Graphinex – Esmeralda Graphite Project Environmental Impact Statement

Appendix H – Soils and Land Suitability Assessment

GRAPHINEX

Soils and Land Suitability Assessment

ESMERALDA GRAPHITE PROJECT

Prepared for
QLD Aus Graphite Pty Ltd

Final V2
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EXECUTIVE SUMMARY

GT Environmental Pty Ltd (GTE) was commissioned by the AARC Environmental Solutions Pty Ltd (AARC) on behalf of the Proponent, Qld Aus Graphite Pty Ltd (Graphinex) to complete a Soils and Land Suitability (SALS) Assessment for the Esmeralda Graphite Project (the Project).

The Project will comprise an open-cut mining operation located within the Mining Lease Application (MLA) area herein referred to as the study area. The study area of covers an area of 4,518.8 hectares (ha) and is located wholly within the Croydon Shire Local Government Area.

Graphinex is seeking to prepare an Environmental Impact Statement (EIS) assessment for the Project based on Terms of Reference for an EIS, Esmerald Graphite Project, September 2025 (ToR).

The key conclusions of the SALS assessment are as follows:

- Seven Soil Profile Classes (SPCs) across 19 Unique Mapping Areas (UMAs) are present in the study area.
    - Soils range from shallow, gravelly sandy soils, moderately deep poorly structured sandy loams to very deep sandy profiles on level to gently undulating plains.
    - SPCs have been classified in five (5) of the 14 Australian Soil Classification (ASC) orders consisting of Arenosols, Dermosol, Kandosols, Rudosols and Tenosols.
- The suitability framework of each SPC was assessed against the nominated Regional Frameworks (DNRM and DSITIA, 2013) for the Gulf Plains Area land uses. The 24 nominated land uses selected and assessed included Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape and Citrus;
    - Five SPCs, 1Cl(Ck), 2Cl(Ck), 3Cl(Ck), 4Cl(Ck) and 6Cl(El), have been assessed as being able to support up to three or more crop land uses.
    - SPC 5Cl(Nm) was assessed to only support Sweet Corn with moderate limitations. All other crop land uses had severe limitations.
    - SPC, 7Cl(Nm) presented severe or extreme limitations with supporting the nominated crop land uses, therefore is not considered suitable for cropping.
    - The suitability of nominated pastures was also assessed, with five SPCs, 1Cl(Ck), 2Cl(Ck), 3Cl(Ck), 4Cl(Ck) and 6Cl(El), identified as being able to support at all four selected pasture land uses; Lablab, Lucerne, Sorghum and Millet.
    - The two SPCs, 5Cl(Nm) and 7Cl(Nm), presented severe or extreme limitations with respect to supporting pastures.
- The assessment of ALCs based on the Regional Frameworks and beef cattle grazing classes indicated the following;
    - Approximately 4,510.5 ha in the study area and 2,407.3 ha in the disturbance area is ALC A1, which is suitable for a wide range of current and potential broadacre and horticultural crops.

  - Approximately 4.2 ha in the study area and 2.4 ha in the disturbance area is ALC B, which 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 4.1 ha in the study area and 4.1 ha in the disturbance area is ALC C2, which is suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than class C1.
  - ALC A2, C1, C3 and D were not mapped within the study area. No areas were designated as disturbed.

- The Regional Planning Interests (RPI) Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The study area was assessed against Strategic Cropping Area (SCA) and Priory Agricultural Area (PAA) requirements.
  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Government, 2023) 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 Government, 2023) 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 (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 all seven (7) SPCs contain soils that are suitable for reuse in rehabilitation activities.
  - Topsoil in the study area consists generally of very low fertility, soft to hard-setting surface, shallow to deep sandy soils which are indicative of the area, however all suitable for reuse for rehabilitation.
  - Soil amelioration recommendations such as organic matter / fertiliser application, management, storage and handling recommendations have been provided to retain and improve the quality of topsoil for rehabilitation reuse pending the final post mine land use (PMLU), which is proposed as cattle grazing.

1 INTRODUCTION

1.1 Project Title and Proponent

The Esmeralda Graphite Project, (herein referred to as the Project) occupies mining leases (ML) 100430 and 100431. QLD Aus Graphite Pty Ltd (QAG) is the Proponent for the Project.

1.2 Project Commission

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

1.3 Project Overview

The Project is a greenfield graphite mine and processing plant located approximately 70 kilometres south of Croydon in the Croydon Shire local government area.

The project includes the following:

- conventional open-cut mine;
- mine infrastructure area (including offices, workshops, laydown areas, washing bays, effluent and liquid waste storage, fuel storage and refuelling facilities, and airfield);
- on-site processing plant, magazine;
- water management infrastructure (including permanent watercourse diversion, flood levee, dams, drains, bunds, pipes and pumps);
- accommodation facility and associated sewage and water treatment plants;
- mine access tracks, haul roads, and internal roads;
- solar farm and energy storage system, transmission infrastructure and back-up diesel generators; and,
- ROM pad, tailing storage facilities, product stockpiles and loading area, waste rock dumps.

The study area of covers an area of approximately 4,518.83 hectares (ha) and is located wholly within the Croydon Shire Local Government Area (LGA). The site location is shown on Figure 1. The Project layout is shown on Figure 2a and Figure 2b.

The Proponent is seeking to prepare an Environmental Impact Statement (EIS) level assessment for the Project based on Terms of Reference for an EIS, Esmeralda Graphite Project, September 2025 (ToR). The study area is shown on Figures 3 to 10.

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 suitability of the land within the study area for selected cropping land uses and agricultural land classes 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).

1.5 EIS ToR Review and Assessment

The ToR outlines the applicable sections which have been addressed or have information supporting within this SALS Assessment.

Table 1-1 below provides a cross-reference for the conditions of the ToR partially or wholly addressed in this EIS supporting report.

Table 1-1: EIS ToR Cross Reference Table

Terms of Reference	Section of SALS Assessment
Content Requirements of the EIS	
Project Proponent 3.3 (f) Experience, qualifications and certification of all suitably qualified consultants and subconsultants engaged by the proponent to complete the EIS	Section 4.4.2 Survey Team
Project Description	
Proposed Development 4.15 Describe, map and illustrate soil types and profiles of the project area including added fill and/or exposed ground surface at a scale relevant to the proposed project and in accordance with relevant guidelines. Identify soils that would require specific management due to wetness, erosivity, sodicity, depth, acidity, salinity or other features.	Section 5: Soil and Land Suitability Results Section 8: Acid Sulfate Soils
Section 9 - Land Use Planning	
Existing Environment 9.1 (f) For the project footprint and surrounding area identify and describe all current and historic land use, including the following detail: Findings of the Agricultural Land Audit (including land of agricultural state interest under the State Planning Policy)	Section 4.1.1 Regional Land and Soils Report References and Documentation
Existing Environment 9.1 (g) For the project footprint and surrounding area identify and describe all current and historic land use, including the following detail: Areas of regional interest under the Regional Planning Interests Act 2014	Section 7 Regional Planning Interests Assessment
Section 10 – Land – Geology, Geomorphology, Topography and Soils	
10.1 The following guidance is relevant for the assessment of land, including geology, geomorphology, topography and soils: (a) Queensland Government, Land – EIS information guideline, ESR/2020/5303, (b) Queensland Government, Rehabilitation – EIS information guideline, ESR/2020/5308 (f) Queensland Government, Queensland Land Resource Assessment Guidelines – Volume 1: Soil and land resource assessment, 2021 (g) Queensland Government, Queensland Land Resource Assessment Guidelines – Volume 1: Field tests, 2020 (i) Soil Science Australia, Guideline for soil survey along linear features, 2015 (j) International Erosion Control Association, Best Practice Erosion and Sediment Control, 2008.	Section 3 Overview of Study Methods and Guidelines Section 4.2.3 Section 9.6.4

Terms of Reference	Section of SALS Assessment
Content Requirements of the EIS	
10.5 Existing Environment Describe and map soil types, soil profiles and unique map areas within the project footprint at a detailed property level scale17 relevant to project disturbance.	Section 5 Soil and land Suitability Results
10.6 Existing Environment Describe physical and chemical soil properties relevant to erosion, stability, salinity, acidity, rehabilitation and agricultural suitability and productivity supported by site-specific soil data.	Section 5 Soil and land Suitability Results Section 6 Land Suitability Assessment Section 9: Soil Management Measures
10.10 Impact Assessment Identify and assess the impacts of project activities and disturbance on soils during each project phase and identify soil types requiring particular management. Analyse and describe the significance of these impacts on environmental values, current and future land use and management requirements, including consideration of erosion, stability, salinity, acidity, rehabilitation and agricultural productivity.	Section 5 Soil and land Suitability Results Section 6 Land Suitability Assessment Section 9: Soil Management Measures
10.13 Mitigation Measures Describe proposed measures to avoid and minimise predicted impacts to land or soils, and the environmental values they support. Demonstrate how proposed measures are consistent with best practice environmental management.	Section 9: Soil Management Measures
10.18 Mitigation Measures Where actual or potential acid sulfate soils will be disturbed by the project, prepare an acid sulfate soil management plan in accordance with accepted industry guidelines to avoid or minimise adverse effects on environmental values.	Section 8: Acid Sulfate Soils

2 PROJECT SETTING

2.1 Local and Regional Context

The Project is located in the Shire of Croydon LGA, approximately 70 kilometres (km) south of Croydon township, Queensland (shown in Figure 1).

2.2 Land Use

The land use observed within the study area includes beef cattle grazing, agricultural activities such as grazing on native pastures with or without the introduction of pasture species (Queensland Government, 2023).

2.3 Climate

The nearest Bureau of Meteorology (BoM) weather station, located at Croydon township (BoM Station Number 029012), is approximately 70 km south of the study area. A summary of weather statistics (BoM, 2026) is provided below in Table 2-1.

Table 2-1: Climate Summary Information, BoM weather station, Richmond Post Office

Climate Statistic	Value
Mean Maximum Temperature (1962-2014)	33.83 degrees Celsius (°C)
Heat Stress. Days in total with temperatures equal to or greater than 40 °C (2013 [Last full year of temperature records])	15 days
Mean Minimum Temperature (1962-2014)	20.46 °C
Mean Minimum Temperature, months per year $<15^0$ (1912-2014)	2 months
Mean Frost. Days in total with temperature below 5°C (1995-2019 [Average])	4 days
Mean Annual Rainfall (1889-2026)	747.6 millimetres (mm)

2.4 Topography and Hydrology

The topography of the study area includes level to gently undulating plains. The elevation across the study area ranges from approximately 120 metres (m) Australian Height Datum (AHD) to 140 mAHD.

The hydrology of the study area includes watercourses and associated tributaries associated with the Warrigal Creek to the west, transecting from south east to north west.

2.5 Regional Geology

The study area is located within the Carpentaria Karumba Basin.

Detailed surface geology (Queensland Government, 2023) indicates the study area is underlain by three major surface geologies. These are summarised in Table 2-2 and shown on Figure 3.

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

Rock Unit Name	Age	Lithology Summary	Dominant Rock	Rock Type
Claraville (Tpc)	Pliocene – Pleistocene	Clayey quartzose sand and sandy mud; minor gravel	Poorly consolidated sediments	Stratified Unit (including volcanic and metamorphic)
Rewan Group (Qa-QLD)	Quaternary	Clay, silt, sand and gravel; alluvium	Alluvium	Stratified Unit (including volcanic and metamorphic)
Qha (Qha-QLD)	Holocene	Clay, silt, sand and gravel; alluvium	Alluvium	Stratified Unit (including volcanic and metamorphic)

2.6 Vegetation

The composition of vegetation communities is generally associated with the topography, soils, land systems and geology material. The distribution of vegetation communities that cover the study area includes rolling grass plains to sparse and dense woodlands.

Vegetation within these communities in gently undulating plains including Paperbark low woodland (Melaleuca viridiflora, M. acacioides, M. nervosa, M. symphyocarpa, sparse E. polycarpa, Erythrophleum chlorostachys), Bylong low woodland (Bauhinia cunninghamil, Terminalia platyptera, Erythrophleum chlorostachys, Grevillea striata, Melaleuca minor). Three-awn-ribbon grass (Aristida hygrometrica, A. ingrata, Chrysopogon fallax, Sorghum).

Small shallow stream channels included frontage woodland (Coarse soils E. polycarpa, Melaleuca species, finer soils have E. microtheca) with frontage grasses (Aristida species, Chrysopogon fallax, finers soils have C. fallax) and fringing woodland (E. microtheca, E. camaldulensis, Pandanus species) with fringing grass (Chrysopogon fallax, Eriachne species).

3 PROJECT AND TOR SURVEY APPROACH SUMMARY

The following section outlines the project and ToR survey approach undertaken by GTE, based on information available, the scope of works required and the study area presented by AARC on behalf of Graphinex (Stakeholders).

3.1 SALS Assessment and Survey Intensity Assessment

The objective of this SALS Assessment is to meet applicable ToR requirements. On initial review, ToR Section 10.5 outlines the requirement for the existing environment and is presented below;

- Describe and map soil types, soil profiles and unique map areas within the project footprint at a detailed property level scale[17] relevant to project disturbance.
    - Footnote '17' - The scale of mapping must be in accordance with section 5 of the *Queensland Soil and Land Resource Survey Information Guideline*, VEG2018/4460 (herein known as (Department of Resources [DoR] 2021).

The "minimum" scale is understood to be project dependent. The appropriate scale may be assessed based on the purpose of the work to be undertaken, the size and extent of the study area and complexity and/or sensitivity of the land including the proposed disturbance. GTE understand fundamentally that the purpose of any soil mapping is to provide sufficient information to address the relevant ToR or applicable Guidelines.

GTE reviewed DOR (2021) and the following information regarding scale of mapping which included;

- Sections 5.4 and 5.4.1 which indicate that detailed investigations are 1:10,000 and in general, a property scale assessment will range from 1:5,000 to 1:25,000 scale, unless the over 10,000 hectares (ha) are to be cleared;
- Table 1 (DOR, 2021) which outlined site density for different surveys; and,
- Table 2 (DOR, 2021) which outlined the classes of observations for high intensity surveys.

GTE initially concluded that, prior to a desktop review being undertaken for the study area, a 1:25,000 scale with 'low' number of observations per unit area would be required.

GTE then conducted a detailed desktop assessment, which included a review of all available data to formulate a hypothesis regarding soils and landscapes likely to be encountered in the study area (refer Section 5 for more detail). It was assessed that the study area likely consisted of low soils complexity based on review of topography, satellite imagery, geology and one land system (Claraville) including up to six soil types being present.

Discussions between all stakeholders indicated that although a 1:25,000 scale may be preferred based on ToR Section 10.5, the desktop assessment findings suggested it was likely the study area could be assessed based on a lower survey intensity such as a 1:50,000 (Semi-detailed property level scale), while ensuring the individual pit disturbance area survey intensity is 1:25,000 (Detailed Project Planning), to adequately map and document to the study area in line with ToR and guideline requirements.

This fell in line with Section 5.3 (DOR, 2021) which discusses identifying the site intensity and scale, and how the number and location of observation sites for further field investigation should be based on the likely number of soil types represented as shown by the desktop assessment.

3.2 SALS Fieldworks at the Proposed Semi-detailed Property Level Scale

A semi-detailed property level scale soil survey was undertaken with a focus on disturbance areas, mainly the pit areas which would include the deepest disturbance of soils and any potential Unique Mapping Area (UMA) including at minimum, a Class IV(a) site.

Two major Australian soil classes, Tenosols and Arenosols, were identified with minor ASC Dermosol, Kandosols and Rudosols observed. Seven Soil Profile Classes (SPCs) were observed in total, including Tenosols SPC 1 and 3 being spilt to differentiated marginal soil depth attributes as well as an additional laboratory site within the proposed effluent area disturbance (Site D10).

UMAs were drafted across the study area, and it was assessed that SPCs as well as SPC phases were identified based on the conducted survey intensity.

3.3 Review of Key Desktop and Fieldwork Data Points for the Proposed Survey Intensity

A review of the key desktop and fieldwork data points by GTE for the survey intensity includes the following;

- One major land system was identified with up to six soil types. This was observed by GTE in the field, across seven SPCs covering all soils in all observed landscapes and land forms;
- The percentage of observation sites meet the minimum scale proposed by GTE (Semi-detailed property scale with low sites) (refer Table 5-1);
    - Where numbers of observation sites exceed the maximum allowed percentage for the target survey intensity, such as with Class IV(b), these additional sites are seen as additional observations recorded on an in-situ basis to refine the survey and assist with the UMA mapping.
    - Mining pit disturbance area meets 1:25,000 (Detailed Project Planning) survey intensity and required observation site percentages (refer Table 5-1),
    - As all other observation sites meet their individual site percentages (DOR, 2021),
- Areas of disturbance, such as open-mining pit areas were targeted with a higher survey intensity of Class I, II and III sites, which assisting in accurately identifying the SPCs in this area;
- Observation sites were conducted to either refusal or up to or beyond 2.00 metres below ground level (mbgl);
- All UMAs identified include at a minimum one observation site;
- Laboratory data analysis for samples collected aligns with expectations of the desktop assessment, with fieldwork undertaken representing the soil types within the study area as outlined in the land systems, the majority of which are identified as Tenosols and Arenosols; and,
- Information presented within this SALS assessment includes an appropriate level of detail for a SALS assessment and rehabilitation requirements such as Progressive Rehabilitation Closure (PRC) Plans, in line with PRC Plan Guideline (Guideline – Progressive rehabilitation and closure plans (PRC Plans), ESR2019/4964, Version 3.01, 16 SEP 2024, Department of Environment and Science) Queensland Government.

3.4 TOR and Survey Intensity Summary

Comparing the study area landscape attributes with survey approach undertaken, it is in GTE's professional view that the survey intensity selected is appropriate for the study area.

Any increase in survey intensity would return marginal, if negligible, value to the study area being assessed.

4 OVERVIEW OF STUDY METHODS AND GUIDELINES

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

4.1 EIS Guidelines

This soil survey was scoped and reviewed against the following EIS guidelines including, *Land EIS Information Guideline* (Department of Environment and Science [DES], 2024) and *Rehabilitation EIS Information Guideline* (Department of Environment, Science and Innovation [DESI], 2024).

4.2 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* (DoR, 2021), *Queensland Land Resource Assessment Guidelines, Volume 1: Soil and Land Resource Assessment* (DES, 2021a) and *Guidelines for the Soil Survey along Linear Features* (Soil Science Australia, 2015).

4.3 Soil Type Classification

Soil characteristics and soil profiles have been described in accordance with the *Australian Soil and Land Survey Field Handbook, Fourth Edition* (Gunn et al. 1988; National Committee on Soil and Terrain [NCST], 2024), DoR (2021), DES (2021a) and *Queensland Land Resource Assessment Guidelines, Volume 2: Field Tests (Department of Environment and Science* [DES], 2021b).

Soils have been grouped according to their parent material and position in the landscape and classified in accordance with *The Australian Soil Classification* (Isbell, 2021). Soils have also been correlated to soils mapped in Commonwealth Scientific and Industrial Research Organisation (CSIRO) Land Systems (General Report on Lands of the Leichardt-Gilbert Area, Queensland 1953-1954, Perry et al. 1964) and *An Assessment of Agricultural Potential of Soils in the Gulf Region, North Queensland* (Wilson and Philip, 1999) over the study area.

4.4 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, 2021).

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;

- *Interpreting Soil Analysis for Agricultural Use in Queensland* (Baker and Eldershaw, 1993),
- *Analytical methods and interpretations used by the Agricultural Chemistry Branch for soil and land use surveys* (Bruce and Rayment, 1982);

- *Soil Testing and Some Test Interpretations used by the Queensland Department of Primary Industries (QDPI)* (Bruce and Rayment, 1984);
- *Understanding Soils and Soil Data*, pp 109–133 (Shaw, 1988);
- *Soil Analysis, an Interpretation Manual* (Peveril et al., 1999); and
- *Interpreting Soil Test Results, Third Edition* (Hazelton and Murphy, 2016).

4.5 Land Capability, Suitability and Agricultural Land Classification

Land classification is based on the Land Capability Classification 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* (DSITI and DNRM, 2013), DoR (2021) and DES (2021). Crop land uses for cropping and beef cattle grazing have been selected by review of the list of crops within the Suitability Framework for the Gulf Plains Area and included reviews of *Agricultural Resource Assessment for the Flinders Catchment* (CSIRO, 2013a), *Agricultural Resource Assessment for the Gilbert catchment* (CSIRO, 2013b) and Wilson and Philip (1999).

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 *Application requirements for activities with impacts to land* (DETSI, 2025). Soil types are defined either as the ASC suborder or SPC within Queensland Soil and Land Resource Survey Information Guideline (DOR, 2021). For the purpose of this assessment and in order to adhere to the more relevant DES (2021), SPC terminology and assessment has been used.

Other guidelines and reports that have assisted in soil classification, nominating criterion 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 published by CSIRO (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.

4.6 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 Progressive Rehabilitation and Closure plan (PRC Plan).

The assessment of the impacts on land and topsoil resources will also include review of the DETSI (2025).

4.7 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 QLD 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.

4.8 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 QLD Globe and Australian Soil Resource Information System (ASRIS) including Atlas of Australian ASSs mapping (ASRIS, 2025).

Onsite fieldworks included field observations of SPCs. These observations have been reviewed against Appendix 1: Soil and Water Field Indicators of the *State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils* (Queensland Government, 2002) and Table 5-1 of the National Acid Sulfate Soils Guidance, National acid sulfate soils sample and identification methods manual (Sullivan et al. 2018) as a guide.

5 DETAILED METHODOLOGY

5.1 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.

5.1.1 Regional Land and Soils Report References and Documentation

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

- *General Report on Lands of the Leichardt-Gilbert Area*, Queensland 1953-1954 (Perry et al. 1964).
    - The area of Gilbert Leichardt encompasses the study area. Based on Perry et al. (1964), two land systems including Claraville (Timbered sandy plains north of the centre of the area) and Prospect (Timbered sandy frontage country north of the centre of the area). The study area was found to consist wholly on the Claraville land system, which includes potentially two land forms (Gently Undulating plain and small shallow stream channels and associated alluvial tracts) with up to potentially seven soil types (Cookatoo, Wallababadah, Elliot, Cullen, Norman, Manbulloo and Nangum).
    - At was proposed at least six soil types, phases may be present across the various land systems including undulating country with sands and sands over clays.
- *An Assessment of Agricultural Potential of Soils in the Gulf Region*, North Queensland (Wilson, P. & Philip, S., 1999).
    - This assessment considers that existing soil information for the Gulf Region is lacking. This report includes new data at regional scales to further map and assess the potential agricultural suitability for eleven key areas. This included reviews of existing documentation, assessment of geomorphology, soil landscapes and agricultural suitability. The assessment also includes potential crops and land use groups assessed against the agricultural suitability framework.
- *Soil and Land Information*, Queensland Globe (Queensland Government, 2026).
    - Review of the available soils information on Queensland Globe, Soil and Land Information (SALI), existing soils, land systems, sites and varying degrees of information such as ASC and Agricultural Land Classes (ALC).
- *Queensland Agricultural Land Audit, Gulf and North West* (Department of Agricultural, Fisheries and Forestry, 2013).
    - The Queensland Agricultural Land Audit for the Gulf and North West covers the study area. 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 an abundance of grazing land opportunities limited by high climate variability as well as large distances and transport costs.

The strengths of the regions includes a huge expanse of relatively undeveloped land with beef production an already well established industry with live cattle exports occurring from the Port of Karumba since the 1980s. Climate includes high levels of sunlight, cool winters, few frosts and low humidity during the dry season which also allows the production of crops such as cotton. Early season production of horticultural crops such as mango production allows niche market opportunities.

Weaknesses of the regions consist of variable climate outside of the noted conditions above, which may include extreme in temperature and rainfall as well as the possibility of floods and cyclones. Road transport may impacted due to the weather conditions including closures up to three months.

Long distances to markets and in general populated areas leads to increased freight costs, the potential of spoilage of agricultural goods as well as the retention of skilled workers, unskilled workers and suitable residents within the region to service the industries.

The introduction of invasive plants also presents a biosecurity concern with the regions.

5.1.2 Satellite Imagery

Satellite Imagery from Google Earth (2026) and Queensland Globe (viewed December 2025) (Queensland Government, 2026) was reviewed as part of the desktop study. The satellite imagery assisted with creating preliminary boundaries, site locations and access on site.

5.2 Field Work

5.2.1 Survey Timing

One field survey was undertaken across the study area during the following time frame:

- 10 to 15 December 2025.

5.2.2 Survey Team

The fieldwork was 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 soil science.

Reece meets the DoR (2021) guidelines for Qualified Personnel in being a suitability skilled and experienced soil and land resources scientist. Reece meets the three criteria which include;

- Understanding of landscapes for the purpose of mapping and describing soil types, soil attributes and limitations;
- Competent in the description of soils in accordance with the Australian Soil and Land Survey Field Handbook (NCST, 2009), and mapping them at a property scale in accordance with the Guidelines for Surveying Soil and Land Resources (McKenzie et al. 2008), and,

- Competent in undertaking agricultural land suitability assessments, considering key soil attributes and land limitations in accordance with the Guidelines for Agricultural Land Evaluation in Queensland (DSITI & DNRM, 2015).

Reece is a member of the Soil Science Australia, non-for-profit professional association, undertakes training within the soil science and related fields and is Director of GT Environmental, a consultancy that specialises in soil and land suitability assessments.

Reece was assisted in the field by experienced environmental consultant Lewis Arnold. Lewis has collaborated with Reece over multiple projects, with an understanding of soil classification and soil surveying experience. Project assistance was provided by Project Director Greg Tuck and Graphinex Operations Manager Damian Hills.

5.2.3 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 survey, transect and gradsect techniques (Gunn et al. 1988; 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.

Transect 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.

As the haul road corridor for the Project is approximately 330 m wide, the Soil Science Australia (2015) guideline assessment methodology was not applied as GTE did not consider Project haul road corridor to adhere to the definition of a linear feature corridor. Soil Science Australia (2015) states that “investigations involving corridor widths greater than 100 m wide, should adopt a standard area based sampling methodology from McKenzie et al. (2008)”.

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

5.2.4 Soil Survey Intensity

A medium (semi-detailed) intensity of 1:50,000 (McKenzie et al. 2008 and DES 2021) soil survey was selected for the disturbance footprint, refer to Table 5-1. In assessing the complexity of soil landscapes of the study area at both desktop and field work stages, GTE’s assessment indicated that the survey intensity is appropriate for this project and the SPCs encountered.

Table 5-1: Survey Intensity

Assessment type / Area	Survey intensity	Percentage (%) of site type required (Medium intensity, Table 14.3, McKenzie at al. (2008) and Table 3, DES (2021)	Sites completed for this survey
Mining pit disturbance area only Approximately 79.8 ha	1:25,000	**Moderately High (Detailed Project Planning) 1:25,000 scale 'B' low density: 1 site per 12.5 ha (6 sites)** Class I – 20-30%: 1-2 sites Class II(a/b) - <5%: Up to 0 sites Class III(a/b) – 5-10%: 0-1 sites Class IV(a) – 30-60%: 2-4 sites Class IV(b) – <20%: Up to 1 site	Within or adjacent (<300 m) to proposed pit area: Class I: 0 Class II: 1 Class III: 3 Class IV (a): 5 Class IV (b): 1
Total proposed disturbance area 2,413.8 ha	1:50,000	**Low (Semi-detailed Project Planning) 1:50,000 scale 'B' low density: 1 site per 48 ha (50 sites)** Class I – 20-30%: 10-14 sites Class II(a/b) - <5%: Up to 2 sites Class III(a/b) – 5-10%: 2-5 sites Class IV(a) – 30-60%: 14-29 sites Class IV(b) – <20%: Up to 10 sites	Class I: 12 Class II: 4 Class III: 5 Class IV (a): 15 Class IV (b): 15[1]
Non-disturbance areas (Areas not proposed to be disturbed) 2,105.0 ha	1:100,000	**Low (Semi-detailed Project Planning) 1:100,000 scale 'A' minimum density: 1 site per 400 ha (5 sites)** Class I – 20-30%: 1 site Class II(a/b) - <5%: 0 sites Class III(a/b) – 5-10%: 1 site Class IV(a) – 30-60%: 2 sites Class IV(b) – <20%: Up to 1 site	Class I: 0[2] Class II: 0[2] Class III: 0[2] Class IV (a): 0[2] Class IV (b): 5[12]

1 - Additional Class IV (b) sites conducted on as needed basis to improve soil survey fidelity.
2 – Sites undertaken in mining disturbance area extrapolated out to assist in mapping non-disturbance area.

5.2.5 Soil Survey Observation Sites

Soil survey sites, as presented on Figure 3, were conducted in accordance with McKenzie et al. (2008), DES (2021) and DoR (2021):

- Detailed sites:
    - Class I - detailed profile description with no laboratory analysis;
    - Class II (a) - deep (equal to [=] or greater than [>] 2 m) boring with no laboratory analysis;
- Detailed sites - Analysed sites:
    - Class II (b) - deep (+/>2 m) boring 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 limited laboratory analysis;

    - Class III (b) - profile with standard laboratory analysis;
        - These profiles are associated with the nominated laboratory analysis for SPC analysed sites;
- Brief Mapping Observation sites:
    - Class IV (a) - brief mapping observations with some soil morphological data recorded; and,
    - Class IV (b) - brief mapping observations with no soil morphological data recorded.

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

Class I and III sites for the mine site were generally conducted to 1.50 metres below ground level (mbgl), in line with current expectations of EIS SALS Assessments referenced against McKenzie at al. (2008), DoR (2021) and DES (2021) guidelines.

Naming conventions for soil survey sites are as follows:

- Detailed sites with “D” prefix indicates Class I, Class II (a), Class II (b), Class III (a) and Class III (b) sites described as part of the assessment; and,
- Brief mapping observation sites with “C” prefix indicates Class IV (a) and Class IV (b) sites described as part of the assessment.

The different site types are labelled separately on Figure 4.

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

Class I and II (a) (herein known as detailed sites) were undertaken at 14 locations, Class II (b), Class III (a) and Class III (b) were undertaken at 8 locations (Figure 4).

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 typically exposed using a hand auger with various attachments including 100 mm jarret auger head. 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, test pit 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;
- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining and jarosite presence; and,
- photographs of the soil profile and surrounding landscape.

Soil sampling of analysed sites 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.

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 5.2.6.

The fieldwork data collected from Class I, II and III sites are presented in Appendix A.

Class II (a) sites were undertaken at two (2) locations (Figure 4). The sites were randomly selected within SPCs that allowed augering to 2.00 mbgl or beyond.

A Class II (b) site was undertaken at one (1) location (Figure 4).

Class IV (a) and IV (b) Sites

Class IV (a) and (b) sites were undertaken at 15 and 20 locations respectively (Figure 4). These sites were used to confirm SPC type and refine mapped soil boundaries.

Class IV (a) and (b) sites included 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 SCP classification could be undertaken (i.e. depth of A horizon, exposing the B21 horizon). The data collected from the Class IV (a) and (b) sites is presented in Appendix B.

5.2.6 Laboratory Analysis

Soil samples were collected from all SPCs present in the study area, a total of seven Class III (b) sites. For each site selected as an analysed site, the soil samples were collected from a detailed site that was considered to be representative of that SPC. One Class III (a) site, D10 was selected for non-standard laboratory analysis, as requested for the effluent irrigation area.

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 Eurofins APAL Pty Ltd and Environmental Analysis Laboratory (EAL) who are accredited by the National Association of Testing Authority (NATA) and certified by the Australasian Soil and Plant Analysis Council (ASPAC).

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

The laboratory analysis parameters and rationale for soil horizons of each analysed site are shown in Table 5-2.

Table 5-2: Analytical Program

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 Standard Operating Procedure 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).
Electrical Conductivity (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	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 (Ca/Mg) ratio, 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 reduces 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.
Available Nitrogen, Total N and Nitrate	Topsoil / Subsoil (B21 horizon)	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Extractable Potassium	Topsoil / Subsoil (B21 horizon)	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Phosphorus / Phosphorus Buffering Index	Topsoil / Subsoil (B21 horizon)	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.
Organic Matter / Carbon	Topsoil / Subsoil (B21 horizon)	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 / Subsoil (B21 horizon)	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).
Particle Size Analysis (PSA) (<2 mm)	Topsoil / subsoil <2.00m	PSA data provides an assessment of the composition of 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.

Test	Soil Profile Horizon	Justification
R1 Dispersion	Topsoil / subsoil <2.00m	The measure of R1 dispersion is useful when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour.
EAT	Topsoil / subsoil <2.00m	The measure of EAT is useful when determining soil physical behaviour.
15 Bar	Topsoil / subsoil <2.00m	The measure of soil water content in soil which no water is available to a plant.

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 J.

5.3 Interpretation of Key Field and Laboratory Soils Data

Key field and laboratory data for each SPC was assessed based on the nominated guidelines, as referenced in Appendix D. 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.

5.4 Effective Rooting Depth

ERD is defined by the depth in which approximately 90 percent 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 Content (PAWC).

Soil salinity – electrical conductivity and chloride' in Soil Analysis: an interpretation manual published by CSIRO (Shaw, 1999) was reviewed in conjunction with Salinity Management Handbook, Second Edition (DERM, 2011) against nominated land uses for the study area. The SALFPREDICT model assesses the water uptake weighted profile mean ECse (saturated extract) 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 III site laboratory data was entered within the SALFPREDICT model. Nine nominated crop land uses 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.

Plant salt-tolerance data was also assessed against 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 percent 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).

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

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

Table 5-3: Effective Rooting Depth Criteria

Physical/Chemical Value	Criteria
Plant yield based on SALFPREDICT modelling for the following crop land uses; Cotton, soybean, lucerne (Hunter River [Temperate]), sugar cane, sweet corn, eggplant, peanut, rice and sorghum.	A yield response >65 percent for any particular crop is considered suitable.
Plant Salt-Tolerance Data (DERM, 2011) for the following crop land uses; Cotton, Soybean, Lablab, Lucerne, Capsicum, Sweet corn, Tomato, Sugarcane, Eggplant, Peanuts, Rice and Sorghum.	A yield response >65 percent 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

5.5 Land Suitability and Agricultural Land Assessment

Land suitability is primarily based on classifications provided within the GALE (DSITI and DNRM, 2015) and Regional Frameworks (DSITI 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 presented in Section 6.

5.6 Regional Planning Interests

The Regional Planning Interests Act 2014 (RPI Act) and Regional Planning Interests Regulation 2014 (RPI Regulation) identify and protect areas of Queensland that are of regional interest. The RPI Act protects Priority Living Areas (PLAs), Strategic Environmental Areas (SEAs), Priority Agricultural Areas (PAAs) and Strategic Cropping Areas (SCAs).

As part of the SALS desktop study, Regional Planning Interests (RPIs) PAAs and SCAs were reviewed across the study area and presented in Section 7.

5.7 Acid Sulfate Soils Assessment

As detailed in Section 3.7, assessment of Acid Sulfate Soils (ASS) was undertaken with the SALS Assessment. Review of available desktop resources included Queensland Globe (Queensland Government, 2026) and Australian Soil Resource Information System (ASRIS) including Atlas of Australian ASSs mapping (ASRIS, 2025).

During SALS fieldworks, field observations of observation sites against Appendix 1: Soil and Water Field Indicators of the State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils (Queensland Government, 2002) and Table 5-1 of the National Acid Sulfate Soils Guidance, National acid sulfate soils sample and identification methods manual (Sullivan et al. 2018) were recorded. Field data was reviewed with an assessment presented in Section 8.

5.8 Existing Soil and Land Information Assessment

No existing soil sites were reported within or adjacent to the study area. The nearest soil site was located approximately 42 kilometres (km) north, Project ZEG Site 45 Observation 1, conducted as part of Perry et al. (1964) as a texture contrast soil.

6 SOIL AND LAND SUITABILTY RESULTS

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

6.1 Soil Profile Classes Summary

A total of seven (7) SPCs have been observed and mapped encompassing 19 UMAs within the study area (shown in Figure 4).

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 five 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 6-1.

Detailed descriptions of each SPC and their Class III analysed site are provided in the following sections (Sections 5.1.1 to 5.1.7). Further detailed site descriptions, class IV site descriptions and the laboratory analysis summary data are available in Appendix A, B and C respectively.

Table 6-1: Land Summary of SPCsin the Study Area as per the SALS Assessment by GTE

SPC map code / Report No.	SPC Concept	ASC (to sub-order)	UMAs (Analysed*)	Detailed sites (Analysed*)	Crop Land Use Suitability (Regional Frameworks / Limitations Suitability)	Pasture and Beef Cattle Grazing (Regional Frameworks)	Agricultural Land Classification	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total in Study Area [Disturbance] (ha)
1Cl(Ck)	Characterised by moderately deep loamy sand soil with a soft surface and single grain to massive-structured subsoils, associated with flat to gently undulating plains with paperbark low woodland	Brown Tenosol	3*, 5, 9*	D1*, D10*, D22	Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3)	Lablab, Lucerne, Sorghum, Millet (Class 3)	Class A1	0.20	106.3 [93.8]
2Cl(Ck)	Characterised by very deep, sandy soil with a soft surface and single to massive grain structured subsoils, associated with flat to gently undulating plains with paperbark low woodlands	Brown Arenosol	2*, 8, 11, 13, 16, 18, 19	D2*, D4, D5, D8, D12, D13	Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3)	Lablab, Lucerne, Sorghum, Millet (Class 3)	Class A1	0.50	1,184.5 [1,072.4]

SPC map code / Report No.	SPC Concept	ASC (to sub-order)	UMAs (Analysed*)	Detailed sites (Analysed*)	Crop Land Use Suitability (Regional Frameworks / Limitations Suitability)	Pasture and Beef Cattle Grazing (Regional Frameworks)	Agricultural Land Classification	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total in Study Area [Disturbance] (ha)
3Cl(Ck)	Characterised by moderately deep, sandy loam soil overlying a cemented pan with a hard setting surface and massively structured subsoils, associated with flat to gently undulating plains including steam channels with sparse woodlands of paperbark low woodland	Brown Tenosol	1*, 12, 15, 17	D3*, D6, D9, D14, D15, D17, D18, D19	UMAs 1, 12, 17: Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3) UMA 15: Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Sorghum, Cashew, African Mahogany, Grape, Citrus (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Rice, Millet, Sunflower (Class 4)	UMAs 1, 12, 17: Lablab, Lucerne, Sorghum, Millet (Class 3) UMA 15: Lucerne, Sorghum (Class 3), Lablab, Millet (Class 4)	Class A1	0.45	3,138.2 [1,159.6]
4Cl(Ck)	Characterised by moderately deep, brown loamy sandy soil with higher percentage clayey field texture subsoils, overlying cemented pan with soft setting surface and massive to weakly structured subsoils, associated with gently undulating plains with paperbark low woodland.	Brown Kandosol	6*	D7*	Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3	Lablab, Lucerne, Sorghum, Millet (Class 3)	Class A1	0.35	62.4 [62.4]

SPC map code / Report No.	SPC Concept	ASC (to sub-order)	UMAs (Analysed*)	Detailed sites (Analysed*)	Crop Land Use Suitability (Regional Frameworks / Limitations Suitability)	Pasture and Beef Cattle Grazing (Regional Frameworks)	Agricultural Land Classification	Topsoil Thickness for Use in Mine Rehabilitation (mbgl)	Total in Study Area [Disturbance] (ha)
5Cl(Nm)	Characterised by shallow, brown loamy sandy soil, overlying coarse gravel layer with firm setting surface and massive structured soil profile, associated with gently undulating plains with paperbark low woodland.	Leptic Tenosol	4, 7*	D11*, D21	Sweet corn (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 4)	Lablab, Lucerne, Sorghum, Millet - Class 4	Class B	0.25	4.2 [2.4]
6Cl(El)	Characterised by very deep loamy sandy soil on sandy clay loam subsoils with a firm surface and massive structured soil profile, associated with flat and gently undulating plains with paperbark low woodlands.	Brown Dermosol	14*	D16*	Cucurbit (Class 2) Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Sweet corn, Tomato, Sugarcane, Mangoes, Eggplant, Rice, Sorghum, Sunflower, Cashew, African Mahogany (Class 3), Bananas, Peanuts, Millet. Grape, Citrus (Class 4)	Millet (Class 2), Lablab, Lucerne, Sorghum (Class 3)	Class A1	0.30	19.1 [19.1]
7Cl(Nm)	Characterised by very shallow loamy sandy soil with a firm surface and massive structured soil profile, associated with flat and gently undulating plains patchy grasslands with no established woodlands.	Leptic Rudosol	10*	D20*	Cotton, Chickpea, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Eggplant, Millet (Class 4), Maize, Mungbean, Soybean, Lablab, Mangoes, Bananas, Peanuts, Rice, Sorghum, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 5)	Lucerne, Sorghum (Class 4), Lablab, Millet (Class 5)	Class C2	0.15	4.1 [4.1]

6.1.1 Soil Profile Class 1Cl(Ck): Brown Tenosol

Overview and Concept

1Cl(Ck) is characterised by moderately deep loamy sand soil with a soft surface and single grain to massive structured subsoils, associated with flat to gently undulating plains with paperbark low woodland. The SPC is located in the centre, north west portion of the study area.

Analysed site

The nominated analysed site, site D1, is summarised in Table 6-2. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-3.

Table 6-2: Land Summary SPC 1Cl(Ck), Analysed Site D1

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.90 m)
Location GDA2020 ZONE 54	628462 7918346
Current Use	Grazing
Geology (Dominant)	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	Limited clearing
Landform pattern / element	Level plain, flat plain
Microrelief / Rock outcrop	No microrelief / rock outcrop
Drainage / Permeability	Rapid drainage / High permeability
Slope (percent) / Erosion	<1.0 / <1.0
Surface condition / Surface coarse fragments or segregations	Soft, no coarse fragments
SPC ASC Order/Suborder	Brown Tenosol
Site ASC Order (s) / Code	Basic, Paralithic, Brown Tenosol; moderately thick, non-gravelly, sandy, loamy, moderately deep (Confidence level 1)
Land System / Soil	Claraville / Cockatoo
Phases	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
A11 0.00-0.17 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR3/4 Dark yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Common	0.10 / 6.0
A12 0.17-0.70 Abrupt 5-20mm	Loamy sand	Massive Weak Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Common	0.40 / 5.5
BC 0.70-0.90 End of borehole (EOBH)	Loamy sand	Single grain	2-10% coarse fragments 20-60mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	No roots	0.80 / 6.0
C Refusal on cemented pan							

Table 6-3: Soil Chemistry for SPC 1Cl(Ck), Analysed Site D1

Key Analysis	Assessment
Soil pH (H_20)	Topsoil is slightly acidic to neutral. Subsoils vary from moderately acidic to neutral alkaline.
EC	Very low throughout the profile.
ECEC	Very low throughout the profile.
ESP	Non-sodic levels in topsoil. Subsoil is non-sodic with elevated levels at 0.80-0.90 mbgl, however clay percentage is <20 %, so results are not assessed as reliable
Ca:Mg Ratio	Very high in topsoil, decreasing to high and low throughout the profile.
Phosphorus	Very low in topsoil. Very low in the A12 horizon of subsoil.
PSA	Sand in topsoil to sandy loam from 0.50 mbgl.
EAT	Soil profile was observed as it disperses after remoulding.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.15
SALFPREDICT PAWC Total (mm/90cm)	56.7
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. 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, sugarcane and tomato at 75% yield. The limitation for ERD is soil depth of 0.90 m.
Summary of limitations and management	The soil has moderate PAWC, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.20 and 0.70 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.

Additional SPC Observations and Comments

SPC 1Cl(Ck) is situated within the largest disturbance area for the project, which includes the pit, effluent irrigation area and camp. Therefore, topsoil and subsoil resources are likely to be disturbed and removed. The intersection of this SPC and disturbance areas is shown on Figure 5.

In addition to primary representative analysed site D1, site D10 was selected for laboratory analysis (Class III (a), non-standard laboratory suite) to provide specific results for the Effluent Irrigation Area within the disturbance area. GTE undertook the request alongside the SALS assessment, augering the site to refusal, recording the data and classifying the soil as SPC 1Cl(Ck). The analysed laboratory results summary is presented in Appendix C.

SPCs 1Cl(Ck) and 3Cl(Ck) are assessed as the same ASC for the study area, however were separated within this assessment due to the marginal delineation in soil depth observed. SPC 1Cl(Ck) was defined by a soil depth between 0.75 – 1.00 mbgl, where SPC 3Cl(Ck) was defined by a soil depth of 0.50 – 0.75 mbgl.

6.1.2 Soil Profile Class 2Cl(Ck): Brown Arenosol

Overview

2Cl(Ck) is characterised by very deep, sandy soil with a soft surface and single to massive grain structured subsoils. The SPC is associated with flat to gently undulating plains with paperbark low woodlands. The SPC is situated in the centre of the mine area and covers the majority of the southern corridor of the study area.

Analysed site

The nominated analysed site, site D2, is summarised in Table 6-4. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-5.

Table 6-4: Land Summary SPC 2Cl(Ck), Analysed Site D2

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top right to bottom left, 2.25 m)
Location GDA2020 ZONE 54	628497 7918738
Current Use	Cattle Grazing
Geology	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	Limited clearing
Landform pattern / pattern	Level plain, Plain flat
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Rapid drainage / High permeability
Slope percent / Erosion	<1.0 / <1.0 No erosion observed
Surface condition / Surface coarse fragments or segregations	Soft, no percent coarse fragments
SPC ASC Order/Suborder	Brown Arenosol
Site ASC Order (s) / Code	Basic, Tenic, Brown Arenosol, non-gravelly, sandy, sandy, very deep (Confidence level 1)
Associated (Ass.) Land System / Soil	Claraville / Cockatoo
Phases	Sites D8, D12, D13; deep phase
Soil Profile Morphology Summary	

Item		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 Field Test
A11 0.00-0.20 Abrupt 5-20mm	Sand	Single grain Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.10 / 6.5
A12 0.20-0.50 Gradual 50-100mm	Sand	Massive Loose	No inclusions or segregations	10YR4/6 Dark yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.35 / 5.5
B21 0.50-1.80 Clear 20-50mm	Sand	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown No mottles or bleaching	Moderately moist Well drained	No roots	1.20 / 6.0
B22 1.80-2.20 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	No roots	2.00 / 6.0
BC 2.20-2.25 EOBH	Loamy sand Silty	Massive Loose	20-50% coarse fragments 2-6mm	10YR6/4 Light yellowish brown Mottles: Pale Grey Common 10%-20% Medium 5-15 mm	Moderately moist Imperfectly drained	No roots	2.22 / 6.0
C Refusal on cemented pan							

Table 6-5: Soil Chemistry for SPC 2CL(CK), Analysed Site D2

Key Analysis	Assessment
Soil pH (H20)	Topsoil is moderately acidic. Subsoils vary from moderately and strongly acidic to slightly acidic to neutral below 2.00 mbgl.
EC	Very low throughout the profile.
ECEC	Very low throughout the profile.
ESP	Non-sodic levels throughout the profile.
Ca:Mg Ratio	Very high in topsoil, decreasing to moderate and low throughout the profile.
Phosphorus	Very low in topsoil. Very low in the B21 horizon of subsoil.
PSA	Sand throughout the profile.
EAT	Soil profile was observed as it disperses after remoulding from 0.00 to 0.80, then does not disperse until 1.70 mbgl.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.15
SALFPREDICT PAWC Total (mm/100cm)	59

Key Analysis	Assessment
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. 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 ERD limitations for this soil profile
Summary of limitations and management	The soil has moderate PAWC for its soil profile, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.50 and 2.20 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.

Additional SPC Observations and Comments

Observations within 2Cl(Ck) include deep phases with refusal on weathered substrate between 1.00 and 1.50 mbgl, based on Sites D8, D12, D13 in UMAs 11 and 18.

An unnamed tributary (stream order 3) which is connected to the Warrigal creek will be interrupted as part of the disturbance works. In order to maintain a hydraulic connection between the unnamed tributary and Warrigal creek as well as prevent inundation of the proposed mining pit, a 1.8 km long permanent diversion of the unnamed tributary is proposed as part of the project.

This diversion location intercepts SPC 2Cl(Ck) to the north west of the pit area, with Class I observation site D2, being the closest site. Channel depth ranges between 1.0 to 1.5 mbgl, where soil depth within SPC 2Cl(Ck) has been observed at 2.25 mbgl at site D2. It is proposed that the majority of the diversion location in the eastern portion intercepts SPC 3Cl(Ck).

No major limitations are observed, and it is recommended that any guidance from Section 9 be considered during the earthworks and diversion.

SPC 2Cl(Ck) is situated within the largest disturbance area for the project, which includes the pit, dump area, main infrastructure area, airstrip and access road. Therefore, topsoil and subsoil resources are likely to be disturbed and removed. The intersection of this SPC and disturbance areas is shown on Figure 5.

6.1.3 Soil Profile Class 3Cl(Ck): Brown Tenosol

Overview

3Cl(Ck) is characterised by moderately deep, sandy loam soil overlying a cemented pan with a hard setting surface and massively structured subsoils. The SPC is associated with flat to gently undulating plains including steam channels with sparse woodlands of paperbark low woodland. The SPC is covers the majority of the northern portion and the most southern portion of the study area.

Analysed site

The nominated analysed site, site D3, is summarised in Table 6-6. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-7.

Table 6-6: Land Summary SPC 3Cl(Ck), Analysed Site D3

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.65 m)
Location GDA2020 ZONE 54	628421 7918991
Current Use	Cattle grazing
Geology	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	Limited clearing
Landform pattern / pattern	Level plain, stream channel
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Well drained / High permeability
Slope percent / Erosion	<1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Hard setting, no coarse fragments
SPC ASC Order/Suborder	Brown Tenosol
Site ASC Order (s) / Code	Basic, Paralithic, Brown Tenosol; moderately thick, non-gravelly, sandy, loamy, moderately deep (Confidence level 1)
Ass. Land System / Soil	Claraville / Cockatoo
Phases	D6 (Slope Phase)
Soil Profile Morphology Summary	

Item		Description					
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
A11 0.00-0.10	Sandy loam	Massive Weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.0
A12 0.10-0.45	Sandy loam	Massive Weak Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.30 / 5.5
BC 0.45-0.65 EOBH	Clayey sand	Massive Weak Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm 2-10% coarse fragments 2-6mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	No roots	0.55 / 9.0
C Refusal on cemented pan							

Table 6-7: Soil Chemistry for SPC 3Cl(Ck), Analysed Site D3

Key Analysis	Assessment
Soil pH (H20)	Topsoil is slightly acidic to neutral. Subsoils vary from moderately acidic to moderately alkaline.
EC	Very low in topsoil and subsoil, increasing to moderate from 0.50 mbgl.
ECEC	Very low throughout the profile.
ESP	Non-sodic levels in topsoil. Subsoil is non-sodic with elevated levels at 0.80-0.90 mbgl, however clay percentage is <20 %, so results are not assessed as reliable.
Ca:Mg Ratio	Moderate in topsoil, decreasing to low throughout the profile.
Phosphorus	Very low in topsoil. Very low in the A12 horizon of subsoil.
PSA	Loamy sand in topsoil to sandy loam from 0.10 mbgl.
EAT	Soil profile was observed as it disperses after remoulding with some dispersion below 0.50 mbgl.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.20.
SALFPREDICT PAWC Total (mm/60cm)	48.5
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. 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 eggplant and maize at 75% yield. The limitation for ERD is soil depth of 0.65 m.
Summary of limitations and management	The soil has moderate PAWC, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas.

Key Analysis	Assessment
	Subsoil resource between 0.45 and 0.65 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.

Additional SPC Observations and Comments

As discussed in Section 6.1.1, SPC 3Cl(Ck) was separated from SPC 1Cl(Ck) to provide further information relating to soil depth below 0.75 m to 0.50 mbgl.

SPC 3Cl(Ck) is the largest SPC covering the northern portion of the study area and includes the majority of disturbance. This disturbance includes the pit, dump area, main infrastructure area, stockpiles, topsoil stockpiles and tailings. Therefore, topsoil and subsoil resources are likely to be disturbed and removed. The intersection of this SPC and disturbance areas is shown on Figure 5.

This diversion location intercepts SPC 3Cl(Ck) to the north of the pit area, with Class I observation site D3, being the closest site. Channel depth ranges between 1.0 to 1.5 mbgl, where soil depth within SPC 3Cl(Ck) has been observed at 0.65 mbgl at site D3.

A limitation of soil depth may be observed in the area, based on the nominated channel depth, and it is recommended that any guidance from Section 9 be considered during earthworks for the diversion.

No further observations or comments for the SPC 3Cl(Ck).

6.1.4 Soil Profile Class 4Cl(Ck): Brown Kandosol

Overview

4Cl(Ck) is characterised by moderately deep, brown loamy sandy soil with higher percentage clayey field texture subsoils, overlying cemented pan with soft setting surface and massive to weakly structured subsoils. The SPC is associated with gently undulating plains with paperbark low woodland. The SPC is situated in the centre northern portion of the study area within one UMA.

Analysed site

The nominated analysed site, site D7, is summarised in Table 6-8. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-9.

Table 6-8: Land Summary SPC 4Cl(Ck), Analysed Site D7

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.75 m)
Location GDA2020 ZONE 54	628712 7917947
Current Use	Beef cattle grazing
Geology	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	No effective disturbance; hoofed animals
Landform pattern / pattern	Plain flat, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Well drained / High permeability
Slope percent / Erosion	1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Soft, no percent coarse fragments
SPC ASC Order/Suborder	Brown Kandosol
Site ASC Order (s) / Code	Haplic, Leptic, Brown Kandosol; moderately thick, non-gravelly, sand, loamy, moderately deep (Confidence level 1)
Ass. Land System / Soil	Claraville / Cockatoo
Phases	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
A11 0.00-0.10	Loamy sand	Single grain	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	6.5
A21 0.10-0.35	Loamy sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	6.0
A22 0.35-0.60	Sandy loam	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	6.0
B21 0.60-0.75 EOBH	Sandy clay loam	Weak Very weak Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR6/3 Pale brown No mottles or bleaching	Moderately moist Well drained	Fine 1-2mm Few	7.5
C Refusal on rock outcrop EOBH							

Table 6-9: Soil Chemistry for SPC 4Cl(Ck), Analysed Site D7

Key Analysis	Assessment
Soil pH (H20)	Topsoil is slightly acidic to neutral. Subsoils vary from slightly acidic to neutral alkaline.
EC	Very low in topsoil and subsoil, increasing to moderate from 0.50 mbgl.
ECEC	Very low throughout the profile.
ESP	Topsoil and subsoils to 0.60 mbgl have elevated levels, however clay percentage is <20 %, so results are not assessed as reliable. Subsoil below 0.60 mbgl is assessed as extreme sodic.
Ca:Mg Ratio	Very high in topsoil, decreasing to high to low throughout the profile.
Phosphorus	Very low in topsoil. Very low in the A21 horizon of subsoil.
PSA	Sand in topsoil to sandy loam from 0.20 mbgl.
EAT	Soil profile was observed as it disperses after remoulding in topsoil, with some dispersion below 0.20 mbgl.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.15.
PAWCER PAWC Total (mm/75cms)	51.85
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. 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 eggplant and maize at 75% yield. The limitation for ERD is soil depth of 0.75 m.
Summary of limitations and management	The soil has moderate PAWC, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.35 and 0.60 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. Subsoils below 0.60 m should be kept separate and placed as the first layer prior to suitable subsoil and then topsoil. Gypsum application after the stripping and stockpiling may assist in reducing potential erosion and dispersion.

Additional SPC Observations and Comments

SPC 4Cl(Ck) includes the disturbance area for stockpiles placement. The intersection of this SPC and disturbance areas is shown on Figure 5.

No further observations or comments for SPC 4Cl(Ck).

6.1.5 Soil Profile Class 5Cl(Nm): Leptic Tenosol

Overview

5Cl(Nm) is characterised by shallow, brown loamy sandy soil, overlying coarse gravel layer with firm setting surface and massive structured soil profile. The SPC is associated with gently undulating plains with paperbark low woodland. The SPC is situated in the centre northern portion of the study area within two UMAs.

Analysed site

The nominated analysed site, site D11, is summarised in Table 6-10. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-11.

Table 6-10: Land Summary SPC 5Cl(Nm), Analysed Site D11

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.35 m)
Location GDA2020 ZONE 54	632521 7916481
Current Use	Beef cattle grazing
Geology	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	No effective disturbance; hoofed animals
Landform pattern / pattern	Plain flat, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Rapidly drained / High permeability
Slope percent / Erosion	1.0 / 1.0, Rill erosion observed
Surface condition / Surface coarse fragments or segregations	Firm, <2% coarse fragments 6-20mm
SPC ASC Order/Suborder	Leptic Tenosol
Site ASC Order (s) / Code	Basic, Paralithic, Leptic Tenosol; moderately thick, gravelly, loamy, - , shallow (Confidence level 1)
Ass. Land System / Soil	Claraville / Norman
Phases	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
A1 0.00-0.10 Abrupt 5-20mm	Loamy sand	Massive Loose	10-20% coarse fragments 6-20mm	7.5YR4/4 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 / 7.0
A21 0.10-0.25 Abrupt 5-20mm	Loamy sand Silty	Massive Loose	2-10% coarse fragments 2-6mm	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.18 / 6.0
A22 0.25-0.35 EOBH	Loamy sand Silty	Massive Loose	50-90% coarse fragments 2-6mm 20-50% coarse fragments 2-6mm	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.30 / 6.0
C Coarse gravel layer							

Table 6-11: Soil Chemistry for SPC 5Cl(Nm), Analysed Site D11

Key Analysis	Assessment
Soil pH (H20)	pH is slightly acidic to neutral throughout profile.
EC	Very low throughout the profile.
ECEC	Very low throughout the profile.
ESP	Non-sodic throughout the profile.
Ca:Mg Ratio	High in topsoil, decreasing to low throughout the profile.
Phosphorus	Very low in topsoil. Very low in the A21 horizon of subsoil.
PSA	Sandy loam in topsoil to sand from 0.25 mbgl.
EAT	Soil profile was observed as it disperses after remoulding.
Surface K-Factor (GTE)	Moderate (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.30.
PAWCER PAWC Total (mm/35cms)	34.9
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.30 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 0.35 m.
Summary of limitations and management	The soil has low PAWC, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.25 and 0.35 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. This subsoil may prove difficult for recovery due to the depth of refusal.

Additional SPC Observations and Comments

SPC 5Cl(Nm) was initially classified as a Rudosol as there is little to minimal A1 horizon and soils are apedal to weak. As a silty texture was observed below 0.10 mbgl and assessed as a A2 horizon overlying a shallow coarse gravel layer, the SPC was subsequently assessed to fit the definition more associated with a Tenosol.

SPC 5Cl(Nm) is not located within an area of disturbance, refer Figure 5. No further observations or comments for SPC 5Cl(Nm).

6.1.6 Soil Profile Class 6Cl(El): Brown Dermosol

Overview

6Cl(El) is characterised by very deep loamy sandy soil on sandy clay loam subsoils with a firm surface and massive structured soil profile. The SPC is associated with flat and gently undulating plains with paperbark low woodlands. The SPC is situated in the southern portion of the study area.

Analysed site

The nominated analysed site, site D16 is summarised in Table 6-12. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-13.

Table 6-12: Land Summary SPC 6Cl(El), Analysed Site D16

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top right to bottom left, 2.00 m)
Location GDA2020 ZONE 54	638936 7912063
Current Use	Beef cattle grazing
Geology	Tpc, Claraville
Vegetation	Paperbark low woodland
Disturbance	Limited clearing
Landform pattern / pattern	Plain flat, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Imperfectly drained / moderate permeability
Slope percent / Erosion	1.0 / 1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Firm, 10-20% coarse fragments <2mm
SPC ASC Order/Suborder	Brown Dermosol
Site Dominant ASC Order (s) / Code	Haplic, Magnesic, Brown Dermosol, moderately thick, sandy, clay loamy, very deep (Confidence level 1)
Ass. Land System / Soil	Claraville / Elliot
Phases	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
A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Single grain Loose	<2% coarse fragments <2mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5
A12 0.10-0.30 Abrupt 5-20mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR6/1 Grey No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.20 / 6.5 No dispersion after 10 mins Complete slaking
A21 0.30-0.80 Gradual 50-100mm	Loam Sandy	Massive Loose	No inclusions or segregations	10YR6/3 Pale brown Mottles: Orange Very few <2% Medium 5-15 mm	Moderately moist Imperfectly drained	Medium 2-5mm Few	0.55 / 6.0 No dispersion after 10 mins Complete slaking
B21 0.80-1.00 Abrupt 5-20mm	Sandy clay loam	Weak / Very weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Grey, Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.90 / 6.0 No dispersion after 10 mins Complete slaking
B22 1.00-1.30 Clear 20-50mm	Clay loam, sandy	Weak to moderate/ Very weak Subangular blocky 10-20 mm, No Slickensides	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Grey, Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Coarse >5mm Few	1.15 / 6.5 No dispersion after 10 mins Complete slaking
B23 1.30-1.70 Clear 20-50mm	Clay loam, sandy	Moderate Weak Subangular blocky 10-20 mm	10-20% coarse fragments 6-20mm	7.5YR6/4 Light brown Mottles: Pale Grey & red (few) medium, Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Very fine <1mm Few	1.50 / 7.0 No dispersion after 10 mins Partial slaking
B24 1.70-2.00 EOBH	Sandy clay loam	Moderate Weak Subangular blocky 10-20 mm	10-20% coarse fragments 6-20mm	10YR7/3 Very pale brown Mottles: Pale brown red mott, few, medium Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Very fine <1mm Few	1.85 / 7.5 Slight Dispersion after 10 mins Partial slaking

Table 6-13: Soil Chemistry for SPC 6CL(EL), Analysed Site D16

Key Analysis	Assessment
Soil pH (H20)	Topsoil is slightly acidic to neutral. Subsoils vary from slightly acidic to moderately alkaline.
EC	Very low levels in topsoil and subsoil, increasing to moderate and low from 1.40 mbgl.
ECEC	Very low throughout the profile.
ESP	Non-sodic throughout the profile.
Ca:Mg Ratio	Very high in topsoil, decreasing from very high and low, varying throughout the profile.
Phosphorus	Very low in topsoil. Very low in the A21 horizon of subsoil.
PSA	Sandy loam in topsoil. Texture increases to sandy clay loam below 0.50 mbgl with a sandy loam horizon between 1.40-1.70 mbgl.
EAT	Topsoil was observed as it disperses after remoulding. Subsoil reported some dispersion below 0.50 mbgl to approximately 1.40 mbgl, and below 1.70 mbgl.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.20.
PAWCER PAWC Total (mm/100cms)	66.4
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. 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 ERD limitations for this soil profile
Summary of limitations and management	The soil has moderate PAWC, very low cation exchange and very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.30 and 1.70 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. Subsoils below 1.70 m should be kept separate and placed as the first layer prior to suitable subsoil and then topsoil. Gypsum application after the stripping and stockpiling may assist in reducing potential erosion and dispersion.

Additional SPC Observations and Comments

SPC 6CL(EL) is located within a small UMA within the access road disturbance area, refer Figure 5.

No further observations or comments for SPC 6Cl(El).

6.1.7 Soil Profile Class 7Cl(Nm): Leptic Rudosol

Overview

7Cl(Nm) is characterised by very shallow loamy sandy soil with a firm surface and massive structured soil profile. The SPC is associated with flat and gently undulating plains patchy grasslands with no established woodlands. The SPC is situated in the centre of the northern portion of the study area over a single UMA.

Analysed site

The nominated analysed site, site D20 is summarised in Table 6-14. A summary of site key laboratory analysis assessment and summary of limitations and management is available in Table 6-15.

Table 6-14: Land Summary SPC 7Cl(Nm), Analysed Site D20

Item	Description
Representative Landscape Photograph	**Soil Profile Photograph**
	 (Profile viewed top to bottom, 0.15 m)
Location GDA2020 ZONE 54	629294 7917294
Current Use	Beef cattle grazing
Geology (Dominant)	Tpc, Claraville
Vegetation	Patchy grasslands
Disturbance	No effective disturbance; hoofed animals
Landform pattern / pattern	Plain flat, gently undulating plain
Microrelief / Rock outcrop	No microrelief or rock outcrop
Drainage / Permeability	Rapid drained / high permeability
Slope percent / Erosion	<1.0 / <1.0, No erosion observed
Surface condition / Surface coarse fragments or segregations	Firm, 10-20% coarse fragments <2mm
SPC ASC Order/Suborder	Brown Dermosol
Site ASC Order (s) / Code	(Confidence level 1)
Ass. Land System / Soil	Claraville / Norman
Phases	None
Soil Profile Morphology Summary	

Item		Description					
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
A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Massive	10-20% coarse fragments 2-6mm 10-20% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	0.05 / 7.0 Not conducted (n/c)
A12 0.10-0.15 EOBH	Loamy sand	Massive	10-20% coarse fragments 2-6mm 10-20% coarse fragments 6-20mm	7.5YR4/3 Brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	0.15 / 6.0 n/c
C	Refusal on cemented pan						

Table 6-15: Soil Chemistry for SPC 7Cl(Nm), Analysed Site D20

Key Analysis	Assessment
Soil pH (H20)	Topsoil is neutral to slightly alkaline. A12 soil horizon is slightly acidic to neutral.
EC	Moderate in topsoil, decreasing to low in A12 soil horizon.
ECEC	Very low throughout the profile.
ESP	Non-sodic throughout the profile.
Ca:Mg Ratio	Very high in topsoil, decreasing to high in A12 soil horizon.
Phosphorus	Low in topsoil. Very low in the A12 soil horizon.
PSA	Loamy sand throughout the profile.
EAT	Soil profile was observed as it disperses after remoulding.
Surface K-Factor (GTE)	Low (Rosewell and Loch, 2002). Estimate USLE (Rosewell, 1993) 0.20.
PAWCER PAWC Total (mm/15cms)	18.65
ERD	Review of analytical data in SALFPREDICT, nine crop land uses (Section 4.4) all have 100% plant yield with the inclusion of rainfall. Based on calculated ECse value (SALFPREDICT) throughout the soil profile and a nominated rooting depth of 0.15 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 0.15 m.
Summary of limitations and management	The soil has very low PAWC, very low cation exchange and low to very low fertility indicators. Soil may benefit from a fertiliser or organic matter input if PMLU results are not achieved. Soil resources may be recommended for use on all rehabilitation areas.

Additional SPC Observations and Comments

SPC 7Cl(Nm) is located within a small UMA within the access main infrastructure area, refer Figure 5. No further observations or comments for SPC 7Cl(Nm).

7 LAND SUITABILITY ASSESSMENT

7.1 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).

7.2 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 7-1) 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 7-1: Land Suitability Classes (DSITI and DNRM 2015)

Land Suitability Class	Suitability	Limitations	Definition[1]
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	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)

Land rated in 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), Class 3 land may be just as productive as Class 1 or 2 land.

Land rated as Land Suitability Class 4 is currently 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.

7.3 Land Suitability Use and Assessments

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

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

- An assessment was based on the cropping examples outlined in the Suitability Framework for the Gulf Plains area.

  In selecting the crop land uses, a review of the CSIRO (2013a), CSIRO (2013b) and Wilson, P. and Philip, S. (1999), was undertaken to establish crops being grown or may be grown in this part of the Gulf region.

  The crops selected included 24 of the 41 crops within the regional frameworks and cover various land use categories of wet, dry and perennial season crops (grain and fodder etc). These 24 nominated crops included the following; cotton, maize, mungbean, soybean, chickpea, lablab, lucerne, capsicum, sugarcane, cucurbit, sweet corn, tomato, mangoes, bananas, eggplant, peanuts, rice, sorghum, millet, sunflower, cashew, african mahogany, grape and citrus.

  - It is noted that the Suitability Framework for the Gulf Plains area does not include beef cattle grazing as a subclass for a potential agricultural land use. An assessment of beef cattle grazing was conducted based on nominated, suitable fodder crops from the nominated 24 crop land uses. The nominated fodder crops include lablab, lucerne, millet and sorghum.
  - Different irrigation strategies for the same crop (e.g., spray, rainfed and furrow irrigation) have been assessed against the most favourable irrigation method. It states in GALE (DSITI & DNRM, 2015) that different irrigation strategies do not increase the number of crops.

The Regional Frameworks (DSITI & DNRM, 2013) Suitability Framework for the Gulf Plains area has been provided in Appendix F. The associated land use limitations have been summarised in Section 6.4.

7.4 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.

The land use limitations that consist of simple diagnostic attributes were selected from the regional suitability framework for the Gulf Plains area and include;

- climate, precipitation (Cp);
- climate, heat stress (Cs);

- climate, frost (Cf);
- climate, temperature variation (Ct);
- wind erosion (A);
- moisture availability, irrigated crops (M);
- moisture availability, rainfed crops (M);
- nutrient balance, pH (Nr);
- physical restrictions (Ps);
- soil depth (Pd);
- water erosion (E);
- wetness (W);
- rockiness, all crops (R);
- gilgai microrelief, all crops (Tm); and,
- irrigation efficiency, all furrow irrigated crops (If).

Irrigation efficiency, all furrow irrigated crops refer to the applied water matching the soil infiltration characteristics to minimise water loss, deep drainage, and waterlogging issues. It is noted that this assessment may reduce the suitability of land uses, where alternative irrigation may be used. Therefore, furrow irrigation has not been assessed separately, as detailed in Appendix G.

As outlined in Section 7.3, different irrigation strategies for the same crop (e.g., spray, rainfed and furrow irrigation) have been assessed against the most favourable irrigation method (spray and rainfed) assessment per crop except for sorghum which is one of the few crop land uses where rainfed may be assessed.

7.5 Regional Frameworks, Complex Limitations SPC Assessment Summary

7.5.1 Regional Frameworks Cropping Assessment

Desktop, field and laboratory data collected from analysed sites in the study area was reviewed against the Regional Frameworks (DSITI and DNRM 2013) limitations (such as climate, precipitation) for each selected land uses (e.g., Mangoes).

The assessment was undertaken with Appendix F and Table 7-2 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 G summarised and shown in Table 7-2 and on Figure 7.

Individual UMAs of each SPC were assessed for land suitability classes against the rule set selected. This is to ensure that the Land Suitability Class reflects specific SPC UMAs with observed differences to the analysed site UMA. Further detail and assessment results are provided in Section 7.5.3.

Table 7-2: SPCs for Regional Frameworks, Suitability Subclasses for Land Uses

Regional Frameworks Assessment	SPCs and specific UMAs	Area within the study area (ha)	Area within the disturbance area (ha)
Cucurbit (Class 2), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Sweet corn, Tomato, Sugarcane, Mangoes, Eggplant, Rice, Sorghum, Sunflower, Cashew, African Mahogany (Class 3), Bananas, Peanuts, Millet, Grape, Citrus (Class 4)	6Cl(El)	19.1	19.1
Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3)	1Cl(Ck), 2Cl(Ck) 3Cl(Ck) (UMAs 1, 12, 17) 4Cl(Ck)	4,467.6	2,364.4
Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Sorghum, Cashew, African Mahogany, Grape, Citrus (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Rice, Millet, Sunflower (Class 4)	3Cl(Ck) (UMA 15)	23.8	23.8
Sweet corn (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 4)	5Cl(Nm)	4.2	2.4
Cotton, Chickpea, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Eggplant, Millet (Class 4), Maize, Mungbean, Soybean, Lablab, Mangoes, Bananas, Peanuts, Rice, Sorghum, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 5)	7Cl(Nm)	4.1	4.1

7.5.2 Regional Frameworks Pasture Assessment for Beef Cattle Grazing

As detailed in Section 7.3, the Suitability Framework for the Gulf Plains Area does not include beef cattle grazing as a subclass for potential agricultural land use.

Following the provisions within the land evaluation guidelines to determine the suitability for pastures and therefore cattle grazing, pastures lablab, lucerne, sorghum and millet were selected from the Suitability Framework for the Gulf Plains Area to be assessed.

The assessment included reviewing the Regional Frameworks Assessment in Table 7-2. This was then assessed against GALE, including Tables 10 and 11 (DSITI and DNRM, 2015). The nominated assessed categories for pastures for beef cattle grazing are presented in Table 7-3, Figure 8 and Appendix H.

Table 7-3: SPCs for Regional Frameworks, Suitability Subclasses for Pastures

Regional Frameworks Assessment	SPCs and specific UMAs	Area within the study area (ha)	Area within the disturbance area (ha)
Millet (Class 2), Lablab, Lucerne, Sorghum (Class 3)	6Cl(El)	19.1	19.1
Millet, Lablab, Lucerne, Sorghum (Class 3)	1Cl(Ck), 2Cl(Ck), 3Cl(Ck) – UMA 1, 12, 17 4Cl(Ck)	4,467.6	2,364.4
Lucerne, Sorghum (Class 3), Lab Lab, Millet (Class 4)	3Cl(Ck) – UMA 15	23.8	23.8
Millet, Lablab, Lucerne, Sorghum (Class 4)	5Cl(Nm)	4.2	2.4
Lucerne, Sorghum (Class 4), Lablab, Millet (Class 5)	7Cl(Nm)	4.1	4.1

7.5.3 Land Use Limitation Summaries for Non-Analysed UMAs, Major SPC Phases

As land suitability assessments are not conventionally conducted at such a scale in which additional laboratory analysis is available, the assessment of observation sites may be undertaken.

This assessment includes reviewing surface conditions such as slope, microrelief, rockiness and where available, soil gradient and soil profile depth in SPC associated UMAs. This may impact the land use limitations and the agricultural land use of individual UMAs. Based on review of the study area SPCs and UMAs, one SPC and UMA (3Cl(Ck) / 15) was reviewed and re-assessed.

UMA 15 was assessed as slightly limited for Regional Framework for cropping and pasture and beef cattle grazing, when compared to Class III(b) site of SPC 3Cl(Ck). A summary of these results applicable to UMA 15 are presented below, and within Appendix I.

- Cropping;
    - Lucerne, Capsicum, Curcubit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Sorghum, Cashew, African Mahogany, Grape, Citrus (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Rice, Millet, Sunflower (Class 4); and,
- Pasture / Beef Cattle Grazing;
    - Lucerne, Sorghum (Class 3) and Lab Lab, Millet (Class 4).

This is presented in Table 6-3 and Figure 8.

7.6 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 7-4.

Table 7-4: Agricultural Land Classes Evaluation Scheme

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.	>=4	1-3
	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.	n/a	4/5
	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 percent of the area, but <70 percent[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 greater than 50 percent, 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 7-6 lists the outcome of the agricultural land assessment using the ALC evaluation scheme as shown in Table 7-5 and the Land Suitability Classes of each SPC. The ALCs within the study area are shown in Figure 9.

Table 7-5: Agricultural Land Classification Assessment Summary

Agricultural Land Class	**Description**	**SPC and specific UMA (if applicable)**	**Area within the study area (ha)**	**Area within the disturbance area (ha)**
A	Land that is suitable for a wide range of current and potential crops with nil to moderate limitations to production.	-	0	0
A1	Suitable for a wide range of current and potential broadacre and horticultural crops.	1Cl(Ck), 2Cl(Ck), 3Cl(Ck), 4Cl(Ck), 6Cl(El)	4,510.5	2,407.3
A2	Suitable for a wide range of current and potential horticultural crops only.	-	0	0
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.	5Cl(Nm)	4.2	2.4
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.	-	0	0
C1	Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.	-	0	0
C2	Suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than C1.	7Cl(Nm)	4.1	4.1
C3	Suitable for light grazing of native pastures in accessible areas and includes steep land more suited to forestry or catchment protection.	-	0	0
D	Land not suitable for agricultural use, including land alienated from agricultural use.	-	0	0

8 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.

8.1 Assessment of Strategic Cropping Areas

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

Identification of SCA was undertaken for the study area. Desktop review of the study area compared to Queensland Government Development Assessment Mapping System confirmed that no SCA was located within the study area.

8.2 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 confirmed that no PAA was located within the study area.

9 ACID SULFATE SOILS ASSESSMENT

As stated in Section 4.8, a review of the ASRIS including the Atlas of Australian Acid Sulfate Soils mapping was undertaken. It was identified that the majority 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 120 to 140 mAHD and is located approximately 207 km inland from the Queensland north west coastline, near Karumba.

Fieldworks included field observations for indicators for ASS materials of observation sites for SPCs. These observations have been reviewed against Appendix 2: Soil and Water Field Indicators of the *State Planning Policy 2/02 Planning and Managing Development involving Acid Sulfate Soils* (Queensland Government, 2002) and 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.

9.1 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 ≤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 9-1.

Table 9-1: Acid Sulphate Soil Assessment

SPC	AASS / PASS Assessment	Assessment
1Cl(Ck)	The pH is moderately acidic to slightly alkaline, no observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS, very unlikely. No field indicators of AASS.
2Cl(Ck)	The pH is strongly acidic to neutral, no observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS, very unlikely. No field indicators of AASS.
3Cl(Ck)	The pH is moderately 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, very unlikely. No field indicators of AASS.
4Cl(Ck)	The pH is slightly acidic to slightly alkaline, no observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS, very unlikely. No field indicators of AASS.
5Cl(Nm)	The pH is slightly acidic to neutral, no observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS, very unlikely. No field indicators of AASS.
6Cl(El)	The pH 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, very unlikely. No field indicators of AASS.
7Cl(Nm)	The pH is slightly acidic to slightly alkaline, no observation of shells, corroded shell, jarosite horizons, iron oxide mottling, sulfurous smell or waterlogged soils.	Very low field indication of PASS, very unlikely. No field indicators of AASS.

All seven SPCs reported pH at with pH levels at or below 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.

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 that the study area includes AASS and/or PASS.

10 SOIL MANAGEMENT MEASURES

10.1 Study Area Disturbance

The study area will have areas of disturbance including but not limited to, conventional open-cut, mine infrastructure area (including offices, workshops, laydown areas, washing bays, effluent and liquid waste storage, fuel storage and refueling facilities, and airfield) , on-site processing plant, magazine, water management infrastructure (including permanent watercourse diversion, flood levee, dams, drains, bunds, pipes and pumps), accommodation facility and associated sewage and water treatment plants, mine access tracks, haul roads, and internal roads, solar farm and energy storage system, transmission infrastructure and back-up diesel generators, ROM pad, tailing storage facilities, product stockpiles and loading area, waste rock dumps.

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

10.1.1 Project Specific Impacts through Study Area Disturbance

Based on the study area disturbance, project specific impacts would include, but are not limited to, the removal of existing vegetation, landform stability, retaining existing soil volumes, soil degradation through earthworks and storage, soil erosion, dispersion, runoff, retaining soil nutrients and existing seed bank.

10.2 Proposed Post Mine Land Use

Soil management measures are recommended for the rehabilitation of the disturbance area to the proposed PMLU. The PMLU is to return the disturbance areas to the previous land use of beef cattle grazing.

Soil management measures include recommendations to achieve this rehabilitation as required such as management of soil resources from stripping, stockpiling to application of gypsum to reduce dispersion.

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.

10.3 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, seedbank, nutrients, and microorganisms necessary 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), Wilson, P. and Philip, S. (1999) 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 all SPCs are suitable for reuse as topsoil in rehabilitation activities, as shown in Table 10-1.

Topsoil in the study area in general was observed to be single grain to massively structured, sandy profiles of varying shallow to very deep depths, with very low fertility soils.

Topsoil within these SPCs may require additional management and input (which may include amelioration) prior to use during rehabilitation if the PMLU isn't achieved, as described in Table 10-1.

10.4 Recommended Topsoil Stripping Depths, Limitations and Volumes

Table 10-1 provides the recommended stripping depth, suitability for reuse, identified limitations, management recommendations for 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.

Further discussion of key limitations and management requirements is provided in Section 10.5. It is recommended that these sections be reviewed in conjunction with Table 10-1. The topsoil stripping depths are shown in Figure 10.

Table 10-1: Recommended Topsoil Stripping Depths, Limitations, Management Measures and Available Volumes

SPC	Topsoil Depth Interval (mbgl)	Subsoil Depth (mbgl)[1]	Suitable for Rehabili-tation	Limitations and/or Recommended Amelioration and Management Measures	Area within disturb-ance (ha)	Available Topsoil Volume within disturb-ance (m^3)	Available Subsoil Volume within disturb-ance (m^3)
1Cl(Ck)	0.00-0.70	-	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.20 and 0.70 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.	93.8	657,090	0

SPC	Topsoil Depth Interval (mbgl)	Subsoil Depth (mbgl)[1]	Suitable for Rehabili-tation	Limitations and/or Recommended Amelioration and Management Measures	Area within disturb-ance (ha)	Available Topsoil Volume within disturb-ance (m^3)	Available Subsoil Volume within disturb-ance (m^3)
2Cl(Ck)	0.00-0.50	UMAs 2, 8, 13, 16: 0.50-2.20 UMA 11: 0.50 – 1.15 UMA 18: 0.50-1.40 UMA 19: 0.50 – 1.70	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.50 and 2.20 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.	1,072.4	5,362,000	UMAs 2, 8, 13, 16: 10,327,500 UMA 11: 407,550 UMA 18: 2,893,500 UMA 19: 968,400
3Cl(Ck)	0.00-0.45	0.45-0.65	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.45 and 0.65 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile.	1,159.6	5,218,200	2,319,200
4Cl(Ck)	0.00-0.60	0.60-0.75	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.35 and 0.60 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. Subsoils below 0.60 m should be kept separate and placed as the first layer prior to suitable subsoil and then topsoil. Gypsum application after the stripping and stockpiling may assist in reducing potential erosion and dispersion.	62.4	374,160	93,540
5Cl(Nm)	0.00-0.35	-	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.25 and 0.35 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. This subsoil may prove difficult for recovery due to the depth of refusal.	2.4	8,400	0

SPC	Topsoil Depth Interval (mbgl)	Subsoil Depth (mbgl)[1]	Suitable for Rehabili-tation	Limitations and/or Recommended Amelioration and Management Measures	Area within disturb-ance (ha)	Available Topsoil Volume within disturb-ance (m^3)	Available Subsoil Volume within disturb-ance (m^3)
6Cl(El)	0.00-0.30	0.30-2.00	Yes	Topsoil and subsoils resources may be recommended for use on all rehabilitation areas. Subsoil resource between 0.30 and 1.70 mbgl may be used as subsoils for rehabilitation use, supporting the placement of topsoil as is the observed soil profile. Subsoils below 1.70 m should be kept separate and placed as the first layer prior to suitable subsoil and then topsoil. Gypsum application after the stripping and stockpiling may assist in reducing potential erosion and dispersion.	19.1	57,720	327,080
7Cl(Nm)	0.00-0.15	-	Yes	Topsoil resources may be recommended for use on all rehabilitation areas.	4.1	6,150	0
Total						12,027,895	17,538,535

1 – Where UMAs of significant size and subsoil depth have been observed, UMAs have been calculated separately.

10.5 Soil Amelioration and Management

As discussed in Table 10-1, 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, poor surface soil structure, very low fertility indicators, very low CEC or hard setting surfaces.

Any amelioration undertaken on a topsoil or subsoil resource should be monitored to ensure the objective of the treatment has been met. Recommendations or management of soil amelioration shall follow the SMART principles (Specific, Measurable, Achievable, Relevant and Time-bound), as outlined in *National Soil Strategy* (Department of Agricultural, Water and the Environment [2021]). The following sections look to provide further details for the management of these limitations.

10.5.1 pH Amelioration

Soil pH levels across the SPCs are generally moderately acidic to slightly alkaline. SPC 2Cl(Ck) had pH values in the strongly acidic (pH <5.5) between 1.10 and 1.80 mbgl which may be associated with reduced availability of nutrients or root growth inhibition. No SPCs reported strongly alkaline (pH >9.0) range soil horizons.

Native vegetation species in the study area appeared to be healthy during the fieldworks period in December 2025. Overall, pH amelioration is not recommended for the SPCs in the study area.

10.5.2 Salinity Amelioration

Salinity within soils and potential crop land uses has been presented in Appendix G as plant yield percent and plant salt-tolerance data (DERM, 2011). Based on the application of rainfall to nine nominated crop land uses (Section 4.4), SPCs have 100 percent plant yield. The plant salt-tolerance data comparison does show that all seven SPCs have 75% yield or better for the nominated crop land uses with SPC 1Cl(Ck) having the lowest yield for Maize, Sugarcane and tomatoes at 75 % yield from the surface.

It is noted that elements such as EC, Cl and Sodium (Na) 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.

10.5.3 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 unfavorable soil conditions such as surface crusting, low infiltration, hard and dense subsoils and susceptibility to erosion.

The general rating for ESP indicates that between 6 and 15 are sodic, with greater than 15 are strongly sodic.

ESP results are assessed in conjunction with ECEC and clay content (percent), where if a result reports ECEC <3 cmol(+)/kg or less than 20 percent clay, ESP results could not be relied upon as an indicator for sodicity.

All seven indicated non-sodic or textures were less than 20% clay for results to be considered applicable.

10.5.4 Fertiliser Amelioration

SPCs were observed in general to have very low fertility indicators of macronutrients phosphorus and varying levels of micronutrients.

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

Fertiliser application would be more appropriate during final soil replacement and seed bed preparation and any of the following recommendations below are a guide only.

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 rehabilitation 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 are reduced to 5.5 or below, however this is unlikely based on pH rates of the SPCs in the study area. Typical application rates of neutralising lime for fertilisers such as MAP and DAP may be approximately 5.4 and 3.6 kg for every 1 kilogram (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.

Calcium magnesium ratio levels are generally very high to high in topsoil across the SPCs and sulfur levels are generally low. These macronutrients are included in most fertilisers such as Single Superphosphate. If fertiliser is assessed as required based on not achieving the desired PMUL outcome, it is recommended that the fertiliser that includes sulfur be considered.

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.

10.5.5 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 SPCs 3Cl(Ck), 5Cl(Nm), 6Cl(El) and 7Cl(Nm).

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 reviewed and considered if the desired PMLU outcome has not been achieved:

- Manure may be applied at a rate of between 5-30 tonne per hectare (t/ha) for small to large feedlots for cattle grazing. This would depend on the type of manure (Tucker et al. 2015);
- Compost may be applied at 70-150 t/ha (Kelly, 2006); and,

- 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 fertilisers 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.

10.6 Topsoil Recovery, Storage and Placement Recommendations

The following subsections (9.5.1 to 9.5.4) are recommendations for the recovery, storage, and placement of topsoil and subsoil resources associated with the observed SPCs, which seek to minimise project specific impacts.

10.6.1 Topsoil Stripping Management

The following are recommended management procedures for topsoil stripping activities which also include handling measures to retain soil attributes for future rehabilitation reuse.

- 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;
- 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 appropriately 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 potential chemical barriers in subsoil such as elevated sodic 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;
- 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 stripping 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; and,

- 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.

10.6.2 Stockpiling Management

The following are recommended procedures for stockpile management which seek to retain soil quality and quantity for the duration of the project, over a 50 year mine life.

- Topsoil and subsoil 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 where possible and away from watercourse and tributaries;
- Any known overland flow, watercourses and tributaries around the stockpiles should be diverted or have appropriate measures in place to prevent erosion;
- 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;
- Topsoil stockpiles which are scheduled to be stored over a long term period, i.e. not utilised within a short term period of stripping to replacement of soil resources, shall be reviewed, with soil turned and mixed into order to engage deeper stockpile soils and spread biological aspects of existing growth medium and existing vegetation (now organic matter). This will reduce the situation of stockpile soil being unbalanced with surface soils retaining their health

(biological, physical and chemical) with deeper soils becoming weathered and transitioning to less healthier, potentially subsoil resources; and,

- An inspection of the stockpiles should occur once they are completed with scheduled ongoing maintenance either as required, or recommended every six months if no scheduling has been considered.

10.6.3 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 percent 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 are 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). Invasive vegetation 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 m and a minimum depth of 0.10 m pending the requirements of the PMLU. Subsoils placed underneath and supporting topsoil should have a minimum of 0.10 m horizon placed, with a recommended horizon of 0.20-0.30 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; and,
- After the placement of topsoil, additional seeding should be use to assist with encouraging suitable vegetation regrowth.

10.6.4 Progressive Rehabilitation and Closure Plan

- Performance of rehabilitated areas should be monitored under a Progressive Rehabilitation and Closure Plan (PRCP). The PRCP shall support the progressive evaluation of rehabilitation on the study area, the practice of mine rehabilitation, identify areas needed for improvement and document rehabilitation success. The PRCP should consider the following:
    - Clear rehabilitation objectives shall be outlined with achieving the PMLU as the rehabilitation objective;
    - Reference sites/areas selected on or near the study area of non-disturbed areas of vegetation, which has been used as the pre-mine land use of Beef Cattle Grazing;
    - Soils placed (as 'Human-made soil profiles, Anthroposols) shall be documented with depths of topsoil and subsoil recorded, from what stockpile;
    - Assessment of initial rehabilitation lots to identify issues or unfavorable results and the causes and potential solutions to apply to these areas and upcoming rehabilitation areas;
    - Review areas of rehabilitation through reviewing the soil structure, vegetation state and if possible, soil profile with laboratory analysis;
    - Document successful rehabilitation areas and as above, apply to upcoming rehabilitation areas. This may include remote sensing such as aerial photography or satellite imagery to assess vegetation cover and identify soil erosion or runoff; and,
    - Ensure tests and rehabilitation methods are documented, so methods may be repeatable and comparable over the life of the mine.

10.6.5 Erosion and Sediment Control Plan

An ESCP addressing soil erosion and sediment control should be prepared by a Certified Professional in Erosion and Sediment Control and developed in accordance with the International Erosion Control Association's 'Best Practice Erosion and Sediment Control' (IECA's) document (IECA, 2008).

The ESCP is to ensure the development would achieve:

- 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 ESCP should be designed to accommodate any ongoing need for erosion and sediment control for all aspects of the Project. The ESCP should be prepared and approved prior to commencement of project work and disturbance of the study area.

10.6.6 Post Mine Land Use Rehabilitation

In review of the SPCs located within the study area and soil management recommendations within Section 9, it would be expected that except for any permanent disturbance feature, such as newly constructed unnamed diversion streams, is it expected that the PMLU of the study area would be achieved to continue the agricultural productivity of cattle grazing.

11 CONCLUSION

The key conclusions of the SALS assessment are as follows:

- Seven (7) Soil Profile Classes (SPCs) across 19 Unique Mapping Areas (UMAs) are present in the study area.
    - Soils range from shallow, gravelly sandy soils, moderately deep poorly structured sandy loams to very deep sandy profiles on level to gently undulating plains.
    - SPCs have been classified in five (5) of the 14 Australian Soil Classification (ASC) orders consisting of Arenosols, Dermosol, Kandosols, Rudosols and Tenosols.
- The suitability framework of each SPC was assessed against the nominated Regional Frameworks (DNRM and DSITIA, 2013) for the Gulf Plains Area land uses. The 24 nominated land uses selected and assessed included Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape and Citrus;
    - Five SPCs, 1Cl(Ck), 2Cl(Ck), 3Cl(Ck), 4Cl(Ck) and 6Cl(El), have been assessed as being able to support up to three or more crop land uses.
    - SPC 5Cl(Nm) was assessed to only support Sweet Corn with moderate limitations. All other crop land uses had severe limitations.
    - SPC, 7Cl(Nm) presented severe or extreme limitations with supporting the nominated crop land uses, therefore is not considered suitable for cropping.
    - The suitability of nominated pastures was also assessed, with five SPCs, 1Cl(Ck), 2Cl(Ck), 3Cl(Ck), 4Cl(Ck) and 6Cl(El), identified as being able to support at all four selected pasture land uses; Lablab, Lucerne, Sorghum and Millet.
    - The two SPCs, 5Cl(Nm) and 7Cl(Nm), presented severe or extreme limitations with respect to supporting pastures.
- The assessment of ALCs based on the Regional Frameworks and beef cattle grazing classes indicated the following;
    - Approximately 4,510.5 ha in the study area and 2,407.3 ha in the disturbance area is ALC A1, which is suitable for a wide range of current and potential broadacre and horticultural crops.
    - Approximately 4.2 ha in the study area and 2.4 ha in the disturbance area is ALC B, which 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 4.1 ha in the study area and 4.1 ha in the disturbance area is ALC C2, which is suitable for grazing native pastures, with or without the introduction of pasture species, and with lower fertility soils than class C1.
  - ALC A2, C1, C3 and D were not mapped within the study area. No areas were designated as disturbed.

- The Regional Planning Interests (RPI) Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The study area was assessed against Strategic Cropping Area (SCA) and Priory Agricultural Area (PAA) requirements.
  - Desktop review of the study area compared to Queensland Government Development Assessment Mapping System (Queensland Government, 2023) 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 Government, 2023) 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 (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 all seven (7) SPCs contain soils that are suitable for reuse in rehabilitation activities.
  - Topsoil in the study area consists generally of very low fertility, soft to hard-setting surface, shallow to deep sandy soils which are indicative of the area, however all suitable for reuse for rehabilitation.
  - Soil amelioration recommendations such as organic matter / fertiliser application, management, storage and handling recommendations have been provided to retain and improve the quality of topsoil for rehabilitation reuse pending the final PMLU, which is proposed as cattle grazing.

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13 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
ASC	Australian Soil Class/Classification
ASPAC	Australasian Soil and Plant Analysis Council
ASS	Acid Sulfate Soils
BoM	Bureau of Meteorology
Ca:Mg	Calcium Magnesium Ratio
CEC	Cation Exchange Capacity
CSIRO	Commonwealth Scientific and Industrial Research Organisation
DAP	Diammonium Phosphate
DERM	Department of Environment and Resource Management
DES	Department of Environment and Science (Queensland)
DETSI	Department of Environment, Tourism, Science and Innovation
DME	Department of Minerals and Energy (Queensland)
DNRM	Department of Natural Resources and Mines (Queensland)
DoR	Department of Resources (Queensland)
EAL	Environmental Analysis Laboratory
EAT	Emerson Aggregate Test
EC	Electrical Conductivity
ECse	Electrical Conductivity (saturated extract)
ECEC	Effective Cation Exchange Capacity
EIS	Environmental Impact Statement
EOBH	End of Borehole
ERD	Effective Rooting Depth
ESCP	Erosion and Sediment Control Plan
ESP	Exchangeable Sodium Percentage
GALE	Guidelines for Agricultural Land Evaluation in Queensland

Acronym	Description
GDA	Geocentric Datum of Australia
GTE	GT Environmental
IECA	International Erosion Control Association
LGA	Local Government Area
LSAT	Land Suitability Assessment Techniques
mAHD	Elevation in metres with respect to the Australian Height Datum
mbgl	Metres below ground level
MAP	Monoammonium Phosphate
MLA	Mining lease application
Na	Sodium
NATA	National Association of Testing Authority
NCST	National Committee on Soil and Terrain
NSW	New South Wales
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
QDPI	Queensland Department of Primary Industries
QLD	Queensland
RPI	Regional Planning Interests
SALI	Soil and Land Information
SALS	Soil and Land Suitability
SCA	Strategic Cropping Areas
SCL	Strategic Cropping Land
SEA	Strategic Environmental Areas

Acronym	Description
SOP	Standard Operating Procedure
SPC	Soil profile class
UMA	Unique Mapping Area

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.
g	Gram. Unit of measurement of mass, equal to one thousandth of a kilogram.
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.
Kg/L	Kilograms per Litre.
Km	Kilometres. Unit of measurement of length, equal to 1,000 metres.
km^2	Kilometres squared.
L	Litre.
m	Metre. Unit of measurement, the system of units base unit of length.
meq	Milliequivalent. Unit of measurement, a measurement of chemical activity.
meq/100g	Milliequivalents per 100 grams of soil.
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.
Anthroposols	These soils result from human activities which have caused a profound modification, mixing, truncation or burial or the original soil horizons, or the creation of new soil parent materials.
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).
Base Status	The sum of exchangeable basic cations (Ca, MG, K and Na) expressed in cmol (+) kg-1 clay. This sum is obtained by multiplying the sum of the reported basic cations (which are determined on a soil fine earth basis) by 100 and dividing by the clay percentage of the sample.
Bolus	A small handful of soil which has been moistened to field capacity and kneaded into a ball which just fails to stick to the fingers when manipulated.
C Horizon	Layers below the solum (AB horizons/profile) 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 less than 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 percent clay.
Colwell P	A laboratory method for the measure of available soil phosphorus using a bicarbonate extractable method.
Compost	Decomposed organic matter.
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.

Term	Description
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.
Emmerson 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 greater than 6 percent are considered sodic, with values greater than 15 percent considered very sodic. ESP = (Exchangeable sodium (meq/100g)/Cation exchange capacity (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.
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.
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+).
Leptic	Other soils which are underlain within 0.5 m of the surface by a hard or partly weathered unweathered rock or other hard materials.
Lithic	Containing large amounts of fragments derived from previously formed rocks.
Loam	A medium textured soil of approximate composition 10-25 percent clay, 25-50 percent silt and >50 percent sand.

Term	Description
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.
Rudosol	Soil with little, if any pedologic organisation apart from a minimal development of an A1 horizon, or the presence of less than 10 percent of B horizon material in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. Little to no texture or colour change with depth or buried soils are present.
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 greater than 10-15 percent of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations.
Solum	The soil profile that includes horizons A and B.
Stratic	Soils that consist dominantly of unconsolidated mineral materials that are distinct, not or only slightly gravelly (10 percent <2mm) sedimentary layers or buried soils but salinity is not high.

Term	Description
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.
Tenosol	Soils that do not fit the requirements of any other Orders and generally with one or more of eight specific attributes.
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.
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.

14 FIGURES

Figure 1 Regional Context

Figure 2a Study Area Layout

Figure 2b Study Area Layout - Access road

Figure 3 Regional Surface Geology

Figure 4 Soil Profile Classes and Sites

Figure 5 Soil Profile Classes and Project Layout

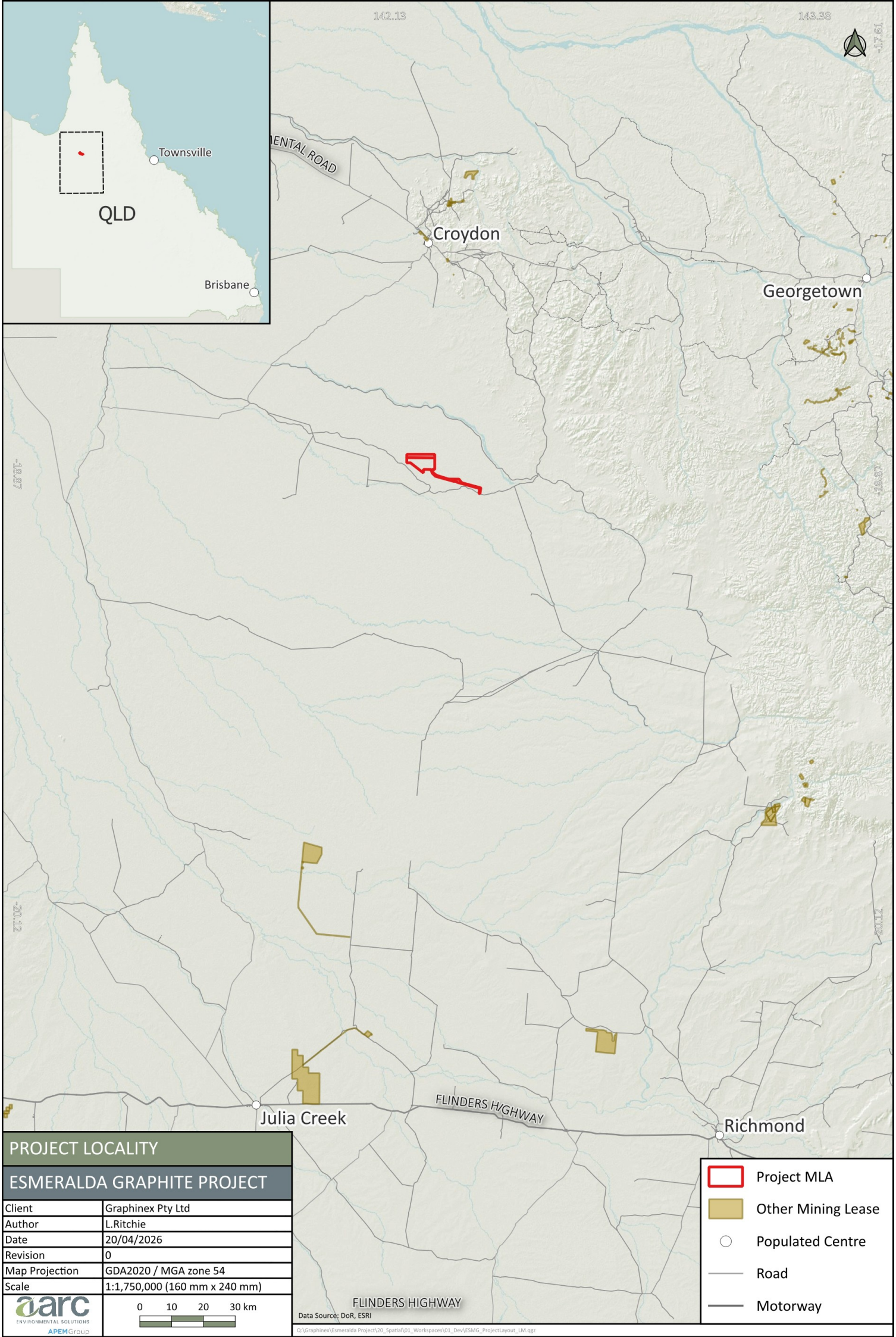
Figure 6 Australian Soil Classification

Figure 7 Crop Land Use Suitability

Figure 8 Pasture and Beef Cattle Grazing Land Use

Figure 9 Suitability Agricultural Land Classes

Figure 10 Topsoil Stripping Depths



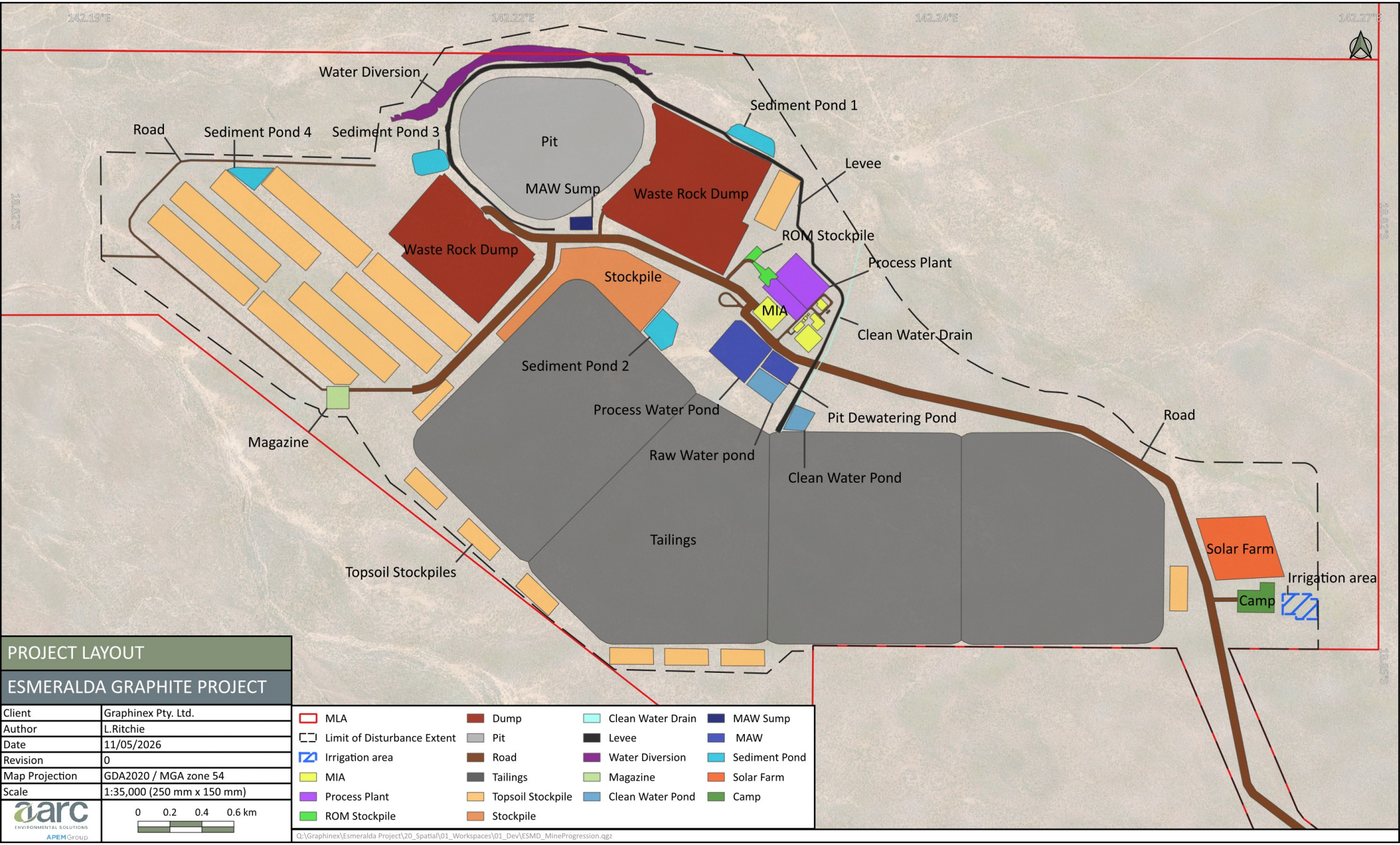
PROJECT LOCALITY

ESMERALDA GRAPHITE PROJECT

Client	Graphinex Pty Ltd
Author	L.Ritchie
Date	20/04/2026
Revision	0
Map Projection	GDA2020 / MGA zone 54
Scale	1:1,750,000 (160 mm x 240 mm)

aarc ENVIRONMENTAL SOLUTIONS APEM Group

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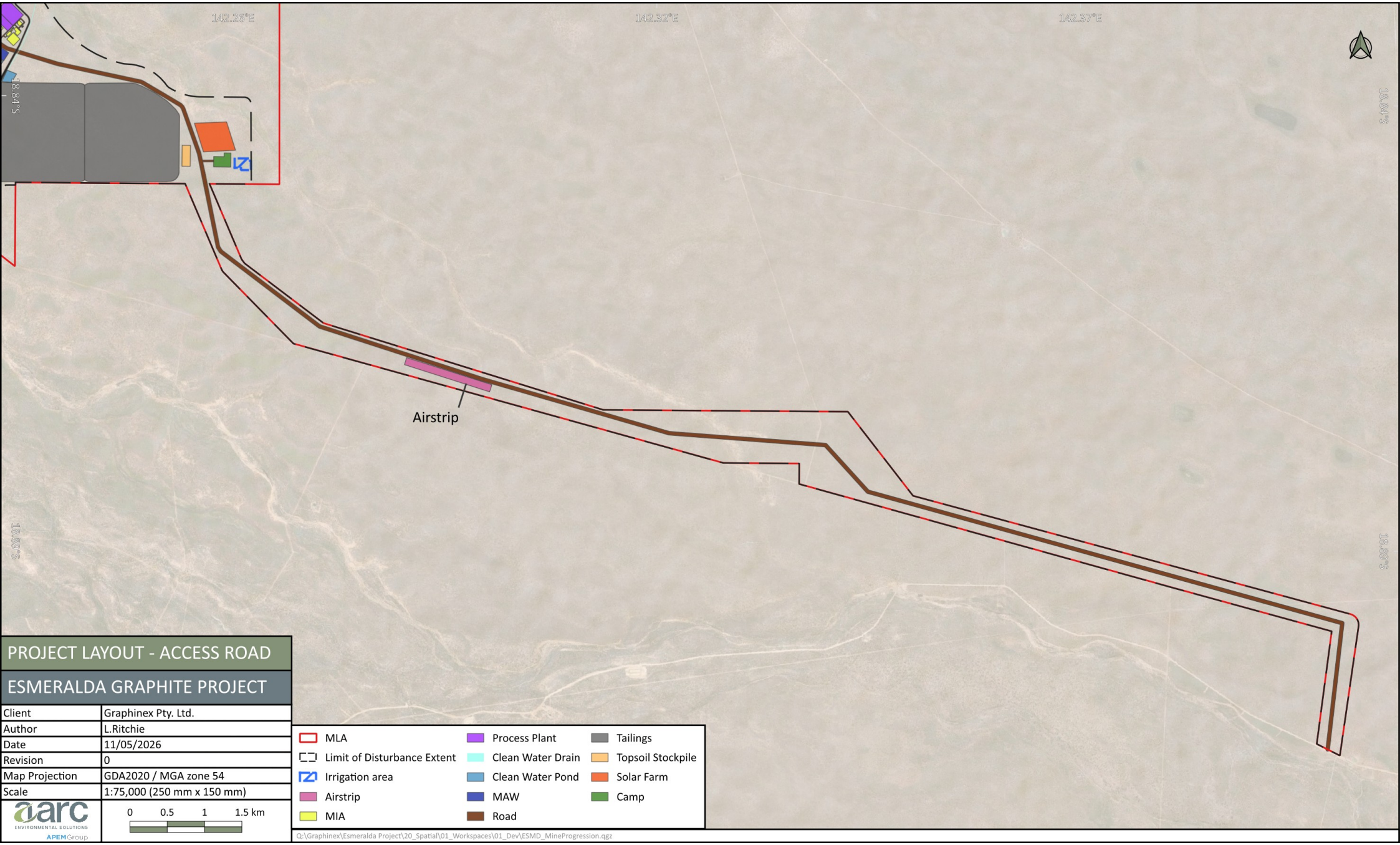


PROJECT LAYOUT

ESMERALDA GRAPHITE PROJECT

Client	Graphinex Pty. Ltd.
Author	L.Ritchie
Date	11/05/2026
Revision	0
Map Projection	GDA2020 / MGA zone 54
Scale	1:35,000 (250 mm x 150 mm)

aarc ENVIRONMENTAL SOLUTIONS APEM Group



PROJECT LAYOUT - ACCESS ROAD

ESMERALDA GRAPHITE PROJECT

Client	Graphinex Pty. Ltd.
Author	L.Ritchie
Date	11/05/2026
Revision	0
Map Projection	GDA2020 / MGA zone 54
Scale	1:75,000 (250 mm x 150 mm)

aarc ENVIRONMENTAL SOLUTIONS
APEM Group

0 0.5 1 1.5 km

- MLA
- Limit of Disturbance Extent
- Irrigation area
- Airstrip
- MIA
- Process Plant
- Clean Water Drain
- Clean Water Pond
- MAW
- Road
- Tailings
- Topsoil Stockpile
- Solar Farm
- Camp

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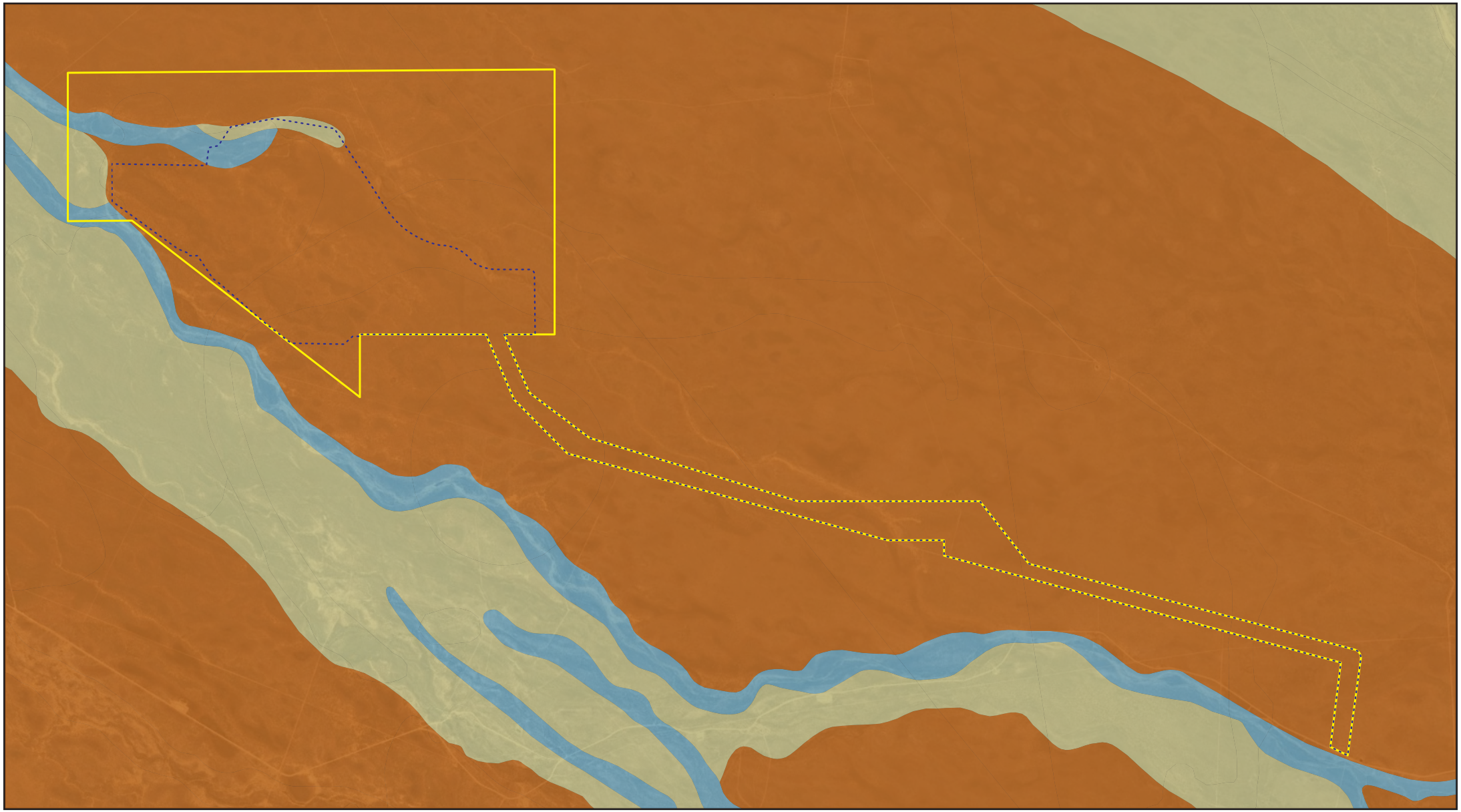


Figure 3: Regional Surface Geology

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Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- Claraville (Tpc) - Clayey quartzose sand and sandy mud; minor gravel
- Rewan Group (Qa-QLD) - Clay, silt, sand and gravel; alluvium
- Qha (Qha-QLD) - Clay, silt, sand and gravel; alluvium

0 2000
Metres

GTenvironmental

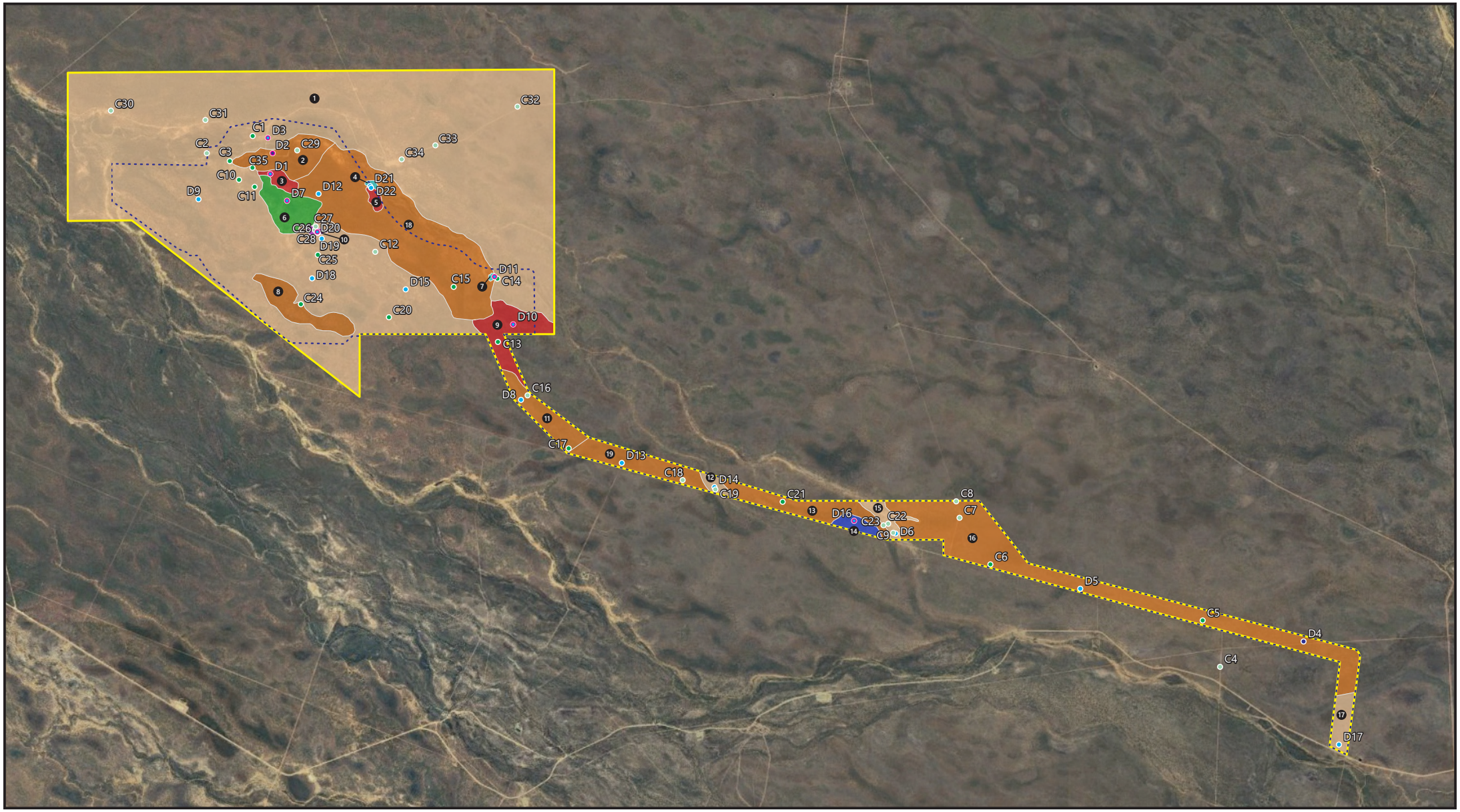


Figure 4: Soil Profile Classes and Sites

Version 2 11/05/2026 Page size: A4

Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- Site - Class I - Detailed profile description
- Site - Class II (a) - Detailed profile description, deep (>2 m) boring
- Site - Class II (b) / III (a/b) - Detailed profile description, laboratory analysis
- Site - Class IV (a) - Brief profile description
- Site - Class IV (b) - Brief mapping observation
- Unique mapping area

- 1Cl(Ck) - Moderately deep loamy sand soil with a soft surface and single grain to massive-structured subsoils
- 2Cl(Ck) - Very deep, sandy soil with a soft surface and single to massive grain structured subsoils
- 3Cl(Ck) - Moderately deep, sandy loam soil overlying a cemented pan with a hard setting surface and massively structured subsoils
- 4Cl(Ck) - Moderately deep, brown loamy sand soil with higher percentage clayey field texture subsoils, overlying cemented pan with soft setting surface and massive to weakly structured subsoils
- 5Cl(Nm) - Shallow, brown loamy sandy soil, overlying coarse gravel layer with firm setting surface and massive structured soil profile
- 6Cl(El) - Very deep loamy sandy soils on sandy clay loam subsoils with a firm surface and massive structured soil profile
- 7Cl(Nm) - Very shallow loamy sandy soil with a firm surface and massive structured soil profile

GTenvironmental

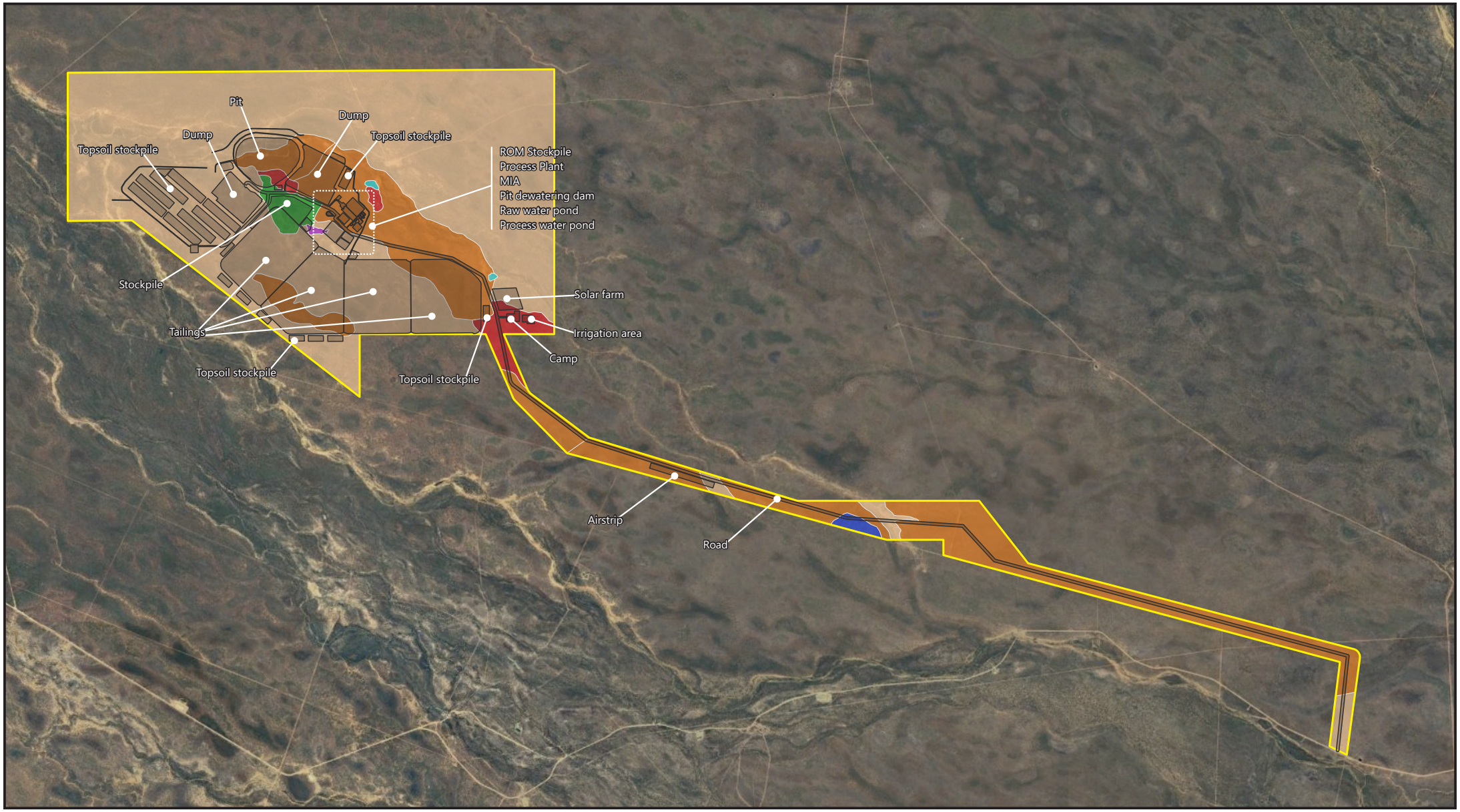


Figure 5: Soil Profile Classes and Project Layout

Version 2 11/05/2026 Page size: A4

Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

0 2000
Metres

Legend

- Study area
- Disturbance Components
- 1Cl(Ck) - Moderately deep loamy sand soil with a soft surface and single grain to massive-structured subsoils
- 2Cl(Ck) - Very deep, sandy soil with a soft surface and single to massive grain structured subsoils
- 3Cl(Ck) - Moderately deep, sandy loam soil overlying a cemented pan with a hard setting surface and massively structured subsoils
- 4Cl(Ck) - Moderately deep, brown loamy sand soil with higher percentage clayey field texture subsoils, overlying cemented pan with soft setting surface and massive to weakly structured subsoils
- 5Cl(Nm) - Shallow, brown loamy sandy soil, overlying coarse gravel layer with firm setting surface and massive structured soil profile
- 6Cl(El) - Very deep loamy sandy soils on sandy clay loam subsoils with a firm surface and massive structured soil profile
- 7Cl(Nm) - Very shallow loamy sandy soil with a firm surface and massive structured soil profile

GTenvironmental

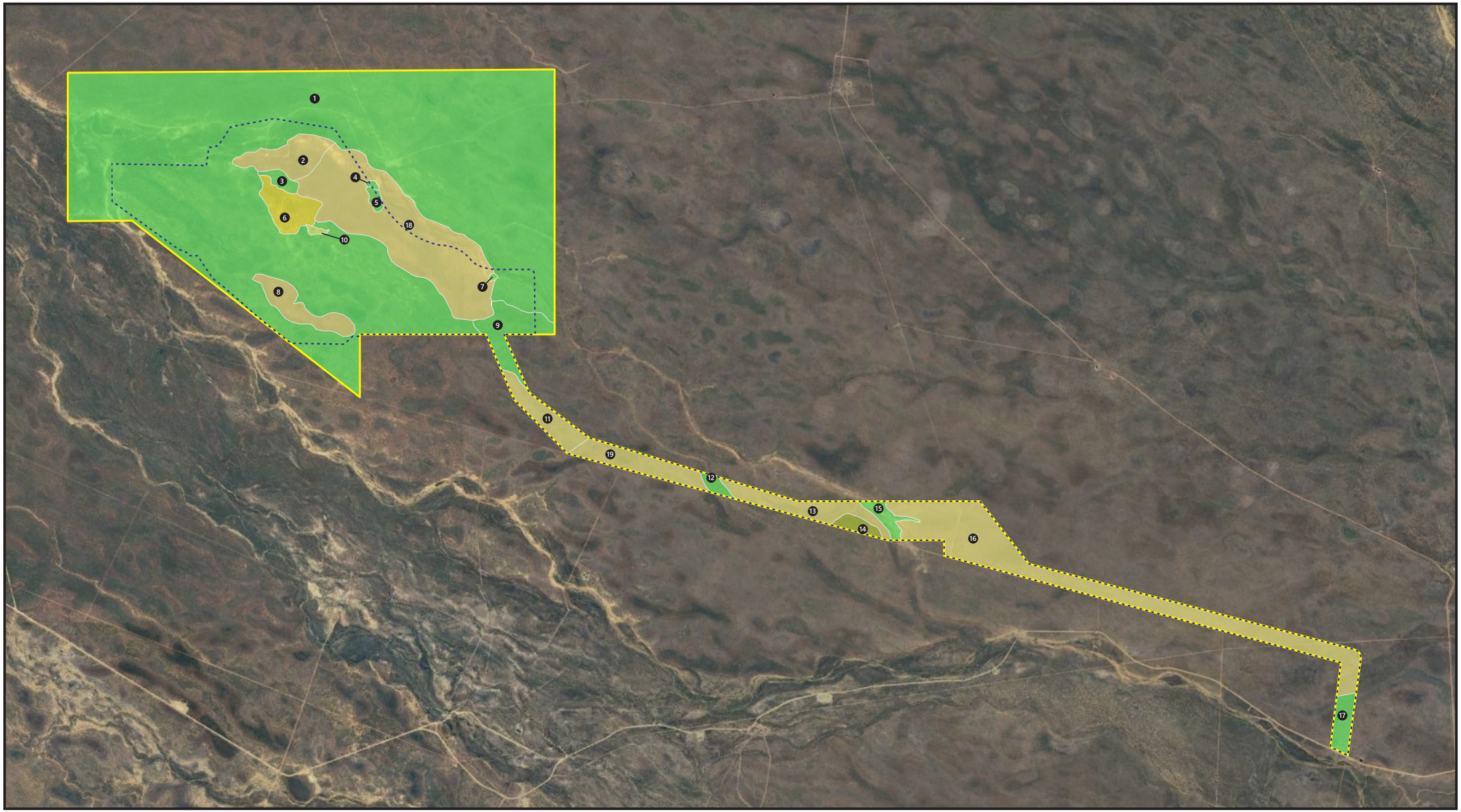


Figure 6: Australian Soil Classification

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Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- 12 Unique mapping area
- Arenosol
- Dermosol
- Kandosol
- Rudosol
- Tenosol

0 2000
Metres

GTenvironmental

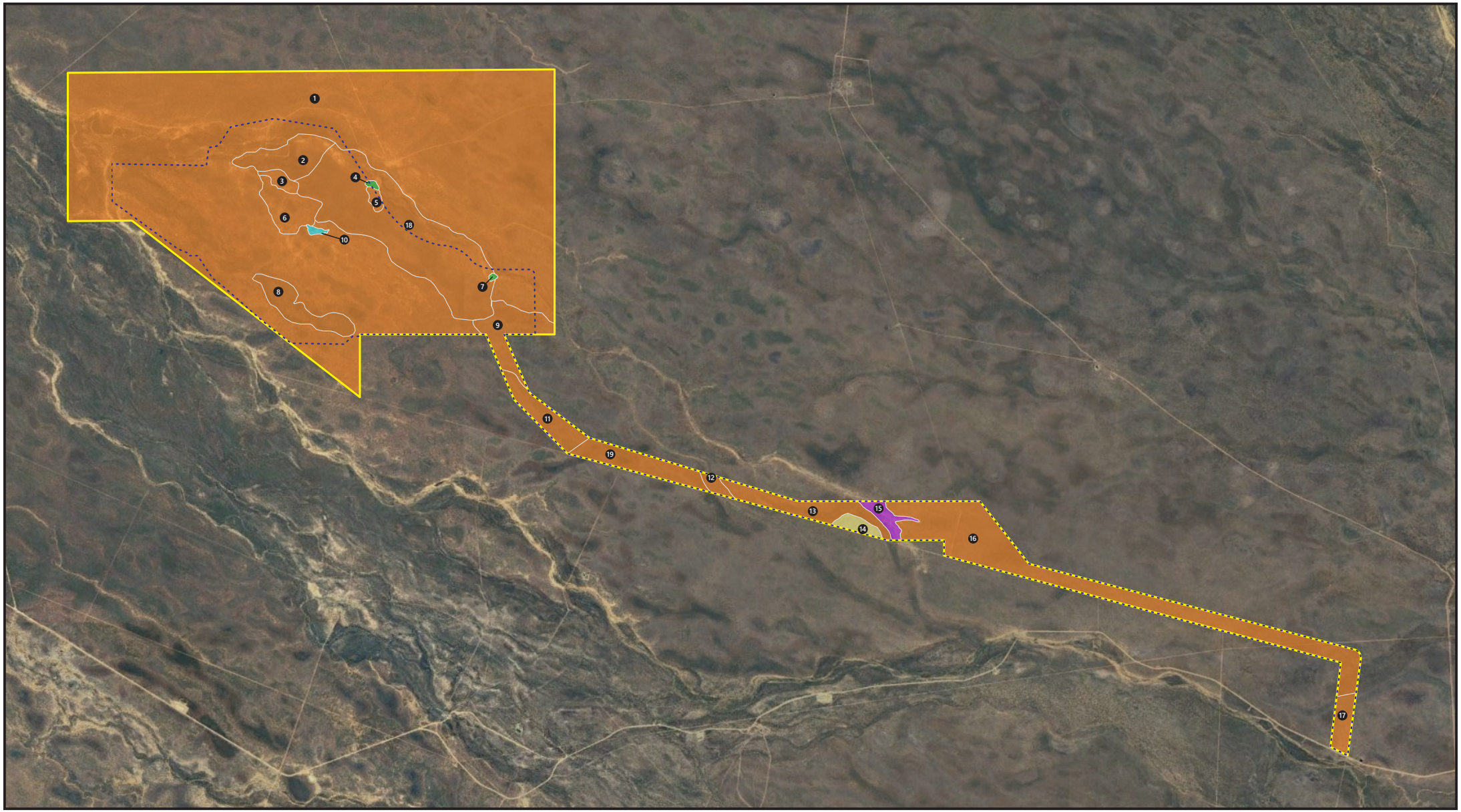


Figure 7: Crop Land Use Suitability

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Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

0 2000
Metres

Legend

- Study area
- Disturbance Footprint
- 12 Unique mapping area

- Cucurbit (Class 2), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Sweet corn, Tomato, Sugarcane, Mangoes, Eggplant, Rice, Sorghum, Sunflower, Cashew, African Mahogany (Class 3), Bananas, Peanuts, Millet, Grape, Citrus (Class 4)
- Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African mahogany, Grape, Citrus (Class 3)
- Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Sorghum, Cashew, African Mahogany, Grape, Citrus (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Rice, Millet, Sunflower (Class 4)
- Sweet corn (Class 3), Cotton, Maize, Mungbean, Soybean, Chickpea, Lablab, Lucerne, Capsicum, Cucurbit, Tomato, Sugarcane, Mangoes, Bananas, Eggplant, Peanuts, Rice, Sorghum, Millet, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 4)
- Cotton, Chickpea, Lucerne, Capsicum, Cucurbit, Sweet corn, Tomato, Sugarcane, Eggplant, Millet (Class 4), Maize, Mungbean, Soybean, Lablab, Mangoes, Bananas, Peanuts, Rice, Sorghum, Sunflower, Cashew, African Mahogany, Grape, Citrus (Class 5)

GTenvironmental

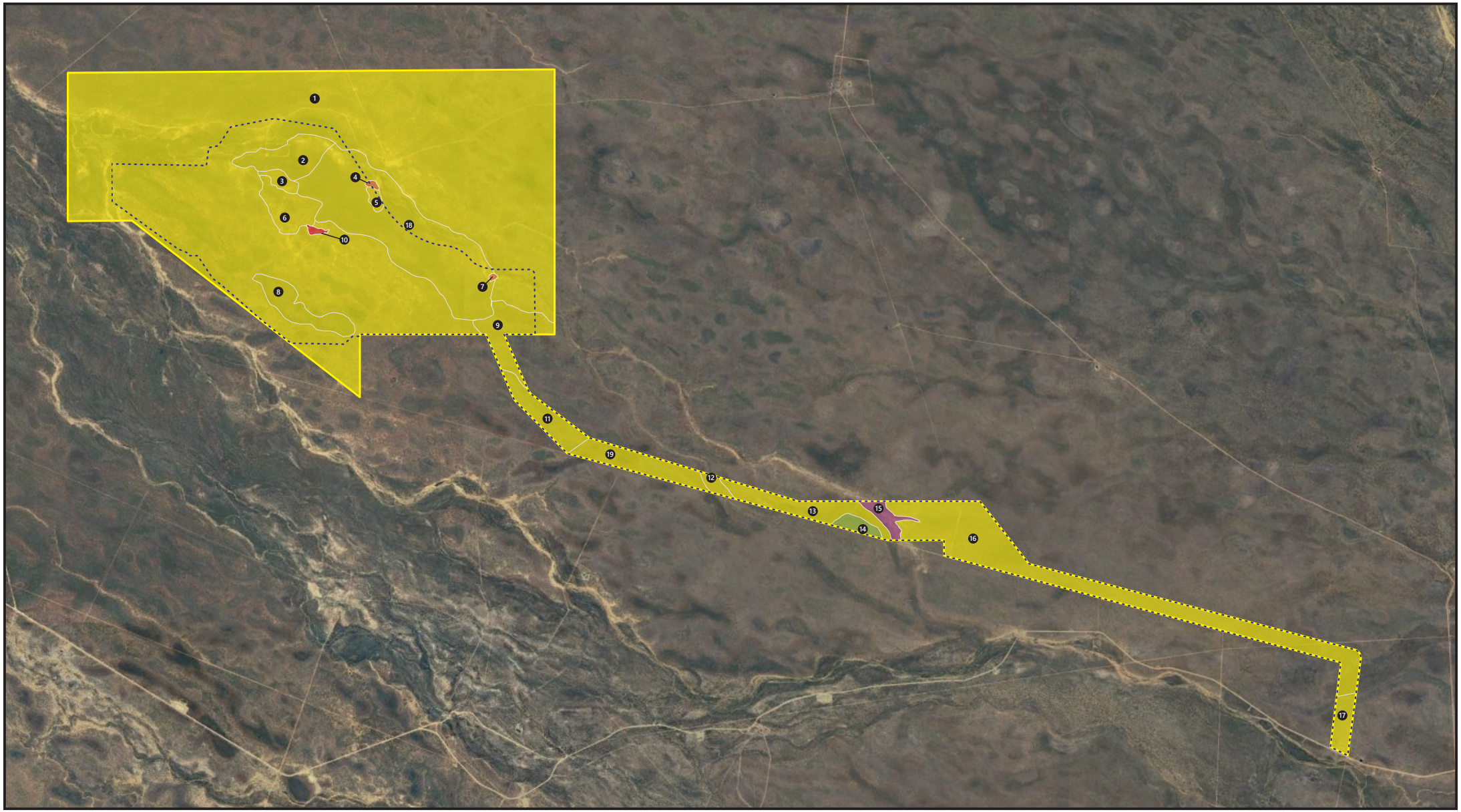


Figure 8: Pasture and Beef Cattle Grazing Land Use Suitability

Version 2 11/05/2026 Page size: A4

Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- 12 Unique mapping area
- Millet (Class 2), Lab Lab, Lucerne, Sorghum (Class 3)
- Millet, Lab Lab, Lucerne, Sorghum (Class 3)
- Millet, Lab Lab, Lucerne, Sorghum (Class 4)
- Lucerne, Sorghum (Class 3), Lab Lab, Millet (Class 4)
- Lucerne, Sorghum (Class 4), Lab Lab, Millet (Class 5)

0 2000
Metres

GTenvironmental

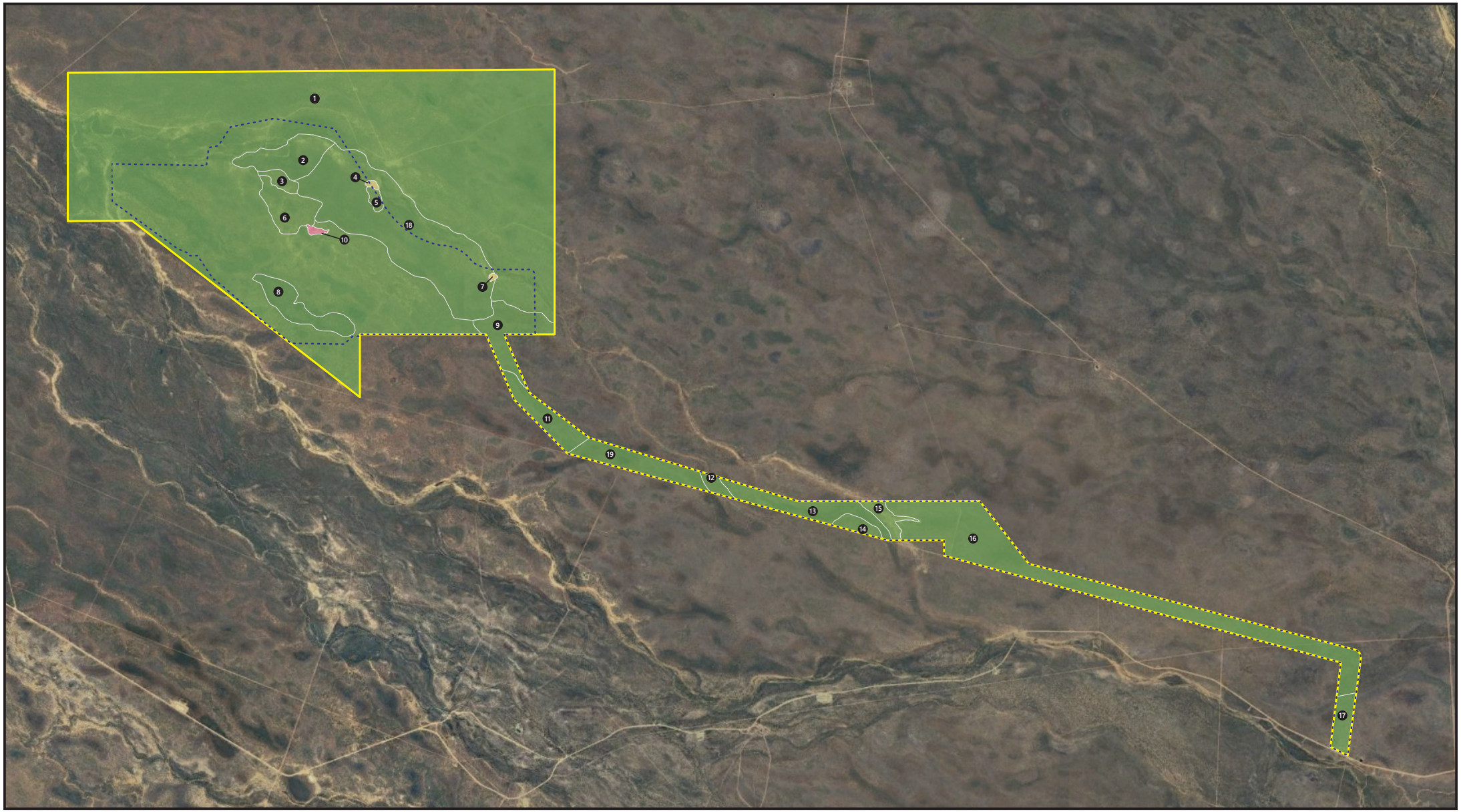


Figure 9: Agricultural Land Classes

Version 2 11/05/2026 Page size: A4

Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- 12 Unique mapping area
- Class A1
- Class B
- Class C2

0 2000
Metres

GTenvironmental

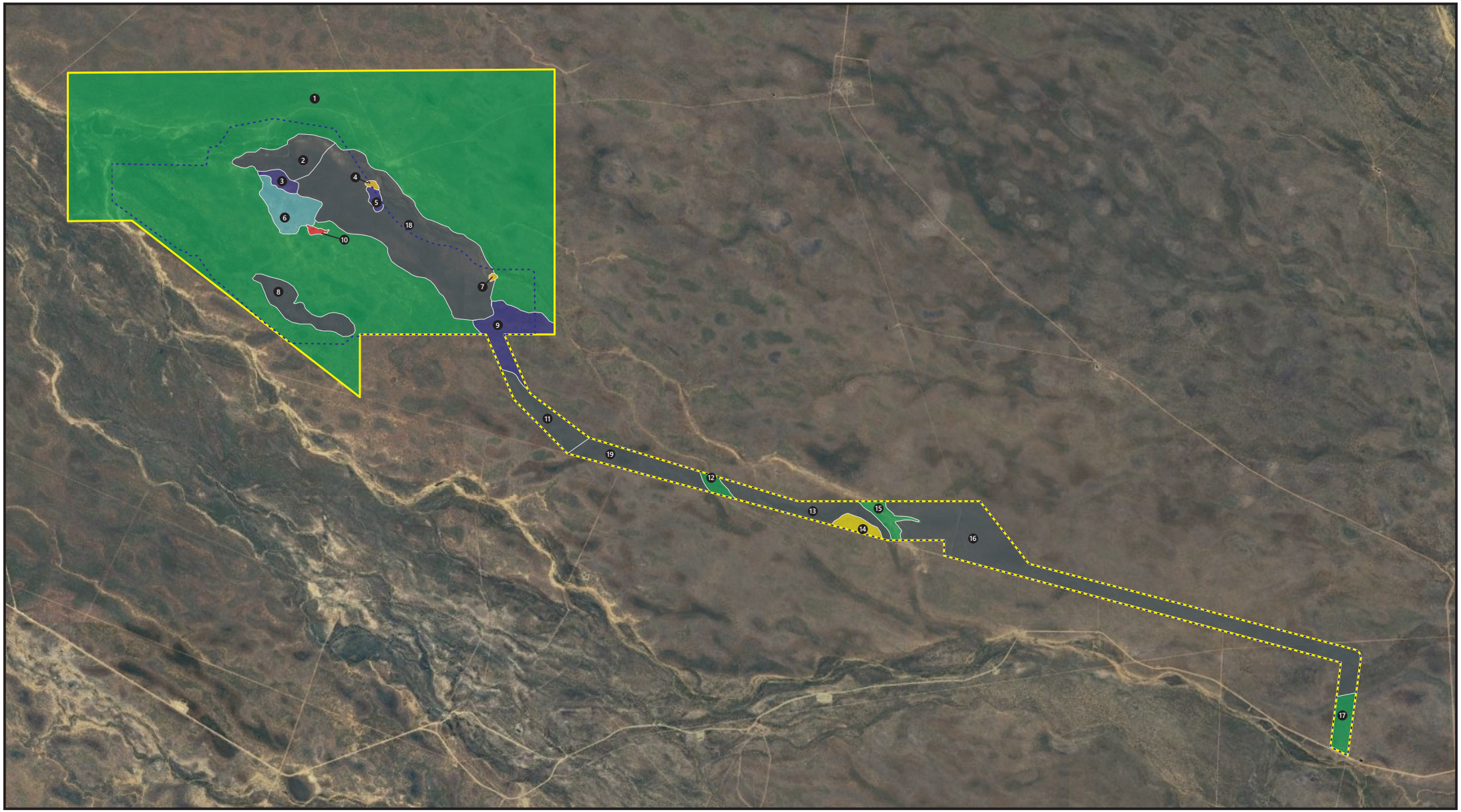


Figure 10: Topsoil Stripping Depths

Version 3 25/09/2026 Page size: A4

Soils and Land Suitability Assessment
ESMERALDA GRAPHITE PROJECT

Legend

- Study area
- Disturbance Footprint
- 12 Unique mapping area
- 0.15 metres
- 0.30 metres
- 0.35 metres
- 0.45 metres
- 0.50 metres
- 0.60 metres
- 0.70 metres

0 2000
Metres

GTenvironmental

15 APPENDICES

Appendix A Detailed Site Descriptions

Site D1	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628462 7918346 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 1Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Woodland No microrelief Limited clearing No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.17 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR3/4 Dark yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Common	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90
			A12 0.17-0.70 Abrupt 5-20mm	Loamy sand	Massive Weak Subangular blocky 20-50 mm No Slickensides	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Common	0.40 / 5.5	
			BC 0.70-0.90 EOBH	Loamy sand	Single grain	2-10% coarse fragments 20-60mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	No roots	0.80 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D2	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628497 7918738 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class II (b)	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark low woodland No microrelief Limited clearing No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.20 Abrupt 5-20mm	Sand	Single grain Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.10 / 6.5	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
			A12 0.20-0.50 Gradual 50-100mm	Sand	Massive Loose	No inclusions or segregations	10YR4/6 Dark yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.35 / 5.5	
			B21 0.50-1.80 Clear 20-50mm	Sand	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown No mottles or bleaching	Moderately moist Rapidly drained	No roots	1.20 / 6.0	
			B22 1.80-2.20 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	No roots	2.00 / 6.0	
			BC 2.20-2.25 EOBH	Loamy sand Silty	Massive Loose	20-50% coarse fragments 2-6mm	10YR6/4 Light yellowish brown Mottles: Pale Grey Common 10%-20% Medium 5-15 mm	Moderately moist Imperfectly drained	No roots	2.22 / 6.0	
			C Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D3	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628421 7918991 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Stream channel Lower slope <1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark low woodland No microrelief Limited clearing No erosion	Hard setting No coarse fragments No rock outcrop	A11 0.00-0.10	Sandy loam	Massive Weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60
			A12 0.10-0.45	Sandy loam	Massive Weak Subangular blocky 20-50 mm No Slickensides	<2% coarse fragments 2-6mm	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.30 / 5.5	
			BC 0.45-0.65 EOBH	Clayey sand	Massive Weak Subangular blocky 10-20 mm No Slickensides	2-10% coarse fragments 6-20mm 2-10% coarse fragments 2-6mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	No roots	0.55 / 9.0	
			C Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D4	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 647005 7909848 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class II (a)	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm	0.05 / 6.0	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 1.90-2.00
			A12 0.10-0.40	Loamy sand	Massive	No inclusions or segregations	7.5YR5/4 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm	0.25 / 6.0	
			B21 0.40-1.70	Loamy sand	Massive	No inclusions or segregations	7.5YR5/4 Brown Mottles: 10YR4/3 Brown	Dry Rapidly drained	Fine 1-2mm	1.00 / 6.0	
			B22 1.80-2.00 EOBH	Loamy sand	Massive	No inclusions or segregations	7.5YR5/6 Strong brown Mottles: 10YR4/3 Brown	Dry Rapidly drained	No roots	1.90 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D5	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 643031 7910787 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class II (a)	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca No microrelief Limited clearing No erosion	Loose No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Sand	Single grain Loose	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 / 5.5	No samples taken
			A2 0.10-0.30 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.20 / 5.5	
			B21 0.30-1.10 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.90 / 6.0	
			B22 1.10-1.90 Abrupt 5-20mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	1.50 / 6.0	
			BC 1.90-2.00 EOBH	Loamy sand	Massive Loose	<2% coarse fragments <2mm	10YR6/6 Brownish yellow Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	No roots	1.95 / 6.0	

Landscape



Surface



Soil Profile



Site D6	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 639698 7911803 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Stream channel Lower slope 5.0 / 3.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca Woodland gums No microrelief Limited clearing Sheet erosion	Loose 2-10% coarse fragments <2mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Clayey sand	Single grain Loose	2-10% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	0.00-0.10 0.10-0.20 0.30-0.40
			A2 0.10-0.25 Abrupt 5-20mm	Loamy sand	Massive Loose	<2% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.18 / 6.0	
			B21 0.25-0.50 EOBH	Sandy clay loam, sandy Silty	Moderate Weak	<2% coarse fragments 6-20mm	10YR6/3 Pale brown Mottles: Yellow Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	Fine 1-2mm Few	0.37 / 6.0 Slight Dispersion after 10 minutes	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D7	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628712 7917947 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 4Cl(Ck) / Brown Kandosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark low woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10	Loamy sand	Single grain	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5	0.00-0.10 0.20-0.30 0.50-0.60 0.65-0.75
			A21 0.10-0.35	Loamy sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.20 / 6.0	
			A22 0.35-0.60	Sandy loam	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.45 / 6.0	
			B21 0.60-0.75 EOBH	Sandy clay loam	Weak Very weak Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 6-20mm	10YR6/3 Pale brown No mottles or bleaching	Moderately moist Well drained	Fine 1-2mm Few	0.68 / 7.5	
			C Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D8	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 632938 7914242 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca No microrelief No effective disturbance; hoofed animals No erosion	Hard setting No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained		0.05 / 6.0	No samples taken
			A2 0.10-0.20 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained		0.15 / 5.5	
			B21 0.20-1.00	Loamy sand	Single grain	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained		0.60 / 5.5	
			BC 1.00-1.15 EOBH	Sandy loam	Massive	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Pale Grey	Moderately moist Well drained		1.08 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D9	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 627243 7917894 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca No microrelief Limited clearing No erosion	Soft 2-10% coarse fragments <2mm No rock outcrop	A1 0.00-0.10 Abrupt 5-20mm	Sand	Massive Loose	<2% coarse fragments <2mm	10YR4/4 Dark yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Common	0.05 / 6.0	No samples taken
			A21 0.10-0.30 Clear 20-50mm	Sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Common	0.20 / 6.0	
			A22 0.30-0.60 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.45 / 6.0	
			B21 0.60-0.65 EOBH	Clayey sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.62 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D10	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 632931 7915554 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 1Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (a)	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	Vegetation / Microrelief / Disturbance	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Open woodland No microrelief No effective disturbance; hoofed animals No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5	0.00-0.10 0.20-0.30 0.40-0.50 0.70-0.80
			A12 0.10-0.30 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.20 / 6.5	
			B21 0.30-0.55 Clear 20-50mm	Clayey sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.42 / 6.5 Slight Dispersion after 10 minutes Complete slaking	
			B21 0.55-0.82 EOBH	Clayey sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.70 / 7.5 Moderate dispersion after 10 minutes Complete slaking	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D11	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 632521 7916481 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 5Cl(Nm) / Leptic Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark low woodland No microrelief Limited clearing Rill erosion	Firm <2% coarse fragments 6-20mm No rock outcrop	A1 0.00-0.10 Abrupt 5-20mm	Loamy sand	Massive Loose	10-20% coarse fragments 6-20mm	7.5YR4/4 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 / 7.0	0.00-0.10 0.10-0.20 0.25-0.35
			A21 0.10-0.25 Abrupt 5-20mm	Loamy sand Silty	Massive Loose	2-10% coarse fragments 2-6mm	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.18 / 6.0	
			A22 0.25-0.35 EOBH	Loamy sand Silty	Massive Loose	50-90% coarse fragments 2-6mm 20-50% coarse fragments 2-6mm	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.30 / 6.0	
			C Coarse gravel layer								

Landscape



Surface



Soil Profile



Site D12	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 629337 7917966 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca Woodland No microrelief Limited clearing No erosion	Firm 2-10% coarse fragments <2mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Single grain Loose	<2% coarse fragments <2mm	10YR3/3 Dark brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	0.05 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.80-0.90 0.90-1.00 1.10-1.20 1.30-1.40
			A12 0.10-0.30 Abrupt 5-20mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Common	0.20 / 6.0	
			A21 0.30-0.80 Clear 20-50mm	Clayey sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	0.50 / 6.0	
			B21 0.80-1.00 Clear 20-50mm	Sandy loam	Weak / Very weak Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments <2mm	10YR6/4 Light yellowish brown Mottles: Pale Grey Many 20%-50%	Moderately moist Imperfectly drained	Very fine <1mm Few	0.90 / 7.0	
			B22 1.00-1.25 Clear 20-50mm	Sandy clay loam	Moderate / Weak Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR6/4 Light yellowish brown Mottles: Grey Many 20%-50%	Moderately moist Imperfectly drained	No roots	1.12 / 7.0	
			BC 1.25-1.40 EOBH	Sandy clay loam	Moderate / Weak Subangular blocky 10-20 mm No Slickensides	<2% coarse fragments 2-6mm	10YR6/4 Light yellowish brown Mottles: Grey Common 10%-20%	Moderately moist Imperfectly drained	No roots	1.32 / 7.0	
			Refusal on weathered substrate								

Landscape



Surface



Soil Profile



Site D13	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 634771 7913099 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca No microrelief Limited clearing No erosion	Firm <2% coarse fragments <2mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 /6.5	No samples taken
			A12 0.10-0.35 Abrupt 5-20mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/2 Greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.22 / 6.5	
			A21 0.35-0.50 Clear 20-50mm	Clayey sand	Massive Loose	No inclusions or segregations	10YR6/4 Light yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.42 / 6.0	
			A22 0.50-0.95 Abrupt 5-20mm	Clayey sand	Massive Loose	No inclusions or segregations	7.5YR5/4 Brown Mottles: Pale Grey Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.73 / 6.0	
			B21 0.95-1.45 Abrupt 5-20mm	Sandy loam	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown Mottles: Grey Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Fine 1-2mm Few	1.10 / 6.0	
			BC 1.45-1.70 EOBH	Sandy loam	Weak Very weak	No inclusions or segregations	7.5YR5/4 Brown Mottles: Grey Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Fine 1-2mm Few	1.55 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D14	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 636459 7912640 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 2.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Open woodland No microrelief No effective disturbance; hoofed animals No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.20 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.10 / 6.0	0.00-0.10 0.20-0.30 0.50-0.60 0.65-0.75
			A21 0.20-0.60 Clear 20-50mm	Sand Sandy Coarse	Single grain	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.35 / 6.0	
			A22 0.60-0.75 EOBH	Sand Sandy Coarse	Single grain	No inclusions or segregations	10YR3/3 Dark brown Mottles: Pale Grey Common 10%-20% Medium 5-15 mm	Wet Moderately well drained	Fine 1-2mm Few	0.68 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D15	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 630912 7916268 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 13/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Melaleuca Open woodland No microrelief Limited clearing No erosion	Loose No coarse fragments No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5	No samples taken
			A2 0.10-0.50 Abrupt 5-20mm	Loamy sand	Massive Loose	No inclusions or segregations	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.30 / 6.5	
			B21 0.50-0.60 EOBH	Sandy loam	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Pale Grey Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.55 / 8.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D16	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 638936 7912063 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 6Cl(El) / Brown Dermosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 13/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Field Test	Sample (m) / Observations
Grazing Gently undulating plain Plain Flat 1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark low woodland No microrelief Limited clearing No erosion	Firm 10-20% coarse fragments <2mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Single grain Loose	<2% coarse fragments <2mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5	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
			A11 0.10-0.30 Abrupt 5-20mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR6/1 Grey No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.20 / 6.5 No dispersion after 10 mins Complete slaking	
			A21 0.30-0.80 Gradual 50-100mm	Loam Sandy	Massive Loose	No inclusions or segregations	10YR6/3 Pale brown Mottles: Orange Very few <2% Medium 5-15 mm	Moderately moist Imperfectly drained	Medium 2-5mm Few	0.55 / 6.0 No dispersion after 10 mins Complete slaking	
			B21 0.80-1.00 Abrupt 5-20mm	Sandy clay loam	Weak / Very weak Subangular blocky 10-20 mm No Slickensides	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Grey, Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.90 / 6.0 No dispersion after 10 mins Complete slaking	
			B22 1.00-1.30 Clear 20-50mm	Clay loam, sandy	Weak to moderate/ Very weak Subangular blocky 10-20 mm, No Slickensides	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Grey, Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Coarse >5mm Few	1.15 / 6.5 No dispersion after 10 mins Complete slaking	
			B23 1.30-1.70 Clear 20-50mm	Clay loam, sandy	Moderate Weak Subangular blocky 10-20 mm	10-20% coarse fragments 6-20mm	7.5YR6/4 Light brown Mottles: Pale Grey & red (few) medium, Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Very fine <1mm Few	1.50 / 7.0 No dispersion after 10 mins Partial slaking	
			B24 1.70-2.00 EOBH	Sandy clay loam	Moderate Weak Subangular blocky 10-20 mm	10-20% coarse fragments 6-20mm	10YR7/3 Very pale brown Mottles: Pale brown red mott, few, medium Many 20%-50% Coarse 15-30 mm	Moist Imperfectly drained	Very fine <1mm Few	1.85 / 7.5 Slight Dispersion after 10 mins Partial slaking	

Landscape



Surface



Soil Profile



Site D17	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 647671 7907920 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 13/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark No microrelief No effective disturbance; hoofed animals No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.20	Loamy sand	Massive	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.10 / 6.0	0.00-0.10 0.20-0.30 0.40-0.50 0.60-0.70
			A12 0.20-0.40 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.30 / 6.0	
			A2 0.40-0.55 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.47 / 6.0	
			BC 0.55-0.70 EOBH	Sandy loam	Massive	20-50% coarse fragments 6-20mm	10YR5/3 Brown No mottles or bleaching	Dry Moderately well drained	No roots	0.62 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D18	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 629188 7916460 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / 1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Open woodland No microrelief Limited clearing No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Sand	Massive	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	No samples taken
			A12 0.10-0.35 Clear 20-50mm	Sand	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.22 / 6.0	
			A21 0.35-0.45 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.40 / 6.0	
			A23 0.45-0.55 EOBH	Clayey sand	Massive	No inclusions or segregations	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.50 / 7.0	

Landscape



Surface



Soil Profile



Site D19	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 629391 7917220 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Open woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	No samples taken
			A12 0.10-0.45 Clear 20-50mm	Sand	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Fine 1-2mm Few	0.27 / 6.0	
			A21 0.45-0.58 EOBH	Loamy sand	Massive	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.50 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D20	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 629294 7917294 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 7Cl(Nm) / Leptic Rudosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class III (b)	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Patchy grasslands No microrelief No effective disturbance; hoofed animals No erosion	Firm 10-20% coarse fragments <2mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Loamy sand	Massive	10-20% coarse fragments 2-6mm 10-20% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 / 7.0	0.00-0.10 0.10-0.15
			A12 0.10-0.15 EOBH	Loamy sand	Massive	10-20% coarse fragments 2-6mm 10-20% coarse fragments 6-20mm	7.5YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.15 / 6.0	
			C Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D21	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 630255 7918128 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 5Cl(Nm) / Leptic Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 15/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Sparse No microrelief No effective disturbance; hoofed animals No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Sand	Massive	<2% coarse fragments 6-20mm	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	0.00-0.10 0.10-0.20 0.24-0.32
			A21 0.10-0.24 Clear 20-50mm	Loamy sand	Massive	10-20% coarse fragments 6-20mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.18 / 6.0	
			A22 0.24-0.32 EOBH	Loamy sand Sandy Coarse	Massive	10-20% coarse fragments 6-20mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.28 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site D22	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 630268 7918115 mu/ GPS <3.00m	Soil Profile Class / Australian Soil Class: 1Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, detailed, auger, Class I	Survey Date / Described by: 15/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1.0 / <1.0 ASS Attributes pH < 5 <4: No Presence of corroded mollusc shell: No Jarositic horizons: No Sulfurous smell: No Dead, dying, stunted vegetation, scalded or bare low-lying areas: No Further Assessment: No	Paperbark Open woodland No microrelief No effective disturbance; hoofed animals No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.15 Clear 20-50mm	Loamy sand	Massive	<2% coarse fragments 6-20mm	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.08 / 6.0	0.00-0.10 0.20-0.30 0.40-0.50 0.60-0.70
			A12 0.15-0.30 Clear 20-50mm	Loamy sand	Massive	2-10% coarse fragments 6-20mm	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.22 / 6.0	
			A2 0.30-0.55 Clear 20-50mm	Loamy sand	Massive	10-20% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.45 / 6.0	
			B21 0.55-0.75 Clear 20-50mm	Sandy clay loam	Moderate Weak Subangular blocky 10-20 mm No Slickensides	10-20% coarse fragments 6-20mm	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.65 / 6.5	
			BC 0.75-0.80 EOBH	Clayey sand	Massive	2-10% coarse fragments 6-20mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Well drained	No roots	0.78 / 7.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Appendix B Class IV Site Descriptions

Site C1	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628126 7919009 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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	Melaleuca No microrelief Limited clearing No erosion	Loose 2-10% coarse fragments 2-6mm No rock outcrop	A1 0.00-0.10 Clear 20-50mm	Loamy sand	Massive Loose	<2% coarse fragments 2-6mm	10YR4/4 Dark yellowish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.05 / 6.0	No samples taken
			A2 0.10-0.60 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.35 / 5.5	
			BC 0.60-0.68 EOBH	Loamy sand	Massive Loose	2-10% coarse fragments 2-6mm	10YR6/6 Brownish yellow No mottles or bleaching	Moderately moist Moderately well drained	No roots	0.64 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C2	627336 7918719 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 10/12/2025 Grazing, level plain, flat, stream channel Open woodland, Paperbark, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Soft with no coarse fragments, loamy sand, 10YR5/4 Yellowish brown	 

Site C3	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 627734 7918585 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Lower slope 1 / 1	Paperbark No microrelief Limited clearing No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.5	No samples taken
			A12 0.10-0.40 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	7.5YR5/6 Strong brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.25 / 5.5	
			A13 0.40-0.70 Clear 20-50mm	Loamy sand	Single grain	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.55 / 5.5	
			BC 0.70-0.80	Loamy sand	Single grain	2-10% coarse fragments 6-20mm	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Imperfectly drained	No roots	0.75 / 8.0	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C4	645518 7909411 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 11/12/2025 Grazing, gently undulating plain, plain, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Soft with 20-50% coarse fragments, 60-200 mm, sand, 10YR4/2 Dark greyish brown	 

Site C5	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 645209 7910179 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1 / 1	Melaleuca No microrelief Limited clearing No erosion	Loose 2-10% coarse fragments <2mm No rock outcrop	A1 0.00-0.10 Sharp <5mm	Sand	Single grain Loose	<2% coarse fragments <2mm	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	-	No samples taken
			A2 0.10-0.30 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	-	
			B21 0.30-1.00 EOBH	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site C6	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 641391 7911237 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 0 / 1	Paperbark Woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A1 0.00-0.12 Abrupt 5-20mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	-	No samples taken
			A21 0.12-0.45 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry	Fine 1-2mm Few	-	
			A22 0.45-1.00 EOBH	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry	Fine 1-2mm Few	-	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C7	640828 7912118 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 11/12/2025 Grazing, gently undulating plain, plain, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 20-50% coarse fragments, 60-200 mm, sand, 10YR4/2 Dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C8	640781 7912394 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 11/12/2025 Grazing, gently undulating plain, plain, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 20-50% coarse fragments, 60-200 mm, sand, 10YR4/2 Dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C9	639675 7911804 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 11/12/2025 Grazing, gently undulating plain, lower slope, slope 1.0% Open woodland, Paperbark, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Hard setting to soft sady surface with 20-50% coarse fragments, 60-200 mm, clayey sand, 10YR4/3 Brown	 

Site C10	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 627869 7918228 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 10/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1 / 1	Paperbark Woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.13 Abrupt 5-20mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm	-	No samples taken
			A12 0.13-0.50 Abrupt 5-20mm	Loamy sand	Single grain Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm	-	
			A12 0.50-0.65 EOBH	Loamy sand	Single grain Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm	-	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C11	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628134 7918075 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 11/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / 1	Melaleuca No microrelief Limited clearing No erosion	Loose 2-10% coarse fragments <2mm No rock outcrop	A1 0.00-0.10 Sharp <5mm	Sand	Massive Loose	No inclusions or segregations	7.5YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	-	No samples taken
			A2 0.10-0.30 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	-	
			B21 0.30-0.50 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	7.5YR5/6 Strong brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	-	
			BC 0.50-0.60 EOBH	Sandy clay loam Silty	Massive Loose	10-20% coarse fragments <2mm	10YR5/4 Yellowish brown Mottles: Pale Grey Common 10%-20% Medium 5-15 mm	Moderately moist Imperfectly drained	No roots	-	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C12	630387 7916933 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 11/12/2025 Grazing, gently undulating plain, plain, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 20-50% coarse fragments, 60-200 mm, sand, 10YR4/2 Dark greyish brown	 

Site C13	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 632541 7915272 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 1Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / 1	Melaleuca No microrelief Limited clearing No erosion	Firm 20-50% coarse fragments <2mm No rock outcrop	A1 0.00-0.20 Clear 20-50mm	Loamy sand	Massive Loose	10-20% coarse fragments <2mm	10YR3/4 Dark brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.10 / 6.0	No samples taken
			A2 0.20-0.45 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	0.32 / 5.5	
			B21 0.45-0.65 Clear 20-50mm	Clayey sand	Massive Loose	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	0.55 / 5.5	
			BC 0.65-0.80 EOBH	Clay loam, sandy	Moderate Very weak Subangular blocky 10-20 mm No Slickensides	20-50% coarse fragments 2-6mm	10YR6/2 Pinkish grey Mottles: Pale brown Many 20%-50% Medium 5-15 mm	Moderately moist Imperfectly drained	No roots	0.73 / 6.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C14	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 632532 7916455 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / <1	Melaleuca No microrelief Limited clearing Rill erosion	Firm 2-10% coarse fragments 2-6mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Sand	Single grain Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	0.10 / 6.5	No samples taken
			A12 0.10-0.40 EOBH	Sand loam	Massive Loose	No inclusions or segregations	10YR4/6 Dark yellowish brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	0.35 / 5.5	

Landscape



Surface



Soil Profile



Site C15	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 631747 7916303 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / <1	Melaleuca No microrelief Limited clearing No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.05 / 6.0	No samples taken
			A12 0.10-0.30 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR6/4 Light yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.20 / 6.0	
			A2 0.30-0.80 Clear 20-50mm	Clayey sand	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.55 / 6.0	
			B21 0.80-1.00 EOBH	Sandy loam	Massive	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Pale Grey Very few <2% Medium 5-15 mm	Dry Rapidly drained	Fine 1-2mm Few	0.90 / 6.5	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C16	633084 7914378 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 12/12/2025 Grazing, gently undulating plain, plain, flat, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 6-20% coarse fragments, loamy sand, loose, 10YR3/3 Dark brown	 

Site C17	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 633791 7913371 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 12/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1 / <1	Paperbark Woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Very fine <1mm Few	-	No samples taken
			A12 0.10-0.40 Clear 20-50mm	Loamy sand	Massive	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	-	
			A21 0.40-0.90 Clear 20-50mm	Clayey sand	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	-	
			A22 0.90-1.00 EOBH	Sandy loam	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	No roots	-	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C18	635843 7912785 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 12/12/2025 Grazing, gently undulating plain, plain, slope 1.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 20-50% coarse fragments, sand, 10YR4/2 Dark greyish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C19	636436 7912665 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 12/12/2025 Grazing, gently undulating plain, drainage depression, slope 2.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 20-50% coarse fragments, loamy sand, 10YR3/2 Very dark greyish brown	 

Site C20	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 630584 7915767 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 13/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 <1 / <1	Paperbark Woodland No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.15 Clear 20-50mm	Sand	Massive	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Common	0.08 / 6.0	No samples taken
			A12 0.15-0.55 Abrupt 5-20mm	Loamy sand	Massive	No inclusions or segregations	10YR3/3 Dark brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	0.25 / 6.0	
			A2 0.55-0.65 EOBH	Sandy loam	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	0.60 / 9.0	
			Refusal on cemented pan								

Landscape



Surface



Soil Profile



Site C21	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 637632 7912390 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 13/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 1 / <1	Poplar Box Gum No microrelief No effective disturbance; hoofed animals No erosion	Soft No coarse fragments No rock outcrop	A11 0.000.20 Clear 20-50mm	Sand	Massive	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	-	No samples taken
			A12 0.20-0.55	Sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	-	
			A21 0.55-0.80	Loamy sand	Massive	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	-	
			A21 0.80-1.00 EOBH	Loamy sand	Massive	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	-	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C22	639541 7911999 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 13/12/2025 Grazing, gently undulating plain, drainage depression, upper slope, 4.0% Open woodland, Malalueca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 2-10% coarse fragments, clayey sand, 10YR4/3 Brown	
Site C23	639480 7911986 GPS <3.00m	2Cl(Ck) / 3Cl(Ck) boundary Class IV(b)	Date: 13/12/2025 Boundary - Surface changing to a sand texture towards the west, clayey sand texture to the east.	-

Site C24	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628996 7916028 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 2Cl(Ck) / Brown Arenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / 1	Melaleuca No microrelief No effective disturbance; natural No erosion	Soft No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Sand	Single grain Loose	No inclusions or segregations	10YR3/2 Very dark greyish brown No mottles or bleaching	Dry Well drained	Very fine <1mm Few	-	No samples taken
			A12 0.10-0.30 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR4/2 Dark greyish brown No mottles or bleaching	Dry Well drained	Fine 1-2mm Few	-	
			A2 0.30-0.80 Clear 20-50mm	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/6 Yellowish brown No mottles or bleaching	Moderately moist Moderately well drained	Fine 1-2mm Few	-	
			B21 0.80-1.00 EOBH	Clayey sand	Massive Loose	No inclusions or segregations	10YR6/4 Light yellowish brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site C25	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 629311 7916941 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 / 1	Melaleuca No microrelief No effective disturbance; natural No erosion	Loose <2% coarse fragments <2mm No rock outcrop	A11 0.00-0.10 Abrupt 5-20mm	Sand	Massive Loose	No inclusions or segregations	10YR4/3 Brown No mottles or bleaching	Moderately moist Rapidly drained	Very fine <1mm Few	-	No samples taken
			A12 0.10-0.25 Clear 20-50mm	Sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	-	
			A2 0.25-0.50 Clear 20-50mm	Sand	Massive Loose	No inclusions or segregations	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	-	
			B21 0.50-0.65 EOBH	Loamy sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown Mottles: Pale Grey Many 20%-50% Coarse 15-30 mm	Moderately moist Imperfectly drained	Very fine <1mm Few	-	

Landscape



Surface



Soil Profile



Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C26	629269 7917351 GPS <3.00m	7Cl(Nm) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, <1.0% Open woodland, patchy grass, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 2-10% coarse fragments, 20-60mm, loamy sand, 10YR4/3 Brown, rocky at 0.10m depth after excavating with trowel	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C27	629279 7917403 GPS <3.00m	3Cl(Ck) / 7Cl(Nm) Boundary / Class IV(b)	Date: 14/12/2025 Boundary – shallow soils to the south, changing soils shown by ant mounts and increasing areas of grass to the north	 
Site C28	629299 7917287 GPS <3.00m	3Cl(Ck) / 7Cl(Nm) Boundary / Class IV(b)	Date: 14/12/2025 Boundary – shallow soils to the north, changing soils shown by ant mounts and increasing areas of grass to the south	

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C29	628937 7918758 GPS <3.00m	2Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, <1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 10-20% coarse fragments, sand, 10YR4/3 Brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C30	625575 7919468 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, <1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 10-20% coarse fragments, sand, 10YR4/4 Dark yellowish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C31	627284 7919302 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, 1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Firm with 10-20% coarse fragments, sand, 10YR4/4 Dark yellowish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C32	633042 7919539 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, 1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 10-20% coarse fragments, sand, 10YR4/4 Dark yellowish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C33	631445 7918824 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, <1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 10-20% coarse fragments, sand, 10YR4/4 Dark yellowish brown	 

Site No.	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy	Soil Profile Class / Observation Class	Description	Plates
Site C34	630825 7918579 GPS <3.00m	3Cl(Ck) / Class IV(b)	Date: 14/12/2025 Grazing, gently undulating plain, flat, <1.0% Open woodland, Malaleuca, limited clearing, no microrelief, no rock outcrop, no erosion. Surface: Loose with 10-20% coarse fragments, sand, 10YR4/4 Dark yellowish brown	 

Site C35	Location (mE/mS GDA2020 ZONE 54) / Method, Accuracy: 628128 7918477 / GPS <3.00m	Soil Profile Class / Australian Soil Class: 3Cl(Ck) / Brown Tenosol	Geology (Dominant): Tpc, Claraville	Soil Survey Type / Observation Class / Method: Free, Class IV (a), auger	Survey Date / Described by: 14/12/2025 / MCCR

Land use / Landform Pattern / Element / Slope (% slope, clinometer)	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 Lower slope	Paperbark Sparse No microrelief Limited clearing No erosion	Firm No coarse fragments No rock outcrop	A11 0.00-0.10 Clear 20-50mm	Sand	Massive	No inclusions or segregations	10YR5/3 Brown No mottles or bleaching	Dry Rapidly drained	Fine 1-2mm Few	-	No samples taken
			A12 0.10-0.25 Clear 20-50mm	Loamy Sand	Massive Loose	No inclusions or segregations	10YR5/4 Yellowish brown No mottles or bleaching	Moderately moist Well drained	Very fine <1mm Few	-	
			A2 0.25-0.60 EOBH	Sandy loam	Massive Loose	No inclusions or segregations	7.5YR5/4 Brown No mottles or bleaching	Moderately moist Moderately well drained	Very fine <1mm Few	-	
			Borehole stopped due to storm / lightning nearby.								

Landscape



Surface



Soil Profile



Appendix C Analysed Site Laboratory Summary

Table AppC-1: Key Soil Chemistry and GTE Assessment for SPC 1Cl(Ck), Analysed Site D1

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90
Soil pH (H_20)	6.19	5.55	5.83	7.59
Soil pH (CaCl2 0.01M)	5.18	4.3	4.28	6.22
Soil EC (dS/m)	0.027	0.012	0.018	0.17
Soil Cl (mg/kg)	<5	<5	15	170
Exchangeable (Exch.). Ca (cmol./kg)	1.97	0.417	0.31	0.227
Exch. Mn (cmol./kg)	0.539	0.283	0.371	0.971
Exch. K (cmol./kg)	0.191	0.134	0.045	0.049
Exch. Na (cmol./kg)	0.025	0.028	0.111	2.82
Exch. Al (cmol./kg)	<0.02	0.23	0.19	<0.02
Exch. H (cmol./kg)	<0.02	0.16	0.14	<0.02
ECEC (cmol./kg)	1.18	1.12	0.94	0.61
ESP (%Na/CEC)	0.9	0.5	1.2	48
Calcium/Magnesium (ratio)	3.7	1.5	0.8	0.2
Potassium/Magnesium (ratio)	0.35	0.47	0.12	0.05
Emerson Class Number (No.)	3	3	3	3
Moisture Content	0.319	0.247	0.214	0.365
Gravel 4.75mm (%)	< 0.1	0.1	0.2	8
Gravel 2 – 4.75mm (%)	0.5	2.1	2.1	15
Coarse Sand 200-2000µm (%)	43.1	38.8	33.6	30.3
Fine Sand 20-200µm (%)	47.1	49.8	51.6	33.1
Silt 2-20µm (%)	2.8	1.1	2.4	1.1
Clay <2µm (%)	6.6	8.1	10.1	12.6
Dispersion Ratio (R1)	0.03	0.21	0.18	0.15
15 Bar (%)	2.3	3.1	3.3	5.8
Texture Class (GTE PSA Review)	Sand	Sand	Sandy loam	Sandy loam
Boron (mg/kg)	0.15	-	-	-
Iron (mg/kg)	32	-	-	-
Manganese (mg/kg)	2.8	-	-	-
Copper (mg/kg)	0.16	-	-	-
Zinc (mg/kg)	0.12	-	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-	-
Dumas Total Nitrogen (% dry wt)	0.056	0.034	-	-
Nitrate - N (2M KCl)	6.1	1.2	-	-
Ammonium - N (2M KCl)	1.2	1.3	-	-
TDS (mg/l)	18	8	12	110

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.80-0.90
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0014	<0.001	-	-
Organic Carbon (W&B)	0.8	0.19	-	-
Organic Matter (%)	1.6	0.39	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-
PBI + Colwell Phosphorus	12	23	-	-
Colwell Potassium (mg/kg)	84	66	-	-
KCl Sulfur (S) (mg/kg)	<2.5	<2.5	-	-

'-' indicates no laboratory assessment was undertaken

Table AppC-2: Key Soil Chemistry and GTE Assessment for SPC 1Cl(Ck), Effluent Irrigation Area, Analysed Site D10

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.40-0.50	0.70-0.80
Soil pH (H_20)	6.4	6.26	7.24	7.74
Soil pH (CaCl2 0.01M)	5.08	4.98	5.9	6.3
Soil EC (dS/m)	<0.010	<0.010	0.023	0.055
Soil Cl (mg/kg)	<5	6	10	29
Exchangeable (Exch.). Ca (cmol./kg)	0.596	0.54	0.97	0.603
Exch. Mn (cmol./kg)	0.122	0.184	0.513	0.863
Exch. K (cmol./kg)	0.12	0.075	0.065	0.159
Exch. Na (cmol./kg)	<0.020	<0.020	<0.020	0.133
Exch. Al (cmol./kg)	<0.02	<0.02	<0.02	<0.02
Exch. H (cmol./kg)	<0.02	<0.02	<0.02	<0.02
ECEC (cmol./kg)	0.84	0.8	1.56	1.76
ESP (%Na/CEC)	<6.0	<6.0	<6.0	30.6
Calcium/Magnesium (ratio)	4.9	2.9	1.9	0.7
Potassium/Magnesium (ratio)	0.98	0.41	0.13	0.18
Moisture Content	<0.1	<0.1	0.2	0.2
Nitrate - N (2M KCl)	<1.0	<1.0	<1.0	<1.0
Ammonium - N (2M KCl)	<1.0	<1.0	<1.0	<1.0
TDS (mg/l)	<6	6	15	35
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	<0.001	<0.001	0.0017	0.0019
Colwell Phosphorus (mg/kg)	<5.0	<5.0	<5.0	<5.0
Wet Bulk Density (Kg/L)	1.61	1.55	1.35	1.24
Dry Bulk Density (Kg/L)	1.59	1.51	1.28	1.16
Moisture Content 105Â°C	1	2.6	5.3	6.4

'-' indicates no laboratory assessment was undertaken

Table AppC-3: Key Soil Chemistry and GTE Assessment for SPC 2Cl(Ck), Analysed Site D2

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
Soil pH (H_20)	5.83	5.9	5.59	5.65	5.33	5.41	5.44	6.39
Soil pH (CaCl2 0.01M)	4.64	4.72	4.2	4.33	4.18	4.21	4.21	4.74
Soil EC (dS/m)	0.03	0.011	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Soil Cl (mg/kg)	7	<5	6	<5	10	8	<5	10
Exchangeable (Exch.). Ca (cmol./kg)	1.3	0.367	<0.050	<0.050	<0.050	<0.050	<0.050	-
Exch. Mn (cmol./kg)	0.492	0.167	<0.080	<0.080	<0.080	<0.080	<0.080	-
Exch. K (cmol./kg)	0.194	0.101	0.07	0.07	0.057	0.063	0.059	-
Exch. Na (cmol./kg)	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	-
Exch. Al (cmol./kg)	<0.02	0.04	0.21	0.21	0.23	0.26	0.22	-
Exch. H (cmol./kg)	0.05	0.08	0.08	0.09	0.08	0.11	0.12	-
ECEC (cmol./kg)	0.92	0.54	0.62	0.4	0.43	0.57	0.52	-
ESP (%Na/CEC)	0.6	1.1	0.6	<0.2	1.1	1.7	0.3	-
Calcium/Magnesium (ratio)	2.7	2.2	0.5	0.7	0.6	<0.1	0.7	-
Potassium/Magnesium (ratio)	0.39	0.6	1.1	1.2	1.1	1.7	1.2	-
Emerson Class Number (No.)	3	3	3	4	4	4	3	-
Moisture Content	0.272	0.121	0.138	0.134	0.128	0.166	0.168	-
Gravel 4.75mm (%)	0.2	0.4	< 0.1	< 0.1	1.4	0.1	< 0.1	-
Gravel 2 – 4.75mm (%)	0.6	0.3	0.6	0.8	1.1	1	0.5	-
Coarse Sand 200-2000µm (%)	40.4	36.7	39.1	40.6	41.4	41	38.4	-
Fine Sand 20-200µm (%)	52.8	56.3	54.6	52.7	49.6	53	55	-
Silt 2-20µm (%)	2.8	1.1	0.5	2.4	2.9	1.6	1.1	-
Clay <2µm (%)	3.3	5.2	5.3	3.6	3.6	3.3	4.9	-
Dispersion Ratio (R1)	0.03	0.08	0.03	0.03	0.03	0.03	0.11	-
15 Bar (%)	1.5	<1.5	1.7	1.9	1.8	1.8	2.2	-
Texture Class (GTE PSA Review)	Sand	Sand	Sand	Sand	Sand	Sand	Sand	-
Boron (mg/kg)	0.13	-	-	-	-	-	-	-
Iron (mg/kg)	22	-	-	-	-	-	-	-
Manganese (mg/kg)	10	-	-	-	-	-	-	-
Copper (mg/kg)	0.14	-	-	-	-	-	-	-
Zinc (mg/kg)	0.24	-	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	0.077	-	<0.030	-	-	-	-	-
Nitrate - N (2M KCl)	3.5	-	<1.0	-	-	-	-	-
Ammonium - N (2M KCl)	2.9	-	<1.0	-	-	-	-	-
TDS (mg/l)	19	7	<6	<6	<6	<6	<6	<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	2.00-2.10
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	<0.001	-	0.0013	-	-	-	-	-
Organic Carbon (W&B)	0.78	-	0.11	-	-	-	-	-
Organic Matter (%)	1.6	-	0.23	-	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	-	<5.0	-	-	-	-	-
PBI + Colwell Phosphorus	7	-	22	-	-	-	-	-
Colwell Potassium (mg/kg)	86	-	25	-	-	-	-	-
KCl Sulfur (S) (mg/kg)	<2.5	-	<2.5	-	-	-	-	-

'-' indicates no laboratory assessment was undertaken

Table AppC-4: Key Soil Chemistry and GTE Assessment for SPC 3Cl(Ck), Analysed Site D3

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
Soil pH (H_20)	6.45	5.75	8.76
Soil pH (CaCl2 0.01M)	5.7	4	7.36
Soil EC (dS/m)	0.055	0.016	0.23
Soil Cl (mg/kg)	32	20	210
Exchangeable (Exch.). Ca (cmol./kg)	0.376	0.115	0.59
Exch. Mn (cmol./kg)	0.364	0.45	1.43
Exch. K (cmol./kg)	0.21	0.048	0.088
Exch. Na (cmol./kg)	0.187	0.15	3.8
Exch. Al (cmol./kg)	<0.02	0.43	<0.02
Exch. H (cmol./kg)	<0.02	0.13	<0.02
ECEC (cmol./kg)	0.76	1.13	1.42
ESP (%Na/CEC)	1.8	2	37
Calcium/Magnesium (ratio)	1	0.3	0.4
Potassium/Magnesium (ratio)	0.58	0.11	0.06
Emerson Class Number (No.)	3	3	2
Moisture Content	0.314	0.286	0.6
Gravel 4.75mm (%)	1.7	< 0.1	0.4
Gravel 2 – 4.75mm (%)	1.5	1.6	11.6
Coarse Sand 200-2000µm (%)	13.2	25.6	25.6
Fine Sand 20-200µm (%)	71.5	60	45.5
Silt 2-20µm (%)	3.8	1.1	0.5
Clay <2µm (%)	8.4	11.7	16.3
Dispersion Ratio (R1)	0.26	0.02	0.53
15 Bar (%)	3.1	3.4	8.2
Texture Class (GTE PSA Review)	Loamy sand	Sandy loam	Sandy loam
Boron (mg/kg)	0.16	-	-
Iron (mg/kg)	24	-	-
Manganese (mg/kg)	2.6	-	-
Copper (mg/kg)	0.17	-	-
Zinc (mg/kg)	<0.08	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-
Dumas Total Nitrogen (% dry wt)	0.034	<0.030	-
Nitrate - N (2M KCl)	4.6	<1.0	-
Ammonium - N (2M KCl)	3	<1.0	-
TDS (mg/l)	35	10	150

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.20-0.30	0.50-0.60
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0018	0.002	-
Organic Carbon (W&B)	0.41	0.27	-
Organic Matter (%)	0.81	0.54	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-
PBI + Colwell Phosphorus	25	37	-
Colwell Potassium (mg/kg)	89	<25	-
KCl Sulfur (S) (mg/kg)	<2.5	<2.5	-

'-' indicates no laboratory assessment was undertaken

Table AppC-5: Key Soil Chemistry and GTE Assessment for SPC 4Cl(Ck), Analysed Site D7

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.65-0.75
Soil pH (H_20)	6.37	6.32	7.04	7.75
Soil pH (CaCl2 0.01M)	4.38	4.56	5.7	6.44
Soil EC (dS/m)	0.023	0.039	0.22	0.24
Soil Cl (mg/kg)	14	28	240	500
Exchangeable (Exch.). Ca (cmol./kg)	0.396	0.311	0.274	0.221
Exch. Mn (cmol./kg)	0.143	0.216	0.515	0.916
Exch. K (cmol./kg)	0.066	0.046	0.029	0.055
Exch. Na (cmol./kg)	0.277	0.424	2.09	4.97
Exch. Al (cmol./kg)	<0.02	<0.02	<0.02	<0.02
Exch. H (cmol./kg)	<0.02	<0.02	<0.02	<0.02
ECEC (cmol./kg)	0.43	0.58	0.56	0.55
ESP (%Na/CEC)	8.2	14	44	62
Calcium/Magnesium (ratio)	2.8	1.4	0.5	0.2
Potassium/Magnesium (ratio)	0.46	0.21	0.06	0.06
Emerson Class Number (No.)	3	2	2	2
Moisture Content	0.244	0.262	0.389	0.503
Gravel 4.75mm (%)	0.1	0.3	5.7	10.4
Gravel 2 – 4.75mm (%)	0.8	1.3	11.2	17.8
Coarse Sand 200-2000µm (%)	54.6	33.3	27.7	27.3
Fine Sand 20-200µm (%)	36.8	50.5	38.9	27.6
Silt 2-20µm (%)	0.5	4.6	7.2	1
Clay <2µm (%)	7.2	10.1	9.4	15.9
Dispersion Ratio (R1)	0.14	0.19	0.47	0.54
15 Bar (%)	2.6	3.3	5.9	7.9
Texture Class (GTE PSA Review)	Sand	Sandy loam	Sandy loam	Sandy loam
Boron (mg/kg)	<0.10	-	-	-
Iron (mg/kg)	30	-	-	-
Manganese (mg/kg)	0.4	-	-	-
Copper (mg/kg)	0.11	-	-	-
Zinc (mg/kg)	<0.08	-	-	-
Oxalate ext. Molybdenum (mg/kg)	0.26	-	-	-
Dumas Total Nitrogen (% dry wt)	<0.030	<0.030	-	-
Nitrate - N (2M KCl)	1.2	2.2	-	-
Ammonium - N (2M KCl)	<1.0	<1.0	-	-
TDS (mg/l)	14	25	140	150

Analysis (Unit)	Sample Depth (mbgl) / Horizon			
	0.00-0.10	0.20-0.30	0.50-0.60	0.65-0.75
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0016	0.0018	-	-
Organic Carbon (W&B)	0.32	0.35	-	-
Organic Matter (%)	0.63	0.71	-	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-	-
PBI + Colwell Phosphorus	29	29	-	-
Colwell Potassium (mg/kg)	<25	<25	-	-
KCl Sulfur (S) (mg/kg)	<2.5	<2.5	-	-

'-' indicates no laboratory assessment was undertaken

Table AppC-6: Key Soil Chemistry and GTE Assessment for SPC 5Cl(Nm), Analysed Site D11

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.10-0.20	0.25-0.35
Soil pH (H_20)	6.33	6	6.99
Soil pH (CaCl2 0.01M)	4.79	4.37	5.54
Soil EC (dS/m)	<0.010	<0.010	0.018
Soil Cl (mg/kg)	10	20	11
Exchangeable (Exch.). Ca (cmol./kg)	0.437	0.196	0.137
Exch. Mn (cmol./kg)	0.281	0.374	0.36
Exch. K (cmol./kg)	0.129	0.077	0.043
Exch. Na (cmol./kg)	0.028	0.086	0.166
Exch. Al (cmol./kg)	<0.02	<0.02	<0.02
Exch. H (cmol./kg)	<0.02	<0.02	<0.02
ECEC (cmol./kg)	0.8	0.54	0.45
ESP (%Na/CEC)	0.8	0.6	2.2
Calcium/Magnesium (ratio)	1.6	0.5	0.4
Potassium/Magnesium (ratio)	0.46	0.21	0.12
Emerson Class Number (No.)	3	3	3
Moisture Content	0.227	0.212	0.225
Gravel 4.75mm (%)	0.6	2.1	22.6
Gravel 2 – 4.75mm (%)	1.6	3.7	11
Coarse Sand 200-2000µm (%)	41.5	45.7	42.7
Fine Sand 20-200µm (%)	43.1	36	17.1
Silt 2-20µm (%)	1.7	2.8	2.2
Clay <2µm (%)	11.6	9.7	4.4
Dispersion Ratio (R1)	0.21	0.36	0.21
15 Bar (%)	3.1	2.8	2.3
Texture Class (GTE PSA Review)	Sandy loam	Sandy loam	Sand
Boron (mg/kg)	0.14	-	-
Iron (mg/kg)	4.1	-	-
Manganese (mg/kg)	2.4	-	-
Copper (mg/kg)	0.11	-	-
Zinc (mg/kg)	<0.08	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-
Dumas Total Nitrogen (% dry wt)	<0.030	<0.030	-
Nitrate - N (2M KCl)	<1.0	<1.0	-
Ammonium - N (2M KCl)	<1.0	<1.0	-
TDS (mg/l)	<6	6	12

Analysis (Unit)	Sample Depth (mbgl) / Horizon		
	0.00-0.10	0.10-0.20	0.25-0.35
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0013	0.0015	-
Organic Carbon (W&B)	0.34	0.15	-
Organic Matter (%)	0.68	0.3	-
Colwell Phosphorus (mg/kg)	<5.0	<5.0	-
PBI + Colwell Phosphorus	26	21	-
Colwell Potassium (mg/kg)	50	<25	-
KCl Sulfur (S) (mg/kg)	<2.5	<2.5	-

'-' indicates no laboratory assessment was undertaken

Table AppC-7: Key Soil Chemistry and GTE Assessment for SPC 6Cl(El), Analysed Site D16

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
Soil pH (H_20)	6.53	6.66	7.2	6.46	7.27	8.04	7.69
Soil pH (CaCl2 0.01M)	5.42	5.13	6.69	4.63	5.63	7.35	6.19
Soil EC (dS/m)	0.016	<0.010	0.063	<0.010	0.026	0.11	0.097
Soil Cl (mg/kg)	<5	9	6	11	29	33	96
Exchangeable (Exch.). Ca (cmol./kg)	1.9	0.807	0.992	0.112	<0.050	1.03	<0.050
Exch. Mn (cmol./kg)	0.354	0.39	0.88	1.06	1.02	0.805	1.58
Exch. K (cmol./kg)	0.131	0.071	0.039	0.021	0.018	0.073	0.04
Exch. Na (cmol./kg)	<0.020	<0.020	0.048	0.11	0.292	0.314	1.93
Exch. Al (cmol./kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Exch. H (cmol./kg)	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
ECEC (cmol./kg)	1.4	1.13	1.35	1.05	1.04	1.04	1.02
ESP (%Na/CEC)	<0.2	0.4	<0.2	1.3	4.7	1.8	32
Calcium/Magnesium (ratio)	5.4	2.1	1.1	0.1	<0.1	1.3	<0.1
Potassium/Magnesium (ratio)	0.37	0.18	<0.05	<0.05	<0.05	0.09	<0.05
Emerson Class Number (No.)	3	4	2	2	2	4	2
Moisture Content	0.26	0.219	0.326	0.378	0.424	0.458	0.399
Gravel 4.75mm (%)	< 0.1	< 0.1	< 0.1	< 0.1	0.1	41.4	6.1
Gravel 2 – 4.75mm (%)	< 0.1	< 0.1	0.2	0.3	0.9	5	5.5
Coarse Sand 200-2000µm (%)	62.7	58.6	54.8	52.2	52.5	31.9	50.6
Fine Sand 20-200µm (%)	24.4	25	21.8	20.9	22.4	9.3	13.2
Silt 2-20µm (%)	3.1	2.4	3	1.7	1	2.5	2.8
Clay <2µm (%)	9.7	13.9	20.3	25	23.2	10	22
Dispersion Ratio (R1)	0.27	0.35	0.32	0.32	0.38	0.43	0.33
15 Bar (%)	3.6	4.2	6.2	7	6.7	5	8.4
Texture Class (GTE PSA Review)	Sandy loam	Sandy loam	Sandy clay loam	Sandy clay loam	Sandy clay loam	Sandy loam	Sandy clay loam
Boron (mg/kg)	0.11	-	-	-	-	-	-
Iron (mg/kg)	14	-	-	-	-	-	-
Manganese (mg/kg)	7.4	-	-	-	-	-	-
Copper (mg/kg)	0.18	-	-	-	-	-	-
Zinc (mg/kg)	0.09	-	-	-	-	-	-
Oxalate ext. Molybdenum (mg/kg)	<0.25	-	-	-	-	-	-
Dumas Total Nitrogen (% dry wt)	<0.030	-	<0.030	-	-	-	-
Nitrate - N (2M KCl)	<1.0	-	<1.0	-	-	-	-

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
Ammonium - N (2M KCl)	<1.0	-	1.4	-	-	-	-
TDS (mg/l)	10	<6	40	<6	17	72	62
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0018	-	0.0031	-	-	-	-
Organic Carbon (W&B)	0.56	-	0.21	-	-	-	-
Organic Matter (%)	1.1	-	0.42	-	-	-	-
Colwell Phosphorus (mg/kg)	<5.0	-	<5.0	-	-	-	-
PBI + Colwell Phosphorus	17	-	39	-	-	-	-
Colwell Potassium (mg/kg)	64	-	<25	-	-	-	-
KCl Sulfur (S) (mg/kg)	<2.5	-	<2.5	-	-	-	-

'-' indicates no laboratory assessment was undertaken

Table AppC-8: Key Soil Chemistry and GTE Assessment for SPC 7Cl(Nm), Analysed Site D20

Analysis (Unit)	Sample Depth (mbgl) / Horizon	
	0.00-0.10	0.10-0.15
Soil pH (H_20)	7.51	6.16
Soil pH (CaCl2 0.01M)	6.92	4.92
Soil EC (dS/m)	0.2	0.052
Soil Cl (mg/kg)	8	35
Exchangeable (Exch.). Ca (cmol./kg)	3.15	0.638
Exch. Mn (cmol./kg)	0.542	0.596
Exch. K (cmol./kg)	0.223	0.149
Exch. Na (cmol./kg)	0.071	0.329
Exch. Al (cmol./kg)	<0.02	<0.02
Exch. H (cmol./kg)	<0.02	<0.02
ECEC (cmol./kg)	1.96	1.28
ESP (%Na/CEC)	0.3	2.9
Calcium/Magnesium (ratio)	5.8	1.1
Potassium/Magnesium (ratio)	0.41	0.25
Emerson Class Number (No.)	3	3
Moisture Content	0.322	0.336
Gravel 4.75mm (%)	0.3	7.5
Gravel 2 – 4.75mm (%)	0.9	4
Coarse Sand 200-2000µm (%)	62.8	49.9
Fine Sand 20-200µm (%)	25	24
Silt 2-20µm (%)	3.5	5.6
Clay <2µm (%)	7.5	9.1
Dispersion Ratio (R1)	0.13	0.29
15 Bar (%)	3.7	3.8
Texture Class (GTE PSA Review)	Loamy sand	Loamy sand
Boron (mg/kg)	0.14	-
Iron (mg/kg)	51	-
Manganese (mg/kg)	12	-
Copper (mg/kg)	0.22	-
Zinc (mg/kg)	0.64	-
Oxalate ext. Molybdenum (mg/kg)	0.27	-
Dumas Total Nitrogen (% dry wt)	0.058	0.036

Analysis (Unit)	Sample Depth (mbgl) / Horizon	
	0.00-0.10	0.10-0.15
Nitrate - N (2M KCl)	<1.0	<1.0
Ammonium - N (2M KCl)	1.2	6.6
TDS (mg/l)	130	33
S7 Gravimetric water content of air dried fine fraction (GWCad-ff) (g/g)	0.0025	0.0022
Organic Carbon (W&B)	0.85	0.46
Organic Matter (%)	1.7	0.92
Colwell Phosphorus (mg/kg)	9.4	<5.0
PBI + Colwell Phosphorus	37	22
Colwell Potassium (mg/kg)	110	73
KCl Sulfur (S) (mg/kg)	3.6	11

'-' 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

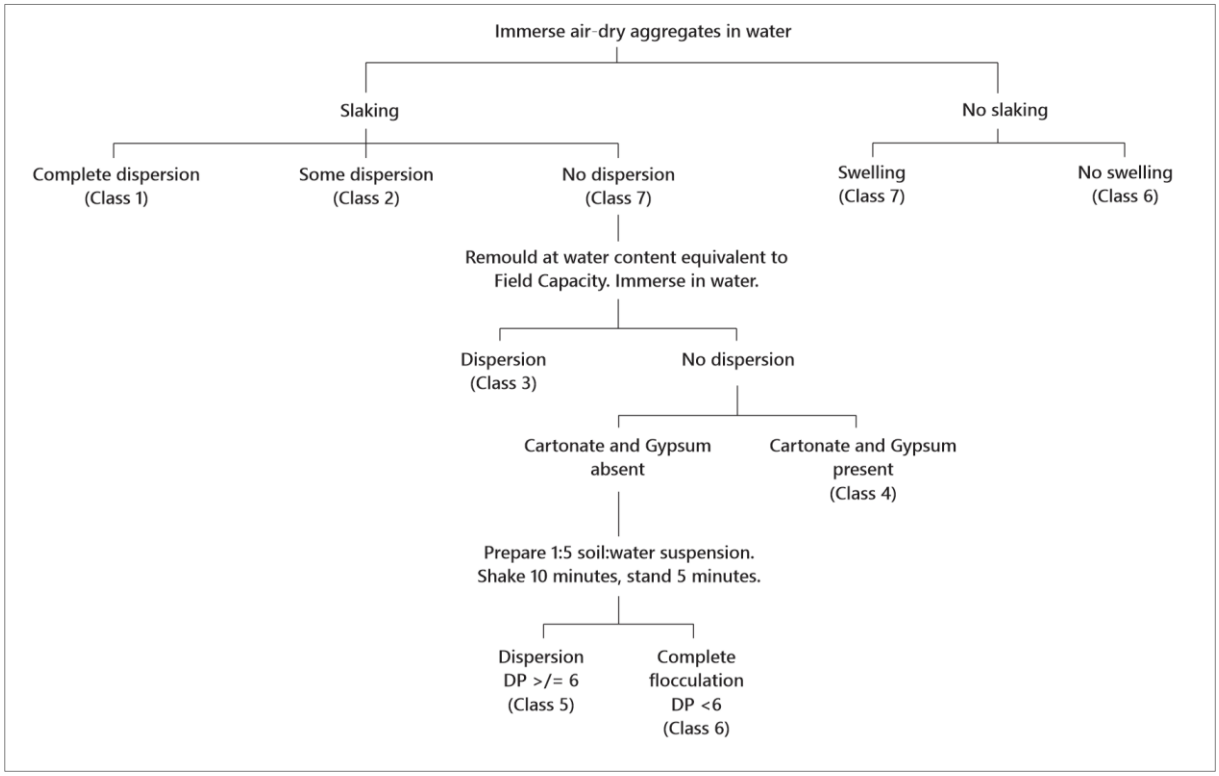


Table AppA-8: Emerson Class Descriptions

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 1.00 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.

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 Plant Yield, Tolerance and Soil Water Storage Calculations

Table AppJ-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	Cotton	Eggplant	Maize	Peanut	Sorghum	Soybean	Sugarcane	Sunflower	Tomato
					90% Yield (Ecse, dS/m)	9.6	2.5	2.5	3.5	7.4	5.5	3.4	5.9	2.8
					75% Yield (Ecse, dS/m)	12.5	4.7	3.8	4.1	8.4	6.3	5.9	6.5	3.6
					50% Yield (Ecse, dS/m)	17.3	12.5	5.9	4.9	9.9	7.5	10.2	7.5	4.9
1Cl(Ck)	D1-0.00-0.10	1.18	3.9	0.70				75% Yield	90% Yield			75% Yield		75% Yield
	D1-0.200-0.30	1.12	3.8											
	D1-0.50-0.60	0.94	3.7											
	D1-0.80-0.90	0.61	4.4			90% Yield	90% Yield		75% Yield	90% Yield	90% Yield		90% Yield	
2Cl(Ck)	D2-0.00-0.10	0.03	0.2	0.50										
	D2-0.20-0.30	0.01	0.1											
	D2-0.50-0.60	0.01	0.1											
	D2-0.80-0.90	0.01	0.1											
	D2-1.10-1.20	0.01	0.1											
	D2-1.40-1.50	0.01	0.1											
	D2-1.70-1.80	0.01	0.1			90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield
3Cl(Ck)	D3-0.00-0.10	0.06	0.6	0.45										
	D3-0.20-0.30	0.02	0.3											
	D3-0.50-0.60	0.23	2.6			90% Yield	75% Yield	75% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield
4Cl(Ck)	D7-0.00-0.10	0.02	0.3	0.75										
	D7-0.20-0.30	0.04	0.4											
	D7-0.50-0.60	0.22	2.8				75% Yield	75% Yield						75% Yield
	D7-0.65-0.75	0.24	4.3			90% Yield			90% Yield	90% Yield	90% Yield	75% Yield	90% Yield	
5Cl(Nm)	D11-0.00-0.10	0.01	0.1	0.35										
	D11-0.10-0.20	0.01	0.2											
	D11-0.25-0.35	0.02	0.2			90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield
6Cl(El)	D16-0.00-0.10	0.02	0.1	2.00										
	D16-0.20-0.30	0.01	0.1											
	D16-0.50-0.60	0.06	0.4											
	D16-0.80-0.90	0.01	0.1											
	D16-1.10-1.20	0.03	0.4											
	D16-1.40-1.50	0.11	0.8											
	D16-1.70-1.80	0.10	1.2			90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield
7Cl(Nm)	D20-0.00-0.10	0.20	0.9	0.15										
	D20-0.10-0.15	0.05	0.6			90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield	90% Yield

Printed on 29/03/2026

PREDICTIVE CALCULATOR

Version Number 2.2.2a 11 February 2022 Return to Front Page Link to Abbreviations and Glossary

Calculates soil leaching, rootzone salinity and sodicity, plant yield, deep drainage to groundwater and gypsum requirement for soil surface stability

WATER AND SOIL SELECTION

Put letter Y in **ONE** box for the irrigation water selected for each soil, your data from the Quick Calculator page will be transferred across.

Sample	Water description	Soil 1	Soil 2	Soil 3
1	Yelarbon bore			
2	Burd 12001253 11/93			
3	14310218			
4	Tenthill 14320222			
5	Rainfall - No irrigation	y	y	y

Plant type Cotton

Choose plant from drop down list in green box. If a user-defined plant has been added it will appear at the bottom of the list.

STEPS

1 Water analysis and rainfall are copied from QUICK CALCULATOR

2 Input clay content, CEC and either ESP or Exchangeable Na soil properties, for up to 3 sites and the depth increment of the analysis up to 12 depth increments. The method of analysis for CEC and ESP is important. The quick method using NH_4Cl in soils with moderate to high EC and pH >7 will give misleading results. See BACKGROUND AND THEORY

3 Input of EC and Cl on a 1:5 suspension (choose applicable units) will allow conversion of $EC_{1:5}$ to EC_{se} and EC_e. If ADMC and/or 1500 kPa values are available they will be used otherwise conversions based on clay and CEC are used. ADMC is the water content between 40°C and 105°C, see ABBREVIATIONS AND GLOSSARY

4 Where sampled depth increments are greater than 0.1m, enter the value for all 0.1m increments within that sampled depth range. Gaps in depth increments > 0.6m are not interpolated by the program.

Note: Results for ESP 0.1m & ESP 0.1m adj SAR are calculated directly from the water analysis

The water data in this section is copied over from the Quick Calculator based on the profile chosen on the left (green shaded boxes).

Water sample	Water description	EC i	EC i+r	SAR	SAR adj Ca	RA	Rainfall (mm/yr)	Irrigation (mm/yr)	Ca	Mg	Na	HCO3	Cl	SO4	ESP 0-0.1m	SAR adj Ca ESP 0-0.1m
1	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
2	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
3	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1

Graphs: The blue line is the soil stability line for the specific Clay/ CCR group of the soil profile. This is set as a relatively conservative value. It is consistent with ANZECC & ARMCANZ (2000) and other Irrigation water guidelines. See the **Background and Theory** section for more details.

Input

Boxes shaded in orange provide a unit option choice.

Profile 1

Site Name/No. & water 1Cl(Ck) Rainfall - No irrigation

Choose unit

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	6.6	1.18	0.025	0.9	1.18	5	0.319	2.3	3.9	8.6	0.003
2	0.3	8.1	1.12	0.028	0.5	1.12	5	0.247	3.1	3.8	8.3	0.004
3	0.6	10.1	0.94	0.111	1.2	0.94	15	0.214	3.3	3.7	8.2	0.004
4	0.9	12.6	0.61	2.82	48	0.61	170	0.365	5.8	4.4	9.7	0.003
5												
6												
7												
8												
9												
10												
11												
12												

Profile 1 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m	9.4	1.0	
Top 0.3m	7.4	1.2	
Top 0.1m	6.6	1.2	

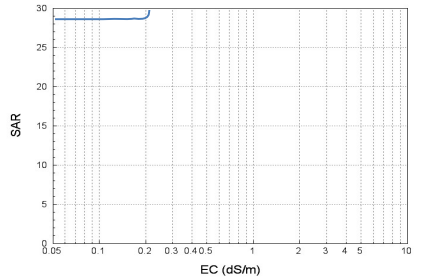
Confidence#	Very Low
LFr	0.054
Ddr *(mm/yr)*	23.3
LF i+r	0.070
Ddi+r *(mm/yr)*	30
Ddi+r/Ddr *(ratio)*	1
ECs of Ddr *(dS/m)*	0.56
ECse of Ddr *(dS/m)*	0.25
ECs of Ddi+r *(dS/m)*	0.4
ECse of Ddi+r *(dS/m)*	0.2
ESP 0.9m adj i+r	0.2
ESP 0.9m i+r adj Ca	-1.1
Av CCR	ESP*
0.10	48
0.16	0.5
0.18	0.9

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca

Uses original soil input ESP at 0.9 m

ESP 0.9	SAR	SAR adj Ca
0.054		
23.3		
0.070		
30		
1		
0.56		
0.25		
0.4		
0.2		
0.2		
-1.1		
*ESP value adjacent is input data at nominated soil depth not an average		



Plant yield %: Cotton 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Profile 2

Site Name/No. & water 2Cl(Ck) Rainfall - No irrigation

Choose unit

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	3.3	0.92	0.02	0.6	0.03	7	0.272	1.5	0.2	0.5	0.060
2	0.3	5.2	0.54	0.02	1.1	0.011	5	0.121	1.5	0.1	0.2	0.123
3	0.6	5.3	0.62	0.02	0.6	0.01	6	0.138	1.7	0.1	0.3	0.120
4	0.9	3.6	0.4	0.02	<0.2	0.01	5	0.134	1.9	0.1	0.2	0.130
5	1.2	3.6	0.43	0.02	1.1	0.01	10	0.128	1.8	0.1	0.3	0.092
6	1.5	3.3	0.57	0.02	1.7	0.01	8	0.166	1.8	0.1	0.3	0.105
7	1.8	4.9	0.52	0.02	0.3	0.01	5	0.168	2.2	0.1	0.2	0.130
8												
9												
10												
11												
12												

Profile 2 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*			
ECse wuw RZ *(dS/m)*			
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r			
SAR Ddi+r adj Ca			
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m	4.4	0.6	
Top 0.3m	4.3	0.7	
Top 0.1m	3.3	0.9	

Confidence#	Very Low
LFr	
Ddr *(mm/yr)*	
LF i+r	
Ddi+r *(mm/yr)*	
Ddi+r/Ddr *(ratio)*	
ECs of Ddr *(dS/m)*	
ECse of Ddr *(dS/m)*	
ECs of Ddi+r *(dS/m)*	
ESP 0.9m adj i+r	
ESP 0.9m i+r adj Ca	
Av CCR	ESP*
0.14	5
0.17	1.1
0.28	0.6

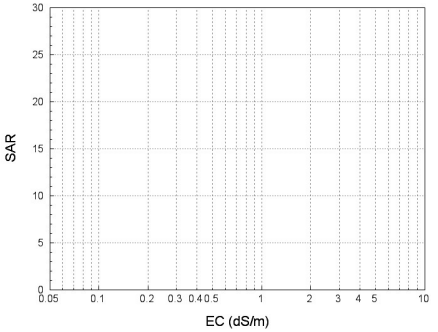
LF value is considered too high, click here for more detail

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca

Uses original soil input ESP at 0.9 m

ESP 0.9	SAR	SAR adj Ca
*ESP value adjacent is input data at nominated soil depth not an average		



Plant yield %: Cotton

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Profile 3

Site Name/No. & water 3Cl(Ck) Rainfall - No irrigation

Choose unit

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	8.4	0.76	0.187	1.8	0.055	32	0.314	3.1	0.6	1.2	0.024
2	0.3	11.7	1.13	0.15	2	0.016	20	0.286	3.4	0.3	0.6	0.054
3	0.6	16.3	1.42	3.8	37	0.23	210	0.6	8.2	2.6	5.7	0.005
4												
5												
6												
7												
8												
9												
10												
11												
12												

Profile 3 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m	12.1	1.1	
Top 0.3m	10.1	0.9	
Top 0.1m	8.4	0.8	

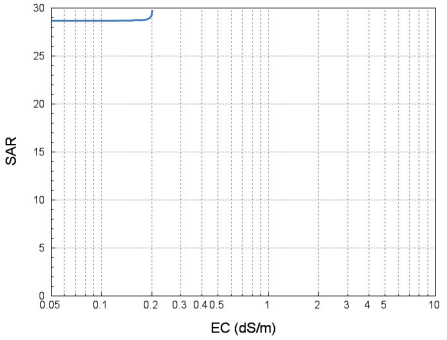
Confidence#	Very Low
LFr	0.055
Ddr *(mm/yr)*	23.9
LF i+r	0.072
Ddi+r *(mm/yr)*	31
Ddi+r/Ddr *(ratio)*	1
ECs of Ddr *(dS/m)*	0.54
ECse of Ddr *(dS/m)*	0.25
ECs of Ddi+r *(dS/m)*	0.4
ECse of Ddi+r *(dS/m)*	0.2
ESP 0.9m adj i+r	0.2
ESP 0.9m i+r adj Ca	-1.2
Av CCR	ESP*
0.09	37
0.09	2
0.09	1.8

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca

Uses original soil input ESP at 0.9 m

ESP 0.9	SAR	SAR adj Ca
0.055		
23.9		
0.072		
31		
1		
0.54		
0.25		
0.4		
0.2		
0.2		
-1.2		
*ESP value adjacent is input data at nominated soil depth not an average		



Plant yield %: Cotton 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

see **Abbreviations & Glossary**. If confidence is very low or low, could check result for nearest clay / CCR group (by altering soil clay % and / or CEC) for an alternative estimate.

The predicted LF and Dd is considered very high with a predicted value of ≥ 0.8. This is most probably unrealistic.

This can be caused by a combination of:

- A sandy textured soil which is too responsive to the electrolyte concentration adjustment used in the model based on the higher clay content soil groups. This is a current known limitation of SALF2
- Low confidence of the predictive relationships for this particular clay / CCR soil group (see confidence rating shown above the results in columns U and V).
- High annual irrigation amounts being applied.

Options

- Use an adjacent clay /CCR group by changing the soil input clay % and/or CEC for the whole profile depth to fit into the adjacent soil group with a higher confidence rating. The soil clay / CCR groups and their confidences can be found in the **Abbreviations and Glossary** tab accessed from the front page of SALF2.

Printed on 29/03/2026

SOIL WATER PARAMETERS

Version Number 2.2.2a 11 February 2022

Link to Abbreviations and Glossary

Return to Front Page

Calculates field estimates of soil water properties, bulk density and plant available water capacity

Steps

1. The same soil properties in the PREDICTIVE CALCULATOR are copied to this calculator. If the properties have not been entered into the PREDICTIVE CALCULATOR go to that page and enter the data.
2. To use the PAWCER model for PAWC, enter coarse sand and fine sand for each soil in the green columns below.
3. For estimates of soil profile PAWC, read off the cumulative PAWC for the root zone depth of interest.

Choose a unit for PAWC results: mm or cm *mm*

Site Name/No. & water

1Cl(Ck)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	6.6	1.18	0.03	0.9	1.18	5	0.319	2.3	43.1	47.1
2	0.3	8.1	1.12	0.03	0.5	1.12	5	0.247	3.1	38.8	49.8
3	0.6	10.1	0.94	0.11	1.2	0.94	15	0.214	3.3	33.6	51.6
4	0.9	12.6	0.61	2.82	48	0.61	170	0.365	5.8	30.3	33.1
5											
6											
7											
8											
9											
10											
11											
12											

Site Name/No. & water

2Cl(Ck)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	3.3	0.92	0.02	0.6	0.03	7	0.272	1.5	40.4	52.8
2	0.3	5.2	0.54	0.02	1.1	0.011	5	0.121	1.5	36.7	56.3
3	0.6	5.3	0.62	0.02	0.6	0.01	6	0.138	1.7	39.1	54.6
4	0.9	3.6	0.4	0.02		0.01	5	0.134	1.9	40.6	52.7
5	1.2	3.6	0.43	0.02	1.1	0.01	10	0.128	1.8	41.4	49.6
6	1.5	3.3	0.57	0.02	1.7	0.01	8	0.166	1.8	41	53
7	1.8	4.9	0.52	0.02	0.3	0.01	5	0.168	2.2	38.4	55
8											
9											
10											
11											
12											

Site Name/No. & water

3Cl(Ck)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	8.4	0.76	0.187	1.8	0.055	32	0.314	3.1	13.2	71.5
2	0.3	11.7	1.13	0.15	2	0.016	20	0.286	3.4	25.6	60
3	0.6	16.3	1.42	3.8	37	0.23	210	0.6	8.2	25.6	45.5
4											
5											
6											
7											
8											
9											
10											
11											
12											

RESULTS

A convergent approach is used to estimate field soil water parameters from various input soil properties. Variation in results from the different surrogate properties is expected due to the range of soils the algorithms were derived from and the soil measurement techniques used. Choose the values considered most realistic or accept the average values.

PAWC in the last 3 columns of results for each soil is interpolated up to 1m soil depth except for PAWCER which is to 1.2m soil depth. Interpolation between depths is limited to gaps of up to and including 0.34m. You can manually add interim depths in the Predictive Calculator if gaps are greater than 0.34m (Equation E40A).

All the results below are calculated values except for ADMC &/or 15000kPa which are copied from the input data if they are present.

Site Name/Number

1Cl(Ck)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth (m)	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.319	1.5	0.5	0.9	2.3	32.4	34.4	9.0	12.7	8.3	8.9	9.7	2.3	1812	13.4	0.8	12.9	1699	20.5	5.4	13.2	1687	13.1	0.1	13.4	20.5	13.1
2	0.3	0.247	1.5	0.5	1.0	3.1	32.0	34.4	8.8	12.7	9.3	9.4	10.0	3.1	1804	12.5	2.0	9.9	1810	14.2	5.3	9.4	1829	7.5	0.2	26.4	37.9	23.5
3	0.6	0.214	1.5	0.5	1.1	3.3	31.7	34.2	8.7	12.6	9.5	10.1	10.2	3.3	1801	12.5	2.9	6.5	1953	7.1	4.1	6.1	1973	3.8	0.3	38.9	52.1	31.0
4	0.9	0.365	1.4	1.1	1.3	5.8	32.7	33.8	9.2	12.4	12.6	11.0	11.3	5.8	1768	9.7	6.1	9.0	1857	5.4	5.5	7.2	1929	3.4	0.4	51.4	64.0	37.2
5																									0.5	63.9	73.4	42.3
6																									0.6	76.4	80.5	46.1
7																									0.7	87.9	87.0	49.8
8																									0.8	98.6	93.0	53.3
9																									0.9	108.3	98.4	56.7
10																									1.0	117.2	103.2	59.9
11																									1.1			
12																									1.2			

Site Name/Number

2Cl(Ck)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.272	1.5	0.5	0.7	1.5	32.1	34.2	8.9	12.6	7.3	7.8	9.1	1.5	1826	13.9	0.0	11.8	1727	20.5	4.9	12.4	1706	12.8	0.1	13.9	20.5	12.8
2	0.3	0.121	1.4	0.5	0.8	1.5	31.1	33.8	8.4	12.4	7.3	8.4	9.1	1.5	1831	14.0	0.4	7.8	1884	14.0	3.8	7.7	1888	7.3	0.2	27.9	37.7	22.8
3	0.6	0.138	1.4	0.5	0.8	1.7	31.2	33.8	8.5	12.4	7.6	8.4	9.2	1.7	1828	13.8	1.3	4.4	2035	6.5	2.6	4.4	2038	3.5	0.3	41.9	51.7	30.2
4	0.9	0.134	1.4	0.5	0.7	1.9	31.2	33.6	8.5	12.4	7.8	7.9	9.1	1.9	1827	13.2	2.1	3.9	2054	3.7	1.4	3.1	2099	3.4	0.4	55.8	63.1	36.2
5	1.2	0.128	1.4	0.5	0.7	1.8	31.2	33.7	8.4	12.4	7.7	7.9	9.1	1.8	1829										0.5	69.6	72.1	41.0
6	1.5	0.166	1.4	0.5	0.7	1.8	31.4	33.8	8.6	12.4	7.7	7.8	9.1	1.8	1827										0.6	83.4	78.5	44.6
7	1.8	0.168	1.4	0.5	0.8	2.2	31.4	33.7	8.6	12.4	8.2	8.3	9.4	2.2	1821										0.7	96.9	84.1	48.1
8																									0.8	110.3	88.7	51.5
9																									0.9	123.5	92.5	55.0
10																									1.0	136.8	97.1	59.0
11																									1.1			63.6
12																									1.2			68.8

Site Name/Number

3Cl(Ck)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.314	1.5	0.5	1.0	3.1	32.4	34.0	9.0	12.5	9.3	9.5	10.1	3.1	1803	12.6	1.6	13.9	1670	20.6	6.1	14.0	1665	13.2	0.1	12.6	20.6	13.2
2	0.3	0.286	1.5	0.5	1.2	3.4	32.2	34.4	8.9	12.7	9.7	10.7	10.5	3.4	1796	12.7	2.3	10.3	1804	14.3	5.3	9.7	1825	8.0	0.2	25.2	38.0	23.8
3	0.6	0.6	1.6	2.1	1.6	8.2	34.3	34.7	9.9	12.8	15.6	12.5	12.7	8.2	1729	7.7	7.8	12.8	1725	8.6	8.9	11.4	1775	4.4	0.3	37.9	52.3	31.8
4																									0.4	49.0	64.7	38.5
5																									0.5	58.4	75.2	44.1
6																									0.6	66.1	83.8	48.5
7																									0.7			
8																									0.8			
9																									0.9			
10																									1.0			
11																									1.1			
12																									1.2			

Printed on 29/03/2026

PREDICTIVE CALCULATOR

Version Number 2.2.2a 11 February 2022 Return to Front Page Link to Abbreviations and Glossary

Calculates soil leaching, rootzone salinity and sodicity, plant yield, deep drainage to groundwater and gypsum requirement for soil surface stability

WATER AND SOIL SELECTION

Put letter Y in **ONE** box for the irrigation water selected for each soil, your data from the Quick Calculator page will be transferred across.

Sample	Water description	Soil 1	Soil 2	Soil 3
1	Yelarbon bore			
2	Burd 12001253 11/93			
3	14310218			
4	Tenthill 14320222			
5	Rainfall - No irrigation	y	y	y

Plant type Eggplant

Choose plant from drop down list in green box. If a user-defined plant has been added it will appear at the bottom of the list.

STEPS

1 Water analysis and rainfall are copied from QUICK CALCULATOR

2 Input clay content, CEC and either ESP or Exchangeable Na soil properties, for up to 3 sites and the depth increment of the analysis up to 12 depth increments. The method of analysis for CEC and ESP is important. The quick method using NH_4Cl in soils with moderate to high EC and pH >7 will give misleading results. See BACKGROUND AND THEORY

3 Input of EC and Cl on a 1:5 suspension (choose applicable units) will allow conversion of $EC_{1:5}$ to EC_{se} and EC_e. If ADMC and/or 1500 kPa values are available they will be used otherwise conversions based on clay and CEC are used. ADMC is the water content between 40°C and 105°C, see ABBREVIATIONS AND GLOSSARY

4 Where sampled depth increments are greater than 0.1m, enter the value for all 0.1m increments within that sampled depth range. Gaps in depth increments > 0.6m are not interpolated by the program.

Note: Results for ESP 0.1m & ESP 0.1m adj SAR are calculated directly from the water analysis

The water data in this section is copied over from the Quick Calculator based on the profile chosen on the left (green shaded boxes).

Water sample	Water description	EC i	EC i+r	SAR	SAR adj Ca	RA	Rainfall (mm/yr)	Irrigation (mm/yr)	Ca	Mg	Na	HCO3	Cl	SO4	ESP 0-0.1m	SAR adj Ca ESP 0-0.1m
1	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
2	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
3	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1

Graphs: The blue line is the soil stability line for the specific Clay/ CCR group of the soil profile. This is set as a relatively conservative value. It is consistent with ANZECC & ARMCANZ (2000) and other Irrigation water guidelines. See the **Background and Theory** section for more details.

Input

Boxes shaded in orange provide a unit option choice.

Profile 1

Site Name/No. & water: 4Cl(Ck) — Rainfall - No irrigation

Choose unit: % | cmolc/kg | % | dS/m | mg/kg | % | % | dS/m | dS/m |

Depth Increment Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	7.2	0.43	0.277	8.2	0.023	14	0.244	2.6	0.3	0.6	0.054
2	0.3	10.1	0.58	0.424	14	0.039	28	0.262	3.3	0.4	1.0	0.030
3	0.6	9.4	0.56	2.09	44	0.22	240	0.389	5.9	2.8	6.2	0.005
4	0.75	15.9	0.55	4.97	62	0.24	500	0.503	7.9	4.3	9.6	0.003
5												
6												
7												
8												
9												
10												
11												
12												

Profile 1 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		

	Av clay *(%)*	Av CEC *(cmolc/kg)*
Full profile to 0.9m	10.7	0.5
Top 0.3m	8.7	0.5
Top 0.1m	7.2	0.4

Confidence#	Very Low
LFr	0.053
Ddr *(mm/yr)*	22.7
LF i+r	0.068
Ddi+r *(mm/yr)*	30
Ddi+r/Ddr *(ratio)*	1
ECs of Ddr *(dS/m)*	0.57
ECse of Ddr *(dS/m)*	0.26
ECs of Ddi+r *(dS/m)*	0.4
ECse of Ddi+r *(dS/m)*	0.2
ESP 0.9m adj i+r	0.2
ESP 0.9m i+r adj Ca	-1.1

Av CCR	ESP*
0.05	62
0.06	14
0.06	8.2

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

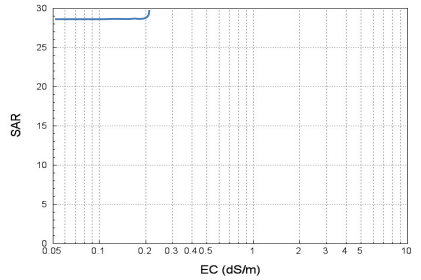
ESP 0.9	SAR	SAR adj Ca
0.053		
22.7		
0.068		
30		
1		
0.57		
0.26		
0.4		
0.2		
0.2		
-1.1		

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca
0.053		
22.7		
0.068		
30		
1		
0.57		
0.26		
0.4		
0.2		
0.2		
-1.1		

*ESP value adjacent is input data at nominated soil depth not an average



Plant yield %: Eggplant 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Profile 2

Site Name/No. & water: 5Cl(Nm) — Rainfall - No irrigation

Choose unit: % | cmolc/kg | % | dS/m | mg/kg | % | % | dS/m | dS/m |

Depth Increment Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	11.6	0.8	0.028	0.8	0.01	10	0.227	3.1	0.1	0.3	0.094
2	0.2	9.7	0.54	0.086	0.6	0.01	20	0.212	2.8	0.2	0.5	0.060
3	0.35	4.4	0.45	0.166	2.2	0.018	11	0.225	2.3	0.2	0.4	0.069
4												
5												
6												
7												
8												
9												
10												
11												
12												

Profile 2 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		

	Av clay *(%)*	Av CEC *(cmolc/kg)*
Full profile to 0.9m	8.6	0.6
Top 0.3m	10.7	0.7
Top 0.1m	11.6	0.8

Confidence#	Very Low
LFr	0.073
Ddr *(mm/yr)*	31.5
LF i+r	0.095
Ddi+r *(mm/yr)*	41
Ddi+r/Ddr *(ratio)*	1
ECs of Ddr *(dS/m)*	0.41
ECse of Ddr *(dS/m)*	0.19
ECs of Ddi+r *(dS/m)*	0.3
ECse of Ddi+r *(dS/m)*	0.1
ESP 0.9m adj i+r	0.1
ESP 0.9m i+r adj Ca	-1.2

Av CCR	ESP*
0.07	2.2
0.06	0.6
0.07	0.8

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

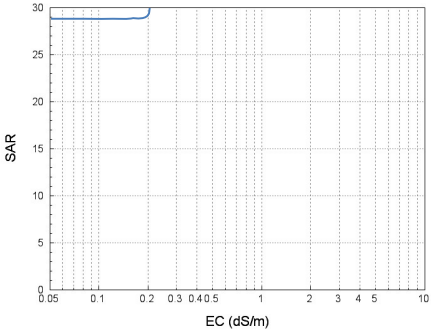
ESP 0.9	SAR	SAR adj Ca
0.073		
31.5		
0.095		
41		
1		
0.41		
0.19		
0.3		
0.1		
0.1		
-1.2		

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca
0.073		
31.5		
0.095		
41		
1		
0.41		
0.19		
0.3		
0.1		
0.1		
-1.2		

*ESP value adjacent is input data at nominated soil depth not an average



Plant yield %: Eggplant 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Profile 3

Site Name/No. & water: 6Cl(El) — Rainfall - No irrigation

Choose unit: % | cmolc/kg | % | dS/m | mg/kg | % | % | dS/m | dS/m |

Depth Increment Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	9.7	1.4	0.02	0.2	0.016	5	0.26	3.6	0.1	0.3	0.101
2	0.3	13.9	1.13	0.02	0.4	0.01	9	0.219	4.2	0.1	0.3	0.100
3	0.6	20.3	1.35	0.048	<0.2	0.063	6	0.326	6.2	0.4	0.8	0.038
4	0.9	25	1.05	0.11	1.3	0.01	11	0.378	7	0.1	0.3	0.092
5	1.2	23.2	1.04	0.292	4.7	0.026	29	0.424	6.7	0.4	0.8	0.037
6	1.5	10	1.04	0.314	1.8	0.11	33	0.458	5	0.8	1.9	0.016
7	1.8	22	1.02	1.93	32	0.10	96	0.399	8.4	1.2	2.7	0.011
8												
9												
10												
11												
12												

Profile 3 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		

	Av clay *(%)*	Av CEC *(cmolc/kg)*
Full profile to 0.9m	17.2	1.2
Top 0.3m	11.8	1.3
Top 0.1m	9.7	1.4

Confidence#	Low
LFr	0.055
Ddr *(mm/yr)*	23.6
LF i+r	0.071
Ddi+r *(mm/yr)*	31
Ddi+r/Ddr *(ratio)*	1
ECs of Ddr *(dS/m)*	0.55
ECse of Ddr *(dS/m)*	0.25
ECs of Ddi+r *(dS/m)*	0.4
ECse of Ddi+r *(dS/m)*	0.2
ESP 0.9m adj i+r	0.2
ESP 0.9m i+r adj Ca	-1.2

Av CCR	ESP*
0.07	1.3
0.11	0.4
0.14	0.2

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

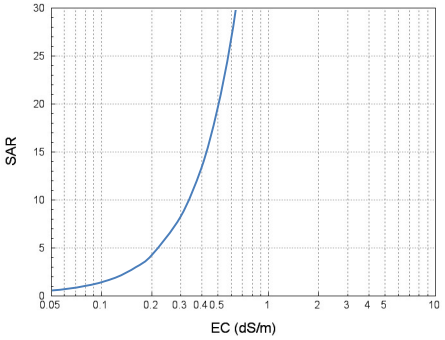
ESP 0.9	SAR	SAR adj Ca
0.055		
23.6		
0.071		
31		
1		
0.55		
0.25		
0.4		
0.2		
0.2		
-1.2		

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

ESP 0.9	SAR	SAR adj Ca
0.055		
23.6		
0.071		
31		
1		
0.55		
0.25		
0.4		
0.2		
0.2		
-1.2		

*ESP value adjacent is input data at nominated soil depth not an average



Plant yield %: Eggplant 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

see **Abbreviations & Glossary**. If confidence is very low or low, could check result for nearest clay / CCR group (by altering soil clay % and / or CEC) for an alternative estimate.

The predicted LF and Dd is considered very high with a predicted value of ≥ 0.8. This is most probably unrealistic.

This can be caused by a combination of:

- A sandy textured soil which is too responsive to the electrolyte concentration adjustment used in the model based on the higher clay content soil groups. This is a current known limitation of SALF2
- Low confidence of the predictive relationships for this particular clay / CCR soil group (see confidence rating shown above the results in columns U and V).
- High annual irrigation amounts being applied.

Options

- Use an adjacent clay /CCR group by changing the soil input clay % and/or CEC for the whole profile depth to fit into the adjacent soil group with a higher confidence rating. The soil clay / CCR groups and their confidences can be found in the **Abbreviations and Glossary** tab accessed from the front page of SALF2.

Printed on 29/03/2026

SOIL WATER PARAMETERS

Version Number 2.2.2a 11 February 2022

Link to Abbreviations and Glossary

Return to Front Page

Calculates field estimates of soil water properties, bulk density and plant available water capacity

Steps

1. The same soil properties in the PREDICTIVE CALCULATOR are copied to this calculator. If the properties have not been entered into the PREDICTIVE CALCULATOR go to that page and enter the data.
2. To use the PAWCER model for PAWC, enter coarse sand and fine sand for each soil in the green columns below.
3. For estimates of soil profile PAWC, read off the cumulative PAWC for the root zone depth of interest.

Choose a unit for PAWC results: mm or cm *mm*

Site Name/No. & water

4Cl(Ck)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	7.2	0.43	0.28	8.2	0.023	14	0.244	2.6	54.6	36.8
2	0.3	10.1	0.58	0.42	14	0.039	28	0.262	3.3	33.3	50.5
3	0.6	9.4	0.56	2.09	44	0.22	240	0.389	5.9	27.7	38.9
4	0.75	15.9	0.55	4.97	62	0.24	500	0.503	7.9	27.3	27.6
5											
6											
7											
8											
9											
10											
11											
12											

Site Name/No. & water

5Cl(Nm)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	11.6	0.8	0.03	0.8	0.01	10	0.227	3.1	41.5	43.1
2	0.2	9.7	0.54	0.09	0.6	0.01	20	0.212	2.8	45.7	36
3	0.35	4.4	0.45	0.17	2.2	0.018	11	0.225	2.3	42.7	17.1
4											
5											
6											
7											
8											
9											
10											
11											
12											

Site Name/No. & water

6Cl(El)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	9.7	1.4	0.02	0.2	0.016	5	0.26	3.6	62.7	24.4
2	0.3	13.9	1.13	0.02	0.4	0.01	9	0.219	4.2	58.6	25
3	0.6	20.3	1.35	0.048		0.063	6	0.326	6.2	54.8	21.8
4	0.9	25	1.05	0.11	1.3	0.01	11	0.378	7	52.2	20.9
5	1.2	23.2	1.04	0.292	4.7	0.026	29	0.424	6.7	52.5	22.4
6	1.5	10	1.04	0.314	1.8	0.11	33	0.458	5	31.9	9.3
7	1.8	22	1.02	1.93	32	0.097	96	0.399	8.4	50.6	13.2
8											
9											
10											
11											
12											

RESULTS

A convergent approach is used to estimate field soil water parameters from various input soil properties. Variation in results from the different surrogate properties is expected due to the range of soils the algorithms were derived from and the soil measurement techniques used. Choose the values considered most realistic or accept the average values.

PAWC in the last 3 columns of results for each soil is interpolated up to 1m soil depth except for PAWCER which is to 1.2m soil depth. Interpolation between depths is limited to gaps of up to and including 0.34m. You can manually add interim depths in the Predictive Calculator if gaps are greater than 0.34m (Equation E40A).

All the results below are calculated values except for ADMC &/or 15000kPa which are copied from the input data if they are present.

Site Name/Number

4Cl(Ck)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth (m)	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.244	1.4	0.5	0.9	2.6	31.9	33.7	8.8	12.4	8.7	9.1	9.7	2.6	1813	12.9	1.1	13.2	1688	20.5	5.7	13.6	1677	13.2	0.1	12.9	20.5	13.2
2	0.3	0.262	1.4	0.5	1.1	3.3	32.1	33.8	8.8	12.4	9.5	10.1	10.2	3.3	1802	12.5	2.2	10.1	1805	14.3	5.3	9.6	1827	7.7	0.2	25.6	38.0	23.7
3	0.6	0.389	1.4	1.1	1.1	5.9	32.9	33.8	9.2	12.4	12.7	9.8	11.1	5.9	1769	9.1	5.5	9.8	1815	7.9	6.8	8.7	1858	3.6	0.3	38.1	52.2	31.4
4	0.75	0.503	1.4	1.9	1.6	7.9	33.6	33.8	9.6	12.4	15.2	12.3	12.4	7.9	1738	7.8	7.8	11.7	1763	6.8	8.1	10.1	1821	3.6	0.4	50.6	66.5	39.1
5																									0.5	59.7	74.4	42.8
6																									0.6	68.8	82.3	46.4
7																									0.7	77.3	89.6	50.0
8																									0.8	85.0	96.4	53.7
9																									0.9	92.8	103.1	57.3
10																									1.0	100.6	109.9	60.9
11																									1.1			
12																									1.2			

Site Name/Number

5Cl(Nm)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.227	1.5	0.5	1.2	3.1	31.8	34.0	8.7	12.5	9.3	10.6	10.3	3.1	1803	13.0	1.6	13.9	1677	20.7	5.8	14.1	1671	13.8	0.1	13.0	20.7	13.8
2	0.2	0.212	1.4	0.5	1.1	2.8	31.7	33.8	8.7	12.4	8.9	9.9	10.0	2.8	1809	13.0	1.5	11.3	1760	17.3	5.3	11.0	1771	10.2	0.2	26.0	38.0	24.0
3	0.35	0.225	1.4	0.5	0.7	2.3	31.8	33.7	8.7	12.4	8.3	8.1	9.4	2.3	1819	12.9	1.3	8.0	1873	12.6	4.5	7.5	1894	5.8	0.3	38.9	52.9	32.0
4																									0.4	51.8	65.5	37.8
5																									0.5	64.7	78.1	43.7
6																									0.6			
7																									0.7			
8																									0.8			
9																									0.9			
10																									1.0			
11																									1.1			
12																									1.2			

Site Name/Number

6Cl(El)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.26	1.6	0.5	1.1	3.6	32.0	34.7	8.8	12.8	9.9	9.9	10.4	3.6	1795	12.1	2.1	14.5	1652	20.6	6.5	14.6	1650	13.4	0.1	12.1	20.6	13.4
2	0.3	0.219	1.5	0.5	1.4	4.2	31.8	34.4	8.7	12.7	10.6	11.5	10.9	4.2	1787	11.9	3.1	11.3	1772	14.5	6.0	10.6	1798	8.2	0.2	24.2	38.1	24.2
3	0.6	0.326	1.5	1.2	2.1	6.2	32.5	34.6	9.0	12.8	13.1	14.1	12.3	6.2	1753	10.6	5.8	10.2	1827	8.1	6.8	9.3	1862	4.7	0.3	36.1	52.6	32.4
4	0.9	0.378	1.5	1.6	2.6	7	32.8	34.3	9.2	12.6	14.1	16.2	13.0	7	1737	10.5	7.3	10.5	1828	5.9	6.8	8.9	1893	3.8	0.4	47.6	64.9	39.4
5	1.2	0.424	1.5	1.4	2.4	6.7	33.1	34.3	9.3	12.6	13.7	15.4	12.8	6.7	1742										0.5	58.7	75.1	45.3
6	1.5	0.458	1.5	0.7	1.1	5	33.3	34.3	9.5	12.6	11.6	10.0	10.9	5	1775										0.6	69.3	83.2	50.1
7	1.8	0.399	1.5	2.2	2.2	8.4	33.0	34.3	9.3	12.6	15.8	14.9	13.1	8.4	1726										0.7	79.9	90.6	54.5
8																									0.8	90.4	97.2	58.7
9																									0.9	100.9	103.1	62.5
10																									1.0	111.4	109.8	66.4
11																									1.1			70.4
12																									1.2			74.4

Printed on 29/03/2026

PREDICTIVE CALCULATOR

Version Number 2.2.2a 11 February 2022 Return to Front Page Link to Abbreviations and Glossary

Calculates soil leaching, rootzone salinity and sodicity, plant yield, deep drainage to groundwater and gypsum requirement for soil surface stability

WATER AND SOIL SELECTION

Put letter Y in **ONE** box for the irrigation water selected for each soil, your data from the Quick Calculator page will be transferred across.

Sample	Water description	Soil 1	Soil 2	Soil 3
1	Yelarbon bore			
2	Burd 12001253 11/93			
3	14310218			
4	Tenthill 14320222			
5	Rainfall - No irrigation	y	y	y

Plant type Tomato

Choose plant from drop down list in green box. If a user-defined plant has been added it will appear at the bottom of the list.

STEPS

1 Water analysis and rainfall are copied from QUICK CALCULATOR

2 Input clay content, CEC and either ESP or Exchangeable Na soil properties, for up to 3 sites and the depth increment of the analysis up to 12 depth increments. The method of analysis for CEC and ESP is important. The quick method using NH_4Cl in soils with moderate to high EC and pH >7 will give misleading results. See BACKGROUND AND THEORY

3 Input of EC and Cl on a 1:5 suspension (choose applicable units) will allow conversion of $EC_{1:5}$ to EC_{se} and EC_s. If ADMC and/or 1500 kPa values are available they will be used otherwise conversions based on clay and CEC are used. ADMC is the water content between 40°C and 105°C, see ABBREVIATIONS AND GLOSSARY

4 Where sampled depth increments are greater than 0.1m, enter the value for all 0.1m increments within that sampled depth range. Gaps in depth increments > 0.6m are not interpolated by the program.

Note: Results for ESP 0.1m & ESP 0.1m adj SAR are calculated directly from the water analysis

The water data in this section is copied over from the Quick Calculator based on the profile chosen on the left (green shaded boxes).

Water sample	Water description	EC i	EC i+r	SAR	SAR adj Ca	RA	Rainfall (mm/yr)	Irrigation (mm/yr)	Ca	Mg	Na	HCO3	Cl	SO4	ESP 0-0.1m	SAR adj Ca ESP 0-0.1m
1	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
2	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1
3	Rainfall - No irrigation	0.03	0.03	1	0.1	0	432	0	0.04	0.02	0.09	0.01	0.10	0.06	<0.1	<0.1

Graphs: The blue line is the soil stability line for the specific Clay/ CCR group of the soil profile. This is set as a relatively conservative value. It is consistent with ANZECC & ARMCANZ (2000) and other Irrigation water guidelines. See the **Background and Theory** section for more details.

Input

Boxes shaded in orange provide a unit option choice.

Profile 1

Site Name/No. & water: 7Cl(Nm) | Rainfall - No irrigation

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
						Choose unit						
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1	0.1	7.5	1.96	0.071	0.3	0.2	8	0.322	3.7	0.9	2.1	0.015
2	0.15	9.1	1.28	0.329	2.9	0.052	35	0.336	3.8	0.6	1.2	0.024
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Profile 1 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*	0.1		
ECse wuw RZ *(dS/m)*	0.0		
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r	1		
SAR Ddi+r adj Ca	0		
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m	8.3	1.6	
Top 0.3m	8.3	1.6	
Top 0.1m	7.5	2.0	

Plant yield %: Tomato 100

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

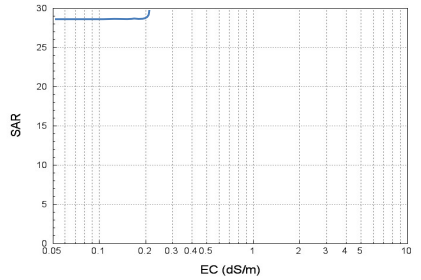
Equilibrium values under long term irrigation by iterative solution using irrigation water by:

Confidence#	Very Low	ESP 0.9	SAR	SAR adj Ca
LFr		0.071		
Ddr *(mm/yr)*		30.7		
LF i+r		0.092		
Ddi+r *(mm/yr)*		40		
Ddi+r/Ddr *(ratio)*		1		
ECs of Ddr *(dS/m)*		0.42		
ECse of Ddr *(dS/m)*		0.19		
ECs of Ddi+r *(dS/m)*		0.3		
ECse of Ddi+r *(dS/m)*		0.1		
ESP 0.9m adj i+r		0.1		
ESP 0.9m i+r adj Ca		-1.2		
Av CCR	ESP*			
0.20	2.9			
0.20	2.9			
0.26	0.3			

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

*ESP value adjacent is input data at nominated soil depth not an average



Profile 2

Site Name/No. & water: Rainfall - No irrigation

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
						Choose unit						
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Profile 2 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*			
ECse wuw RZ *(dS/m)*			
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r			
SAR Ddi+r adj Ca			
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m			
Top 0.3m			
Top 0.1m			

Plant yield %: Tomato

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

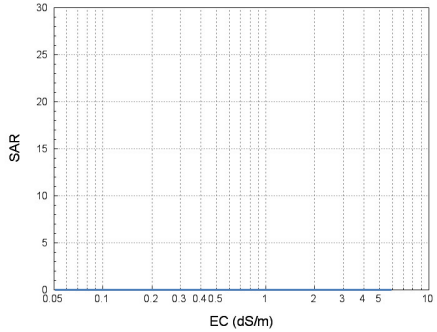
LF value is considered too high, click here for more detail

Confidence#	Low	ESP 0.9	SAR	SAR adj Ca
LFr				
Ddr *(mm/yr)*				
LF i+r				
Ddi+r *(mm/yr)*				
Ddi+r/Ddr *(ratio)*				
ECs of Ddr *(dS/m)*				
ECse of Ddr *(dS/m)*				
ECs of Ddi+r *(dS/m)*				
ECse of Ddi+r *(dS/m)*				
ESP 0.9m adj i+r				
ESP 0.9m i+r adj Ca				
Av CCR	ESP*			

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

*ESP value adjacent is input data at nominated soil depth not an average



Profile 3

Site Name/No. & water: Rainfall - No irrigation

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	dS/m	dS/m	
						Choose unit						
Number	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	ECse	ECs	LF/depth
1												
2												
3												
4												
5												
6												
7												
8												
9												
10												
11												
12												

Profile 3 Results

	ESP 0.9	SAR	SAR adj Ca
ECse av RZ *(dS/m)*			
ECse wuw RZ *(dS/m)*			
Time to EC equil *(years)*	not implemented		
ESP 0.1m *(%)*	0.5		
ESP 0.1m adj Ca *(%)*	0.5		
SAR Ddi+r			
SAR Ddi+r adj Ca			
GR SMH *(t/ha/yr)*	0.0		
GR Oster *(t/ha/yr)*	0.0		
GR SMH ESPadjCa *(t/ha/yr)*	0.0		
GR Oster ESPadjCa *(t/ha/yr)*	0.0		
	Av clay *(%)*	Av CEC *(cmolc/kg)*	
Full profile to 0.9m			
Top 0.3m			
Top 0.1m			

Plant yield %: Tomato

Predicted ECse & ECs maybe underestimated if large quantity of Na_2SO_4 is present.

Where the result indicates "Threshold value used", a Productivity value was not available, see the Plant Salt Tolerance page for details.

GR (gypsum requirement) is calculated to achieve an ESP = 5 in the 0.1m depth

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

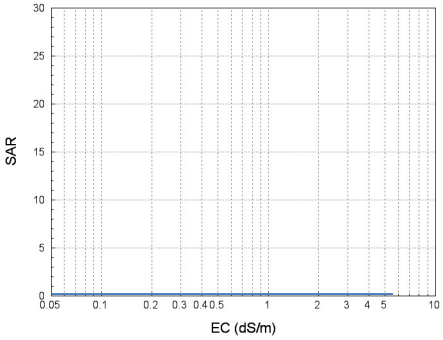
LF value is considered too high, click here for more detail

Confidence#	Low	ESP 0.9	SAR	SAR adj Ca
LFr				
Ddr *(mm/yr)*				
LF i+r				
Ddi+r *(mm/yr)*				
Ddi+r/Ddr *(ratio)*				
ECs of Ddr *(dS/m)*				
ECse of Ddr *(dS/m)*				
ECs of Ddi+r *(dS/m)*				
ECse of Ddi+r *(dS/m)*				
ESP 0.9m adj i+r				
ESP 0.9m i+r adj Ca				
Av CCR	ESP*			

Uses original soil input ESP at 0.9 m

Equilibrium values under long term irrigation by iterative solution using irrigation water by:

*ESP value adjacent is input data at nominated soil depth not an average



see **Abbreviations & Glossary**. If confidence is very low or low, could check result for nearest clay / CCR group (by altering soil clay % and / or CEC) for an alternative estimate.

The predicted LF and Dd is considered very high with a predicted value of ≥ 0.8. This is most probably unrealistic.

This can be caused by a combination of:

- A sandy textured soil which is too responsive to the electrolyte concentration adjustment used in the model based on the higher clay content soil groups. This is a current known limitation of SALF2
- Low confidence of the predictive relationships for this particular clay / CCR soil group (see confidence rating shown above the results in columns U and V).
- High annual irrigation amounts being applied.

Options

- Use an adjacent clay /CCR group by changing the soil input clay % and/or CEC for the whole profile depth to fit into the adjacent soil group with a higher confidence rating. The soil clay / CCR groups and their confidences can be found in the **Abbreviations and Glossary** tab accessed from the front page of SALF2.

Printed on 29/03/2026

SOIL WATER PARAMETERS

Version Number 2.2.2a 11 February 2022

Link to Abbreviations and Glossary

Return to Front Page

Calculates field estimates of soil water properties, bulk density and plant available water capacity

Steps

1 The same soil properties in the PREDICTIVE CALCULATOR are copied to this calculator. If the properties have not been entered into the PREDICTIVE CALCULATOR go to that page and enter the data.

2 To use the PAWCER model for PAWC, enter coarse sand and fine sand for each soil in the green columns below.

3 For estimates of soil profile PAWC, read off the cumulative PAWC for the root zone depth of interest.

Choose a unit for PAWC results: mm or cm *mm*

Site Name/No. & water

7Cl(Nm)

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1	0.1	7.5	1.96	0.07	0.3	0.2	8	0.322	3.7	62.8	25
2	0.15	9.1	1.28	0.33	2.9	0.052	35	0.336	3.8	49.9	24
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Site Name/No. & water

0

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

Site Name/No. & water

0

Depth Increment		%	cmolc/kg		%	dS/m	mg/kg	%	%	%	%
#	Depth (m)	Clay	CEC	Na	ESP	EC 1:5	Cl 1:5	ADMC	1500kPa	CS	FS
1											
2											
3											
4											
5											
6											
7											
8											
9											
10											
11											
12											

RESULTS

A convergent approach is used to estimate field soil water parameters from various input soil properties. Variation in results from the different surrogate properties is expected due to the range of soils the algorithms were derived from and the soil measurement techniques used. Choose the values considered most realistic or accept the average values.

PAWC in the last 3 columns of results for each soil is interpolated up to 1m soil depth except for PAWCER which is to 1.2m soil depth. Interpolation between depths is limited to gaps of up to and including 0.34m. You can manually add interim depths in the Predictive Calculator if gaps are greater than 0.34m (Equation E40A).

All the results below are calculated values except for ADMC &/or 15000kPa which are copied from the input data if they are present.

Site Name/Number

7Cl(Nm)

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth (m)	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1	0.1	0.322	1.6	0.5	0.9	3.7	32.5	35.2	9.0	13.0	10.0	9.2	10.3	3.7	1792	11.8	2.2	14.7	1643	20.5	6.8	14.7	1643	13.0	0.1	11.8	20.5	13.0
2	0.15	0.336	1.5	0.5	1.0	3.8	32.5	34.5	9.1	12.7	10.2	9.7	10.4	3.8	1792	11.9	2.4	13.7	1679	18.9	6.5	13.2	1693	11.3	0.2	23.7	39.4	24.3
3																									0.3			
4																									0.4			
5																									0.5			
6																									0.6			
7																									0.7			
8																									0.8			
9																									0.9			
10																									1.0			
11																									1.1			
12																									1.2			

Site Name/Number

0

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1																									0.1			
2																									0.2			
3																									0.3			
4																									0.4			
5																									0.5			
6																									0.6			
7																									0.7			
8																									0.8			
9																									0.9			
10																									1.0			
11																									1.1			
12																									1.2			

Site Name/Number

0

Depth Increment		ADMC (kg/100kg) calculated from				1500kPa	SP (kg/100kg) from		Wmax (kg/100kg) from					Wmin	BD @ Wmax	PAWC	PAWC (Shaw & Yule)				PAWCER				Depth	Cumulative PAWC (mm/0.1m)		
#	Depth (m)	ADMC	CEC	1500kPa	Clay	(kg/100kg)	AMDC	CEC	ADMC	CEC	1500kPa	Clay	Average	1500kPa	(kg/m3)	mm	Wmin	Wmax	BD	PAWC (mm/0.1m)	LSL	USL	BD	PAWC (mm/0.1m)	Interpolated	Generic	Shaw & Yule	PAWCER
1																									0.1			
2																									0.2			
3																									0.3			
4																									0.4			
5																									0.5			
6																									0.6			
7																									0.7			
8																									0.8			
9																									0.9			
10																									1.0			
11																									1.1			
12																									1.2			

Appendix F Regional Frameworks

14 Suitability Framework for the Gulf Plains area

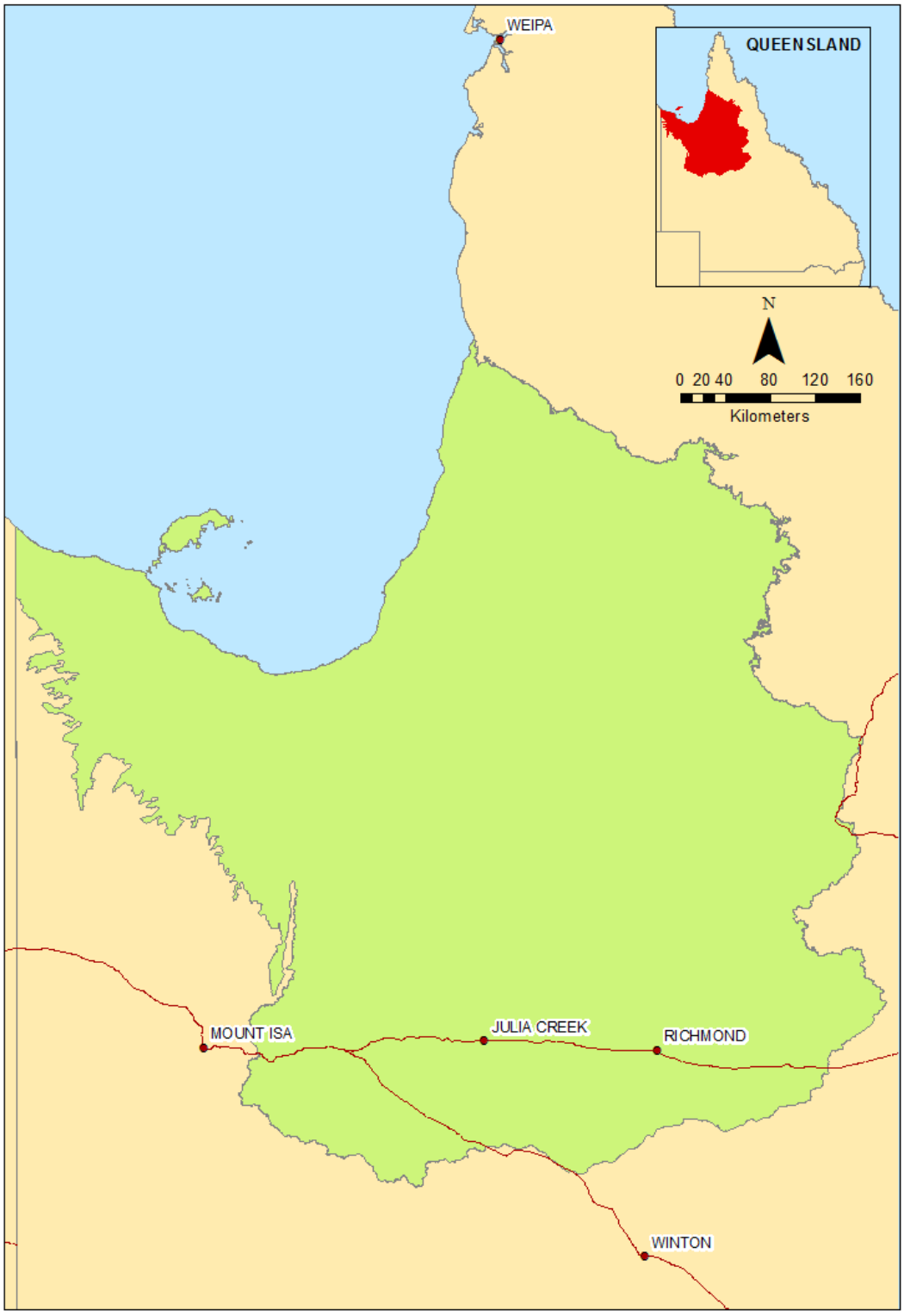


Figure 13. Area covered by the Gulf Plains suitability framework

List of crops

No.	Name	Season (wet, dry, perennial)	Code
1	Cane - furrow	P	Cane_fur
2	Cane - spray	P	Cane_spray
3	Cane - trickle	P	Cane_tric
4	Cotton - furrow	W	Cotton_fur
5	Cotton - spray	W	Cotton_spray
6	Rice-flood	W	Rice_flood
7	Rice-furrow	W	Rice_fur
8	Maize-wet-furrow	W	Maize_wet_fur
9	Maize-wet-spray	W	Maize_wet_spr
10	Sorghum-grain-wet-furrow	W	Sorg_gr_wet_fur
11	Sorghum-grain-wet-spray	W	Sorg_gr_wet_spr
12	Sorghum-grain-dry-furrow	D	Sorg_gr_dry_fur
13	Sorghum-grain-dry-spray	D	Sorghum_gr_dry_spr
14	Millet-wet-furrow	W	Millet_wet_fur
15	Millet-wet-spray	W	Millet_wet_spr
16	Sunflower - furrow	W	Sunflwr_fur
17	Sunflower-wet-spray	W	Sunflwr_wet_spr
18	Oats-dry-furrow	D	Oats_dry_fur
19	Oats-dry-spray	D	Oats-dry-spr
20	Sorghum-forage-wet-spray	W	Sorg_forg_wet_spr
21	Sorghum-forage-dry-spray	D	Sorg_forg_dry_spr
22	Rhodes grass-wet-spray	P	Rhodes_wet_spray
23	Lablab-wet-furrow	W	Lablab_wet_fur
24	Lablab-spray	W	Lablab_spray
25	Lucerne-wet-spray	P	Lucerne_wet_spray
26	Chickpea-dry-furrow	D	Chickpea_dry_fur
27	Chickpea-dry-spray	D	Chickpea_dry_spr
28	Soybean-wet-furrow	W	Soy_wet_fur
29	Soybean-wet-spray	W	Soy_wet_spray

No.	Name	Season (wet, dry, perennial)	Code
30	Mungbean-wet-furrow	W	Mung_wet_fur
31	Mungbean-wet-spray	W	Mung_wet_spr
32	Navy bean-wet-furrow	W	Navy_wet_fur
33	Navy bean-wet-spray	W	Navy_wet_spr
34	Sweet corn-wet-furrow	D	SwtCorn_wet_fur
35	Sweet corn-wet-spray	D	SwtCorn_wet_spr
36	Sweet corn-wet-trickle	D	SwtCorn_wet_tric
37	Sweet corn-dry-furrow	D	SwtCorn_dry_fur
38	Sweet corn-dry-spray	D	SwtCorn_dry_spr
39	Sweet corn-dry-trickle	D	SwtCorn_dry_tric
40	Cucurbit-dry-furrow	D	Cucurbit_dry_fur
41	Cucurbit-dry-spray	D	Cucurbit_dry_spray
42	Cucurbit-dry-trickle	D	Cucurbit_dry_tric
43	Capsicum/chili-dry-furrow	D	CapsChili_dry_fur
44	Capsicum/chili-dry-spray	D	CapsChili_dry_spray
45	Capsicum/chili-dry-trickle	D	CapsChili_dry_tric
46	Tomato-dry-furrow	D	Tomato_dry_fur
47	Tomato-dry-spray	D	Tomato_dry_spray
48	Tomato-dry-trickle	D	Tomato_dry_tric
49	Eggplant-dry-furrow	D	Eggplant_dry_fur
50	Eggplant-dry-trickle	D	Eggplant_dry_tric
51	Peanut-wet-furrow	W	Peanut_wet_fur
52	Peanut-wet-spray	W	Peanut_wet_spr
53	Sweet Potato-wet-furrow	W	SwtPot_wet_fur
54	Sweet Potato-wet-spray	W	SwtPot_wet_spray
55	Cassava-wet-furrow	W	Cassava_wet_fur
56	Cassava-wet-spray	W	Cassava_wet_spray
57	Pineapple-spr	P	Pineapple_spray
58	Pineapple-tri	P	Pineapple_tric
59	Lychee-tri	P	Lychee_tric
60	Cashew-tri	P	Cashew_tric
61	Mango-tri	P	Mango_tric

No.	Name	Season (wet, dry, perennial)	Code
62	Banana-spr	P	Banana_spray
63	Banana-tri	P	Banana_tric
64	Carambola-tri	P	Carambola_tric
65	Citrus-tri	P	Citrus_tric
66	Grape-tri	P	Grape_tric
67	Coffee-tri	P	Coffee_tric
68	Avocado-tri	P	Avocado_tric
69	Cust. apple-tri	P	CustApple_tric
70	Caribbean pine-irrig	P	CaribPine_irr
71	African mahogany-irrig	P	AfrMahog_irr
72	African mahogany-rain	P	AfrMahog_rain
73	Spotted gum-irrig	P	SpotdGum_irr
74	Spotted gum-rain	P	SpotdGum_rain
75	Teak-irrig	P	Teak_irr
76	Indian sandalwood-irrig	P	IndSandlWd_irr
77	Sorghum-grain-rainfed	W	Sorghum_rainfed
78	Maize-grain-rainfed	W	Maize_rainfed
79	Soybean-rainfed	W	Soy_rainfed
80	Mungbean-rainfed	W	Mung_rainfed

Cp – Climate, precipitation

The amount of rain that falls during the growing season is relevant for irrigated cropping in terms of the quantity of supplementary irrigation required. However, suitability subclasses have only been determined for crops that are totally rainfed. The crops are wet season grain/pulse crops and perennial tree crops.

Code	Description	Suitability subclasses for various land uses		
	Mean annual rainfall	**A**	**B**	**C**
Cp1	Annual rainfall >1000 mm	2	1	1
Cp2	Annual rainfall 800-1000 mm	3	1	2
Cp3	Annual rainfall 600-800 mm	3	2	3
Cp4	Annual rainfall 500-600 mm	4	3	4
Cr5	Annual rainfall <500 mm	5	4	5
		African mahogany Spotted gum	Sorghum	Maize Soybean Mungbean

Cs – Climate, heat stress

The Gulf Plains region is noted for its exceptionally hot temperatures that occur over a long period. For example, Julia Creek has on average 154 days per year with a maximum of >35°C. The intense solar radiation associated with high temperatures (often combined with wind as well) is likely to cause damage to the leaves and fruit of many crops, being particularly significant for horticulture crops. Small crops (e.g. capsicum) will generally not be significantly affected, as they will be grown in the dry season when temperatures are less intense.

Code	Description	Suitability subclasses for various land uses							
		A		B	C	D	E	F	G
Cs1	Low heat stress (<5 40°days)	1		1	1	1	1	1	2
Cs2	Moderate heat stress (5-20 40°days)	1		1	2	2	2	3	4
Cs3	Severe heat stress (≥20 40°days)	2		3	2	3	4	4	4
		Cane_fur	Navy_wet_fur	Mango_tric	Maize_wet_fur	Teak_irr	Pineapple_spray	Citrus_tric	Coffee_tric
		Cane_spray	Navy_wet_spr		Maize_wet_spr		Pineapple_tric	Grape_tric	CustApple_tric
		Cane_tric	SwtCorn_dry_fur		SwtCorn_wet_fur		Lychee_tric	Avocado_tric	
		Cotton_fur	SwtCorn_dry_spr		SwtCorn_wet_spr		Cashew_tric		
		Cotton_spray	SwtCorn_dry_tric		SwtCorn_wet_tric		Banana_spray		
		Rice_flood	Cucurbit_dry_fur		Maize_rainfed		Banana_tric		
		Rice_fur	Cucurbit_dry_spray				Carambola_tric		
		SorgGrain_wet_fur	Cucurbit_dry_tric						
		SorgGrain_wet_spr	CapsChili_dry_fur						
		SorgGrain_dry_fur	CapsChili_dry_spray						
		SorgGrain_dry_spr	CapsChili_dry_tric						
		Millet_wet_fur	Tomato_dry_fur						
		Millet_wet_spr	Tomato_dry_spray						
		Sunflwr_fur	Tomato_dry_tric						
		Sunflwr_wet_spr	Eggplant_dry_fur						
		Oats_dry_fur	Eggplant_dry_tric						
		Oats_dry_spr	Peanut_wet_fur						
		SorgForag_wet_spr	Peanut_wet_spr						
		SorgForag_dry_spr	SwtPot_wet_fur						
		Rhodes_wet_spray	SwtPot_wet_spray						
		Lablab_wet_fur	Cassava_wet_fur						
		Lablab_spray	Cassava_wet_spray						
		Lucerne_wet_spray	CaribPine_irr						
		Chickpea_dry_fur	AfrMahog_irr						
		Chickpea_dry_spr	AfrMahog_rainfed						
		Soy_wet_fur	SpotdGum_irr						
		Soy_wet_spray	SpotdGum_rainfed						
		Mung_wet_fur	IndSandlWd_irr						
		Mung_wet_spr	Mung_rainfed						
		Soy_rainfed	Sorg_rainfed						

Cf – Climate, frost

Frosts occur in the Gulf Plains region, but these are usually light. However, it is likely that frost would need to be considered in site selection and the management regime for certain frost sensitive crops.

Code	Description	Suitability subclasses for various land uses									
		A		B		C		D			
Cf1	frost free	1		1		1		1			
Cf2	occasional frost (<2 days)	1		1		2		2			
Cf3	regular light frosts (≥2 days)	2		3		2		3			
		Cane_fur	Chickpea_dry_fur	CapsChili_dry_fur		Rice_fur		Cashew_tric			
		Cane_spray	Chickpea_dry_spr	CapsChili_dry_spray		Pineapple_spray		Mango_tric			
		Cane_tric	Soy_wet_fur	CapsChili_dry_tric		Pineapple_tric		Banana_spray			
		Cotton_fur	Soy_wet_spray	Tomato_dry_fur		Lychee_tric		Banana_tric			
		Cotton_spray	Mung_wet_fur	Tomato_dry_spray		CaribPine_irr		Carambola_tric			
		Rice_flood	Mung_wet_spr	Tomato_dry_tric		SpotdGum_irr		Citrus_tric			
		Maize_wet_fur	Navy_wet_fur	Eggplant_dry_fur		SpotdGum_rainfed		Grape_tric			
		Maize_wet_spr	Navy_wet_spr	Eggplant_dry_tric				Coffee_tric			
		SorgGrain_wet_fur	SwtCorn_wet_fur	SwtPot_wet_fur				Avocado_tric			
		SorgGrain_wet_spr	SwtCorn_wet_spr	SwtPot_wet_spray				CustApple_tric			
		SorgGrain_dry_fur	SwtCorn_wet_tric	Cassava_wet_fur				AfrMahog_irr			
		SorgGrain_dry_spr	SwtCorn_dry_fur	Cassava_wet_spray				AfrMahog_rainfed			
		Millet_wet_fur	SwtCorn_dry_spr					Teak_irr			
		Millet_wet_spr	SwtCorn_dry_tric					IndSandlWd_irr			
		Sunflwr_fur	Cucurbit_dry_fur								
		Sunflwr_wet_spr	Cucurbit_dry_spray								
		Oats_dry_fur	Cucurbit_dry_tric								
		Oats_dry_spr	Peanut_wet_fur								
		SorgForag_wet_spr	Peanut_wet_spr								
		SorgForag_dry_spr	Sorg_rainfed								
		Rhodes_wet_spray	Maize_rainfed								
		Lablab_wet_fur	Soy_rainfed								
		Lablab_spray	Mung_rainfed								
		Lucerne_wet_spray									

Ct – Climate, temperature variation

Certain crops (e.g. chickpea) require cool temperatures for efficient seed set. Other crops (e.g. Cassava) show a preference for climates that do not include cool winter temperatures.

Code	Description	Suitability subclasses for various land uses					
		A		B	C	D	E
Ct1	Mean min. monthly temperature <15° for 4 months or more	1		1	1	2	3
Ct2	Mean min. monthly temperature <15° for 3 months or less	1		2	3	1	1
		Cane_fur	Lucerne_wet_spray	Citrus_tric	Chickpea_dry_fur	Cucurbit_dry_fur	Cassava_wet_fur
		Cane_spray	Soy_wet_fur	Grape_tric	Chickpea_dry_spr	Cucurbit_dry_spray	Cassava_wet_spray
		Cane_tric	Soy_wet_spray	CustApple_tric	Lychee_tric	Cucurbit_dry_tric	
		Cotton_fur	Mung_wet_fur			CapsChili_dry_fur	
		Cotton_spray	Mung_wet_spr			CapsChili_dry_spray	
		Rice_flood	Navy_wet_fur			CapsChili_dry_tric	
		Rice_fur	Navy_wet_spr			Tomato_dry_fur	
		Maize_wet_fur	SwtCorn_wet_fur			Tomato_dry_spray	
		Maize_wet_spr	SwtCorn_wet_spr			Tomato_dry_tric	
		SorgGrain_wet_fur	SwtCorn_wet_tric			Eggplant_dry_fur	
		SorgGrain_wet_spr	SwtCorn_dry_fur			Eggplant_dry_tric	
		SorgGrain_dry_fur	SwtCorn_dry_spr			Cashew_tric	
		SorgGrain_dry_spr	SwtCorn_dry_tric			Mango_tric	
		Millet_wet_fur	Peanut_wet_fur			Banana_spray	
		Millet_wet_spr	Peanut_wet_spr			Banana_tric	
		Sunflwr_fur	SwtPot_wet_fur			Carambola_tric	
		Sunflwr_wet_spr	SwtPot_wet_spray			Coffee_tric	
		Oats_dry_fur	Pineapple_spray			Avocado_tric	
		Oats_dry_spr	Pineapple_tric			AfrMahog_irr	
		SorgForag_wet_spr	CaribPine_irr			AfrMahog_rainfed	
		SorgForag_dry_spr	Sorg_rainfed			SpotdGum_irr	
		Rhodes_wet_spray	Maize_rainfed			SpotdGum_rainfed	
		Lablab_wet_fur	Soy_rainfed				
		Lablab_spray	Mung_rainfed				

A - Wind erosion

Sandy surfaced soils in arid areas (<500 mm annual rainfall) are vulnerable to wind erosion.

Code	Description	Suitability subclasses for various land uses	
		A	B
A1	No restriction: annual rainfall >= 500 mm OR surface texture not sandy	1	1
A2	Annual rainfall <500 mm AND surface texture class 1 (sandy)	2	3
A3	Annual rainfall <500 mm AND surface texture class 1 (sandy) AND Soil Gen Grp 8 (Sodosols)	3	4
		SwtCorn_wet_fur SwtCorn_wet_spr SwtCorn_wet_tric SwtCorn_dry_fur SwtCorn_dry_spr SwtCorn_dry_tric Cucurbit_dry_fur Cucurbit_dry_spray Cucurbit_dry_tric CapsChili_dry_fur CapsChili_dry_spray CapsChili_dry_tric Tomato_dry_fur Tomato_dry_spray Tomato_dry_tric Eggplant_dry_fur Eggplant_dry_tric Pineapple_spray Pineapple_tric Mango_tric Grape_tric Citrus_tric Coffee_tric Teak_irr IndSandlWd_irr	Lychee_tric Cashew_tric Banana_spray Banana_tric Carambola_tric Avocado_tric CustApple_tric CaribPine_irr AfrMahog_irr AfrMahog_rain SpotdGum_irr SpotdGum_rain	Cane_fur Cane_spray Cane_tric Cotton_fur Cotton_spray Rice_flood Rice_fur Maize_wet_fur Maize_wet_spr SorgGrain_wet_fur SorgGrain_wet_spr SorgGrain_dry_fur SorgGrain_dry_spr Millet_wet_fur Millet_wet_spr Sunflwr_fur Sunflwr_wet_spr Oats_dry_fur Oats_dry_spr SorgForag_wet_spr SorgForag_dry_spr Rhodes_wet_spray	Lablab_wet_fur Lablab_spray Lucerne_wet_spray Chickpea_dry_fur Chickpea_dry_spr Soy_wet_fur Soy_wet_spray Mung_wet_fur Mung_wet_spr Navy_wet_fur Navy_wet_spr Peanut_wet_fur Peanut_wet_spr SwtPot_wet_fur SwtPot_wet_spray Cassava_wet_fur Cassava_wet_spray Sorg_rainfed Maize_rainfed Soy_rainfed Mung_rainfed

M - Moisture availability, irrigated crops

Adequate water storage in the profile relates to irrigation efficiency (i.e. the frequency of water application required).(Note: rainfed tree crops are also listed in this table)

Description	Code M1	Suitability subclasses for various land uses. Different soil depths apply for various crop groups.				Code M5			
	PAWC to 0.5 m soil depth	PAWC to 1.0 m soil depth Code M4				PAWC to 1.5 m soil depth			
	Value	A	Value	B	C	D	E	Value	F	G	H
PAWC >150 mm		-	M7	1	1	1	1	M1	1	1	1
PAWC 100-150 mm	M13	1	M8	1	1	1	1	M2	1	1	1
PAWC 75-100 mm	M14	1	M9	1	2	2	2	M3	1	1	2
PAWC 60-75 mm	M15	2	M10	2	2	2	3	M4	2	3	3
PAWC 40-60 mm	M16	3	M11	3	3	3	3	M5	3	3	4
PAWC <40 mm	M17	4	M12	4	3	4	4	M6	4	4	4
		Cucurbit_dry_fur		Millet_wet_fur	SwtCorn_wet_fur	Lychee_tric	Cane_fur		Coffee_tric	SpotdGum_rain	AfrMahog_rain
		Cucurbit_dry_spray		Millet_wet_spr	SwtCorn_wet_spr	Cashew_tric	Cane_spray		Avocado_tric		
		Cucurbit_dry_tric			SwtCorn_wet_tric	Mango_tric	Cane_tric		CaribPine_irr		
		CapsChili_dry_fur			SwtCorn_dry_fur	Banana_spray	Cotton_fur		AfrMahog_irr		
		CapsChili_dry_spray			SwtCorn_dry_spr	Banana_tric	Cotton_spray		SpotdGum_irr		
		CapsChili_dry_tric			SwtCorn_dry_tric	Carambola_tric	Rice_flood		Teak_irr		
		Tomato_dry_fur				Citrus_tric	Rice_fur		IndSandlWd_irr		
		Tomato_dry_spray				Grape_tric	Maize_wet_fur				
		Tomato_dry_tric				CustApple_tric	Maize_wet_spr				
		Eggplant_dry_fur					SorgGrain_wet_fur				
		Eggplant_dry_tric					SorgGrain_wet_spr				
		Peanut_wet_fur					SorgGrain_dry_fur				
		Peanut_wet_spr					SorgGrain_dry_spr				
		SwtPot_wet_fur					Sunflwr_fur				
		SwtPot_wet_spray					Sunflwr_wet_spr				
		Cassava_wet_fur					Oats_dry_fur				
		Cassava_wet_spray					Oats_dry_spr				
		Pineapple_spray					SorgForag_wet_spr				
		Pineapple_tric					SorgForag_dry_spr				
							Rhodes_wet_spray				
							Lablab_wet_fur				
							Lablab_spray				
							Lucerne_wet_spray				
							Chickpea_dry_fur				
							Chickpea_dry_spr				
							Soy_wet_fur				
							Soy_wet_spray				
							Mung_wet_fur				
							Mung_wet_spr				
							Navy_wet_fur				
							Navy_wet_spr				

M - Moisture availability, rainfed crops

Adequate moisture storage in the soil profile is required to maintain crop growth without irrigation. Different suitability subclasses apply in each rainfall zone (A to E). This section not included in FGARA Technical report.

Attribute description	Suitability subclasses for various land uses in different rainfall zones												
PAWC to 1.0 m soil depth	A. Rainfall >1000 mm (M6)			B. Rainfall 800 - 1000 mm (M7)			C. Rainfall 600 - 800 mm (M8)			D. Rainfall 500 - 600 mm (M9)		E. Rainfall <500 mm (M10)	
	A1	A2	A3	B1	B2	B3	C1	C2	C3	D1	D2	E1	E2
M7 - PAWC >150 mm	1	1	1	1	2	2	2	3	3	3	4	4	5
M8 - PAWC 125-150 mm	1	1	1	2	2	2	3	3	3	4	4	5	5
M9 - PAWC 100-125 mm	2	2	2	3	3	3	4	4	4	5	5	5	5
M10 - PAWC 75-100 mm	2	3	3	4	3	4	5	4	5	5	5	5	5
M11 - PAWC 50-75 mm	3	4	4	5	4	5	5	5	5	5	5	5	5
M12 - PAWC <50 mm	4	4	5	5	5	5	5	5	5	5	5	5	5
	Soybean Mungbean	Sorghum	Maize	Sorghum	Soybean	Maize	Sorghum	Soybean Mungbean	Maize	Sorghum	Maize Soybean Mungbean	Sorghum	Maize Soybean Mungbean

Mungbean

Nr - Nutrient balance, pH

Soil pH is affects the availability of nutrients for plant use. Strong acidity or alkalinity may lead to certain nutrient deficiencies and/or toxicities.

Code	Description	Suitability subclasses for various land uses					
		A	B	C	D	E	
Nr1	pH 5.5-7.0	1	1	1	1	3	
Nr2	pH 7.0-8.5	1	1	1	2	1	
Nr3	pH <5.5	2	2	3	2	4	
Nr4	pH >8.5	2	3	3	3	2	
		Cane_fur	Navy_wet_fur	Peanut_wet_fur	Cotton_fur	SwtPot_wet_fur	Teak_irr
		Cane_spray	Navy_wet_spr	Peanut_wet_spr	Cotton_spray	SwtPot_wet_spray	
		Cane_tric	SwtCorn_wet_fur	Pineapple_spray		Cassava_wet_fur	
		Rice_flood	SwtCorn_wet_spr	Pineapple_tric		Cassava_wet_spray	
		Rice_fur	SwtCorn_wet_tric	Lychee_tric		Carambola_tric	
		Maize_wet_fur	SwtCorn_dry_fur	Cashew_tric			
		Maize_wet_spr	SwtCorn_dry_spr	Mango_tric			
		SorgGrain_wet_fur	SwtCorn_dry_tric	Banana_spray			
		SorgGrain_wet_spr	Cucurbit_dry_fur	Banana_tric			
		SorgGrain_dry_fur	Cucurbit_dry_spray	Citrus_tric			
		SorgGrain_dry_spr	Cucurbit_dry_tric	Grape_tric			
		Millet_wet_fur	CapsChili_dry_fur	Coffee_tric			
		Millet_wet_spr	CapsChili_dry_spray	Avocado_tric			
		Sunflwr_fur	CapsChili_dry_tric	CustApple_tric			
		Sunflwr_wet_spr	Tomato_dry_fur				
		Oats_dry_fur	Tomato_dry_spray				
		Oats_dry_spr	Tomato_dry_tric				
		SorgForag_wet_spr	Eggplant_dry_fur				
		SorgForag_dry_spr	Eggplant_dry_tric				
		Rhodes_wet_spray	CaribPine_irr				
		Lablab_wet_fur	AfrMahog_irr				
		Lablab_spray	AfrMahog_rainfed				
		Lucerne_wet_spray	SpotdGum_irr				
		Chickpea_dry_fur	SpotdGum_rainfed				
		Chickpea_dry_spr	IndSandlWd_irr				
		Soy_wet_fur	Sorg_rainfed				
		Soy_wet_spray	Maize_rainfed				
		Mung_wet_fur	Soy_rainfed				
		Mung_wet_spr	Mung_rainfed				

P - Physical restrictions (part one)

The physical condition of soil affects a range of cropping activities such as the timing of cultivation and the harvesting of root crops.

Code	Description	Suitability subclasses for various land uses						
		A	B	C	D	E	F	G
Ps1	No restriction: surface condition class 2	1	1	1	1	1	1	1
Ps2	Firm/hardsetting - light texture: surface condition 3; surface texture 1 or 2	1	1	1	1	1	1	1
Ps3	Firm/hardsetting - heavy texture: surface condition 3 or 4; surface texture 4	1	1	1	1	1	2	2
Ps4	Cracking clay soils - fine structure: surface condition 1; soil stucture 3	3	3	3	4	4	2	2
Ps5	Cracking clay soils - coarse structure: surface condition 1; soil stucture 4	3	3	3	4	4	2	3
Ps6	ESP ≥6 or Hardsetting - silty: surface condition 3; surface texture 3	3	3	4	3	4	3	3
Ps7	Depth of A horizon <=0.2 m AND Generic soil group 8 (Sodic/intractable clay B horizons)	3	4	3	3	3	3	3
		CaribPine_irr AfrMahog_irr	Teak_irr IndSandlWd_irr	AfrMahog_rainfed	SpotdGum_irr	SpotdGum_rainfed	Cane_fur Cane_tric Cotton_fur Rice_flood Rice_fur	Maize_wet_fur SorgGrain_wet_fur SorgGrain_dry_fur Millet_wet_fur Sunflwr_fur Oats_dry_fur Lablab_wet_fur Chickpea_dry_fur Soy_wet_fur Mung_wet_fur Navy_wet_fur SwtCorn_wet_fur SwtCorn_wet_tric SwtCorn_dry_fur SwtCorn_dry_spr SwtCorn_dry_tric Cucurbit_dry_fur Cucurbit_dry_spray Cucurbit_dry_tric CapsChili_dry_fur CapsChili_dry_spray CapsChili_dry_tric Tomato_dry_fur Tomato_dry_spray Tomato_dry_tric Eggplant_dry_fur Eggplant_dry_tric

P - Physical restrictions (part two)

The physical condition of soil affects a range of cropping activities such as the timing of cultivation and the harvesting of root crops.

Code	Description	Suitability subclasses for land uses							
		H	I	J	K	L	M	N	O
Ps1	No restriction: surface condition loose	1	1	1	1	1	1	1	1
Ps2	Surface condition firm/hardsetting and light textures of sands and loams	1	1	1	1	1	2	2	2
Ps3	Surface condition firm/hardsetting and heavy texture of clay	2	2	3	3	4	2	2	3
Ps4	Cracking clay soils with fine structure	2	2	3	4	4	2	3	3
Ps5	Cracking clay soils with coarse structure	3	3	4	4	4	3	3	3
Ps6	ESP ≥6 or surface condition firm/hardsetting and silty surface texture	3	4	4	4	4	3	3	3
Ps7	Depth of A horizon <=0.2 m AND the Soil Generic Group – “Sand or loam over intractable clay subsoils”	4	4	5	5	5	3	3	4
		SwtCorn_wet_spr	Cane_spray Cotton_spray Maize_wet_spr SorgGrain_wet_spr SorgGrain_dry_spr Millet_wet_spr Sunflwr_wet_spr Oats_dry_spr SorgForag_wet_spr SorgForag_dry_spr Rhodes_wet_spray Lablab_spray Lucerne_wet_spray Chickpea_dry_spr Soy_wet_spray Mung_wet_spr Navy_wet_spr Sorg_rainfed Maize_rainfed Soy_rainfed Mung_rainfed	Peanut_wet_fur Peanut_wet_spr	SwtPot_wet_fur SwtPot_wet_spr	Cassava_wet_fur Cassava_wet_spr	Pineapple_spr Pineapple_tric Banana_spr Banana_tric	Lychee_tric Cashew_tric Mango_tric Carambola_tric Citrus_tric Citrus_tric Grape_tric	Coffee_tric Avocado_tric CustApple_tric

Pd - Soil depth

The soil depth limitation generally relates to the requirement for physical support for the plant. Additional soil depth is required to fulfil the requirements for certain crops e.g. avocado. Additional soil depth is required for efficient harvesting of root crops.

Code	Description	Suitability subclasses for various land uses							
		A	B	C	D	E	F	G	H
Pd1	Very deep (>=1.5 m)	1	1	1	1	1	1	1	1
Pd2	Deep (1.0-<1.5)	1	1	1	1	1	1	1	2
Pd3	Moderate (0.5-<1.0 m)	1	1	1	2	2	2	3	4
Pd4	Shallow (0.25-<0.5 m)	2	3	4	2	3	4	4	4
Pd5	Very shallow (< 0.25 m)	4	4	5	4	4	5	5	5
		Cane_fur Cane_spray Cane_tric Millet_wet_fur Millet_wet_spr Cucurbit_dry_fur Cucurbit_dry_spray Cucurbit_dry_tric CapsChili_dry_fur CapsChili_dry_spray CapsChili_dry_tric Tomato_dry_fur Tomato_dry_spray Tomato_dry_tric Eggplant_dry_fur Eggplant_dry_tric	Cotton_fur Cotton_spray SorgForag_wet_spr SorgForag_dry_spr Rhodes_wet_spray Lablab_spray Lucerne_wet_spray	Peanut_wet_fur Peanut_wet_spr SwtPot_wet_fur SwtPot_wet_spray Cassava_wet_fur Cassava_wet_spray	SwtCorn_dry_fur SwtCorn_dry_spr SwtCorn_dry_tric	SorgGrainfed_dry_fur SorgGrainfed_dry_spr Oats_dry_fur Oats_dry_spr Chickpea_dry_fur Chickpea_dry_spr SwtCorn_wet_fur SwtCorn_wet_spr SwtCorn_wet_tric Pineapple_spray Pineapple_tric	Rice_flood Rice_fur Maize_wet_fur Maize_wet_spr SorgGrainfed_wet_fur SorgGrainfed_wet_spr Sunflwr_fur Sunflwr_wet_spr Lablab_wet_fur Soy_wet_fur Soy_wet_spray Mung_wet_fur Mung_wet_spr Navy_wet_fur Navy_wet_spr Citrus_tric SpotdGum_irr SpotdGum_rainfed Sorg_rainfed Maize_rainfed Soy_rainfed Mung_rainfed	Lychee_tric Cashew_tric Mango_tric Banana_spray Banana_tric Carambola_tric Grape_tric CustApple_tric AfrMahog_irr AfrMahog_rainfed Teak_irr IndSandlWd_irr CaribPine_irr	Coffee_tric Avocado_tric

E - Water erosion (part one)

Soil loss from water erosion needs to be minimised. Suitability subclasses were also determined for 'very stable' soils (K-factor <0.02), but using the digital soil mapping techniques, none of these soils were predicted to occur.

Code	Description	Suitability subclasses for various land uses						
		A	B	C	D	E	F	G
E11	Stable soils: K factor 0.02-0.04 and slope <0.5%	1	1	1	1	1	1	1
E12	Stable soils: K factor 0.02-0.04 and slope 0.5-1.0%	1	1	1	2	2	2	2
E13	Stable soils: K factor 0.02-0.04 and slope 1-2%	1	1	1	3	2	3	3
E14	Stable soils: K factor 0.02-0.04 and slope 2-3%	1	1	1	3	2	3	3
E15	Stable soils: K factor 0.02-0.04 and slope 3-5%	1	2	2	3	3	3	4
E16	Stable soils: K factor 0.02-0.04 and slope 5-8%	2	2	3	3	3	4	4
E17	Stable soils: K factor 0.02-0.04 and slope 8-12%	3	3	4	4	4	4	5
E18	Stable soils: K factor 0.02-0.04 and slope 12-15%	3	3	4	4	4	5	5
E19	Stable soils: K factor 0.02-0.04 and slope 15-20%	3	4	5	5	5	5	5
E20	Stable soils: K factor 0.02-0.04 and slope >20%	4	5	5	5	5	5	5
E21	Unstable soils: K factor 0.04-0.06 and slope <0.5%	1	1	1	2	2	2	2
E22	Unstable soils: K factor 0.04-0.06 and slope 0.5-1.0%	1	1	1	3	3	3	3
E23	Unstable soils: K factor 0.04-0.06 and slope 1-2%	1	1	1	3	3	3	3
E24	Unstable soils: K factor 0.04-0.06 and slope 2-3%	2	2	2	3	3	3	4
E25	Unstable soils: K factor 0.04-0.06 and slope 3-5%	2	2	3	3	4	4	4
E26	Unstable soils: K factor 0.04-0.06 and slope 5-8%	3	3	4	4	4	4	5
E27	Unstable soils: K factor 0.04-0.06 and slope 8-12%	3	3	4	4	5	5	5
E28	Unstable soils: K factor 0.04-0.06 and slope 12-15%	3	4	5	5	5	5	5
E29	Unstable soils: K factor 0.04-0.06 and slope 15-20%	4	5	5	5	5	5	5
E30	Unstable soils: K factor 0.04-0.06 and slope >20%	5	5	5	5	5	5	5
E31	Very unstable soils: K factor >0.06 and slope <0.5%	1	1	1	2	2	2	2
E32	Very unstable soils: K factor >0.06 and slope 0.5-1.0%	2	2	2	3	3	3	3
E33	Very unstable soils: K factor >0.06 and slope 1-2%	2	2	2	3	3	3	3
E34	Very unstable soils: K factor >0.06 and slope 2-3%	2	2	3	3	3	3	4
E35	Very unstable soils: K factor >0.06 and slope 3-5%	3	2	4	3	4	4	4
E36	Very unstable soils: K factor >0.06 and slope 5-8%	3	3	4	4	5	5	5
E37	Very unstable soils: K factor >0.06 and slope 8-12%	4	4	5	5	5	5	5
E38	Very unstable soils: K factor >0.06 and slope 12-15%	4	4	5	5	5	5	5
E39	Very unstable soils: K factor >0.06 and slope 15-20%	5	5	5	5	5	5	5
E40	Very unstable soils: K factor >0.06 and slope >20%	5	5	5	5	5	5	5
		CaribPine_irr AfrMahog_irr AfrMahog_rain SpotdGum_irr SpotdGum_rain Teak_irr IndSandlWd_irr	Lychee_tric Cashew_tric Mango_tric Banana_tric Carambola_tric Citrus_tric Grape_tric Coffee_tric Avocado_tric CustApple_tric	Banana_spray	Cane_spray Cane_tric	Oats_spray_dry Chickpea_spray_dry	Cotton_spray Maize_spray Sorghum_spray Millet_spray Sunflwr_spray SorghumForg_spray Rhodes_spray Lablab_spray Lucerne_spray Soy_spray Mung_spray Navy_spray Sorghumrainfed Maize_rainfed Soy_rainfed Mung_rainfed	Cane_fur Rice_fur

E - Water erosion (part two)

Minimise land degradation due to soil erosion by water. Suitability subclasses were also determined for 'very stable' soils (K-factor <0.02), but using the digital soil mapping techniques, none of these soils were predicted to occur.

Code	Description	Suitability subclasses for various land uses						
		H	I	J	K	L	M	N
E11	Stable soils: K factor 0.02-0.04 and slope <0.5%	1	1	1	1	1	1	1
E12	Stable soils: K factor 0.02-0.04 and slope 0.5-1.0%	2	2	2	2	2	2	2
E13	Stable soils: K factor 0.02-0.04 and slope 1-2%	3	3	2	2	2	2	2
E14	Stable soils: K factor 0.02-0.04 and slope 2-3%	3	4	3	3	3	3	3
E15	Stable soils: K factor 0.02-0.04 and slope 3-5%	4	4	3	3	3	3	4
E16	Stable soils: K factor 0.02-0.04 and slope 5-8%	4	4	3	3	4	4	4
E17	Stable soils: K factor 0.02-0.04 and slope 8-12%	5	5	4	4	4	4	5
E18	Stable soils: K factor 0.02-0.04 and slope 12-15%	5	5	4	5	5	5	5
E19	Stable soils: K factor 0.02-0.04 and slope 15-20%	5	5	5	5	5	5	5
E20	Stable soils: K factor 0.02-0.04 and slope >20%	5	5	5	5	5	5	5
E21	Unstable soils: K factor 0.04-0.06 and slope <0.5%	2	2	2	2	2	2	2
E22	Unstable soils: K factor 0.04-0.06 and slope 0.5-1.0%	3	3	2	2	2	2	2
E23	Unstable soils: K factor 0.04-0.06 and slope 1-2%	3	3	2	3	2	2	2
E24	Unstable soils: K factor 0.04-0.06 and slope 2-3%	4	4	2	3	3	3	4
E25	Unstable soils: K factor 0.04-0.06 and slope 3-5%	4	4	3	3	4	4	4
E26	Unstable soils: K factor 0.04-0.06 and slope 5-8%	5	5	4	4	4	4	5
E27	Unstable soils: K factor 0.04-0.06 and slope 8-12%	5	5	4	5	5	5	5
E28	Unstable soils: K factor 0.04-0.06 and slope 12-15%	5	5	5	5	5	5	5
E29	Unstable soils: K factor 0.04-0.06 and slope 15-20%	5	5	5	5	5	5	5
E30	Unstable soils: K factor 0.04-0.06 and slope >20%	5	5	5	5	5	5	5
E31	Very unstable soils: K factor >0.06 and slope <0.5%	2	2	2	2	2	2	2
E32	Very unstable soils: K factor >0.06 and slope 0.5-1.0%	3	3	2	2	3	2	3
E33	Very unstable soils: K factor >0.06 and slope 1-2%	3	3	3	3	3	3	3
E34	Very unstable soils: K factor >0.06 and slope 2-3%	4	4	3	3	3	4	4
E35	Very unstable soils: K factor >0.06 and slope 3-5%	5	4	4	4	4	5	5
E36	Very unstable soils: K factor >0.06 and slope 5-8%	5	5	5	5	5	5	5
E37	Very unstable soils: K factor >0.06 and slope 8-12%	5	5	5	5	5	5	5
E38	Very unstable soils: K factor >0.06 and slope 12-15%	5	5	5	5	5	5	5
E39	Very unstable soils: K factor >0.06 and slope 15-20%	5	5	5	5	5	5	5
E40	Very unstable soils: K factor >0.06 and slope >20%	5	5	5	5	5	5	5
		Cotton_fur Maize_fur Sorghum_fur Millet_fur Sunflwr_fur Oats_fur_dry Lablab_fur Chickpea_fur_dry Soy_fur Mung_fur Navy_fur	Rice_flood	SwtCorn_tric_wet SwtCorn_tric_dry Cucurbit_tric CapsChili_tric Tomato_tric Eggplant_tric Pineapple_tric	SwtCorn_spray_wet SwtCorn_spray_dry Cucurbit_spray CapsChili_spray Tomato_spray Pineapple_spray	Peanut_spray SwtPot_spray Cassava_spray	SwtCorn_fur_wet SwtCorn_fur_dry Cucurbit_fur CapsChili_fur Tomato_fur Eggplant_fur	Peanut_fur SwtPot_fur Cassava_fur

W - Wetness (part one)

Adequate soil aeration is required for plant growth. Crops grown entirely in the dry season (e.g. all intensive horticulture crops, oats, chickpeas) are less affected by this limitation as they will not generally experience very wet conditions.

Code	Description	Suitability subclasses for various land uses											
		A	B	C	C	D	E	F	G	H	I	J	K
W1	Rapidly drained - Drainage class 6	1	1	1	1	1	1	1	1	1	1	1	1
W2	Well drained - Drainage class 5, permeability class 4	1	1	1	1	1	1	1	1	1	1	1	1
W3	Well drained - Drainage class 5, permeability class 3	1	1	1	1	1	1	1	1	1	1	1	2
W4	Well drained - Drainage class 5, permeability class 2	1	1	1	1	1	1	1	1	1	1	2	2
W5	Well drained - Drainage class 5, permeability class 1	2	2	2	2	3	3	3	3	3	3	4	3
W6	Moderately well-drained - Drainage class 4, permeability class 4	1	1	1	1	1	1	1	2	2	3	3	2
W7	Moderately well-drained - Drainage class 4, permeability class 3	1	1	2	1	1	1	2	3	3	3	3	2
W8	Moderately well-drained - Drainage class 4, permeability class 2	2	2	3	2	2	2	3	3	3	3	4	3
W9	Moderately well-drained - Drainage class 4, permeability class 1	3	3	3	4	3	4	4	3	4	4	4	4
W10	Imperfectly drained - Drainage class 3, permeability class 4	2	2	3	4	2	4	4	3	4	4	4	4
W11	Imperfectly drained - Drainage class 3, permeability class 3	3	3	3	4	3	4	4	3	4	4	4	4
W12	Imperfectly drained - Drainage class 3, permeability class 2	3	4	4	4	4	4	4	4	4	4	5	5
W13	Imperfectly drained - Drainage class 3, permeability class 1	4	4	4	4	4	4	5	4	4	5	5	5
W14	Poorly drained - Drainage class 2, permeability class 3 or 4	4	4	5	4	5	5	5	5	5	5	5	5
W15	Poorly drained - Drainage class 2, permeability class 1 or 2	4	5	5	5	5	5	5	5	5	5	5	5
W16	Very poorly drained - Drainage class 1	5	5	5	5	5	5	5	5	5	5	5	5
		AfrMahog_ irrig AfrMahog_ rainfed	CaribPine_ irrig SpotdGum_ irrig SpotdGum_ rainfed Sorghum_ rainfed	Maize-rainfed Soy_rainfed Mung_rainfed	Teak_irr IndSandlWd _irr	Pineapple_ spray Pineapple_tric	Banana_ spray	Carambola_tric Citrus_tric	Lychee_tric Cashew_tric Mango_tric	Banana_tric	Grape_tric	Coffee_tric Avocado_tric CustApple_tric	SwtPot_wet_ fur SwtPot_wet _spray

W - Wetness (part two)

Adequate soil aeration is required for plant growth. Crops grown entirely in the dry season (e.g. all intensive horticulture crops, oats, chickpeas) are less affected by this limitation as they will not generally experience very wet conditions.

Code	Description	Suitability subclasses for various land uses									
		L	M	N	O	P	Q	R	S	T	U
W1	Rapidly drained - Drainage class 6	1	1	1	1	1	1	1	1	1	1
W2	Well drained - Drainage class 5, permeability class 4	1	1	1	1	1	1	1	1	1	1
W3	Well drained - Drainage class 5, permeability class 3	2	2	2	2	2	2	2	2	2	2
W4	Well drained - Drainage class 5, permeability class 2	2	2	2	2	2	2	2	2	2	2
W5	Well drained - Drainage class 5, permeability class 1	3	3	3	3	3	3	3	3	3	3
W6	Moderately well-drained - Drainage class 4, permeability class 4	2	2	2	2	2	2	2	2	2	2
W7	Moderately well-drained - Drainage class 4, permeability class 3	3	2	2	2	2	2	2	2	2	2
W8	Moderately well-drained - Drainage class 4, permeability class 2	3	3	3	3	3	3	3	3	3	3
W9	Moderately well-drained - Drainage class 4, permeability class 1	4	3	3	3	3	3	3	3	4	4
W10	Imperfectly drained - Drainage class 3, permeability class 4	4	2	2	2	2	2	3	3	3	3
W11	Imperfectly drained - Drainage class 3, permeability class 3	4	2	2	2	2	3	3	3	3	4
W12	Imperfectly drained - Drainage class 3, permeability class 2	5	3	3	3	3	3	4	3	4	4
W13	Imperfectly drained - Drainage class 3, permeability class 1	5	3	4	4	3	4	4	3	4	4
W14	Poorly drained - Drainage class 2, permeability class 3 or 4	5	3	3	4	3	4	4	3	4	4
W15	Poorly drained - Drainage class 2, permeability class 1 or 2	5	4	4	4	4	5	5	4	5	5
W16	Very poorly drained - Drainage class 1	5	5	5	5	5	5	5	5	5	5
		Peanut_wet_furrow Peanut_wet_spray Cassava_wet_furrow Cassava_wet_spray	Cucurbit_dry_fur Cucurbit_dry_spray Cucurbit_dry_tric CapsChili_dry_fur CapsChili_dry_spray CapsChili_dry_tric Tomato_dry_fur Tomato_dry_spray Tomato_dry_tric Eggplant_dry_fur Eggplant_dry_tric	Cane_fur Cane_spray Cane_tric	Cotton_furrow Cotton_spray	SorgGrain_dry_furrow SorgGrain_dry_spray Oats_dry_fur Oats_dry_spr SorgForag_dry_spray Chickpea_dry_furro Chickpea_dry_spray SwtCorn_dry_furrow SwtCorn_dry_spray	Sorg_forag_wet_spr Rhodes_wet_spray Lablab_wet_fur Lablab_spray SwtCorn_wet_fur SwtCorn_wet_spr SwtCorn_wet_tric	Maize_wet_fur Maize_wet_spr SorgGrain_wet_fur SorgGrain_wet_spr Sunflwr_fur Sunflwr_wet_spr Lucerne_wet_spray Soy_wet_fur Soy_wet_spray Soy_rainfed Sorghum_rainfed Maize_rainfed	Rice_flood Rice_fur	Mung_wet_fur Mung_wet_spr Mung_rainfed Navy_wet_fur Navy_wet_spr	Millet_wet_furrow Millet_wet_spray

SwtCorn_dry_tric

R – Rockiness, all crops

Surface rockiness affects machinery and harvesting operations

Code	Description	Suitability subclass
R1	Not rocky or not significantly rocky	1
R2	Rocky	4

Tm - Gilgai microrelief, all crops

Severe gilgai microrelief affects machinery use and irrigation efficiency.

Code	Description	Suitability subclass
Tm1	No gilgai or vertical interval <0.3 m	1
Tm2	Vertical interval >0.3 m	4

If - Irrigation efficiency, all furrow irrigated crops

Applied water must match soil infiltration characteristics to minimise water loss and deep drainage. Waterlogging may also be a problem at the upper end of furrows if they are too long.

Code	Description	Suitability subclass
If1	Very slowly permeable – permeability class 1	1
If2	Slowly permeable – permeability class 2	3
If3	Moderately permeable – permeability class 3	4
If4	Highly permeable – permeability class 4	5

Appendix G Crop Land Use Suitability Assessment

Table AppG-1: Summary of Land Suitability classes for SPC 1Cl(Ck), Analysed Site D1

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp[1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf[5]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3[4]	3	3
Nr	Nr2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ps	Ps2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2
Pd	Pd3	1	1	2	2	2	2	1	1	1	2	1	1	3	3	1	1	2	2	1	2	3	3	3	2
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If[3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land use s, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- African Mahogany assessed as irrigated, not rainfed for moisture availability.

5- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-2: Summary of Land Suitability classes for SPC 2Cl(Ck), Analysed Site D2

Limitation	Limitation Value	Suitability subclasses for different land uses																						
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp[1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf[5]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3[4]	3	3
Nr	Nr3	3	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2
Ps	Ps1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pd	Pd1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If[3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- African Mahogany assessed as irrigated, not rainfed for moisture availability.

5- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-3: Summary of Land Suitability classes for SPC 3Cl(Ck), Analysed Site D3

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp[1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf[5]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3[4]	3	3
Nr	Nr4	3	2	2	2	2	2	2	2	2	2	2	2	3	3	2	3	2	2	2	2	3	2	3	3
Ps	Ps2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2
Pd	Pd3	1	1	2	2	2	2	1	1	1	2	1	1	3	3	1	1	2	2	1	2	3	3	3	2
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If[3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- African Mahogany assessed as irrigated, not rainfed for moisture availability.

5- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-4: Summary of Land Suitability classes for SPC 4Cl(Ck), Analysed Site D7

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp [1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf [5]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M [2]	M16 / M11 / M5	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3 [4]	3	3
Nr	Nr2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ps	Ps1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Pd	Pd3	1	1	2	2	2	2	1	1	1	2	1	1	3	3	1	1	2	2	1	2	3	3	3	2
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- African Mahogany assessed as irrigated, not rainfed for moisture availability.

5- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-5: Summary of Land Suitability classes for SPC 5Cl(Nm), Analysed Site D11

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp [1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf [4]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M [2]	M17 / M12 / M6	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Nr	Nr1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ps	Ps2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2
Pd	Pd4	3	4	4	4	3	4	3	2	2	2	2	2	4	4	2	4	4	4	2	4	4	4	4	4
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-6: Summary of Land Suitability classes for SPC 6Cl(El), Analysed Site D16

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp [1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf [4]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M [2]	M15 / M19 / M4	3	3	3	3	3	3	3	2	2	2	2	3	2	2	2	2	3	3	2	3	2	2	2	2
Nr	Nr2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ps	Ps2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2
Pd	Pd1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W11	2	3	3	3	2	3	3	2	2	3	2	2	3	4	2	4	3	3	4	3	3	3	4	4
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		3	3	3	3	3	3	3	3	2	3	3	3	3	4	3	4	3	3	4	3	3	3	4	4

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppG-7: Summary of Land Suitability classes for SPC 7Cl(Nm), Analysed Site D20

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
Cp [1]	Cp5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cs	Cs2	1	2	1	1	1	1	1	1	1	1	1	1	1	2	1	1	1	1	1	1	2	1	3	3
Cf [4]	Cf3	2	2	2	2	2	2	2	3	2	2	3	2	3	3	3	2	2	2	2	2	3	3	3	3
Ct	Ct2	1	1	1	1	3	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2
A	A1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
M [2]	M17 / M12 / M6	4	4	4	4	4	4	4	4	4	3	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Nr	Nr2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ps	Ps2	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	1	1	1	1	1	2	1	2	2
Pd	Pd5	4	5	5	5	4	5	4	4	4	4	4	4	5	5	4	5	5	5	4	5	5	5	5	5
E	E12	2	2	2	2	2	2	2	2	2	2	2	2	1	1	2	2	2	2	2	2	1	1	1	1
W	W1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
R	R1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Tm	Tm1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
If [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Overall Suitability Class		4	5	5	5	4	5	4	4	4	4	4	4	5	5	4	5	5	5	4	5	5	5	5	5

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Appendix H Beef Cattle Suitability Assessment

Table AppH-1: Summary of Land Suitability classes for SPC 1Cl(Ck), Analysed Site D1

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3
Nr	Nr2	1	1	1	1
Ps	Ps1	1	1	1	1
Pd	Pd3	2	1	2	1
E	E12	2	2	2	2
W	W1	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-2: Summary of Land Suitability classes for SPC 2Cl(Ck), Analysed Site D2

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3
Nr	Nr3	2	2	2	2
Ps	Ps1	1	1	1	1
Pd	Pd1	1	1	1	1
E	E12	2	2	2	2
W	W1	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed.

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-3: Summary of Land Suitability classes for SPC 3Cl(Ck), Analysed Site D3

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3
Nr	Nr4	2	2	2	2
Ps	Ps2	1	1	1	1
Pd	Pd3	2	1	2	1
E	E12	2	2	2	2
W	W2	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-4: Summary of Land Suitability classes for SPC 4Cl(Ck), Analysed Site D7

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M16 / M11 / M5	3	3	3	3
Nr	Nr2	1	1	1	1
Ps	Ps1	1	1	1	1
Pd	Pd3	2	1	2	1
E	E12	2	2	2	2
W	W2	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		3	3	3	3

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.
2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.
3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed
4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-5: Summary of Land Suitability classes for SPC 5Cl(Nm), Analysed Site D11

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M17 / M12 / M6	4	4	4	4
Nr	Nr1	1	1	1	1
Ps	Ps2	1	1	1	1
Pd	Pd4	4	3	3	2
E	E12	2	2	2	2
W	W1	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		4	4	4	4

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.
2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.
3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed
4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-6: Summary of Land Suitability classes for SPC 6Cl(EI), Analysed Site D16

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M15 / M19 / M4	3	3	3	2
Nr	Nr2	1	1	1	1
Ps	Ps2	1	1	1	1
Pd	Pd1	1	1	1	1
E	E12	2	2	2	2
W	W11	3	3	3	2
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		3	3	3	2

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.

2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.

3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed

4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Table AppH-7: Summary of Land Suitability classes for SPC 7Cl(Nm), Analysed Site D20

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
Cp[1]	Cp5	-	-	-	-
Cs	Cs3	1	1	1	1
Cf[4]	Cf3	2	2	2	2
Ct	Ct1	1	1	1	1
A	A1	1	1	1	1
M[2]	M17 / M12 / M6	4	4	4	4
Nr	Nr2	1	1	1	1
Ps	Ps2	1	1	1	1
Pd	Pd5	5	4	4	5
E	E12	2	2	2	2
W	W1	1	1	1	1
R	R1	1	1	1	1
Tm	Tm1	1	1	1	1
If[3]	-	-	-	-	-
Overall Suitability Class		5	4	4	5

1- Climate, precipitation has been excluded from the crop land assessment. It is assume irrigation will be available and suitable for all land uses.
2- Moisture availability based on the assessment of SPC Class III site PAWC (SALFPREDICT]) soil profile depth or refusal on a physical barrier. Moisture availability for rainfed cropping , for crop land uses Maize, Mungbean, Soybean and Sorghum has not been included as it is assumed water for irrigation will be made available.
3- Irrigation efficiency with respect to 'furrow irrigated crops' may increase the overall suitability unfavourably for land uses, when other irrigation such as spray, flood and trickle may be suitable. Therefore, this limitation category has not been assessed
4- Temperature for frost is assessed from air temperature of five degrees centigrade or below.

Appendix I UMA Land Suitability Assessments

Table AppI-1: Land Suitability Classes, Limitation and Crop Land Assessment UMAs distinct from SPCs

UMA	SPC	Key UMA Observation 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	3	D3, D9, D15, D18, D19	1	No limitations or crop land amendments to UMA		
2	2	D2, C29	1	No limitations or crop land amendments to UMA		
3	1	D1	1	No limitations or crop land amendments to UMA		
4	5	D21	1	No limitations or crop land amendments to UMA		
5	1	D22	1	No limitations or crop land amendments to UMA		
6	4	D7	1	No limitations or crop land amendments to UMA		
7	5	D11	1	No limitations or crop land amendments to UMA		
8	2	C24	2	No limitations or crop land amendments to UMA		
9	1	D10, C13	1	No limitations or crop land amendments to UMA		
10	7	D20, C26	1	No limitations or crop land amendments to UMA		
11	2	D8, C16, C17	1	No limitations or crop land amendments to UMA. It is noted that subsoil depth within this UMA is shallower than the adjacent UMA 19		
12	3	D14	1	No limitations or crop land amendments to UMA		
13	2	C21	1	No limitations or crop land amendments to UMA		
14	6	D16	1	No limitations or crop land amendments to UMA		
15	3	D6, C9, c22z	1	Soil profile indicates slope of 3 to 5 %. This impacts water erosion which increases the suitability subclasses for land uses		
				Assessment updated in Table AppX-2	Assessment updated in Table AppX-3	Assessment updated in Table AppX-4
16	2	D4, D5, c5, c6, c7, c8	1	No limitations or crop land amendments to UMA		
17	3	D17	1	No limitations or crop land amendments to UMA		
18	2	D12, C15	1	No limitations or crop land amendments to UMA. It is noted that subsoil depth within this UMA is shallower than the adjacent UMA 2		
19	2	D13, C18	1	No limitations or crop land amendments to UMA		

Table Appl-2: UMA 15 Re-assessment for SPC 3 – Regional Frameworks

Limitation	Limitation Value	Suitability subclasses for different land uses																							
		Cotton	Maize	Mungbean	Soybean	Chickpea	Lablab	Lucerne	Capsicum	Cucurbit	Sweet corn	Tomato	Sugarcane	Mangoes	Bananas	Eggplant	Peanuts	Rice	Sorghum	Millet	Sunflower	Cashew	African M.	Grape	Citrus
E	E15	4	4	4	4	4	4	3	3	3	3	3	2	2	2	3	3	4	3	4	4	2	1	2	2
Re-reviewed Overall Suitability Class		4	4	4	4	4	4	3	3	3	3	3	3	3	3	3	3	4	3	4	4	3	3	3	3

Results in Table Appl-3 indicate that UMA 15 is different from the analysed site (Class III(b)) for SPC 3.

Table Appl-3: UMA 15 Re-assessment for SPC 3 – Beef Cattle Grazing

Limitation Categories	Limitation Value	Suitability subclasses for different land uses			
		Lablab	Lucerne	Sorghum	Millet
E	E15	4	3	3	4
Re-reviewed Overall Suitability Class		4	3	3	4

Results in Table Appl-3 indicate that UMA 15 is different from the analysed site (Class III(b)) for SPC 3.

Table Appl-4: UMA 15 Re-assessment for SPC 3 - ALC

ALC	SPC
A1	SPC 3

Appendix J Laboratory Certificates

eurofins | APAL

Eurofins APAL Test Method Codes												
Crop	Actual Crop	SubmissionID	SamplingDate	DateReceived	BatchID	Batch Position No.	AgentName	ClientName	SampleName	Barcode	SampleDepth	Postcode
		150334		2026-01-19	47754	12	GT Environmental - Reece McCann	GT Environmental	D1-0.00-0.10	111353276		4120
		150334		2026-01-19	47754	11	GT Environmental - Reece McCann	GT Environmental	D1-0.200-0.30	111353277		4120
		150334		2026-01-19	47754	1	GT Environmental - Reece McCann	GT Environmental	D1-0.50-0.60	111353278		4120
		150334		2026-01-19	47754	13	GT Environmental - Reece McCann	GT Environmental	D1-0.80-0.90	111353279		4120
		150334		2026-01-19	47754	14	GT Environmental - Reece McCann	GT Environmental	D2-0.00-0.10	111353280		4120
		150334		2026-01-19	47754	2	GT Environmental - Reece McCann	GT Environmental	D2-0.20-0.30	111353281		4120
		150334		2026-01-19	47736	35	GT Environmental - Reece McCann	GT Environmental	D2-0.50-0.60	111353282		4120
		150334		2026-01-19	47736	18	GT Environmental - Reece McCann	GT Environmental	D2-0.80-0.90	111353283		4120
		150334		2026-01-19	47736	31	GT Environmental - Reece McCann	GT Environmental	D2-1.10-1.20	111353284		4120
		150334		2026-01-19	47736	21	GT Environmental - Reece McCann	GT Environmental	D2-1.40-1.50	111353285		4120
		150334		2026-01-19	47736	17	GT Environmental - Reece McCann	GT Environmental	D2-1.70-1.80	111353286		4120
		150334		2026-01-19	47736	22	GT Environmental - Reece McCann	GT Environmental	D3-0.00-0.10	111353287		4120
		150334		2026-01-19	47736	32	GT Environmental - Reece McCann	GT Environmental	D3-0.20-0.30	111353288		4120
		150334		2026-01-19	47736	2	GT Environmental - Reece McCann	GT Environmental	D3-0.50-0.60	111353289		4120
		150334		2026-01-19	47736	16	GT Environmental - Reece McCann	GT Environmental	D7-0.00-0.10	111353290		4120
		150334		2026-01-19	47736	33	GT Environmental - Reece McCann	GT Environmental	D7-0.20-0.30	111353291		4120
		150334		2026-01-19	47736	19	GT Environmental - Reece McCann	GT Environmental	D7-0.50-0.60	111353292		4120
		150334		2026-01-19	47736	24	GT Environmental - Reece McCann	GT Environmental	D7-0.65-0.75	111353293		4120
		150334		2026-01-19	47736	34	GT Environmental - Reece McCann	GT Environmental	D11-0.00-0.10	111353294		4120
		150334		2026-01-19	47736	20	GT Environmental - Reece McCann	GT Environmental	D11-0.10-0.20	111353295		4120
		150334		2026-01-19	47736	23	GT Environmental - Reece McCann	GT Environmental	D11-0.25-0.35	111353296		4120
		150334		2026-01-19	47736	15	GT Environmental - Reece McCann	GT Environmental	D16-0.00-0.10	111978301		4120
		150334		2026-01-19	47736	30	GT Environmental - Reece McCann	GT Environmental	D16-0.20-0.30	111978302		4120
		150334		2026-01-19	47736	14	GT Environmental - Reece McCann	GT Environmental	D16-0.50-0.60	111978303		4120
		150334		2026-01-19	47736	28	GT Environmental - Reece McCann	GT Environmental	D16-0.80-0.90	111978304		4120
		150334		2026-01-19	47736	29	GT Environmental - Reece McCann	GT Environmental	D16-1.10-1.20	111978305		4120
		150334		2026-01-19	47736	1	GT Environmental - Reece McCann	GT Environmental	D16-1.40-1.50	111978306		4120
		150334		2026-01-19	47736	26	GT Environmental - Reece McCann	GT Environmental	D16-1.70-1.80	111978307		4120
		150334		2026-01-19	47736	13	GT Environmental - Reece McCann	GT Environmental	D20-0.00-0.10	111978308		4120
		150334		2026-01-19	47736	27	GT Environmental - Reece McCann	GT Environmental	D20-0.10-0.15	111978309		4120
		150334		2026-01-19	47736	25	GT Environmental - Reece McCann	GT Environmental	D20-2.00-2.10	111978314		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 techi

		TMs-004A	TMs-004B4	TMs-006A	TMs-007NO3	TMs-007NH4	TMs-009B	TMs-009I2	TMs-018	TMs-010D	TMs-015E
Transect GPS Start	Transect GPS Finish	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
		pH units	pH units	% (40°C)	mg/kg	mg/kg	mg/kg		mg/kg	mg/kg	mg/kg
N/A	N/A	6.19	5.18	0.8	6.1	1.2	<5.0	12	84	<2.5	395
N/A	N/A	5.55	4.3	0.19	1.2	1.3	<5.0	23	66	<2.5	84
N/A	N/A	5.83	4.28								62
N/A	N/A	7.59	6.22								45
N/A	N/A	5.83	4.64	0.78	3.5	2.9	<5.0	7	86	<2.5	261
N/A	N/A	5.9	4.72								74
N/A	N/A	5.59	4.2	0.11	<1.0	<1.0	<5.0	22	25	<2.5	<10
N/A	N/A	5.65	4.33								<10
N/A	N/A	5.33	4.18								<10
N/A	N/A	5.41	4.21								<10
N/A	N/A	5.44	4.21								<10
N/A	N/A	6.45	5.7	0.41	4.6	3	<5.0	25	89	<2.5	75
N/A	N/A	5.75	4	0.27	<1.0	<1.0	<5.0	37	<25	<2.5	23
N/A	N/A	8.76	7.36								118
N/A	N/A	6.37	4.38	0.32	1.2	<1.0	<5.0	29	<25	<2.5	79
N/A	N/A	6.32	4.56	0.35	2.2	<1.0	<5.0	29	<25	<2.5	62
N/A	N/A	7.04	5.7								55
N/A	N/A	7.75	6.44								44
N/A	N/A	6.33	4.79	0.34	<1.0	<1.0	<5.0	26	50	<2.5	88
N/A	N/A	6	4.37	0.15	<1.0	<1.0	<5.0	21	<25	<2.5	39
N/A	N/A	6.99	5.54								27
N/A	N/A	6.53	5.42	0.56	<1.0	<1.0	<5.0	17	64	<2.5	381
N/A	N/A	6.66	5.13								162
N/A	N/A	7.2	6.69	0.21	<1.0	1.4	<5.0	39	<25	<2.5	199
N/A	N/A	6.46	4.63								23
N/A	N/A	7.27	5.63								<10
N/A	N/A	8.04	7.35								207
N/A	N/A	7.69	6.19								<10
N/A	N/A	7.51	6.92	0.85	<1.0	1.2	9.4	37	110	3.6	631
N/A	N/A	6.16	4.92	0.46	<1.0	6.6	<5.0	22	73	11	128
N/A	N/A	6.39	4.74								

ınical note is available upon request. The exception is for quoted work that specifically required laboratory wet chemistry.

TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015E	TMs-015C1
Magnesium (Mg) - NH4Cl/BaCl2	Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Calcium (Ca) - NH4Cl/BaCl2	Magnesium (Mg) - NH4Cl/BaCl2	Potassium (K) - NH4Cl/BaCl2	Sodium (NH4Cl/BaCl2)	Ca:Mg ratio	K:Mg ratio	GTRI	ECR	Calcium (Ca) - prewash alc. pH 8.5 NH4Cl
mg/kg	mg/kg	mg/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg				%	mg/kg
66	75	5.7	1.97	0.539	0.191	0.025	3.7	0.35		7.9	171
34	52	6.5	0.417	0.283	0.134	0.028	1.5	0.47		19	58
45	17	25.5	0.31	0.371	0.045	0.111	0.8	0.12		19	55
118	19	648	0.227	0.971	0.049	2.82	0.2	0.05		71	17
60	76	4.1	1.3	0.492	0.194	<0.020	2.7	0.39		11	109
20	39	<4.0	0.367	0.167	0.101	<0.020	2.2	0.6		17	36
<10	28	<4.0	<0.050	<0.080	0.07	<0.020	0.5	1.1		49	14
<10	27	<4.0	<0.050	<0.080	0.07	<0.020	0.7	1.2		43	18
<10	22	<4.0	<0.050	<0.080	0.057	<0.020	0.6	1.1		43	13
<10	25	<4.0	<0.050	<0.080	0.063	<0.020	<0.1	1.7		66	12
<10	23	<4.0	<0.050	<0.080	0.059	<0.020	0.7	1.2		46	14
44	82	43.1	0.376	0.364	0.21	0.187	1	0.58		35	62
55	19	34.4	0.115	0.45	0.048	0.15	0.3	0.11		26	22
173	34	874	0.59	1.43	0.088	3.8	0.4	0.06		66	66
17	26	63.7	0.396	0.143	0.066	0.277	2.8	0.46		39	56
26	18	97.4	0.311	0.216	0.046	0.424	1.4	0.21		47	52
63	11	480	0.274	0.515	0.029	2.09	0.5	0.06		73	29
111	21	1140	0.221	0.916	0.055	4.97	0.2	0.06		82	<10
34	51	6.5	0.437	0.281	0.129	0.028	1.6	0.46		18	76
46	30	19.7	0.196	0.374	0.077	0.086	0.5	0.21		22	43
44	17	38.2	0.137	0.36	0.043	0.166	0.4	0.12		30	27
43	51	<4.0	1.9	0.354	0.131	<0.020	5.4	0.37		6	248
47	28	4.3	0.807	0.39	0.071	<0.020	2.1	0.18		7	144
107	15	11	0.992	0.88	0.039	0.048	1.1	<0.05		4.5	133
129	8	25.2	0.112	1.06	0.021	0.11	0.1	<0.05		10	32
124	7	67.2	<0.050	1.02	0.018	0.292	<0.1	<0.05		23	15
98	29	72.3	1.03	0.805	0.073	0.314	1.3	0.09		17	108
192	16	444	<0.050	1.58	0.04	1.93	<0.1	<0.05		55	<10
66	87	16.2	3.15	0.542	0.223	0.071	5.8	0.41		7.4	316
72	58	75.7	0.638	0.596	0.149	0.329	1.1	0.25		28	106

TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015G
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	K:Mg ratio	GTRI	ECR	Exchangeable acidity
mg/kg	mg/kg	mg/kg	cmol/kg	cmol/kg	cmol/kg	cmol/kg				%	cmol/kg
25	41.6	<6.0	0.855	0.206	0.106	<0.020	4.2	0.52		9.9	<0.02
16.6	118	<6.0	0.287	0.137	0.302	<0.020	2.1	2.2		42	0.39
27.6	40.2	<6.0	0.272	0.227	0.103	<0.020	1.2	0.45		19	0.33
24.1	14.8	67.5	0.084	0.198	0.038	0.294	0.4	0.19		54	<0.02
25.2	39.3	<6.0	0.545	0.207	0.101	<0.020	2.6	0.48		12	0.06
17.3	33.5	<6.0	0.179	0.142	0.086	<0.020	1.3	0.6		22	0.12
22.7	26.7	<6.0	0.071	0.187	0.068	<0.020	0.4	0.37		22	0.29
<10.0	16.2	<6.0	0.089	<0.080	0.041	<0.020	<0.1	<0.05		34	0.3
<10.0	21	<6.0	0.063	<0.080	0.054	<0.020	7	5.9		45	0.3
<10.0	25.5	<6.0	0.058	<0.080	0.065	<0.020	0.8	0.91		37	0.36
<10.0	19.7	<6.0	0.071	<0.080	0.05	<0.020	1.2	0.86		28	0.34
31.2	70.1	<6.0	0.308	0.257	0.179	<0.020	1.2	0.7		25	<0.02
45.2	27.3	<6.0	0.109	0.372	0.07	0.022	0.3	0.19		16	0.56
61.4	21.2	122	0.327	0.505	0.054	0.53	0.7	0.11		41	<0.02
<10.0	28.3	8.1	0.281	<0.080	0.072	0.035	6.7	1.7		25	<0.02
20.1	27.3	19	0.259	0.165	0.07	0.083	1.6	0.42		26	<0.02
17.5	9.8	55.8	0.145	0.144	0.025	0.243	1	0.17		48	<0.02
16.1	13	79.4	<0.050	0.132	0.033	0.345	0.3	0.25		68	<0.02
38	41.7	<6.0	0.377	0.313	0.107	<0.020	1.2	0.34		14	<0.02
31.6	26.6	<6.0	0.213	0.26	0.068	<0.020	0.8	0.26		13	<0.02
31.6	18.6	<6.0	0.137	0.26	0.048	<0.020	0.5	0.18		13	<0.02
13.1	21.4	<6.0	1.24	0.108	0.055	<0.020	11	0.51		3.9	<0.02
41.2	25.6	<6.0	0.718	0.339	0.066	<0.020	2.1	0.19		6.2	<0.02
74.4	29	<6.0	0.661	0.612	0.074	<0.020	1.1	0.12		5.6	<0.02
101	18.3	<6.0	0.157	0.828	0.047	<0.020	0.2	0.06		5.8	<0.02
106	18.2	11.2	0.073	0.874	0.047	0.049	<0.1	0.05		9.1	<0.02
52.5	19.3	<6.0	0.537	0.432	0.049	<0.020	1.2	0.11		6.5	<0.02
71	26.8	74.1	<0.050	0.584	0.069	0.322	<0.1	0.12		38	<0.02
30.7	50.4	<6.0	1.58	0.253	0.129	<0.020	6.2	0.51		6.8	<0.02
67.6	62	8.5	0.528	0.556	0.159	0.037	1	0.29		15	<0.02

TMs-015G	TMs-015G	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-028	TMs-005	TMs-003
Exchangeable aluminium	Exchangeable hydrogen	ECEC	Calcium	Magnesium	Potassium	Sodium	Aluminium	Hydrogen	CaCl2 extr. Aluminium	Chloride	Salinity EC 1:5
cmol/kg	cmol/kg	cmol/kg	%	%	%	%	%	%	mg/kg	mg/kg	dS/m
<0.02	<0.02	1.18	72.6	17.5	9	0.9	0	0	<0.1	<5	0.027
0.23	0.16	1.12	25.7	12.2	27	0.5	20	14		<5	0.012
0.19	0.14	0.94	28.9	24.1	11	1.2	20	15		15	0.018
<0.02	<0.02	0.61	13.7	32.3	6.2	48	0	0		170	0.17
<0.02	0.05	0.92	59.4	22.6	11	0.6	0.8	5.7	0.3	7	0.03
0.04	0.08	0.54	33.3	26.5	16	1.1	8.2	15		<5	0.011
0.21	0.08	0.62	11.5	30.2	11	0.6	34	12		6	<0.010
0.21	0.09	0.4	22.3	<0.2	10	<0.2	52	22		<5	<0.010
0.23	0.08	0.43	14.7	2.1	12	1.1	52	17		10	<0.010
0.26	0.11	0.57	10.2	12.7	12	1.7	45	19		8	<0.010
0.22	0.12	0.52	13.8	11.3	9.7	0.3	42	23		<5	<0.010
<0.02	<0.02	0.76	40.7	33.9	24	1.8	0	0	<0.1	32	0.055
0.43	0.13	1.13	9.6	32.9	6.2	2	38	11		20	0.016
<0.02	<0.02	1.42	23.1	35.7	3.8	37	0	0		210	0.23
<0.02	<0.02	0.43	65.3	9.8	17	8.2	0	0	1.9	14	0.023
<0.02	<0.02	0.58	44.9	28.6	12	14	0	0		28	0.039
<0.02	<0.02	0.56	26	25.9	4.5	44	0	0		240	0.22
<0.02	<0.02	0.55	7.6	24	6	62	0	0		500	0.24
<0.02	<0.02	0.8	46.9	39	13	0.8	0	0	<0.1	10	<0.010
<0.02	<0.02	0.54	39.1	47.8	13	0.6	0	0		20	<0.010
<0.02	<0.02	0.45	30.1	57.2	10	2.2	0	0		11	0.018
<0.02	<0.02	1.4	88.4	7.7	3.9	<0.2	0	0	<0.1	<5	0.016
<0.02	<0.02	1.13	63.7	30.1	5.8	0.4	0	0		9	<0.010
<0.02	<0.02	1.35	49	45.4	5.5	<0.2	0	0		6	0.063
<0.02	<0.02	1.05	15	79.2	4.5	1.3	0	0		11	<0.010
<0.02	<0.02	1.04	7	83.8	4.5	4.7	0	0		29	0.026
<0.02	<0.02	1.04	51.8	41.7	4.8	1.8	0	0		33	0.11
<0.02	<0.02	1.02	4.4	57.3	6.7	32	0	0		96	0.097
<0.02	<0.02	1.96	80.3	12.9	6.6	0.3	0	0	<0.1	8	0.2
<0.02	<0.02	1.28	41.3	43.4	12	2.9	0	0		35	0.052
										10	<0.010

TMs-012C	TMs-012A	TMs-012A	TMs-012A	TMs-012A	TMs-031	TMs-007	TMs-003	TMs-002A1	TMs-002A1	TMs-Cal04
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)	Organic matter
mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	% dry wt	mg/L	% of dry wt	g/g	%
0.15	32	2.8	0.16	0.12	<0.25	0.056	18	0.1	0.0014	1.6
						0.034	8	<0.1	<0.001	0.39
							12			
							110			
0.13	22	10	0.14	0.24	<0.25	0.077	19	<0.1	<0.001	1.6
							7			
						<0.030	<6	0.1	0.0013	0.23
							<6			
							<6			
							<6			
							<6			
0.16	24	2.6	0.17	<0.08	<0.25	0.034	35	0.2	0.0018	0.81
						<0.030	10	0.2	0.002	0.54
							150			
<0.10	30	0.4	0.11	<0.08	0.26	<0.030	14	0.2	0.0016	0.63
						<0.030	25	0.2	0.0018	0.71
							140			
							150			
0.14	4.1	2.4	0.11	<0.08	<0.25	<0.030	<6	0.1	0.0013	0.68
						<0.030	6	0.1	0.0015	0.3
							12			
0.11	14	7.4	0.18	0.09	<0.25	<0.030	10	0.2	0.0018	1.1
							<6			
						<0.030	40	0.3	0.0031	0.42
							<6			
							17			
							72			
							62			
0.14	51	12	0.22	0.64	0.27	0.058	130	0.3	0.0025	1.7
						0.036	33	0.2	0.0022	0.92
							<6			

ESSA /EAL(ASPAC)

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Date Received: 21/01/2026
Date Completed: 7/02/2026

FINAL REPORT

Project: ESM

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 BSc CPSS

Sample Type: Soil

Number of samples: 30 ESM

ESSA (EAL)Pty Ltd

Soil Analysis Report

Reference: 26000704 ESSA 267965

				Recd		21/01/2026			
				Reported		7/02/2026			
Client Sample ID:				D1-0.00-0.10	D1-0.20-0.30	D1-0.50-0.60	D1-0.80-0.90	D2-0.00-0.10	D2-0.20-0.30
EAL Sample ID:				E26-00-0704-0001	E26-00-0704-0002	E26-00-0704-0003	E26-00-0704-0004	E26-00-0704-0005	E26-00-0704-0006
Parameter	Unit	Method Reference	LOR	---	---	---	---	---	---
Moisture (dry basis)	%	**Rayment & Lyons 20	---	0.319	0.247	0.214	0.365	0.272	0.121
Gravel > 4.75 mm fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	< 0.1	0.1	0.2	8	0.2	0.4
Gravel 2.00-4.75 mm fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	0.5	2.1	2.1	15	0.6	0.3
Coarse Sand 200-2000 um fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	43.1	38.8	33.6	30.3	40.4	36.7
Fine Sand 20-200 um fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	47.1	49.8	51.6	33.1	52.8	56.3
Silt 2-20 um fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	2.8	1.1	2.4	1.1	2.8	1.1
Clay < 2 um fraction	% of total oven-dry equivalent	** Inhouse S30	<0.1	6.6	8.1	10.1	12.6	3.3	5.2
R1 Dispersion Ratio	---	** Inhouse S87	---	0.03	0.21	0.18	0.15	0.03	0.08
Emerson Aggregate No.	---	** Inhouse S28	---	3	3	3	3	3	3

D2-0.50-0.60	D2-0.80-0.90	D2-1.10-1.20	D2-1.40-1.50	D2-1.70-1.80	D3-0.00-0.10	D3-0.20-0.30	D3-0.50-0.60	D7-0.00-0.10	D7-0.20-0.30	D7-0.50-0.60	D7-0.65-0.75
E26-00-0704-0007	E26-00-0704-0008	E26-00-0704-0009	E26-00-0704-0010	E26-00-0704-0011	E26-00-0704-0012	E26-00-0704-0013	E26-00-0704-0014	E26-00-0704-0015	E26-00-0704-0016	E26-00-0704-0017	E26-00-0704-0018
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0.138	0.134	0.128	0.166	0.168	0.314	0.286	0.6	0.244	0.262	0.389	0.503
< 0.1	< 0.1	1.4	0.1	< 0.1	1.7	< 0.1	0.4	0.1	0.3	5.7	10.4
0.6	0.8	1.1	1	0.5	1.5	1.6	11.6	0.8	1.3	11.2	17.8
39.1	40.6	41.4	41	38.4	13.2	25.6	25.6	54.6	33.3	27.7	27.3
54.6	52.7	49.6	53	55	71.5	60	45.5	36.8	50.5	38.9	27.6
0.5	2.4	2.9	1.6	1.1	3.8	1.1	0.5	0.5	4.6	7.2	1
5.3	3.6	3.6	3.3	4.9	8.4	11.7	16.3	7.2	10.1	9.4	15.9
0.03	0.03	0.03	0.03	0.11	0.26	0.02	0.53	0.14	0.19	0.47	0.54
3	4	4	4	3	3	3	2	3	2	2	2

D11-0.00-0.10	D11-0.10-0.20	D11-0.25-0.35	D16-0.00-0.10	D16-0.20-0.30	D16-0.50-0.60	D16-0.80-0.90	D16-1.10-1.20	D16-1.40-1.50	D16-1.70-1.80	D20-0.00-0.10	D20-0.10-0.15
E26-00-0704-0019	E26-00-0704-0020	E26-00-0704-0021	E26-00-0704-0022	E26-00-0704-0023	E26-00-0704-0024	E26-00-0704-0025	E26-00-0704-0026	E26-00-0704-0027	E26-00-0704-0028	E26-00-0704-0029	E26-00-0704-0030
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0.227	0.212	0.225	0.26	0.219	0.326	0.378	0.424	0.458	0.399	0.322	0.336
0.6	2.1	22.6	< 0.1	< 0.1	< 0.1	< 0.1	0.1	41.4	6.1	0.3	7.5
1.6	3.7	11	< 0.1	< 0.1	0.2	0.3	0.9	5	5.5	0.9	4
41.5	45.7	42.7	62.7	58.6	54.8	52.2	52.5	31.9	50.6	62.8	49.9
43.1	36	17.1	24.4	25	21.8	20.9	22.4	9.3	13.2	25	24
1.7	2.8	2.2	3.1	2.4	3	1.7	1	2.5	2.8	3.5	5.6
11.6	9.7	4.4	9.7	13.9	20.3	25	23.2	10	22	7.5	9.1
0.21	0.36	0.21	0.27	0.35	0.32	0.32	0.38	0.43	0.33	0.13	0.29
3	3	3	3	4	2	2	2	4	2	3	3

ESSA Pty Ltd/ EAL

METHOD DESCRIPTIONS

Soil

Reference:26000704 ESSA 267965

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/EAL

QUALITY CONTROL DATA

Reference:26000704 ESSA 267965

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

email:e.s.s.a@bigpond.net.au

Date Received: 23/01/2026
Date Completed: 12/02/2026

FINAL REPORT

Project: ESM (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: 30 Selected of 30

ESSA (DETSI)Pty Ltd

Soil Analysis Report

Reference: DESTI 280090 Ex 2600 0704

Reported 12/02/2026

Client: GTE

Soil Analysis Report

Job No: 267965

Sample No	Customer's ID	Site ID	Project ID	Description(m)	S_15_BAR 15 Bar %
26-0090-0001	E26-00-0704-0001		ESM	D1-0.0-0.1	2.3
26-0090-0002	E26-00-0704-0002		ESM	D1-0.2-0.3	3.1
26-0090-0003	E26-00-0704-0003		ESM	D1-0.5-0.6	3.3
26-0090-0004	E26-00-0704-0004		ESM	D1-0.8-0.9	5.8
26-0090-0005	E26-00-0704-0005		ESM	D2-0.0-0.1	1.5
26-0090-0006	E26-00-0704-0006		ESM	D2-0.2-0.3	<1.5
26-0090-0007	E26-00-0704-0007		ESM	D2-0.5-0.6	1.7
26-0090-0008	E26-00-0704-0008		ESM	D2-0.8-0.9	1.9
26-0090-0009	E26-00-0704-0009		ESM	D2-1.1-1.2	1.8
26-0090-0010	E26-00-0704-0010		ESM	D2-1.4-1.5	1.8
26-0090-0011	E26-00-0704-0011		ESM	D2-1.7-1.8	2.2
26-0090-0012	E26-00-0704-0012		ESM	D3-0.0-0.1	3.1
26-0090-0013	E26-00-0704-0013		ESM	D3-0.2-0.3	3.4
26-0090-0014	E26-00-0704-0014		ESM	D3-0.5-0.6	8.2
26-0090-0015	E26-00-0704-0015		ESM	D7-0.0-0.1	2.6
26-0090-0016	E26-00-0704-0016		ESM	D7-0.2-0.3	3.3
26-0090-0017	E26-00-0704-0017		ESM	D7-0.5-0.6	5.9
26-0090-0018	E26-00-0704-0018		ESM	D7-0.65-0.75	7.9
26-0090-0019	E26-00-0704-0019		ESM	D11-0.0-0.1	3.1
26-0090-0020	E26-00-0704-0020		ESM	D11-0.1-0.2	2.8
26-0090-0021	E26-00-0704-0021		ESM	D11-0.25-0.35	2.3
26-0090-0022	E26-00-0704-0022		ESM	D16-0.0-0.1	3.6
26-0090-0023	E26-00-0704-0023		ESM	D16-0.2-0.3	4.2
26-0090-0024	E26-00-0704-0024		ESM	D16-0.5-0.6	6.2
26-0090-0025	E26-00-0704-0025		ESM	D16-0.8-0.9	7
26-0090-0026	E26-00-0704-0026		ESM	D16-1.1-1.2	6.7
26-0090-0027	E26-00-0704-0027		ESM	D16-1.4-1.5	5
26-0090-0028	E26-00-0704-0028		ESM	D16-1.7-1.8	8.4
26-0090-0029	E26-00-0704-0029		ESM	D20-0.0-0.1	3.7
26-0090-0030	E26-00-0704-0030		ESM	D20-0.10-0.15	3.8

This job has been authorized by: R Wang

NATA Accredited Laboratory
Number: 5072

This document is issued in accordance with NATA's accreditation requirements.
Accredited for compliance ISO/IEC 17025 - Chemical testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

ESSA Pty Ltd/ DETSI

METHOD DESCRIPTIONS

Soil

Reference: Reference: DESTI 280090 Ex 2600 0704

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: DESTI DESTI 280090 Ex 2600 0704

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

eurofins | APAL

Eurofins APAL Test Method Codes												
Crop	Actual Crop	SubmissionID	SamplingDate	DateReceived	BatchID	Batch Position No.	AgentName	ClientName	SampleName	Barcode	SampleDepth	Postcode
		150293		2026-01-19	47754	7	GT Environmental - Reece McCann	GT Environmental	D10-0.00-0.10	111978310		4120
		150293		2026-01-19	47754	9	GT Environmental - Reece McCann	GT Environmental	D10-0.20-0.30	111978311		4120
		150293		2026-01-19	47754	8	GT Environmental - Reece McCann	GT Environmental	D10-0.40-0.50	111978312		4120
		150293		2026-01-19	47754	6	GT Environmental - Reece McCann	GT Environmental	D10-0.70-0.80	111978313		4120

		TMs-004A	TMs-004B4	TMs-007NO3	TMs-007NH4	TMs-009B	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1
Transect GPS Start	Transect GPS Finish	pH 1:5 water	pH CaCl2 (following 4A1)	Nitrate - N (2M KCl)	Ammonium - N (2M KCl)	Colwell Phosphorus	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
		pH units	pH units	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	cmol/kg
N/A	N/A	6.4	5.08	<1.0	<1.0	<5.0	120	14.8	46.8	<6.0	0.596
N/A	N/A	6.26	4.98	<1.0	<1.0	<5.0	108	22.4	29.4	<6.0	0.54
N/A	N/A	7.24	5.9	<1.0	<1.0	<5.0	194	62.3	25.4	<6.0	0.97
N/A	N/A	7.74	6.3	<1.0	<1.0	<5.0	121	105	62.2	30.6	0.603

TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015C1	TMs-015G	TMs-015G	TMs-015G	TMs-Cal02	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	Calcium
cmol/kg	cmol/kg	cmol/kg				%	cmol/kg	cmol/kg	cmol/kg	cmol/kg	%
0.122	0.12	<0.020	4.9	0.98		14	<0.02	<0.02	<0.02	0.84	71.2
0.184	0.075	<0.020	2.9	0.41		9.9	<0.02	<0.02	<0.02	0.8	67.2
0.513	0.065	<0.020	1.9	0.13		5	<0.02	<0.02	<0.02	1.56	62.2
0.863	0.159	0.133	0.7	0.18		17	<0.02	<0.02	<0.02	1.76	34.3

TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-Cal02	TMs-005	TMs-003	TMs-007	TMs-003	TMs-002A1	TMs-002A1
Magnesium	Potassium	Sodium	Aluminium	Hydrogen	Chloride	Salinity EC 1:5	Dumas Total Nitrogen	TDS	% Air-dry Moisture Content	S7 Gravimetric water content of air dried fine fraction (GWCad-ff)
%	%	%	%	%	mg/kg	dS/m	% dry wt	mg/L	% of dry wt	g/g
14.5	14	<0.2	0	0	<5	<0.010	<0.030	<6	<0.1	<0.001
22.9	9.3	0.5	0	0	6	<0.010	<0.030	6	<0.1	<0.001
32.9	4.2	0.8	0	0	10	0.023	<0.030	15	0.2	0.0017
49.1	9	7.6	0	0	29	0.055	0.032	35	0.2	0.0019

ESSA /EAL(ASPAC)

5 Dunphy St Sunnybank Hills
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Phone: 0403245560

email:e.s.s.a@bigpond.net.au

Date Received: 21/01/2026
Date Completed: 30/01/2026

FINAL REPORT

Project: ESM

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 BSc CPSS

Sample Type: Soil

Number of samples: 4 Selected GSM D10

ESSA (EAL)Pty Ltd

Soil Analysis Report

Reference: 26000668 ESSA 267965

Recd 21/01/2026

Reported 30/01/2026

Client: GTE GSM

				D10 - 0.00 - 0.10m	D10 - 0.20 - 0.30m	D10 - 0.40 - 0.50m	D10 - 0.70 - 0.80m
Wet Bulk Density	kg/L	** AS4419 Appendix B	---	1.61	1.55	1.35	1.24
Dry Bulk Density	kg/L	** AS4419 Appendix B	---	1.59	1.51	1.28	1.16
Moisture Content 105Â°C	%	** AS4454:2012 Appendix I	<0.1	1	2.6	5.3	6.4

ESSA Pty Ltd/ EAL

METHOD DESCRIPTIONS

Soil

Reference:26000668 ESSA 267965

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
Bulk Density					BD AS4419	AS4419
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/EAL

QUALITY CONTROL DATA

Reference:26000668 ESSA 267965

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
Bulk Density	Kg/L	NA		NA
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
Bulk Density	Kg/L			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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