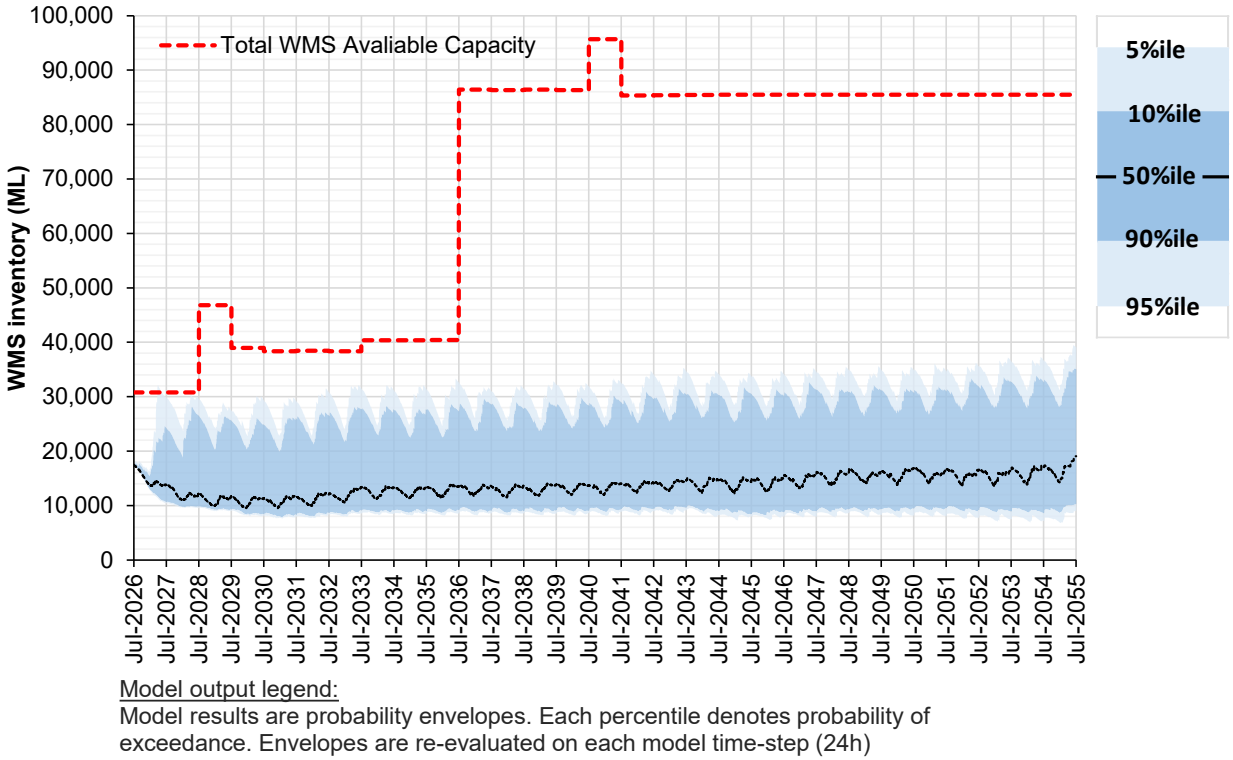


Figure 7.1 – Forecast WMS inventory

7.4 External water supply

The forecast annual Bedford East and Bedford West pipeline importation volumes are shown in Figure 7.2 and Figure 7.3. The following is of note regarding the external water demand:

- The pipelines supply the minimum raw water demands to the site for all climatic conditions (as outlined in Section 6.5).
- For Bedford East pipeline:
  - External water is only imported under median (50%ile), dry (90%ile) and very dry (95%ile) climatic conditions, in addition to the minimum raw water demands.
  - The annual Bedford East external water demands do not exceed the raw water allocation under any climatic conditions.
- For Bedford West pipeline:
  - External water is only imported under median (50%ile), dry (90%ile) and very dry (95%ile) climatic conditions, in addition to the minimum raw water demands.
  - The annual Bedford West external water demands do not exceed the raw water allocation under any climatic conditions.

The existing Bedford West and Bedford East pipeline allocations are sufficient for maintaining operations at BWM. Additional external water supply allocation is not required as a result of the BNEP.

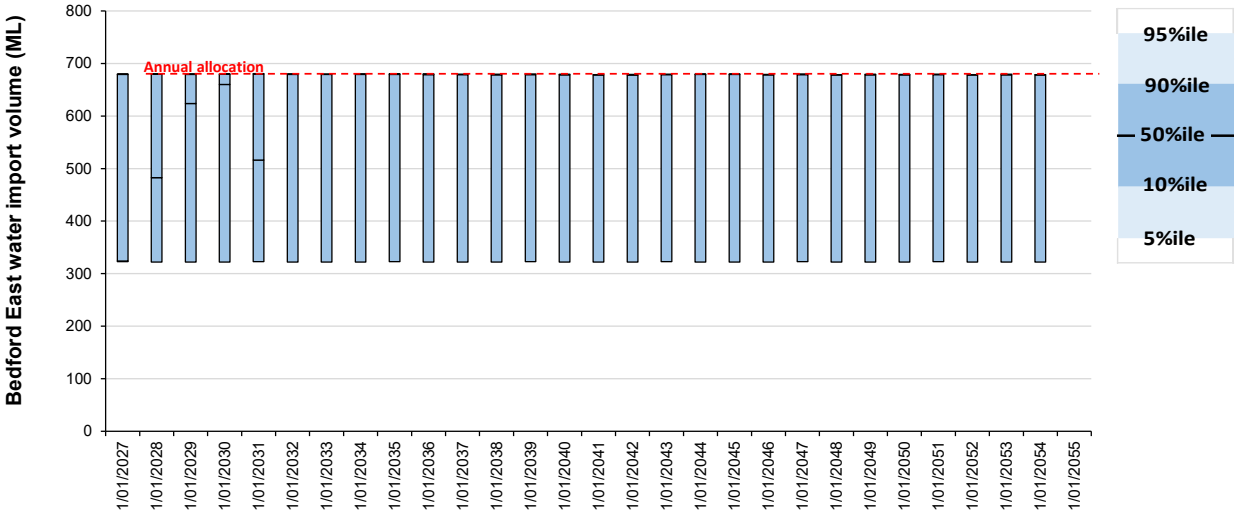


Figure 7.2 - Forecast Bedford East pipeline demand

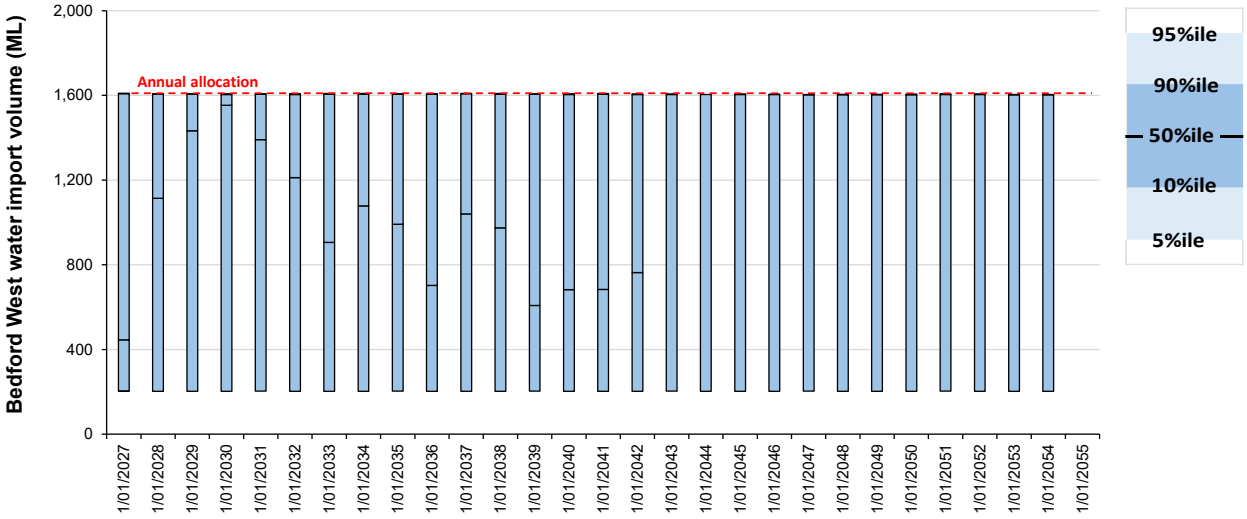


Figure 7.3 - Forecast Bedford West pipeline demand

7.5 Controlled releases

The Project would continue to operate within an established and regulated surface water management framework that prioritises the capture, reuse and controlled release of MAW. Surface water management measures include separation of clean and contaminated water, sediment and erosion control structures, operational water balance controls, and TARPs to prevent uncontrolled releases.

Modelling of site water balances and flooding behaviour indicates that controlled releases, where required, would occur in accordance with existing EA conditions (Schedule F) and relevant water quality objectives.

Controlled releases under Schedule F of EA EPML00717813 would only occur when receiving waterways have recorded a natural flow event in excess of the minimum flow trigger in response to rainfall-generated catchment runoff. At these times, local creeks would be exhibiting elevated, event-driven flows characterised by increased water levels, higher

velocities and short-duration runoff pulses which would likely include natural turbidity and sediment transport reflecting storm conditions.

The forecast annual controlled release volumes, in accordance with EA conditions, are shown in Figure 7.4. The following points are noted in relation to the controlled releases:

- Controlled releases are expected to be required in very wet (5%ile), wet (10%ile) and median climatic conditions, as well as dry (90%) climatic conditions in some years.
- During very wet climatic conditions (5%ile), the annual releases volumes range from 2,950 ML to 5,130 ML.
- During wet climatic conditions (10%ile), the annual releases volumes range from 2,350 ML to 2,930 ML.
- During median climatic conditions (50%ile), the annual releases volumes range from 760 ML to 1,120 ML.

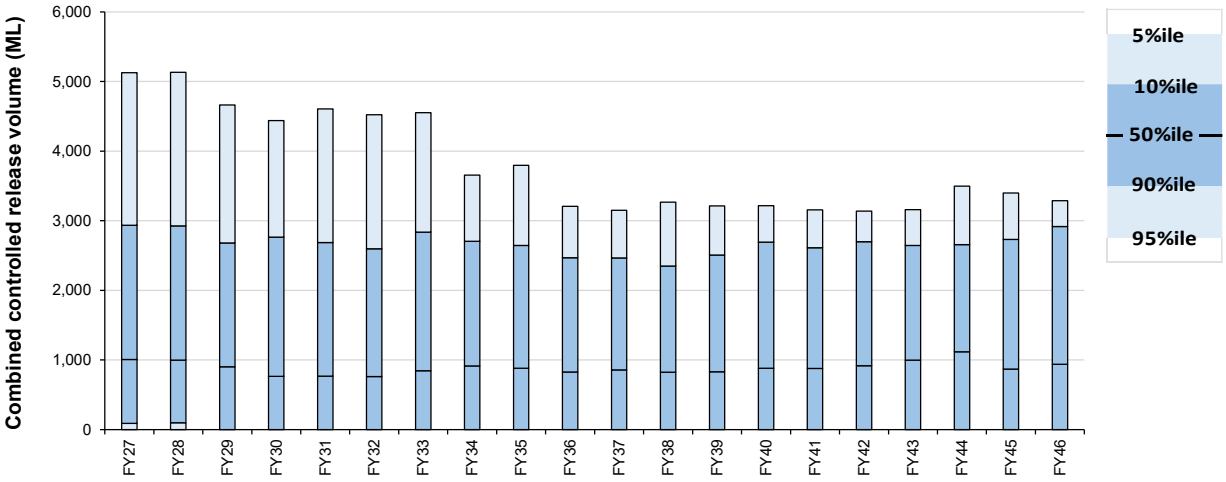


Figure 7.4 - Forecast controlled release volumes - Project

There are no proposed changes to the currently approved controlled release strategy as a result of the Project. In addition, there are no proposed changes to release infrastructure (release dams and pipelines).

7.5.1 Comparison against Approved case

The Project results in the following key changes to water inflows within the water management system:

- Estimated 60% increase in groundwater inflows up to Year 2055.
- Minor changes in captured catchment areas.

An assessment of the impact of the Project on controlled release volumes has been undertaken by comparing the Project results against an Approved case. The outcomes of this assessment have identified the following changes to controlled releases due to the Project:

- During very wet climatic conditions (5%ile), the annual releases volumes for the Approved case range from 2,880 ML to 4,940 ML. That is, under very wet climatic conditions (5%ile), annual controlled release volumes for the Project are predicted to increase by around 2-4% (70-190 ML) compared with the Approved Case.
- During wet climatic conditions (10%ile), the annual releases volumes for the Approved case range from 2,200 ML to 3,100 ML. That is, under wet climatic conditions (10%ile), annual controlled release volumes for the Project are predicted to increase by up to 7% (150 ML) compared with the Approved Case.

- During median climatic conditions (50%ile), the annual releases volumes for the Approved case range from 630 ML to 1,010 ML. That is, under median climatic conditions (50%ile), annual controlled release volumes for the Project are predicted to increase by around 11-20% (110-130 ML) compared with the Approved Case.

This assessment indicates that the Project would result in relatively small volumetric changes to annual release volumes. The release water quality is not expected to change as a result of the Project.

7.5.2 Controlled release rates and dilution requirement

An assessment of potential controlled-release rates and dilution requirements has been undertaken for:

- release point (RP) 2 and RP3, discharging to Blackwater Creek; and
- RP4, discharging to Two Mile Gully.

For the purposes of this assessment, a downstream mixed EC value of 2,000 µS/cm has been adopted, as per Table F5 of the EA (80th percentile receiving water contaminant trigger level for EC). The adopted value is an assessment assumption only and does not necessarily represent the operational trigger or target applied by BWM Operations during an actual controlled release. Operational releases would continue to be managed in accordance with the EA and site procedures, which include:

- Assess stream flow conditions and applicable release limits in accordance with the EA.
- Check release water quality for compliance with the EA Release Contaminant Limits.
- Check receiving water quality for compliance with the EA Receiving Waters Contaminant Limits.
- Use the BWM Release Contaminant Model to assess opportunities to commence an EA compliant MAW release.
- Continue monitoring water quality and release conditions and model outputs.
- Inform the HSE Superintendent prior to commencing a release.

Typical upstream EC concentrations were estimated from relationships developed using recorded streamflow and EC data for the Blackwater Creek and Two Mile Gully gauges over the period 2016–2025. The assessment considers receiving flows of:

- 1 to 100 m^3/s in Blackwater Creek; and
- 1 to 10 m^3/s in Two Mile Gully.

The indicative release rates and dilution requirements are summarised in Table 7.2.

Table 7.2 – Indicative release rates and dilution requirements

Release water EC	Indicative dilution ratio[1]	Indicative release rate
2,500 µS/cm	Approximately 0.27–0.28	Approximately 3.5–3.7 times the receiving-stream flow
5.000 µS/cm	Approximately 1.63–1.69	Approximately 0.5-0.62 times the receiving-stream flow
10,000 µS/cm	Approximately 4.34–4.52	Approximately 0.22–0.23 times the receiving-stream flow

[1] Dilution ratio is defined as receiving-stream flow divided by release flow.

These results demonstrate that the allowable release rate reduces as the EC of the release water increases. For example, at the minimum assessed receiving flow of 1 m^3/s:

- release water with an EC of approximately 2,500 µS/cm could theoretically be released at approximately 3.5–3.6 m^3/s;

- release water with an EC of approximately 5,000 µS/cm could theoretically be released at approximately 0.6 m^3/s; and
- release water with an EC of approximately 10,000 µS/cm could theoretically be released at approximately 0.2 m^3/s.

For RP2 and RP3, the calculated release rate represents the combined allowable discharge from the two release points, rather than a separate allowable rate for each release point.

At higher receiving-stream flows, the achievable discharge rate would be constrained by the capacity of the release infrastructure rather than the calculated receiving-stream dilution capacity. Consequently, the dilution achieved under these conditions would generally be greater than the minimum values presented in the assessment.

The assessment demonstrates that controlled releases can be managed by adjusting the combined release rate in response to:

- the measured receiving-stream flow;
- the receiving-stream EC;
- the EC of the water proposed for release;
- the applicable downstream EC limit; and
- the hydraulic capacity of the release infrastructure.

The calculations are indicative desktop estimates and assume complete and instantaneous mixing of release water with the receiving stream. Actual releases would continue to be undertaken in accordance with the approved EA, including all applicable minimum-flow, water-quality, monitoring and release-point requirements.

7.6 Uncontrolled releases

The Whitehaven documents "*WHC QLD Standard – Erosion & Sediment Control and Mine Affected Water*" (Whitehaven, 2024), "*BWM Plan – Water Management*" (Whitehaven, 2026) and "*BWM Plan – Erosion and Sediment Control Plan*" (Whitehaven, 2026) outline the strategies and design objectives currently implemented at BWM to manage legacy risks associated with uncontrolled discharges from MAW storages and sediment dams. The management strategies described in these documents will continue to apply to the Project.

The Project is not expected to increase the risk of uncontrolled discharges from site storages to receiving waterways for the following reasons:

- The proposed changes to the Project footprint are limited to the eastward expansion of existing pits. Resulting catchment changes are confined to the expanding pits, which drain internally.
- The Project does not alter the contributing catchments or drainage arrangements of existing MAW storages or sediment dams that have a higher potential for uncontrolled discharge.
- The Project does not modify the catchments of New Taurus Creek Dam or New Deep Creek Dam, which have a higher potential for uncontrolled discharges due to their on-stream configuration.

8 Final void behaviour

8.1 Overview

Water levels in the final voids will vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff, and groundwater. A final void GoldSim model (separate to the GoldSim model used for the operational modelling) was used to assess the likely long-term water level behaviour of the final voids.

The proposed final landform layout relevant to the Project is presented in Figure 8.1 and Figure 8.2, and includes five residual voids:

- Mimosa/Besgrove (MB);
- Ramp 30 (R30);
- Deep Creek (DC);
- Stewarton North (ST-N); and
- Stewarton South (ST-S).

BWM is operated under Environmental Authority EPML00717813 (EA). Condition E10 of the EA stipulates that "residual voids must not cause any serious environmental harm to land, surfaces waters or any recognised groundwater aquifer, other than the environmental harm constituted by the existence of the residual void itself".

The BWM residual voids will be operated as non-use management areas (NUMAs) as part of the Progressive Rehabilitation Closure Plan (PRCP).

The long-term final void hydrology and water quality behaviour of the proposed final voids has been modelled over a 1,000-year post-closure period to assess whether the final voids would be safe and non-polluting. This report outlines the methodology and assessment of the expected final void pit lake behaviour, which has been modelled using the GoldSim water balance simulation software.

8.2 Final void geometry

The proposed Project final landform incorporates five residual voids that span across the reaches of the Sagittarius Creek, Blackwater Creek, Taurus Creek and Two Mile Gully catchments.

This final landform would form during mining, incorporating in-pit backfilled spoil sitting atop a mined pit shell. A digital elevation model (DEM) of the final landform (i.e. the final surface expected at the end of the mine life) was provided by Whitehaven.

A summary of the residual void geometries is provided in Table 7.1, including the year that the void commences.

Table 8.1 - Final void geometries

Void	Floor level (metres Australian Height Datum [mAHD])	Crest level (mAHD)	Depth (m)	Volume to crest (ML)	Surface area at crest (ha)
MB	24	200	176	374,878	597.2
R30	139	217	78	16,316	59.7
DC	52	202	150	54,895	109.4
ST-N	-4	204	208	302,582	380.1
ST-S	92	232	140	42,632	82.5

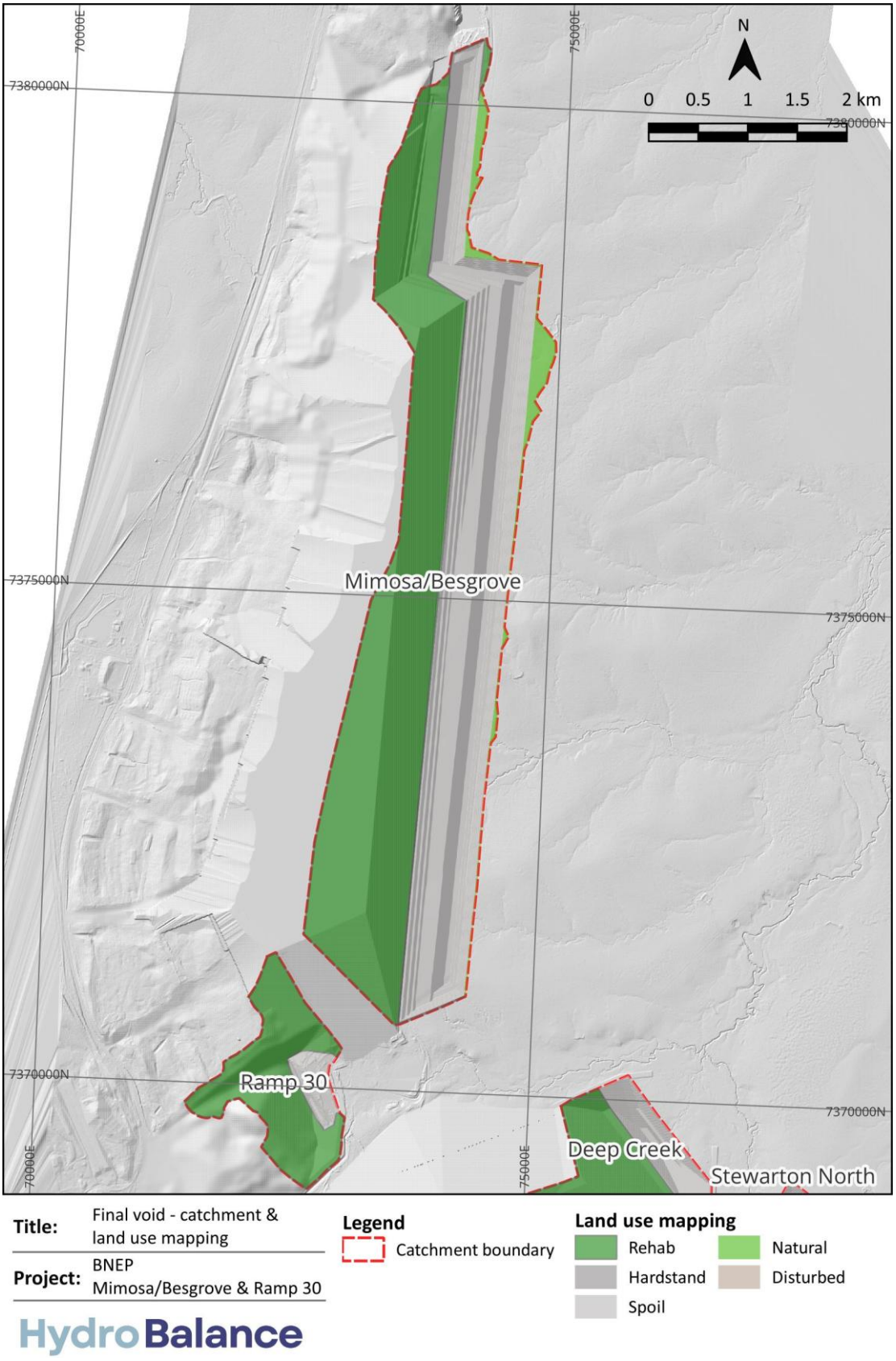


Figure 8.1 - Final void configuration - Mimosa/Besgrove & Ramp 30

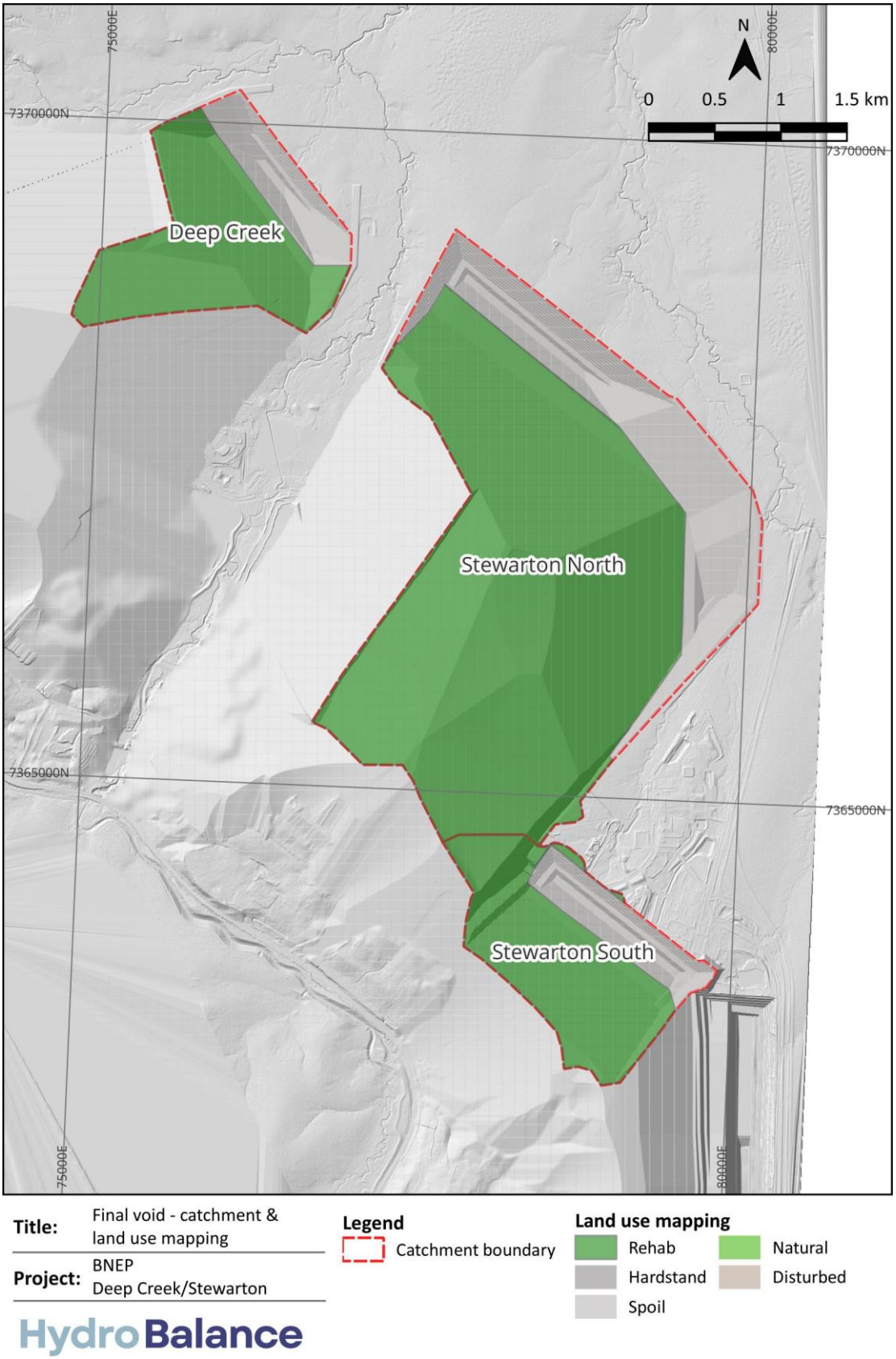


Figure 8.2 -Final void configuration - Deep Creek, Stewarton North & South

8.3 Model configuration

8.3.1 Modelling approach

The GoldSim software platform was used to simulate the long-term water level behaviour for the five Project voids. Water levels in the residual voids would vary over time, depending on the prevailing climatic conditions, and the balance between evaporation losses and inflows from rainfall, surface runoff, and groundwater.

The GoldSim model was used to simulate the generation, movement, and loss of water on a daily time-step within the final void, over a 1,000-year period. The volume of water in the voids was calculated at each time step as the sum of direct rainfall to the void surface, catchment runoff, and groundwater flux, less evaporation losses. The model also tracks the quantity of salt captured and stored within the system.

Key components of the model are summarised in the following sub-sections, including descriptions of key model inputs, assumptions, and sensitivity parameters.

8.3.2 Climate data

The Australian Government Consistent Climate Scenarios (CCS) project was used to generate climate change adjusted rainfall and evaporation data, which transformed historical climate data from the period between 1960 and 2024 (64 years). The CCS project provides climate projections as a daily time series across Australia on a 0.05-degree grid. The grid point closest to the central of BWM was used for this assessment.

The Shared Socioeconomic Pathway SSP2-4.5 was selected as the emission pathway for the Intergovernmental Panel on Climate Change (IPCC) assessment report AR5, with a base case global warming sensitivity for the Year 2070. The Year 2070 was selected as it represents a general mid-point for the varying void commencement dates.

SSP2-4.5 assumes that global development and environmental policies will continue along their current trajectories, and represents a moderate path where social, economic and technological trends do not shift markedly from historical patterns. It leads to moderate greenhouse gas emissions and radiative forcing of 4.5 Watts per square metre (W/m^2) by 2100.

The climate data was selected according to the following climate sensitivity and climate change model composites:

- climate warming sensitivity assumed to fall in the medium category; and
- the representative future climate cluster was selected as HP, which represents a high level of global warming.

The 64 years of historical climate data adjusted rainfall and evaporation data was looped to create a long-term (1,000-year) climate sequence.

Figure 8.3 shows the long-term monthly averages for the rainfall data and pan evaporation.

Pan evaporation has been converted to Morton's Lake (mLake) and Morton's Wet (mWet) evapotranspiration to account for evapotranspiration losses from the pit lake and catchment as follows:

- Pan evaporation to mLake factor: 0.883 – applied to the evaporation acting on the surface of the pit lake.
- Pan evaporation to mWet factor: 0.845 – applied to the evaporation.

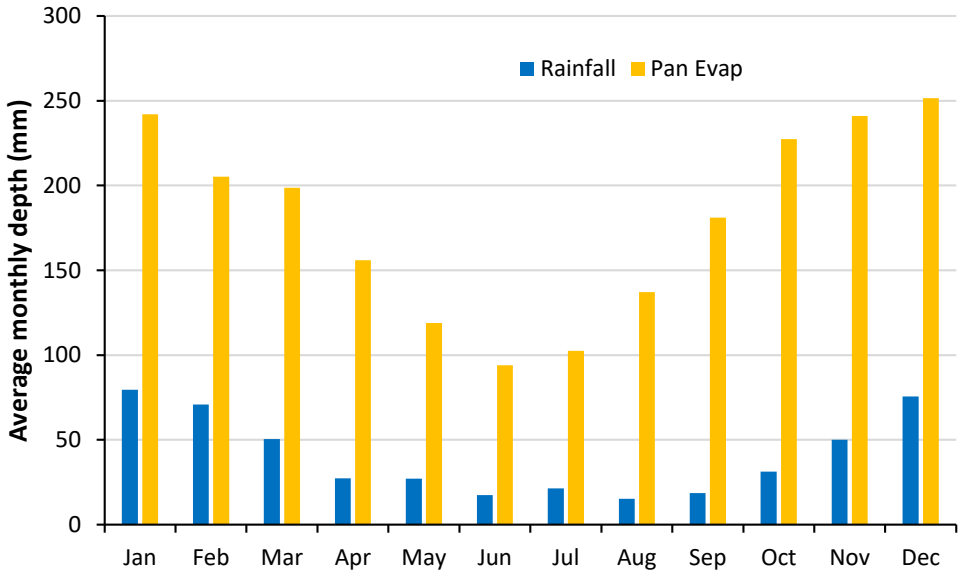


Figure 8.3 - Distribution of monthly rainfall and pan evaporation (CCS 1960 - 2024)

8.4 Catchment runoff

8.4.1 Catchment areas

The final landform catchment area was delineated from the final landform surface provided by Whitehaven. The landuse of the void floor has been characterised as spoil. Figure 8.1 to Figure 8.2 show the catchment boundary and land uses adopted for the final void water balance. The catchment and land use values used in the GoldSim model are shown in Table 8.2.

Table 8.2 - Final void catchment and land use areas

Void	Catchment area (ha)			
	Undisturbed	Spoil	Rehabilitated spoil	Total
MB	39.1	596.5	622.4	1,258.0
R30	0.0	24.1	149.2	173.3
DC	0.0	52.9	167.3	220.2
ST-N	0.0	195.2	678.1	873.3
ST-S	0.0	50.9	150.3	201.2

8.4.2 AWBM parameters

The final void GoldSim model uses the same AWBM parameters as per the operational model. Refer to Section 6.3 for further details.

8.4.3 Groundwater inflows

Groundwater water inflows into the five voids have been provided by the project groundwater consultants (SLR, 2026). The inflows were provided as a time series over the 1,000 year simulation. Refer to SLR (2026) for further details on the groundwater inflows to the voids.

8.5 Final void model results

8.5.1 Water level

The final void modelled water levels for the five voids are presented in Figure 8.4 to Figure 8.8. The following is of note regarding these results:

- MB void reaches equilibrium within 100 years post mining, with a median water level of around 83 mAHD. The maximum void water level (88.1 mAHD) is 112 m below the pit crest level (200 mAHD). The pit crest does not overtop at any point in the 1,000-year simulation.
- R30 void reaches equilibrium within 100 years post mining, with an inventory cycling between empty (during extended dry periods) and a maximum void water level of around 160 mAHD during extended wet periods. The maximum void water level (160.1 mAHD) is 57 m below the pit crest level (217 mAHD). The pit crest does not overtop at any point in the 1,000-year simulation.
- DC void reaches equilibrium within 150 years post mining, with a median water level of around 138 mAHD. The maximum void water level (149.8 mAHD) is 52 m below the pit crest level (202 mAHD). The pit crest does not overtop at any point in the 1,000-year simulation.
- ST-N void reaches equilibrium within 100 years post mining, with a median water level of around 73 mAHD. The maximum void water level (79.4 mAHD) is 124 m below the pit crest level (204 mAHD). The pit crest does not overtop at any point in the 1,000-year simulation.
- ST-S void reaches equilibrium within 100 years post mining, with a median water level of around 104 mAHD. The maximum void water level (118.5 mAHD) is 113 m below the pit crest level (232 mAHD). The pit crest does not overtop at any point in the 1,000-year simulation.

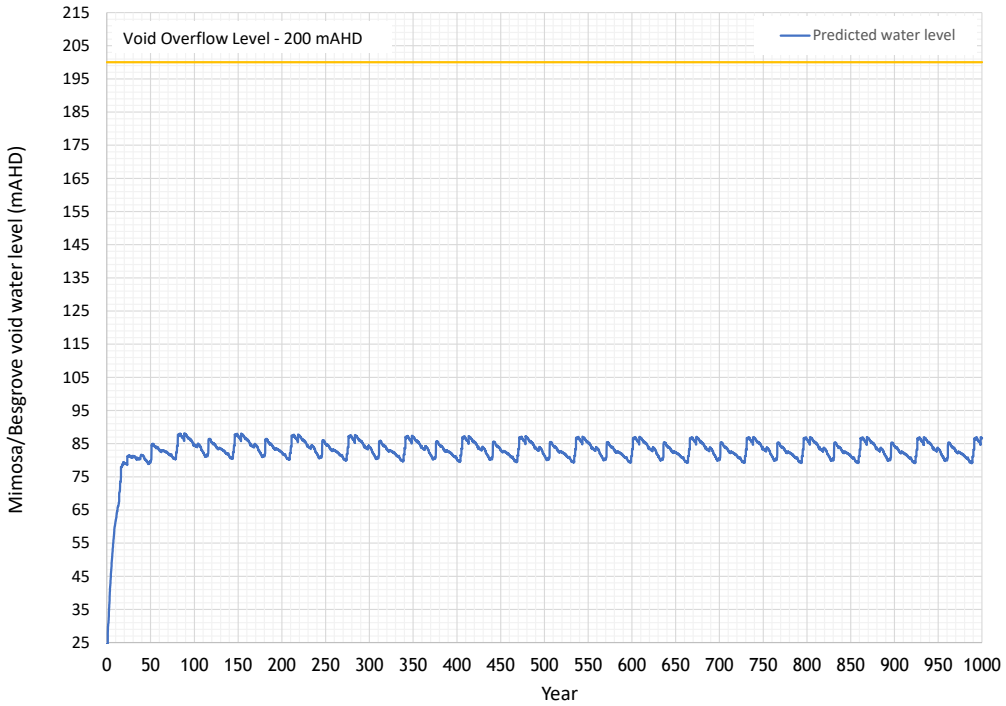


Figure 8.4 - Mimosa/Besgrove void - long term predicted final void water level

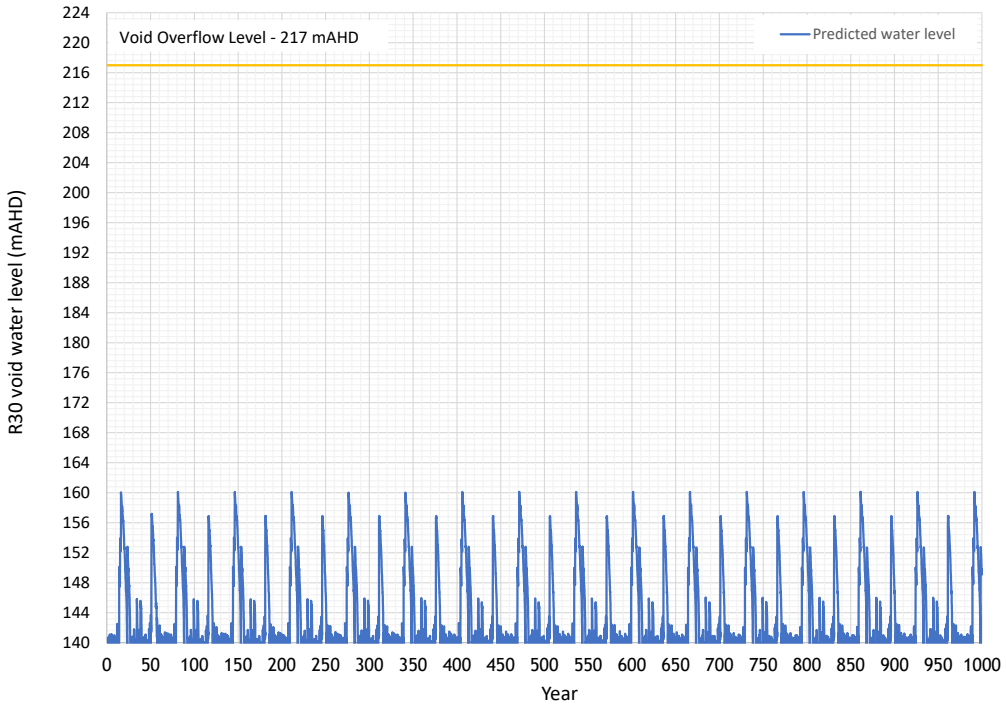


Figure 8.5 - Ramp 30 void - long term predicted final void water level

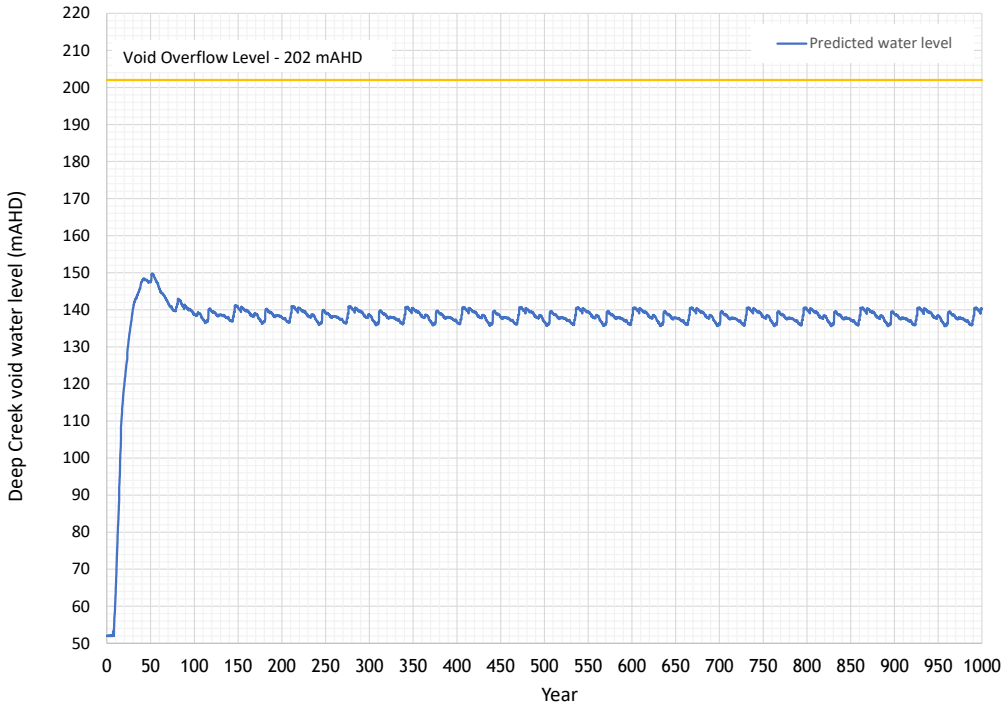


Figure 8.6 - Deep Creek void - long term predicted final void water level

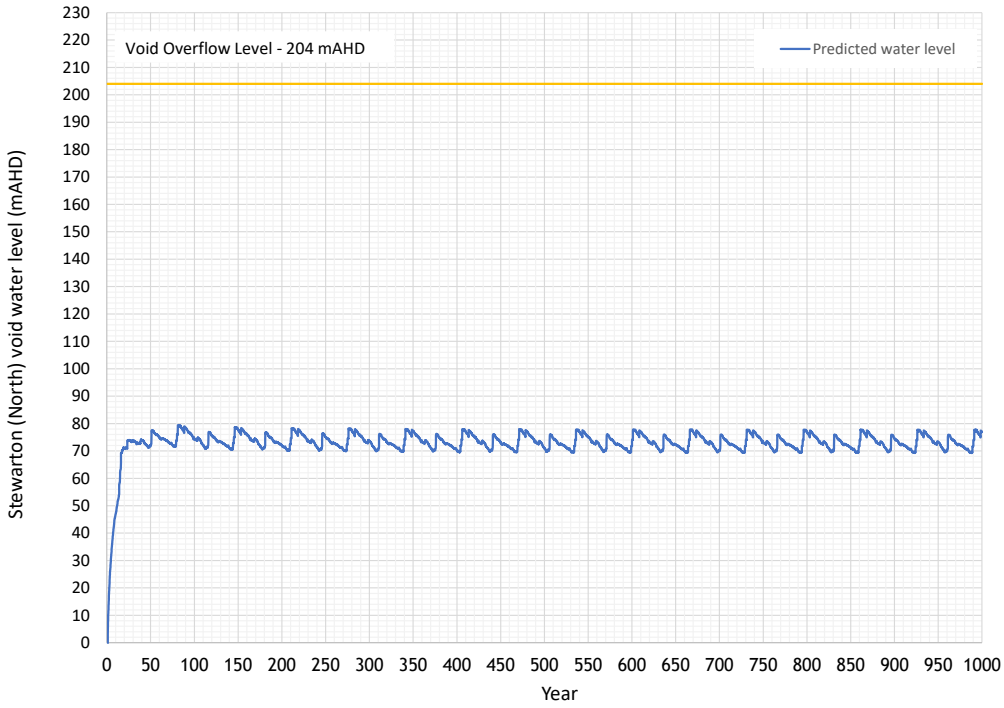


Figure 8.7 - Stewarton North void - long term predicted final void water level

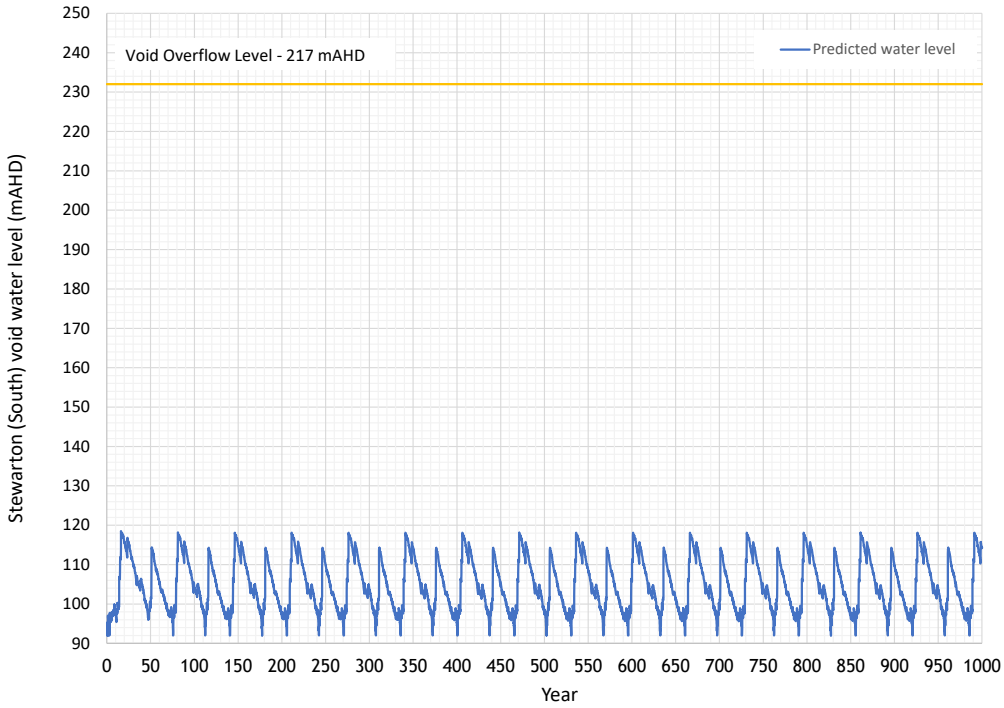


Figure 8.8 - Stewarton South void - long term predicted final void water level

8.5.2 Salinity

The final void modelled salinity levels for the five voids are presented in Figure 8.9 to Figure 8.13. The long-term salinity generally increases over time, which is expected for closed-loop systems with no mechanism for salt removal. This assessment is considered conservative, as it:

- Assumes an unlimited source of salt within the catchment and does not include any allowance for potential reduction in the localised leaching of salts from the catchment over time.
- Does not take into account the potential precipitation of dissolved salts as mineral compounds.

The following is of note regarding these results:

- For Mimose/Besgrove void, the salinity of the pit lake progressively increases, rising to 250,000 µS/cm over the 1,000-year simulation.
- For Ramp 30 void, the salinity of the pit lake fluctuates over time as the void empties in cycles. The peak salinity during these cycles is around 5,000 µS/cm.
- For Deep Creek void, the salinity of the pit lake progressively increases, rising to 180,000 µS/cm over the 1,000-year simulation.
- For Stewarton North void, the salinity of the pit lake progressively increases, rising to 195,000 µS/cm over the 1,000-year simulation.
- For Stewarton South void, the salinity of the pit lake fluctuates over time as the void empties in cycles. The peak salinity during these cycles is around 10,000 µS/cm.

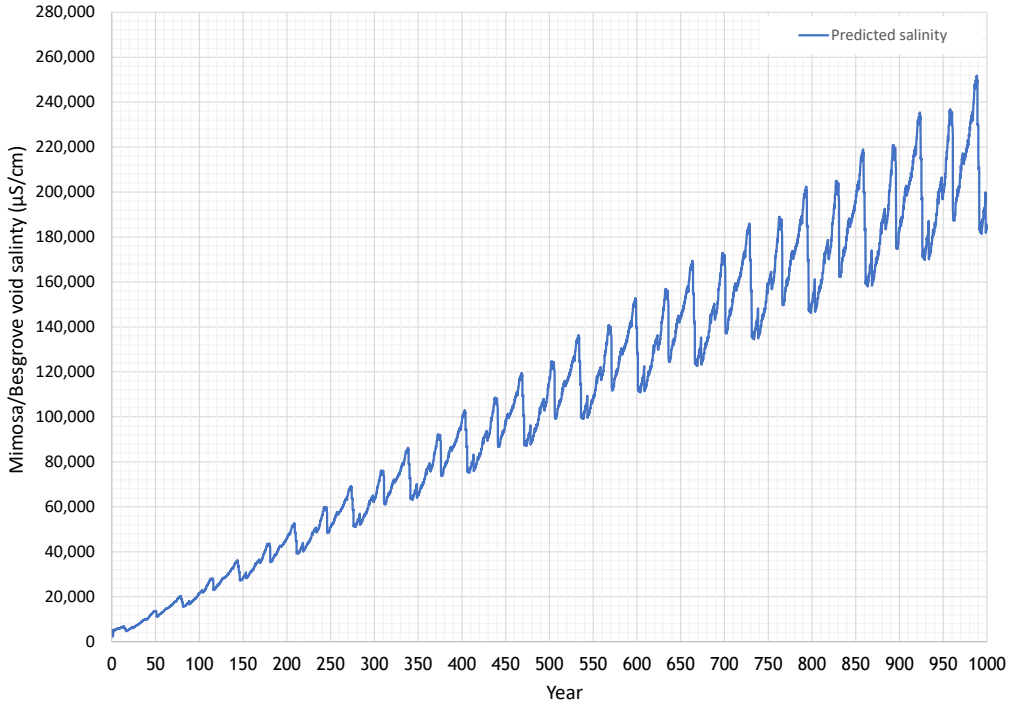


Figure 8.9 - Mimosa/Besgrove void - long term predicted void water salinity

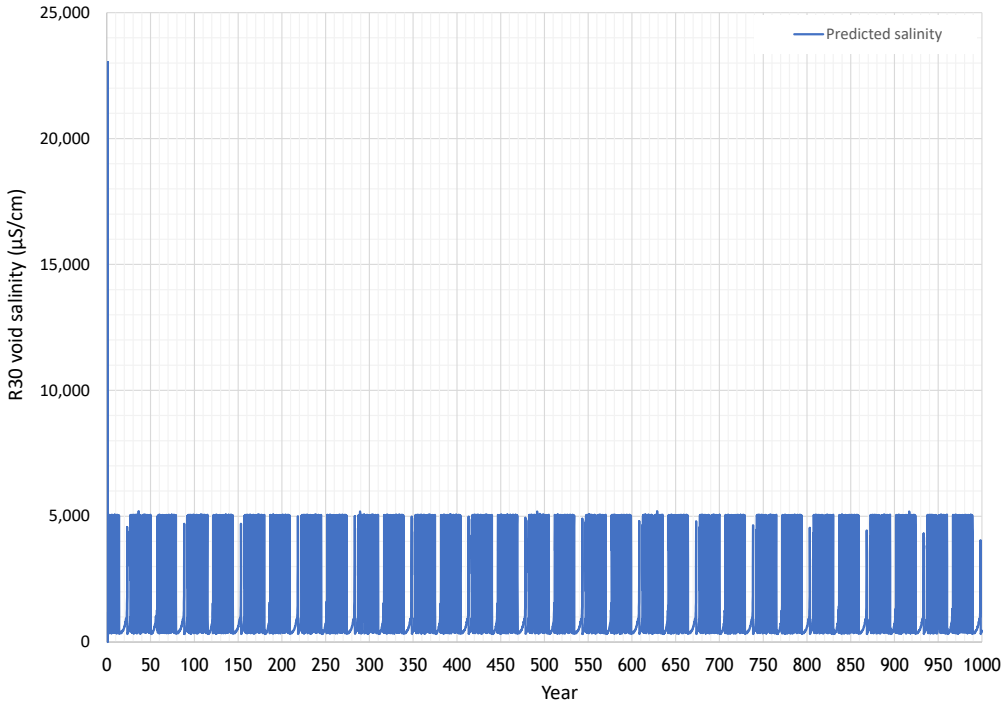


Figure 8.10 - Ramp 30 void - long term predicted final void water salinity

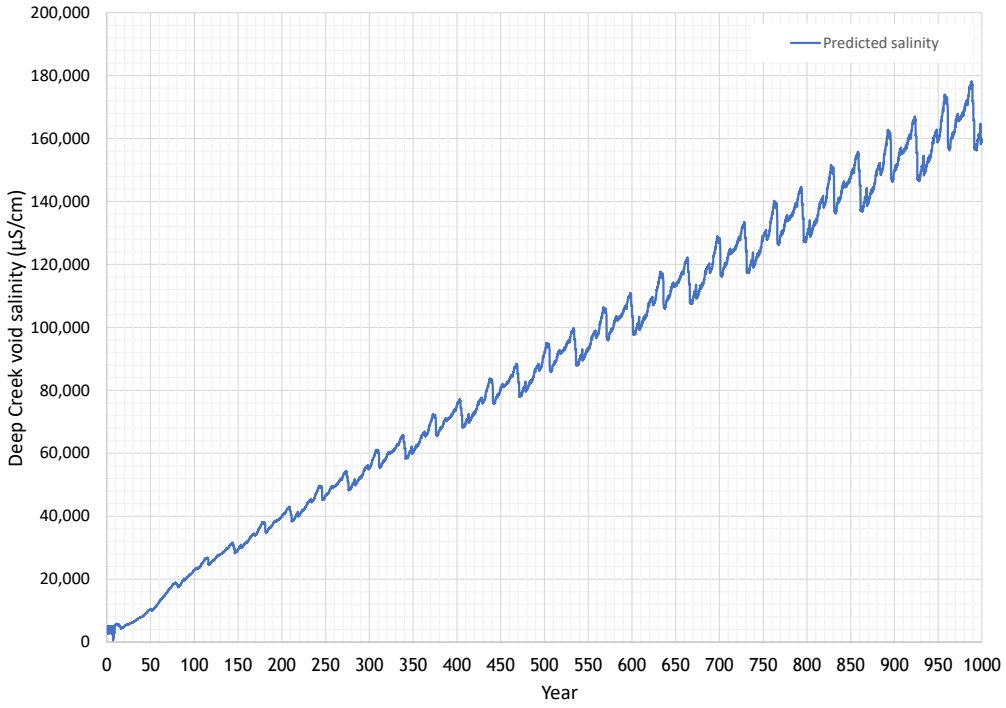


Figure 8.11 - Deep Creek void - long term predicted final void water salinity

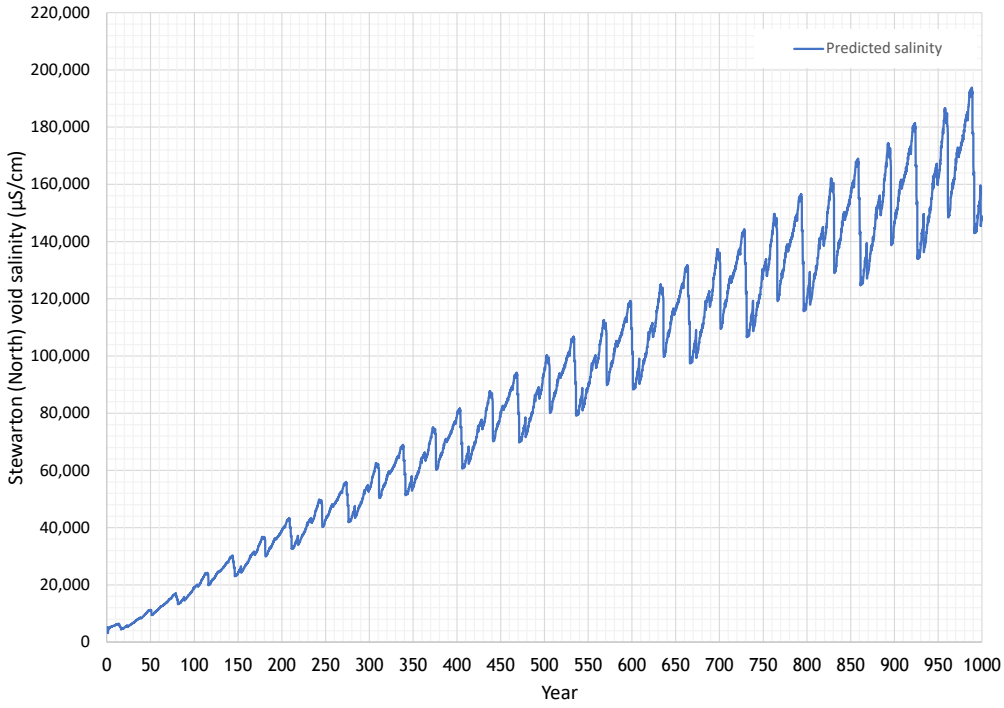


Figure 8.12 – Stewarton North void – long term predicted final void water salinity

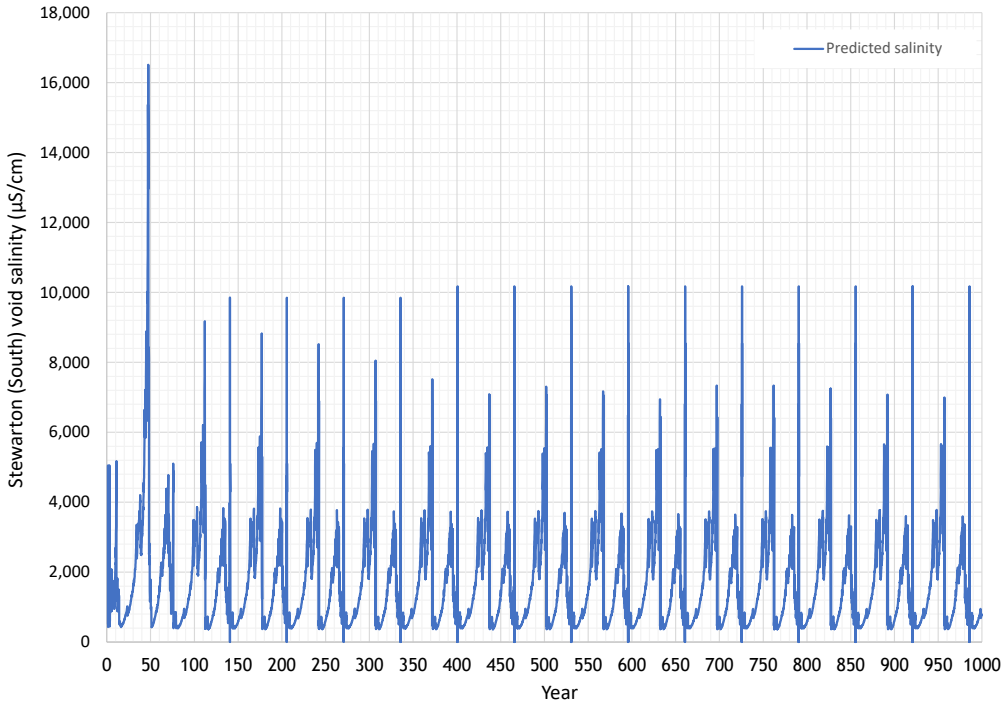


Figure 8.13 – Stewarton South void – long term predicted final void water salinity

8.6 Extreme storm event behaviour

8.6.1 Methodology

An assessment of the impact of extreme storm events on the water levels in the final voids has been undertaken. The potential for discharge of void water during a large storm was assessed for the 1 in 1,000 Annual Exceedance Probability (AEP) (or 0.1% AEP) 72-hour (3 day) design storm. For conservatism, it has been assumed that the extreme storm would occur coincident with the peak modelled long-term water levels.

Design rainfall depths for the above events were estimated using standard procedures in Australian Rainfall and Runoff (ARR) (Ball et al., 2019). The runoff generated from the storm events has been conservatively calculated assuming 100% of runoff reports to the voids (i.e. no losses) from the surface catchment reporting to the voids.

8.6.2 Results

The results of the storm event analysis are presented in Table 8.3. These results show that, even during extreme short duration storm events, the pit crest would not be overtopped for any of the final voids.

Table 8.3 – Storm event modelling results

Void	Runoff Volume (ML)	Water level increase (m)	Final Volume (ML)	Final Level (mAHD)	Pit crest level (mAHD)	Freeboard (m)
MB	3,585	3.4	29,316	91.5	200	108.5
R30	494	6.3	1,124	166.1	217	50.9
DC	628	2.6	7,884	129.9	202	72.1
ST-N	2,489	1.5	59,120	115.0	204	89.0
ST-S	573	3.6	4,992	150.0	232	82.0

9 References

Ball et al. (2019)	Ball, J., Babister, M., Nathan, R., Weeks, W., Weinmann, E., Retallick, M., & Testoni, I. (Editors) (2019). *Australian Rainfall and Runoff: A Guide to Flood Estimation*. Commonwealth of Australia (Geoscience Australia), Canberra.
Engeny Australia Pty Ltd (2025)	Engeny Australia Pty Ltd. (2025). *Summary of 2025 AWT Methods*. Prepared for Whitehaven Coal Limited.
Jeffrey et al. (2001)	Jeffrey, S. J., Carter, J. O., Moodie, K. B., & Beswick, A. R. (2001). *Using spatial interpolation to construct a comprehensive archive of Australian climate data*. Environmental Modelling & Software, 16(4), 309-330.
SLR (2026)	SLR Consulting Australia Pty Ltd. (2023). *Blackwater North Extension Project Groundwater Impact Assessment*. Prepared for Whitehaven Blackwater Pty Ltd.
Whitehaven (2024)	Whitehaven Coal Limited. (2024). *WHC QLD Standard: Erosion & Sediment Control and Mine Affected Water*.
Whitehaven (2026a)	Whitehaven Coal Limited. (2026a). *BWM Plan – Erosion and Sediment Control Plan*.
Whitehaven (2026b)	Whitehaven Coal Limited. (2026b). *BWM Plan – Water Management Plan*.

APPENDIX C GREAT BARRIER REEF SURFACE WATER IMPACT ASSESSMENT MEMORANDUM

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WRM
WATER +
ENVIRONMENT

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MEMORANDUM

Date	15 October 2026
Attention	Brendan Dillon
Company	Whitehaven Blackwater Pty Ltd
WRM ref.	1559-11-B5
Subject	Blackwater North Extension Project – Great Barrier Reef (GBR) surface water impact assessment

Dear Brendan,

1 INTRODUCTION

1.1 BACKGROUND

The Blackwater Mine (BWM) is an existing, open cut metallurgical coal mine located approximately 20 kilometres (km) southwest of Blackwater, Central Queensland (refer to Figure 1.1). The BWM produces up to 17.6 million tonnes per annum (Mtpa) of product coal, predominantly high-quality coking coal for use in steelmaking as well as high energy thermal coal. The BWM is currently owned and operated by Whitehaven Blackwater Pty Ltd (Whitehaven Blackwater), a wholly owned subsidiary of Whitehaven Coal Limited (Whitehaven), and operates under Environmental Authority (EA) EPML00717813.

Whitehaven Blackwater proposes to develop the Blackwater North Extension Project (the Project), which would extend the current open cut mining development to within Surface Area (SA) 7 on Mining Lease (ML) 1762 and SA 10 on ML 1759 (refer to Figure 1.2). The Project would involve an indicative mining rate of up to 19 Mtpa of run-of-mine coal. Figure 1.2 shows the general arrangement of the Project site, including the open cut pit extents within SA 7 and SA 10.

1.2 PURPOSE AND SCOPE

This surface water assessment was prepared to support the Referral for the Project under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). It addresses the potential for the Project to result in surface water impacts on the Great Barrier Reef World Heritage Property, National Heritage Place, and Marine Park, which are listed as Matters of National Environmental Significance under the following sections of the EPBC Act:

- sections 12 and 5A – World Heritage Property;
- sections 15B and 15C – National Heritage Place; and
- sections 24B and 24C – Great Barrier Reef Marine Park.

For the purpose of this assessment, the Project is also referred to as ‘the Action', defined broadly in the EPBC Act as either ‘a project, a development, an undertaking, an activity or a series of activities, or an alteration of any of these things.’

This assessment addresses whether the potential surface water impacts associated with the Action on the Great Barrier Reef Marine Park meets the ‘substantial cause’ requirement of an indirect impact as outlined in section 527E(2) of the EPBC Act.

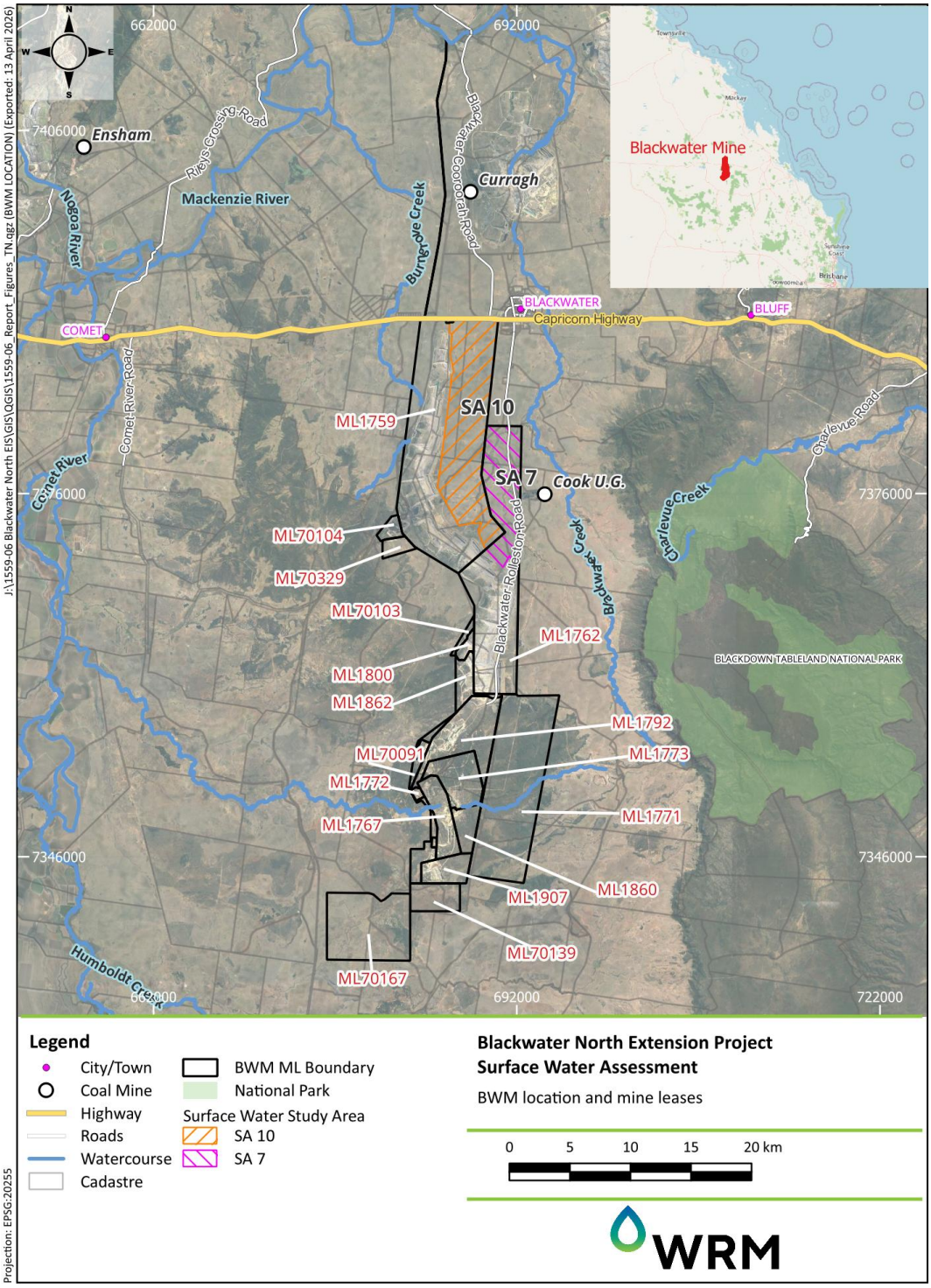


Figure 1.1 BWM locality

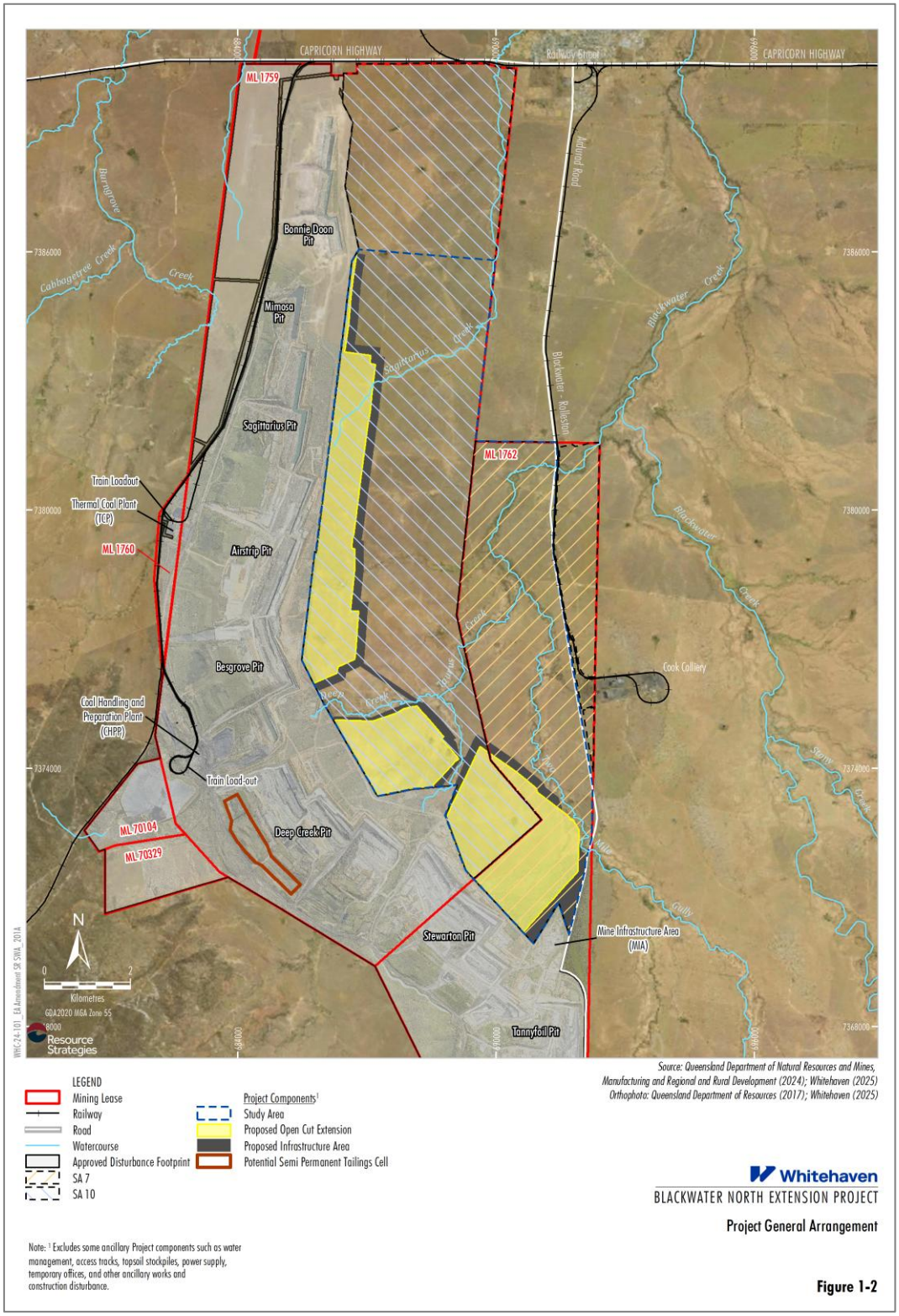


Figure 1.2 Project General Arrangement

2 REGULATORY FRAMEWORK

2.1 OVERVIEW

This memorandum has been prepared in consideration of the following:

- *EPBC Act 1999 Referral Preparation Guideline* (Commonwealth Department of Climate Change, Energy, the Environment and Water [DCCEEW], 2024);
- *Matters of National Environmental Significance: Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013);
- *Significant Impact Guidelines 1.3 Coal Seam Gas and Large Coal Mining Developments — Impacts on Water Resources* (Commonwealth of Australia, 2022);
- *EPBC Act Referral Guidelines for the Outstanding Universal Value of the Great Barrier Reef World Heritage Area* (Commonwealth of Australia, 2014);
- *Reef 2050 Water Quality Improvement Plan 2017–2022* (Queensland Government, 2018);
- *Reef Water Quality Report Card 2021 and 2022* (Queensland Government, 2024);
- *Environmental Protection Act 1994 Guideline – Reef discharge standards for industrial activities* (DESI, 2024); and
- *Best Practice Erosion and Sediment Control* (International Erosion Control Association [IECA], 2008).

2.2 COMMONWEALTH

2.2.1 Environment Protection and Biodiversity Conservation Act 1999

The Action is being referred to the Commonwealth Minister for the Environment and Water for consideration as to whether the Project is a 'controlled action' and requires approval under the EPBC Act. This memorandum forms part of the Referral.

With regards to the Great Barrier Reef (GBR) World Heritage property, National Heritage Place and Marine Park, the *Significant Impact Guidelines 1.1* (Commonwealth of Australia, 2013) identifies that:

- *Approval under the EPBC Act is required for any action occurring within or outside a declared World Heritage property that has, will have, or is likely to have a significant impact on the World Heritage values of the World Heritage property.*
- *An action will require approval if:*
    - *the action is taken in the Great Barrier Reef Marine Park and the action has, will have, or is likely to have a significant impact on the environment, or*
    - *the action is taken outside the Great Barrier Reef Marine Park and the action has, will have, or is likely to have a significant impact on the environment in the Great Barrier Reef Marine Park.*

The GBR is located approximately 600 river km downstream (and 210 km east "as the crow flies") of the Action (as shown in Figure 2.1). As such, the Action would not result in any direct impacts to the GBR. Therefore, this assessment was prepared to assess the potential indirect impacts of the Action due to runoff and surface water releases.

Regarding indirect impacts, section 527E of the EPBC Act describes that an event or circumstance is considered an 'impact' of an Action only if the Action is a 'substantial cause' of that event or circumstance.



Figure 2.1 Map of Great Barrier Reef Region, Marine Park and World Heritage Area (Commonwealth of Australia, 2024)

2.3 QUEENSLAND

2.3.1 Environmental Protection Act 1994

In addition to approval of the Action under the EPBC Act, Whitehaven Blackwater is currently seeking to obtain an EA Amendment for the Project (including the Action) under the *Environmental Protection Act 1994* (EP Act).

The EP Act and the *Environmental Protection Regulation 2019* (EP Regulation) specify the regulatory requirements for prescribed environmentally relevant activities (ERAs). Regarding the potential impacts to the 'GBR catchment waters', section 41AA of the EP Regulation states:

3. *The administering authority must refuse to grant the application if the authority considers that –*
    a. *the relevant activity will, or may, have a residual impact; and*
    b. *having regard to the matters mentioned in the water quality offset policy, the residual impact will not be adequately counterbalanced by offset measures for the relevant activity.*
4. *A residual impact of a relevant activity is the presence of fine sediment (FS), or dissolved inorganic nitrogen (DIN), in Great Barrier Reef catchment waters, that –*
    a. *was released to the water because of the relevant activity; and*
    b. *remains, or is likely to remain in the water despite mitigation measures for the relevant activity.*

The intent of section 41AA of the EP Regulation is to achieve a 'no net decline' in water quality from the release of waters into the GBR catchment waters as outlined in the *Reef discharge standards for industrial activities* (DESI, 2024) (the Reef Discharge Standards).

3 EXISTING SURFACE WATER ENVIRONMENT

3.1 DRAINAGE CHARACTERISTICS

3.1.1 Regional drainage features

The GBR receives runoff from six natural resource management regions and 35 catchments which drain 424,000 square kilometres (km^2) of coastal Queensland (Department of Environment, Tourism, Science and Innovation [DETSI], 2025). Grazing is the dominant agricultural land use (77 percent [%]), particularly in the Burdekin and Fitzroy regions.

Figure 3.1 shows the regional drainage characteristics in the vicinity of the Action. Figure 3.1 also shows the locations of surface water monitoring sites that are active as part of the Fitzroy Regional Receiving Environment Monitoring Program (FRREMP) and are relevant to the Action.

The Action is located within the Mackenzie River catchment, part of the greater Fitzroy Basin, and is approximately 600 river km upstream of the GBR. The Mackenzie River joins the Fitzroy River, which flows initially north and then east towards the east coast of Queensland, ultimately discharging into the Coral Sea southeast of Rockhampton, near Port Alma. The total Fitzroy River catchment is 142,665 km^2.

Blackwater Creek, a tributary of the Mackenzie River, is the main watercourse in the vicinity of the Action and flows in a northerly direction to the east of the Action. Figure 3.2 shows the Blackwater Creek catchment to the Mackenzie River.

The catchment area of Blackwater Creek, encompassing the Action, is approximately 1,100 km^2. This represents around 0.8% of the overall Fitzroy River catchment. The disturbance footprint of the Action is approximately 23 km^2 and represents 2% of the Blackwater Creek catchment and 0.016% of the overall Fitzroy River catchment area.

3.1.2 Local drainage features

Figure 3.3 shows the local drainage features in the vicinity of the Action. Figure 3.1 also shows the locations of local surface water monitoring sites in the vicinity of the Action.

The Action is drained by several tributaries of Blackwater Creek, including Deep Creek, Taurus Creek, Emu Creek, Two Mile Gully and Sagittarius Creek. These local tributaries generally drain in a northeasterly direction and join Blackwater Creek to the east of the Action.

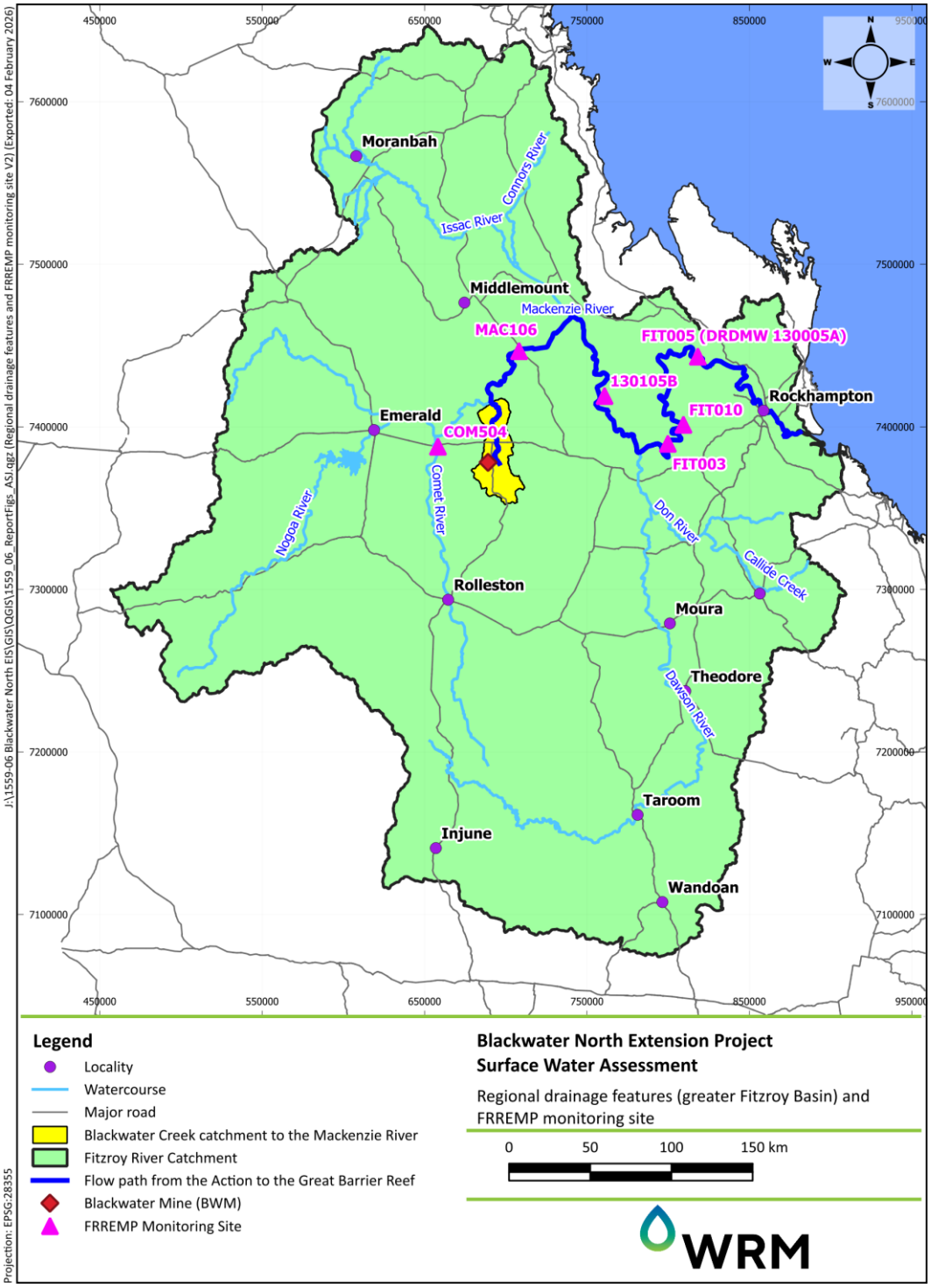


Figure 3.1 Regional drainage features (greater Fitzroy basin) and FREEMP monitoring sites

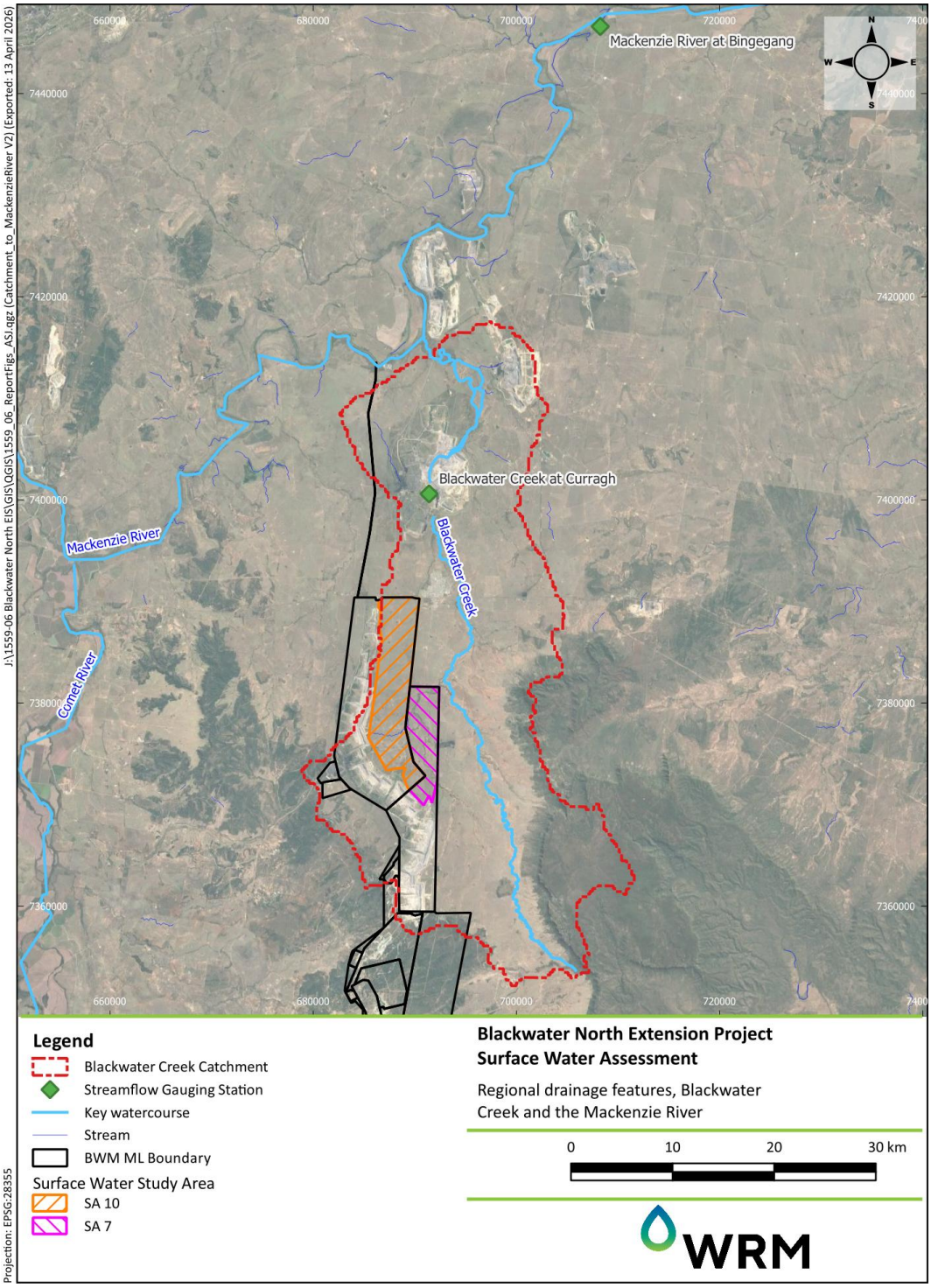


Figure 3.2 Regional drainage features, Blackwater Creek and the Mackenzie River

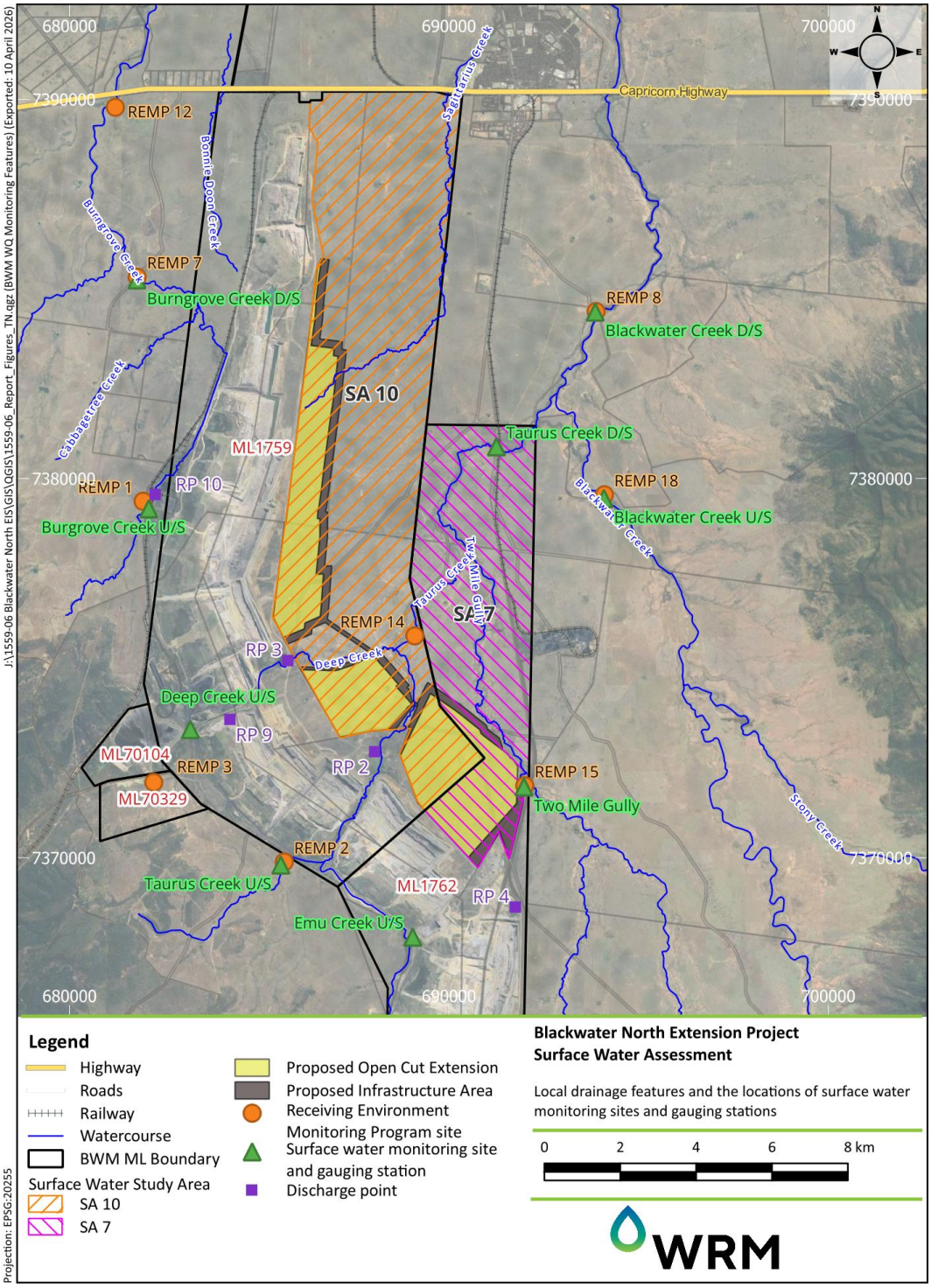


Figure 3.3 Local drainage features and surface water quality monitoring locations

3.2 STREAMFLOW

Historical flow and water level (river height) monitoring data was assessed to provide an indication of local flow regime in the vicinity of the Action and regional flow regime in the Fitzroy River at the following locations:

- Taurus Creek at Taurus Creek D/S gauge (WHC station no. 330101) (2016 – 2025) (refer to Figure 3.3);
- Blackwater Creek at Curragh (DRDMW station no. 130108A/130108B) (1972 – 2009) (refer to Figure 3.2); and
- Fitzroy River at The Gap (DRDMW station no. 130005A) (1971-2025) (refer to Figure 3.1).

Figure 3.4, Figure 3.6 and Figure 3.8 present daily discharge exceedance curves of flows (in megalitres per day) in Taurus Creek, Blackwater Creek and the Fitzroy River as recorded at the above three stream gauging stations.

Figure 3.5, Figure 3.7 and Figure 3.9 present monthly box and whisker plots of stream flows in Taurus Creek, Blackwater Creek and the Fitzroy River as recorded at the above three stream gauging stations. The box and whisker plots show:

- The lower and upper extents of the 'whiskers' show the 10th and 90th percentile recorded monthly flows.
- The box represents the range within which 50% of recorded monthly flows fall. The lower bound of the box is the 25th percentile monthly flow (i.e. 25% of flows are equal to or smaller, 75% of flows are larger) while the upper bound of the box is the 75th percentile flow (i.e. 75% of flows are equal to or smaller, only 25% of flows are larger).
- The middle line in the box represents the median or 50th percentile recorded monthly flow (i.e. 50% of flows are equal to or smaller, 50% of flows are larger).

The data indicates the following:

- At all three watercourses, flows are most likely to occur during the summer months. Stream flows are highly variable, especially during the summer months.
- Taurus Creek and Blackwater Creek are ephemeral streams, where flows to the greater Fitzroy basin occur during the summer months often in short durations, but generally drying out during winter and early spring. Stream flows greater than 10 megalitres per day occur less than 6% of the time in Taurus Creek, and less than 14% of the time in Blackwater Creek.
- The Fitzroy River, located in the lower Fitzroy basin, is more perennial, providing permanent flows entering the GBR Marine Park.

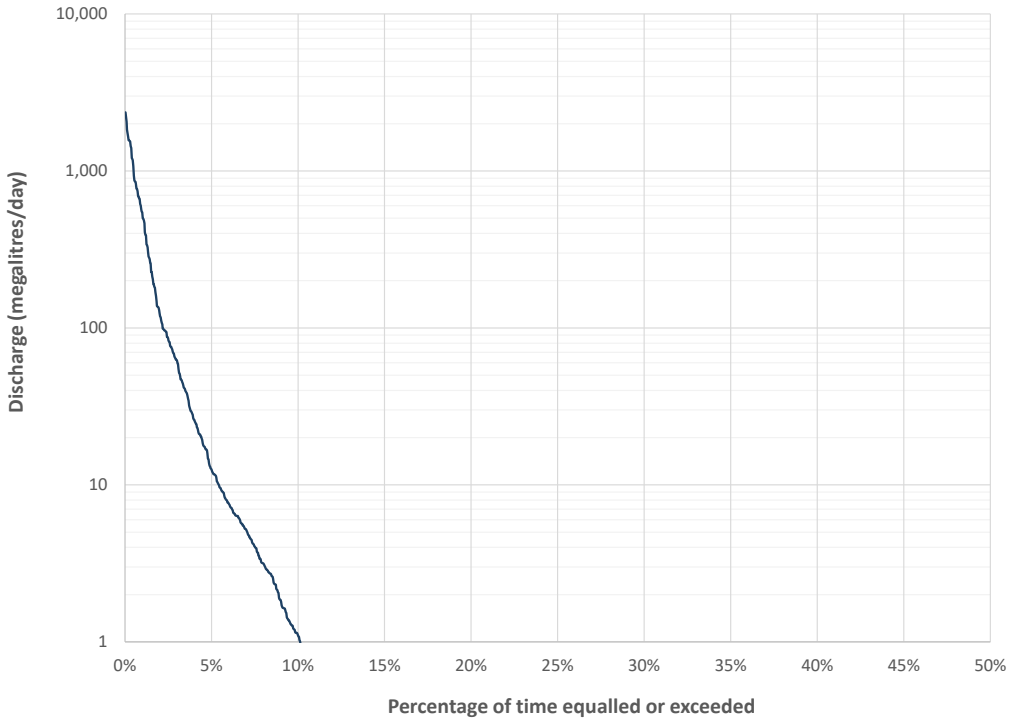


Figure 3.4 Daily discharge exceedance curve (2016 – 2025) for Taurus Creek at the Taurus Creek D/S gauge

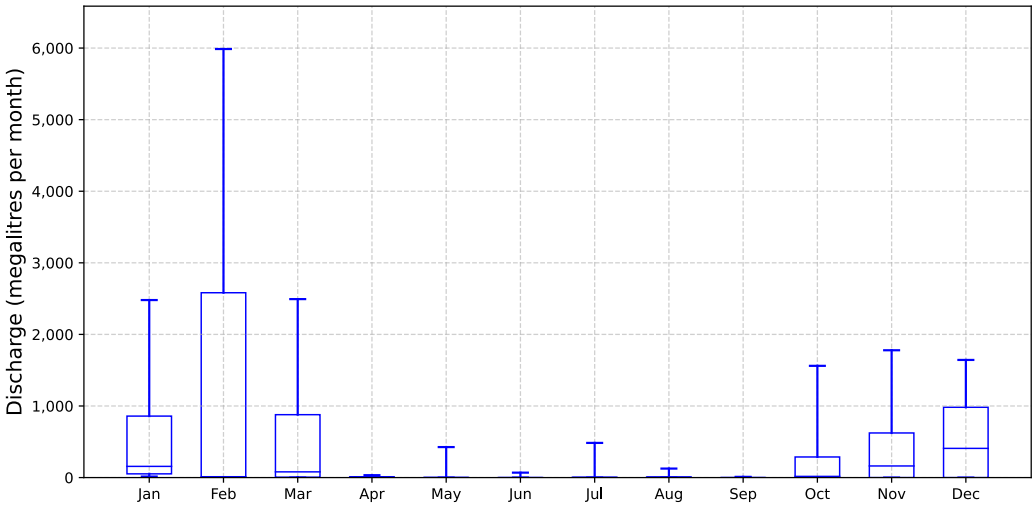


Figure 3.5 Monthly box and whisker plot of flow volume (2016 – 2025) for Taurus Creek at the Taurus Creek D/S gauge

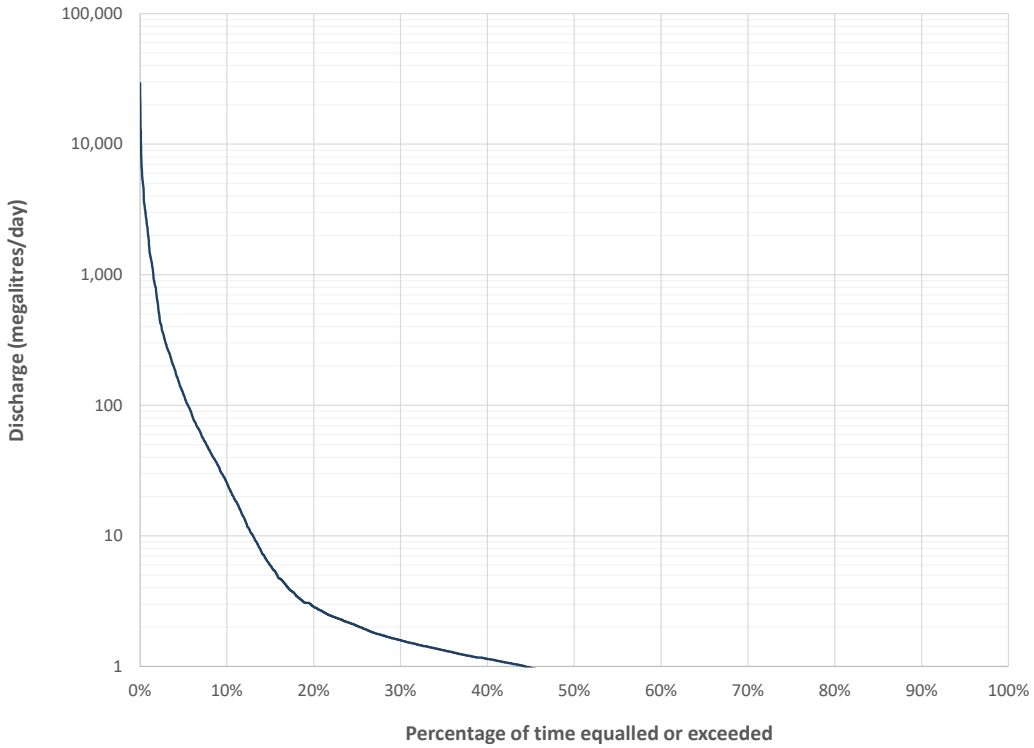


Figure 3.6 Daily discharge exceedance curve (1972 – 2009) for Blackwater Creek at Curragh (DRDMW station No. 130108A and 130108B)

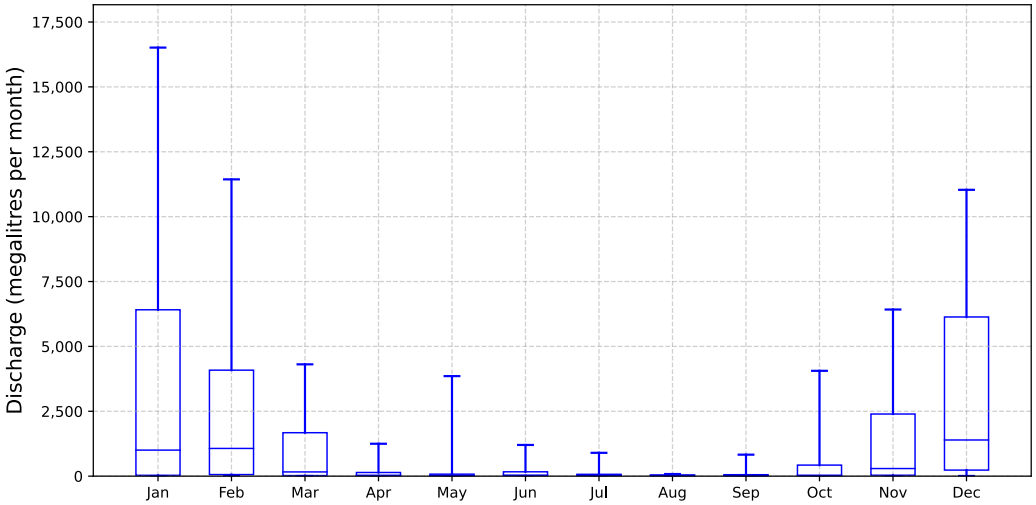


Figure 3.7 Monthly box and whisker plot of flow volume (1972 – 2009) for Blackwater Creek at Curragh (DRDMW station No. 130108A and 130108B)

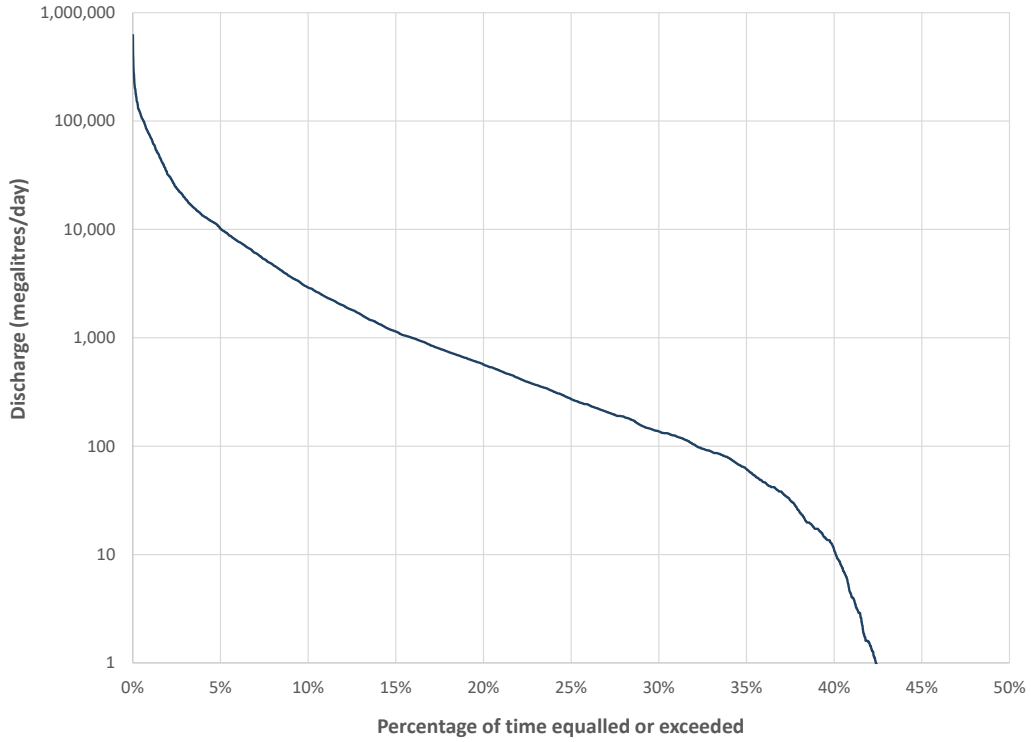


Figure 3.8 Daily discharge exceedance curve (1971 – 2025) for the Fitzroy River at the Gap stream gauging station

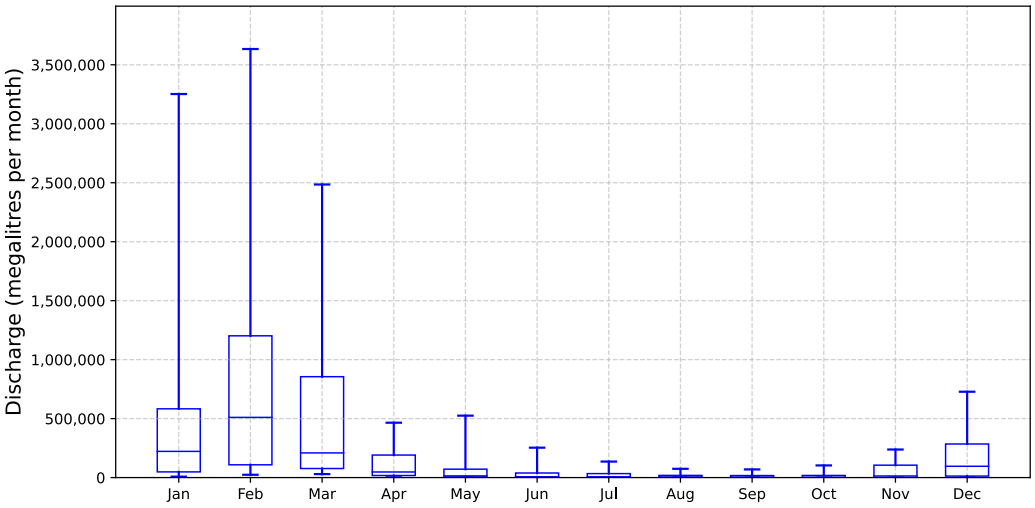


Figure 3.9 Monthly box and whisker plot of flow volume (1971 – 2025) for the Fitzroy River at the Gap stream gauging station

3.3 SURFACE WATER QUALITY

3.3.1 Overview

The following sections describe the water quality characteristics of the local creeks and regional waterways in the vicinity of the Action, based on surface water quality monitoring results.

The *Reef 2050 Water Quality Improvement Plan*, prepared by the Queensland Government (2018) states that the greatest water quality risks to the GBR are from nutrients, fine sediments and pesticides. Water quality targets have been set for dissolved inorganic nitrogen (DIN), fine sediment (which is measured as total suspended solids [TSS]), particulate phosphorous and particulate nitrogen. This report also states that:

'There is insufficient science to set quantitative water quality targets for other pollutants, including plastics. As the science is refined, quantitative measures can be developed for other pollutants.'

Further, the *Reef discharge standards for industrial activities* (DESI, 2024) states that:

'In the absence of data or information on DIN that would be sufficient to support an application, the administering authority may consider the use total nitrogen (TN) as the contaminant of interest for the purposes of section 41AA of the EP Reg. This will ensure that the intent of 'no net decline' of DIN to GBR catchment waters is met.'

In consideration of the above and the availability of data, existing surface water quality have been characterised for TSS, total nitrogen (TN) and total phosphorus (TP) only, based on water quality monitoring results described in the following reports:

- *Receiving Environment Monitoring Program (REMP) Annual Report, July 2021 – June 2022* (BMA, 2023);
- *Fitzroy Regional Receiving Environment Monitoring Program Annual Report, July 2022 – June* 2023 (FRREMP, 2023); and
- *Fitzroy Regional Receiving Environment Monitoring Program Annual Report, July 2023 – June 2024* (FRREMP, 2025).

It should be noted that after June 2022, Whitehaven Blackwater became a participant in the FRREMP and as such, FRREMP reports were not available for the period before June 2022.

Local monitoring stations at BWM that still contribute data to the FRREMP include the Sirius Creek downstream (D/S) and the Rockland Creek upstream (U/S) gauges, which are not located within the Project area (including the Action). However, data from these local monitoring sites reported in the FRREMP (2023 and 2025) is limited to electrical conductivity and pH and does not include TSS, TP and TN.

3.3.2 Sub-basin Water Quality Objectives

The *Environmental Protection (Water and Wetland Biodiversity) Policy 2019* (EPP (Water)), which is subordinate legislation to the EP Act, provides a framework for identifying environmental values (EVs) for a waterway and deciding Water Quality Objectives (WQOs) to protect or enhance those EVs.

WQOs from the following documents, pursuant to the EPP (Water), are relevant for the Action:

- *the Comet River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Comet River Sub-basin, September 2011* (DEHP, 2013a).
- *the Mackenzie River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Mackenzie River Sub-basin, September 2011* (DEHP, 2013b).
- *the Fitzroy River Sub-basin Environmental Values and Water Quality Objectives Basin No. 130 (part), including all waters of the Fitzroy River Sub-basin, September 2011* (DEHP, 2013c).

The "Sub-basin WQOs" from the above documents have also been referred to in the FRREMP (2025) report.

3.3.3 Water quality in local creeks

Table 3.1, Table 3.2 and Table 3.3 show the water quality monitoring results for the local monitoring sites in the vicinity of the Action for TSS, TN and TP respectively. These tables also show the Sub-basin WQOs for the Comet River Sub-basin (Water Quality [WQ] 1307), the Mackenzie River Sub-basin (WQ 1304) and the Fitzroy River Sub-basin (WQ 1305), obtained from the FRREMP (2025).

The water quality monitoring results shown in Table 3.1, Table 3.2 and Table 3.3 reflect existing site conditions excluding the Action. The data indicates that:

- At the two upstream sites not affected by mining activities (Taurus Creek U/S and Deep Creek U/S), the median (50th percentile) concentrations of TSS, TN and TP generally exceed the WQOs. At Emu Creek U/S, median pollutant concentrations are even higher.
- Median concentrations of TSS, TN and TP at gauges downstream of BWM are generally higher than concentrations upstream of BWM, which may be due to existing mining activities (excluding the Action), but is also likely due to the larger catchments contributing runoff to these downstream sites.
- Whilst median TSS concentrations at the downstream monitoring sites appear to be elevated compared to the upstream sites, mean TSS concentrations at the downstream monitoring sites are broadly similar to those recorded at the upstream monitoring sites Emu Creek U/S, Two Mile Gully and Blackwater Creek U/S. Mean TSS concentrations are generally higher than median concentrations at all monitoring sites, likely due to occasional high TSS concentrations recorded during larger flow events.

3.3.4 Regional water quality

Table 3.1, Table 3.2 and Table 3.3 show the water quality monitoring results for the regional FRREMP monitoring sites for TSS, TN and TP, respectively. The statistical summary of the FRREMP data is presented separately for the July 2022 to June 2023 and the July 2024 to June 2025 reporting periods, as that is how the data was reported in the FRREMP annual reports.

The water quality monitoring results shown in Table 3.1, Table 3.2 and Table 3.3 reflect existing site conditions excluding the Action. The data indicates that at the FRREMP monitoring sites:

- Median TSS concentrations are generally below the WQOs.
- Median TN concentrations generally exceed the WQOs.
- Median TP concentrations are generally within or slightly above the WQOs in the Mackenzie and Fitzroy rivers for the 2022/23 reporting period. However, TP concentrations in the Mackenzie and Fitzroy rivers are significantly higher for the 2023/24 reporting period. The

reason for elevated TPs during the 2023/24 period compared to the previous year is unknown.

- Median concentrations of TSS, TN and TP in the Mackenzie and Fitzroy rivers are significantly lower than those recorded at the local monitoring sites closer to the Action. This is due to significantly higher flows, and hence a much higher level of dilution in the Mackenzie and Fitzroy rivers compared to the local creeks in the vicinity of the Action.

3.4 CONTRIBUTION OF SEDIMENTS TO THE GBR DUE TO SPECIFIC LAND USES

The 2022 Scientific Consensus Statement (Prosser, 2024) investigated how much anthropogenic sediment and particulate nutrients are exported from GBR catchments, the most important characteristics of anthropogenic sediments and particulate nutrients and the primary sources. The findings in Posser (2024) are summarised below.

Concentrations of sediment and particulate nutrients have been measured in subcatchments dominated by particular land uses. The findings from Packett et al (2009) found a strong correlation in the Fitzroy River between the concentration of suspended sediment and the proportion of cropland in the contributing catchment, suggesting that cropland is the more significant sediment source. Prosser (2024) noted that in the Fitzroy River, mines make up a very small proportion of the basin and located much further inland.

Bartley et al (2017) quantified the contributions of suspended sediment by land use by region. Bartley et al (2017) fond that in the Fitzroy River catchment, the estimated proportion of total fine sediment loads exported to the GBR from each land use are approximately 40% from grazing, approximately 40% from streambank erosion, approximately 10% from dryland cropping, approximately 5% from nature conservation and the remainder of approximately 5% from forestry, irrigated cropping, dairy, horticulture, sugarcane, urban and other land uses.

Table 3.1 Comparison of sub-basin Water Quality Objectives and water quality monitoring results for total suspended solids

Monitoring site	Analyte	Sub-Basin WQO			Surface water quality monitoring results						
		Comet (WQ 1307)	Mackenzie (WQ 1304)	Fitzroy (WQ 1305)	Total samples	Median	Mean	Min	Max	20%ile	80%ile
Sites upstream (west) of BWM											
Taurus Creek U/S	TSS (mg/L)	< 30 mg/L	< 110 mg/L	< 85 mg/L	38	75	496	8	10,000	38	311
Deep Creek U/S					13	75	399	12	3,850	29	181
Emu Creek U/S					6	471	895	248	2,940	290	950
Blackwater Creek U/S					12	142	622	8	3,620	65	696
Two Mile Gully					21	444	722	21	2,340	236	1,280
Sites downstream (east) of BWM											
Blackwater Creek D/S	TSS (mg/L)	< 30 mg/L	< 110 mg/L	< 85 mg/L	72	270	716	6	6,010	137	1,042
Taurus Creek D/S					13	462	795	42	2,420	165	1,400
FRREMP monitoring sites (July 2022 – June 2023)											
Comet River at Comet Weir (COM504)	TSS (mg/L)	< 30 mg/L	< 110 mg/L	< 85 mg/L	6	31	99	10	382	18	122
Mackenzie River at Bingegang (MAC106)					6	38	45	3	86	28	62
Mackenzie River at Coolmaringa (130105B)					6	26	51	7	146	10	92
Fitzroy River at Riverslea (FIT003)					6	20	33	9	90	16	46
Fitzroy River at The Gap (FIT005)					5	27	58	10	178	19	80
FRREMP monitoring sites (July 2023 – June 2024)											
Comet River at Comet Weir (COM504)	TSS (mg/L)	< 30 mg/L	< 110 mg/L	< 85 mg/L	6	33	-	3	372	12	92
Mackenzie River at Bingegang (MAC106)					6	22	-	11	69	18	38
Fitzroy River at Riverslea (FIT010)					6	22	-	10	103	16	42
Fitzroy River at The Gap (FIT005)					5	27	-	11	146	16	88

Note: mg/L = milligrams per litre

Table 3.2 Comparison of sub-basin Water Quality Objectives and water quality monitoring results for total nitrogen

Monitoring site	Analyte	Sub-basin WQO			Surface water quality monitoring results						
		Comet (WQ 1307)	Mackenzie (WQ 1304)	Fitzroy (WQ 1305)	Total samples	Median	Mean	Min.	Max.	20%ile	80%ile
Sites upstream (west) of BWM											
Taurus Creek U/S	TN (µg/L)	< 500 µg/L	< 775 µg/L	< 500 µg/L	2	-	1,500	1,300	1,700	-	-
Deep Creek U/S					1	-	1,700	1,700	1,700	-	-
Emu Creek U/S					n/a	n/a	n/a	n/a	n/a	n/a	n/a
Blackwater Creek U/S					1	-	100	100	100	-	-
Two Mile Gully					1	-	600	600	600	-	-
Sites downstream (east) of BWM											
Blackwater Creek D/S	TN (µg/L)	< 500 µg/L	< 775 µg/L	< 500 µg/L	3	2,200	2,867	800	5,600	1,360	4,240
Taurus Creek D/S					1	-	4,400	4,400	4,400	-	-
FRREMP monitoring sites (July 2022 – June 2023)											
Comet River at Comet Weir (COM504)	TN (µg/L)	< 500 µg/L	< 775 µg/L	< 500 µg/L	6	950	1,000	400	1,900	800	1,000
Mackenzie River at Bingegang (MAC106)					6	850	830	500	1,200	500	1,100
Mackenzie River at Coolmaringa (130105B)					6	850	820	500	1,200	600	900
Fitzroy River at Riverslea (FIT003)					6	500	570	400	800	400	800
Fitzroy River at The Gap (FIT005)					5	800	960	500	1,500	580	1,420
FRREMP monitoring sites (July 2023 – June 2024)											
Comet River at Comet Weir (COM504)	TN (µg/L)	< 500 µg/L	< 775 µg/L	< 500 µg/L	6	600	-	400	1,800	600	1,600
Mackenzie River at Bingegang (MAC106)					6	750	-	400	4,200	500	1,200
Fitzroy River at Riverslea (FIT010)					6	950	-	400	1,200	500	1,000
Fitzroy River at The Gap (FIT005)					5	900	-	500	1,000	580	1,000

Note: µg/L = micrograms per litre

Table 3.3 Comparison of sub-basin Water Quality Objectives and water quality monitoring results for total phosphorus

Monitoring site	Analyte	Sub-basin WQO			Surface water quality monitoring results						
		Comet (WQ 1307)	Mackenzie (WQ 1304)	Fitzroy (WQ 1305)	Total samples	Median	Mean	Min.	Max.	20%ile	80%ile
Sites upstream (west) of BWM											
Taurus Creek U/S	TP (µg/L)	< 50 µg/L	< 160 µg/L	< 50 µg/L	2	-	170	80	260	-	-
Deep Creek U/S					1	-	130	130	130	-	-
Emu Creek U/S					n/a	n/a	n/a	n/a	n/a	n/a	n/a
Blackwater Creek U/S					1	-	20	20	20	-	-
Two Mile Gully					1	-	120	120	120	-	-
Sites downstream (east) of BWM (East)											
Blackwater Creek D/S	TP (µg/L)	< 50 µg/L	< 160 µg/L	< 50 µg/L	3	660	840	80	1,780	312	1,332
Taurus Creek D/S					1	-	1,300	1,300	1,300	-	-
FRREMP monitoring sites (July 2022 – June 2023)											
Comet River at Comet Weir (COM504)	TP (µg/L)	< 50 µg/L	<160 µg/L	< 50 µg/L	6	95	107	30	180	60	180
Mackenzie River at Bingegang (MAC106)					6	55	90	5	260	30	160
Mackenzie River at Coolmaringa (130105B)					6	20	61	5	220	20	80
Fitzroy River at Riverslea (FIT003)					6	55	73	10	200	30	90
Fitzroy River at The Gap (FIT005)					5	60	60	5	80	49	80
FRREMP monitoring sites (July 2023 – June 2024)											
Comet River at Comet Weir (COM504)	TP (µg/L)	< 50 µg/L	<160 µg/L	< 50 µg/L	6	190	-	40	700	80	290
Mackenzie River at Bingegang (MAC106)					6	125	-	20	500	60	400
Fitzroy River at Riverslea (FIT010)					6	245	-	30	360	40	350
Fitzroy River at The Gap (FIT005)					5	220	-	50	370	146	330

Note: µg/L = micrograms per litre

4 SURFACE WATER IMPACT ASSESSMENT

4.1 OVERVIEW

The following sections assessed the potential changes to TSS, TN and TP loads to the GBR as a result of the Action during the maximum disturbance stage of its mining operations, to ultimately determine if the Action would cause an 'impact' to the GBR as defined in section 527E of the EPBC Act.

4.2 CATCHMENT LOSS ANALYSIS

Figure 4.1 compares the Taurus Creek catchment (to Taurus Creek D/S gauge) and the Sagittarius Creek catchment (to the northern ML boundary) under existing and Project conditions (including the Action during mining). The changes in catchment areas are tabulated in Table 4.1.

The Action would involve an extension of the open cut pit footprint towards the east, which would reduce the Taurus Creek and Sagittarius Creek catchments during mining, as a greater portion of undisturbed land would drain to the open cut pits.

The Action, during mining, would result in an 8.9% reduction of the Taurus Creek catchment and a 7.9% reduction in the Sagittarius Creek catchment. The Action would result in a reduction in catchment runoff volumes from undisturbed land. This in turn, is expected to reduce the TSS, TN and TP loads generated from undisturbed land to the greater Fitzroy basin and ultimately to the GBR.

Table 4.1 Analysis of catchment loss due to the Action

Catchment	Area (km^2)		Difference (%)
	Existing conditions	Project conditions (including the Action)	
Taurus Creek to Taurus Creek D/S gauge	250.4	228.2	-8.9
Sagittarius Creek to northern ML boundary	42.7	39.3	-7.9

Whitehaven Blackwater is committed to undertaking progressive rehabilitation as land becomes available. Rehabilitation would include re-establishing the majority of the Taurus Creek and Sagittarius Creek catchments.

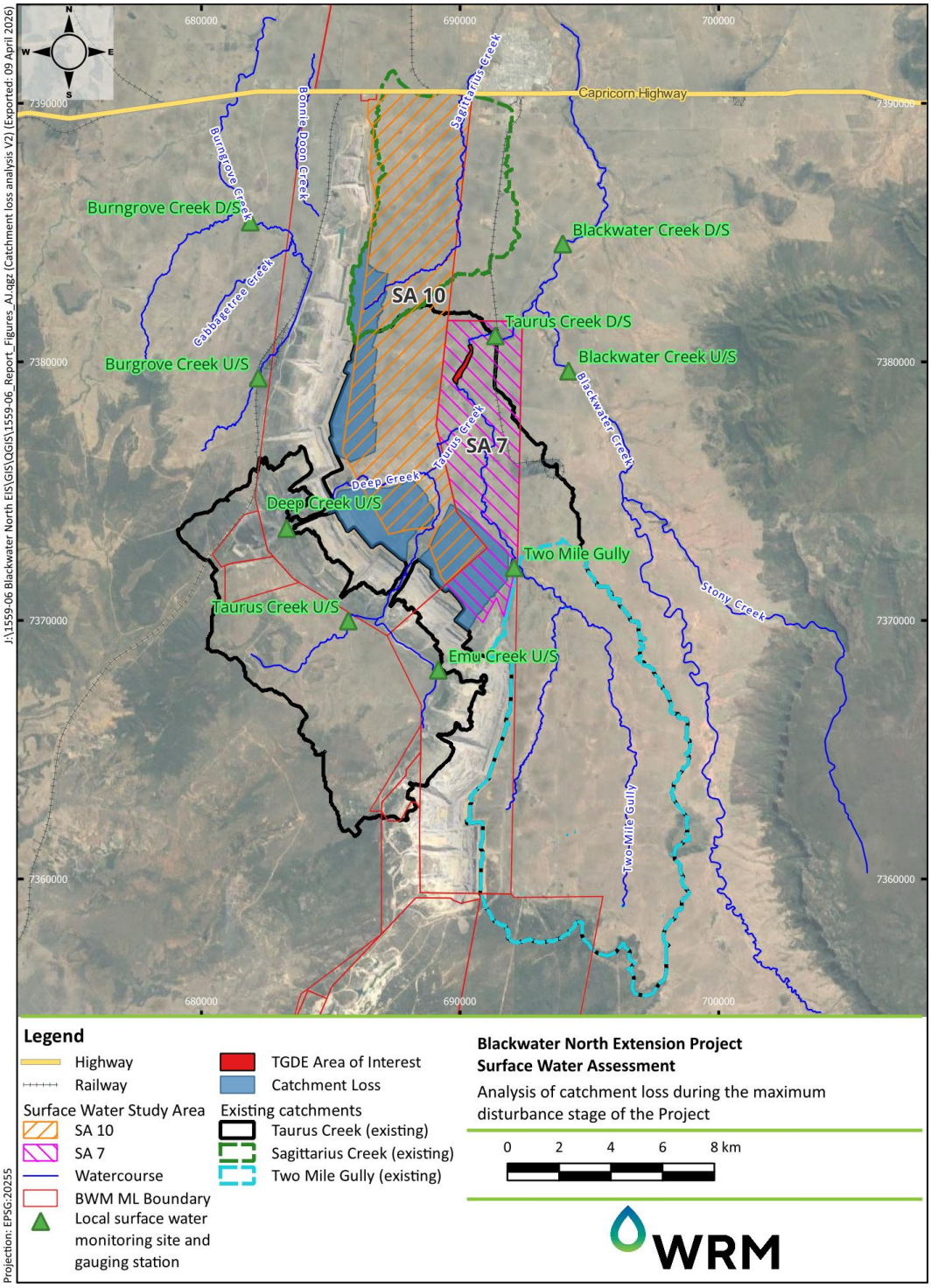


Figure 4.1 Analysis of catchment loss due to the Action during the maximum disturbance stage of its mining operations

4.3 SIMPLIFIED ESTIMATION OF TSS, TN AND TP LOAD REDUCTONS

4.3.1 Water quality targets

The *Reef 2050 Water Quality Improvement Plan*, prepared by the Queensland Government (2018), describes end-of-catchment water quality targets for nutrients and sediments based on the GBR Marine Park Authority's *Water Quality Guidelines for the Great Barrier Reef Marine Park*. They are expressed as end-of-catchment load reductions (see Table 4.2).

The 2025 end-of-catchment water quality targets are expressed as percentage reductions of anthropogenic loads and the required reduction is also shown in tonnes (or kilotonnes for fine sediment).

Table 4.2 End-of-catchment anthropogenic water quality targets for the Reef catchments by 2025 and relative priorities for water quality improvement

Region	Catchment / Basin	Area (ha)	Targets							
			Dissolved inorganic nitrogen		Fine sediment		Particulate phosphorus		Particulate nitrogen	
			tonnes	% reduction	kilotonnes	% reduction	tonnes	% reduction	tonnes	% reduction
Fitzroy	Styx River	301,340	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL
	Shoalwater Creek	360,180	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL
	Waterpark Creek	183,650	MCL	MCL	MCL	MCL	MCL	MCL	MCL	MCL
	Fitzroy River	14,254,470	MCL	MCL	390	30	380	30	640	30
	Calliope River	224,060	MCL	MCL	15	30	54	30	107	30
	Boyne River	249,630	MCL	MCL	6	40	5	40	9	40

Note: MCL = maintain current load

Source: Queensland Government (2018)

4.3.2 Simplified calculation methodology

Section 4.2 demonstrated that the Action, during its operational phase, would result in a 8.9% reduction of the Taurus Creek catchment and 7.9% reduction in the Sagittarius Creek catchment. This would result in a reduction in catchment runoff from undisturbed land that would otherwise report directly to Taurus Creek and Sagittarius Creek.

A simplified analysis was undertaken to estimate the expected reduction in TSS, TN and TP loads from undisturbed land (in tonnes or kilotonnes) as a result of the Action during mining, based on recorded flow data (described in Section 3.2) and water quality monitoring data (described in Section 3.3).

The simplified calculation was undertaken based on the following assumptions:

- The Action, during mining, would result in a net loss of approximately 25.5 km^2 of undisturbed land that currently contributes runoff, including fine sediments and nutrients, to the GBR.
- An annual median runoff volume from these 'loss' undisturbed areas was estimated based on the total of the recorded median monthly flow volumes in Taurus Creek at the Taurus Creek D/S gauge (as shown in Figure 3.5), which were factored down in proportion to the catchment area that would be loss.
- Representative pollutant concentrations were adopted for TSS (496 mg/L), TN (1,700 micrograms per litre [µg/L]) and TP (170 µg/L), based on the highest mean concentration of samples between the Taurus Creek U/S and Deep Creek D/S local monitoring sites given in Table 3.1, Table 3.2 and Table 3.3. Runoff reporting to these local monitoring sites is relatively unaffected by mining activities and is therefore representative of 'undisturbed' land.

4.3.3 Results

Table 4.3 shows the estimated annual reduction of TSS, TN and TP loads (in tonnes) from undisturbed land as a result of the Action. The Action would result in minor reductions in TSS, TN and TP loads from undisturbed land which is in line with the Queensland Government (2018) end-of-catchment water targets.

The loss of undisturbed catchment to the GBR adds additional catchment reporting to the BWM water management system (WMS). However, current investigations indicate that the Action would not result in material changes to the frequency and volume of releases from the BWM due to the additional catchment reporting to the WMS.

Table 4.3 Simplified calculation of predicted reduction in annual total suspended solids, total nitrogen and total phosphorus loads to the Great Barrier Reef

Loss of median annual discharge volume (ML/a)	TSS		TN		TP	
	Representative concentration (mg/L)	Load reduction (kilotonnes)	Representative concentration (µg/L)	Load reduction (tonnes)	Representative concentration (µg/L)	Load reduction (tonnes)
73.9	496	0.04	1,700	0.13	170	0.01

Note: ML/a = megalitres per annum

4.4 WATER RELEASES

4.4.1 Overview

The Project would continue to operate within an established and regulated surface water management framework that prioritises the capture, reuse and controlled release of Mine Affected Water (MAW). Surface water management measures include separation of clean and contaminated water, sediment and erosion control structures, operational water balance controls, and Trigger Action Response Plans (TARPs) to prevent uncontrolled releases.

4.4.2 Controlled release strategy

Controlled release of MAW is currently authorised under the EA. Releases shall only occur in compliance with the EA release conditions to ensure no environmental impacts from MAW to the receiving environment. Within the Taurus Creek catchment, controlled release of MAW can occur

(in compliance with the EA release conditions) at "Licensed Discharge Points" RP2 (Taurus Dam), RP3 (New Deep Creek Dam) and RP4 (Tannyfoil Dam), as shown in Figure 3.3.

Modelling of the site water balance (HydroBalance, 2026) and flooding behaviour (WRM, 2026) indicates that controlled releases, where required, would occur in accordance with existing EA conditions (Schedule F) and relevant WQOs.

Controlled releases under Schedule F of the EA EPML00717813 would only occur during periods when receiving waterways have recorded a natural flow in excess of the minimum flow trigger in response to rainfall-generated catchment runoff. At these times, local creeks would be exhibiting elevated, event-driven flows characterised by increased water levels, higher velocities and short-duration runoff pulses which would likely include natural turbidity and sediment transport reflecting storm conditions.

There are no proposed changes to the currently approved controlled release strategy as a result of the Action. In addition, there are no proposed changes to release infrastructure (release dams and pipelines). In summary, controlled releases would continue to be undertaken in accordance with the EA release conditions.

The site water balance assessment (HydroBalance, 2026) predicted that the Action would increase controlled releases by around 11% - 20% (110 - 130 ML) under median climate conditions compared to the Approved operations. However, the potential increase in controlled releases is primarily due to the groundwater modelling outputs that predict an increase in groundwater inflows during the operation of the Action. Groundwater inflows are not anticipated to result in a significant increase in the TSS load to the mine water management system.

Bartley et al (2017) estimated that approximately 1,805 kt of suspended sediment are released annually to the GBR from the Fitzroy River catchment. Assuming that controlled releases from BWM discharge an additional 130 ML/a at a TSS concentration of 462 mg/L (the median TSS at Taurus Creek D/S), this equates to approximately 0.06 kt of sediments annually. This represents less than 0.01% of the estimated total sediment load to the GBR from the Fitzroy River catchment. The BWM mine water storages including NTCD (RP2), NDCD (RP3) and TFD (RP4) provide extended detention and settling opportunities that promote sediment deposition and therefore the above estimate of sediment loads from controlled releases may be conservative and would need to be reviewed with additional monitoring for TSS.

The water balance assessment (HydroBalance, 2026) indicates that the Action can be managed within the existing water management system and existing controlled release framework, with releases continuing to occur only in accordance with the approved EA (Schedule F) release conditions. Accordingly, the Action is not expected to result in a material residual impact to GBR catchment waters.

4.4.3 Uncontrolled releases

The Whitehaven documents *WHC QLD Standard – Erosion & Sediment Control and Mine Affected Water* (Whitehaven, 2024), *BWM Plan – Water Management* (Whitehaven, 2026a) and *BWM Plan – Erosion and Sediment Control Plan* (Whitehaven, 2026b) outline the strategies and design objectives currently implemented at BWM to manage legacy risks associated with uncontrolled discharges from MAW storages and sediment dams. The management strategies described in this standard will continue to apply to the Project.

The Project is not expected to increase the risk of uncontrolled discharges from site storages to receiving waterways for the following reasons (HydroBalance, 2026):

- The proposed changes to the Project footprint are limited to the eastward expansion of existing pits. Resulting catchment changes are confined to the expanding pits, which drain internally.

- The Project does not alter the contributing catchments or drainage arrangements of existing MAW storages or sediment dams that have been identified as having potential for uncontrolled discharge.
- The Project does not modify the catchments of New Taurus Creek Dam or New Deep Creek Dam, which have a higher potential for uncontrolled discharges due to their on-stream configuration.

4.5 EROSION AND SEDIMENT CONTROL STRATEGY

4.5.1 Erosion and Sediment Control Plan

The *BWM Erosion and Sediment Control Plan* (ESC Plan) by Whitehaven (2026b), outlines the current ESC strategy for BWM. The selection of sediment control requirements is guided by the catchment 'risk matrix' shown in Table 4.4 (Whitehaven, 2026b). Catchments are assigned a risk rating ranging between 'Very Low', 'Low', 'Medium', 'High', 'Very High' and 'MAW' depending on the catchment characteristics.

For catchments classified as 'Very Low' to 'Low' risk rating, small-scale or supplementary sediment controls or supplementary sediment controls may be appropriate controls on a temporary basis during small-scale, short-term construction/exploration stages prior to implementing erosion protection measures such as revegetation. Typical supplementary sediment controls are listed in the *Best Practice Erosion and Sediment Control Guidelines* (IECA, 2008), but may include:

- excavated sediment traps;
- rock check dams; and
- sediment fencing/bunds.

For catchments classified with a risk rating of 'Medium' or higher, sediment basins are used as a sediment control measure.

The Action would not increase the catchment draining southwest into Deep Creek and Taurus Creek (downslope of the overburden dumps) during mining, compared to current conditions. No specific requirements for additional sediment basins have been identified. However, there is potential additional sediment basins may be required for the Project associated with disturbance in advance (to the east) of mining operations including infrastructure corridors, pre-stripping and topsoil stockpiles. The requirement for, and location and sizing of, any new sediment basins would be confirmed during detailed design, having regard to the final disturbance footprint, catchment configuration, drainage design and anticipated sediment-generation risk.

Table 4.4 Catchment risk assessment criteria and sediment control design standard (Whitehaven, 2026b)

Risk Rating	Soil/spoil category	Disturbed Catchment area (ha)	Duration of disturbance	Average catchment slope	Sediment control design standard
Very Low	Competent material	Less than 0.5 ha	Less than 3 months	Less than 1%	No controls
Low		0.5 to 1 ha	3 to 6 months	1% to 3%	Supplementary sediment controls
Medium	Non-dispersive topsoil	1 to 4 ha	6 months to 2 years	3% to 10%	FT Sediment basin (80%ile 5 day)
High	Dispersive topsoil	Greater than 4 ha	Greater than 2 years	Greater than 10%	FT Sediment basin (90%ile 5 day)
	Non-dispersive spoil				
Very High	Dispersive spoil	Any	Any	Any	Containment basin (95%ile 5 day)
MAW	Per MAW definition	Any	Any	Any	MAW Dam

4.5.2 ESC implementation plan

The *Blackwater Mine Water Management Plan* (WMP) by Whitehaven (2025), outlines the BWM's ESC 'implementation plan', which include the actions to mitigate potential environmental harm for each catchment discharging to Burngrove Creek, Deep Creek, Taurus Creek, and Emu Creek during rainfall events. The Water Management Plan (WMP) states that these actions include both permanent controls and temporary mitigating works, which may be undertaken while further studies and design work are completed to inform the final permanent controls required.

Figure 4.2 shows the catchments included in the ESC implementation plan and whether ESC measures are in place or proposed in each catchment (Whitehaven, 2025). As operations at the mine progress, these catchments are likely to change. Figure 4.2 shows that ESC measures are already in place in the catchments immediately adjacent to receiving waterways. Rehabilitation and/or installation of appropriate erosion and sediment controls is planned to be completed over significant areas of the BWM by June 2031.

In summary, the ESC implementation plan as described in the WMP would minimise the release of fine sediments to the receiving waterways and ultimately to the GBR, resulting from currently approved operations as well as the Action.

4.6 POST-CLOSURE

At the completion of mining, surface runoff from rehabilitated in-pit and out of pit waste rock emplacement areas would flow to the receiving environment, with the exception of approximately 27.3 km^2 which would report to five residual voids associated with the Project (WRM, 2026).

There would be no releases from the Action post-closure. SLR (2026) predicted that of the five residual voids, three are expected to become long-term sinks, and the other two are predicted to become flow-through systems reporting to these long-term sinks.

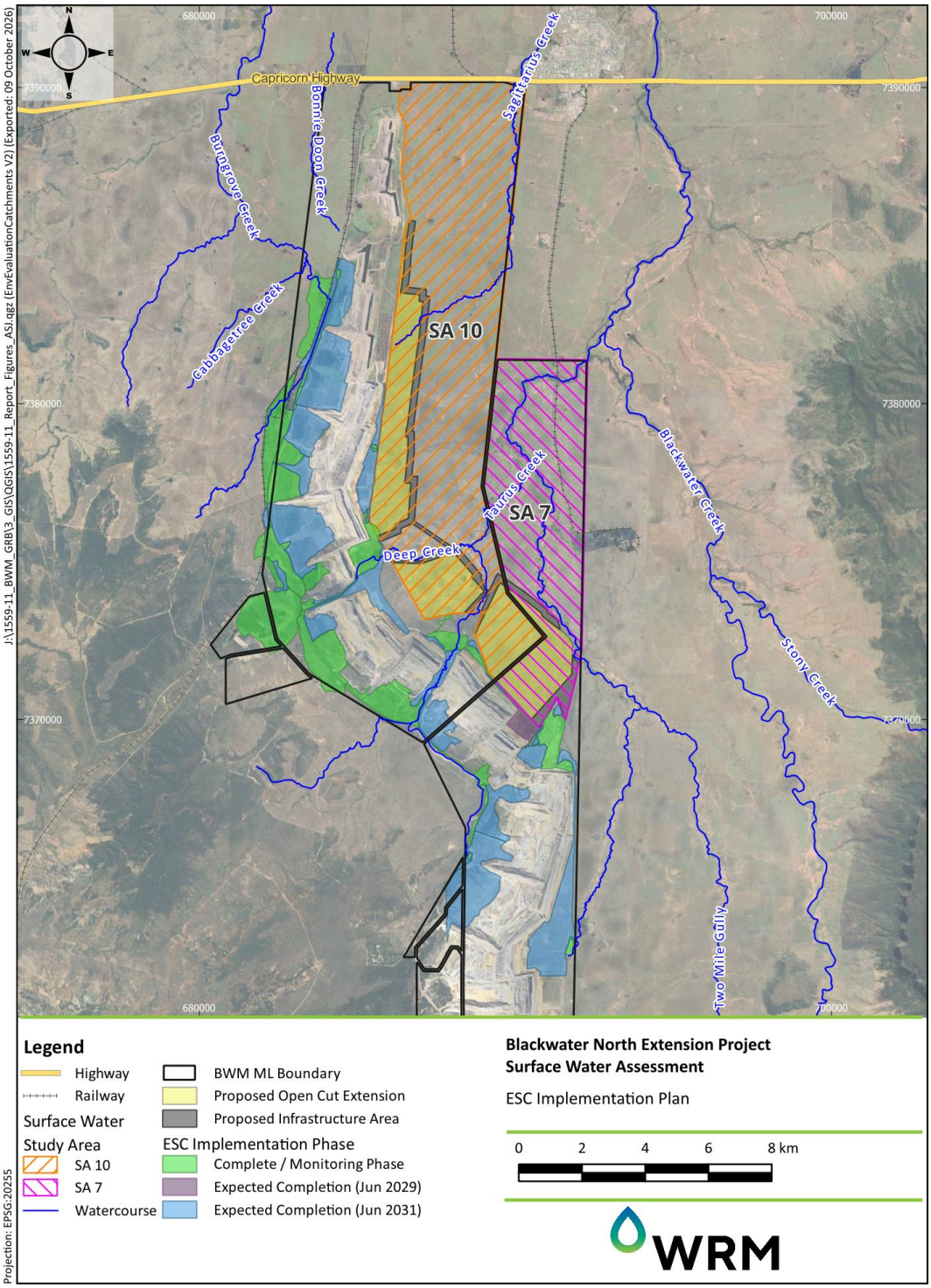


Figure 4.2 ESC Implementation Plan

5 SUMMARY

The GBR is located approximately 600 river km downstream (and 210 km east) of the Action. As such, the Action would not result in any direct impacts to the GBR. Therefore, only the potential indirect impacts of the Action due to runoff and surface water releases were assessed.

The greatest water quality risks to the GBR are from nutrients, fine sediments and pesticides. Water quality targets have been set for DIN, fine sediment (which is measured as TSS), particulate phosphorous and particulate nitrogen. Based on the availability of data, potential impacts on surface water quality were assessed for TSS, TN and TP only.

The Action, during mining, would result in an 8.9% reduction of the Taurus Creek catchment and 7.9% reduction in the Sagittarius Creek catchment. The Action would result in a reduction in catchment runoff volumes from undisturbed land. This in turn, is expected to reduce the TSS, TN and TP loads generated from undisturbed land to the Greater Fitzroy Basin and ultimately to the GBR. The minor loss of annual TSS, TN and TP loads from undisturbed land to the GBR as a result of the Action is in line with the Queensland Government (2018) end-of-catchment water targets.

There are no proposed changes to the currently approved controlled release strategy as a result of the Action. In addition, there are no proposed changes to release infrastructure (release dams and pipelines). Controlled releases would continue to be undertaken in accordance with the EA release conditions.

The ESC implementation plan as described in the WMP (Whitehaven, 2025) would minimise the release of fine sediments to the receiving waterways and ultimately to the GBR, resulting from currently approved operations as well as the Action (Whitehaven, 2025).

The potential surface water impacts associated with the Action on the GBR Marine Park would be insignificant and would not meet the ‘substantial cause’ requirement of an indirect impact as outlined in section 527E(2) of the EPBC Act.

With regards to the Reef Discharge Standards (DESI, 2024), the water balance assessment (HydroBalance, 2026) indicates that the Action can be managed within the existing water management system and existing controlled release framework, with releases continuing to occur only in accordance with the approved EA (Schedule F) release conditions. Accordingly, in view of the Reef Discharge standards, the Project is not expected to result in a residual impact to GBR catchment waters for the purposes of section 41AA of the EP Regulation.

Regards,

Ardianto Notodirdjo

Principal Engineer

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