# SOIL & LAND RESOURCE ASSESSMENT

## Goschen Rare Earths and Mineral Sands Project

Prepared for:

VHM Limited

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## BASIS OF REPORT



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## DOCUMENT CONTROL

| Reference | Date | Prepared | Checked | Authorised |
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## APPENDICES

# 1 Introduction

This technical report is an attachment to VHM Limited's Goschen Rare Earths and Mineral Sands Project (the Project) Environment Effects Statement (EES). It has been used to inform the EES required for the Project.

## 1.1 Requirement for an EES

The Project was referred to the Minister for Planning ("the Minister") to seek advice on the need for an EES under the *Environment Effects Act 1978* (Vic) (EE Act).

On 10 October 2018, the Minister for Planning decided that an EES was required on the basis that the Project has the potential for a range of significant environmental effects.

On 19 December 2018 under delegated authority from the Minister for the Environment, the Department of the Environment and Energy (now referred to as the Department of Climate Change, Energy, Environment and Water (DCCEEW)) made a decision that the Project is a controlled action under the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) and would require assessment and a decision about whether approval should be given under the EPBC Act. The EES for the Project is an accredited assessment process under the EPBC Act through a Bilateral Assessment Agreement that exists between the Commonwealth and State of Victoria.

The EES allows stakeholders to understand the likely environmental impacts of the Project and how they are proposed to be managed. The Minister's assessment of the EES will also inform statutory decisions that need to be made on the Project.

The EES was developed in consultation with the community and stakeholders.

# 2 Project Description

## 2.1 Project Overview

The Project is a rare earth and mineral sands mine and processing facility, proposed to be operational for approximately 20 years. VHM has been developing the Project in the context of a rapidly growing global demand for rare earths. One of the world's largest, highest grade zircon, rutile and rare earth mineral deposits is in the Loddon Mallee region of Victoria in Australia. VHM intends to establish the Project to mine these deposits and process to produce and market a range of products to national and international consumers.

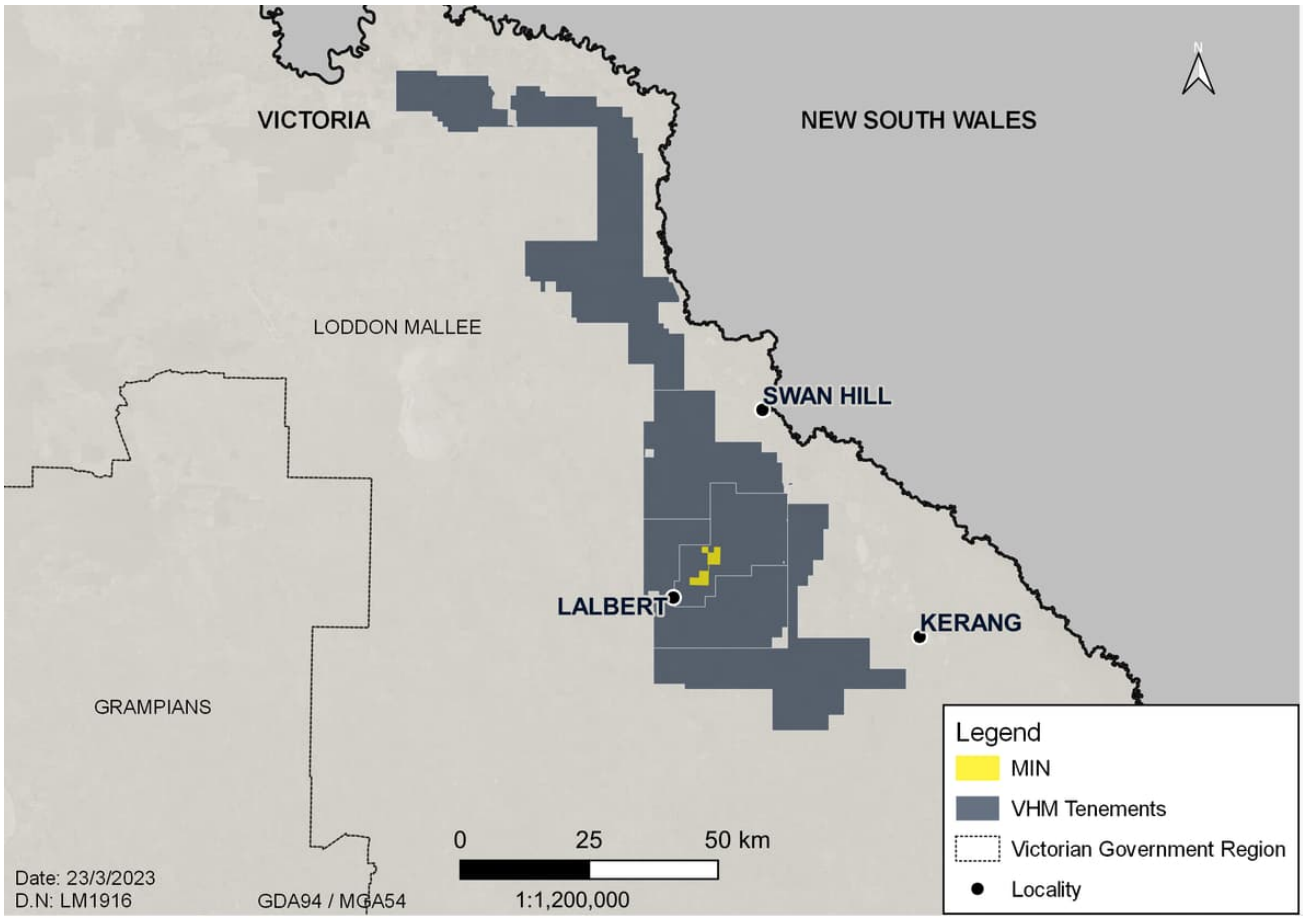
The mine footprint has been restricted to avoid intersection with groundwater and significant areas of remnant native vegetation. VHM will implement a staged development approach. Initially developing phase 1 consisting of a mining unit plant (MUP), wet concentrator plant (WCP), feed preparation plant (FPP) and a rare earth mineral concentrate (REMC) flotation plant. The product suite for Phase 1 consists of zircon. titania heavy mineral concentrate (HMC) and REMC products. Phase 1A would add a hydrometallurgical plant (HMP) downstream of the REMC flotation plant. The HMP would commence operations approximately 18 months post first production. The product suite for Phase 1A consists of mixed rare earth carbonate (MREC) products and zircon/ titania HMC.

Phase 2 will commence either at the same time as Phase 1 or some 24 months post-production depending on prevailing market circumstances and consist of an additional mineral separation plant (MSP), hot acid leach (HAL) and chrome removal circuit. The additional plant would allow for the production of premium zircon, zircon concentrate, high titanium (HiTi) rutile, HiTi leucoxene and low chromium ilmenite.

Mining will occur within two Project areas known as Area 1 and Area 3. Area 1 will be mined for eight to 10 years and Area 3 will be mined for a further 12 to 15 years once the mining of ore within Area 1 has ceased.

The Project is located approximately 4 hours' drive (275 km) northwest of Melbourne and 30 minutes (35 km) south-southwest of Swan Hill within Gannawarra Shire (Figure 1).

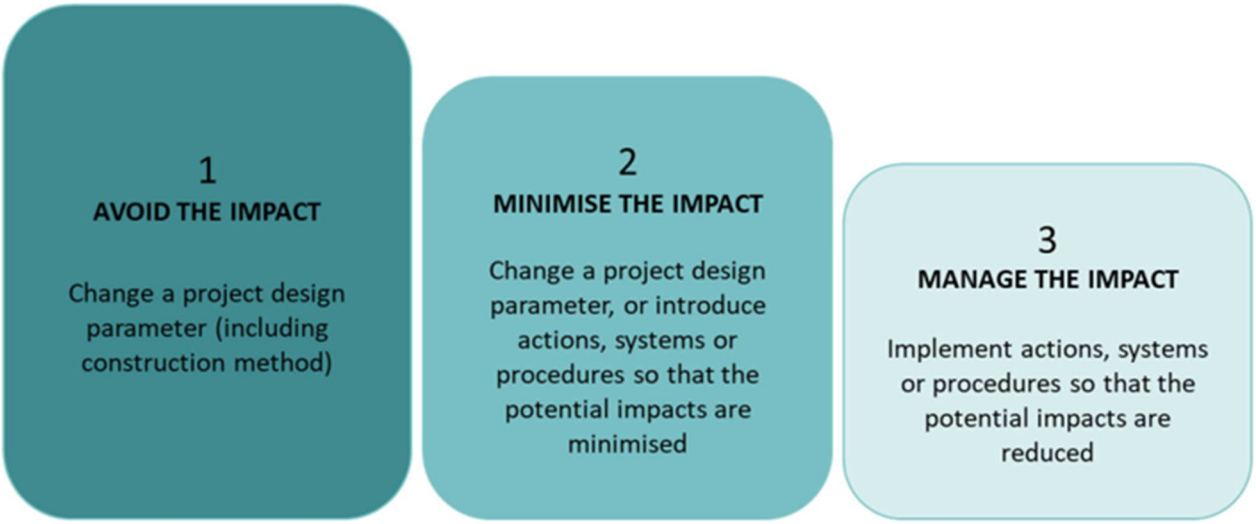
Figure 1 Project Location




## 2.2 Project Development

It is recognised that there are opportunities to avoid or minimise environmental impacts during the many stages of Project development. During Project inception and early design development stages of the Project, decisions on the location of the Project, its design and construction techniques have enabled impacts to be significantly avoided or minimised in accordance with the hierarchy presented in Figure 2.

Figure 2 Mitigation Hierarchy




Avoidance or minimisation of social and environmental impacts is central to the Project's decision making and as such, the Project will continue to be refined in response to technical requirements and potential environmental and social impacts identified during the development phase. This was considered in the preparation of a project description which is found at Chapter 4: Project description.

Examples of this include the decision to create vegetation protection zones within the Project (mining area), restricting mining operations to daylight hours only to avoid noise related impacts to certain receptors, and restricting mining to depths above the water table to avoid impacts to the groundwater table.

After opportunities to avoid impact were incorporated into the Project, minimisation and rehabilitation measures were developed. These are described in the construction and operation impact assessment sections below.

## 2.3 Key Project Components

The Project site consists of a heavy mineral sand mining and processing operation that will produce several HMCs and a range of critical rare earth minerals across two defined mining areas known as Area 1 and Area 3 (Figure 3 and Figure 4).

### 2.3.1 Construction

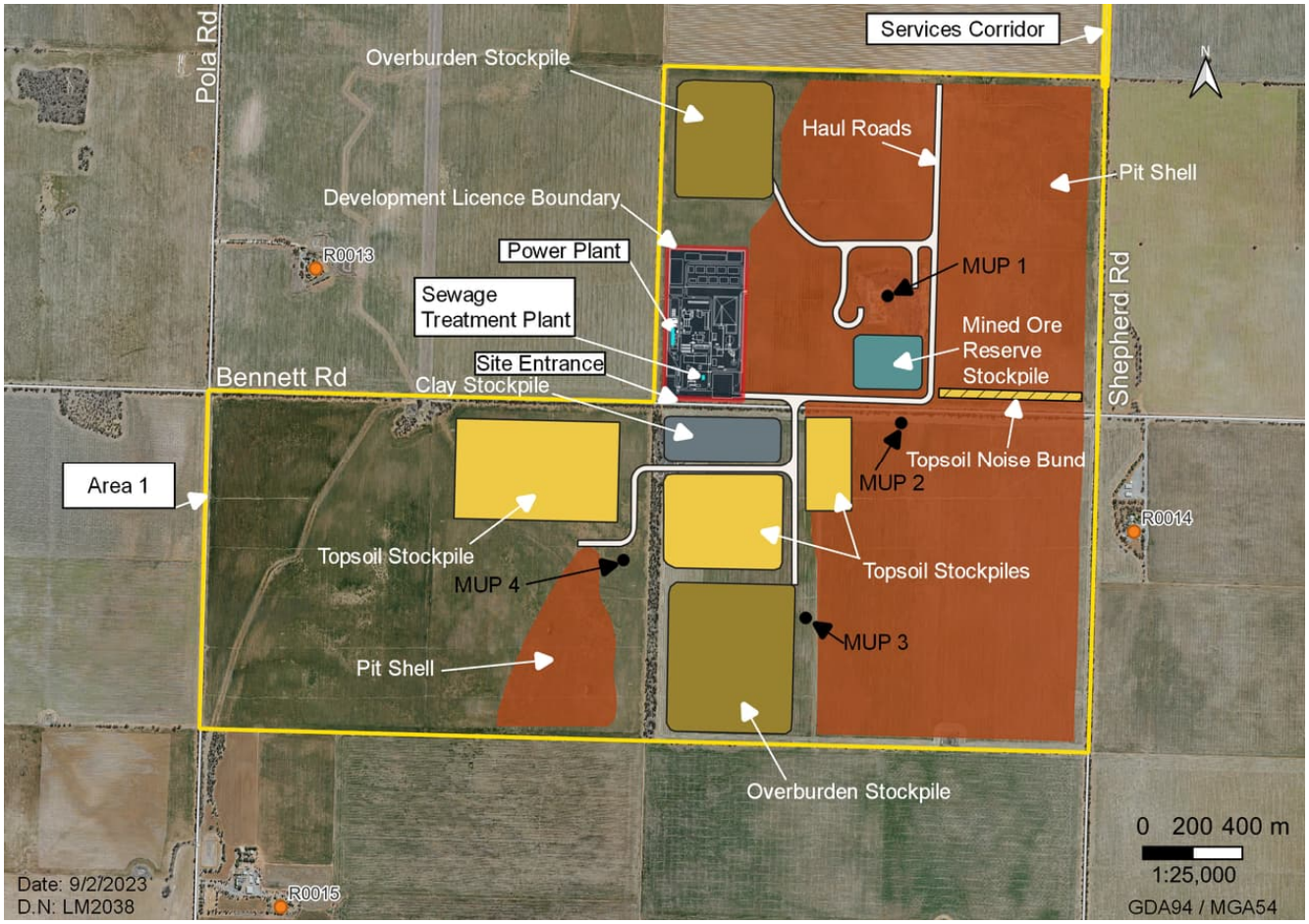
Construction within Area 1 will include vegetation and topsoil stripping before establishment of hardstand areas, construction of the processing plant and MUP, and roadways. Construction equipment will be as per typical industry usage, and may include cranes and mobile lifting plant, service vehicles, welding plant, lighting towers, assembly workshops, etc.

Construction of the pipeline will progress linearly and may include excavators, mobile lifting plant and flatbed truck delivery of pre-fabricated pipeline.

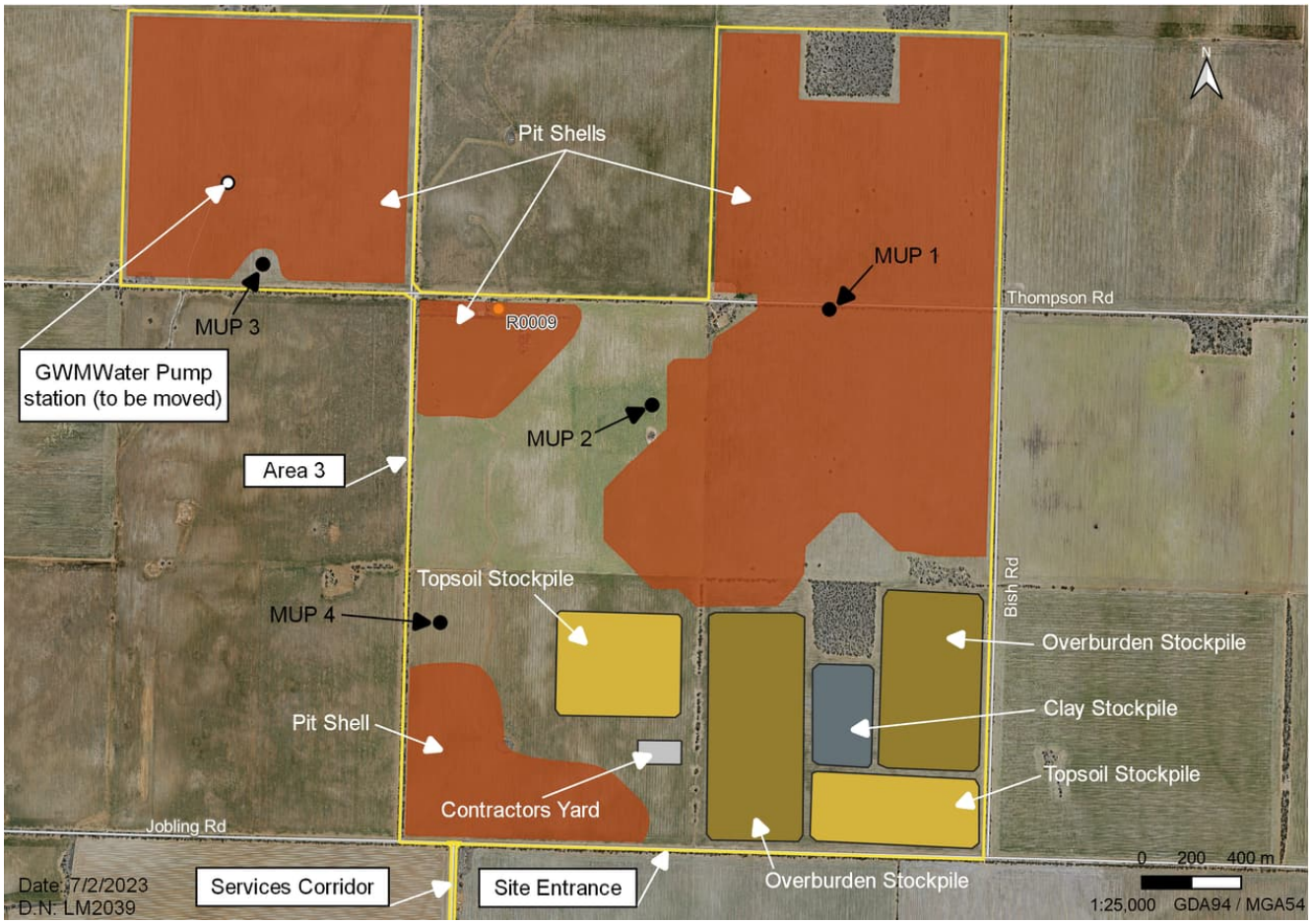
### 2.3.2 Operation

Conventional open pit mining equipment (truck and excavator) will be used for a strip-mining operation in Area 1 and Area 3. Mining will progress by blocks, each with a final floor footprint of approximately 500 m x 200 m. Topsoil and overburden will be stockpiled in waste dumps in the first instance. Ore will be transported by haul truck to the MUP where it will be turned into a slurry and piped to the processing plant. As the mining of the blocks continues, waste material (topsoil, overburden and tailings) from the initial mining voids will backfill the mined voids, reducing haulage and double handling. The stockpiled material on the surface will ultimately be rehandled to the final mine void. The land will then be rehabilitated to its original, or other approved, land use.

Figure 3 Project Area 1



## Figure 4 Project Area 3




The key components that make up the Project are described below.

Mining – Mining would operate 24hrs a day and would take 20 to 25 years at a throughput of 5 Mt per year and would occur above the groundwater table across approximately 1,479 hectares of farmland using conventional open cut mining methods of excavation, load and haul.

Processing – The processing would operate 24hrs a day with heavy mineral sands and rare earths ore separated via an on-site WCP and MSP to generate a rare earth mineral concentrate (REMC). Refining of the REMC on-site is limited to hydrometallurgical extraction to produce a mixed rare earth carbonate. Tailings from the various mineral processes would be homogenised and placed back into the ore zone earlier mined.

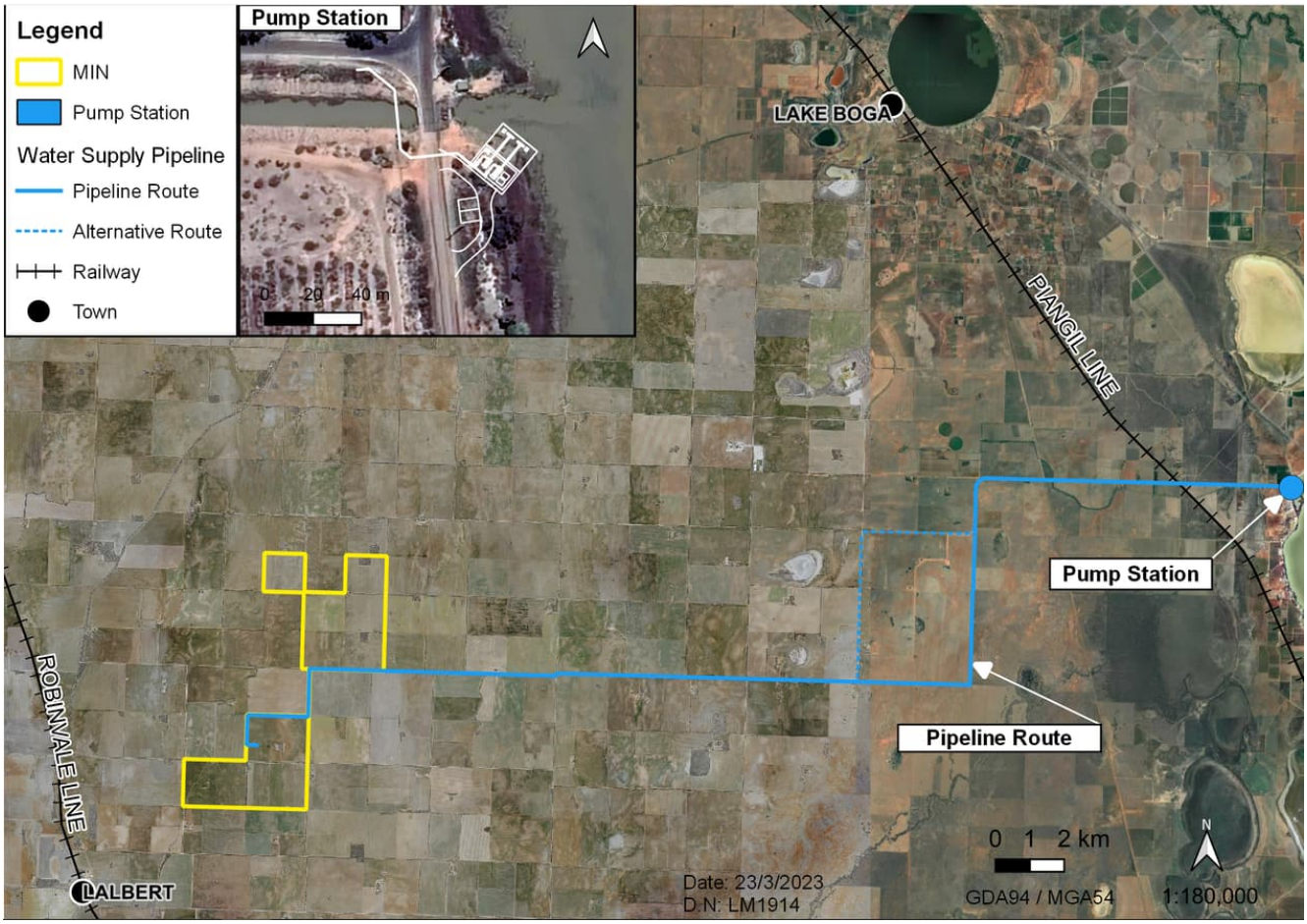
Rehabilitation – The mined areas (cells) would be progressively backfilled in a staged manner, with tailings dewatered in-pit to allow overburden and topsoil placement in a profile that reinstates the background soil structure. This would result in the ability for a return to the current agricultural land uses within three years.

Power – All electrical power needed for mining and processing would be produced from an on-site power plant able to be fuelled by diesel, LNG and/or LPG. A gradual evolution over the life of mine to renewables, hydrogen and/or battery will occur as technologies and commercial viability increase. Heat energy for the on-site gas fired appliances would be provided from an extension of the distribution network from the main LNG storage and regasification system.

Transport – Final products would be containerised in 20ft sealed sea containers on site and exported via road to an intermodal at Ultima and then rail to the Port of Melbourne.

Water – Water will be required for construction earthworks, processing, dust suppression and rehabilitation. Up to 4.5 GL a year will be needed for the Project. Water will be sourced from Goulburn Murray Water (GMW) from a new pumpstation at Kangaroo Lake via the open water market with no constraints put on existing or future agricultural availability. A 38 km underground pipeline is proposed beneath existing local road easements as shown in Figure 5, noting the section of pipeline labelled 'alternative route' is not proposed to be constructed.

Figure 5 Proposed Water Supply Pipeline Route




## 2.3.3 Closure & Rehabilitation

Closure/rehabilitation would involve the dismantling and removal of infrastructure and services, with the following two aims.

- return the land to a condition that is as near as practicable to pre-existing environmental conditions
- decommission the infrastructure in a manner that minimises potential impacts to the environment, land use and third parties.

For the purposes of the EES, it is assumed that decommissioning would be undertaken in line with regulatory standards at time of decommissioning, involving the dismantling and removal of processing plant, equipment and ancillary facilities, including decommissioning of the water pipeline and removal of offtake pumping station unless it could be used by the local community.

# 3 Scope of Work

## 3.1 EES Evaluation Objectives and Scoping Requirements

The June 2022 scoping requirements for the Goschen Rare Earths and Mineral Sands Project Environment Effects Statement ('scoping requirements') by the Minister for Planning, set out the specific environmental matters the Project must address in order to satisfy the Victorian assessment and approval requirements.

The scoping requirements include a set of evaluation objectives. These objectives identify the desired outcomes to be achieved in managing the potential impacts of constructing and operating the Project in accordance with the Ministerial guidelines for assessment of environmental effects under the EE Act.

Under Section 1.2 of the scoping requirements, and relevant to the Soil and Land Resource Assessment and associated impacts on land stability and soil productivity, this report addresses:

- Effects on land stability, erosion and soil productivity associated with the construction and operation of the project, including progressive rehabilitation works.

The aspects from the scoping requirements relevant to the Soil and Land Resource Assessment are shown in Table 1 as well as the location where these items have been addressed in this report.

Table 1 Scoping Requirements Relevant to Soil and Land Resources

| Aspect | Scoping Requirement | Section Addressed |
|---|---|---|
| Key Issues | Effects on land stability, erosion and soil productivity associated with the construction and operation of the project, including progressive rehabilitation works. | 6.6, 6.7 & 8 |
| Existing Environment | Characterise the physical and chemical properties of the project area soils/mine geological materials including the potential environmental risks (e.g. potential for erosion, salinity, nutrients and acidification). | 6.3, 6.6 & 6.7 |
| Design and Mitigation Measures | Proposed depth of topsoil to be extracted, storage and management of stockpiled topsoil and treatment measures. | 8.1 & 8.2 |
| | Describe proposed design options and measures which could avoid or minimise significant effects | 6.6.1 |
| | Outline and assess design and mitigation measures that address the potential for adverse land use effects during construction, operations (including progressive rehabilitation), decommissioning/rehabilitation and post-closure, including the proposed principles for sustainable land use set for rehabilitation of soils and landforms post mining. | 6.6, 6.7 & 8 |

# 4 Evaluation Framework

The principal legislation governing the mining industry in Victoria is the *Mineral Resources (Sustainable Development) Act 1990* (MRSDA) and the associated *Mineral Resources (Sustainable Development) (Mineral Industries) Regulations 2019*. The Minister for Resources (Victorian Government) and the Earth Resources Regulation (ERR) Branch of the Department of Jobs, Precincts and Regions (DJPR) are responsible for administering the MRSDA and Regulations.

The MRSDA establishes a legal framework aimed at ensuring that land which has been mined is rehabilitated. Before a proponent is granted consent to conduct mining activities it must submit a rehabilitation and closure plan (along with other required information, including – but not limited to – rehabilitation plan, community engagement plan and a risk management plan) to ERR for its review and approval. Section 79 of the MRSDA sets out the minimum requirements for rehabilitation and closure plans submitted to ERR.

The rehabilitation and closure plan must take into account –

- Any special characteristics of the land.
- The surrounding environment.
- The need to stabilise the land.
- The desirability or otherwise of returning agricultural land to a state that is as close as is reasonably possible to its state before the mining licence, prospecting licence or extractive industry work authority was granted.
- Any potential long term degradation of the environment.

In cases where mining activities are proposed on private land, the MRSDA requires that the mining proponent consult with affected private landholders as part of the development of the rehabilitation and closure plan.

Consideration was given to the *Environment Effects Act 1978* (Vic) and *Planning and Environment Act 1987* (Vic) since the definition of "works", which also forms part of the definition of "development", includes any change to the natural or existing condition or topography of land including the removal, destruction or lopping of trees and the removal of vegetation or topsoil. The *Environment Reference Standard 2021* was also considered, specifically the environmental value for production of food, flora and fibre, in that land quality is suitable for the safe human consumption of food, flora and fibre and that does not adversely affect produce quality or yield.

The guideline applicable to this assessment is Managing Soil Disturbance, Publication 1894 (September 2020), Environment Protection Authority Victoria. This publication outlines how to eliminate or reduce the risk of harm from erosion, sediment and dust.

# 5 Methodology

## 5.1 Soil Survey

A survey density of 1:100,000 (as per McKenzie et al. 2008) was undertaken across the Project Area. This density was selected after an initial site inspection, given the small variation in topography and similarity of remnant vegetation in paddocks and along road reserves. Agriculture Victoria online soil mapping has classed the entire Project Area as Calcarosols and Chromosols.

Sites were selected to represent the minor changes in landform across the Project Area i.e. flat, lower slope, midslope and upper slope. Areas of remnant vegetation were avoided during the soil survey given the long history of disturbance via cultivation across the Project Area, which may have influenced clay content and texture in the A horizon.

Soil profiles were assessed at 14 sites (Figure 6) in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was sampled with a hydraulic soil corer, either a depth of 1.2 metres, to equipment refusal, or to bedrock. Detailed soil profile morphological descriptions were prepared at all sites to record the information for the major parameters specified in Table 2.

Global Positioning System (GPS) readings was taken for all sites where soil descriptions are recorded. Vegetation type, landform and aspect were noted. Soil exposures were photographed during field operations.

Table 2 Field Assessment Parameters

| Descriptor | Application |
|---|---|
| Horizon depth | Weathering characteristics, soil development |
| Field colour | Permeability, susceptibility to dispersion/erosion |
| Field texture grade | Erodibility, hydraulic conductivity, moisture retention, root penetration |
| Boundary distinctness and shape | Erosional/dispositional status, textural grade |
| Consistence force | Structural stability, dispersion, ped formation |
| Structure pedality grade | Soil structure, root penetration, permeability, aeration |
| Structure ped and size | Soil structure, root penetration, permeability, aeration |
| Stones – amount and size | Water holding capacity, weathering status, erosional/depositional character |
| Roots – amount and size | Effective rooting depth, vegetative sustainability |
| Ants, termites, worms etc. | Biological mixing depth |

A total of 14 detailed sites were evaluated, with soil collected from each major soil horizon (soil layer). Soil samples from 11 detailed sites were utilised in the laboratory testing program. Samples were analysed in order to classify Australian Soil Classification (ASC) (Isbell, 2002) soil taxonomic class. Full laboratory analysis results are shown in Appendix B.

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia (NATA) accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in Table 3.

## Table 3 Laboratory Analysis Parameters

| Property | Application |
|---|---|
| Coarse Fragments (>2mm) | Soil workability; root development |
| Particle-Size Distribution (<2mm) | Determine fraction of clay, silt, fine sand and coarse sand; nutrient retention; exchange properties; erodibility; workability; permeability; sealing; drainage; interpretation of most other physical and chemical properties and soil qualities |
| Soil Reaction (pH) | Nutrient availability; nutrient fixation; toxicities (especially aluminium and manganese); liming; Sodicity; correlation with other soil properties |
| Electrical Conductivity (EC) | Appraisal of salinity hazard in soil substrates or groundwater; total soluble salts |
| Cation Exchange Capacity (CEC) & Exchangeable Cations | Nutrient status; calculation of exchangeable cations including sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP); assessment of other physical and chemical properties, especially dispersivity, shrink – swell, water movement, aeration. Used to derive calcium to magnesium ratio (Ca:Mg) |
| Munsell Colour Chart (Munsell) | Drainage, oxidation, fertility, correlation with other physical, chemical and biological properties |
| Emerson Aggregate Test (EAT) | Measure of the soils potential for dispersion and erosion. |

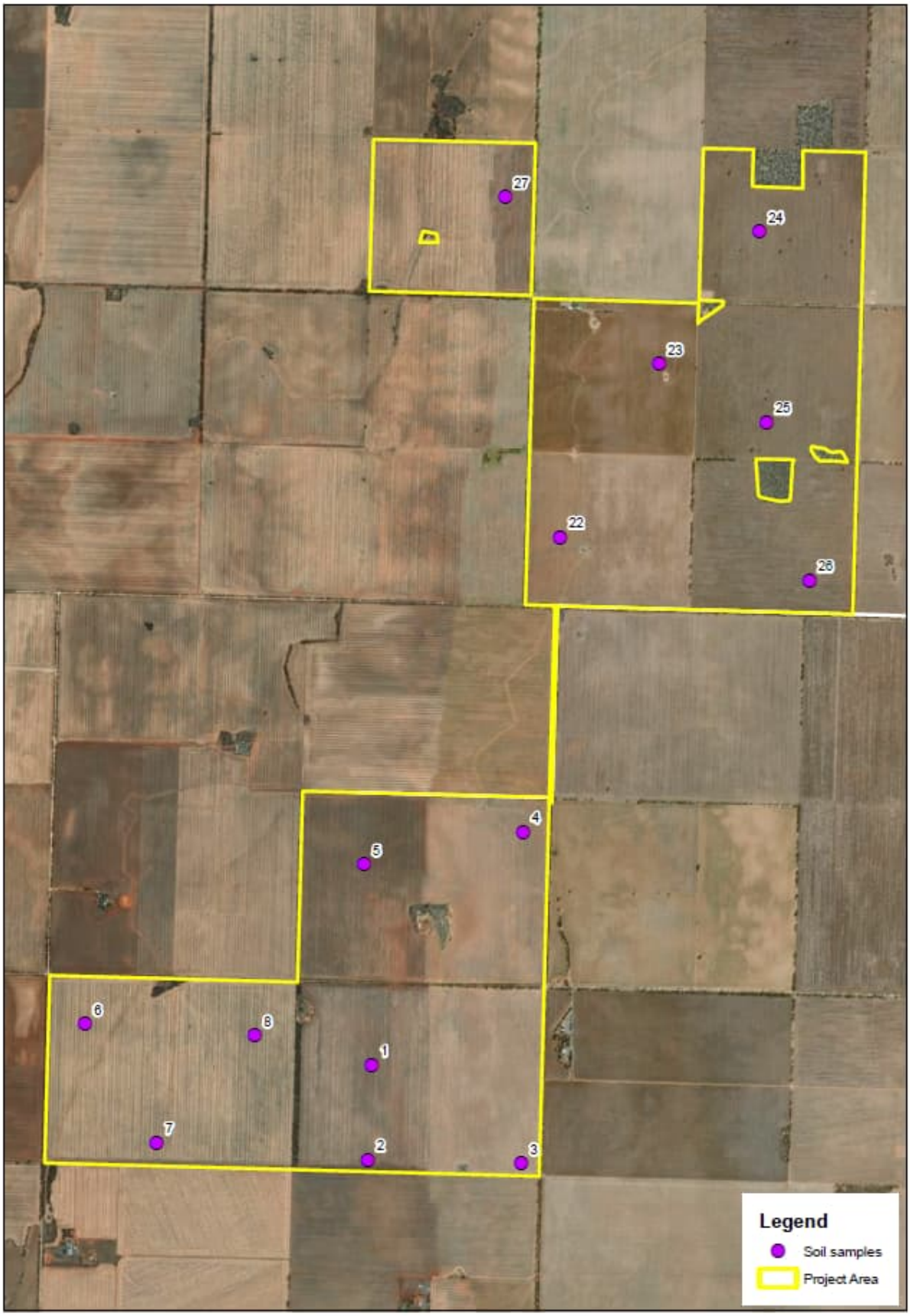
Soil salinity in the samples from the detailed sites was determined through measurement of the electrical conductivity (EC) of soil:water (1:5) suspensions. These values were converted to the EC of a saturated extract ($EC_e$) based on soil texture in, which gives a more accurate comparison of soil types and salinity rating than those based solely on clay content.

Ratings for each of the chemical analytes were then applied for each analysed soil horizon, with the analyte ranges and corresponding rating shown in Table 4. Analyte ratings are taken from Hazelton & Murphy (2007), which have been used by SLR for Soil & Land Resource Assessments across Australia for the past 20 years.

## Table 4 Analyte Rating Thresholds

| Analyte | Rating | Range | Analyte | Rating | Range |
|---|---|---|---|---|---|
| pH | Neutral | 6.6-7.3 | ECe | Non-Saline | <2 |
| | Mildly Alkaline | 7.4-7.8 | | Slightly Saline | 2.1-4.0 |
| | Moderately Alkaline | 7.9-8.4 | | Moderately Saline | 4.1-8.0 |
| | Strongly Alkaline | 8.5-8.9 | | Highly Saline | 8.1-16.0 |
| | Very Strongly Alkaline | >9.0 | Ca:Mg | Ca Deficient | >1.30 |
| ESP | Non-Sodic | <6.0 | | Ca Low | 1.0-4.0 |
| | Marginally Sodic | 6.1-9.9 | | Balanced | 4.1-6.0 |
| | Sodic | 10.0-13.9 | | Mg Low | 6.1-10.0 |
| | Strongly Sodic | >14.0 | | Mg Deficient | >10.0 |

## Figure 6 Detailed Soil Sample Sites



# 6 Existing Environment

## 6.1 Climate

Climate data was obtained from the Bureau of Meteorology Station at Lake Boga (Kunat), ID 77021, located approximately 10 kilometres north-east of the Project Area. Mean minimum and maximum temperatures range between 9.7°C to 23°C. Average annual rainfall is 320 millimetres and evaporation 1,620 millimetres. The area experiences a relatively dry climate where average monthly rates of rainfall are exceeded by evaporation in all months of the year.

## 6.2 Topography

The topography within the Project Area ranges from approximately 75 to 125 metres AHD and is characterised by a north-south orientated ridge elevated around 100 to 125 metres AHD that transects the proposed pit areas.

## 6.3 Geology

The outcropping geology in the Project Area is comprised of a thin quaternary cover of sandy clay, and ranges in thickness from approximately 5 to 10 metres below ground surface. The quaternary material overlays the Loxton Parilla Sands, which hosts the target mineralisation zone. The Loxton Parilla Sands overlays the Geera Clay, which separates the Loxton Parilla Sands from the Renmark Group. (GeoScience Australia, 2022). The mine pit does not intercept the Geera Clay.

Drilling investigations undertaken by CDM Smith (2022) identified the Geera Clay to be prominent across the site with a thickness ranging from 32 to 46 metres. Field observations were typically consistent with VHM drillhole data, with depths ranging from 43 to 56 metres below ground level.

### Acid Generation Potential

Sediments are slightly acidic after being subjected to oxidisation, this is due to very little carbonate material being present and only minor amounts of sulfide material. In addition the minor amount of acidity generated long term would be neutralised by alkalinity in the natural waters (VHM, 2021).

Sand tails have no detectable sulfide material or carbonate alkalinity and net acid generation is below the detection limit. Acid drainage is not considered to pose a significant risk (VHM, 2021). In general the tailings have no risk of acid drainage.

## 6.4 Groundwater

Four regional hydrogeological units have been identified by CDM Smith (2022):

- Loxton Parilla Sands, which forms the main aquifer in the Project Area, with aquifer thickness ranging from 35 to 55 metres.
- Geera Clay, which acts as an aquitard in the region, separating the Loxton-Parilla Sands and the underlying Renmark Group aquifer, with aquitard thickness ranging from 32 to 46 metres.
- Renmark Group, consisting of the Olney Formation underlying the Geera Clay and the Warina Sand which forms an aquifer underlying the Olney Formation

There are no licenced or stock and domestic bores domestic within 10 kilometres of the Project Area. All monitoring bores have recorded EC of over 19,000 uS/cm (up to 44,100) and TDS of over 13,000 mg/L (up to 29,500) (CDM Smith, 2022), making the groundwater unsuitable for agricultural or domestic use.

Based on the available information groundwater is not used for human consumption, stock watering, irrigation or industrial purposes within 10 kilometres of the Project Area (CDM Smith, 2022). The mine pit does not intercept any of the identified aquifers.

## 6.5 Land Use

The majority of the Project Area has been cleared of native vegetation, with only remnant areas left along road reserves and isolated patches within paddocks

The predominant land use within and surrounding the Project Area is dryland winter cereal cropping, with wheat, barley, oats and canola the most commonly sown crops. Crops are sown using minimum or zero tillage techniques with an emphasis on minimal ground disturbance and stubble retention to protect the topsoil.

Grazing of sheep and cattle is undertaken opportunistically, however cropping is the predominant land use.

## 6.6 Soil Type Assessment

One soil map unit (SMU), a Calcic Red-Brown Calcarosol, was identified in the Project Area, having been mapped according to the dominant ASC soil type (Figure 7), using a combination of the soil survey field data and laboratory analysis results. The detailed sites associated with SMU 1 are shown below in Table 5.

One representative site for each of the identified ASC soil types follow Table 5. The remaining detailed sites are shown in Appendix C.

### Table 5 ASC Soil Types within Project Area

| SMU | ASC Soil Type | Soil Type Group | Detailed Site | Hectares |
|---|---|---|---|---|
| 1 | Calcic Red Calcarosol | Dominant | 1, 2, 5, 6, 8, 22, 23, 27 | 1,479 |
| | Calcic Brown Calcarosol | | 24, 25, 26 | |
| | Eutrophic Red Chromosol | Sub-Dominant | 4, 7 | |
| | Subnatric Brown Sodosol | | 3 | |
| | | Total | 14 | 1,479 |

It is possible that the “original” soil type across the entire Project Area was a Calcarosol, with the actual physical textural characteristics of the topsoil (A horizon) having changed through loss of fine clay particles due to wind erosion, resulting from the rabbit plagues of the late 1880’s and 150 years of cultivation in the Mallee region, with minimum and zero tillage methods only adopted in the early 1980’s.

The characteristics of the three identified soil types are:

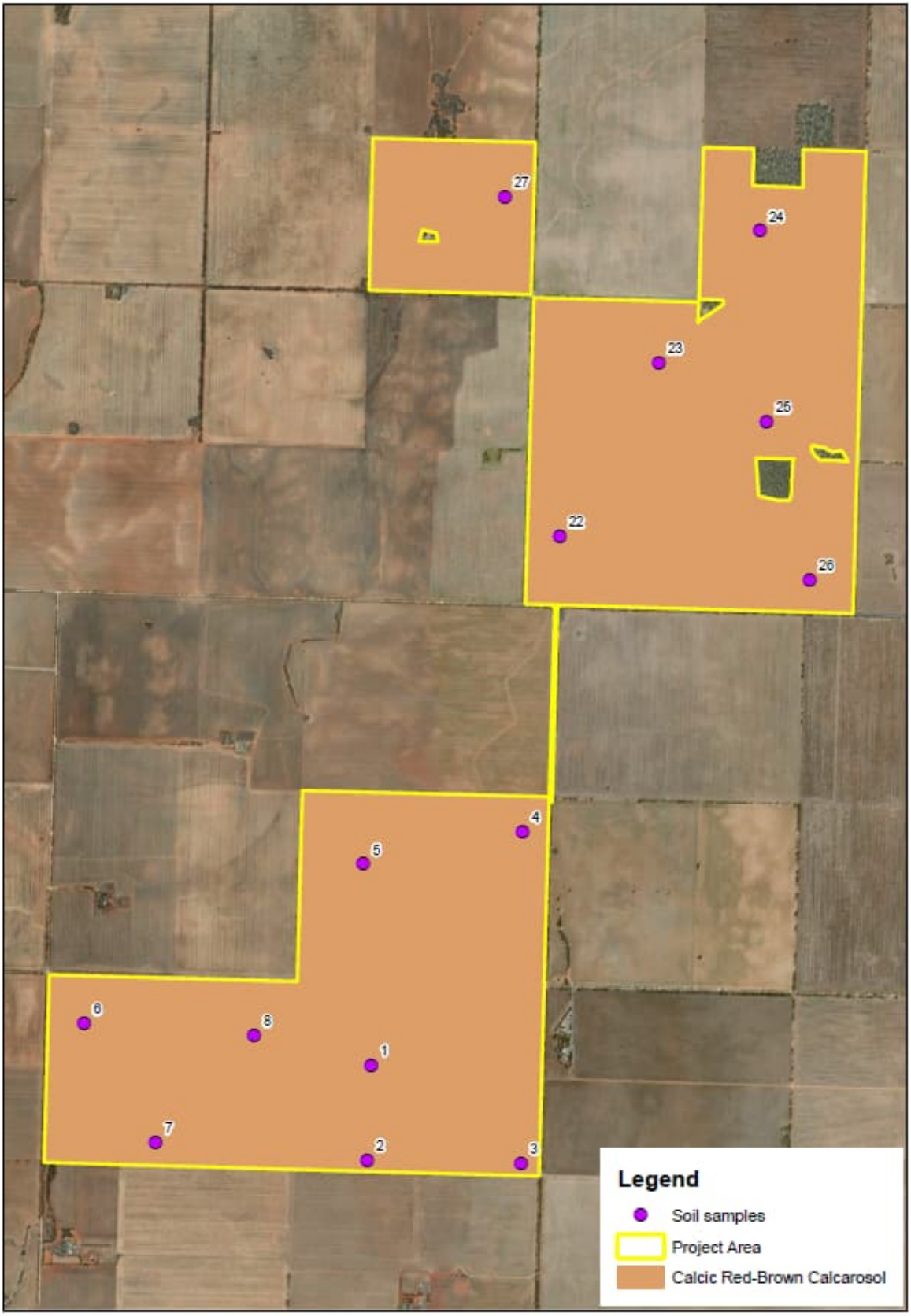
- Calcarosols are soils which are calcareous throughout the solum, or calcareous at least directly below the A1 horizon, or within a depth of 0.2 metres. Carbonate accumulations must be judged to be pedogenic. Calcarosols do not have a clear or abrupt texture contrast between the A and B horizons.
- Chromosols are soils with a strong texture contrast between the A and B horizons, where the B horizon is not strongly acidic or sodic.

- Sodosols are soils with a strong texture contrast between the A horizon and a sodic B horizon which is not strongly acidic.

### Potential Acid Sulfate Soils

Given the soil types present (Calcarosols and Sodosols) in the Project Area do not have strongly acidic subsoils (pH is greater than 5.5), the potential for the presence of potential acid sulfate soils is negligible.

## Figure 7 ASC Soil Type



# Soil Map Unit 1: Calcic Red-Brown Calcarosol

## Dominant Soil Type: Calcic Red Calcarosol

### Table 6 Summary: Calcic Red Calcarosol (Site 2)

| Overview | |
|---|---|
|  Landscape Site 2 | |
| ASC Name | Calcic Red Calcarosol |
| Representative Site | Site 2 |
| Other Mapped Sites | 1, 5, 6, 8, 22, 23, 27 |
| Survey Type | Detailed |
| Dominant Topography | Lower Slope |
| Dominant Land Use | Cultivation |
| Vegetation | Oat Stubble |
| Inherent Soil Fertility | Moderately Low |
| Slope (%) | Minimal |
| Aspect | Nil |

## Table 7 Profile: Calcic Red Calcarosol (Site 2)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.15 | Dark reddish-brown (5YR 3/3) clay loam, weakly crumb structured 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.15 – 0.30 | Reddish-brown (5YR 4/4) medium clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.60 | Yellowish-red (5YR 4/6) light clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric.<br>Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B23<br>+0.60 | Yellowish-red (5YR 4/6) medium clay, massively structured.<br>Nil mottling, nil stone content, nil segregations, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 and 0.90 – 1.0 |

## Table 8 Chemical Parameters: Calcic Red Calcarosol (Site 2)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.3 | Neutral | 3.3 | Non-Sodic | 1.2 | Non-Saline | 2.2 | Ca Low |
| B21 | 9.2 | Very Strongly Alkaline | 7.2 | Marginally Sodic | 1.8 | Non-Saline | 2.7 | Ca Low |
| B22 | 9.5 | Very Strongly Alkaline | 14.5 | Strongly Sodic | 4.3 | Moderately Saline | 1.7 | Ca Low |
| B23 | 9.5 | Very Strongly Alkaline | 20.2 | Strongly Sodic | 5.3 | Moderately Saline | 1.5 | Ca Low |
| B23 | 9.4 | Very Strongly Alkaline | 24.6 | Strongly Sodic | 7.0 | Moderately Saline | 1.5 | Ca Low |

## Dominant Soil Type: Calcic Brown Calcarosol

### Table 9 Summary: Calcic Brown Calcarosol (Site 24)

| Overview | |
|---|---|
|  Landscape Site 24 | |
| ASC Name | Calcic Brown Calcarosol |
| Representative Site | Site 24 |
| Other Mapped Sites | 25, 26 |
| Survey Type | Detailed |
| Dominant Topography | Flat |
| Dominant Land Use | Cultivation |
| Vegetation | Barley Stubble, Milk Thistle |
| Inherent Soil Fertility | Moderately Low |
| Slope (%) | Minimal |
| Aspect | Nil |

## Table 10 Profile: Calcic Brown Calcarosol (Site 24)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark brown (7.5YR 3/4) silty clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.25 | Brown (7.5YR 5/2) medium clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 5% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.25 – 0.50 | Brown (7.5YR 5/3) medium clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.50 | Brown (7.5YR 5/3) light-medium clay, massively structured.<br>Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 and 0.90 – 1.0 |

## Table 11 Chemical Parameters: Calcic Brown Calcarosol (Site 24)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 9.0 | Very Strongly Alkaline | 3.7 | Non-Sodic | 2.0 | Slightly Saline | 4.1 | Balanced |
| B21 | 9.6 | Very Strongly Alkaline | 11.5 | Sodic | 4.4 | Moderately Saline | 2.3 | Ca Low |
| B22 | 9.7 | Very Strongly Alkaline | 19.1 | Strongly Sodic | 7.6 | Moderately Saline | 1.7 | Ca Low |
| B23 | 9.6 | Very Strongly Alkaline | 25.7 | Strongly Sodic | 11.3 | Highly Saline | 1.4 | Ca Low |
| B23 | 9.4 | Very Strongly Alkaline | 32.5 | Strongly Sodic | 11.2 | Highly Saline | 1.0 | Ca Low |

## Sub Dominant Soil Type: Eutrophic Red Chromosol

### Table 12 Summary: Eutrophic Red Chromosol (Site 4)

| Overview | |
|---|---|
|  Landscape Site 4 | |
| ASC Name | Eutrophic Red Chromosol |
| Representative Site | Site 4 |
| Other Mapped Sites | 7 |
| Survey Type | Detailed |
| Dominant Topography | Flat |
| Dominant Land Use | Cultivation |
| Vegetation | Wheat Stubble |
| Inherent Soil Fertility | Moderately High |
| Slope (%) | Minimal |
| Aspect | Nil |

## Table 13 Profile: Eutrophic Red Chromosol (Site 4)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark reddish brown (5YR 3/4) sandy loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.40 | Dark reddish brown (2.5YR 2.5/4) light-medium clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.40 – 0.70 | Dark red (2.5YR 3/6) medium clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric.<br>Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B23<br>+0.70 | Yellowish red (5YR 5/8) heavy clay, massively structured.<br>Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.70 – 0.80 |

## Table 14 Chemical Parameters: Eutrophic Red Chromosol (Site 4)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.8 | Moderately Alkaline | 1.8 | Non-Sodic | 1.9 | Non-Saline | 4.3 | Balanced |
| B21 | 8.9 | Strongly Alkaline | 5.2 | Non-Sodic | 1.7 | Non-Saline | 2.7 | Ca Low |
| B22 | 9.5 | Very Strongly Alkaline | 8.7 | Marginally Sodic | 2.4 | Slightly Saline | 2.2 | Ca Low |
| B23 | 9.7 | Very Strongly Alkaline | 14.5 | Strongly Sodic | 3.0 | Slightly Saline | 1.6 | Ca Low |

## Sub Dominant Soil Type: Subnatric Brown Sodosol

### Table 15 Summary: Subnatric Brown Sodosol (Site 3)

| Overview | |
|---|---|
|  Landscape Site 3 | |
| ASC Name | Subnatric Brown Sodosol |
| Representative Site | Site 3 |
| Other Mapped Sites | Nil |
| Survey Type | Detailed |
| Dominant Topography | Flat |
| Dominant Land Use | Cultivation |
| Vegetation | Oat Stubble |
| Inherent Soil Fertility | Moderately Low |
| Slope (%) | Minimal |
| Aspect | Nil |

## Table 16 Profile: Subnatric Brown Sodosol (Site 3)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark brown (7.5YR 3/4) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Light reddish brown (5YR 6/3) heavy clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.60 | Reddish brown (5YR 5/3) heavy clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.60 | Yellowish red (5YR 4/6) medium clay, massively structured.<br>Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 and 0.90 – 1.0 |

## Table 17 Chemical Parameters: Subnatric Brown Sodosol (Site 3)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.7 | Strongly Alkaline | 1.5 | Non-Sodic | 1.6 | Non-Saline | 5.3 | Balanced |
| B21 | 9.5 | Very Strongly Alkaline | 9.9 | Marginally Sodic | 2.5 | Slightly Saline | 2.4 | Ca Low |
| B22 | 9.7 | Very Strongly Alkaline | 16.1 | Strongly Sodic | 3.9 | Slightly Saline | 1.9 | Ca Low |
| B23 | 9.6 | Very Strongly Alkaline | 21.5 | Strongly Sodic | 7.0 | Moderately Saline | 1.7 | Ca Low |
| B23 | 9.5 | Very Strongly Alkaline | 23.7 | Strongly Sodic | 9.4 | Highly Saline | 1.8 | Ca Low |

### 6.6.1 Soil Stripping Depths

Actual topsoil (A horizon) and subsoil (B horizon) profile stripping depths were determined from field observation and laboratory results for each of the described detailed sites, with the results shown below in Table 18. Comment is made where the B horizon becomes strongly sodic (ESP >14) or field high.

Table 18 Soil Stripping Depth by Site

| Site | Profile Type | Soil Type | Strip A (cm) | Strip B2 (cm) | Strip B2 (cm) | Comment |
|---|---|---|---|---|---|---|
| 1 | Detailed | Red Calcarosol | 10 | 10-30 | +30 | High field dispersion at +30 |
| 2 | Detailed Lab | Red Calcarosol | 15 | 15-30 | +30 | ESP >14 at +30 |
| 3 | Detailed Lab | Brown Sodosol | 10 | 10-30 | +30 | ESP >14 at +30 |
| 4 | Detailed Lab | Red Chromosol | 10 | 10-70 | +70 | ESP >14 at +70 |
| 5 | Detailed Lab | Red Calcarosol | 10 | 10-60 | Nil | Weathered parent material at +60 |
| 6 | Detailed Lab | Red Calcarosol | 10 | 10-90 | +90 | ESP >14 at +90 |
| 7 | Detailed Lab | Red Chromosol | 10 | 10-65 | +65 | ESP >14 at +65 |
| 8 | Detailed | Red Calcarosol | 10 | 10-65 | +65 | High field dispersion at +65 |
| 22 | Detailed Lab | Red Calcarosol | 10 | 10-40 | +40 | ESP >14 at +40 |
| 23 | Detailed Lab | Red Calcarosol | 40 | 40-65 | +65 | ESP >14 at +65 |
| 24 | Detailed Lab | Brown Calcarosol | 10 | 10-40 | +40 | ESP >14 at +40 |
| 25 | Detailed Lab | Brown Calcarosol | 20 | 20-65 | +65 | ESP >14 at +65 |
| 26 | Detailed Lab | Brown Calcarosol | 15 | 15-40 | +40 | ESP >14 at +40 |
| 27 | Detailed | Red Calcarosol | 15 | 15-65 | +65 | High field dispersion at +65 |

Given the similarity in soil types across the Project Area there is the opportunity to strip and stockpile at greater topsoil resource than is currently available. Table 19 shows the similar chemical parameters between the topsoil (A horizon) and the upper portion of the subsoil (B21 horizon).

Table 19 A & B21 Horizon Chemical Parameter Summary

| Analyte | Rating | A Horizon Sites | B21 Horizon Sites |
|---|---|---|---|
| pH | Neutral | 2, 5, 7 | Nil |
| | Mildly Alkaline | 6, | Nil |
| | Moderately Alkaline | 4, 22, | Nil |
| | Strongly Alkaline | 3, 23, 25, 26 | 4, 5, 6, 7, 23 |
| | Very Strongly Alkaline | 24 | 2, 3, 22, 24, 25, 26 |
| ESP | Non-Sodic | 2, 3, 4, 5, 6, 7, 22, 23, 24, 25, 26 | 4, 5, 6, 7, 23 |
| | Marginally Sodic | Nil | 2, 3, 22, 26 |
| | Sodic | Nil | 24, 25 |
| | Strongly Sodic | Nil | Nil |
| ECe | Non-Saline | 2, 3, 4, 5, 6, 25, 26 | 2, 4, 5, 6, 23 |
| | Slightly Saline | 7, 22, 23, 24 | 3, 7, 22, 26 |
| | Moderately Saline | Nil | 24, 25 |
| | Highly Saline | Nil | Nil |

| Analyte | Rating | A Horizon Sites | B21 Horizon Sites |
|---|---|---|---|
| Ca:Mg | Balanced | 3, 4, 22, 24, 25, 26 | Nil |
| | Ca Low | 2, 5, 6, 7 | 2, 3, 4, 5, 6, 7, 22, 23, 24, 25, 26 |
| | Mg Deficient | 23 | Nil |
| Texture | Sandy Loam | 4, 5, 7, 23 | Nil |
| | Loam | 26 | Nil |
| | Sandy Clay Loam | Nil | 23 |
| | Clay Loam | 1*, 2, 3, 6, 8*, 22, 25, 27* | 5 |
| | Silty Clay Loam | 24 | Nil |
| | Light Clay | Nil | 1, 6, 7, 8, 26, 27 |
| | Light-Medium Clay | Nil | 4, 22, 25 |
| | Medium Clay | Nil | 2, 24 |
| | Heavy Clay | Nil | 3 |

*Field texture assessment only, no laboratory testing for Sites 1, 8 and 27

Stripping topsoil to a depth of 20 centimetres will increase the clay content, cation exchange capacity (nutrient retention potential) and water holding capacity by blending the lighter sandy loams and loams with the higher clay content upper B21 horizon soils. Although there will be a slight increase in sodicity this can be mitigated by the application of gypsum prior to stripping works being undertaken, as discussed in Section8.1. Gypsum will increase Ca:Mg closer towards "balanced" (4 to 5) by providing a calcium source (also a plant available sulfur source).

A comparison of ECe, ESP and clay content between the A1 and upper B21 horizons are shown in the following Tables 20 to 22, with comment made the impacts to the stripped soil following each table.

### Table 20 A1 and B21 ECe Comparison

| Site | Horizon | Depth | ECe | Rating | Site | Horizon | Depth | ECe | Rating |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A1 | 0.1 | Not Lab Tested | | 22 | A1 | 0.1 | 3.4 | Slightly Saline |
| | B21 | 0.3 | | | | B21 | 0.3 | 2.7 | Slightly Saline |
| 2 | A1 | 0.15 | 1.2 | Non-Saline | 23 | A1 | 0.1 | 2.1 | Slightly Saline |
| | B21 | 0.3 | 1.8 | Non-Saline | | B21 | 0.4 | 1.1 | Non-Saline |
| 3 | A1 | 0.1 | 1.6 | Non-Saline | 24 | A1 | 0.1 | 2 | Slightly Saline |
| | B21 | 0.3 | 2.5 | Slightly Saline | | B21 | 0.25 | 4.4 | Moderately Saline |
| 4 | A1 | 0.1 | 1.9 | Non-Saline | 25 | A1 | 0.2 | 1.7 | Non-Saline |
| | B21 | 0.4 | 1.7 | Non-Saline | | B21 | 0.5 | 4.5 | Moderately Saline |
| 5 | A1 | 0.1 | 1.1 | Non-Saline | 26 | A1 | 0.15 | 1.5 | Non-Saline |
| | B21 | 0.3 | 1.2 | Non-Saline | | B21 | 0.3 | 2.5 | Slightly Saline |
| 6 | A1 | 0.1 | 1.8 | Non-Saline | 27 | A1 | 0.15 | Not Lab Tested | |
| | B21 | 0.3 | 1.5 | Non-Saline | | B21 | 0.3 | | |
| 7 | A1 | 0.1 | 2.3 | Slightly Saline | Rating Legend | | | | |
| | B21 | 0.3 | 2.2 | Slightly Saline | <2 Non-Saline | | | | |
| 8 | A1 | 0.1 | Not Lab Tested | | <4 Slightly Saline | | | | |
| | B21 | 0.3 | | | <8 Moderately Saline | | | | |

Stripping to a depth of 20 centimetres will have a negligible impact on ECe (salinity), with the "blended" topsoil still having rating of slightly saline or less i.e. the average of the ECe is less than 4 for all sites. This will have negligible impact on crop establishment or growth.

Table 21 A1 and B21 ESP Comparison

| Site | Horizon | Depth | ESP | Rating | Site | Horizon | Depth | ESP | Rating |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A1 | 0.1 | Not Lab Tested | Nil Dispersion | 22 | A1 | 0.1 | 2.2 | Non-Sodic |
| | B21 | 0.3 | | Moderate Dispersion | | B21 | 0.3 | 8.8 | Marginally Sodic |
| 2 | A1 | 0.15 | 3.3 | Non-Sodic | 23 | A1 | 0.1 | 0.4 | Non-Sodic |
| | B21 | 0.3 | 7.2 | Marginally Sodic | | B21 | 0.4 | 0.7 | Non-Sodic |
| 3 | A1 | 0.1 | 1.5 | Non-Sodic | 24 | A1 | 0.1 | 3.7 | Non-Sodic |
| | B21 | 0.3 | 9.9 | Marginally Sodic | | B21 | 0.25 | 11.5 | Sodic |
| 4 | A1 | 0.1 | 1.8 | Non-Sodic | 25 | A1 | 0.2 | 2 | Non-Sodic |
| | B21 | 0.4 | 5.2 | Non-Sodic | | B21 | 0.5 | 10.7 | Sodic |
| 5 | A1 | 0.1 | 0.8 | Non-Sodic | 26 | A1 | 0.15 | 2 | Non-Sodic |
| | B21 | 0.3 | 0.6 | Non-Sodic | | B21 | 0.3 | 7.6 | Marginally Sodic |
| 6 | A1 | 0.1 | 1.5 | Non-Sodic | 27 | A1 | 0.15 | Not Lab Tested | Nil Dispersion |
| | B21 | 0.3 | 2.1 | Non-Sodic | | B21 | 0.3 | | Slight Dispersion |
| 7 | A1 | 0.1 | 2.6 | Non-Sodic | Rating Legend | | | | |
| | B21 | 0.3 | 4.3 | Non-Sodic | <6 Non-Sodic | | | | |
| 8 | A1 | 0.1 | Not Lab Tested | Nil Dispersion | <10 Marginally Sodic | | | | |
| | B21 | 0.3 | | Moderate Dispersion | <14 Sodic | | | | |

Stripping to a depth of 20 centimetres will have a negligible impact ESP (sodicity), with the "blended" topsoil still having rating of marginally sodic or less i.e. the average of the ESP is less than 10% for all sites. This will have negligible impact on crop establishment or growth.

Table 22 A1 and B21 Clay Content Comparison

| Site | Horizon | Depth | Clay % | Texture | Site | Horizon | Depth | Clay % | Texture |
|---|---|---|---|---|---|---|---|---|---|
| 1 | A1 | 0.1 | Not Lab Tested | Clay Loam | 8 | A1 | 0.1 | Not Lab Tested | Clay Loam |
| | B21 | 0.3 | | Light Clay | | B21 | 0.3 | | Light Clay |
| 2 | A1 | 0.15 | 28 | Clay Loam | 22 | A1 | 0.1 | 32 | Clay Loam |
| | B21 | 0.3 | 46 | Medium Clay | | B21 | 0.3 | 43 | Light-Medium Clay |
| 3 | A1 | 0.1 | 28 | Clay Loam | 23 | A1 | 0.1 | 10 | Sandy Loam |
| | B21 | 0.3 | 52 | Heavy Clay | | B21 | 0.4 | 22 | Sandy Clay Loam |
| 4 | A1 | 0.1 | 17 | Sandy Loam | 24 | A1 | 0.1 | 34 | Silty Clay Loam |
| | B21 | 0.4 | 43 | Light-Medium Clay | | B21 | 0.25 | 46 | Medium Clay |
| 5 | A1 | 0.1 | 14 | Sandy Loam | 25 | A1 | 0.2 | 27 | Clay Loam |
| | B21 | 0.3 | 28 | Clay Loam | | B21 | 0.5 | 42 | Light-Medium Clay |
| 6 | A1 | 0.1 | 22 | Clay Loam | 26 | A1 | 0.15 | 22 | Loam |
| | B21 | 0.3 | 39 | Light Clay | | B21 | 0.3 | 39 | Light Clay |
| 7 | A1 | 0.1 | 10 | Sandy Loam | 27 | A1 | 0.15 | Not Lab Tested | Clay Loam |
| | B21 | 0.3 | 39 | Light Clay | | B21 | 0.3 | | Light Clay |

Stripping to a depth of 20 centimetres will increase clay content in the “blended” topsoil having a clay content of 20% or greater (excepting Site 23). This will increase the moisture holding capacity, increase nutrient retention capability and improve structure, which will positively impact crop establishment and growth i.e. the soil will hold more moisture and nutrients for a longer period of time during crop germination and establishment.

It is recommended to strip all disturbance areas, including haul roads, infrastructure areas, subsoil and overburden stockpile locations, and water supply pipeline to a depth of 20 centimetres for topsoil, with the remaining mine pit areas stripped to 80 centimetres of subsoil giving a profile reinstatement potential of 0.9 to 1 metre. Given the predominant land use is cropping, reinstating 20 centimetres of topsoil would be conducive to attaining or even improving pre-disturbance yields.

Due to their age Australian soils are naturally deficient in nitrogen & phosphorus, blending will have no impact on these nutrients, historically N & P has been and will continue to be supplied for crop growth with fertiliser. Blending will increase the cation exchange capacity, which will increase the topsoils ability to attenuate N, P and S.

## 6.7 Erosion Potential

The dispersion class and erosive potential of soils within the Project Area were determined using the Emerson Aggregate Test (EAT), shown in Table 23. All soil horizons within the Project Area are classed as having moderate to moderately high dispersion ratings and are therefore prone to erosion. Appropriate erosion and sediment control measures should be undertaken, including the application of gypsum (as described in Section 8.2), wherever surface disturbance is to be undertaken. The management of water flows over and through dispersive soils is a key tool in control of detrimental impacts. Approaches may include:

- Diversion of water flows away from areas of disturbance.
- Minimising potential convergence and/or ponding of surface flows, particularly on disturbed soils.

- Development of appropriate cover/protection of dispersive soils (i.e. creation of stable linings that are resistant to rainfall erosion and runoff).

## Table 23 Dispersion Rating

| Site | Horizon | Sample Depth (cm) | EAT Score | Dispersivity Rating |
|---|---|---|---|---|
| 2 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 65-75 | 2 | Moderately High |
| | B23 | 90-100 | 2 | Moderately High |
| 3 | A1 | 0-10 | 4 | Negligible |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 65-75 | 2 | Moderately High |
| | B23 | 90-100 | 2 | Moderately High |
| 4 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 70-80 | 2 | Moderately High |
| 5 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 2 | Moderately High |
| | B22 | 40-50 | 2 | Moderately High |
| 6 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 3 | Moderate |
| | B23 | 65-75 | 2 | Moderately High |
| | B23 | 90-100 | 2 | Moderately High |
| 7 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 3 | Moderate |
| | B23 | 65-75 | 2 | Moderately High |
| 22 | A1 | 0-10 | 2 | Moderately High |
| | B21 | 20-30 | 2 | Moderately High |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 65-75 | 2 | Moderately High |
| | B24 | 90-100 | 2 | Moderately High |
| 23 | A1 | 0-10 | 3 | Moderate |
| | A2 | 20-30 | 2 | Moderately High |
| | B21 | 40-50 | 2 | Moderately High |
| | B22 | 65-75 | 2 | Moderately High |

| Site | Horizon | Sample Depth (cm) | EAT Score | Dispersivity Rating |
|---|---|---|---|---|
| | B23 | 90-100 | 2 | Moderately High |
| 24 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 65-75 | 2 | Moderately High |
| | B23 | 90-100 | 2 | Moderately High |
| 25 | A1 | 0-10 | 3 | Moderate |
| | B21 | 20-30 | 3 | Moderate |
| | B21 | 40-50 | 2 | Moderately High |
| | B22 | 65-75 | 2 | Moderately High |
| 26 | A1 | 0-10 | 4 | Negligible |
| | B21 | 20-30 | 3 | Moderate |
| | B22 | 40-50 | 2 | Moderately High |
| | B23 | 65-75 | 2 | Moderately High |

### 6.7.1 Potential for Acid Sulfate Soils

Given the soil types present (Calcarosols, Chromosols and Sodosols) and very alkaline pH measurements to a depth of 1 metre in the soil profile, the presence of acid sulfate soils is extremely unlikely.

### 6.7.2 Potential for Soil Acidification

Given the very alkaline pH and high clay content throughout the profile to a depth of 1 metre, the soil types in the Project Area have a very low potential for acidification.

### 6.7.3 Potential for Salinity

As shown in Appendix D the majority of soil profiles are non-saline in the topsoil and slightly to moderately saline in the subsoil. Given the very good drainage characteristics of the soils, highlighted by the presence of calcium carbonate nodules and lack of mottling, the potential for an increase in salinity is low.

# 7 Preliminary Risk Assessment

The identified risks and associated residual risk ratings are listed in Table 24. The likelihood and consequence ratings determined during the risk assessment process and the mitigation measures to be achieved are presented in Appendix A.

From a soils perspective, the main risk for the Project is exposure of dispersive subsoils to rainfall or water movement which could result in significant erosion if suitable mitigation measures, as outlined in Section 8, are not undertaken.

Table 24 Soil & Land Resource Risks

| Risk ID | Potential threat and impact on the environment | Residual risk rating |
|---|---|---|
| 1 | Mixing of different soil types and non-dispersive topsoil with dispersive subsoil during soil stripping operations. | Low |
| 2 | Degradation of soil structure resulting in increased erosion potential and lowering agricultural productivity post rehabilitation. | Low |
| 3 | Exposure of dispersive subsoil during stockpiling resulting in erosion and loss of subsoil resource. | Medium |
| 4 | Exposure of dispersive subsoil on the open pit face during active mining operations and post final rehabilitation, resulting in erosion and soil loss during rainfall events | Medium |
| 5 | Exposure of dispersive subsoil during decommissioning resulting in erosion and soil loss during rainfall events. | Medium |
| 6 | Mixing of topsoil and subsoil and subsequent exposure of dispersive subsoil during water supply pipeline construction, resulting in erosion and soil loss during rainfall events. | Low |
| 7 | Weed infestation during stockpiling of soil resources resulting in a weed seed bank building up in the stockpile and spread during rehabilitation activities. | Low |

# 8 Construction, Operation & Decommissioning Impact Assessment

The following discusses the potential impacts of the Project as a result of construction, operation and decommissioning of the Project and the associated mitigation and management measures to reduce impacts to as low a level as possible.

The avoidance of impact has, wherever reasonably practical, been undertaken. However, due to the inherent nature of the Project, avoidance has been limited and the mitigation and management of impacts has ensured the soil and land resource risks identified are minimised.

## 8.1 Mixing of soil types during stripping

### Impacts

Mixing of significantly different ASC soil types during stripping could impact on successful rehabilitation and reduce agricultural production post rehabilitation.

### Mitigation

As the dominant ASC soil type across the Project Area is a Red-Brown Chromosol, with 2 sub-dominant soil types (Chromosol and Sodosol) which have very similar physical and chemical properties, such as all have Eutrophic properties and similar textures throughout the same horizons. It is recommended to strip topsoil on all disturbance areas to a depth of 20 centimetres.

Prior to stripping disturbance areas the soil surface should have a minimum of 5 tonnes per hectare of natural gypsum applied, with up to 10 tonnes the ideal amount. Gypsum rates of 10 tonnes per hectare are recommended where ESP is greater than 14 (i.e. strongly sodic) (Incitec, 2021), which will apply to the majority of stripped and stockpiled subsoil. Gypsum should be applied as stripping continues in 200 millimetre depth ranges. This will mitigate the mixing of the more dispersive upper part of the B2 horizon, whilst also increasing calcium, and hence the Ca:Mg ratio towards the “balanced” rating and also increase sulfur level, both of which are generally deficient for optimal production across the Project Area.

Application of gypsum prior to stripping will ensure thorough mixing throughout the top 20 centimetres, resulting in a stable stockpile with an excellent growing medium.

Analogue sites which are representative of the vegetation to be established should be established. Soil parameters for remediation success will be compared to analogue sites and will be incorporated into the Rehabilitation Management Plan as follows:

- Testing verifies that pH (water 1:5) is within +/- 2 pH units of analogue sites.
- Testing verifies that EC (water 1:5) of surface soils is below 1,000 uS/cm or similar to analogue sites at Year 9 following establishment.
- Average surface sodicity (ESP) is less than 10% and +/- 10 % of analogue sites.

### Residual impact

By implementing recommended mitigation measures residual impacts are not expected.

## 8.2 Degradation of soil structure

### Impacts

Degradation of soil structure during stripping and stockpiling resulting in increased erosion potential and lowering of agricultural productivity post rehabilitation.

### Mitigation

Soil should be stripped in a slightly moist to moist condition, whereby soil is pliable when hand texturing (15-30% soil moisture) wherever possible. Material should not be stripped in either an excessively dry, powdery or very friable when hand texturing (<15% moisture), or wet condition, loses integrity when hand texturing or leaves mud on hands (>30% moisture). Stripping operations should not be undertaken during excessive dry periods to prevent pulverisation of the natural soil aggregates. Similarly, stripping during wet periods should not be undertaken to prevent damage of the resource through compaction by equipment. Given the normally dry climate, consideration should be given to stripping and stockpiling large areas of topsoil when soil moisture conditions are favourable, given the very dry climate.

To reduce soil degradation during stripping operations preference should be given to using equipment which can grade or push soil into windrows such as graders or dozers for later collection by open bowl scrapers or for loading into rear dump trucks by front-end loaders. This will minimise compaction impacts of heavy equipment that is often necessary for economical transport of soil material. These techniques are examples of preferential, less aggressive soil handling systems which may be adopted.

All soils removed during construction and operation should be placed in designated stockpile areas. Freshly stripped and placed topsoil retains seed that is more viable and a greater number of micro-organisms and nutrients, than does stockpiled sub soil. Vegetation establishment is generally improved by the direct return of topsoil and is considered ‘best practice’ topsoil management. Should longer term storage of stockpiles be proposed (six months or greater) accurate records are required, indicating stockpile volumes and areas to be covered by each stockpile upon rehabilitation and final decommissioning. Soil stockpiles within construction areas could be utilised as long term batters or bunds to facilitate noise, visual screening and surface water diversion where required.

The following management and mitigation strategies should be implemented to reduce degradation during stockpiling operations:

- Locations of stockpiles are recorded using GPS along with data relating to the soil type and volume. An inventory of available soil will be maintained and updated regularly to ensure adequate topsoil and subsoil materials are available for planned rehabilitation activities.
- The surface of soil stockpiles should be left in as coarsely structured condition as possible to promote rainfall infiltration and minimise erosion prior to cover vegetation becoming established. The coarse structure will also prevent anaerobic zones forming.
- Maintain a maximum stockpile height of two metres.
- Topsoil and subsoil stockpiles are to be stored separately.

- Storage time should be minimised, where possible. If long-term stockpiling is planned (greater than three months), such as those stockpiles which will be formed during the initial pit and infrastructure development, stockpiles should be seeded with an annual cover crop species. A rapid growing and healthy annual pasture sward provides sufficient competition to minimise the emergence of undesirable weed species. The annual pasture species will not persist in the rehabilitation areas but will provide sufficient competition for emerging weed species, enhance the desirable micro-organism activity in the soil and minimise the erosivity potential of the stockpile. Pasture growth on stockpiles will also provide protection from wind and water erosion by dry matter shielding the stockpile surface and root growth binding the soil together.
- Subsoil and topsoil are spread to depths according to target requirements.
- Where possible, freshly stripped subsoil and topsoil should be re-spread directly onto rehabilitation areas. Topsoil will be spread, treated with fertiliser and seeded in one consecutive operation, reducing the potential for compaction and also topsoil loss to wind and water erosion.

Maximum stockpile heights are to be no more than two metres and stockpiles should not be disturbed until required for rehabilitation, weed management, erosion control or for seeding and fertilising purposes.

The surface of all stockpiles should be treated with the ameliorants shown in Table 25, which will create the most suitable growth medium for the chosen rehabilitation pasture species, while Table 26 details ameliorant application rates to be applied immediately post-spreading of soil resources on rehabilitation areas.

Gypsum rates of 10 tonnes per hectare are recommended where ESP is greater than 14 (i.e. strongly sodic) (Incitec, 2021), which will apply to the majority of stripped and stockpiled subsoil. The gypsum sourced should have a minimum 19% calcium and 15% sulfur.

Any stockpiled topsoil would have already been treated with gypsum, further treatment of the stockpile surface is not necessary.

Granulock 15 nutrient analysis is 11% nitrogen, 22% phosphorus and 4% sulfur.

### Table 25 Stockpile Ameliorant Application

| Ameliorant | Topsoil Stockpile Surface | Subsoil Stockpile Surface |
|---|---|---|
| Gypsum | - | 5-10 tonnes per hectare |
| Granulock 15 | 80 kilograms per hectare | 80 kilograms per hectare |

### Table 26 Re-Spread Material Ameliorant Application

| Ameliorant | Re-Spread Topsoil | Re-Spread Subsoil |
|---|---|---|
| Gypsum | - | *10 tonnes per hectare* |
| Granulock 15 | 120 kilograms per hectare | 120 kilograms per hectare |

*Gypsum only recommended if subsoil is to be left exposed for longer than one month prior to topsoil respreading*

### Residual Impact

By implementing recommended mitigation measures residual impacts are not expected.

## 8.3 Exposure of stockpiled dispersive subsoil

### Impacts

Dispersive subsoil stockpiles being exposed to rainfall events on resulting in erosion and loss of soil resources to be used in rehabilitation.

### Mitigation

The surface of all subsoil stockpiles should be treated with ameliorants described in Section 8.2 and sown to suitable pasture species or cover crop to provide groundcover protection from rainfall events. Appropriate erosion and sediment control measures should also be applied, as per a site specific Erosion & Sediment Control Plan, particularly when the timing of stockpiling is not conducive to cover crop germination. Should areas of erosion be observed on subsoil stockpiles they will be stabilised with gypsum application and sown with the cover crop and Granulock 15 at rates specified in Table 25. If water is available via the water supply pipeline incorporation of gypsum and establishment of cover crop is to be hastened by spray irrigation.

VHM has proposed the use of spray irrigation for establishment of pasture and/or cover crops to extend the growing season and facilitate faster establishment on stockpile surfaces. Water for the spray irrigation would be supplied from the Kangaroo Lake water pipeline.

### Residual Impact

By implementing recommended mitigation measures residual impacts are not expected.

## 8.4 Exposure of dispersive subsoil during construction & mining

### Impacts

Exposure of dispersive subsoil to rainfall events during construction, operation of mine infrastructure and on open mine pit faces during active mining operations and pre-final rehabilitation, resulting in erosion and soil loss.

### Mitigation

Driving the progressive rehabilitation program is the intention to commence backfilling of mine cells as soon as practicable following mining completion within each cell. Satisfactory achievement of this goal will mean there are never more than about 3 or 4 mine cells open at a time. Forward stripping will be minimised as far as possible (Pitt & Sherry, 2022).

Ensure mine pit faces are as steep as recommended in the geotechnical assessment to minimise surface area of exposed subsoil layers during the mining process. Ensure progressive rehabilitation is undertaken behind the advancing mine pit to minimise to length of time the mine pits faces are exposed to potential rainfall events. Investigate the possibility of scarifying and application of gypsum to exposed subsoil, dependent of steepness of slope.

Measures to mitigate the potential erosive impacts from disturbance to construct and operate drainage and other mine infrastructure are presented in Section 9 of the *Mine Site Surface Water Impact Assessment* (Pitt & Sherry, 2022).

In the unlikely occurrence of an erosion event delivering turbid water and/or soil material into the mine pit it will be wholly contained within the pit and will be mitigated utilising sediment basins to ensure no turbid water is discharged from site, as described by Pitt & Sherry (2022).

### Residual Impact

The soil resource assessment found all soil profiles to have a depth of 1.2 metres (excluding Site 5 which is in a non-disturbance area), indicating a surplus of soil resource for the proposed reinstatement of a 1 metre soil profile. Any subsoil which may be eroded by rainfall events will remain in the bottom of the mine pit, as such residual impacts are not expected, as described in Section 9 of the *Mine Site Surface Water Impact Assessment* (Pitt & Sherry, 2022).

## 8.5 Exposure of dispersive subsoil during decommissioning

### Impacts

Exposure of dispersive subsoil during decommissioning resulting in erosion and soil loss during rainfall events.

### Mitigation

Ensure rehabilitation and topsoil placement is undertaken as soon as practicable, should rehabilitation be delayed the exposed subsoil should be treated with gypsum and appropriate erosion and sediment control measures should also be applied.

### Residual Impact

By implementing recommended mitigation measures residual impacts are not expected.

## 8.6 Exposure of dispersive subsoil during water supply pipeline construction

### Impacts

With similar sodic and dispersive subsoils expected during the water supply pipeline construction there is the potential for mixing of topsoil and subsoil and subsequent exposure of dispersive subsoil to rainfall events during pipeline construction, resulting in erosion and soil loss.

### Mitigation

Strip topsoil to a depth of 20 centimetres prior to trenching for pipeline. Ensure progressive backfill of subsoil first, followed by topsoil subsequent and ameliorant application (including gypsum application to the surface of in-filled material) is undertaken directly behind pipeline construction to minimise the length of time subsoil is exposed to potential rainfall events.

### Residual Impact

By implementing recommended mitigation measures residual impacts are not expected.

## 8.7 Weed infestation during topsoil stockpiling

### Impacts

An increase in the weed seed bank during stockpiling and subsequent increase in weeds in agricultural areas once topsoil is replaced post rehabilitation. Increased cost in weed control during cropping and pasture phases.

### Mitigation

Continuation of weed control in areas that are yet to be mined if they are not under agricultural production to prevent seed set prior to topsoil stripping. Control of weeds biannually (both summer and winter weed species control) on stockpiles during autumn/winter and spring/summer, along with sowing suitable pasture species or cover crop to provide competition for weed species. Sow only grass species (monocotyledons) on stockpiles to allow use of selective herbicides for control of broadleaf weeds (dicotyledons). Continual weed control will prevent a build-up of weeds and reduce the weed seed bank in stockpiles prior to use in rehabilitation.

### Residual Impact

By implementing recommended mitigation measures residual impacts are not expected.

# 9 Monitoring & Contingency Measures

Visual monitoring of stockpiles should be undertaken regularly, particularly after significant rainfall events. The following characteristics should form part of the checklist in both a site-specific Soil Stockpile Management Plan and an Erosion & Sediment Control Plan, which will include action triggers and contingency actions to be implemented:

- Integrity of sediment control.
- Effectiveness of drainage.
- Integrity of erosion and sediment control measures.
- Pasture growth.
- Weed infestation.

Should any of the above parameters not be satisfactory post inspection, the mitigation measures described in Section 8 are to be applied as appropriate. Sampling of topsoil stockpiles should occur prior to respreading with testing undertaken for agricultural nutrients.

Monitoring and contingency measures for assessing the integrity of drainage infrastructure, pit walls and other mine related surface disturbance are described in Section 10 of the *Mine Site Surface Water Impact Assessment* (Pitt & Sherry, 2022).

# 10 Conclusion

The purpose of this report is to assess the potential soil and land resource impacts associated with the Project to inform the preparation of the EES required for the Project. In response to the EES evaluation objective and scoping requirements described in Section 3.1, impacts of the Project on the soils and land resource have been assessed and mitigation measures have been identified to avoid or minimise adverse effects.

A summary of the key assets, values or uses potentially affected by the Project, and an associated assessment of soil and land resource impacts and recommended mitigation measures, are summarised below.

## Existing environment

The existing environments comprises ASC soil type Calcic Red-Brown Calcarosol which is predominantly used by the landholders for winter cereal cropping. Soil depth exceeds 1 metre, with root growth from winter cereal crops having been observed at the base of sampling. Soils have good structure and could be classed as being in good condition for the current agricultural activities.

## Impact assessment findings

The current good condition of the soil provides the proponent with an ample resource for rehabilitation activities during and post mining. With the implementation of the mitigation measures recommended throughout this assessment, potential adverse impacts on the soil and land resources will be minimised.

## Mitigation measures

The mitigation and management measures comprise stripping, stockpiling and maintenance of available topsoil and subsoil resources, application of gypsum to prevent erosion of dispersive subsoils and monitoring of stockpiles for weed infestation and erosion. By implementing the recommended mitigation measures residual impacts are not expected

# 11 References

CDM Smith (2022) Goschen Project EES - Groundwater

GeoScience Australia, (2022) Geoscience Australia and Australian Stratigraphy Commission, 2017

Hazelton, P. & Murphy, B. (2007) Interpreting Soil Test Results: What Do All the Numbers Mean? Australia: CSIRO Publishing

Incitec (2021) Incitec Pivot Fertilisers Gypsum Agritopic

Isbell, R. F. (2002). The Australian Soil Classification Revised Edition. Australia: CSIRO Publishing

McKenzie, N. J., Grundy, M. J., Webster, R. & Ringrose-Voase, A. J., (2008). Guidelines for Surveying Soil and Land Resources (2ed), Melbourne: CSIRO Publishing.

National Committee on Soil and Terrain. (2009). Australian Soil and Land Survey Field Handbook, 3rd. Australia: CSIRO Publishing

Pitt & Sherry (2022) Goschen Rare Earths and Mineral Sands Project Mine Site Surface Water Impact Assessment

VHM (2021) Tailings Geochemical Characterisation

# APPENDIX A

## Risk Register

# APPENDIX A

## Risk Register

| Risk ID | Risk pathway | Causes / Background | Initial risk level | | | Final mitigation | Residual risk level | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Risk | | Likelihood | Consequence | Risk |
| 1 | Mixing of different soil types and non-dispersive topsoil with dispersive subsoil during soil stripping operations | Natural variation in soil depth | Almost certain | Moderate | Very high | Treat all disturbance areas with gypsum prior to stripping to a depth of 20 cm | Rare | Minor | Low |
| 2 | Degradation of soil structure | Use of unsuitable soil stripping equipment and overhandling of soil | Unlikely | Major | High | Implement soil stripping plan as described and stockpile to remain in place until respreading | Rare | Minor | Low |
| 3, 4, 5 | Exposure of dispersive subsoil during stockpiling, construction and mining | Rainfall events or water movement causing erosion of dispersive subsoils | Likely | Moderate | High | Treatment of exposed subsoil with gypsum and minimising time of exposure through progressive rehabilitation | Rare | Moderate | Medium |
| 6 | Mixing of topsoil and subsoil during pipeline construction and subsequent exposure of dispersive subsoil | Rainfall events or water movement causing erosion of dispersive subsoils | Likely | Moderate | High | Stripping topsoil to a depth of 20 centimetres prior to trenching for pipeline. Back fill subsoil, then topsoil and apply ameliorants | Rare | Minor | Low |

| Risk ID | Risk pathway | Causes / Background | Initial risk level | | | Final mitigation | Residual risk level | | |
|---|---|---|---|---|---|---|---|---|---|
| | | | Likelihood | Consequence | Risk | | Likelihood | Consequence | Risk |
| 7 | Weed infestation during stockpiling of soil resources | Current seed bank in topsoil to be stripped | Almost certain | Moderate | Very high | Continue to treat weeds in areas yet to be stripped. Sowing pasture species on stockpiles. Periodic weed treatment when soil is stockpiled. | Rare | Minor | Low |

# APPENDIX B

## Laboratory Certificates of Analysis

Environmental Analysis Laboratory

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|---|---|
| | Sample ID: | G2 | G5 | G10 | G12 | G13 |
| | Crop: | N/G | N/G | N/G | N/G | 0-10, 2/4/19 |
| | Client: | VHM | VHM | VHM | VHM | VHM |
| Parameter | Method reference | I1027/1 | I1027/2 | I1027/3 | I1027/4 | I1027/5 |
| Phosphorus (mg/kg P) | **Rayment & Lyons 2011 - 9B2 (Colwell) | 62 | 66 | 41 | 53 | 59 |
| Nitrate Nitrogen (mg/kg N) | **Inhouse S37 (KCl) | 35 | 19 | 33 | 88 | 22 |
| Ammonium Nitrogen (mg/kg N) | | 11 | 6.3 | 7.7 | 18 | 4.6 |
| Sulfur (mg/kg S) | | 6.9 | 3.6 | 8.4 | 24 | 5.9 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 7.27 | 6.98 | 7.35 | 6.50 | 8.53 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.142 | 0.076 | 0.142 | 0.714 | 0.136 |
| Estimated Organic Matter (% OM) | **Calculation: Total Carbon x 1.75 | 3.0 | 1.9 | 2.5 | 2.3 | 2.3 |
| Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 14.84 | 7.33 | 14.20 | 11.60 | 34.02 |
| Exchangeable Calcium (kg/ha) | | 6660 | 3290 | 6372 | 5209 | 15274 |
| Exchangeable Calcium (mg/kg) | | 2973 | 1469 | 2845 | 2325 | 6819 |
| Exchangeable Magnesium (cmol$_+$/kg) | | 6.72 | 3.48 | 5.92 | 8.00 | 6.80 |
| Exchangeable Magnesium (kg/ha) | | 1829 | 948 | 1611 | 2179 | 1850 |
| Exchangeable Magnesium (mg/kg) | | 816 | 423 | 719 | 973 | 826 |
| Exchangeable Potassium (cmol$_+$/kg) | | 2.25 | 1.33 | 1.99 | 1.81 | 1.77 |
| Exchangeable Potassium (kg/ha) | | 1969 | 1165 | 1739 | 1585 | 1552 |
| Exchangeable Potassium (mg/kg) | | 879 | 520 | 776 | 708 | 693 |
| Exchangeable Sodium (cmol$_+$/kg) | | 0.81 | 0.14 | 0.77 | 3.45 | 0.54 |
| Exchangeable Sodium (kg/ha) | | 419 | 72 | 395 | 1778 | 279 |
| Exchangeable Sodium (mg/kg) | | 187 | 32 | 176 | 794 | 125 |
| Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Exchangeable Aluminium (kg/ha) | | <1 | <1 | <1 | <1 | 1 |
| Exchangeable Aluminium (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | 0.01 | <0.01 |
| Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 24.62 | 12.28 | 22.87 | 24.88 | 43.14 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 60.3 | 59.7 | 62.1 | 46.6 | 78.9 |
| Magnesium (%) | | 27.3 | 28.4 | 25.9 | 32.2 | 15.8 |
| Potassium (%) | | 9.1 | 10.8 | 8.7 | 7.3 | 4.1 |
| Sodium - ESP (%) | | 3.3 | 1.1 | 3.4 | 13.9 | 1.3 |
| Aluminium (%) | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrogen | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.2 | 2.1 | 2.4 | 1.4 | 5.0 |
| Zinc (mg/kg) | Rayment & Lyons 2011 - 12A1 (DTPA) | 1.4 | 3.8 | 1.8 | 0.8 | 1.1 |
| Manganese (mg/kg) | | 30 | 17 | 21 | 52 | 7.1 |
| Iron (mg/kg) | | 6.7 | 7.3 | 8.5 | 15 | 7.1 |
| Copper (mg/kg) | | 0.7 | 0.4 | 0.8 | 1.6 | 0.6 |

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24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | Method reference | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|---|---|---|
| | **Sample ID:** | | **G2** | **G5** | **G10** | **G12** | **G13** |
| | **Crop:** | | **N/G** | **N/G** | **N/G** | **N/G** | **0-10, 2/4/19** |
| | **Client:** | | **VHM** | **VHM** | **VHM** | **VHM** | **VHM** |
| | | | **I1027/1** | **I1027/2** | **I1027/3** | **I1027/4** | **I1027/5** |
| | **Boron (mg/kg)** | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)** | 1.53 | 1.27 | 1.59 | 2.10 | 1.22 |
| | **Silicon (mg/kg Si)** | **Inhouse S11 (Hot CaCl2) | 104 | 88 | 92 | 92 | 40 |
| | **Total Carbon (%)** | Inhouse S4a (LECO Trumac Analyser) | 1.74 | 1.10 | 1.44 | 1.33 | 1.32 |
| | **Total Nitrogen (%)** | | 0.13 | 0.07 | 0.12 | 0.13 | 0.10 |
| | **Carbon/Nitrogen Ratio** | **Calculation: Total Carbon/Total Nitrogen | 13.4 | 15.7 | 11.6 | 10.5 | 13.2 |
| | **Basic Texture** | **Inhouse S65 | Loam | Loam | Loam | Loam | Loam |
| | **Basic Colour** | | Brownish | Brownish | Brownish | Brownish | Brownish |
| | **Chloride Estimate (equiv. mg/kg)** | **Calculation: Electrical Conductivity x 640 | 91 | 49 | 91 | 457 | 87 |
| | **Total Molybdenum (mg/kg)** | Rayment & Lyons 2011 - 17C1 Aqua Regia | 0.3 | 0.3 | 0.3 | 0.3 | <0.2 |
| | **Total Cobalt (mg/kg)** | | 6.2 | 4.5 | 5.6 | 7.6 | 6.7 |
| | **Total Selenium (mg/kg)** | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | **Total Organic Carbon (%)** | LECO Trumac Analyser - Inhouse S15b | 1.68 | 1.01 | 1.44 | 1.15 | 1.08 |
| | **pH** | **Rayment & Lyons 2011 - 4B4 ($CaCl_2$) | 6.66 | 6.32 | 6.67 | 6.13 | 7.75 |
| | **Phosphorus Buffer Index** | **Rayment & Lyons 2011 - 9I4b (PBI) | 49 | 22 | 42 | 55 | 134 |
| | **Phosphorus Buffer Index - Colwell adj.** | **Rayment & Lyons 2011 - 9I2b ($PBI_{COLWELL}$) | 59 | 33 | 49 | 64 | 147 |
| | **Sulfur (mg/kg S )** | **Rayment & Lyons 2011 - 10D1 (KCl 40) | 2.4 | 1.7 | 2.3 | 10.7 | 2.7 |
| | **Emerson Aggregate Test (EAT)** | **AS1289.3.8.1-2017 | 3 | 3 | 3 | 3 | 4 |
| | **Gravel Content (%)** | **Inhouse S67 | 0.03 | 1.08 | 0.10 | 0.04 | 0.09 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | **Inhouse | 5YR | 5YR 3/3 | 7.5YR 3/2 | 5YR 3/3 | 5YR 3/3 |
| | **Colour (Munsell Soil Colour Classification)** | **Inhouse | DARK REDDISH BROWN | DARK REDDISH BROWN | DARK BROWN | DARK REDDISH BROWN | DARK REDDISH BROWN |

**Notes:**

**1**. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
**2**. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
**3**. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
**4**. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
**5**. Guidelines for phosphorus have been reduced for Australian soils.
**6**. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
**7**. Total Acid Extractable Nutrients indicate a store of nutrients.
**8**. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
**9**. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
**10.** Conversions for 1 $cmol_+$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
**11.** Conversions to kg/ha = mg/kg x 2.24
**12.** The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
**13.** ** NATA accreditation does not cover the performance of this service.
**14.** Analysis conducted between sample arrival date and reporting date.
**15.** This report is not to be reproduced except in full. Results only relate to the item tested.
**16**. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

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10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 6 | Sample 7 | Sample 8 | Sample 9 | Sample 10 |
|---|---|---|---|---|---|---|---|---|
| | **Sample ID:** | | | **G15** | **G17** | **G20** | **G22** | **G23** |
| | **Crop:** | | | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** |
| | **Client:** | | | **VHM** | **VHM** | **VHM** | **VHM** | **VHM** |
| | **Phosphorus (mg/kg P)** | | **Rayment & Lyons 2011 - 9B2 (Colwell) | 7.9 | 22 | 50 | 33 | 17 |
| | **Nitrate Nitrogen (mg/kg N)** | | | 6.1 | 9.5 | 24 | 43 | 12 |
| | **Ammonium Nitrogen (mg/kg N)** | | **Inhouse S37 (KCl) | 4.4 | 2.2 | 3.7 | 11 | 2.8 |
| | **Sulfur (mg/kg S)** | | | 2.5 | 3.7 | 5.2 | 28 | 37 |
| | **pH** | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 7.28 | 6.15 | 8.21 | 8.30 | 8.49 |
| | **Electrical Conductivity (dS/m)** | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.052 | 0.041 | 0.111 | 0.392 | 0.151 |
| | **Estimated Organic Matter (% OM)** | | **Calculation: Total Carbon x 1.75 | 1.2 | 1.0 | 1.8 | 2.9 | 2.3 |
| | **Exchangeable Calcium** | **(cmol$_+$/kg)** | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 6.37 | 2.23 | 16.00 | 32.58 | 19.88 |
| | | **(kg/ha)** | | 2861 | 1002 | 7183 | 14626 | 8925 |
| | | **(mg/kg)** | | 1277 | 447 | 3207 | 6530 | 3984 |
| | **Exchangeable Magnesium** | **(cmol$_+$/kg)** | | 2.84 | 0.60 | 3.63 | 5.83 | 1.81 |
| | | **(kg/ha)** | | 773 | 162 | 987 | 1586 | 492 |
| | | **(mg/kg)** | | 345 | 72 | 441 | 708 | 220 |
| | **Exchangeable Potassium** | **(cmol$_+$/kg)** | | 0.72 | 0.30 | 1.93 | 1.96 | 1.59 |
| | | **(kg/ha)** | | 630 | 267 | 1692 | 1718 | 1389 |
| | | **(mg/kg)** | | 281 | 119 | 755 | 767 | 620 |
| | **Exchangeable Sodium** | **(cmol$_+$/kg)** | | 0.27 | <0.065 | 0.23 | 0.87 | 0.10 |
| | | **(kg/ha)** | | 140 | <33 | 121 | 446 | 50 |
| | | **(mg/kg)** | | 62 | <15 | 54 | 199 | 22 |
| | **Exchangeable Aluminium** | **(cmol$_+$/kg)** | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Exchangeable Hydrogen** | **(cmol$_+$/kg)** | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | 0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)** | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 10.21 | 3.18 | 21.80 | 41.24 | 23.38 |
| | **Calcium (%)** | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 62.4 | 70.3 | 73.4 | 79.0 | 85.1 |
| | **Magnesium (%)** | | | 27.8 | 18.8 | 16.6 | 14.1 | 7.7 |
| | **Potassium (%)** | | | 7.1 | 9.6 | 8.9 | 4.8 | 6.8 |
| | **Sodium - ESP (%)** | | | 2.7 | 0.9 | 1.1 | 2.1 | 0.4 |
| | **Aluminium (%)** | | | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| | **Hydrogen** | | | 0.0 | 0.3 | 0.0 | 0.0 | 0.0 |
| | **Calcium/Magnesium Ratio** | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.2 | 3.7 | 4.4 | 5.6 | 11.0 |
| | **Zinc (mg/kg)** | | Rayment & Lyons 2011 - 12A1 (DTPA) | <0.5 | 0.6 | 1.2 | 0.8 | 1.1 |
| | **Manganese (mg/kg)** | | | 7.9 | 11 | 6.4 | 8.9 | 11 |
| | **Iron (mg/kg)** | | | 8.2 | 13 | 7.7 | 5.9 | 3.2 |
| | **Copper (mg/kg)** | | | 0.4 | 0.2 | 0.7 | 0.8 | 0.4 |

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | Method reference | Sample 6 | Sample 7 | Sample 8 | Sample 9 | Sample 10 |
|---|---|---|---|---|---|---|---|
| Sample ID: | | | G15 | G17 | G20 | G22 | G23 |
| Crop: | | | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 |
| Client: | | | VHM | VHM | VHM | VHM | VHM |
| | | | I1027/6 | I1027/7 | I1027/8 | I1027/9 | I1027/10 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 0.76 | 0.39 | 1.01 | 1.39 | 0.79 |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | 60 | 33 | 42 | 30 | 59 |
| | Total Carbon (%) | Inhouse S4a (LECO Trumac Analyser) | 0.71 | 0.56 | 1.02 | 1.66 | 1.33 |
| | Total Nitrogen (%) | | 0.11 | 0.11 | 0.15 | 0.16 | 0.08 |
| | Carbon/Nitrogen Ratio | **Calculation: Total Carbon/Total Nitrogen | 6.7 | 5.1 | 6.9 | 10.4 | 17.1 |
| | Basic Texture | **Inhouse S65 | Loam | Loam | Loam | Loam | Loam |
| | Basic Colour | | Red | Red | Brownish | Red | Brownish |
| | Chloride Estimate (equiv. mg/kg) | **Calculation: Electrical Conductivity x 640 | 33 | 26 | 71 | 251 | 97 |
| | Total Molybdenum (mg/kg) | Rayment & Lyons 2011 - 17C1 Aqua Regia | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | Total Cobalt (mg/kg) | | 3.1 | 1.7 | 6.1 | 8.3 | 4.3 |
| | Total Selenium (mg/kg) | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | Total Organic Carbon (%) | LECO Trumac Analyser - Inhouse S15b | 0.62 | 0.51 | 1.01 | 1.17 | 1.06 |
| | pH | **Rayment & Lyons 2011 - 4B4 ($CaCl_2$) | 6.67 | 5.26 | 7.44 | 7.67 | 7.63 |
| | Phosphorus Buffer Index | **Rayment & Lyons 2011 - 9I4b (PBI) | 26 | 2 | 78 | 134 | 42 |
| | Phosphorus Buffer Index - Colwell adj. | **Rayment & Lyons 2011 - 9I2b ($PBI_{COLWELL}$) | 27 | 6 | 88 | 142 | 45 |
| | Sulfur (mg/kg S ) | **Rayment & Lyons 2011 - 10D1 (KCl 40) | <1 | 2.1 | 2.5 | 16 | 24 |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 3 | 3 | 3 | 2 | 3 |
| | Gravel Content (%) | **Inhouse S67 | 0.10 | 0.05 | 0.93 | 0.17 | 0.39 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 2.5YR 4/6 | 7.5YR 3/4 | 7.5YR 3/3 | 5YR 4/4 | 7.5YR 3/2 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | RED | DARK BROWN | DARK BROWN | REDDISH BROWN | DARK BROWN |

**Notes:**

**1**. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
**2**. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
**3**. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
**4**. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
**5**. Guidelines for phosphorus have been reduced for Australian soils.
**6**. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
**7**. Total Acid Extractable Nutrients indicate a store of nutrients.
**8**. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
**9**. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
**10.** Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
**11.** Conversions to kg/ha = mg/kg x 2.24
**12.** The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
**13.** ** NATA accreditation does not cover the performance of this service.
**14.** Analysis conducted between sample arrival date and reporting date.
**15.** This report is not to be reproduced except in full. Results only relate to the item tested.
**16**. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

*Quality Checked: Kris Saville*
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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 11 | Sample 12 | Sample 13 | Sample 14 | Sample 15 |
|---|---|---|---|---|---|---|---|---|
| | | | Sample ID: | G28 | G30 | G32 | G33 | G34 |
| | | | Crop: | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 |
| | | | Client: | VHM | VHM | VHM | VHM | VHM |
| | | | | I1027/11 | I1027/12 | I1027/13 | I1027/14 | I1027/15 |
| | Phosphorus (mg/kg P) | | **Rayment & Lyons 2011 - 9B2 (Colwell) | 19 | 19 | 73 | 48 | 19 |
| | Nitrate Nitrogen (mg/kg N) | | **Inhouse S37 (KCl) | 15 | 13 | 25 | 24 | 37 |
| | Ammonium Nitrogen (mg/kg N) | | | 4.5 | 7.7 | 4.4 | 8.8 | 5.3 |
| | Sulfur (mg/kg S) | | | 4.8 | 4.7 | 6.4 | 4.4 | 31 |
| | pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 6.47 | 8.74 | 8.51 | 8.60 | 8.49 |
| | Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.069 | 0.178 | 0.154 | 0.139 | 0.198 |
| | Estimated Organic Matter (% OM) | | **Calculation: Total Carbon x 1.75 | 1.3 | 3.5 | 3.1 | 1.8 | 3.5 |
| | Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 2.35 | 29.41 | 30.34 | 22.61 | 31.93 |
| | | (kg/ha) | | 1055 | 13200 | 13618 | 10150 | 14335 |
| | | (mg/kg) | | 471 | 5893 | 6080 | 4531 | 6400 |
| | Exchangeable Magnesium | (cmol$_+$/kg) | | 1.07 | 7.23 | 5.07 | 6.33 | 4.24 |
| | | (kg/ha) | | 293 | 1968 | 1381 | 1723 | 1153 |
| | | (mg/kg) | | 131 | 879 | 616 | 769 | 515 |
| | Exchangeable Potassium | (cmol$_+$/kg) | | 0.55 | 1.55 | 1.88 | 1.19 | 2.44 |
| | | (kg/ha) | | 486 | 1357 | 1646 | 1041 | 2139 |
| | | (mg/kg) | | 217 | 606 | 735 | 465 | 955 |
| | Exchangeable Sodium | (cmol$_+$/kg) | | <0.065 | 0.90 | 0.23 | 0.66 | 0.43 |
| | | (kg/ha) | | <33 | 465 | 120 | 338 | 220 |
| | | (mg/kg) | | <15 | 208 | 54 | 151 | 98 |
| | Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | 1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 4.04 | 39.09 | 37.53 | 30.79 | 39.04 |
| | Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 58.2 | 75.2 | 80.8 | 73.4 | 81.8 |
| | Magnesium (%) | | | 26.6 | 18.5 | 13.5 | 20.6 | 10.8 |
| | Potassium (%) | | | 13.7 | 4.0 | 5.0 | 3.9 | 6.3 |
| | Sodium - ESP (%) | | | 1.2 | 2.3 | 0.6 | 2.1 | 1.1 |
| | Aluminium (%) | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Hydrogen | | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| | Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.2 | 4.1 | 6.0 | 3.6 | 7.5 |
| | Zinc (mg/kg) | | Rayment & Lyons 2011 - 12A1 (DTPA) | 0.8 | <0.5 | 1.4 | 1.0 | <0.5 |
| | Manganese (mg/kg) | | | 15 | 8.2 | 11 | 7.6 | 7.5 |
| | Iron (mg/kg) | | | 10.1 | 6.0 | 8.0 | 6.2 | 4.6 |
| | Copper (mg/kg) | | | 0.2 | 0.8 | 0.8 | 0.7 | 0.5 |

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | Method reference | Sample 11 | Sample 12 | Sample 13 | Sample 14 | Sample 15 |
|---|---|---|---|---|---|---|---|
| | **Sample ID:** | | **G28** | **G30** | **G32** | **G33** | **G34** |
| | **Crop:** | | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** |
| | **Client:** | | **VHM** | **VHM** | **VHM** | **VHM** | **VHM** |
| | **Boron (mg/kg)** | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 0.48 | 1.57 | 0.99 | 1.33 | 1.20 |
| | **Silicon (mg/kg Si)** | **Inhouse S11 (Hot CaCl2) | 57 | 25 | 38 | 34 | 40 |
| | **Total Carbon (%)** | Inhouse S4a (LECO Trumac Analyser) | 0.74 | 1.99 | 1.76 | 1.05 | 1.98 |
| | **Total Nitrogen (%)** | | 0.07 | 0.08 | 0.11 | 0.09 | 0.17 |
| | **Carbon/Nitrogen Ratio** | **Calculation: Total Carbon/Total Nitrogen | 11.1 | 24.3 | 16.1 | 11.9 | 11.9 |
| | **Basic Texture** | **Inhouse S65 | Loam | Loam | Loam | Loam | Loam |
| | **Basic Colour** | | Red | Brownish | Brownish | Brownish | Brownish |
| | **Chloride Estimate (equiv. mg/kg)** | **Calculation: Electrical Conductivity x 640 | 44 | 114 | 99 | 89 | 127 |
| | **Total Molybdenum (mg/kg)** | Rayment & Lyons 2011 - 17C1 Aqua Regia | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | **Total Cobalt (mg/kg)** | | 1.0 | 5.2 | 7.1 | 6.0 | 6.9 |
| | **Total Selenium (mg/kg)** | | <0.5 | <0.5 | <0.5 | <0.5 | <0.5 |
| | **Total Organic Carbon (%)** | LECO Trumac Analyser - Inhouse S15b | 0.69 | 0.95 | 1.14 | 0.96 | <0.02 |
| | **pH** | **Rayment & Lyons 2011 - 4B4 ($CaCl_2$) | 5.84 | 7.81 | 7.75 | 7.78 | 7.71 |
| | **Phosphorus Buffer Index** | **Rayment & Lyons 2011 - 9I4b (PBI) | <1 | 133 | 122 | 100 | 89 |
| | **Phosphorus Buffer Index - Colwell adj.** | **Rayment & Lyons 2011 - 9I2b ($PBI_{COLWELL}$) | 1 | 137 | 138 | 109 | 92 |
| | **Sulfur (mg/kg S )** | **Rayment & Lyons 2011 - 10D1 (KCl 40) | <1 | <1 | 2.6 | 2.5 | 15.3 |
| | **Emerson Aggregate Test (EAT)** | **AS1289.3.8.1-2017 | 3 | 3 | 3 | 2 | 3 |
| | **Gravel Content (%)** | **Inhouse S67 | 0.97 | 0.34 | 0.30 | 0.09 | 1.19 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | **Inhouse | 7.5YR 3/4 | 7.5YR 4/3 | 7.5YR 4/3 | 7.5YR 4/3 | 7.5YR 3/4 |
| | **Colour (Munsell Soil Colour Classification)** | **Inhouse | DARK BROWN | BROWN | BROWN | BROWN | DARK BROWN |

**Notes:**

**1**. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
**2**. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
**3**. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
**4**. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
**5**. Guidelines for phosphorus have been reduced for Australian soils.
**6**. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
**7**. Total Acid Extractable Nutrients indicate a store of nutrients.
**8**. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
**9**. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
**10.** Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
**11.** Conversions to kg/ha = mg/kg x 2.24
**12.** The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
**13.** ** NATA accreditation does not cover the performance of this service.
**14.** Analysis conducted between sample arrival date and reporting date.
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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

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10 Kings Road NEW LAMBTON NSW 2305

| | | Sample 16 | Sample 17 | Sample 18 | Sample 19 | Sample 20 |
|---|---|---|---|---|---|---|
| | Sample ID: | G35 | G37 | G38 | G40 | G42 |
| | Crop: | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 |
| | Client: | VHM | VHM | VHM | VHM | VHM |
| Parameter | Method reference | I1027/16 | I1027/17 | I1027/18 | I1027/19 | I1027/20 |
| Phosphorus (mg/kg P) | **Rayment & Lyons 2011 - 9B2 (Colwell) | 35 | 52 | 77 | 53 | 63 |
| Nitrate Nitrogen (mg/kg N) | **Inhouse S37 (KCl) | 14 | 37 | 26 | 13 | 28 |
| Ammonium Nitrogen (mg/kg N) | | 3.3 | 6.6 | 4.2 | 2.2 | 3.7 |
| Sulfur (mg/kg S) | | 3.8 | 4.4 | 4.1 | 6.2 | 13 |
| pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.14 | 8.65 | 8.14 | 8.61 | 8.62 |
| Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.075 | 0.188 | 0.140 | 0.149 | 0.160 |
| Estimated Organic Matter (% OM) | **Calculation: Total Carbon x 1.75 | 1.4 | 2.8 | 2.1 | 2.8 | 2.8 |
| Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 8.41 | 32.21 | 13.82 | 15.46 | 30.20 |
| Exchangeable Calcium (kg/ha) | | 3773 | 14458 | 6202 | 6941 | 13559 |
| Exchangeable Calcium (mg/kg) | | 1684 | 6455 | 2769 | 3098 | 6053 |
| Exchangeable Magnesium (cmol$_+$/kg) | | 1.97 | 6.60 | 3.30 | 1.68 | 6.35 |
| Exchangeable Magnesium (kg/ha) | | 536 | 1797 | 898 | 457 | 1728 |
| Exchangeable Magnesium (mg/kg) | | 239 | 802 | 401 | 204 | 771 |
| Exchangeable Potassium (cmol$_+$/kg) | | 0.84 | 1.79 | 1.18 | 0.45 | 1.74 |
| Exchangeable Potassium (kg/ha) | | 736 | 1571 | 1036 | 397 | 1524 |
| Exchangeable Potassium (mg/kg) | | 329 | 701 | 462 | 177 | 680 |
| Exchangeable Sodium (cmol$_+$/kg) | | 0.30 | 1.08 | 0.15 | 0.11 | 0.62 |
| Exchangeable Sodium (kg/ha) | | 156 | 556 | 80 | 59 | 321 |
| Exchangeable Sodium (mg/kg) | | 70 | 248 | 36 | 26 | 143 |
| Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Exchangeable Aluminium (kg/ha) | | 2 | <1 | 1 | <1 | 2 |
| Exchangeable Aluminium (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 11.53 | 41.69 | 18.46 | 17.71 | 38.92 |
| Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 72.9 | 77.3 | 74.9 | 87.3 | 77.6 |
| Magnesium (%) | | 17.1 | 15.8 | 17.9 | 9.5 | 16.3 |
| Potassium (%) | | 7.3 | 4.3 | 6.4 | 2.6 | 4.5 |
| Sodium - ESP (%) | | 2.6 | 2.6 | 0.8 | 0.6 | 1.6 |
| Aluminium (%) | | 0.1 | 0.0 | 0.0 | 0.0 | 0.0 |
| Hydrogen | | 0.0 | 0.0 | 0.0 | 0.0 | 0.0 |
| Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 4.3 | 4.9 | 4.2 | 9.2 | 4.8 |
| Zinc (mg/kg) | Rayment & Lyons 2011 - 12A1 (DTPA) | 1.2 | 0.6 | <0.5 | 0.7 | 1.1 |
| Manganese (mg/kg) | | 6.0 | 6.4 | 7.4 | 5.7 | 6.1 |
| Iron (mg/kg) | | 5.3 | 8.3 | 6.9 | 7.2 | 7.0 |
| Copper (mg/kg) | | 0.3 | 0.9 | 0.5 | 0.7 | 0.8 |

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | Method reference | Sample 16 | Sample 17 | Sample 18 | Sample 19 | Sample 20 |
|---|---|---|---|---|---|---|---|
| | **Sample ID:** | | **G35** | **G37** | **G38** | **G40** | **G42** |
| | **Crop:** | | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** | **0-10, 2/4/19** |
| | **Client:** | | **VHM** | **VHM** | **VHM** | **VHM** | **VHM** |
| | **Boron (mg/kg)** | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)** | 0.78 | 1.23 | 0.91 | 1.53 | 1.37 |
| | **Silicon (mg/kg Si)** | **Inhouse S11 (Hot CaCl2) | 63 | 26 | 65 | 34 | 42 |
| | **Total Carbon (%)** | Inhouse S4a (LECO Trumac Analyser) | 0.79 | 1.58 | 1.21 | 1.61 | 1.62 |
| | **Total Nitrogen (%)** | | 0.05 | 0.11 | 0.11 | 0.16 | 0.11 |
| | **Carbon/Nitrogen Ratio** | **Calculation: Total Carbon/Total Nitrogen | 14.9 | 14.5 | 10.6 | 10.3 | 14.7 |
| | **Basic Texture** | **Inhouse S65 | Loam | Loam | Loam | Loam | Loam |
| | **Basic Colour** | | Brownish | Brownish | Brownish | Brownish | Brownish |
| | **Chloride Estimate (equiv. mg/kg)** | **Calculation: Electrical Conductivity x 640 | 48 | 120 | 90 | 95 | 103 |
| | **Total Molybdenum (mg/kg)** | Rayment & Lyons 2011 - 17C1 Aqua Regia | <0.2 | <0.2 | <0.2 | <0.2 | <0.2 |
| | **Total Cobalt (mg/kg)** | | 2.3 | 7.2 | 5.1 | 8.1 | 6.2 |
| | **Total Selenium (mg/kg)** | | <0.5 | 0.5 | <0.5 | 0.6 | <0.5 |
| | **Total Organic Carbon (%)** | LECO Trumac Analyser - Inhouse S15b | 0.65 | 0.98 | 0.97 | 1.14 | 1.09 |
| | **pH** | **Rayment & Lyons 2011 - 4B4 ($CaCl_2$) | 7.24 | 7.85 | 7.53 | 7.82 | 7.79 |
| | **Phosphorus Buffer Index** | **Rayment & Lyons 2011 - 9I4b (PBI) | 8 | 116 | 39 | 118 | 100 |
| | **Phosphorus Buffer Index - Colwell adj.** | **Rayment & Lyons 2011 - 9I2b ($PBI_{COLWELL}$) | 14 | 127 | 52 | 130 | 113 |
| | **Sulfur (mg/kg S )** | **Rayment & Lyons 2011 - 10D1 (KCl 40) | <1 | 3.4 | 1.3 | 4.6 | 2.3 |
| | **Emerson Aggregate Test (EAT)** | **AS1289.3.8.1-2017 | 3 | 3 | 3 | 3 | 3 |
| | **Gravel Content (%)** | **Inhouse S67 | 0.21 | 0.22 | 0.10 | 0.17 | 1.85 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | **Inhouse | 7.5YR 3/2 | 7.5YR 4/3 | 5YR 3/2 | 7.5YR 4/3 | 7.5YR 3/4 |
| | **Colour (Munsell Soil Colour Classification)** | **Inhouse | DARK BROWN | BROWN | DARK REDDISH BROWN | BROWN | DARK BROWN |

**Notes:**

**1**. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
**2**. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
**3**. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
**4**. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
**5**. Guidelines for phosphorus have been reduced for Australian soils.
**6**. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
**7**. Total Acid Extractable Nutrients indicate a store of nutrients.
**8**. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
**9**. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
**10.** Conversions for 1 $cmol_+$/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
**11.** Conversions to kg/ha = mg/kg x 2.24
**12.** The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
**13.** ** NATA accreditation does not cover the performance of this service.
**14.** Analysis conducted between sample arrival date and reporting date.
**15.** This report is not to be reproduced except in full. Results only relate to the item tested.
**16**. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

*Quality Checked: Kris Saville*
*Agricultural Co-Ordinator*

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 21 | Sample 22 | Sample 23 | Sample 24 |
|---|---|---|---|---|---|---|
| | | Sample ID: | G43 | G46 | G48 | G51 |
| | | Crop: | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 |
| | | Client: | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1027/21 | I1027/22 | I1027/23 | I1027/24 |
| | Phosphorus (mg/kg P) | **Rayment & Lyons 2011 - 9B2 (Colwell) | 59 | 24 | 23 | 17 |
| | Nitrate Nitrogen (mg/kg N) | **Inhouse S37 (KCl) | 46 | 35 | 34 | 6.8 |
| | Ammonium Nitrogen (mg/kg N) | | 3.1 | 3.9 | 3.2 | 3.1 |
| | Sulfur (mg/kg S) | | 6.1 | 7.9 | 6.0 | 3.6 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.58 | 8.38 | 8.49 | 8.11 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.183 | 0.233 | 0.170 | 0.143 |
| | Estimated Organic Matter (% OM) | **Calculation: Total Carbon x 1.75 | 3.0 | 4.2 | 3.5 | 2.8 |
| | Exchangeable Calcium (cmol+/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 31.96 | 26.70 | 28.26 | 19.53 |
| | Exchangeable Calcium (kg/ha) | | 14346 | 11983 | 12687 | 8766 |
| | Exchangeable Calcium (mg/kg) | | 6405 | 5350 | 5664 | 3914 |
| | Exchangeable Magnesium (cmol+/kg) | | 5.18 | 3.91 | 2.77 | 4.14 |
| | Exchangeable Magnesium (kg/ha) | | 1411 | 1066 | 753 | 1126 |
| | Exchangeable Magnesium (mg/kg) | | 630 | 476 | 336 | 503 |
| | Exchangeable Potassium (cmol+/kg) | | 1.88 | 2.06 | 2.28 | 1.65 |
| | Exchangeable Potassium (kg/ha) | | 1651 | 1805 | 1994 | 1444 |
| | Exchangeable Potassium (mg/kg) | | 737 | 806 | 890 | 645 |
| | Exchangeable Sodium (cmol+/kg) | | 0.84 | 0.68 | 0.17 | 0.35 |
| | Exchangeable Sodium (kg/ha) | | 434 | 349 | 89 | 179 |
| | Exchangeable Sodium (mg/kg) | | 194 | 156 | 40 | 80 |
| | Exchangeable Aluminium (cmol+/kg) | **Inhouse S37 (KCl) | <0.01 | 0.01 | <0.01 | <0.01 |
| | Exchangeable Aluminium (kg/ha) | | 1 | 3 | 2 | 2 |
| | Exchangeable Aluminium (mg/kg) | | <1 | 1 | <1 | <1 |
| | Exchangeable Hydrogen (cmol+/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol+/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg) | 39.87 | 33.36 | 33.49 | 25.67 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol+/kg / ECEC x 100 | 80.1 | 80.0 | 84.4 | 76.1 |
| | Magnesium (%) | | 13.0 | 11.7 | 8.3 | 16.1 |
| | Potassium (%) | | 4.7 | 6.2 | 6.8 | 6.4 |
| | Sodium - ESP (%) | | 2.1 | 2.0 | 0.5 | 1.4 |
| | Aluminium (%) | | 0.0 | 0.0 | 0.0 | 0.0 |
| | Hydrogen | | 0.0 | 0.0 | 0.0 | 0.0 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol+/kg) | 6.2 | 6.8 | 10.2 | 4.7 |
| | Zinc (mg/kg) | Rayment & Lyons 2011 - 12A1 (DTPA) | 0.7 | 0.5 | 0.6 | <0.5 |
| | Manganese (mg/kg) | | 6.9 | 9.2 | 8.2 | 9.6 |
| | Iron (mg/kg) | | 5.9 | 5.5 | 4.2 | 8.1 |
| | Copper (mg/kg) | | 0.6 | 0.3 | 0.4 | 0.4 |

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# AGRICULTURAL SOIL ANALYSIS REPORT

24 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1027

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | Sample 21 | Sample 22 | Sample 23 | Sample 24 |
|---|---|---|---|---|---|
| | Sample ID: | G43 | G46 | G48 | G51 |
| | Crop: | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 | 0-10, 2/4/19 |
| | Client: | VHM | VHM | VHM | VHM |
| | Parameter / Method reference | I1027/21 | I1027/22 | I1027/23 | I1027/24 |
| | **Boron (mg/kg)** — **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$)** | 0.94 | 1.16 | 0.66 | 1.10 |
| | **Silicon (mg/kg Si)** — **Inhouse S11 (Hot CaCl2) | 33 | 35 | 42 | 55 |
| | **Total Carbon (%)** — Inhouse S4a (LECO Trumac Analyser) | 1.73 | 2.40 | 2.01 | 1.61 |
| | **Total Nitrogen (%)** — Inhouse S4a (LECO Trumac Analyser) | 0.11 | 0.20 | 0.16 | 0.14 |
| | **Carbon/Nitrogen Ratio** — **Calculation: Total Carbon/Total Nitrogen | 15.6 | 12.1 | 12.4 | 11.2 |
| | **Basic Texture** — **Inhouse S65 | Loam | Loam | Loam | Loam |
| | **Basic Colour** — **Inhouse S65 | Brownish | Brownish | Brownish | Brownish |
| | **Chloride Estimate (equiv. mg/kg)** — **Calculation: Electrical Conductivity x 640 | 117 | 149 | 109 | 91 |
| | **Total Molybdenum (mg/kg)** — Rayment & Lyons 2011 - 17C1 Aqua Regia | <0.2 | <0.2 | <0.2 | <0.2 |
| | **Total Cobalt (mg/kg)** — Rayment & Lyons 2011 - 17C1 Aqua Regia | 6.4 | 5.3 | 4.3 | 4.8 |
| | **Total Selenium (mg/kg)** — Rayment & Lyons 2011 - 17C1 Aqua Regia | <0.5 | 0.8 | <0.5 | <0.5 |
| | **Total Organic Carbon (%)** — LECO Trumac Analyser - Inhouse S15b | 1.18 | 2.27 | 1.43 | 1.61 |
| | **pH** — **Rayment & Lyons 2011 - 4B4 ($CaCl_2$) | 7.78 | 7.53 | 7.62 | 7.44 |
| | **Phosphorus Buffer Index** — **Rayment & Lyons 2011 - 9I4b (PBI) | 91 | 74 | 71 | 49 |
| | **Phosphorus Buffer Index - Colwell adj.** — **Rayment & Lyons 2011 - 9I2b ($PBI_{COLWELL}$) | 103 | 79 | 76 | 52 |
| | **Sulfur (mg/kg S )** — **Rayment & Lyons 2011 - 10D1 (KCl 40) | 1.3 | 2.9 | 2.4 | <1 |
| | **Emerson Aggregate Test (EAT)** — **AS1289.3.8.1-2017 | 4 | 3 | 3 | 3 |
| | **Gravel Content (%)** — **Inhouse S67 | 0.20 | 3.65 | 0.08 | 0.36 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** — **Inhouse | 7.5YR 4/3 | 5YR 3/3 | 7.5YR 2.5/2 | 7.5YR 3/2 |
| | **Colour (Munsell Soil Colour Classification)** — **Inhouse | BROWN | DARK REDDISH BROWN | VERY DARK BROWN | DARK BROWN |

**Notes:**

**1**. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
**2**. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
**3**. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
**4**. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
**5**. Guidelines for phosphorus have been reduced for Australian soils.
**6**. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
**7**. Total Acid Extractable Nutrients indicate a store of nutrients.
**8**. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
**9**. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
**10.** Conversions for 1 $cmol_+/kg$ = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
**11.** Conversions to kg/ha = mg/kg x 2.24
**12.** The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
**13.** ** NATA accreditation does not cover the performance of this service.
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*Quality Checked: Kris Saville*
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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G2 20-30 | G2 40-50 | G2 65-75 | G2 90-100 | G5 20-30 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/1 | I1032/2 | I1032/3 | I1032/4 | I1032/5 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.16 | 9.47 | 9.47 | 9.38 | 8.69 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.236 | 0.498 | 0.713 | 0.932 | 0.134 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 27.44 | 23.02 | 20.65 | 19.28 | 25.03 |
| | Exchangeable Calcium (kg/ha) | | 12317 | 10333 | 9271 | 8655 | 11238 |
| | Exchangeable Calcium (mg/kg) | | 5499 | 4613 | 4139 | 3864 | 5017 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 10.33 | 13.33 | 13.74 | 12.53 | 7.11 |
| | Exchangeable Magnesium (kg/ha) | | 2812 | 3629 | 3739 | 3412 | 1936 |
| | Exchangeable Magnesium (mg/kg) | | 1255 | 1620 | 1669 | 1523 | 864 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 0.77 | 0.72 | 0.90 | 0.96 | 1.13 |
| | Exchangeable Potassium (kg/ha) | | 670 | 631 | 784 | 843 | 987 |
| | Exchangeable Potassium (mg/kg) | | 299 | 282 | 350 | 376 | 441 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 2.99 | 6.28 | 8.86 | 10.74 | 0.24 |
| | Exchangeable Sodium (kg/ha) | | 1541 | 3232 | 4561 | 5528 | 121 |
| | Exchangeable Sodium (mg/kg) | | 688 | 1443 | 2036 | 2468 | 54 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 41.52 | 43.35 | 44.14 | 43.51 | 33.51 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 66.1 | 53.1 | 46.8 | 44.3 | 74.7 |
| | Magnesium (%) | | 24.9 | 30.8 | 31.1 | 28.8 | 21.2 |
| | Potassium (%) | | 1.8 | 1.7 | 2.0 | 2.2 | 3.4 |
| | Sodium - ESP (%) | | 7.2 | 14.5 | 20.1 | 24.7 | 0.7 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.7 | 1.7 | 1.5 | 1.5 | 3.5 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 3 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 5YR 4/4 | 5YR 4/6 | 5YR 4/6 | 5YR 4/6 | 5YR 3/4 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | REDISH BROWN | YELLOWISH RED | YELLOWISH RED | YELLOWISH RED | DARK REDDISH BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 6 | Sample 7 | Sample 8 | Sample 9 | Sample 10 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G5 40-50 | G10 20-30 | G10 40-50 | G10 65-75 | G10 90-100 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/6 | I1032/7 | I1032/8 | I1032/9 | I1032/10 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.14 | 9.17 | 9.43 | 9.37 | 9.25 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.150 | 0.431 | 0.883 | 1.386 | 1.608 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 21.92 | 24.39 | 21.58 | 19.11 | 18.31 |
| | Exchangeable Calcium (kg/ha) | | 9838 | 10946 | 9688 | 8579 | 8218 |
| | Exchangeable Calcium (mg/kg) | | 4392 | 4887 | 4325 | 3830 | 3669 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 10.79 | 11.99 | 15.15 | 13.14 | 12.16 |
| | Exchangeable Magnesium (kg/ha) | | 2937 | 3264 | 4124 | 3578 | 3309 |
| | Exchangeable Magnesium (mg/kg) | | 1311 | 1457 | 1841 | 1597 | 1477 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 0.60 | 1.16 | 1.04 | 0.98 | 0.98 |
| | Exchangeable Potassium (kg/ha) | | 528 | 1019 | 912 | 863 | 860 |
| | Exchangeable Potassium (mg/kg) | | 236 | 455 | 407 | 385 | 384 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 0.65 | 5.36 | 10.87 | 14.37 | 15.22 |
| | Exchangeable Sodium (kg/ha) | | 333 | 2760 | 5596 | 7399 | 7840 |
| | Exchangeable Sodium (mg/kg) | | 149 | 1232 | 2498 | 3303 | 3500 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 33.95 | 42.92 | 48.66 | 47.63 | 46.69 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 64.5 | 56.8 | 44.4 | 40.1 | 39.2 |
| | Magnesium (%) | | 31.8 | 27.9 | 31.1 | 27.6 | 26.0 |
| | Potassium (%) | | 1.8 | 2.7 | 2.1 | 2.1 | 2.1 |
| | Sodium - ESP (%) | | 1.9 | 12.5 | 22.3 | 30.2 | 32.6 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.0 | 2.0 | 1.4 | 1.5 | 1.5 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | 3.44 | 7.46 | 9.82 | 10.34 |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | 19 | 10 | 9 | 10 |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 5YR 5/8 | 7.5YR 4/3 | 7.5YR 5/4 | 7.5YR 4/4 | 7.5YR 7/6 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | YELLOWISH RED | BROWN | BROWN | BROWN | REDDISH YELLOW |

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10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 11 | Sample 12 | Sample 13 | Sample 14 | Sample 15 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G12 20-30 | G12 40-50 | G12 65-75 | G12 90-100 | G13 20-30 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/11 | I1032/12 | I1032/13 | I1032/14 | I1032/15 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.94 | 9.16 | 9.14 | 8.47 | 9.18 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.905 | 1.588 | 2.122 | 4.066 | 0.257 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 23.70 | 19.96 | 20.98 | 29.55 | 26.88 |
| | Exchangeable Calcium (kg/ha) | | 10640 | 8960 | 9417 | 13267 | 12066 |
| | Exchangeable Calcium (mg/kg) | | 4750 | 4000 | 4204 | 5923 | 5387 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 9.89 | 12.39 | 12.93 | 12.08 | 11.12 |
| | Exchangeable Magnesium (kg/ha) | | 2693 | 3372 | 3520 | 3289 | 3027 |
| | Exchangeable Magnesium (mg/kg) | | 1202 | 1505 | 1571 | 1468 | 1351 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.07 | 1.17 | 1.25 | 1.26 | 1.10 |
| | Exchangeable Potassium (kg/ha) | | 937 | 1021 | 1093 | 1100 | 964 |
| | Exchangeable Potassium (mg/kg) | | 418 | 456 | 488 | 491 | 430 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 9.33 | 16.35 | 20.74 | 19.76 | 3.87 |
| | Exchangeable Sodium (kg/ha) | | 4803 | 8418 | 10678 | 10176 | 1991 |
| | Exchangeable Sodium (mg/kg) | | 2144 | 3758 | 4767 | 4543 | 889 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | 0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | 4 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | 2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 44.01 | 49.86 | 55.89 | 62.65 | 42.97 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 53.9 | 40.0 | 37.5 | 47.2 | 62.6 |
| | Magnesium (%) | | 22.5 | 24.8 | 23.1 | 19.3 | 25.9 |
| | Potassium (%) | | 2.4 | 2.3 | 2.2 | 2.0 | 2.6 |
| | Sodium - ESP (%) | | 21.2 | 32.8 | 37.1 | 31.5 | 9.0 |
| | Aluminium (%) | | 0.0 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | 0.0 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.4 | 1.6 | 1.6 | 2.4 | 2.4 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 5.18 | 10.12 | 12.40 | 10.52 | 1.56 |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | 12 | 10 | 11 | 8 | 10 |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 5YR 4/4 | 5YR 5/6 | 5YR 5/6 | 5YR 6/6 | 7.5YR 4/3 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | REDDISH BROWN | YELLOWISH RED | YELLOWISH RED | REDDISH YELLOW | BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 16 | Sample 17 | Sample 18 | Sample 19 | Sample 20 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G13 40-50 | G13 65-75 | G13 90-100 | G15 20-30 | G15 40-50 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/16 | I1032/17 | I1032/18 | I1032/19 | I1032/20 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.45 | 9.55 | 9.50 | 8.90 | 9.25 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.441 | 0.644 | 0.848 | 0.187 | 0.239 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 23.94 | 19.85 | 20.10 | 20.65 | 19.33 |
| | Exchangeable Calcium (kg/ha) | | 10747 | 8910 | 9025 | 9271 | 8675 |
| | Exchangeable Calcium (mg/kg) | | 4798 | 3978 | 4029 | 4139 | 3873 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 15.85 | 13.83 | 14.23 | 8.03 | 9.29 |
| | Exchangeable Magnesium (kg/ha) | | 4315 | 3764 | 3873 | 2185 | 2529 |
| | Exchangeable Magnesium (mg/kg) | | 1926 | 1680 | 1729 | 975 | 1129 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.12 | 1.03 | 1.21 | 1.18 | 1.05 |
| | Exchangeable Potassium (kg/ha) | | 982 | 906 | 1062 | 1031 | 921 |
| | Exchangeable Potassium (mg/kg) | | 439 | 404 | 474 | 460 | 411 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 7.43 | 8.42 | 11.27 | 1.15 | 1.75 |
| | Exchangeable Sodium (kg/ha) | | 3828 | 4337 | 5804 | 594 | 899 |
| | Exchangeable Sodium (mg/kg) | | 1709 | 1936 | 2591 | 265 | 401 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 48.35 | 43.14 | 46.82 | 31.02 | 31.42 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 49.5 | 46.0 | 42.9 | 66.6 | 61.5 |
| | Magnesium (%) | | 32.8 | 32.0 | 30.4 | 25.9 | 29.6 |
| | Potassium (%) | | 2.3 | 2.4 | 2.6 | 3.8 | 3.3 |
| | Sodium - ESP (%) | | 15.4 | 19.5 | 24.1 | 3.7 | 5.6 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.5 | 1.4 | 1.4 | 2.6 | 2.1 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 3.46 | 4.08 | 4.08 | 1.11 | 1.65 |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | 11 | 11 | 11 | 14 | 9 |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 7.5YR 4/4 | 7.5YR 5/4 | 7.5YR 5/4 | 2.5YR 4/6 | 2.5YR 4/6 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | BROWN | BROWN | BROWN | RED | RED |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| Parameter | | Method reference | Sample 21 G15 65-75 N/G VHM I1032/21 | Sample 22 G15 90-100 N/G VHM I1032/22 | Sample 23 G17 20-30 N/G VHM I1032/23 | Sample 24 G17 40-50 N/G VHM I1032/24 | Sample 25 G17 65-75 N/G VHM I1032/25 |
|---|---|---|---|---|---|---|---|
| pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.60 | 9.80 | 8.74 | 9.28 | 9.63 |
| Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.327 | 0.486 | 0.146 | 0.191 | 0.291 |
| Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 16.74 | 13.68 | 20.16 | 18.51 | 16.36 |
| | (kg/ha) | | 7515 | 6139 | 9051 | 8310 | 7342 |
| | (mg/kg) | | 3355 | 2741 | 4041 | 3710 | 3278 |
| Exchangeable Magnesium | (cmol$_+$/kg) | | 8.95 | 9.49 | 8.76 | 10.35 | 9.77 |
| | (kg/ha) | | 2435 | 2583 | 2384 | 2816 | 2659 |
| | (mg/kg) | | 1087 | 1153 | 1064 | 1257 | 1187 |
| Exchangeable Potassium | (cmol$_+$/kg) | | 0.99 | 1.16 | 1.28 | 1.16 | 1.22 |
| | (kg/ha) | | 870 | 1014 | 1123 | 1019 | 1070 |
| | (mg/kg) | | 388 | 452 | 501 | 455 | 478 |
| Exchangeable Sodium | (cmol$_+$/kg) | | 2.88 | 5.32 | 0.45 | 1.29 | 2.69 |
| | (kg/ha) | | 1485 | 2737 | 232 | 667 | 1386 |
| | (mg/kg) | | 663 | 1222 | 103 | 298 | 619 |
| Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 29.57 | 29.65 | 30.66 | 31.33 | 30.05 |
| Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 56.6 | 46.1 | 65.8 | 59.1 | 54.4 |
| Magnesium (%) | | | 30.3 | 32.0 | 28.6 | 33.0 | 32.5 |
| Potassium (%) | | | 3.4 | 3.9 | 4.2 | 3.7 | 4.1 |
| Sodium - ESP (%) | | | 9.8 | 17.9 | 1.5 | 4.1 | 9.0 |
| Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.9 | 1.4 | 2.3 | 1.8 | 1.7 |
| Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 3.69 | 5.56 | 1.78 | 4.68 | 9.28 |
| Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | 7 | 6 | 11 | 6 | 8 |
| Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 2.5YR 4/8 | 2.5YR 4/8 | 2.5YR 4/6 | 2.5YR 5/8 | 2.5YR 5/6 |
| Colour (Munsell Soil Colour Classification) | | **Inhouse | RED | RED | RED | RED | RED |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 26 G17 90-100 N/G VHM | Sample 27 G20 20-30 N/G VHM | Sample 28 G20 40-50 N/G VHM | Sample 29 G20 65-75 N/G VHM | Sample 30 G20 90-100 N/G VHM |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | | I1032/26 | I1032/27 | I1032/28 | I1032/29 | I1032/30 |
| | pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.83 | 8.91 | 9.20 | 9.29 | 9.28 |
| | Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.357 | 0.172 | 0.335 | 0.584 | 0.713 |
| | Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 15.20 | 18.83 | 23.50 | 21.52 | 20.50 |
| | | (kg/ha) | | 6825 | 8453 | 10548 | 9658 | 9201 |
| | | (mg/kg) | | 3047 | 3774 | 4709 | 4312 | 4108 |
| | Exchangeable Magnesium | (cmol$_+$/kg) | | 7.44 | 9.65 | 13.43 | 14.64 | 15.07 |
| | | (kg/ha) | | 2026 | 2628 | 3656 | 3985 | 4102 |
| | | (mg/kg) | | 904 | 1173 | 1632 | 1779 | 1831 |
| | Exchangeable Potassium | (cmol$_+$/kg) | | 1.08 | 0.96 | 0.97 | 1.22 | 1.37 |
| | | (kg/ha) | | 945 | 845 | 851 | 1069 | 1200 |
| | | (mg/kg) | | 422 | 377 | 380 | 477 | 536 |
| | Exchangeable Sodium | (cmol$_+$/kg) | | 3.58 | 2.21 | 4.56 | 6.92 | 7.89 |
| | | (kg/ha) | | 1845 | 1139 | 2350 | 3562 | 4066 |
| | | (mg/kg) | | 824 | 509 | 1049 | 1590 | 1815 |
| | Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 27.32 | 31.67 | 42.48 | 44.30 | 44.84 |
| | Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 55.7 | 59.5 | 55.3 | 48.6 | 45.7 |
| | Magnesium (%) | | | 27.2 | 30.5 | 31.6 | 33.0 | 33.6 |
| | Potassium (%) | | | 4.0 | 3.0 | 2.3 | 2.8 | 3.1 |
| | Sodium - ESP (%) | | | 13.1 | 7.0 | 10.7 | 15.6 | 17.6 |
| | Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.0 | 2.0 | 1.7 | 1.5 | 1.4 |
| | Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 8.44 | 1.24 | 1.92 | 3.60 | 4.46 |
| | Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | 6 | 9 | 7 | 6 | 7 |
| | Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 2.5YR 5/6 | 5YR 4/4 | 5YR 4/4 | 7.5YR 5/4 | 10YR 6/4 |
| | Colour (Munsell Soil Colour Classification) | | **Inhouse | RED | REDISH BROWN | REDISH BROWN | BROWN | LIGHTISH BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 31 G22 20-30 N/G VHM | Sample 32 G22 40-50 N/G VHM | Sample 33 G22 65-75 N/G VHM | Sample 34 G22 90-100 N/G VHM | Sample 35 G23 20-30 N/G VHM |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | | G22 20-30 | G22 40-50 | G22 65-75 | G22 90-100 | G23 20-30 |
| | | Crop: | | N/G | N/G | N/G | N/G | N/G |
| | | Client: | | VHM | VHM | VHM | VHM | VHM |
| | | | | I1032/31 | I1032/32 | I1032/33 | I1032/34 | I1032/35 |
| | pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.11 | 9.43 | 9.41 | 9.32 | 8.85 |
| | Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.310 | 0.614 | 0.973 | 1.024 | 0.121 |
| | Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 24.00 | 20.00 | 18.28 | 17.39 | 21.56 |
| | | (kg/ha) | | 10772 | 8977 | 8205 | 7806 | 9676 |
| | | (mg/kg) | | 4809 | 4008 | 3663 | 3485 | 4320 |
| | Exchangeable Magnesium | (cmol$_+$/kg) | | 8.44 | 10.85 | 12.91 | 11.66 | 5.71 |
| | | (kg/ha) | | 2299 | 2953 | 3515 | 3175 | 1553 |
| | | (mg/kg) | | 1026 | 1318 | 1569 | 1417 | 693 |
| | Exchangeable Potassium | (cmol$_+$/kg) | | 0.77 | 0.79 | 1.12 | 1.13 | 1.63 |
| | | (kg/ha) | | 674 | 688 | 978 | 989 | 1430 |
| | | (mg/kg) | | 301 | 307 | 436 | 441 | 638 |
| | Exchangeable Sodium | (cmol$_+$/kg) | | 3.19 | 6.49 | 11.10 | 11.66 | 0.18 |
| | | (kg/ha) | | 1644 | 3342 | 5714 | 6005 | 92 |
| | | (mg/kg) | | 734 | 1492 | 2551 | 2681 | 41 |
| | Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 36.41 | 38.13 | 43.41 | 41.85 | 29.08 |
| | Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 65.9 | 52.4 | 42.1 | 41.5 | 74.1 |
| | Magnesium (%) | | | 23.2 | 28.4 | 29.7 | 27.9 | 19.6 |
| | Potassium (%) | | | 2.1 | 2.1 | 2.6 | 2.7 | 5.6 |
| | Sodium - ESP (%) | | | 8.8 | 17.0 | 25.6 | 27.9 | 0.6 |
| | Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.8 | 1.8 | 1.4 | 1.5 | 3.8 |
| | Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 2.62 | 4.87 | 10.22 | 9.86 | 1.18 |
| | Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | 13 | 8 | 8 | 8 | 26 |
| | Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 5YR 4/6 | 5YR 4/6 | 2.5YR 4/6 | 2.5YR 4/6 | 5YR 4/6 |
| | Colour (Munsell Soil Colour Classification) | | **Inhouse | YELOWISH RED | YELOWISH RED | RED | RED | YELOWISH RED |

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 36 G23 40-50 N/G VHM (I1032/36) | Sample 37 G23 65-75 N/G VHM (I1032/37) | Sample 38 G23 90-100 N/G VHM (I1032/38) | Sample 39 G28 20-30 N/G VHM (I1032/39) | Sample 40 G28 40-50 N/G VHM (I1032/40) |
|---|---|---|---|---|---|---|---|---|
| | pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.57 | 10.05 | 10.09 | 8.38 | 9.03 |
| | Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.257 | 0.574 | 0.626 | 0.145 | 0.135 |
| | Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 19.11 | 16.47 | 16.04 | 19.61 | 20.92 |
| | | (kg/ha) | | 8579 | 7392 | 7201 | 8805 | 9390 |
| | | (mg/kg) | | 3830 | 3300 | 3215 | 3931 | 4192 |
| | Exchangeable Magnesium | (cmol$_+$/kg) | | 9.86 | 7.48 | 5.63 | 7.06 | 8.10 |
| | | (kg/ha) | | 2684 | 2035 | 1532 | 1921 | 2205 |
| | | (mg/kg) | | 1198 | 909 | 684 | 858 | 984 |
| | Exchangeable Potassium | (cmol$_+$/kg) | | 2.14 | 2.15 | 1.95 | 0.68 | 0.60 |
| | | (kg/ha) | | 1875 | 1882 | 1704 | 591 | 529 |
| | | (mg/kg) | | 837 | 840 | 761 | 264 | 236 |
| | Exchangeable Sodium | (cmol$_+$/kg) | | 2.44 | 6.76 | 7.66 | 0.40 | 0.75 |
| | | (kg/ha) | | 1256 | 3481 | 3947 | 207 | 387 |
| | | (mg/kg) | | 561 | 1554 | 1762 | 92 | 173 |
| | Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 33.56 | 32.86 | 31.28 | 27.76 | 30.38 |
| | Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 56.9 | 50.1 | 51.3 | 70.7 | 68.8 |
| | Magnesium (%) | | | 29.4 | 22.8 | 18.0 | 25.4 | 26.7 |
| | Potassium (%) | | | 6.4 | 6.5 | 6.2 | 2.4 | 2.0 |
| | Sodium - ESP (%) | | | 7.3 | 20.6 | 24.5 | 1.4 | 2.5 |
| | Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.9 | 2.2 | 2.9 | 2.8 | 2.6 |
| | Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | 3.04 | 15.08 | 18.14 | .. | .. |
| | Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | 11 | 18 | 17 | .. | .. |
| | Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 5YR 4/6 | 5YR 7/6 | 5YR 6/6 | 2.5YR 4/8 | 5YR 5/6 |
| | Colour (Munsell Soil Colour Classification) | | **Inhouse | YELOWISH RED | REDISH YELLOW | REDISH YELLOW | RED | YELOWISH RED |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 41 | Sample 42 | Sample 43 | Sample 44 | Sample 45 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G28 65-75 | G28 90-100 | G30 20-30 | G30 40-50 | G30 65-75 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/41 | I1032/42 | I1032/43 | I1032/44 | I1032/45 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.26 | 9.61 | 9.60 | 9.75 | 9.58 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.192 | 0.258 | 0.608 | 0.919 | 1.335 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 19.39 | 18.29 | 20.32 | 17.03 | 14.88 |
| | Exchangeable Calcium (kg/ha) | | 8702 | 8209 | 9121 | 7647 | 6679 |
| | Exchangeable Calcium (mg/kg) | | 3885 | 3665 | 4072 | 3414 | 2982 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 10.93 | 9.93 | 13.14 | 14.55 | 14.68 |
| | Exchangeable Magnesium (kg/ha) | | 2975 | 2704 | 3578 | 3961 | 3997 |
| | Exchangeable Magnesium (mg/kg) | | 1328 | 1207 | 1597 | 1768 | 1784 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 0.80 | 1.00 | 1.09 | 1.37 | 1.67 |
| | Exchangeable Potassium (kg/ha) | | 701 | 873 | 956 | 1196 | 1464 |
| | Exchangeable Potassium (mg/kg) | | 313 | 390 | 427 | 534 | 653 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 1.66 | 2.86 | 6.29 | 10.13 | 14.73 |
| | Exchangeable Sodium (kg/ha) | | 853 | 1475 | 3239 | 5215 | 7585 |
| | Exchangeable Sodium (mg/kg) | | 381 | 658 | 1446 | 2328 | 3386 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 32.77 | 32.08 | 40.84 | 43.08 | 45.96 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 59.2 | 57.0 | 49.7 | 39.5 | 32.4 |
| | Magnesium (%) | | 33.4 | 31.0 | 32.2 | 33.8 | 31.9 |
| | Potassium (%) | | 2.4 | 3.1 | 2.7 | 3.2 | 3.6 |
| | Sodium - ESP (%) | | 5.1 | 8.9 | 15.4 | 23.5 | 32.0 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.8 | 1.8 | 1.5 | 1.2 | 1.0 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 2.5YR 5/6 | 5YR 5/6 | 7.5YR 5/4 | 7.5YR 5/4 | 5YR 6/6 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | RED | YELOWISH RED | BROWN | BROWN | REDISH YELLOW |

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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 46 G30 90-100 N/G VHM I1032/46 | Sample 47 G32 20-30 N/G VHM I1032/47 | Sample 48 G32 40-50 N/G VHM I1032/48 | Sample 49 G32 65-75 N/G VHM I1032/49 | Sample 50 G32 90-100 N/G VHM I1032/50 |
|---|---|---|---|---|---|---|---|---|
| | **pH** | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.37 | 8.87 | 9.13 | 9.41 | 9.57 |
| | **Electrical Conductivity (dS/m)** | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 1.489 | 0.180 | 0.216 | 0.316 | 0.450 |
| | **Exchangeable Calcium** | **(cmol$_+$/kg)** | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 8.71 | 26.21 | 24.42 | 23.03 | 21.95 |
| | | **(kg/ha)** | | 3908 | 11764 | 10962 | 10339 | 9853 |
| | | **(mg/kg)** | | 1745 | 5252 | 4894 | 4616 | 4399 |
| | **Exchangeable Magnesium** | **(cmol$_+$/kg)** | | 15.16 | 6.96 | 9.42 | 10.73 | 11.83 |
| | | **(kg/ha)** | | 4127 | 1895 | 2565 | 2921 | 3219 |
| | | **(mg/kg)** | | 1842 | 846 | 1145 | 1304 | 1437 |
| | **Exchangeable Potassium** | **(cmol$_+$/kg)** | | 1.75 | 0.91 | 0.80 | 0.78 | 0.83 |
| | | **(kg/ha)** | | 1531 | 797 | 699 | 681 | 723 |
| | | **(mg/kg)** | | 684 | 356 | 312 | 304 | 323 |
| | **Exchangeable Sodium** | **(cmol$_+$/kg)** | | 16.41 | 1.46 | 3.38 | 5.71 | 8.25 |
| | | **(kg/ha)** | | 8452 | 750 | 1739 | 2939 | 4247 |
| | | **(mg/kg)** | | 3773 | 335 | 776 | 1312 | 1896 |
| | **Exchangeable Aluminium** | **(cmol$_+$/kg)** | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | **(kg/ha)** | | <5 | <5 | <5 | <5 | <5 |
| | | **(mg/kg)** | | <2 | <2 | <2 | <2 | <2 |
| | **Exchangeable Hydrogen** | **(cmol$_+$/kg)** | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)** | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 42.02 | 35.53 | 38.02 | 40.25 | 42.85 |
| | **Calcium (%)** | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 20.7 | 73.8 | 64.2 | 57.2 | 51.2 |
| | **Magnesium (%)** | | | 36.1 | 19.6 | 24.8 | 26.7 | 27.6 |
| | **Potassium (%)** | | | 4.2 | 2.6 | 2.1 | 1.9 | 1.9 |
| | **Sodium - ESP (%)** | | | 39.1 | 4.1 | 8.9 | 14.2 | 19.2 |
| | **Aluminium (%)** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Hydrogen** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Calcium/Magnesium Ratio** | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 0.6 | 3.8 | 2.6 | 2.1 | 1.9 |
| | **Boron (mg/kg)** | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | **Silicon (mg/kg Si)** | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | **Emerson Aggregate Test (EAT)** | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | | **Inhouse | 7.5YR 6/4 | 7.5YR 3/2 | 7.5YR 4/3 | 7.5YR 4/3 | 7.5YR 4/3 |
| | **Colour (Munsell Soil Colour Classification)** | | **Inhouse | LIGHTISH BROWN | DARK BROWN | BROWN | BROWN | BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 51 | Sample 52 | Sample 53 | Sample 54 | Sample 55 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G33 20-30 | G33 40-50 | G33 65-75 | G33 90-100 | G34 29-30 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/51 | I1032/52 | I1032/53 | I1032/54 | I1032/55 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.28 | 9.61 | 9.70 | 9.53 | 8.86 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.241 | 0.414 | 0.697 | 0.786 | 0.200 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 25.38 | 22.01 | 18.76 | 15.87 | 26.49 |
| | Exchangeable Calcium (kg/ha) | | 11392 | 9882 | 8420 | 7123 | 11892 |
| | Exchangeable Calcium (mg/kg) | | 5086 | 4412 | 3759 | 3180 | 5309 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 11.12 | 13.13 | 13.59 | 12.92 | 6.36 |
| | Exchangeable Magnesium (kg/ha) | | 3027 | 3573 | 3699 | 3517 | 1731 |
| | Exchangeable Magnesium (mg/kg) | | 1351 | 1595 | 1651 | 1570 | 773 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 0.85 | 0.85 | 1.08 | 1.19 | 1.42 |
| | Exchangeable Potassium (kg/ha) | | 745 | 745 | 948 | 1045 | 1241 |
| | Exchangeable Potassium (mg/kg) | | 333 | 333 | 423 | 467 | 554 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 3.36 | 5.45 | 8.51 | 9.83 | 1.34 |
| | Exchangeable Sodium (kg/ha) | | 1730 | 2807 | 4384 | 5060 | 692 |
| | Exchangeable Sodium (mg/kg) | | 772 | 1253 | 1957 | 2259 | 309 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 40.71 | 41.44 | 41.94 | 39.81 | 35.61 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 62.3 | 53.1 | 44.7 | 39.9 | 74.4 |
| | Magnesium (%) | | 27.3 | 31.7 | 32.4 | 32.5 | 17.9 |
| | Potassium (%) | | 2.1 | 2.1 | 2.6 | 3.0 | 4.0 |
| | Sodium - ESP (%) | | 8.3 | 13.2 | 20.3 | 24.7 | 3.8 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.3 | 1.7 | 1.4 | 1.2 | 4.2 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 3 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 7.5YR 3/4 | 5YR 4/6 | 5YR 4/6 | 7.5YR 4/4 | 7.5YR 4/4 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | DARK BROWN | YELLOWISH RED | YELLOWISH RED | YELLOWISH RED | BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

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| Parameter | | Method reference | Sample 56 G34 40-50 N/G VHM I1032/56 | Sample 57 G34 65-75 N/G VHM I1032/57 | Sample 58 G90-100 N/G VHM I1032/58 | Sample 59 G35 20-30 N/G VHM I1032/59 | Sample 60 G35 40-50 N/G VHM I1032/60 |
|---|---|---|---|---|---|---|---|
| pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.43 | 9.47 | 9.32 | 9.52 | 9.65 |
| Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.376 | 0.738 | 1.153 | 0.280 | 0.478 |
| Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 23.03 | 20.47 | 18.20 | 22.94 | 18.56 |
| | (kg/ha) | | 10337 | 9190 | 8171 | 10297 | 8332 |
| | (mg/kg) | | 4615 | 4103 | 3648 | 4597 | 3720 |
| Exchangeable Magnesium | (cmol$_+$/kg) | | 12.38 | 13.58 | 12.33 | 9.00 | 13.32 |
| | (kg/ha) | | 3369 | 3697 | 3356 | 2451 | 3625 |
| | (mg/kg) | | 1504 | 1650 | 1498 | 1094 | 1618 |
| Exchangeable Potassium | (cmol$_+$/kg) | | 0.88 | 1.09 | 1.02 | 0.82 | 1.12 |
| | (kg/ha) | | 775 | 953 | 890 | 716 | 984 |
| | (mg/kg) | | 346 | 425 | 398 | 320 | 439 |
| Exchangeable Sodium | (cmol$_+$/kg) | | 5.27 | 9.80 | 11.99 | 3.73 | 6.99 |
| | (kg/ha) | | 2715 | 5049 | 6173 | 1921 | 3602 |
| | (mg/kg) | | 1212 | 2254 | 2756 | 857 | 1608 |
| Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 41.56 | 44.94 | 43.54 | 36.49 | 40.00 |
| Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 55.4 | 45.6 | 41.8 | 62.9 | 46.4 |
| Magnesium (%) | | | 29.8 | 30.2 | 28.3 | 24.7 | 33.3 |
| Potassium (%) | | | 2.1 | 2.4 | 2.3 | 2.2 | 2.8 |
| Sodium - ESP (%) | | | 12.7 | 21.8 | 27.5 | 10.2 | 17.5 |
| Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.9 | 1.5 | 1.5 | 2.5 | 1.4 |
| Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 7.5YR 4/4 | 7.5YR 4/4 | 7.5YR 4/4 | 10YR 5/3 | 10YR 5/3 |
| Colour (Munsell Soil Colour Classification) | | **Inhouse | BROWN | BROWN | BROWN | BROWN | BROWN |

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| | | | Sample 61 | Sample 62 | Sample 63 | Sample 64 | Sample 65 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G35 65-75 | G35 90-100 | G37 20-30 | G37 40-50 | G37 65-75 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/61 | I1032/62 | I1032/63 | I1032/64 | I1032/65 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.75 | 9.72 | 9.47 | 9.51 | 9.38 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.695 | 0.857 | 0.507 | 0.747 | 1.108 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 15.92 | 13.63 | 23.10 | 18.48 | 9.06 |
| | Exchangeable Calcium (kg/ha) | | 7147 | 6117 | 10371 | 8294 | 4065 |
| | Exchangeable Calcium (mg/kg) | | 3191 | 2731 | 4630 | 3703 | 1815 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 14.81 | 13.78 | 11.48 | 14.06 | 14.14 |
| | Exchangeable Magnesium (kg/ha) | | 4033 | 3750 | 3125 | 3826 | 3849 |
| | Exchangeable Magnesium (mg/kg) | | 1800 | 1674 | 1395 | 1708 | 1718 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.40 | 1.57 | 0.89 | 1.15 | 1.27 |
| | Exchangeable Potassium (kg/ha) | | 1230 | 1376 | 780 | 1003 | 1112 |
| | Exchangeable Potassium (mg/kg) | | 549 | 614 | 348 | 448 | 497 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 10.58 | 14.17 | 5.45 | 8.87 | 13.73 |
| | Exchangeable Sodium (kg/ha) | | 5448 | 7296 | 2809 | 4570 | 7069 |
| | Exchangeable Sodium (mg/kg) | | 2432 | 3257 | 1254 | 2040 | 3156 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 42.72 | 43.14 | 40.93 | 42.55 | 38.19 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 37.3 | 31.6 | 56.4 | 43.4 | 23.7 |
| | Magnesium (%) | | 34.7 | 31.9 | 28.1 | 33.0 | 37.0 |
| | Potassium (%) | | 3.3 | 3.6 | 2.2 | 2.7 | 3.3 |
| | Sodium - ESP (%) | | 24.8 | 32.8 | 13.3 | 20.9 | 35.9 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.1 | 1.0 | 2.0 | 1.3 | 0.6 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 10YR 5/3 | 10YR 5/4 | 7.5YR 4/4 | 7.5YR 5/3 | 7.5YR 4/4 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | BROWN | Yellowish Brown | BROWN | BROWN | BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 66 G37 90-100 N/G VHM | Sample 67 G38 20-30 N/G VHM | Sample 68 G38 40-50 N/G VHM | Sample 69 G38 65-75 N/G VHM | Sample 70 G38 90-100 N/G VHM |
|---|---|---|---|---|---|---|---|---|
| | | | | **Sample ID:** | | | | |
| | | | | **Crop:** | | | | |
| | | | | **Client:** | | | | |
| | | | | **I1032/66** | **I1032/67** | **I1032/68** | **I1032/69** | **I1032/70** |
| | **pH** | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.96 | 8.75 | 9.06 | 9.34 | 9.79 |
| | **Electrical Conductivity (dS/m)** | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 1.206 | 0.129 | 0.139 | 0.203 | 0.369 |
| | **Exchangeable Calcium** | **(cmol$_+$/kg)** | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 4.95 | 25.87 | 22.00 | 16.57 | 14.11 |
| | | **(kg/ha)** | | 2221 | 11612 | 9873 | 7436 | 6332 |
| | | **(mg/kg)** | | 992 | 5184 | 4408 | 3320 | 2827 |
| | **Exchangeable Magnesium** | **(cmol$_+$/kg)** | | 13.30 | 8.86 | 9.85 | 10.39 | 10.88 |
| | | **(kg/ha)** | | 3620 | 2413 | 2682 | 2830 | 2962 |
| | | **(mg/kg)** | | 1616 | 1077 | 1197 | 1263 | 1322 |
| | **Exchangeable Potassium** | **(cmol$_+$/kg)** | | 1.23 | 0.95 | 0.66 | 0.86 | 0.89 |
| | | **(kg/ha)** | | 1081 | 830 | 582 | 757 | 778 |
| | | **(mg/kg)** | | 482 | 370 | 260 | 338 | 347 |
| | **Exchangeable Sodium** | **(cmol$_+$/kg)** | | 15.65 | 0.64 | 1.07 | 2.20 | 4.45 |
| | | **(kg/ha)** | | 8062 | 332 | 553 | 1133 | 2289 |
| | | **(mg/kg)** | | 3599 | 148 | 247 | 506 | 1022 |
| | **Exchangeable Aluminium** | **(cmol$_+$/kg)** | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | **(kg/ha)** | | <5 | <5 | <5 | <5 | <5 |
| | | **(mg/kg)** | | <2 | <2 | <2 | <2 | <2 |
| | **Exchangeable Hydrogen** | **(cmol$_+$/kg)** | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)** | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 35.14 | 36.32 | 33.58 | 30.03 | 30.32 |
| | **Calcium (%)** | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 14.1 | 71.2 | 65.5 | 55.2 | 46.5 |
| | **Magnesium (%)** | | | 37.9 | 24.4 | 29.3 | 34.6 | 35.9 |
| | **Potassium (%)** | | | 3.5 | 2.6 | 2.0 | 2.9 | 2.9 |
| | **Sodium - ESP (%)** | | | 44.6 | 1.8 | 3.2 | 7.3 | 14.7 |
| | **Aluminium (%)** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Hydrogen** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Calcium/Magnesium Ratio** | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 0.4 | 2.9 | 2.2 | 1.6 | 1.3 |
| | **Boron (mg/kg)** | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | **Silicon (mg/kg Si)** | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | **Emerson Aggregate Test (EAT)** | | **AS1289.3.8.1-2017 | 2 | 4 | 2 | 2 | 2 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | | **Inhouse | 7.5YR 4/4 | 7.5YR 3/3 | 5YR 3/4 | 5YR 3/4 | 5YR 4/4 |
| | **Colour (Munsell Soil Colour Classification)** | | **Inhouse | BROWN | DARK BROWN | DARK REDDISH BROWN | DARK REDDISH BROWN | REDDISH BROWN |

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# AGRICULTURAL SOIL ANALYSIS REPORT

94 samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019. Lab Job No.i1032

Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 71 G40 20-30 N/G VHM | Sample 72 G40 40-50 N/G VHM | Sample 73 G40 65-75 N/G VHM | Sample 74 G40 90-100 N/G VHM | Sample 75 G42 20-30 N/G VHM |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | | I1032/71 | I1032/72 | I1032/73 | I1032/74 | I1032/75 |
| | pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.46 | 9.72 | 9.79 | 9.77 | 9.41 |
| | Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.279 | 0.453 | 0.703 | 0.865 | 0.343 |
| | Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 14.98 | 19.29 | 16.15 | 15.32 | 22.59 |
| | | (kg/ha) | | 6726 | 8659 | 7248 | 6876 | 10142 |
| | | (mg/kg) | | 3003 | 3866 | 3236 | 3070 | 4528 |
| | Exchangeable Magnesium | (cmol$_+$/kg) | | 2.96 | 13.36 | 14.27 | 12.18 | 11.55 |
| | | (kg/ha) | | 805 | 3636 | 3885 | 3316 | 3143 |
| | | (mg/kg) | | 359 | 1623 | 1734 | 1480 | 1403 |
| | Exchangeable Potassium | (cmol$_+$/kg) | | 0.19 | 1.19 | 1.27 | 1.17 | 1.20 |
| | | (kg/ha) | | 165 | 1043 | 1114 | 1020 | 1053 |
| | | (mg/kg) | | 74 | 466 | 497 | 456 | 470 |
| | Exchangeable Sodium | (cmol$_+$/kg) | | 0.71 | 6.08 | 10.18 | 13.04 | 4.82 |
| | | (kg/ha) | | 368 | 3129 | 5244 | 6713 | 2484 |
| | | (mg/kg) | | 164 | 1397 | 2341 | 2997 | 1109 |
| | Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | | (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | | (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 18.84 | 39.91 | 41.87 | 41.70 | 40.17 |
| | Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 79.5 | 48.3 | 38.6 | 36.7 | 56.2 |
| | Magnesium (%) | | | 15.7 | 33.5 | 34.1 | 29.2 | 28.7 |
| | Potassium (%) | | | 1.0 | 3.0 | 3.0 | 2.8 | 3.0 |
| | Sodium - ESP (%) | | | 3.8 | 15.2 | 24.3 | 31.3 | 12.0 |
| | Aluminium (%) | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 5.1 | 1.4 | 1.1 | 1.3 | 2.0 |
| | Boron (mg/kg) | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | | **AS1289.3.8.1-2017 | 3 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | | **Inhouse | 7.5YR 4/4 | 7.5YR 5/6 | 7.5YR 5/4 | 7.5YR 5/4 | 5YR 5/6 |
| | Colour (Munsell Soil Colour Classification) | | **Inhouse | BROWN | Strong Brown | BROWN | BROWN | YELLOWISH RED |

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# AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 76 G42 40-50 N/G VHM I1032/76 | Sample 77 G42 65-75 N/G VHM I1032/77 | Sample 78 G42 90-100 N/G VHM I1032/78 | Sample 79 G43 20-30 N/G VHM I1032/79 | Sample 80 G43 40-50 N/G VHM I1032/80 |
|---|---|---|---|---|---|---|---|---|
| | **pH** | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.64 | 9.78 | 9.59 | 9.41 | 9.64 |
| | **Electrical Conductivity (dS/m)** | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.505 | 0.755 | 0.904 | 0.298 | 0.451 |
| | **Exchangeable Calcium** | **($cmol_+/kg$)** | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 19.77 | 16.55 | 10.03 | 22.91 | 20.61 |
| | | **(kg/ha)** | | 8874 | 7427 | 4504 | 10283 | 9253 |
| | | **(mg/kg)** | | 3962 | 3316 | 2011 | 4591 | 4131 |
| | **Exchangeable Magnesium** | **($cmol_+/kg$)** | | 13.60 | 13.21 | 11.62 | 7.25 | 9.67 |
| | | **(kg/ha)** | | 3703 | 3596 | 3163 | 1973 | 2633 |
| | | **(mg/kg)** | | 1653 | 1605 | 1412 | 881 | 1175 |
| | **Exchangeable Potassium** | **($cmol_+/kg$)** | | 1.30 | 1.51 | 1.44 | 0.57 | 0.52 |
| | | **(kg/ha)** | | 1136 | 1325 | 1257 | 496 | 460 |
| | | **(mg/kg)** | | 507 | 592 | 561 | 222 | 205 |
| | **Exchangeable Sodium** | **($cmol_+/kg$)** | | 7.01 | 11.42 | 13.06 | 3.52 | 5.70 |
| | | **(kg/ha)** | | 3611 | 5882 | 6724 | 1815 | 2934 |
| | | **(mg/kg)** | | 1612 | 2626 | 3002 | 810 | 1310 |
| | **Exchangeable Aluminium** | **($cmol_+/kg$)** | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | **(kg/ha)** | | <5 | <5 | <5 | <5 | <5 |
| | | **(mg/kg)** | | <2 | <2 | <2 | <2 | <2 |
| | **Exchangeable Hydrogen** | **($cmol_+/kg$)** | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Effective Cation Exchange Capacity (ECEC) ($cmol_+/kg$)** | | **Calculation: Sum of Ca,Mg,K,Na,Al,H ($cmol_+/kg$) | 41.68 | 42.69 | 36.15 | 34.25 | 36.51 |
| | **Calcium (%)** | | **Base Saturation Calculations - Cation $cmol_+/kg$ / ECEC x 100 | 47.4 | 38.8 | 27.8 | 66.9 | 56.5 |
| | **Magnesium (%)** | | | 32.6 | 30.9 | 32.1 | 21.2 | 26.5 |
| | **Potassium (%)** | | | 3.1 | 3.5 | 4.0 | 1.7 | 1.4 |
| | **Sodium - ESP (%)** | | | 16.8 | 26.8 | 36.1 | 10.3 | 15.6 |
| | **Aluminium (%)** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Hydrogen** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Calcium/Magnesium Ratio** | | **Calculation: Calcium / Magnesium ($cmol_+/kg$) | 1.5 | 1.3 | 0.9 | 3.2 | 2.1 |
| | **Boron (mg/kg)** | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | **Silicon (mg/kg Si)** | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | **Emerson Aggregate Test (EAT)** | | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 3 | 2 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | | **Inhouse | 5YR 4/6 | 5YR 4/6 | 5YR 4/6 | 7.5YR 5/6 | 7.5YR 5/6 |
| | **Colour (Munsell Soil Colour Classification)** | | **Inhouse | YELLOWISH RED | YELLOWISH RED | YELLOWISH RED | Strong Brown | Strong Brown |

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10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 81 | Sample 82 | Sample 83 | Sample 84 | Sample 85 |
|---|---|---|---|---|---|---|---|
| | | Sample ID: | G43 65-75 | G43 90-100 | G46 20-30 | G46 40-50 | G46 65-75 |
| | | Crop: | N/G | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/81 | I1032/82 | I1032/83 | I1032/84 | I1032/85 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.71 | 9.72 | 9.10 | 8.80 | 9.07 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.720 | 0.920 | 0.272 | 0.268 | 0.333 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 18.66 | 17.56 | 22.80 | 23.58 | 23.30 |
| | Exchangeable Calcium (kg/ha) | | 8377 | 7884 | 10236 | 10584 | 10460 |
| | Exchangeable Calcium (mg/kg) | | 3740 | 3520 | 4570 | 4725 | 4670 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 11.80 | 11.54 | 4.00 | 4.81 | 9.60 |
| | Exchangeable Magnesium (kg/ha) | | 3213 | 3141 | 1089 | 1308 | 2612 |
| | Exchangeable Magnesium (mg/kg) | | 1434 | 1402 | 486 | 584 | 1166 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 0.56 | 0.64 | 1.30 | 0.44 | 0.59 |
| | Exchangeable Potassium (kg/ha) | | 488 | 561 | 1138 | 388 | 520 |
| | Exchangeable Potassium (mg/kg) | | 218 | 250 | 508 | 173 | 232 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 8.99 | 11.63 | 2.10 | 1.69 | 3.25 |
| | Exchangeable Sodium (kg/ha) | | 4628 | 5990 | 1081 | 870 | 1671 |
| | Exchangeable Sodium (mg/kg) | | 2066 | 2674 | 483 | 389 | 746 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 40.01 | 41.37 | 30.20 | 30.52 | 36.74 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 46.6 | 42.5 | 75.5 | 77.3 | 63.4 |
| | Magnesium (%) | | 29.5 | 27.9 | 13.2 | 15.7 | 26.1 |
| | Potassium (%) | | 1.4 | 1.5 | 4.3 | 1.5 | 1.6 |
| | Sodium - ESP (%) | | 22.5 | 28.1 | 7.0 | 5.5 | 8.8 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.6 | 1.5 | 5.7 | 4.9 | 2.4 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 2 | 2 | 2 | 2 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 7.5YR 5/4 | 7.5YR 5/6 | 7.5YR 3/4 | 5YR 3/2 | 5YR 4/6 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | BROWN | Strong Brown | DARK BROWN | DARK REDDISH BROWN | YELLOWISH RED |

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Analysis requested by Murray Fraser. Your Job: Goschen Soils

10 Kings Road NEW LAMBTON NSW 2305

| | Parameter | | Method reference | Sample 86 G46 90-100 N/G VHM I1032/86 | Sample 87 G48 20-30 N/G VHM I1032/87 | Sample 88 G48 40-50 N/G VHM I1032/88 | Sample 89 G48 65-75 N/G VHM I1032/89 | Sample 90 G48 90-100 N/G VHM I1032/90 |
|---|---|---|---|---|---|---|---|---|
| | **pH** | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.26 | 8.61 | 8.82 | 8.97 | 8.91 |
| | **Electrical Conductivity (dS/m)** | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.365 | 0.139 | 0.173 | 0.559 | 1.207 |
| | **Exchangeable Calcium** | **(cmol$_+$/kg)** | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 20.09 | 23.77 | 25.00 | 21.23 | 20.15 |
| | | **(kg/ha)** | | 9018 | 10671 | 11222 | 9531 | 9047 |
| | | **(mg/kg)** | | 4026 | 4764 | 5010 | 4255 | 4039 |
| | **Exchangeable Magnesium** | **(cmol$_+$/kg)** | | 8.15 | 3.42 | 7.43 | 10.95 | 14.62 |
| | | **(kg/ha)** | | 2218 | 931 | 2023 | 2980 | 3981 |
| | | **(mg/kg)** | | 990 | 416 | 903 | 1330 | 1777 |
| | **Exchangeable Potassium** | **(cmol$_+$/kg)** | | 0.45 | 1.41 | 1.24 | 1.17 | 1.51 |
| | | **(kg/ha)** | | 398 | 1234 | 1086 | 1024 | 1326 |
| | | **(mg/kg)** | | 178 | 551 | 485 | 457 | 592 |
| | **Exchangeable Sodium** | **(cmol$_+$/kg)** | | 3.42 | 0.23 | 0.73 | 3.10 | 6.33 |
| | | **(kg/ha)** | | 1764 | 120 | 377 | 1599 | 3259 |
| | | **(mg/kg)** | | 787 | 53 | 168 | 714 | 1455 |
| | **Exchangeable Aluminium** | **(cmol$_+$/kg)** | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 | <0.02 |
| | | **(kg/ha)** | | <5 | <5 | <5 | <5 | <5 |
| | | **(mg/kg)** | | <2 | <2 | <2 | <2 | <2 |
| | **Exchangeable Hydrogen** | **(cmol$_+$/kg)** | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | | **(kg/ha)** | | <1 | <1 | <1 | <1 | <1 |
| | | **(mg/kg)** | | <1 | <1 | <1 | <1 | <1 |
| | **Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)** | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 32.12 | 28.83 | 34.40 | 36.45 | 42.62 |
| | **Calcium (%)** | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 62.6 | 82.4 | 72.7 | 58.2 | 47.3 |
| | **Magnesium (%)** | | | 25.4 | 11.9 | 21.6 | 30.0 | 34.3 |
| | **Potassium (%)** | | | 1.4 | 4.9 | 3.6 | 3.2 | 3.6 |
| | **Sodium - ESP (%)** | | | 10.7 | 0.8 | 2.1 | 8.5 | 14.8 |
| | **Aluminium (%)** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Hydrogen** | | | <0.1 | <0.1 | <0.1 | <0.1 | <0.1 |
| | **Calcium/Magnesium Ratio** | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.5 | 6.9 | 3.4 | 1.9 | 1.4 |
| | **Boron (mg/kg)** | | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. | .. |
| | **Silicon (mg/kg Si)** | | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. | .. |
| | **Emerson Aggregate Test (EAT)** | | **AS1289.3.8.1-2017 | 2 | 4 | 4 | 2 | 2 |
| | **Colour (Munsell Soil Colour Classification) - Hue/Colour** | | **Inhouse | 2.5YR 2.5/4 | 2.5YR 3/3 | 7.5YR 4/6 | 7.5YR 5/6 | 7.5YR 5/6 |
| | **Colour (Munsell Soil Colour Classification)** | | **Inhouse | DARK REDDISH BROWN | DARK REDDISH BROWN | Strong Brown | Strong Brown | Strong Brown |

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| | | | Sample 91 | Sample 92 | Sample 93 | Sample 94 |
|---|---|---|---|---|---|---|
| | | Sample ID: | G51 20-30 | G51 40-50 | G51 65-75 | G51 90-100 |
| | | Crop: | N/G | N/G | N/G | N/G |
| | | Client: | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | I1032/91 | I1032/92 | I1032/93 | I1032/94 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.40 | 9.63 | 9.26 | 9.52 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.353 | 0.609 | 1.910 | 1.185 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 23.97 | 22.31 | 18.80 | 19.57 |
| | Exchangeable Calcium (kg/ha) | | 10758 | 10015 | 8440 | 8787 |
| | Exchangeable Calcium (mg/kg) | | 4803 | 4471 | 3768 | 3923 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 10.58 | 14.29 | 14.48 | 14.03 |
| | Exchangeable Magnesium (kg/ha) | | 2879 | 3891 | 3943 | 3820 |
| | Exchangeable Magnesium (mg/kg) | | 1285 | 1737 | 1760 | 1705 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.01 | 0.95 | 1.14 | 1.09 |
| | Exchangeable Potassium (kg/ha) | | 884 | 836 | 997 | 958 |
| | Exchangeable Potassium (mg/kg) | | 395 | 373 | 445 | 428 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 5.54 | 9.62 | 16.07 | 13.50 |
| | Exchangeable Sodium (kg/ha) | | 2854 | 4955 | 8275 | 6951 |
| | Exchangeable Sodium (mg/kg) | | 1274 | 2212 | 3694 | 3103 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.02 | <0.02 | <0.02 | <0.02 |
| | Exchangeable Aluminium (kg/ha) | | <5 | <5 | <5 | <5 |
| | Exchangeable Aluminium (mg/kg) | | <2 | <2 | <2 | <2 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 41.09 | 47.18 | 50.49 | 48.20 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 58.3 | 47.3 | 37.2 | 40.6 |
| | Magnesium (%) | | 25.7 | 30.3 | 28.7 | 29.1 |
| | Potassium (%) | | 2.5 | 2.0 | 2.3 | 2.3 |
| | Sodium - ESP (%) | | 13.5 | 20.4 | 31.8 | 28.0 |
| | Aluminium (%) | | <0.1 | <0.1 | <0.1 | <0.1 |
| | Hydrogen | | <0.1 | <0.1 | <0.1 | <0.1 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.3 | 1.6 | 1.3 | 1.4 |
| | Boron (mg/kg) | **Rayment & Lyons 2011 - 12C2 (Hot $CaCl_2$) | .. | .. | .. | .. |
| | Silicon (mg/kg Si) | **Inhouse S11 (Hot CaCl2) | .. | .. | .. | .. |
| | Emerson Aggregate Test (EAT) | **AS1289.3.8.1-2017 | 3 | 2 | 3 | 2 |
| | Colour (Munsell Soil Colour Classification) - Hue/Colour | **Inhouse | 7.5YR 4/1 | 7.5YR 4/2 | 7.5YR 5/4 | 7.5YR 5/4 |
| | Colour (Munsell Soil Colour Classification) | **Inhouse | Dark Grey | BROWN | BROWN | BROWN |

# GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

24 soil samples supplied by SLR Consulting Australia Pty Ltd on 23/4/19 - Lab Job No. i1027
Analysis requested by Murray Fraser
(10 Kings Road NEW LAMBTON NSW 2305)

| SAMPLE ID | Lab Code | MOISTURE CONTENT (% of water in air-dry sample) | TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent) | COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent) | FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent) | SILT 2-20 µm ISSS (% of total oven-dry equivalent) | CLAY < 2 µm (% of total oven-dry equivalent) | Total soil fractions (incl. Gravel) |
|---|---|---|---|---|---|---|---|---|
| **G2** | I1027/1 | 3.2% | 0.1% | 20.5% | 40.5% | 10.7% | 28.2% | 100.0% |
| **G5** | I1027/2 | 1.7% | 0.6% | 43.2% | 34.6% | 7.2% | 14.4% | 100.0% |
| **G10** | I1027/3 | 3.1% | 0.1% | 26.8% | 34.0% | 8.4% | 30.8% | 100.0% |
| **G12** | I1027/4 | 3.2% | 0.0% | 20.3% | 33.1% | 12.2% | 34.4% | 100.0% |
| **G13** | I1027/5 | 3.9% | 0.1% | 28.7% | 24.3% | 18.1% | 28.8% | 100.0% |
| **G15** | I1027/6 | 1.5% | 0.0% | 57.1% | 27.3% | 0.7% | 14.8% | 100.0% |
| **G17** | I1027/7 | 0.6% | 0.0% | 61.3% | 28.8% | 7.6% | 2.3% | 100.0% |
| **G20** | I1027/8 | 2.8% | 0.4% | 28.8% | 31.3% | 14.9% | 24.6% | 100.0% |
| **G22** | I1027/9 | 3.6% | 0.3% | 24.0% | 30.2% | 14.0% | 31.5% | 100.0% |
| **G23** | I1027/10 | 1.5% | 11.2% | 38.3% | 35.8% | 4.3% | 10.3% | 100.0% |
| **G28** | I1027/11 | 0.6% | 0.3% | 61.8% | 31.3% | 0.9% | 5.8% | 100.0% |
| **G30** | I1027/12 | 3.0% | 0.4% | 28.4% | 26.1% | 14.4% | 30.7% | 100.0% |
| **G32** | I1027/13 | 3.0% | 0.3% | 25.6% | 30.1% | 16.0% | 27.9% | 100.0% |
| **G33** | I1027/14 | 3.2% | 0.1% | 31.8% | 21.5% | 18.4% | 28.2% | 100.0% |
| **G34** | I1027/15 | 2.8% | 0.8% | 25.3% | 40.3% | 13.8% | 19.8% | 100.0% |
| **G35** | I1027/16 | 1.3% | 0.0% | 52.1% | 39.2% | 2.9% | 5.8% | 100.0% |
| **G37** | I1027/17 | 3.2% | 0.1% | 22.4% | 34.9% | 17.5% | 25.1% | 100.0% |
| **G38** | I1027/18 | 2.0% | 0.0% | 39.8% | 37.9% | 7.9% | 14.3% | 100.0% |
| **G40** | I1027/19 | 3.3% | 0.0% | 22.9% | 31.0% | 19.1% | 26.9% | 100.0% |
| **G42** | I1027/20 | 2.9% | 9.1% | 25.2% | 34.6% | 12.0% | 19.2% | 100.0% |
| **G43** | I1027/21 | 2.7% | 0.2% | 25.0% | 37.1% | 12.7% | 24.9% | 100.0% |
| **G46** | I1027/22 | 2.0% | 1.7% | 29.0% | 45.8% | 4.8% | 18.7% | 100.0% |
| **G48** | I1027/23 | 2.0% | 0.1% | 27.2% | 43.2% | 14.8% | 14.6% | 100.0% |
| **G51** | I1027/24 | 2.3% | 0.5% | 20.6% | 54.7% | 11.2% | 13.0% | 100.0% |

**Note:**

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2: All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions.
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checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

# GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

94 soil samples supplied by SLR Consulting Australia Pty Ltd on 23rd April, 2019 - Lab Job No. i1032
Analysis requested by Murray Fraser. Your Project: SLR640.11763.005 Goschen Soils
10 Kings Road NEW LAMBTON NSW 2305

| SAMPLE ID | Lab Code | MOISTURE CONTENT (% of water in air-dry sample) | TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent) | COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent) | FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent) | SILT 2-20 µm ISSS (% of total oven-dry equivalent) | CLAY < 2 µm (% of total oven-dry equivalent) |
|---|---|---|---|---|---|---|---|
| **G2 20-30** | i1032/1 | 3.6% | 0.1% | 14.2% | 24.0% | 15.3% | 46.3% |
| **G2 40-50** | i1032/2 | 3.3% | 0.3% | 13.9% | 23.8% | 22.3% | 39.6% |
| **G2 65-75** | i1032/3 | 3.1% | 0.2% | 15.1% | 28.0% | 7.9% | 48.7% |
| **G2 90-100** | i1032/4 | 3.0% | 0.2% | 14.7% | 31.8% | 7.6% | 45.7% |
| **G5 20-30** | i1032/5 | 2.3% | 0.4% | 25.6% | 37.9% | 8.1% | 28.1% |
| **G5 40-50** | i1032/6 | 2.1% | 0.9% | 24.3% | 30.0% | 12.0% | 32.8% |
| **G10 20-30** | i1032/7 | 3.3% | 0.1% | 18.7% | 29.7% | 7.1% | 44.4% |
| **G10 40-50** | i1032/8 | 3.5% | 0.0% | 18.2% | 23.1% | 9.8% | 48.9% |
| **G10 65-75** | i1032/9 | 3.1% | 0.0% | 21.6% | 27.9% | 7.0% | 43.5% |
| **G10 90-100** | i1032/10 | 3.0% | 0.0% | 21.8% | 8.6% | 24.9% | 44.7% |
| **G12 20-30** | i1032/11 | 3.1% | 0.0% | 18.5% | 29.7% | 6.0% | 45.8% |
| **G12 40-50** | i1032/12 | 3.2% | 0.5% | 18.5% | 27.5% | 8.5% | 45.0% |
| **G12 65-75** | i1032/13 | 3.5% | 0.0% | 13.8% | 22.3% | 27.3% | 36.5% |
| **G12 90-100** | i1032/14 | 3.9% | 0.0% | 15.1% | 20.2% | 25.8% | 38.9% |
| **G13 20-30** | i1032/15 | 3.7% | 0.0% | 30.6% | 1.1% | 14.1% | 54.3% |
| **G13 40-50** | i1032/16 | 3.7% | 0.0% | 20.9% | 19.0% | 6.6% | 53.6% |
| **G13 65-75** | i1032/17 | 3.5% | 0.1% | 18.5% | 8.1% | 16.3% | 57.0% |
| **G13 90-100** | i1032/18 | 3.1% | 0.1% | 21.1% | 22.0% | 5.5% | 51.3% |
| **G15 20-30** | i1032/19 | 2.1% | 0.0% | 38.8% | 24.3% | 5.3% | 31.6% |
| **G15 40-50** | i1032/20 | 2.1% | 5.8% | 37.2% | 26.1% | 1.7% | 29.2% |
| **G15 65-75** | i1032/21 | 1.5% | 20.2% | 34.4% | 23.2% | 5.3% | 16.9% |
| **G15 90-100** | i1032/22 | 2.0% | 0.1% | 39.5% | 25.2% | 3.5% | 31.6% |
| **G17 20-30** | i1032/23 | 2.1% | 0.0% | 48.3% | 8.9% | 5.3% | 37.6% |
| **G17 40-50** | i1032/24 | 1.7% | 0.7% | 40.1% | 25.7% | 3.1% | 30.4% |
| **G17 65-75** | i1032/25 | 1.5% | 3.3% | 41.4% | 23.5% | 8.4% | 23.3% |
| **G17 90-100** | i1032/26 | 1.2% | 0.1% | 45.5% | 30.7% | 2.9% | 20.8% |
| **G20 20-30** | i1032/27 | 3.2% | 0.1% | 20.3% | 21.1% | 13.4% | 45.0% |
| **G20 40-50** | i1032/28 | 3.3% | 0.1% | 18.8% | 18.8% | 7.0% | 55.4% |
| **G20 65-75** | i1032/29 | 3.5% | 0.1% | 18.7% | 19.8% | 7.9% | 53.4% |
| **G20 90-100** | i1032/30 | 3.6% | 0.0% | 18.4% | 16.0% | 6.4% | 59.2% |
| **G22 20-30** | i1032/31 | 2.6% | 0.0% | 22.4% | 29.3% | 5.1% | 43.1% |
| **G22 40-50** | i1032/32 | 2.6% | 0.4% | 20.5% | 36.6% | 8.1% | 34.4% |
| **G22 65-75** | i1032/33 | 2.7% | 0.1% | 22.8% | 25.4% | 7.1% | 44.5% |
| **G22 90-100** | i1032/34 | 2.5% | 0.8% | 27.1% | 29.5% | 5.0% | 37.5% |
| **G23 20-30** | i1032/35 | 1.8% | 0.4% | 29.3% | 40.7% | 7.3% | 22.3% |
| **G23 40-50** | i1032/36 | 2.0% | 0.3% | 26.1% | 33.1% | 10.2% | 30.4% |
| **G23 65-75** | i1032/37 | 1.5% | 5.0% | 21.3% | 27.5% | 11.9% | 34.3% |
| **G23 90-100** | i1032/38 | 1.5% | 6.6% | 16.9% | 39.3% | 10.7% | 26.5% |
| **G28 20-30** | i1032/39 | 1.8% | 0.0% | 46.1% | 23.2% | 3.7% | 27.0% |
| **G28 40-50** | i1032/40 | 1.9% | 5.6% | 39.1% | 16.6% | 9.2% | 29.5% |
| **G28 65-75** | i1032/41 | 2.2% | 1.3% | 39.5% | 22.2% | 2.4% | 34.6% |
| **G28 90-100** | i1032/42 | 2.0% | 9.2% | 29.6% | 13.9% | 7.8% | 39.5% |
| **G30 20-30** | i1032/43 | 2.6% | 0.0% | 24.3% | 25.2% | 8.6% | 41.9% |
| **G30 40-50** | i1032/44 | 2.7% | 0.0% | 25.8% | 20.4% | 7.2% | 46.7% |
| **G30 65-75** | i1032/45 | 3.2% | 0.0% | 22.3% | 20.1% | 7.5% | 50.0% |
| **G30 90-100** | i1032/46 | 3.1% | 0.0% | 20.7% | 22.0% | 8.6% | 48.6% |
| **G32 20-30** | i1032/47 | 2.7% | 0.5% | 25.9% | 27.6% | 11.1% | 34.9% |
| **G32 40-50** | i1032/48 | 3.5% | 0.1% | 23.6% | 26.3% | 7.2% | 42.8% |
| **G32 65-75** | i1032/49 | 3.3% | 0.1% | 20.9% | 19.2% | 9.4% | 50.4% |
| **G32 90-100** | i1032/50 | 3.0% | 1.1% | 21.8% | 27.9% | 5.1% | 44.0% |

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **G33 20-30** | i1032/51 | 3.0% | 0.0% | 26.6% | 26.7% | 2.7% | 44.0% |
| **G33 40-50** | i1032/52 | 2.5% | 0.4% | 21.6% | 27.7% | 7.7% | 42.6% |
| **G33 65-75** | i1032/53 | 2.5% | 0.4% | 25.0% | 21.9% | 14.3% | 38.5% |
| **G33 90-100** | i1032/54 | 2.4% | 0.7% | 30.5% | 25.2% | 7.5% | 36.1% |
| **G34 29-30** | i1032/55 | 2.9% | 0.0% | 27.8% | 27.6% | 12.3% | 32.3% |
| **G34 40-50** | i1032/56 | 2.8% | 0.1% | 22.9% | 19.1% | 13.8% | 44.1% |
| **G34 65-75** | i1032/57 | 2.8% | 0.3% | 23.9% | 22.2% | 6.7% | 46.9% |
| **G90-100** | i1032/58 | 2.8% | 0.1% | 26.2% | 22.4% | 4.8% | 46.5% |
| **G35 20-30** | i1032/59 | 2.2% | 2.0% | 19.5% | 29.0% | 7.4% | 42.1% |
| **G35 40-50** | i1032/60 | 2.7% | 2.1% | 18.5% | 25.6% | 6.1% | 47.8% |
| **G35 65-75** | i1032/61 | 2.7% | 0.2% | 15.7% | 28.3% | 5.0% | 50.9% |
| **G35 90-100** | i1032/62 | 2.9% | 0.0% | 14.4% | 26.0% | 4.3% | 55.3% |
| **G37 20-30** | i1032/63 | 2.8% | 0.1% | 20.1% | 26.6% | 6.3% | 46.9% |
| **G37 40-50** | i1032/64 | 2.9% | 0.0% | 15.6% | 47.2% | 6.0% | 31.2% |
| **G37 65-75** | i1032/65 | 2.8% | 0.0% | 21.3% | 29.3% | 5.4% | 43.9% |
| **G37 90-100** | i1032/66 | 2.8% | 0.0% | 20.9% | 27.6% | 5.8% | 45.8% |
| **G38 20-30** | i1032/67 | 2.5% | 2.8% | 26.2% | 30.0% | 5.8% | 35.2% |
| **G38 40-50** | i1032/68 | 1.7% | 4.3% | 28.6% | 34.5% | 6.3% | 26.2% |
| **G38 65-75** | i1032/69 | 1.5% | 1.4% | 33.7% | 32.2% | 7.3% | 25.5% |
| **G38 90-100** | i1032/70 | 1.6% | 2.1% | 38.7% | 28.1% | 4.6% | 26.6% |
| **G40 20-30** | i1032/71 | 2.2% | 0.2% | 19.9% | 26.2% | 6.6% | 47.2% |
| **G40 40-50** | i1032/72 | 2.3% | 0.0% | 20.7% | 19.9% | 12.4% | 47.0% |
| **G40 65-75** | i1032/73 | 2.4% | 0.1% | 22.3% | 34.7% | 4.2% | 38.6% |
| **G40 90-100** | i1032/74 | 2.4% | 0.0% | 27.1% | 25.5% | 7.5% | 40.0% |
| **G42 20-30** | i1032/75 | 2.6% | 0.4% | 15.0% | 28.2% | 13.0% | 43.4% |
| **G42 40-50** | i1032/76 | 2.5% | 4.3% | 16.0% | 22.9% | 14.9% | 42.0% |
| **G42 65-75** | i1032/77 | 2.4% | 0.3% | 20.6% | 25.9% | 11.2% | 42.0% |
| **G42 90-100** | i1032/78 | 2.6% | 0.1% | 24.0% | 27.2% | 7.0% | 41.6% |
| **G43 20-30** | i1032/79 | 2.2% | 0.0% | 22.2% | 27.6% | 6.1% | 44.1% |
| **G43 40-50** | i1032/80 | 2.2% | 0.1% | 20.2% | 23.8% | 6.1% | 49.8% |
| **G43 65-75** | i1032/81 | 2.3% | 0.0% | 21.4% | 26.0% | 7.5% | 45.1% |
| **G43 90-100** | i1032/82 | 2.2% | 0.0% | 25.2% | 28.1% | 5.6% | 41.1% |
| **G46 20-30** | i1032/83 | 1.6% | 0.4% | 35.3% | 38.3% | 2.7% | 23.3% |
| **G46 40-50** | i1032/84 | 1.8% | 0.3% | 37.9% | 33.2% | 9.3% | 19.3% |
| **G46 65-75** | i1032/85 | 2.2% | 0.9% | 30.9% | 27.5% | 4.1% | 36.6% |
| **G46 90-100** | i1032/86 | 1.7% | 2.2% | 40.2% | 24.0% | 6.1% | 27.5% |
| **G48 20-30** | i1032/87 | 1.4% | 0.0% | 37.1% | 31.5% | 14.0% | 17.4% |
| **G48 40-50** | i1032/88 | 2.1% | 0.9% | 26.7% | 24.3% | 17.7% | 30.3% |
| **G48 65-75** | i1032/89 | 2.0% | 3.3% | 22.6% | 26.0% | 8.4% | 39.6% |
| **G48 90-100** | i1032/90 | 2.2% | 3.8% | 17.9% | 25.0% | 11.0% | 42.4% |
| **G51 20-30** | i1032/91 | 2.9% | 0.0% | 19.1% | 31.7% | 9.2% | 39.9% |
| **G51 40-50** | i1032/92 | 2.8% | 0.0% | 16.5% | 23.1% | 17.1% | 43.3% |
| **G51 65-75** | i1032/93 | 2.7% | 0.1% | 14.6% | 20.3% | 11.1% | 53.9% |
| **G51 90-100** | i1032/94 | 2.5% | 0.1% | 13.7% | 21.7% | 11.4% | 53.2% |

**Notes:**

1. The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.
2. Analysis conducted between sample arrival date and reporting date.
3. .. Denotes not requested.
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5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
6. This report was issued on 21/05/2019.

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

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# AGRICULTURAL SOIL ANALYSIS REPORT

31 samples supplied by SLR Consulting Australia Pty Ltd on 4/05/2022 . Lab Job No.M8291
Analysis requested by Murray Fraser. Your Job: Job Ref SLR 640.30299.003
10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 1 | Sample 2 | Sample 3 | Sample 4 | Sample 5 | Sample 6 |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | G3 | G3 | G3 | G3 | G3 | G4 |
| | | Crop: | Soil | Soil | Soil | Soil | Soil | Soil |
| | | Client: | VHM | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | M8291/1 | M8291/2 | M8291/3 | M8291/4 | M8291/5 | M8291/6 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.66 | 9.53 | 9.69 | 9.64 | 9.48 | 7.84 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.188 | 0.426 | 0.680 | 0.937 | 1.094 | 0.136 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 34 | 29 | 25 | 23 | 21 | 12 |
| | Exchangeable Calcium (kg/ha) | | 15,203 | 13,209 | 11,409 | 10,205 | 9,485 | 5,549 |
| | Exchangeable Calcium (mg/kg) | | 6,787 | 5,897 | 5,093 | 4,556 | 4,235 | 2,477 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 6.3 | 12 | 14 | 13 | 12 | 2.9 |
| | Exchangeable Magnesium (kg/ha) | | 1,728 | 3,309 | 3,739 | 3,654 | 3,245 | 787 |
| | Exchangeable Magnesium (mg/kg) | | 771 | 1,477 | 1,669 | 1,631 | 1,448 | 351 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.6 | 0.91 | 0.96 | 1.1 | 1.0 | 1.3 |
| | Exchangeable Potassium (kg/ha) | | 1,415 | 796 | 842 | 951 | 910 | 1,159 |
| | Exchangeable Potassium (mg/kg) | | 632 | 355 | 376 | 425 | 406 | 517 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 0.65 | 4.7 | 7.7 | 10 | 11 | 0.31 |
| | Exchangeable Sodium (kg/ha) | | 336 | 2,397 | 3,972 | 5,249 | 5,466 | 158 |
| | Exchangeable Sodium (mg/kg) | | 150 | 1,070 | 1,773 | 2,343 | 2,440 | 70 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | 0.05 | 0.01 | 0.01 | 0.01 | 0.01 | <0.01 |
| | Exchangeable Aluminium (kg/ha) | | 11 | 2.8 | 2.3 | 2.5 | 2.6 | 1.9 |
| | Exchangeable Aluminium (mg/kg) | | 4.8 | 1.3 | 1.0 | 1.1 | 1.2 | <1 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 43 | 47 | 48 | 47 | 45 | 17 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 80 | 62 | 53 | 48 | 47 | 73 |
| | Magnesium (%) | | 15 | 26 | 29 | 28 | 27 | 17 |
| | Potassium (%) | | 3.8 | 1.9 | 2.0 | 2.3 | 2.3 | 7.8 |
| | Sodium - ESP (%) | | 1.5 | 9.9 | 16 | 21 | 24 | 1.8 |
| | Aluminium (%) | | 0.13 | 0.03 | 0.02 | 0.03 | 0.03 | 0.06 |
| | Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 5.3 | 2.4 | 1.9 | 1.7 | 1.8 | 4.3 |

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# AGRICULTURAL SOIL ANALYSIS REPORT

31 samples supplied by SLR Consulting Australia Pty Ltd on 4/05/2022 . Lab Job No.M8291
Analysis requested by Murray Fraser. Your Job: Job Ref SLR 640.30299.003
10 Kings Road NEW LAMBTON NSW 2305

| | | | Sample 7 | Sample 8 | Sample 9 | Sample 10 | Sample 11 | Sample 12 |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | G4 | G4 | G4 | G6 | G6 | G6 |
| | | Crop: | Soil | Soil | Soil | Soil | Soil | Soil |
| | | Client: | VHM | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | M8291/7 | M8291/8 | M8291/9 | M8291/10 | M8291/11 | M8291/12 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 8.94 | 9.48 | 9.73 | 7.49 | 8.98 | 9.33 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.202 | 0.325 | 0.521 | 0.213 | 0.175 | 0.265 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 24 | 28 | 24 | 12 | 29 | 27 |
| | Exchangeable Calcium (kg/ha) | | 10,841 | 12,635 | 10,768 | 5,479 | 13,027 | 11,963 |
| | Exchangeable Calcium (mg/kg) | | 4,840 | 5,641 | 4,807 | 2,446 | 5,816 | 5,341 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 8.9 | 13 | 15 | 4.5 | 9.7 | 14 |
| | Exchangeable Magnesium (kg/ha) | | 2,419 | 3,464 | 4,097 | 1,237 | 2,639 | 3,719 |
| | Exchangeable Magnesium (mg/kg) | | 1,080 | 1,546 | 1,829 | 552 | 1,178 | 1,660 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.0 | 0.89 | 1.2 | 2.1 | 1.5 | 1.6 |
| | Exchangeable Potassium (kg/ha) | | 876 | 775 | 1,030 | 1,821 | 1,357 | 1,443 |
| | Exchangeable Potassium (mg/kg) | | 391 | 346 | 460 | 813 | 606 | 644 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 1.9 | 4.0 | 6.8 | 0.29 | 0.86 | 2.1 |
| | Exchangeable Sodium (kg/ha) | | 955 | 2,048 | 3,513 | 148 | 442 | 1,058 |
| | Exchangeable Sodium (mg/kg) | | 426 | 914 | 1,568 | 66 | 198 | 473 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| | Exchangeable Aluminium (kg/ha) | | 1.6 | 1.8 | 2.5 | 2.1 | 2.3 | 2.1 |
| | Exchangeable Aluminium (mg/kg) | | <1 | <1 | 1.1 | <1 | 1.0 | <1 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 36 | 46 | 47 | 19 | 41 | 44 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 67 | 62 | 51 | 64 | 71 | 61 |
| | Magnesium (%) | | 25 | 28 | 32 | 24 | 24 | 31 |
| | Potassium (%) | | 2.8 | 1.9 | 2.5 | 11 | 3.8 | 3.7 |
| | Sodium - ESP (%) | | 5.2 | 8.7 | 14 | 1.5 | 2.1 | 4.7 |
| | Aluminium (%) | | 0.02 | 0.02 | 0.03 | 0.05 | 0.03 | 0.02 |
| | Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.7 | 2.2 | 1.6 | 2.7 | 3.0 | 2.0 |

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| | | | Sample 13 | Sample 14 | Sample 15 | Sample 16 | Sample 17 | Sample 18 |
|---|---|---|---|---|---|---|---|---|
| | | Sample ID: | G6 | G6 | G7 | G7 | G7 | G7 |
| | | Crop: | Soil | Soil | Soil | Soil | Soil | Soil |
| | | Client: | VHM | VHM | VHM | VHM | VHM | VHM |
| | Parameter | Method reference | M8291/13 | M8291/14 | M8291/15 | M8291/16 | M8291/17 | M8291/18 |
| | pH | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.79 | 9.96 | 7.14 | 8.78 | 9.60 | 9.87 |
| | Electrical Conductivity (dS/m) | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.406 | 0.523 | 0.163 | 0.256 | 0.337 | 0.616 |
| | Exchangeable Calcium (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 21 | 20 | 6.2 | 27 | 25 | 22 |
| | Exchangeable Calcium (kg/ha) | | 9,516 | 8,755 | 2,781 | 12,120 | 11,277 | 9,844 |
| | Exchangeable Calcium (mg/kg) | | 4,248 | 3,908 | 1,242 | 5,411 | 5,035 | 4,395 |
| | Exchangeable Magnesium (cmol$_+$/kg) | | 13 | 12 | 2.7 | 9.7 | 12 | 14 |
| | Exchangeable Magnesium (kg/ha) | | 3,482 | 3,397 | 733 | 2,637 | 3,160 | 3,886 |
| | Exchangeable Magnesium (mg/kg) | | 1,554 | 1,516 | 327 | 1,177 | 1,411 | 1,735 |
| | Exchangeable Potassium (cmol$_+$/kg) | | 1.7 | 1.9 | 1.5 | 1.6 | 1.1 | 1.5 |
| | Exchangeable Potassium (kg/ha) | | 1,464 | 1,688 | 1,277 | 1,394 | 977 | 1,273 |
| | Exchangeable Potassium (mg/kg) | | 654 | 753 | 570 | 623 | 436 | 568 |
| | Exchangeable Sodium (cmol$_+$/kg) | | 4.0 | 5.6 | 0.28 | 1.7 | 3.3 | 6.5 |
| | Exchangeable Sodium (kg/ha) | | 2,036 | 2,901 | 145 | 877 | 1,701 | 3,327 |
| | Exchangeable Sodium (mg/kg) | | 909 | 1,295 | 65 | 392 | 759 | 1,485 |
| | Exchangeable Aluminium (cmol$_+$/kg) | **Inhouse S37 (KCl) | 0.01 | 0.01 | 0.01 | 0.01 | <0.01 | <0.01 |
| | Exchangeable Aluminium (kg/ha) | | 2.5 | 2.2 | 2.8 | 2.0 | 1.2 | <1 |
| | Exchangeable Aluminium (mg/kg) | | 1.1 | <1 | 1.3 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | Exchangeable Hydrogen (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Exchangeable Hydrogen (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 40 | 40 | 11 | 40 | 41 | 44 |
| | Calcium (%) | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 53 | 49 | 58 | 68 | 61 | 50 |
| | Magnesium (%) | | 32 | 32 | 25 | 24 | 28 | 32 |
| | Potassium (%) | | 4.2 | 4.9 | 14 | 4.0 | 2.7 | 3.3 |
| | Sodium - ESP (%) | | 10.0 | 14 | 2.6 | 4.3 | 8.0 | 15 |
| | Aluminium (%) | | 0.03 | 0.03 | 0.13 | 0.03 | 0.01 | 0.01 |
| | Hydrogen (%) | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| | Calcium/Magnesium Ratio | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 1.7 | 1.6 | 2.3 | 2.8 | 2.2 | 1.5 |

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| Parameter | | Method reference | Sample 19 | Sample 20 | Sample 21 | Sample 22 | Sample 23 | Sample 24 |
|---|---|---|---|---|---|---|---|---|
| Sample ID: | | | G24 | G24 | G24 | G24 | G24 | G25 |
| Crop: | | | Soil | Soil | Soil | Soil | Soil | Soil |
| Client: | | | VHM | VHM | VHM | VHM | VHM | VHM |
| | | | M8291/19 | M8291/20 | M8291/21 | M8291/22 | M8291/23 | M8291/24 |
| pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.01 | 9.58 | 9.66 | 9.61 | 9.43 | 8.55 |
| Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.236 | 0.589 | 1.012 | 1.313 | 1.493 | 0.199 |
| Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 32 | 27 | 22 | 19 | 12 | 33 |
| | (kg/ha) | | 14,492 | 12,028 | 10,090 | 8,441 | 5,540 | 14,976 |
| | (mg/kg) | | 6,470 | 5,370 | 4,505 | 3,768 | 2,473 | 6,686 |
| Exchangeable Magnesium | (cmol$_+$/kg) | | 7.8 | 12 | 13 | 13 | 12 | 6.1 |
| | (kg/ha) | | 2,120 | 3,165 | 3,554 | 3,667 | 3,342 | 1,652 |
| | (mg/kg) | | 946 | 1,413 | 1,586 | 1,637 | 1,492 | 737 |
| Exchangeable Potassium | (cmol$_+$/kg) | | 1.3 | 0.78 | 0.92 | 1.2 | 1.3 | 2.7 |
| | (kg/ha) | | 1,153 | 681 | 802 | 1,032 | 1,116 | 2,356 |
| | (mg/kg) | | 515 | 304 | 358 | 461 | 498 | 1,052 |
| Exchangeable Sodium | (cmol$_+$/kg) | | 1.6 | 5.1 | 8.6 | 12 | 12 | 0.84 |
| | (kg/ha) | | 810 | 2,621 | 4,438 | 5,974 | 6,434 | 435 |
| | (mg/kg) | | 361 | 1,170 | 1,981 | 2,667 | 2,872 | 194 |
| Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 43 | 44 | 45 | 45 | 38 | 43 |
| Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 75 | 60 | 50 | 42 | 32 | 78 |
| Magnesium (%) | | | 18 | 26 | 29 | 30 | 32 | 14 |
| Potassium (%) | | | 3.1 | 1.8 | 2.0 | 2.6 | 3.3 | 6.3 |
| Sodium - ESP (%) | | | 3.7 | 11 | 19 | 26 | 33 | 2.0 |
| Aluminium (%) | | | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Hydrogen (%) | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 4.1 | 2.3 | 1.7 | 1.4 | 1.0 | 5.5 |

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| Parameter | | Method reference | Sample 25 | Sample 26 | Sample 27 | Sample 28 | Sample 29 | Sample 30 |
|---|---|---|---|---|---|---|---|---|
| Sample ID: | | | G25 | G25 | G25 | G26 | G26 | G26 |
| Crop: | | | Soil | Soil | Soil | Soil | Soil | Soil |
| Client: | | | VHM | VHM | VHM | VHM | VHM | VHM |
| | | | M8291/25 | M8291/26 | M8291/27 | M8291/28 | M8291/29 | M8291/30 |
| pH | | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.63 | 9.84 | 9.82 | 8.52 | 9.42 | 9.84 |
| Electrical Conductivity (dS/m) | | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.525 | 0.948 | 1.151 | 0.154 | 0.294 | 0.583 |
| Exchangeable Calcium | (cmol$_+$/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 26 | 20 | 11 | 25 | 31 | 24 |
| | (kg/ha) | | 11,700 | 9,029 | 4,739 | 11,431 | 13,909 | 10,955 |
| | (mg/kg) | | 5,223 | 4,031 | 2,116 | 5,103 | 6,210 | 4,891 |
| Exchangeable Magnesium | (cmol$_+$/kg) | | 11 | 15 | 14 | 5.8 | 9.1 | 12 |
| | (kg/ha) | | 3,126 | 3,956 | 3,886 | 1,578 | 2,487 | 3,180 |
| | (mg/kg) | | 1,396 | 1,766 | 1,735 | 705 | 1,110 | 1,420 |
| Exchangeable Potassium | (cmol$_+$/kg) | | 0.77 | 1.0 | 1.3 | 1.6 | 0.89 | 1.2 |
| | (kg/ha) | | 679 | 888 | 1,127 | 1,378 | 783 | 1,021 |
| | (mg/kg) | | 303 | 396 | 503 | 615 | 349 | 456 |
| Exchangeable Sodium | (cmol$_+$/kg) | | 4.6 | 8.4 | 11 | 0.65 | 3.4 | 6.5 |
| | (kg/ha) | | 2,363 | 4,337 | 5,786 | 337 | 1,726 | 3,327 |
| | (mg/kg) | | 1,055 | 1,936 | 2,583 | 150 | 770 | 1,485 |
| Exchangeable Aluminium | (cmol$_+$/kg) | **Inhouse S37 (KCl) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| Exchangeable Hydrogen | (cmol$_+$/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 | <0.01 |
| | (kg/ha) | | <1 | <1 | <1 | <1 | <1 | <1 |
| | (mg/kg) | | <1 | <1 | <1 | <1 | <1 | <1 |
| Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg) | | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg) | 43 | 44 | 37 | 33 | 44 | 44 |
| Calcium (%) | | **Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100 | 61 | 46 | 28 | 76 | 70 | 56 |
| Magnesium (%) | | | 27 | 33 | 38 | 17 | 21 | 27 |
| Potassium (%) | | | 1.8 | 2.3 | 3.4 | 4.7 | 2.0 | 2.7 |
| Sodium - ESP (%) | | | 11 | 19 | 30 | 2.0 | 7.6 | 15 |
| Aluminium (%) | | | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 | 0.01 |
| Hydrogen (%) | | | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 | 0.00 |
| Calcium/Magnesium Ratio | | **Calculation: Calcium / Magnesium (cmol$_+$/kg) | 2.3 | 1.4 | 0.74 | 4.4 | 3.4 | 2.1 |

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| | | | Sample 31 | *Heavy Soil* | *Medium Soil* | *Light Soil* | *Sandy Soil* |
|---|---|---|---|---|---|---|---|
| | | **Sample ID:** | **G26** | | | | |
| | | **Crop:** | **Soil** | | | | |
| | | **Client:** | **VHM** | *Clay* | *Clay Loam* | *Loam* | *Loamy Sand* |
| | **Parameter** | **Method reference** | **M8291/31** | **Indicative guidelines - refer to Notes 6 and 8** | | | |
| | **pH** | Rayment & Lyons 2011 - 4A1 (1:5 Water) | 9.89 | *6.5* | *6.5* | *6.3* | *6.3* |
| | **Electrical Conductivity (dS/m)** | Rayment & Lyons 2011 - 3A1 (1:5 Water) | 0.975 | *0.200* | *0.150* | *0.120* | *0.100* |
| | **Exchangeable Calcium** (cmol+/kg) | Rayment & Lyons 2011 - 15D3 (Ammonium Acetate) | 20 | *15.6* | *10.8* | *5.0* | *1.9* |
| | **Exchangeable Calcium** (kg/ha) | | 9,200 | *7000* | *4816* | *2240* | *840* |
| | **Exchangeable Calcium** (mg/kg) | | 4,107 | *3125* | *2150* | *1000* | *375* |
| | **Exchangeable Magnesium** (cmol+/kg) | | 14 | *2.4* | *1.7* | *1.2* | *0.60* |
| | **Exchangeable Magnesium** (kg/ha) | | 3,726 | *650* | *448* | *325* | *168* |
| | **Exchangeable Magnesium** (mg/kg) | | 1,664 | *290* | *200* | *145* | *75* |
| | **Exchangeable Potassium** (cmol+/kg) | | 1.6 | *0.60* | *0.50* | *0.40* | *0.30* |
| | **Exchangeable Potassium** (kg/ha) | | 1,421 | *526* | *426* | *336* | *224* |
| | **Exchangeable Potassium** (mg/kg) | | 634 | *235* | *190* | *150* | *100* |
| | **Exchangeable Sodium** (cmol+/kg) | | 10 | *0.3* | *0.26* | *0.22* | *0.11* |
| | **Exchangeable Sodium** (kg/ha) | | 5,390 | *155* | *134* | *113* | *57* |
| | **Exchangeable Sodium** (mg/kg) | | 2,406 | *69* | *60* | *51* | *25* |
| | **Exchangeable Aluminium** (cmol+/kg) | **Inhouse S37 (KCl) | <0.01 | *0.6* | *0.5* | *0.4* | *0.2* |
| | **Exchangeable Aluminium** (kg/ha) | | <1 | *121* | *101* | *73* | *30* |
| | **Exchangeable Aluminium** (mg/kg) | | <1 | *54* | *45* | *32* | *14* |
| | **Exchangeable Hydrogen** (cmol+/kg) | **Rayment & Lyons 2011 - 15G1 (Acidity Titration) | <0.01 | *0.6* | *0.5* | *0.4* | *0.2* |
| | **Exchangeable Hydrogen** (kg/ha) | | <1 | *13* | *11* | *8* | *3* |
| | **Exchangeable Hydrogen** (mg/kg) | | <1 | *6* | *5* | *4* | *2* |
| | **Effective Cation Exchange Capacity (ECEC) (cmol+/kg)** | **Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg) | 46 | *20.1* | *14.3* | *7.8* | *3.3* |
| | **Calcium (%)** | **Base Saturation Calculations - Cation cmol+/kg / ECEC x 100 | 44 | *77.6* | *75.7* | *65.6* | *57.4* |
| | **Magnesium (%)** | | 30 | *11.9* | *11.9* | *15.7* | *18.1* |
| | **Potassium (%)** | | 3.5 | *3.0* | *3.5* | *5.2* | *9.1* |
| | **Sodium - ESP (%)** | | 23 | *1.5* | *1.8* | *2.9* | *3.3* |
| | **Aluminium (%)** | | 0.01 | *6.0* | *7.1* | *10.5* | *12.1* |
| | **Hydrogen (%)** | | 0.00 | | | | |
| | **Calcium/Magnesium Ratio** | **Calculation: Calcium / Magnesium (cmol+/kg) | 1.5 | *6.5* | *6.4* | *4.2* | *3.2* |

# GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

31 soil samples supplied by SLR Consulting Australia Pty Ltd on 4th May, 2022 - Lab Job No. M8291
Analysis requested by Murray Fraser. Job Ref SLR 640.30299.003
10 Kings Road NEW LAMBTON NSW 2305

| SAMPLE ID | Lab Code | EMERSON AGGREGATE CLASS | MOISTURE CONTENT (% of water in sample) | TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent) | GRAVEL > 4.75 mm (% of total oven-dry equivalent) | GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent) | COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent) | FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent) | SILT 2-20 µm ISSS (% of total oven-dry equivalent) | CLAY < 2 µm (% of total oven-dry equivalent) |
|---|---|---|---|---|---|---|---|---|---|---|
| **G3 0-10** | M8291/1 | 4 | 7.8% | 0.1% | 0.0% | 0.1% | 22.7% | 30.5% | 18.3% | 28.4% |
| **G3 20-30** | M8291/2 | 3 | 14.3% | 0.2% | 0.0% | 0.2% | 17.9% | 23.4% | 6.1% | 52.4% |
| **G3 40-50** | M8291/3 | 2 | 14.5% | 0.1% | 0.0% | 0.1% | 19.0% | 24.3% | 4.6% | 51.9% |
| **G3 65-75** | M8291/4 | 2 | 14.7% | 0.0% | 0.0% | 0.0% | 22.0% | 27.1% | 5.6% | 45.2% |
| **G3 90-100** | M8291/5 | 2 | 14.7% | 0.0% | 0.0% | 0.0% | 26.4% | 29.0% | 1.0% | 43.7% |
| **G4 0-10** | M8291/6 | 3 | 3.7% | 0.3% | 0.0% | 0.3% | 36.5% | 41.5% | 4.7% | 17.0% |
| **G4 20-30** | M8291/7 | 3 | 12.6% | 0.2% | 0.0% | 0.2% | 25.9% | 26.4% | 4.9% | 42.5% |
| **G4 40-50** | M8291/8 | 2 | 14.8% | 0.6% | 0.0% | 0.6% | 18.6% | 26.6% | 5.3% | 49.0% |
| **G4 70-80** | M8291/9 | 2 | 15.3% | 0.0% | 0.0% | 0.0% | 13.1% | 24.2% | 11.0% | 51.7% |
| **G6 0-10** | M8291/10 | 3 | 4.9% | 0.5% | 0.0% | 0.5% | 46.9% | 19.4% | 11.3% | 21.9% |
| **G6 20-30** | M8291/11 | 3 | 10.3% | 0.0% | 0.0% | 0.0% | 31.0% | 19.6% | 10.1% | 39.3% |
| **G6 40-50** | M8291/12 | 3 | 12.5% | 1.6% | 1.0% | 0.6% | 26.3% | 21.2% | 7.9% | 43.0% |
| **G6 65-75** | M8291/13 | 2 | 11.4% | 1.0% | 0.0% | 1.0% | 27.9% | 25.1% | 12.2% | 33.8% |
| **G6 90-100** | M8291/14 | 2 | 12.4% | 0.0% | 0.0% | 0.0% | 29.2% | 30.2% | 6.4% | 34.2% |
| **G7 0-10** | M8291/15 | 3 | 2.5% | 0.4% | 0.0% | 0.4% | 44.2% | 41.9% | 4.0% | 9.6% |
| **G7 20-30** | M8291/16 | 3 | 9.8% | 0.1% | 0.0% | 0.1% | 26.0% | 28.7% | 5.8% | 39.4% |
| **G7 40-50** | M8291/17 | 3 | 10.9% | 0.2% | 0.0% | 0.2% | 26.3% | 24.2% | 12.3% | 37.0% |
| **G7 65-75** | M8291/18 | 2 | 10.8% | 0.0% | 0.0% | 0.0% | 17.3% | 53.7% | 4.2% | 24.8% |
| **G24 0-10** | M8291/19 | 3 | 7.1% | 0.0% | 0.0% | 0.0% | 33.2% | 7.1% | 25.9% | 33.8% |
| **G24 20-30** | M8291/20 | 3 | 11.0% | 0.0% | 0.0% | 0.0% | 19.9% | 26.7% | 7.5% | 45.8% |
| **G24 40-50** | M8291/21 | 2 | 13.5% | 0.0% | 0.0% | 0.0% | 20.5% | 26.5% | 6.3% | 46.7% |
| **G24 65-75** | M8291/22 | 2 | 13.1% | 0.0% | 0.0% | 0.0% | 21.6% | 30.5% | 4.4% | 43.4% |
| **G24 90-100** | M8291/23 | 2 | 14.9% | 0.0% | 0.0% | 0.0% | 20.9% | 25.7% | 6.2% | 47.2% |
| **G25 0-10** | M8291/24 | 3 | 6.8% | 0.0% | 0.0% | 0.0% | 23.3% | 32.4% | 16.9% | 27.4% |
| **G25 20-30** | M8291/25 | 3 | 8.0% | 0.4% | 0.0% | 0.4% | 24.2% | 24.4% | 9.0% | 42.0% |
| **G25 40-50** | M8291/26 | 2 | 10.0% | 0.0% | 0.0% | 0.0% | 26.3% | 25.5% | 6.6% | 41.6% |
| **G25 65-75** | M8291/27 | 2 | 10.6% | 0.0% | 0.0% | 0.0% | 24.1% | 24.6% | 3.8% | 47.5% |
| **G26 0-10** | M8291/28 | 4 | 6.1% | 0.0% | 0.0% | 0.0% | 28.7% | 33.0% | 15.8% | 22.4% |
| **G26 20-30** | M8291/29 | 3 | 9.7% | 0.1% | 0.0% | 0.1% | 20.9% | 26.7% | 13.8% | 38.5% |
| **G26 40-50** | M8291/30 | 2 | 11.3% | 4.5% | 4.4% | 0.1% | 17.0% | 21.1% | 13.3% | 44.1% |
| **G26 65-75** | M8291/31 | 2 | 12.5% | 0.2% | 0.0% | 0.2% | 18.4% | 21.2% | 9.1% | 51.1% |

**Note:**

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.

2: Australian Standard 1289.3.8.1-1997 (see attached)

3. Analysis conducted between sample arrival date and reporting date.

4. This report is not to be reproduced except in full. Results only relate to the item tested.

5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal).

6. This report was issued on 25/05/2022.

Environmental Analysis Laboratory, Southern Cross University,
Tel. 02 6620 3678, website: scu.edu.au/eal

checked: .....
Graham Lancaster (Nata signatory)
Laboratory Manager

# MUNSELL COLOUR ANALYSIS

31 soil samples supplied by SLR Consulting Australia Pty Ltd on 4th May, 2022 - Lab Job No. M8291
Analysis requested by Murray Fraser. Job Ref SLR 640.30299.003
10 Kings Road NEW LAMBTON NSW 2305

| SAMPLE ID | Lab Code | MOIST MUNSELL COLOUR | | MOTTLE MUNSELL COLOUR | | DEGREE OF MOTTLING (%) |
|---|---|---|---|---|---|---|
| | | Code | Description | Code | Description | |
| **G3 0-10** | M8291/1 | 7.5YR3/4 | Dark brown | .. | .. | .. |
| **G3 20-30** | M8291/2 | 7.5YR3/4 | dark brown | .. | .. | .. |
| **G3 40-50** | M8291/3 | 7.5YR5/6 | strong brown | .. | .. | .. |
| **G3 65-75** | M8291/4 | 7.5YR4/6 | strtong brown | .. | .. | .. |
| **G3 90-100** | M8291/5 | 7.5YR4/6 | strong brown | .. | .. | .. |
| **G4 0-10** | M8291/6 | 5YR3/4 | dark reddish brown | .. | .. | .. |
| **G4 20-30** | M8291/7 | 2.5YR2.5/4 | dark reddish brown | .. | .. | .. |
| **G4 40-50** | M8291/8 | 2.5YR3/6 | dark reddish brown | .. | .. | .. |
| **G4 70-80** | M8291/9 | 5YR 5/8 | yellowish red | .. | .. | .. |
| **G6 0-10** | M8291/10 | 7.5YR2.5/2 | very dark brown | .. | .. | .. |
| **G6 20-30** | M8291/11 | 2.5YR3/6 | dark reddish brown | .. | .. | .. |
| **G6 40-50** | M8291/12 | 2.5YR3/6 | dark reddish brown | 5YR7/8 | Reddish Yellow | 0 |
| **G6 65-75** | M8291/13 | 5YR4/6 | yellowish red | .. | .. | .. |
| **G6 90-100** | M8291/14 | 5YR 5/8 | yellowish red | 5YR7/8 | Reddish Yellow | 0 |
| **G7 0-10** | M8291/15 | 7.5YR2.5/2 | very dark brown | .. | .. | .. |
| **G7 20-30** | M8291/16 | 2.5YR2.5/4 | dark reddish brown | .. | .. | .. |
| **G7 40-50** | M8291/17 | 7.5YR4/6 | strong brown | 5YR6/8 | Reddish Yellow | 10 |
| **G7 65-75** | M8291/18 | 7.5YR4/6 | Strong Brown | .. | .. | .. |
| **G24 0-10** | M8291/19 | 7.5YR3/4 | Dark brown | 7.5YR6/4 | Light Brown | 10 |
| **G24 20-30** | M8291/20 | 7.5YR4/3 | Brown | 7.5YR7/4 | Pink | 5 |
| **G24 40-50** | M8291/21 | 7.5YR5/3 | Brown | .. | .. | .. |
| **G24 65-75** | M8291/22 | 7.5YR5/3 | Brown | .. | .. | .. |
| **G24 90-100** | M8291/23 | 7.5YR5/2 | Brown | .. | .. | .. |
| **G25 0-10** | M8291/24 | 7.5YR3/3 | Dark brown | .. | .. | .. |
| **G25 20-30** | M8291/25 | 7.5YR5/2 | Brown | 10YR8/3 | Very Pale Brown | 2 |
| **G25 40-50** | M8291/26 | 7.5YR5/2 | Brown | 7.5YR8/2 | Pinkish White | 10 |
| **G25 65-75** | M8291/27 | 10YR5/3 | Brown | .. | .. | .. |
| **G26 0-10** | M8291/28 | 7.5YR2.5/3 | Very Dark Brown | .. | .. | .. |
| **G26 20-30** | M8291/29 | 7.5YR4/4 | Brown | 7.5YR8/4 | Pink | 10 |
| **G26 40-50** | M8291/30 | 10YR4/4 | Dark Yellowish Brown | 7.5YR7/4 | Pink | 10 |
| **G26 65-75** | M8291/31 | 7.5YR5/3 | Brown | .. | .. | .. |

**Note:**

1: The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986),
in *Methods of Soil Analysis. Part 1* Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.
2: Australian Standard 1289.3.8.1-1997 (see attached)
3. Analysis conducted between sample arrival date and reporting date.
4. This report is not to be reproduced except in full. Results only relate to the item tested.
5. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal).
6. This report was issued on 25/05/2022.

# APPENDIX C

## Detailed Site Descriptions

## 1.1 Soil Map Unit 1: Calcic Red-Brown Calcarosol

Calcarosols are soils which are calcareous throughout the solum, or calcareous at least directly below the A1 horizon, or within a depth of 0.2 metres. Carbonate accumulations must be judged to be pedogenic. Calcarosols do not have a clear or abrupt texture contrast between the A and B horizons.

### Dominant Soil Type: Calcic Red Calcarosol

**Table 1 Summary: Calcic Red Calcarosol (Site 1)**

| Overview | |
|---|---|
|  Landscape Site 1 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 1 |
| **Other Mapped Sites** | 2, 5, 6, 8, 22, 23, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Lower Slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Oat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | Minimal |
| **Aspect** | East |

## Table 2 Profile: Calcic Red Calcarosol (Site 1)

| 0 | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark reddish brown (5YR 3/3) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Reddish brown (5YR 4/4) light clay, moderately structured 10-20 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, 15% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.60 | Yellowish red (5YR 4/6) light clay, moderately structured 15-30 mm blocky peds with strong consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.60 | Yellowish red (5YR 4/8) medium clay, massively structured.<br>Nil mottling, nil stone content, 5% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 |

## Table 3 Field Chemical Parameters: Calcic Red Calcarosol (Site 1)

| Layer | Field pH | | Field Dispersion | Field Effervescence |
|---|---|---|---|---|
| | Unit | Rating | Rating | Rating |
| A1 | 7 | Neutral | Nil | Nil |
| B21 | 9 | Strongly Alkaline | Moderate | Strong |
| B22 | 9 | Strongly Alkaline | High | Strong |
| B23 | 9 | Strongly Alkaline | High | Strong |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 4 Summary: Calcic Red Calcarosol (Site 5)

| Overview | |
|---|---|
|  | |
| Landscape Site 5 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 5 |
| **Other Mapped Sites** | 1, 2, 6, 8, 22, 23, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Mid Slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | 3 |
| **Aspect** | West |

## Table 5 Profile: Calcic Red Calcarosol (Site 5)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark reddish-brown (5YR 3/3) sandy loam, weakly crumb structured 5-10 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Dark reddish-brown (5YR 3/4) clay loam, moderately crumb structured 5-10 mm peds with weak consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.60 | Yellowish-red (5YR 5/8) clay loam, moderately structured 10-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a clear and even boundary.<br>Sampled 0.40 – 0.50 |
| | BC<br>+0.60 | Weathered parent material<br>Not sampled |

## Table 6 Chemical Parameters: Calcic Red Calcarosol (Site 5)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.0 | Neutral | 0.8 | Non-Sodic | 1.1 | Non-Saline | 2.1 | Ca Low |
| B21 | 8.7 | Strongly Alkaline | 0.6 | Non-Sodic | 1.2 | Non-Saline | 3.5 | Ca Low |
| B22 | 9.1 | Very Strongly Alkaline | 1.8 | Non-Sodic | 1.3 | Non-Saline | 2.0 | Ca Low |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 7 Summary: Calcic Red Calcarosol (Site 6)

| Overview | |
|---|---|
|  | |
| Landscape Site 6 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 6 |
| **Other Mapped Sites** | 1, 2, 5, 8, 22, 23, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Flat |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | Minimal |
| **Aspect** | Nil |

## Table 8 Profile: Calcic Red Calcarosol (Site 6)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Very dark brown (2.5YR 2.5/2) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Dark red (2.5YR 3/6) light clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric.<br>Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.50 | Dark red (2.5YR 3/6) light-medium clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.50 | Yellowish red (5YR 4/6) light clay, massively structured.<br>Nil mottling, nil stone content, 30% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 and 0.90 – 1.0 |

## Table 9 Chemical Parameters: Calcic Red Calcarosol (Site 6)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.5 | Mildly Alkaline | 1.5 | Non Sodic | 1.8 | Non-Saline | 2.7 | Ca Low |
| B21 | 9.0 | Strongly Alkaline | 2.1 | Non Sodic | 1.5 | Non-Saline | 3.0 | Ca Low |
| B22 | 9.3 | Very Strongly Alkaline | 4.7 | Non Sodic | 2.3 | Slightly Saline | 2.0 | Ca Low |
| B23 | 9.8 | Very Strongly Alkaline | 10.0 | Marginally Sodic | 3.5 | Slightly Saline | 1.7 | Ca Low |
| B23 | 10.0 | Very Strongly Alkaline | 14.2 | Strongly Sodic | 4.5 | Moderately Saline | 1.6 | Ca Low |

## Sub Dominant Soil Type: Eutrophic Red Chromosol

Chromosols are soils with a strong texture contrast between the A and B horizons, where the B horizon is not strongly acidic or sodic.

### Table 10 Summary: Eutrophic Red Chromosol (Site 7)

| Overview | |
|---|---|
|  Landscape Site 7 | |
| **ASC Name** | Eutrophic Red Chromosol |
| **Representative Site** | Site 7 |
| **Other Mapped Sites** | 4 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Mid Slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately High |
| **Slope (%)** | 1 |
| **Aspect** | West |

## Table 11 Profile: Eutrophic Red Chromosol (Site 7)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Very dark brown (7.5YR 2.5/2) sandy loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a clear and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Dark-reddish brown (2.5YR 2.5/4) light clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.50 | Strong brown (7.5YR 4/6) light clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B23<br>+0.50 | Strong brown (7.5YR 4/6) sandy clay loam, massively structured.<br>Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 |

## Table 12 Chemical Parameters: Eutrophic Red Chromosol (Site 7)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 7.1 | Neutral | 2.6 | Non Sodic | 2.3 | Slightly Saline | 2.3 | Ca Low |
| B21 | 8.8 | Strongly Alkaline | 4.3 | Non Sodic | 2.2 | Slightly Saline | 2.8 | Ca Low |
| B22 | 9.6 | Very Strongly Alkaline | 8.0 | Marginally Sodic | 2.9 | Slightly Saline | 2.2 | Ca Low |
| B23 | 9.9 | Very Strongly Alkaline | 14.6 | Strongly Sodic | 5.9 | Moderately Saline | 1.5 | Ca Low |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 13 Summary: Calcic Red Calcarosol (Site 8)

| Overview | |
|---|---|
|  | |
| Landscape Site 8 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 8 |
| **Other Mapped Sites** | 1, 2, 5, 6, 22, 23, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Upper Slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | 2 |
| **Aspect** | North |

## Table 14 Profile: Calcic Red Calcarosol (Site 8)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Light reddish brown (5YR 6/4) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Reddish brown (5YR 5/4) light clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.50 | Reddish brown (5YR 4/5) light clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.50 | Yellowish red (5YR 4/6) medium clay, massively structured.<br>Nil mottling, nil stone content, 30% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 |

## Table 15 Field Chemical Parameters: Calcic Red Calcarosol (Site 8)

| Layer | Field pH | | Field Dispersion | Field Effervescence |
|---|---|---|---|---|
| | Unit | Rating | Rating | Rating |
| A1 | 7 | Neutral | Nil | Nil |
| B21 | 8 | Moderately Alkaline | Moderate | Strong |
| B22 | 9 | Strongly Alkaline | Moderate | Strong |
| B23 | 9 | Strongly Alkaline | High | Strong |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 16 Summary: Calcic Red Calcarosol (Site 22)

| Overview | |
|---|---|
|  | |
| Landscape Site 22 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 22 |
| **Other Mapped Sites** | 1, 2, 5, 6, 8, 23, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Mid Slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | 1 |
| **Aspect** | West |

## Table 17 Profile: Calcic Red Calcarosol (Site 22)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Reddish-brown (5YR 4/4) clay loam, weakly crumb structured 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.10 – 0.30 | Yellowish-red (5YR 4/6) light-medium clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.50 | Yellowish-red (5YR 4/6) light clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B23<br>0.50 – 0.80 | Red (2.5YR 4/6) light-medium clay, massively structured. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.65 – 0.75 |
| | B24<br>+0.80 | Red (2.5 4/6) light clay, massively structured. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.90 – 1.0 |

## Table 18 Chemical Parameters: Calcic Red Calcarosol (Site 22)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.3 | Moderately Alkaline | 2.2 | Non-Sodic | 3.4 | Slightly Saline | 5.6 | Balanced |
| B21 | 9.1 | Very Strongly Alkaline | 8.8 | Marginally Sodic | 2.7 | Slightly Saline | 2.9 | Ca Low |
| B22 | 9.4 | Very Strongly Alkaline | 17.1 | Strongly Sodic | 5.3 | Moderately Saline | 1.9 | Ca Low |
| B23 | 9.4 | Very Strongly Alkaline | 25.6 | Strongly Sodic | 8.4 | Highly Saline | 1.4 | Ca Low |
| B24 | 9.3 | Very Strongly Alkaline | 27.9 | Strongly Sodic | 8.8 | Highly Saline | 1.5 | Ca Low |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 19 Summary: Calcic Red Calcarosol (Site 23)

| Overview | |
|---|---|
|  | |
| Landscape Site 23 | |
| **ASC Name** | Calcic Red Calcarosol |
| **Representative Site** | Site 23 |
| **Other Mapped Sites** | 1, 2, 5, 6, 8, 22, 27 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Lower slope |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Canola Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | 2 |
| **Aspect** | East |

## Table 20 Profile: Calcic Red Calcarosol (Site 23)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.10 | Dark brown (7.5YR 3/2) sandy loam, weakly crumb structured 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, 10% gravel 5-10mm, 5% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | A2<br>0.10 – 0.40 | Yellowish red (5YR 4/6) sandy clay loam, weakly crumb structured 5-15 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 5% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary.<br>Sampled 0.20 – 0.30 |
| | B21<br>0.40 – 0.50 | Yellowish red (5YR 4/6) clay loam, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B22<br>+0.50 | Reddish-yellow (5YR 7/6) light clay, massively structured.<br>Nil mottling, 10% gravel 5-10mm, 20% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 and 0.90 – 1.0 |

## Table 21 Chemical Parameters: Calcic Red Calcarosol (Site 23)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.5 | Strongly Alkaline | 0.4 | Non-Sodic | 2.1 | Slightly Saline | 11.1 | Mg Deficient |
| A2 | 8.9 | Strongly Alkaline | 0.7 | Non-Sodic | 1.1 | Non-Saline | 3.8 | Ca Low |
| B21 | 9.6 | Very Strongly Alkaline | 7.1 | Marginally Sodic | 2.2 | Slightly Saline | 1.9 | Ca Low |
| B22 | 10.1 | Very Strongly Alkaline | 20.7 | Strongly Sodic | 4.9 | Moderately Saline | 2.2 | Ca Low |
| B22 | 10.1 | Very Strongly Alkaline | 24.6 | Strongly Sodic | 5.4 | Moderately Saline | 2.9 | Ca Low |

## Dominant Soil Type: Calcic Brown Calcarosol

### Table 22 Summary: Calcic Brown Calcarosol (Site 25)

| Overview | |
|---|---|
|  | |
| Landscape Site 25 | |
| **ASC Name** | Calcic Brown Calcarosol |
| **Representative Site** | Site 25 |
| **Other Mapped Sites** | 24, 26 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Flat |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Barley Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | Minimal |
| **Aspect** | Nil |

## Table 23 Profile: Calcic Brown Calcarosol (Site 25)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.20 | Dark brown (7.5YR 3/3) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary.<br>Sampled 0.0 – 0.10 |
| | B21<br>0.20 – 0.50 | Brown (7.5YR 5/2) light clay-medium, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 5% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary.<br>Sampled 0.20 – 0.30 and 0.40 – 0.50 |
| | B22<br>+0.50 | Brown (10YR 5/3) medium clay, massively structured.<br>Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 |

## Table 24 Chemical Parameters: Calcic Brown Calcarosol (Site 25)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.6 | Strongly Alkaline | 2.0 | Non Sodic | 1.7 | Non-Saline | 5.5 | Balanced |
| B21 | 9.6 | Very Strongly Alkaline | 10.7 | Sodic | 4.5 | Moderately Saline | 2.3 | Ca Low |
| B21 | 9.8 | Very Strongly Alkaline | 19.1 | Strongly Sodic | 8.2 | Highly Saline | 1.4 | Ca Low |
| B22 | 9.8 | Very Strongly Alkaline | 30.1 | Strongly Sodic | 8.6 | Highly Saline | 0.7 | Ca Deficient |

## Dominant Soil Type: Calcic Brown Calcarosol

### Table 25 Summary: Calcic Brown Calcarosol (Site 26)

| Overview | |
|---|---|
|  | |
| Landscape Site 26 | |
| **ASC Name** | Calcic Brown Calcarosol |
| **Representative Site** | Site 26 |
| **Other Mapped Sites** | 24, 25 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Flat |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Wheat Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | Minimal |
| **Aspect** | Nil |

## Table 26 Profile: Calcic Brown Calcarosol (Site 26)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.15 | Very dark brown (7.5YR 2.5/3) loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.15 – 0.30 | Brown (7.5YR 4/4) light clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.60 | Dark yellowish brown (10YR 4/4) medium clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, 5% gravel 5-10 mm, 10% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary. Sampled 0.40 – 0.50 |
| | B23<br>+0.60 | Brown (7.5YR 5/3) heavy clay, massively structured. Nil mottling, nil stone content, 10% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth. Sampled 0.65 – 0.75 |

## Table 27 Field Chemical Parameters: Calcic Brown Calcarosol (Site 26)

| Layer | pH (1:5 water) | | ESP | | ECe | | Ca:Mg | |
|---|---|---|---|---|---|---|---|---|
| | Unit | Rating | % | Rating | dS/m | Rating | Ratio | Rating |
| A1 | 8.5 | Strongly Alkaline | 2.0 | Non Sodic | 1.5 | Non-Saline | 4.4 | Balanced |
| B21 | 9.4 | Very Strongly Alkaline | 7.6 | Marginally Sodic | 2.5 | Slightly Saline | 3.4 | Ca Low |
| B22 | 9.8 | Very Strongly Alkaline | 14.8 | Strongly Sodic | 4.4 | Moderately Saline | 2.1 | Ca Low |
| B22 | 9.9 | Very Strongly Alkaline | 22.6 | Strongly Sodic | 5.7 | Moderately Saline | 1.5 | Ca Low |

## Dominant Soil Type: Calcic Red Calcarosol

### Table 28 Summary: Red Calcarosol (Site 27)

| Overview | |
|---|---|
|  | |
| Landscape Site 27 | |
| **ASC Name** | Red Calcarosol |
| **Representative Site** | Site 27 |
| **Other Mapped Sites** | 1, 2, 5, 6, 8, 22, 23 |
| **Survey Type** | Detailed |
| **Dominant Topography** | Flat |
| **Dominant Land Use** | Cultivation |
| **Vegetation** | Barley Stubble |
| **Inherent Soil Fertility** | Moderately Low |
| **Slope (%)** | Minimal |
| **Aspect** | Nil |

## Table 29 Profile: Red Calcarosol (Site 27)

| Profile | Horizon / Depth (m) | Description |
|---|---|---|
|  | A1<br>0.0 – 0.15 | Reddish brown (5YR 5/4) clay loam, weak crumb structure 5-10 mm peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, nil segregations, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.0 – 0.10 |
| | B21<br>0.15 – 0.30 | Dark reddish brown (5YR 3/3) light clay, moderately structured 10-20 mm blocky peds with moderate consistence and a rough fabric. Nil mottling, nil stone content, 10% soft calcium nodules, abundant fine roots. Well drained with a gradual and even boundary. Sampled 0.20 – 0.30 |
| | B22<br>0.30 – 0.50 | Dark reddish brown (5YR 3/4) light clay, moderately structured 15-30 mm blocky peds with moderate consistence and a rough fabric.<br>Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained with a gradual and even boundary.<br>Sampled 0.40 – 0.50 |
| | B23<br>+0.50 | Yellowish red (5YR 5/6) medium clay, massively structured.<br>Nil mottling, nil stone content, 20% soft calcium nodules, coarse roots common. Well drained, layer continues beyond sample depth.<br>Sampled 0.65 – 0.75 |

## Table 30 Field Chemical Parameters: Red Calcarosol (Site 27)

| Layer | Field pH | | Field Dispersion | Field Effervescence |
|---|---|---|---|---|
| | Unit | Rating | Rating | Rating |
| A1 | 8 | Moderately Alkaline | Nil | Nil |
| B21 | 9 | Strongly Alkaline | Slight | Strong |
| B22 | 9 | Strongly Alkaline | Moderate | Strong |
| B23 | 9 | Strongly Alkaline | High | Strong |

# APPENDIX D

## Soil Salinity Ratings

## Table 1 Soil Salinity Ratings

| Site | Horizon | Sample Depth (cm) | EC (dS/m) | Multiplier | ECe | Salinity Rating |
|---|---|---|---|---|---|---|
| 2 | A1 | 0-10 | 0.1 | 8.6 | 1.2 | Non-Saline |
| | B21 | 20-30 | 0.2 | 7.5 | 1.8 | Non-Saline |
| | B22 | 40-50 | 0.5 | 8.6 | 4.3 | Moderately Saline |
| | B23 | 65-75 | 0.7 | 7.5 | 5.3 | Moderately Saline |
| | B23 | 90-100 | 0.9 | 7.5 | 7.0 | Moderately Saline |
| 3 | A1 | 0-10 | 0.2 | 8.6 | 1.6 | Non-Saline |
| | B21 | 20-30 | 0.4 | 5.8 | 2.5 | Slightly Saline |
| | B22 | 40-50 | 0.7 | 5.8 | 3.9 | Slightly Saline |
| | B23 | 65-75 | 0.9 | 7.5 | 7.0 | Moderately Saline |
| | B23 | 90-100 | 1.1 | 8.6 | 9.4 | Highly Saline |
| 4 | A1 | 0-10 | 0.1 | 14 | 1.9 | Non-Saline |
| | B21 | 20-30 | 0.2 | 8.6 | 1.7 | Non-Saline |
| | B22 | 40-50 | 0.3 | 7.5 | 2.4 | Slightly Saline |
| | B23 | 70-80 | 0.5 | 5.8 | 3.0 | Slightly Saline |
| 5 | A1 | 0-10 | 0.1 | 14 | 1.1 | Non-Saline |
| | B21 | 20-30 | 0.1 | 8.6 | 1.2 | Non-Saline |
| | B22 | 40-50 | 0.2 | 8.6 | 1.3 | Non-Saline |
| 6 | A1 | 0-10 | 0.2 | 8.6 | 1.8 | Non-Saline |
| | B21 | 20-30 | 0.2 | 8.6 | 1.5 | Non-Saline |
| | B22 | 40-50 | 0.3 | 8.6 | 2.3 | Slightly Saline |
| | B23 | 65-75 | 0.4 | 8.6 | 3.5 | Slightly Saline |
| | B23 | 90-100 | 0.5 | 8.6 | 4.5 | Moderately Saline |
| 7 | A1 | 0-10 | 0.2 | 14 | 2.3 | Slightly Saline |
| | B21 | 20-30 | 0.3 | 8.6 | 2.2 | Slightly Saline |
| | B22 | 40-50 | 0.3 | 8.6 | 2.9 | Slightly Saline |
| | B23 | 65-75 | 0.6 | 9.5 | 5.9 | Moderately Saline |
| 22 | A1 | 0-10 | 0.4 | 8.6 | 3.4 | Slightly Saline |
| | B21 | 20-30 | 0.3 | 8.6 | 2.7 | Slightly Saline |
| | B22 | 40-50 | 0.6 | 8.6 | 5.3 | Moderately Saline |
| | B23 | 65-75 | 1.0 | 8.6 | 8.4 | Highly Saline |
| | B24 | 90-100 | 1.0 | 8.6 | 8.8 | Highly Saline |
| 23 | A1 | 0-10 | 0.2 | 14 | 2.1 | Slightly Saline |
| | A2 | 20-30 | 0.1 | 9.5 | 1.1 | Non-Saline |
| | B21 | 40-50 | 0.3 | 8.6 | 2.2 | Slightly Saline |
| | B22 | 65-75 | 0.6 | 8.6 | 4.9 | Moderately Saline |
| | B23 | 90-100 | 0.6 | 8.6 | 5.4 | Moderately Saline |

| Site | Horizon | Sample Depth (cm) | EC (dS/m) | Multiplier | ECe | Salinity Rating |
|---|---|---|---|---|---|---|
| 24 | A1 | 0-10 | 0.2 | 8.6 | 2.0 | Slightly Saline |
| | B21 | 20-30 | 0.6 | 7.5 | 4.4 | Moderately Saline |
| | B22 | 40-50 | 1.0 | 7.5 | 7.6 | Moderately Saline |
| | B23 | 65-75 | 1.3 | 8.6 | 11.3 | Highly Saline |
| | B23 | 90-100 | 1.5 | 7.5 | 11.2 | Highly Saline |
| 25 | A1 | 0-10 | 0.2 | 8.6 | 1.7 | Non-Saline |
| | B21 | 20-30 | 0.5 | 8.6 | 4.5 | Moderately Saline |
| | B21 | 40-50 | 0.9 | 8.6 | 8.2 | Highly Saline |
| | B22 | 65-75 | 1.2 | 7.5 | 8.6 | Highly Saline |
| 26 | A1 | 0-10 | 0.2 | 9.5 | 1.5 | Non-Saline |
| | B21 | 20-30 | 0.3 | 8.6 | 2.5 | Slightly Saline |
| | B22 | 40-50 | 0.6 | 7.5 | 4.4 | Moderately Saline |
| | B23 | 65-75 | 1.0 | 5.8 | 5.7 | Moderately Saline |

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