Yinnetharra Project - Baseline Soil Assessment

Electrostate Malinda Pty Ltd

11 February 2025

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Executive Summary

Mine Earth was commissioned by Electrostate Malinda Pty Ltd (a subsidiary of Delta Lithium, referred to as Electrostate hereafter) to complete a soil and landform assessment for the proposed Yinnetharra Lithium Project (the Project) located approximately 260 km east of Carnarvon in the Gascoyne region of Western Australia.

Electrostate is proposing to develop the Project to include open pits, waste rock landforms, TSF, processing facilities, workshops, administration and other infrastructure. The study area for the soil and landform assessment comprised tenements E09/2169 and E09/2283.

Assessment of the physical and chemical characteristics of soil resources within the study area is required to identify soil management requirements, develop rehabilitation prescriptions, and fulfil requirements for future regulatory approval.

The objectives of the assessment were to:

- Review regional soil and land system information.
- Characterise the physical and chemical characteristics of soils within the study area.
- Develop recommendations for soil salvaging, management, stockpiling and application of soil resources in rehabilitation and mine closure activities.
- Develop a preliminary soil resource inventory for the Project.

Surface Soil Characteristics

The physical and chemical characteristics of the topsoil materials were assessed from 27 locations within the study area. Sampling sites were focussed within and surrounding the proposed disturbance areas within the study area. Surface soil samples and relevant field-based information were collected by Mine Earth personnel in August 2024.

The surface soils, as identified by the field sampling regime and sampling and analysis program, have been grouped into five soil-landform associations (SLAs), based primarily on land system mapping, imagery and surface feature morphology, namely: ‘Undulating Stony Plain’, ‘Outcropping Low Rises’, ‘Undulating Low Hills’, ‘Major Channels’ and ‘Major Drainage Tracts’. The SLAs are summarised as follows:

- Undulating Low Hills
  - Gently undulating low relief hills intersected with vegetated drainage lines.
  - Abundant surface mantle of mostly quartz coarse fragments with pockets of ironstone.
  - Shallow surface soils, with weathered rock present from 30-50 cm within the profile.
  - High percentage of coarse fragments (>2mm) through the surface profile.
  - Soils characterised as Red shallow loams (WA Soil Group 522).
  - Soil textures were mostly loams (sandy, silty and clay loams), with some loamy sands.
  - Soils were typically non-saline to slightly saline, typically non-sodic, potentially dispersive upon severe disturbance, typically had a low propensity to hard-set, had a moderate to moderately slow hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.
- Undulating Stony Plain
  - Flat / low relief undulating stony plains.

- Surface mantle of mostly quartz with pockets of ironstone and other coarse fragments.
- Shallow surface soils, with hardpan typically present >25 cm.
- Low to moderate amounts of coarse fragments (>2mm) through top 0-20 cm of soil profile.
- Soils characterised as Red shallow loams (WA Soil Group 522), Red-brown hardpan shallow loam (WA Soil Group 523) and Red loamy earths (WA Soil Group 544).
- Soil textures were mostly loams (sandy, silty and clay loams), with some loamy sands and clays.
- Soils were non-saline to extremely saline (more saline than the soils from the other SLAs), ranged from non-sodic to highly sodic, ranged from being dispersive to potentially dispersive upon severe disturbance, typically had a low propensity to hard-set, typically had a moderately slow to moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.

- Outcropping Low Rises
  - Low relief rocky rises.
  - Surface mantle of quartz and ironstone.
  - Shallow surface soils over hardpan.
  - High percentage of competent rock fragments within the top 10 cm, decreasing with depth.
  - Areas of outcropping granite present in some areas.
  - Soils characterised as Red-brown hardpan shallow loam (WA Soil Group 523).
  - Soils textures included sands, loams and clays.
  - Soils were mostly non-saline, ranged from non-sodic to sodic, were mostly dispersive, had a low propensity to hard-set, had a moderately slow to moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.
- Major Drainage Tracts
  - Broad, shallow, un-channelled drainage tracts, typically draining in a southerly direction towards major channels.
  - Generally, well vegetated with trees and shrubs.
  - Typically, loamy soils with a surface mantle of quartz and ironstone in higher landscape positions.
  - Fewer coarse fragments throughout the soil profile (>2mm).
  - Soils characterised as Red loamy earths (WA Soil Group 544).
  - Soils were loams.
  - Soils were non-saline, non-sodic, had a low propensity to hard-set, moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.
- Major Channels
  - Major alluvial ephemeral channels.
  - Sandy substrate.
  - Soils characterised as No suitable group (dry river bed) (WA Soil Group 703).
  - Soils were sands.
  - Soils were non-sodic, non-saline, with a very rapid hydraulic conductivity and low in organic carbon and plant-available nutrients.

Soil Management Recommendations

The topsoil (0 to 20 cm) from the Undulating Low Hills SLA is considered suitable as a surface rehabilitation material. The erodibility of these topsoils is likely to be relatively low, unless subject to concentrated surface water flow. This topsoil should be used preferentially on the slopes of waste rock landforms.

The topsoil (0 to 20 cm) from the Undulating Stony Plain, Outcropping Low Rises and Major Drainage Tracts SLAs is potentially more saline, clay rich, sodic and dispersive than the topsoil from the Undulating Low Hills, and is likely to be more erodible. It is recommended that this topsoil be stockpiled separately, with application as a surface rehabilitation medium restricted to flat areas, where possible. There is currently no planned disturbance in the Outcropping Low Rises and Major Drainage Tracts SLAs. The Major Channels SLA will not be disturbed.

Where salvaged soils are utilised as a surface rehabilitation medium on the slopes of waste rock landforms, the soils will require ripping into underlying competent waste rock to armour the surface and minimise erosion as far as practicable. Adequate surface water management on constructed landforms will be required to minimise the potential for surface water concentration and flow.

Weathered / transitional rock was present at varying depths within the Undulating Low Hills and Undulating Stony Plain SLA. These materials may be a useful surface / near-surface rehabilitation material and should be salvaged and stockpiled from pit areas.

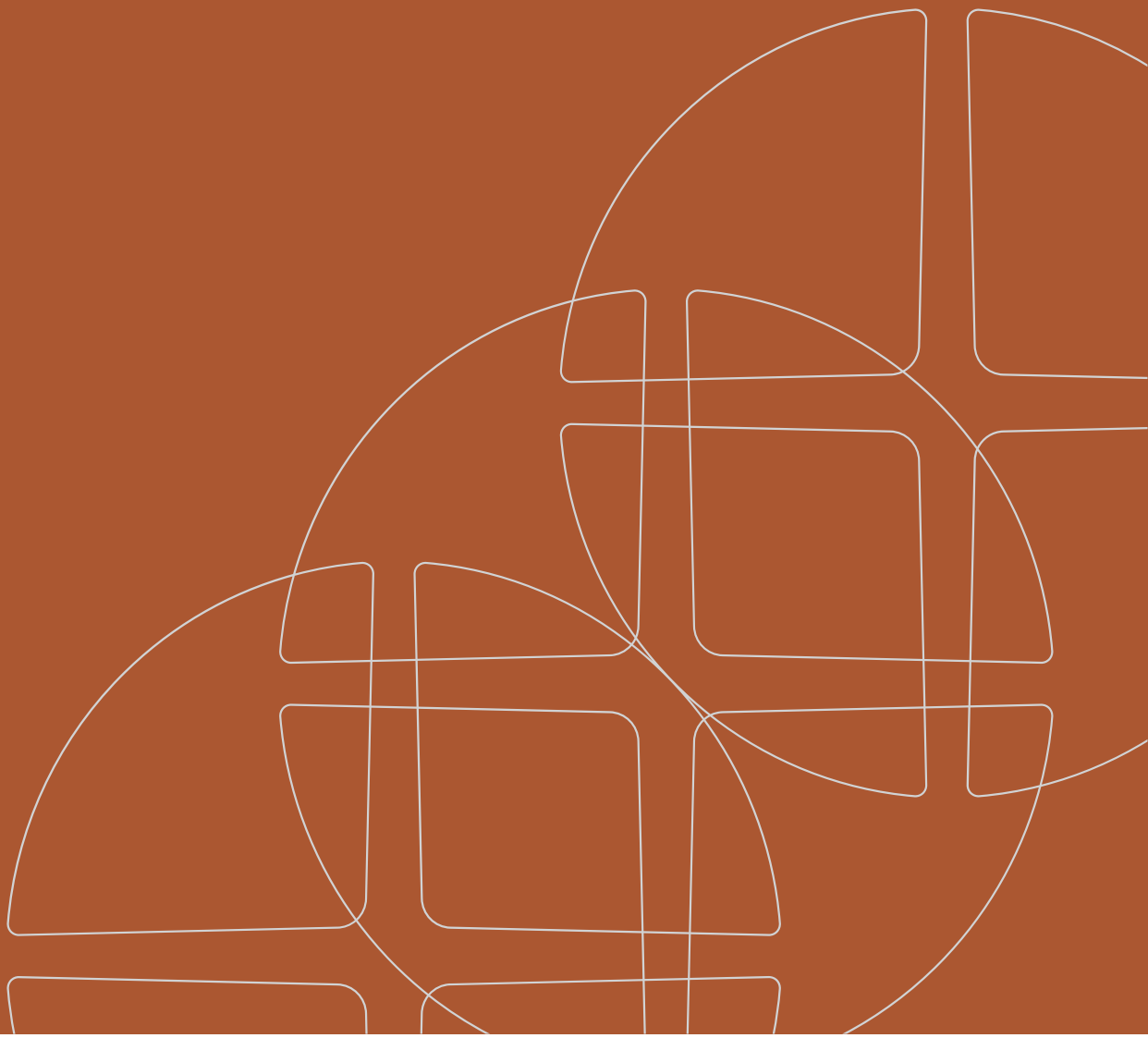
A hardpan layer was identified at numerous sampling locations within the undulating Stony Plain SLA, typically present at approximately 25 to 30 cm depth across the study area. If there is a deficit of benign waste rock for rehabilitation purposes this hardpan material may be a valuable resource for near-surface rehabilitation activities. It is understood that investigations are currently being undertake into the volumes of hardpan material likely to be available and to confirm suitability as a rehabilitation resource.

Preliminary volumes of soil resources likely to be available have been calculated, based on the information derived from the soil survey, aerial imagery, landscape photography and site topography. The preliminary topsoil volumes are presented in a topsoil inventory (Section 5.3).

It is recommended that:

- The upper 0.2m (topsoil) of the soil profiles within all of the proposed disturbance areas is stripped (where possible) and stockpiled for use as a surface rehabilitation medium. Soils from the Undulating Low Hills SLA should be stockpiled separately to the soils from the Undulating Stony Plain SLA. If future disturbance is planned in the Outcropping Low Rises and Major Drainage Tracts SLAs, soils from these SLAs should be stockpiled separately from the Undulating Low Hills SLA.
- Consideration should be given to salvage and stockpile of hardpan and / or near-surface competent rock materials present within the pit footprints as a source of surface armour / rehabilitation material, if required.
- Prior to soil salvage operations, areas of available topsoil within each disturbance footprint should be demarcated in the field, to facilitate collection of the maximum volume of material possible. The actual volume of topsoil salvaged from each disturbance footprint should then be updated within the inventory and balanced against the volume of soil required for rehabilitation works, to facilitate optimal application of soil rehabilitation resources.

Introduction



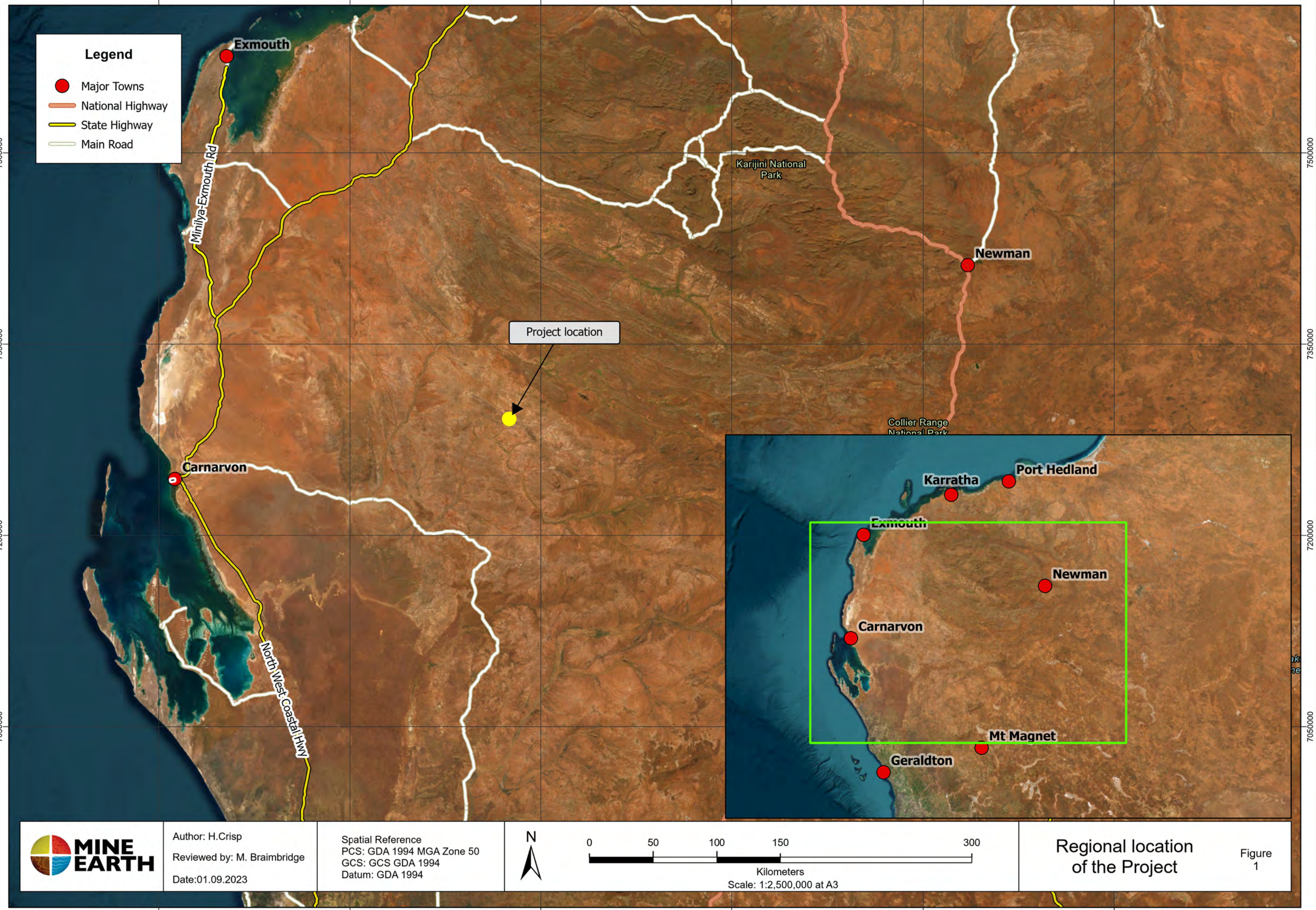
1. Introduction

Electrostate Malinda Pty Ltd (a subsidiary of Delta Lithium) (Electrostate) are developing the Yinnetharra Lithium Project (the Project) located approximately 260 km from Carnarvon in the Gascoyne region of Western Australia. (Figure 1). Electrostate is proposing to develop the Project to include pits, waste rock landforms, processing facilities, workshops, administration and other infrastructure. Mine Earth was commissioned to complete a baseline soil assessment for the Project. The study area for the soil and landform assessment comprised tenements E09/2169 and E09/2283, with a total area of 6,548 ha (Figure 1).

An assessment of the physical and chemical characteristics of the soil resources associated with the Project was undertaken to identify likely soil management requirements, develop appropriate rehabilitation prescriptions, and fulfil requirements for future regulatory approval.

This report includes:

- A description of the study area and summary of regional soil and landform information.
- A description of the materials and methods used during the sampling and analysis stages.
- A description of surface soil physical characteristics including surface soil profile morphology, soil texture, soil structure, structural stability, and hydraulic conductivity.
- A description of the surface soil chemical characteristics including pH, electrical conductivity, organic matter, exchangeable cations, exchangeable sodium percentage, and plant-available nutrients.
- Recommendations for soil resource management, including topsoil stripping, handling and placement as a rehabilitation resource.
- A preliminary topsoil inventory, detailing the approximate volumes of topsoil resources available for salvage from each of the major disturbance areas.


Legend
Major Towns
National Highway
State Highway
Main Road
Exmouth
Minilya-Exmouth Rd
Karijini National Park
Newman
Project location
Collier Range National Park
Carnarvon
North West Coastal Hwy
Karratha
Port Hedland
Exmouth
Newman
Carnarvon
Mt Magnet
Geraldton
150000
300000
450000
600000
750000
900000
7500000
7350000
7200000
7050000
MINE EARTH
Author: H.Crisp
Reviewed by: M. Braimbridge
Date:01.09.2023
Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994
N
0 50 100 150 300
Kilometers
Scale: 1:2,500,000 at A3
Regional location of the Project
Figure 1

Legend

- Proposed Pits
- Topsoil Stockpile
- Waste Rock Landforms
- Study Area

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Proposed Disturbance and Study Area

Figure 2

N

0 1,000 2,000 3,000

Meters

Scale: 1:48,000 at A3

Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994

Author: S. Parnaby
Reviewed by: S. Perry
Date:29.10.2024

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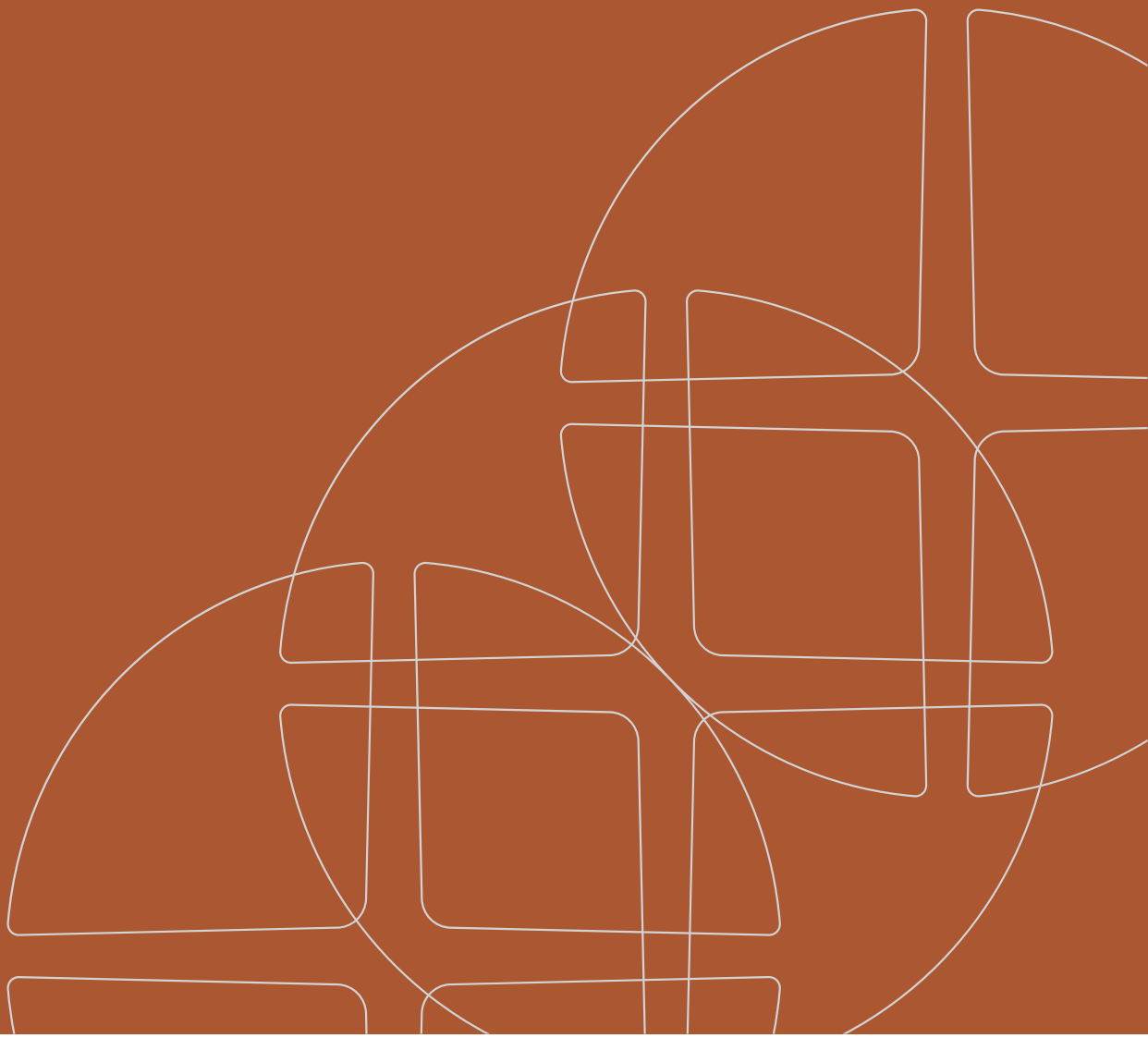
Description of Study Area



2. Description of Study Area

2.1 Climate

The closest active Bureau of Meteorology (BOM) weather station to the study area is located at Gascoyne Junction (approximately 125km west-southwest). The climate at Gascoyne Junction is classified as arid desert, with hot summers, cool winters and both summer and winter rainfall (BOM, 2024).

The Gascoyne Junction meteorological station records a mean monthly maximum temperature ranging from 40.7°C in January to 23.0°C in July (BOM, 2024). Mean total annual rainfall for this region is 210.4 mm, ranging between a maximum average monthly rainfall of 31.1 mm in June and a minimum of 2.9 mm in September (Figure 3).

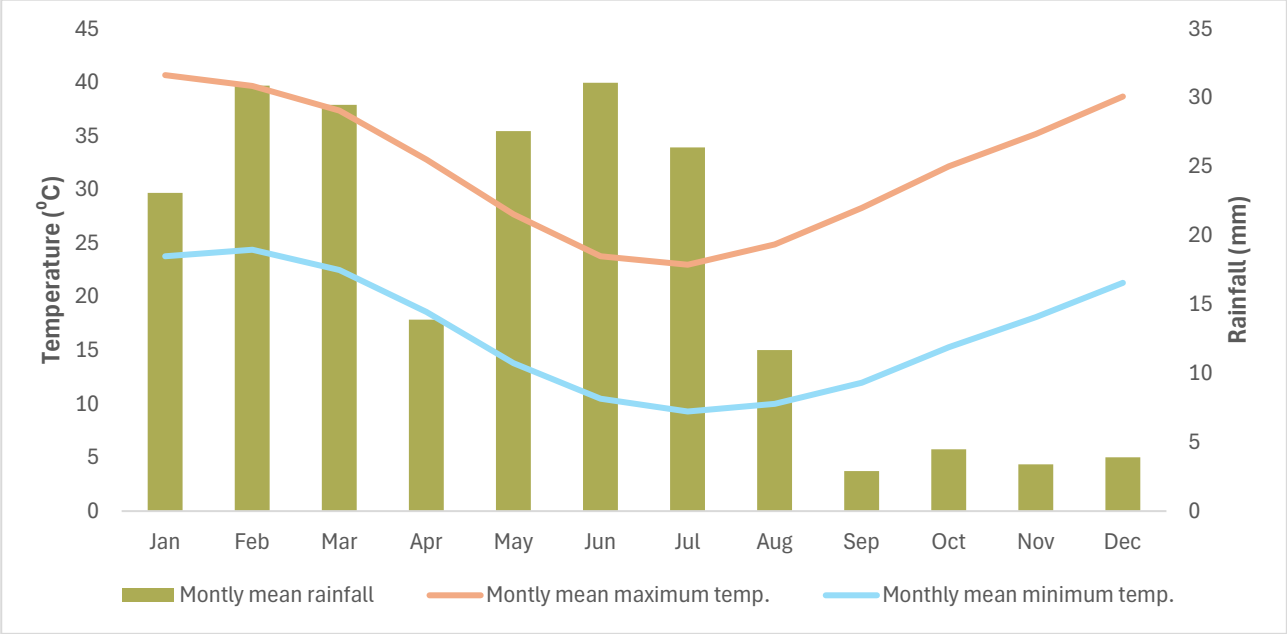


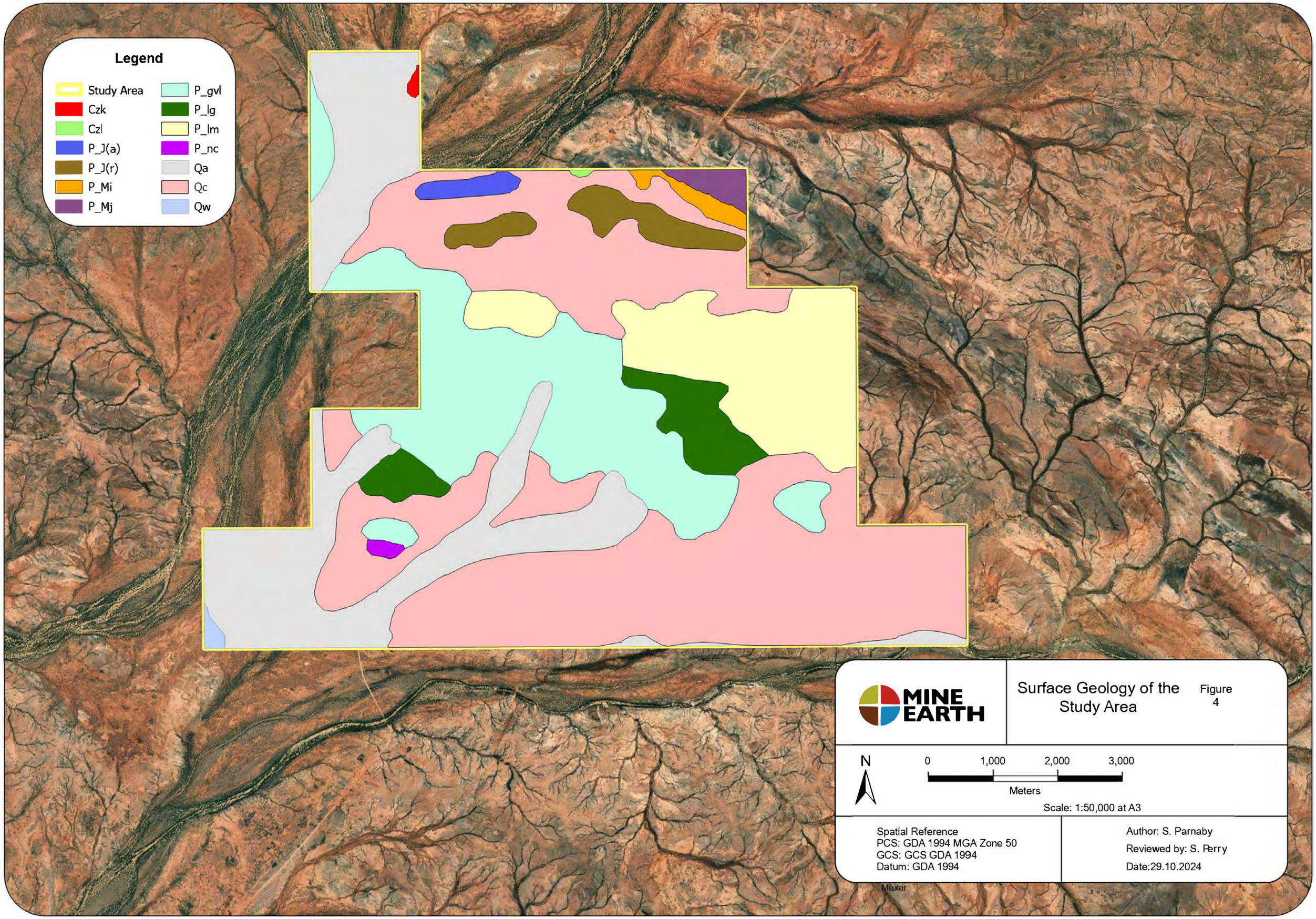
Figure 3: Climate summary for Gascoyne Junction (BOM Station ID: 006022)

2.2 Surface geology

The surface geology mapping for the region indicates that there are 13 surface geology units within the study area as outlined in Table 1 and Figure 4 (DEMIRS, 2024). The largest proportion of geological unit found in the study area (42% of total area) is comprised of the Qc unit described as *Colluvium unconsolidated silt, sand, gravel and rubble forming scree or talus slopes.*

Table 1: Surface geology units within the study area

Unit code	Description	Area (ha)	Percent of total study area (%)
Czk	Czk - Calcrete and kankar, in part replaced by opaline silica.	6	<1%
Czl	Czl - Laterite and ferruginous deposits.	3	<1%
P_J(a)	P_J(a) - Mt James formation: Metamorphosed, foliated quartz arenite, with thin metaconglomerate lenses in some areas.	45	1%
P_J(r)	P_J(r) - Mt James formation: Metaconglomerate, polymitic.	167	3%
P_Mi	P_Mi - Irregular Formation: dolomite, with shale and minor arenite, stromatolites present	45	1%
P_Mj	P_Mj - Jillawara Formation: shale and siltstone with minor chert.	47	1%
P_gvl	P_gvl - Biotite-tourmaline-muscovite granite and adamellite; porphyritic and seriate, coarse to fine grained.	1,169	18%
P_lg	P_lg - Quartz-biotite-muscovite-garnet (-staurolite-andalusite-chlorite-sillimanite-cordierite) schist.	240	4%
P_lm	P_lm - Quartz-muscovite-biotite (-sericite-chlorite-andalusite-garnet-tourmaline) schist, includes prograde and retrograde assemblages.	752	11%
P_nc	P_nc - Actinolite-tremolite-quartz-feldspar-clinopyroxene-sphene compositionally layered assemblages; calc-silicate gneiss and granofels.	12	<1%
Qa	Qa - Alluvium unconsolidated silt sand and gravel associated with water courses.	1,283	20%
Qc	Qc - Colluvium unconsolidated silt, sand, gravel and rubble forming scree or talus slopes	2,765	42%
Qw	Qw - Alluvium unconsolidated silt and sand in sheet wash piedmont overlaying tertiary hardpan surfaces often with banks of windblown sand.	13	<1%


Legend
Study Area
Czk
Czl
P_J(a)
P_J(r)
P_Mi
P_Mj
P_gvl
P_lg
P_lm
P_nc
Qa
Qc
Qw
MINE EARTH
Surface Geology of the Study Area
Figure 4
N
0
1,000
2,000
3,000
Meters
Scale: 1:50,000 at A3
Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994
Author: S. Parnaby
Reviewed by: S. Perry
Date:29.10.2024
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2.3 Bioregion

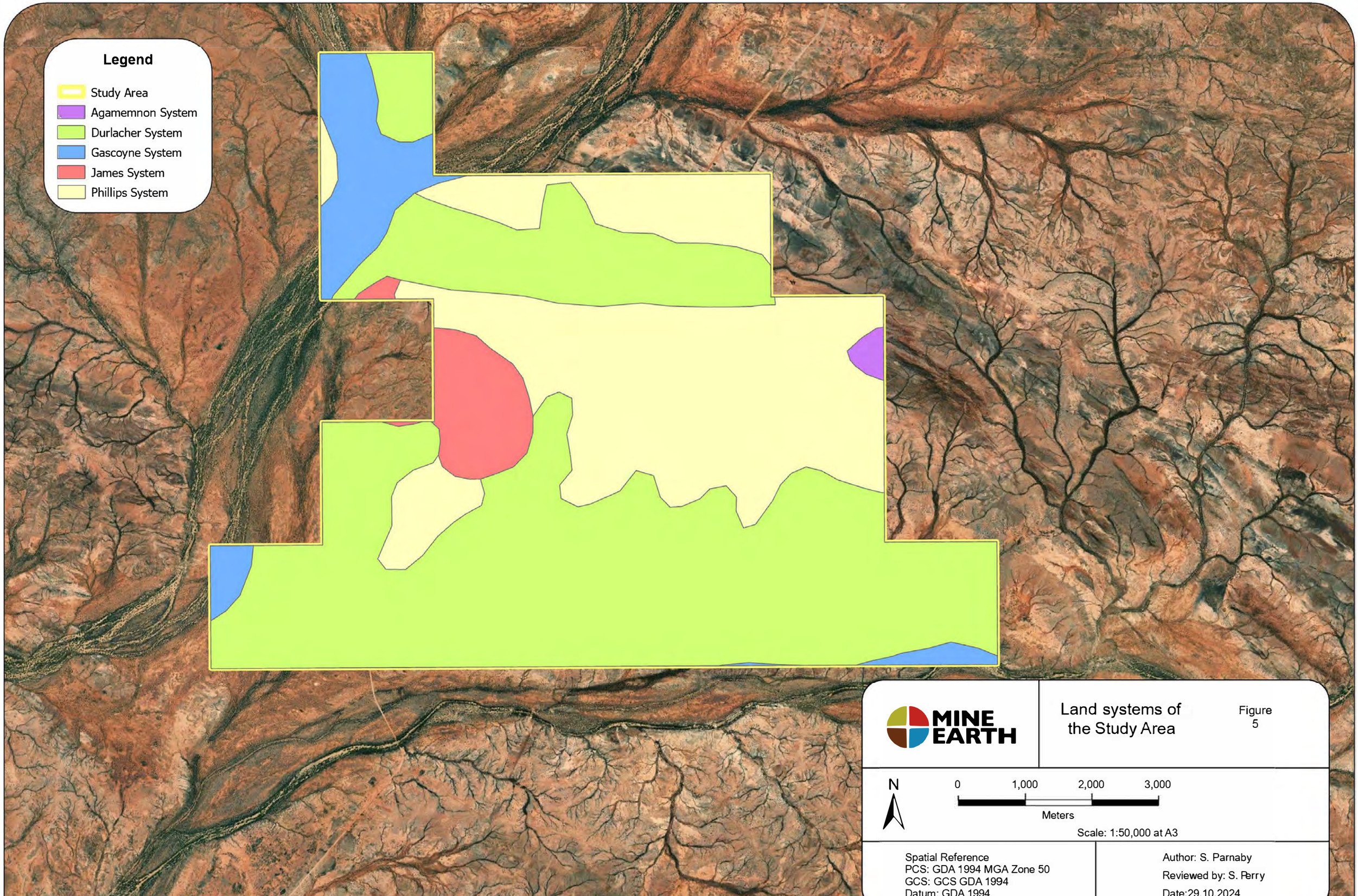
The Project is situated within the Augustus subregion of the Gascoyne bioregion according to the Interim Biogeographic Regionalisation for Australia (IBRA) (McKenzie, May, & McKenna, 2003). This subregion is described as southern and inland sections of the Bangemall Basin (shales, sandstone and carbonates). It also includes the Narryera Complex and Bryah Basin of the Proterozoic Capricorn Orogen (on northern margin of the Yilgarn Craton), as well as the Archaean Marymia and Sylvania Inliers. Although the Gascoyne River System provides the main drainage of this sub-region, it is also the headwaters of the Ashburton and Fortescue Rivers. There are extensive areas of alluvial valley-fill deposits. Mulga woodland with *Triodia* occur on rises, while the plains are covered by Mulga parkland. The region experiences a desert climate with biomodal rainfall (McKenzie, Keighery, & Gibson, 2000).

2.4 Land systems

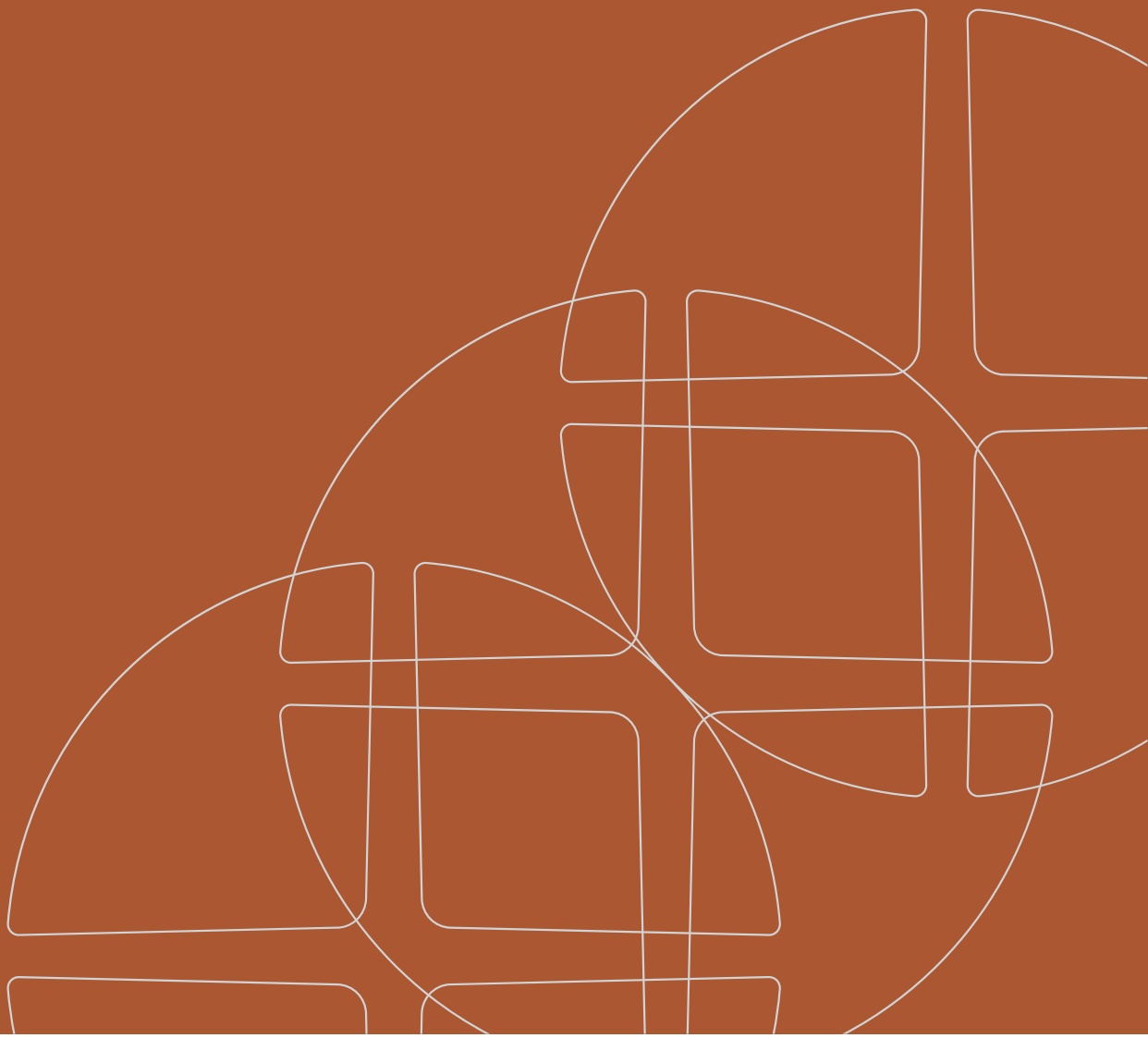
Land systems within the study area are described in Table 2 and shown on Figure 5.

Table 2: Land system descriptions and areas

Landsystem	Description	Area (ha) in Study Area	Percent of total study area (%)
Durlacher	Stony plains, lower tributary drainage plains and low stony rises, supporting scattered tall shrublands of mulga, other acacias and chenopod low shrubs.	3,702	56%
Phillips	Low hills and undulating uplands on gneiss and quartz supporting mulga and other acacia tall shrublands.	2,090	32%
Gascoyne	River channels and associated narrow alluvial plains and inclusions, supporting river redgum fringing woodlands, also mulga and other acacias, Senna spp. and buffel grass.	444	7%
James	Low hills, ridges and tors of granite and quartz, with stony lower plains, rises and drainage floors, supporting scattered tall shrublands of mulga and other acacias.	282	4%
Agamemnon	Rocky hills, with peaks and ridges above extensive stony slopes, supporting scattered tall shrublands of mulga and other acacias.	28	<1%


Legend
Study Area
Agamemnon System
Durlacher System
Gascoyne System
James System
Phillips System
MINE EARTH
Land systems of the Study Area
Figure 5
N
0
1,000
2,000
3,000
Meters
Scale: 1:50,000 at A3
Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994
Author: S. Parnaby
Reviewed by: S. Perry
Date:29.10.2024
Maxar

Materials and Methods



3. Methods and Materials

3.1 Sampling regime

Soil samples were collected by Mine Earth personnel from 27 sites within the study area in August 2024 (Figure 6). Details of sample locations, descriptions and photographs of the soil profiles at each location are included in Appendix A. Sampling sites were focussed within and surrounding the proposed disturbance areas within the study area. Soil pits were excavated at each sampling location to a maximum depth of 1.5m for the mechanical excavation sites, or to approximately 30 cm at those sites excavated using hand tools.

3.2 Test work and procedures

Laboratory test work on the sampled soils was conducted at the Mine Earth laboratory for soil physical parameters and sent to the CSBP Laboratory for analysis of chemical parameters.

Laboratory based soil analyses included:

- Physical characteristics:
    - Soil texture and particle size distribution (Including coarse rock fraction >2 mm).
    - Emerson Aggregate test to indicate soil structural stability and potential for clay dispersion upon saturation.
    - Saturated hydraulic conductivity.
    - Soil strength (modified Modulus of Rupture).
- Chemical characteristics:
    - pH and electrical conductivity.
    - Effective cation exchange capacity and exchangeable sodium percentage (ESP).
    - Total organic carbon (to indicate organic matter content).
    - Plant-available nutrients (N, P, K, S).
    - Total metal concentrations.

All physical soil test work was conducted in accordance with standard analytical procedures to assess potential soil erodibility and soil properties related to the support of plant growth (Rayment & Lyons, 2010). Descriptions of relevant soil classification categories are detailed in Appendix B. All external laboratory results for the soils sampled are provided in Appendix C.

Legend

- Sampling Locations
- Study Area

YIN24
YIN28
YIN23
YIN12
YIN11
YIN19
YIN07
YIN20
YIN08
YIN05
YIN09
YIN06
YIN10
YIN04
YIN03
YIN01
YIN02
YIN25
YIN18
YIN29
YIN14
YIN26
YIN16
YIN15
YIN31
YIN13
YIN27

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Sampling Locations

Figure 6

N

0 1,000 2,000 3,000

Meters

Scale: 1:33,000 at A3

Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994

Author: S. Parnaby
Reviewed by: S. Perry
Date:28.10.2024

Maxar

Results and discussion

4. Results and discussion

The findings of the soil survey and laboratory test work program are presented and discussed in the following sections.

4.1 Notes on data interpretation

The results in this section are presented in tabulated form and, where applicable, in a ternary graph (soil texture triangle). The ternary figure in section 4.3.1 is a categorical diagram utilising the three particle size ranges of soils (< 2 mm fraction), classified as Sand, Silt and Clay where the composite percentage of each size range from a sample is represented as the intersection of the three particle size categories. This intersection defines the soil texture of the sampled material.

4.2 Soil profile morphology

Surface soils within the study area were variable in terms of their physical, chemical and morphological characteristics. The surface soils were grouped into five SLAs, primarily based on the morphology of the landscape within the study area. Namely, 'Undulating Stony Plain', 'Outcropping Low Rises', 'Undulating Low Hills', 'Major Channels' and 'Major Drainage Tracts' (Figure 7).

The characteristics of the soil profiles within each SLA are described below:

- Undulating Low Hills
  - Gently undulating low relief hills intersected with vegetated drainage lines.
  - Abundant surface mantle of mostly quartz coarse fragments with pockets of ironstone.
  - Shallow surface soils, with partially weathered / fractured rock present from 30-50 cm depth within the profile.
  - High percentage of coarse fragments (>2mm) through the surface soil profile.
  - Soils characterised as Red shallow loams (WA Soil Group 522).
- Undulating Stony Plain
  - Flat / low relief undulating stony plains.
  - Surface mantle of mostly quartz with pockets of ironstone and other coarse rock fragments.
  - Shallow surface soils, with hardpan typically present >25 cm depth.
  - Low to moderate amounts of coarse rock fragments (>2mm) through top 0-20 cm of soil profile.
  - Soils characterised as Red shallow loams (WA Soil Group 522), Red-brown hardpan shallow loam (WA Soil Group 523) and Red loamy earths (WA Soil Group 544).
- Outcropping Low Rises
  - Low relief rocky rises.
  - Surface mantle of quartz and ironstone.
  - Shallow surface soils over hardpan / partially weathered rock.
  - High percentage of competent rock fragments within the top 10 cm of the soil profile, with a lower percentage of fragments below 10 cm depth.
  - Areas of outcropping granite present in some areas.
  - Soils characterised as Red-brown hardpan shallow loam (WA Soil Group 523).

- Major Drainage Tracts
  - Broad, shallow, un-channelled drainage tracts, typically draining in a southerly direction towards major channels.
  - Generally, well vegetated with trees and shrubs.
  - Typically, loamy soils with a surface mantle of quartz and ironstone in higher landscape positions.
  - Fewer coarse fragments throughout the soil profile (>2mm).
  - Soils characterised as Red loamy earths (WA Soil Group 544).
- Major Channels
  - Major alluvial ephemeral channels.
  - Sandy substrate.
  - Soils characterised as No suitable group (dry river bed) (WA Soil Group 703).

Legend

- Proposed Pits
- Topsoil Stockpile
- Waste Rock Landforms
- Major Channels
- Major Drainage Tracts
- Outcropping Low Rises
- Undulating Low Hills
- Undulating Stony Plain

MINE EARTH

SLAs within the Study Area

Figure 7

N

0 1,000 2,000 3,000

Meters

Scale: 1:48,000 at A3

Spatial Reference
PCS: GDA 1994 MGA Zone 50
GCS: GCS GDA 1994
Datum: GDA 1994

Author: S. Parnaby
Reviewed by: S. Perry
Date:04.11.2024

Earthstar Geographics, Maxar

4.3 Soil physical characteristics

The physical characteristics of the surface soils within the study area, as defined by the field sampling and laboratory analysis program are discussed in the following sections.

4.3.1 Soil texture

Soil texture describes the proportions of sand, silt and clay (the particle size distribution) within the <2 mm fraction of a soil. The particle size distribution and resulting textural class of a soil is an important factor influencing most physical, and many chemical and biological, properties. Soil structure, water holding capacity, hydraulic conductivity, soil strength, fertility, erodibility, and susceptibility to compaction are some of the factors closely linked to the texture of a soil material.

There were a range of soil textures recorded throughout the study area, with textures of collected samples ranging from 'sand' (approximately 0-10% clay) to 'clay' (up to 55% clay) (Figure 8). There was little consistent difference in the clay content of the soils from the different SLAs (Figure 9). On average, clay content increased slightly with sampling depth and was relatively consistent across all SLAs (Figure 9).

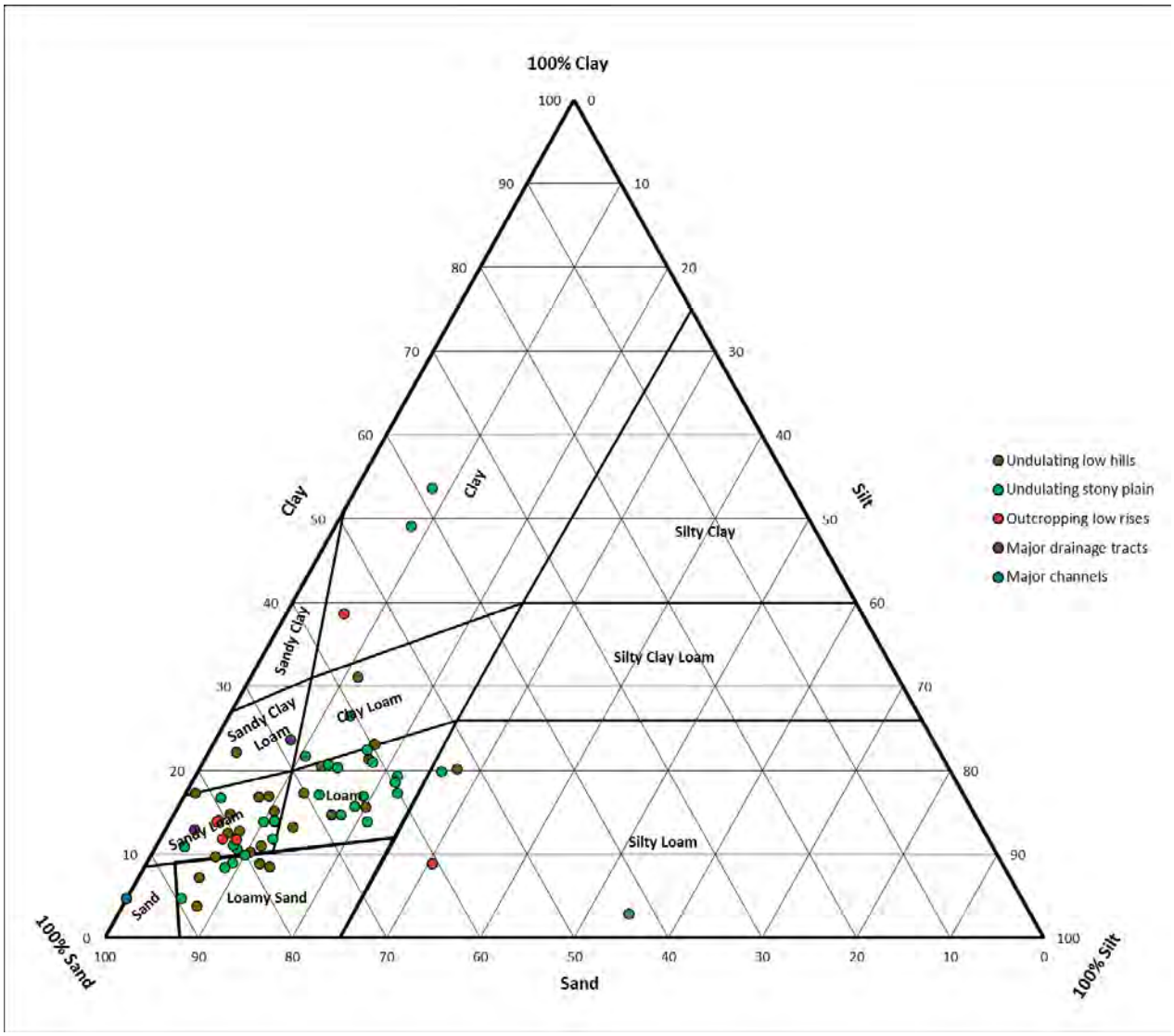


Figure 8: Soil texture triangle

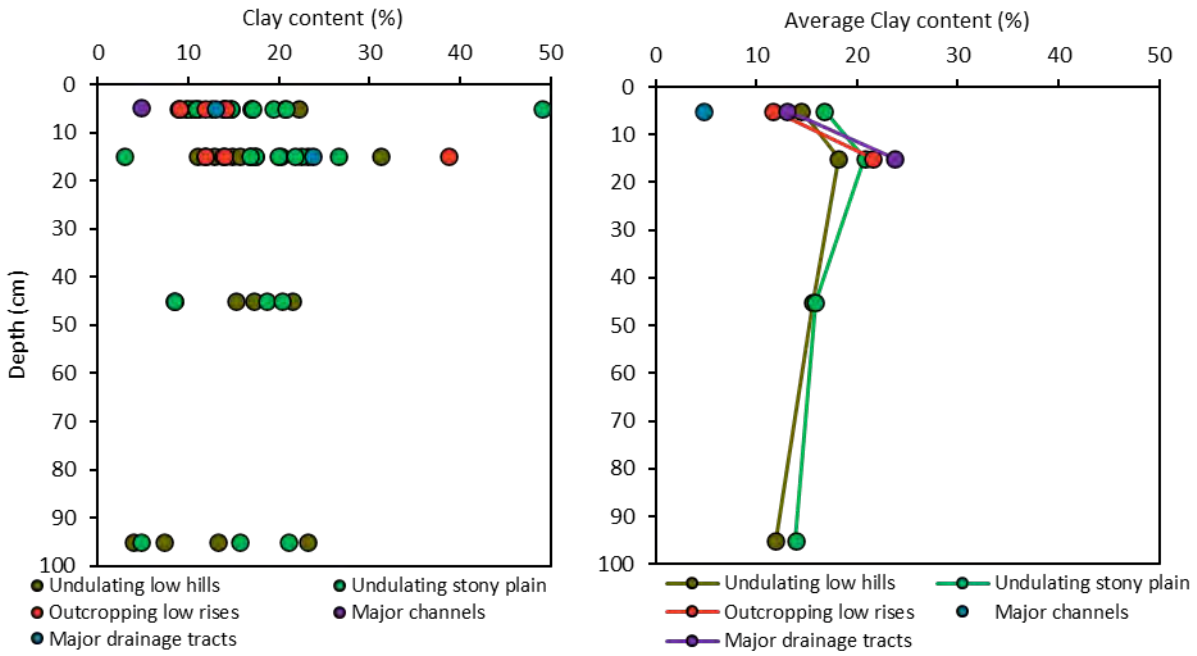


Figure 9: Individual and average clay contents for each SLA by depth

4.3.2 Soil structure

Soil structure describes the arrangement of solid particles and void space in a soil. It is an important factor influencing the ability of soil to support plant growth, store and transmit water and resist erosional processes. A well-structured soil is one with a range of different sized aggregates; with component particles bound together to give a range of pore sizes facilitating root growth and the transfer of air and water.

Soil structure can be influenced by the particle size distribution, chemical composition, and organic matter content of a soil. Soil structure is often influenced by root growth, vehicle compaction and, with respect to reconstructed soil profiles, the methods of soil handling and deposition. When a soil material is disturbed, the breakdown of aggregates into primary particles can lead to structural decline (Moore, 1998). This can result in hard-setting and crusting at the soil surface and a 'massive' soil structure at depth, potentially reducing the ability of seeds to germinate, roots to penetrate the soil matrix and water to infiltrate to the root zone.

The surface soils within the study area were typically characterised by having a weak to moderate structure with an increase in strength with depth (Appendix A).

4.3.3 Structural stability

The structural stability of a soil and its susceptibility to structural decline is complex and depends on the net effect of several properties, including the amount and type of clay present, organic matter content, soil chemistry and the nature of disturbance. Soil aggregates that slake and, particularly those that disperse, indicate a weak soil structure that is easily degraded. These soils should be seen as potentially problematic when used as a rehabilitation medium, particularly if left exposed at the surface.

The Emerson Aggregate Test identifies the potential slaking and dispersive properties of soil aggregates. The dispersion test identifies the properties of the soil materials under a worst-case scenario, where severe stress is applied to the soil material. Generally, samples allocated into Emerson Classes 1 and 2 are those most likely to exhibit dispersion of the clay sized fraction and therefore be the most problematic.

Most surface soils from the study area were identified as Emerson Class 3a or 3b, indicating that the soils are not prone to dispersion in their natural state but may become more dispersive following repeated severe disturbance (e.g., earth works). A small number of samples were identified as Emerson Class 5 and 6,

indicating a tendency to disperse only when saturated and subject to severe disturbance. Thirteen samples were classified as Emerson Class 2 indicating that those soils are susceptible to partial dispersion in their natural state. Four samples were classified as Emerson Class 1, indicating that these soils are susceptible to complete dispersion of the clay fraction in their natural state. In general, care should be taken to minimise the handling of all soil materials where possible, particularly when wet.

Table 3 Soil texture, clay content and Emerson Test Class

Sample ID	Depth interval (cm)	SLAs	Soil texture (<2mm soil fraction)	Clay content (%)	Emerson Class
YIN-01	0-10	Undulating Low Hills	Loam	20.6	2
	10-20		Clay Loam	23.1	3b
	40-50		-	-	5
	90-100		Loamy Sand	3.9	3b
YIN-02	0-10	Undulating Low Hills	Loamy Sand	8.9	3b
	10-20		Silty Loam	20.2	3b
	40-50		Sandy Loam	15.2	5
	90-100		Loamy Sand	7.3	3a
YIN-03	0-10	Undulating Low Hills	Sandy Loam	9.7	3a
	10-20		Sandy Loam	11.1	3a
	40-50		-	-	3a
YIN-04	0-10	Undulating Low Hills	Sandy Clay Loam	22.2	3a
	10-20		Sandy Loam	14.8	3a
	40-50		Sandy Clay Loam	17.3	3a
YIN-05	0-10	Undulating Low Hills	Sandy Loam	16.9	3a
	10-20		Sandy Loam	16.9	3a
	40-50		-	-	3a
YIN-06	0-10	Undulating Low Hills	Sandy Loam	10.3	3b
	10-20		Loam	17.3	3b
	40-50		Loamy Sand	8.5	3a
YIN-07	0-10	Undulating Low Hills	Sandy Loam	12.5	2
	10-20		Sandy Loam	12.8	3a
	40-50		-	-	3a
	90-100		Loam	13.3	3a
YIN-09	0-10	Undulating Low Hills	Sandy Loam	13.9	2
	10-20		Clay Loam	31.2	5
	40-50		-	-	3a
YIN-10	0-10	Undulating Low Hills	Loam	14.7	3a
	10-20		Loam	15.7	5
	40-50		Loam	21.4	3a
	90-100		Loam	23.2	5
YIN-08	0-10	Undulating stony plain	Loam	13.9	1
	10-20		Loam	22.5	3b
	40-50		Loamy Sand	8.5	3a
	90-100		Loamy Sand	4.8	3a

Sample ID	Depth interval (cm)	SLAs	Soil texture (<2mm soil fraction)	Clay content (%)	Emerson Class
YIN-11	0-10	Undulating stony plain	Loam	19.4	2
	10-20		Silty Loam	2.9	3b
	40-50		Loam	18.6	3a
	90-100		Loam	20.9	3b
YIN-12	0-10	Undulating stony plain	Sandy Loam	10.7	3b
	10-20		Clay Loam	21.8	2
	40-50		Loam	20.4	3b
	90-100		Loam	15.7	3a
YIN-13	0-10	Undulating stony plain	Loam	17.0	2
	10-20		Loam	17.3	2
YIN-14	0-10	Undulating stony plain	Sandy Loam	14.0	3a
	10-25		-	-	5
YIN-15	0-10	Undulating stony plain	Loam	17.1	1
	10-25		Silty Loam	19.9	2
YIN-16	0-10	Undulating stony plain	Sandy Loam	11.1	1
	10-25		Sandy Loam	13.9	2
YIN-19	0-10	Undulating stony plain	Loam	14.7	3a
	10-25		Clay Loam	26.6	5
YIN-23	0-10	Undulating stony plain	Sandy Loam	9.9	3b
	10-20		Loam	11.9	5
YIN-24	0-10	Undulating stony plain	Clay	49.1	5
	10-25		Clay	53.7	5
YIN-26B	0-10	Undulating stony plain	Sandy Loam	10.9	5
	10-25		Sandy Loam	16.8	6
YIN-28	0-10	Undulating stony plain	Loam	20.7	3b
	10-25		-	-	3b
YIN-29	0-10	Undulating stony plain	Loamy Sand	9.0	3a
	10-20		-	-	6
YIN-18	0-10	Outcropping Low Rises	Loamy Sand	8.9	2
	10-25		Sandy Loam	13.9	1
YIN-20	0-10	Outcropping Low Rises	Sandy Loam	14.1	2
	10-20		Clay	38.7	5
YIN-25	0-10	Outcropping Low Rises	Sandy Loam	11.9	3a
	10-20		Sandy Loam	11.8	2
	0-10 (River	Major Channels	-	4.8	-
YIN-27	0-10	Major Drainage Tracts	Sandy Loam	13.0	2
	10-20		Sandy Clay Loam	23.7	5

[1] Class 1 – complete dispersion of natural aggregate
Class 2 – partial dispersion of natural aggregate
Class 3a - aggregate slakes but does not disperse, complete dispersion of remoulded soil
Class 3b - aggregate slakes but does not disperse, partial dispersion of remoulded soil
Class 5 - aggregate slakes but does not disperse, no dispersion of remoulded soil, soil:water suspension remains dispersed
Class 6 - aggregate slakes but does not disperse, no dispersion of remoulded soil, soil:water suspension remains flocculated

4.3.4 Hydraulic conductivity

Hydraulic conductivity (K_{sat}) refers to the saturated permeability of soil, or the ability of water to infiltrate and drain through the soil matrix and is dependent on soil properties such as texture and structure (Moore, 2004). Freely draining soils with high K_{sat} values will generally be less susceptible to surface runoff and erosion. Slow draining soils with low K_{sat} values, are more likely to experience waterlogging, increased surface runoff and erosion.

The hydraulic conductivity of the tested samples was highly variable, ranging between 0.6 and 3,759.5 mm/hr, with an average of 111.9 mm/hr (Table 4). Drainage classes were determined according to their K_{sat} (Hunt, N and Gilkes, R, 1992) (Table 4). The majority of samples were classified as having either a 'moderate' or 'moderately slow' drainage class. The sample from the Major Channels SLA was omitted from Figure 10, as it was a severe outlier with a very rapid drainage class (K_{sat} of 3,759.5 mm/hr).

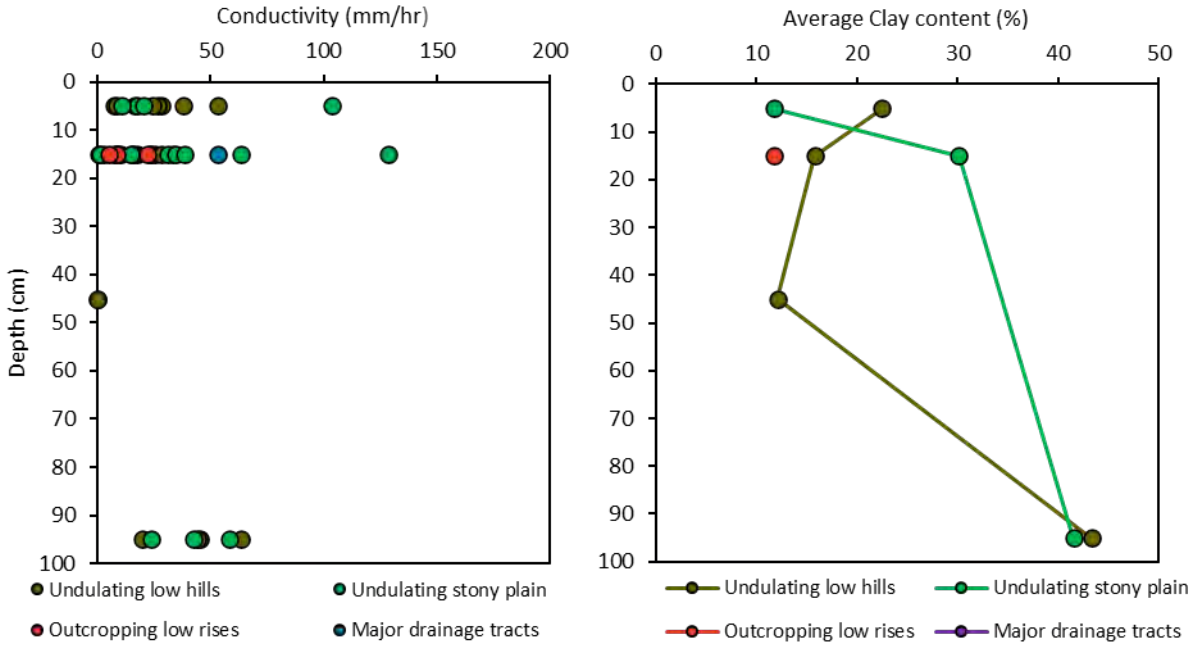


Figure 10: Individual and average K_{SAT} for each SLA by depth

Table 4 Saturated hydraulic conductivity (K_{sat})

Sample ID	Depth interval (cm)	SLA	Clay content (%)	K_{SAT} (mm/hr)	Drainage Class[1]
YIN-01	0-10	Undulating Low Hills	20.6	7.4	Moderately slow
	40-50		-	63.3	Moderately rapid
	90-100		3.9	28.1	Moderate
YIN-02	0-10	Undulating Low Hills	8.9	7.5	Moderately slow
	40-50		15.2	45.5	Moderate
	90-100		7.3	37.8	Moderate
YIN-03	0-10	Undulating Low Hills	9.7	15.1	Moderately slow
	40-50		-	26.7	Moderate
YIN-04	0-10	Undulating Low Hills	22.2	25.4	Moderate
	40-50		17.3	24.2	Moderate

Sample ID	Depth interval (cm)	SLA	Clay content (%)	K_{SAT} (mm/hr)	Drainage Class[1]
YIN-05	0-10	Undulating Low Hills	16.9	23.5	Moderate
	40-50		-	53.3	Moderate
YIN-06	0-10	Undulating Low Hills	10.3	24.1	Moderate
	40-50		8.5	16.7	Moderately slow
YIN-07	0-10	Undulating Low Hills	12.5	28.1	Moderate
	40-50		-	44.2	Moderate
	90-100		13.3	17.7	Moderately slow
YIN-09	0-10	Undulating Low Hills	13.9	8.4	Moderately slow
	40-50		-	8.5	Moderately slow
YIN-10	0-10	Undulating Low Hills	14.7	10.2	Moderately slow
	40-50		21.4	20.1	Moderate
	90-100		23.2	10.7	Moderately slow
YIN-08	0-10	Undulating stony plain	13.9	3.0	Slow
	40-50		8.5	42.3	Moderate
YIN-11	0-10	Undulating stony plain	19.4	17.4	Moderately slow
	40-50		18.6	23.8	Moderate
	90-100		20.9	20.5	Moderate
YIN-12	0-10	Undulating stony plain	10.7	16.0	Moderately slow
	40-50		20.4	58.5	Moderate
	90-100		15.7	103.6	Moderately rapid
YIN-13	0-10	Undulating stony plain	17.0	33.2	Moderate
YIN-14	0-10	Undulating stony plain	14.0	31.2	Moderate
YIN-15	0-10	Undulating stony plain	17.1	0.6	Very slow
YIN-16	0-10	Undulating stony plain	11.1	34.3	Moderate
YIN-19	0-10	Undulating stony plain	14.7	9.3	Moderately slow
YIN-23	0-10	Undulating stony plain	9.9	128.7	Rapid
YIN-24	0-10	Undulating stony plain	49.1	1.2	Very slow
YIN-26B	0-10	Undulating stony plain	10.9	63.6	Moderately rapid
YIN-28	0-10	Undulating stony plain	20.7	38.4	Moderate
YIN-29	0-10	Undulating stony plain	9.0	14.9	Moderately slow
YIN-18	0-10	Outcropping Low Rises	8.9	8.4	Moderately slow
YIN-20	0-10	Outcropping Low Rises	14.1	5.0	Moderately slow
YIN-25	0-10	Outcropping Low Rises	11.9	22.1	Moderate
YIN-26	0-10	Major Channels	4.8	3,759.5	Very rapid

Sample ID	Depth interval (cm)	SLA	Clay content (%)	K_{SAT} (mm/hr)	Drainage Class[1]
YIN-27	0-10	Major Drainage Tracts	13.0	53.3	Moderate
Range			3.9 - 49.1%	0.59 - 3759.5 mm / hr	
Average			14.8%	111.9 mm / hr	

[1] (Hunt, N and Gilkes, R, 1992)

4.3.5 Soil strength

A modified Modulus of Rupture (MOR) test was conducted on the samples, representative of the various soil materials from across the study area. This test is a measure of soil strength and identifies the tendency of a soil to hard-set as a direct result of soil slaking and dispersion. An MOR of over 60 kPa has been described as the critical value for distinguishing potentially problematic soils in agricultural scenarios (Cochrane & Alymore, 1997). Restricted root penetration into the soil matrix is a likely consequence of a high modulus of rupture. In reconstructed soil profiles, materials normally deep within the profile that may have a high MOR can often be re-deposited closer to the surface, leading to germination / emergence and root penetration problems.

As this test is conducted on reconstructed soil blocks composed of the < 2 mm soil fraction, it does not take into account the effect of soil structure on soil strength, nor any degree of compaction that may be present in the field. It does, however, provide insight into the potential for soils to hard-set and compact with repeated wetting and drying cycles, and the ability of roots to fracture the soil and penetrate crack faces.

The results of the MOR test were variable across the SLAs and with sample depth, however the majority of the soils tested recorded MOR values below the 60 kPa threshold (Table 5). Three samples recorded MOR values above the 60 kPa threshold, indicating they are likely to hard-set with repeated wetting / drying cycles (two samples from 90-100 cm, one from 0-10 cm depth intervals). There was a no apparent correlation between MOR values and sample depth.

Table 5 Modulus of Rupture (soil strength)

Sample ID	Depth interval (cm)	SLA	Modulus of Rupture (kPa)[1]
YIN-01	0-10	Undulating Low Hills	40.0
	40-50		33.7
	90-100		29.3
YIN-02	0-10	Undulating Low Hills	37.5
	40-50		26.3
	90-100		**67.6**
YIN-03	0-10	Undulating Low Hills	1.6
	40-50		10.6
YIN-04	0-10	Undulating Low Hills	4.0
	40-50		26.4
YIN-05	0-10	Undulating Low Hills	6.0
	40-50		4.1
	0-10		11.4

Sample ID	Depth interval (cm)	SLA	Modulus of Rupture (kPa)[1]
YIN-06	40-50	Undulating Low Hills	35.4
YIN-07	0-10	Undulating Low Hills	22.0
	40-50		15.6
	90-100		18.5
YIN-09	0-10	Undulating Low Hills	24.8
	40-50		51.5
YIN-10	0-10	Undulating Low Hills	42.3
	40-50		36.0
	90-100		**73.5**
YIN-08	0-10	Undulating stony plain	57.2
	40-50		7.8
	90-100		23.8
YIN-11	0-10	Undulating stony plain	2.7
	40-50		14.3
	90-100		17.0
YIN-12	0-10	Undulating stony plain	8.0
	40-50		23.3
	90-100		4.0
YIN-13	0-10	Undulating stony plain	1.8
YIN-14	0-10	Undulating stony plain	3.8
YIN-15	0-10	Undulating stony plain	**114.5**
YIN-16	0-10	Undulating stony plain	7.4
YIN-19	0-10	Undulating stony plain	23.8
YIN-23	0-10	Undulating stony plain	2.3
YIN-24	0-10	Undulating stony plain	35.0
YIN-26B	0-10	Undulating stony plain	2.1
YIN-28	0-10	Undulating stony plain	10.8
YIN-29	0-10	Undulating stony plain	13.5
YIN-18	0-10	Outcropping Low Rises	13.7
YIN-20	0-10	Outcropping Low Rises	16.5
YIN-25	0-10	Outcropping Low Rises	6.9
YIN-26	0-10	Major Channels	0.0
YIN-27	0-10	Major Drainage Tracts	2.0
Range			0-114.5
Average			22.4

[1] Values above the threshold of 60kPa, in bold font, are identified as potentially hard-setting (Cochrane and Aylmore 1997).

4.4 Soil chemical characteristics

4.4.1 Soil pH and Electrical Conductivity

Soil pH (H_2O) measures the acidity or alkalinity of the soil in relation to suitability for plant growth. Ratings for soil pH are based on the Land Evaluation Standards for Land Resource Mapping categories (van Gool, 2005).

Soil pH (H_2O) was variable across the study area, with individual soil pH (H_2O) values ranging from pH 6.6 (classified as 'neutral') to pH 9.1 ('strongly alkaline'), with an average pH of 7.9 ('neutral'). Soil pH was relatively consistent with increasing sample depth (Figure 11).

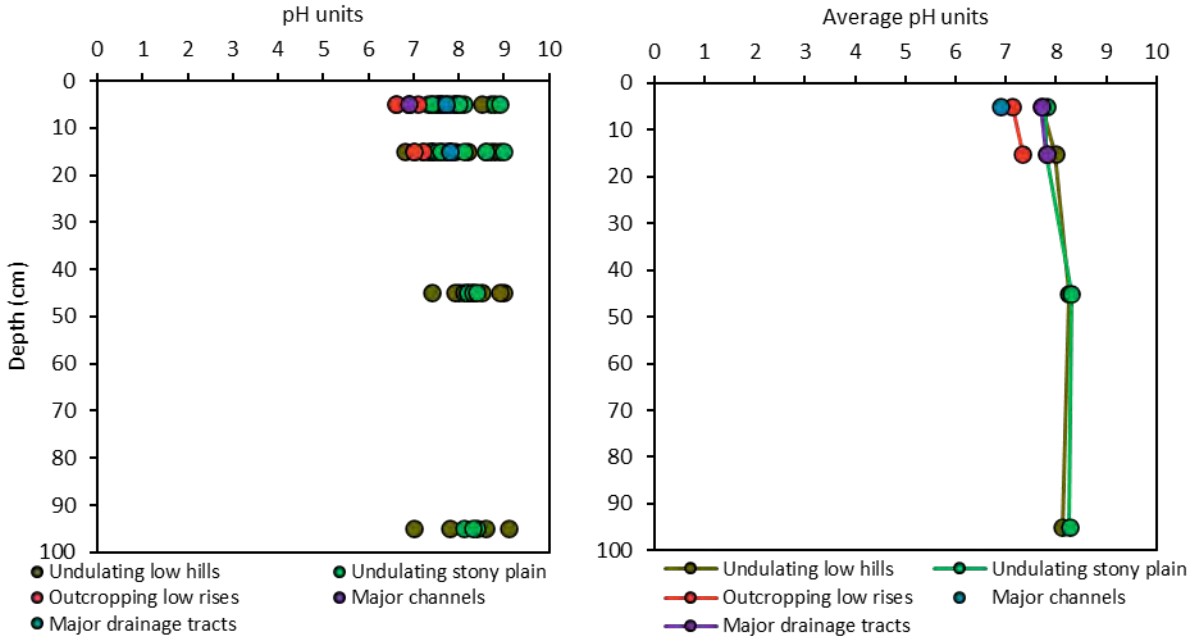


Figure 11 Soil pH (H_2O) of individual samples and average values for each SLA with depth

Electrical conductivity (EC) is a measurement of the soluble salts in soils or water. Soil salinity results from natural processes of landscape evolution, hydrological processes, and rainfall (Hunt, N and Gilkes, R, 1992).

The individual soil EC values from the study area ranged from below detection limit (<0.010 dS/m) to 16.16 dS/m, with an average of 1.43 dS/m across the study. While most samples were classified as 'non-saline'; eight samples were classified as 'slightly saline' (six from 'undulating low hills, two from 'undulating stony plain'), six were classified as 'moderately saline' (five from 'undulating stony plain', one from 'undulating low hills'), one was classified as 'highly saline' ('undulating stony plain') and one sample was classified as 'extremely saline' ('undulating stony plain') (based on the standard USDA and CSIRO electrical conductivity categories - Appendix A). As the only 'extremely saline' and 'highly saline' samples were taken at the 10-20 cm interval from the stony plain rise SLA, it significantly skews the data for that depth interval and SLA combination. There was no notable correlation of soil EC with depth found, however on average the soils from the 'undulating stony plain' SLA were more saline than soils from the other SLAs (Figure 12).

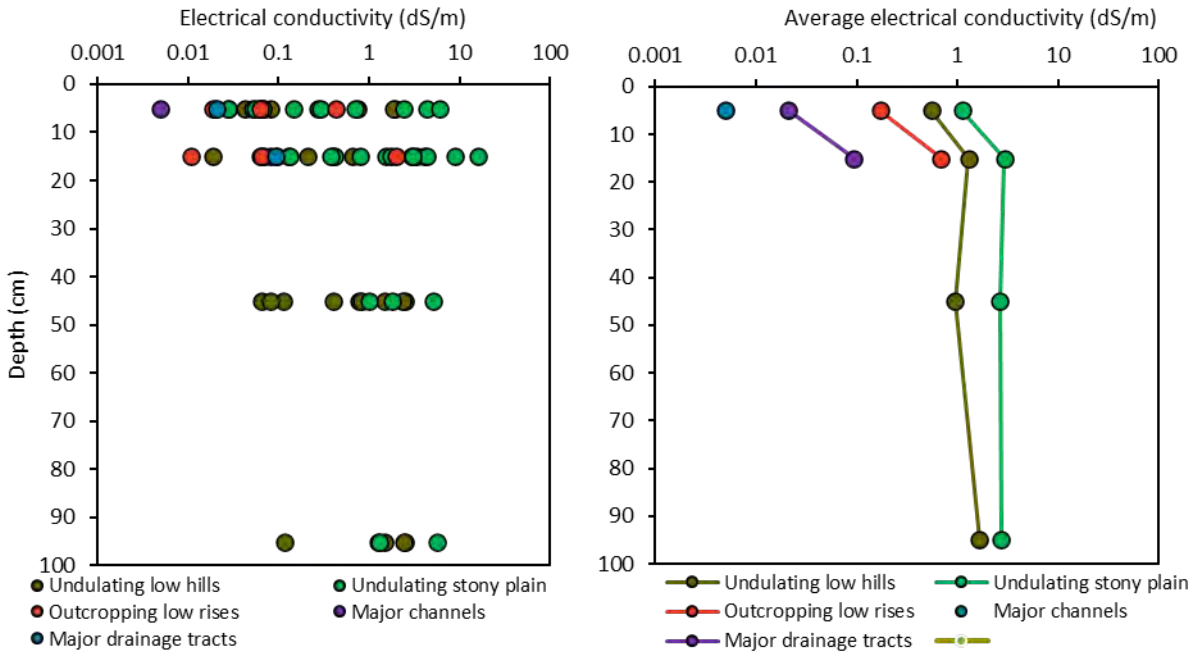


Figure 12 Electrical Conductivity (dS/m) of individual samples and average values for each SLA with depth (base 10 log

4.4.2 Soil Organic Matter

The organic matter content of soil is an important factor influencing many physical, chemical, and biological soil characteristics. Directly derived from plants and animals, its functions in soil include supporting the micro and macro fauna and flora populations, increasing the water retention capacity, buffering pH and improving soil structure.

The organic matter content of the soils within the study area was determined as a measure of the soil organic carbon percentage (SOC%). The SOC% of all soils sampled was low, as is typical of most highly weathered soils in the region, ranging between 0.025% and 0.40% with an average of 0.13%. The SOC% of the soils on average was consistent between all the SLAs. Minor increases in SOC% were noted between the 0-10 cm and 10-20 cm sampling intervals (for all SLAs except the Outcropping Low Rises). As would be expected there was steady decrease in SOC% below the surface soil horizons (Figure 13).

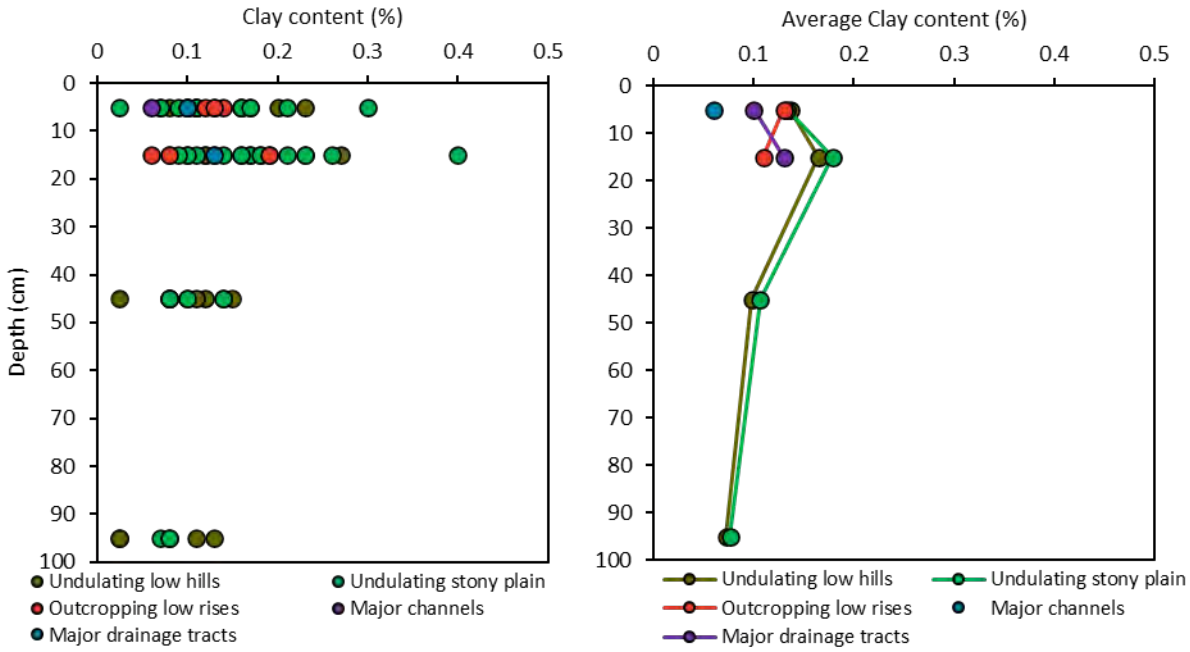


Figure 13 Organic Carbon (%) of individual samples and average values for each SLA with depth

4.4.3 Exchangeable Cations and Exchangeable Sodium Percentage

Exchangeable cations, held on clay surfaces and within organic matter, are an important source of soil fertility and can influence the physical properties of soil. Generally, if cations such as Ca2+, Mg2+ and K+ are dominant on the clay exchange surfaces, the soil will typically display increased physical structure and stability, leading to increased aeration, drainage and root growth (Moore, 2004). If Na cations (Na+) are dominant on exchange surfaces and the exchangeable sodium percentage (ESP) exceeds more than 6% of the total exchangeable cations, then the soil is considered to be 'sodic', which can lead to poor physical properties (i.e. dispersion, hard setting and erosion in clay-rich soils). ESP values over 15% are classified as 'highly sodic'.

Exchangeable cation concentration, effective cation exchange capacity (eCEC) and ESP results were relatively consistent across the study area (Table 6). Five samples were identified as 'highly sodic', with four of these found in the 'Undulating stony plains' SLA, all sampled from the 0-10 cm and 10-20 cm depth intervals. Twelve samples were identified as 'sodic', four from the Undulating Low Hills, seven from the Undulating Stony Plains and one from the Outcropping Low Rises' (Table 6). There was no apparent correlation between exchangeable cations and SLA or sample depth.

Table 6 Exchangeable cations and ESP of selected samples. Shading of ESP values denotes non-sodic, sodic and highly sodic classifications

Sample ID	Depth (cm)	SLA	Exchangeable cations (meq/100g)				eCEC (meq/100g)	ESP (%)
			Ca	K	Mg	Na		
YIN-01	0-10	Undulating Low Hills	3.65	0.11	2.80	0.29	6.9	4.2
	10-20		3.82	0.06	3.06	0.44	7.4	5.96
	40-50		5.70	0.05	0.76	0.24	6.8	3.6
	90-100		17.22	0.05	0.24	< 0.10	17.6	0.3
YIN-02	0-10	Undulating Low Hills	2.66	0.12	0.64	0.22	3.6	6.0
	10-20		7.85	0.15	3.58	0.92	12.5	7.4
	40-50		5.85	0.03	1.27	0.42	7.6	5.6

Sample ID	Depth (cm)	SLA	Exchangeable cations (meq/100g)				eCEC (meq/100g)	ESP (%)
			Ca	K	Mg	Na		
	90-100		7.70	0.02	0.87	0.99	9.6	10.3
YIN-03	0-10	Undulating Low Hills	5.46	0.21	0.70	< 0.10	6.4	0.8
	10-20		6.64	0.24	0.56	< 0.10	7.5	0.7
YIN-04	0-10	Undulating Low Hills	5.07	0.16	1.97	< 0.10	7.3	0.7
	10-20		1.64	0.21	1.26	< 0.10	3.2	1.6
	40-50		4.01	0.06	1.51	< 0.10	5.6	0.9
YIN-05	0-10	Undulating Low Hills	5.75	0.21	3.00	< 0.10	9.0	0.6
	10-20		7.19	0.09	1.75	< 0.10	9.1	0.6
	40-50		5.74	0.12	0.53	< 0.10	6.4	0.8
YIN-06	0-10	Undulating Low Hills	3.74	0.31	0.81	< 0.10	3.7	1.0
	10-20		5.20	0.23	0.44	< 0.10	5.2	0.8
	40-50		5.45	0.05	0.30	< 0.10	5.5	0.9
YIN-07	0-10	Undulating Low Hills	4.62	0.27	1.52	< 0.10	6.5	0.8
	10-20		9.92	0.24	1.10	< 0.10	11.3	0.4
	40-50		9.19	0.06	1.84	0.24	11.3	2.1
	90-100		15.16	0.1	3.07	0.23	18.6	1.2
YIN-09	0-10	Undulating Low Hills	2.21	0.15	1.72	< 0.10	4.1	1.2
	10-20		5.76	0.11	7.07	0.45	13.4	3.4
	40-50		14.18	0.05	1.61	< 0.10	15.9	0.3
YIN-10	0-10	Undulating Low Hills	5.30	0.35	1.36	0.18	7.2	2.5
	10-20		7.58	0.18	1.44	0.39	9.6	4.1
	40-50		8.37	0.08	1.74	0.46	10.7	4.3
	90-100		10.79	0.05	2.86	0.92	14.6	6.3
YIN-08	0-10	Undulating Stony plain	3.97	0.19	1.45	0.24	5.9	4.1
	10-20		5.86	0.15	3.36	0.41	9.8	4.2
	40-50		4.80	0.05	1.69	0.29	6.8	4.2
	90-100		4.28	0.03	1.25	0.39	5.9	6.6
YIN-11	0-10	Undulating Stony plain	2.88	0.40	2.29	0.65	6.2	10.5
	10-20		4.69	0.54	2.96	0.88	9.1	9.7
	40-50		5.61	0.19	1.92	0.82	8.5	9.6
	90-100		9.57	0.12	1.16	0.73	11.6	6.3
YIN-12	0-10	Undulating Stony plain	1.23	0.17	0.93	< 0.10	2.4	2.1
	10-20		2.89	0.20	1.94	0.14	5.2	2.7
	40-50		7.74	0.17	4.62	0.47	13.0	3.6

Sample ID	Depth (cm)	SLA	Exchangeable cations (meq/100g)				eCEC (meq/100g)	ESP (%)
			Ca	K	Mg	Na		
	90-100		10.34	0.21	7.14	1.40	19.1	7.3
YIN-13	0-10	Undulating Stony plain	5.30	0.43	2.03	0.42	8.2	5.1
	10-20		8.30	0.34	1.92	0.41	10.9	3.7
YIN-14	0-10	Undulating Stony plain	7.22	0.35	0.64	< 0.10	8.3	0.6
	10-25		4.21	0.06	3.16	0.23	7.7	3.0
YIN-15	0-10	Undulating Stony plain	0.70	0.19	0.63	1.55	3.1	50.5
	10-25		1.83	0.31	3.20	3.52	8.9	39.7
YIN-16	0-10	Undulating Stony plain	5.76	0.30	0.45	< 0.10	6.6	0.8
	10-25		6.35	0.18	0.46	0.15	7.1	2.1
YIN-19	0-10	Undulating Stony plain	2.96	0.44	2.33	0.13	5.9	2.2
	10-25		3.92	0.27	3.21	0.59	7.9	7.4
YIN-23	0-10	Undulating Stony plain	3.73	0.57	1.42	< 0.10	5.8	0.9
	10-20		7.34	0.57	0.69	< 0.10	8.7	0.6
YIN-24	0-10	Undulating Stony plain	0.97	0.43	7.72	5.37	14.5	37.1
	10-25		7.86	0.15	6.46	2.40	16.9	14.2
YIN-26B	0-10	Undulating Stony plain	1.64	0.28	1.49	< 0.10	3.5	1.5
	10-25		2.79	0.40	1.87	< 0.10	5.1	0.9
YIN-28	0-10	Undulating Stony plain	4.52	0.26	2.34	< 0.10	7.2	0.7
	10-25		8.90	0.21	0.30	< 0.10	9.5	0.5
YIN-29	0-10	Undulating Stony plain	1.30	0.36	0.60	< 0.10	2.3	2.2
	10-20		4.17	0.14	0.93	< 0.10	5.3	0.9
YIN-18	0-10	Outcropping Low Rises	1.84	0.15	1.15	< 0.10	3.2	1.6
	10-20		1.75	0.13	1.38	0.17	3.4	4.9
YIN-20	0-10	Outcropping Low Rises	1.60	0.19	1.09	0.27	3.2	8.6
	10-20		6.47	0.29	4.40	2.89	14.1	20.6
YIN-25	0-10	Outcropping Low Rises	1.07	0.15	0.84	< 0.10	2.1	2.4
	10-20		1.50	0.10	0.86	< 0.10	2.5	1.9
YIN-26	0-10	Major Channels	0.47	0.03	0.16	< 0.10	0.7	7.0
YIN-27	0-10	Major Drainage Tracts	2.25	0.27	1.24	< 0.10	3.8	1.3
	10-20		4.09	0.47	2.07	< 0.10	6.7	0.8

4.4.4 Soil Nutrients

The most important macro-nutrients for plant growth are nitrogen (N), Phosphorus (P), potassium (K) and sulphur (S). These nutrients are largely derived from the soil mineral component and organic matter. Native plant species have a number of physiological adaptations that enable them to be productive in areas where

the supply of macronutrients is limited. Therefore, the use of analogue sites is an effective way to baseline the soil nutritional requirements of native plant species within the study area.

4.4.4.1 Nitrogen

Most (>98%) N in soils is organic (Moore, 1998). Plant-available forms of inorganic N (nitrate, nitrite, and ammonium) are produced via mineralisation of soil organic matter. The plant-available ammonium concentrations of the soils from the study area were consistently low, ranging from below detection (<1 mg/kg) to 5 mg/kg ammonium, with an average of 1.5 mg/kg (Figure 14). The concentrations of N in the form of nitrate were varied, ranging from below detection (<1 mg/kg) to 127 mg/kg, with an average of 11.6 mg/kg (Figure 15). Concentrations of nitrate were relatively consistent across SLAs and depths, with the exception of the soils from the Undulating Stony Plains which recorded the highest nitrate concentrations across all depth intervals (Figure 15).

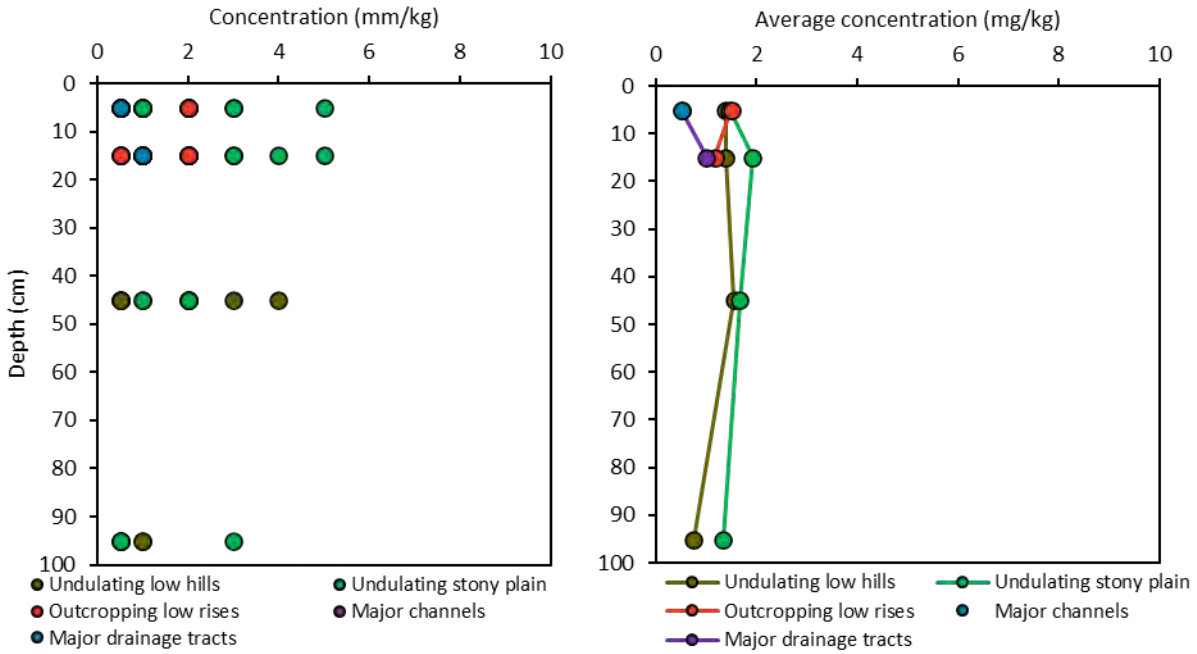


Figure 14: Ammonium (N) of individual samples and average values for each SLA with depth

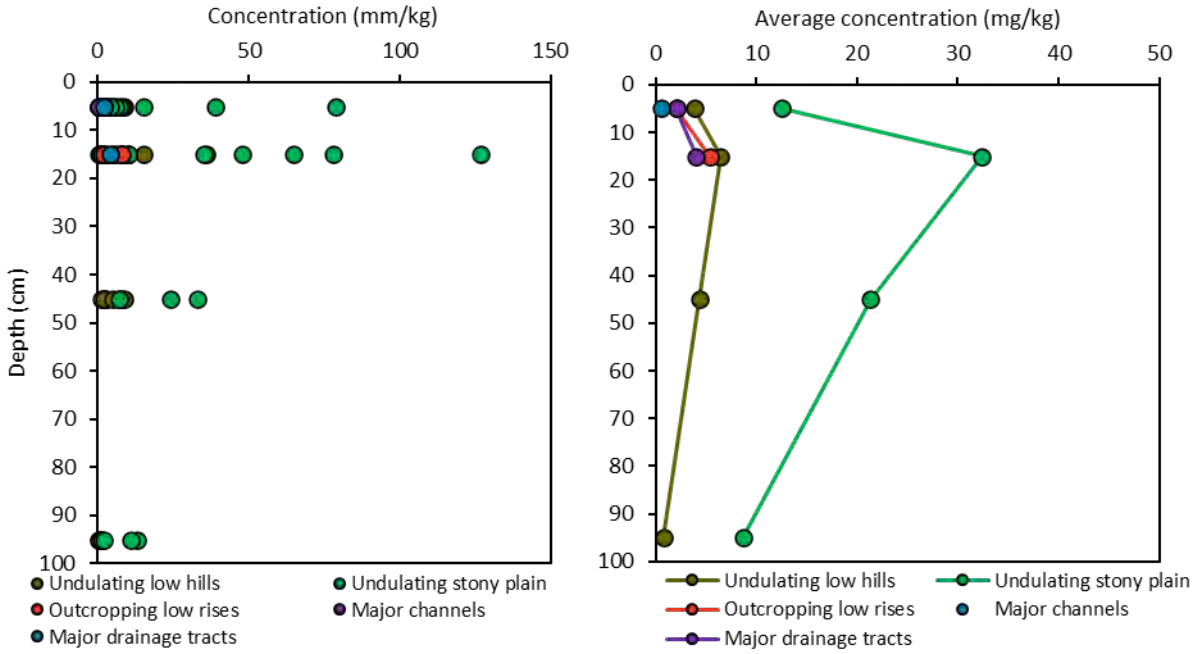


Figure 15 Nitrate (N) of individual samples and average values for each SLA with depth

4.4.4.2 Phosphorus

Phosphorus is essential for the growth of vegetation as it plays a key role in the formulation of energy producing organic compounds. Adequate P nutrition enhances many aspects of plant physiology, including the fundamental processes of photosynthesis, nitrogen fixation, flowering, fruiting (including seed production), and maturation (Brady, N. and Weil, R., 2002).

The plant-available P concentrations of the soils from the study area were variable and ranged from below detection (<2 mg/kg) to 17.0 mg/kg with an average of 7.8 mg/kg (Figure 16). These values are considered to be 'low' (Moore, 2004). A notable decrease in concentration was observed from the 0-10 cm interval to the 10-20 cm interval for all SLAs (excluding 'major channels'), after which it varies at greater depths.

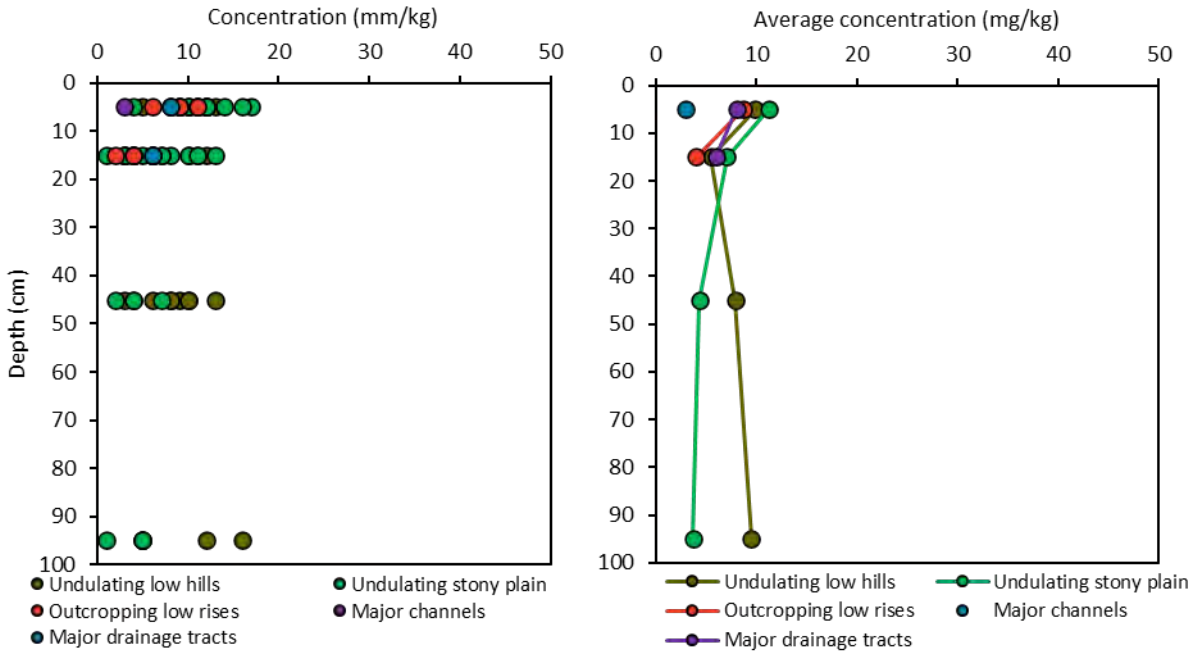


Figure 16: Phosphorus (P) of individual samples and average values for each SLA with depth

4.4.4.3 Potassium

Potassium (K) plays a critical role in a number of plant physiological processes. Adequate amounts of K have been linked to improved drought tolerance, better resistance to certain fungal diseases and greater tolerance to insect pests (Brady, N. and Weil, R., 2002).

The plant-available K concentrations of the soils from the study area were highly variable, ranging from <20 mg/kg to 425 mg/kg, with an overall average of 138.7 mg/kg. These values range between a low and high rating (low rating: <90 mg/kg, high rating: >200 mg/kg (Moore, 2004)). The highest concentrations of plant-available K were recorded at 10-20 cm depth of the Major Drainage Tracts SLA (Figure 17). There was a general decrease in plant-available K with depth.

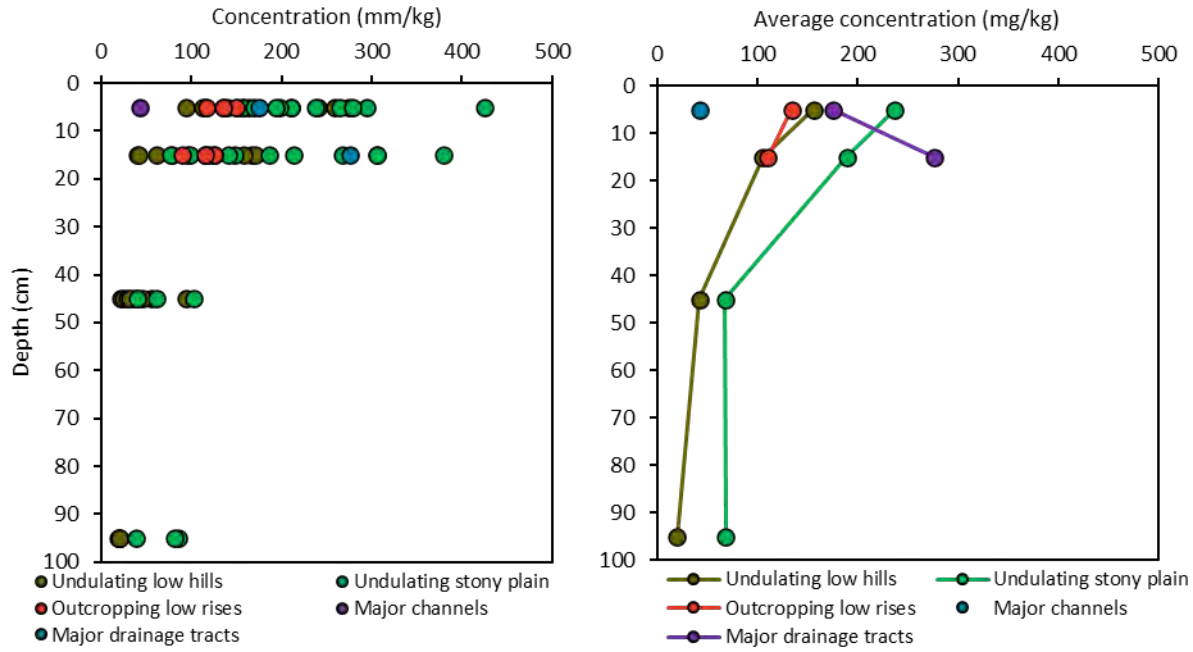


Figure 17: Potassium (K) of individual samples and average values for each SLA with depth

4.4.4.4 Sulfur

Plant-available sulfur (S) (i.e. sulfate) concentrations measured for soils from the study area were variable, ranging from 0.7 mg/kg to 6,170.2 mg/kg (Figure 18). Two of the three highest values recorded were found in the 90-100 cm interval from the Undulating Low Hills and Stony Plains SLAs, significantly skewing the average data for those depth intervals and SLA combinations.

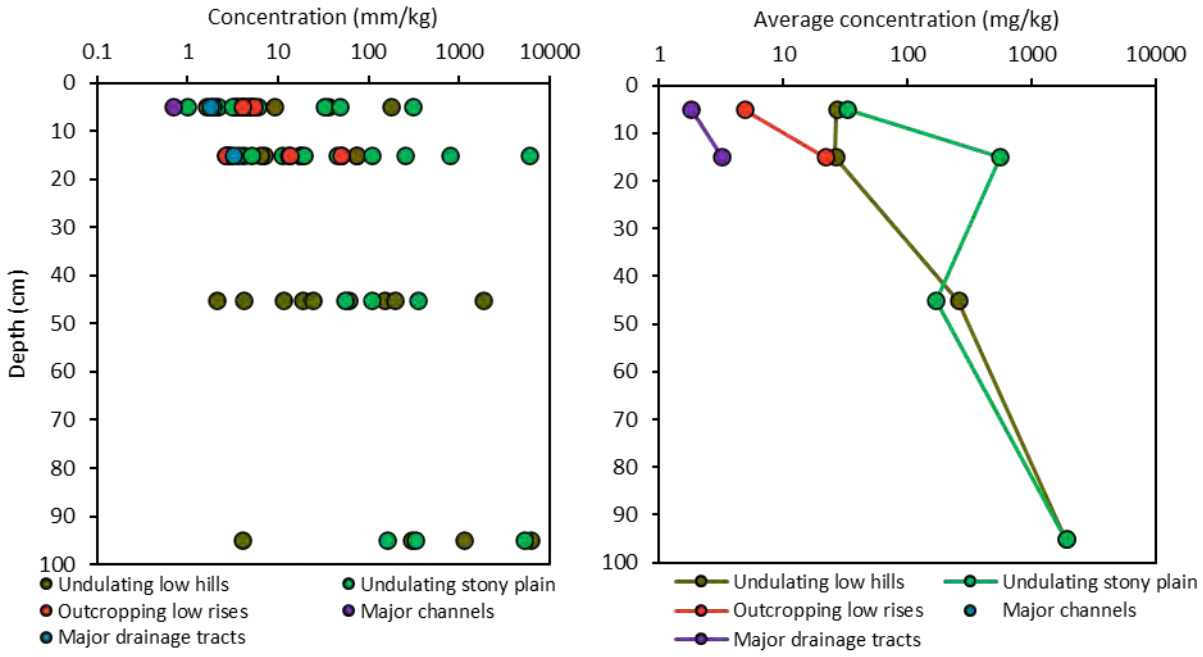


Figure 18: Sulfur (S) of individual samples and average values for each SLA with depth (base 10 logarithmic scale)

4.4.5 Total metal concentrations

The total concentration of selected metals was measured for surface soil samples, with the results presented in Table 7. The soils samples were digested using a hydrochloric and nitric acid mixture and read using inductively couple plasma mass spectroscopy (ICP-MS). As a point of comparison, the average crustal abundance (ACA) (Reimann, C. and de Caritat, P, 1998) for each metal is also provide in Table 7.

Of particular note are the high baseline concentrations of selenium (Se), arsenic (As), cobalt (Co) and lead (Pb) relative to the average crustal abundance. These metal concentrations are unlikely to have any implications for soil management or rehabilitation, however, they provide a baseline measure should any comparison against baseline values be required in the future.

Table 7: Total metal concentrations for selected samples. Concentrations above the ACA are denoted in bold font

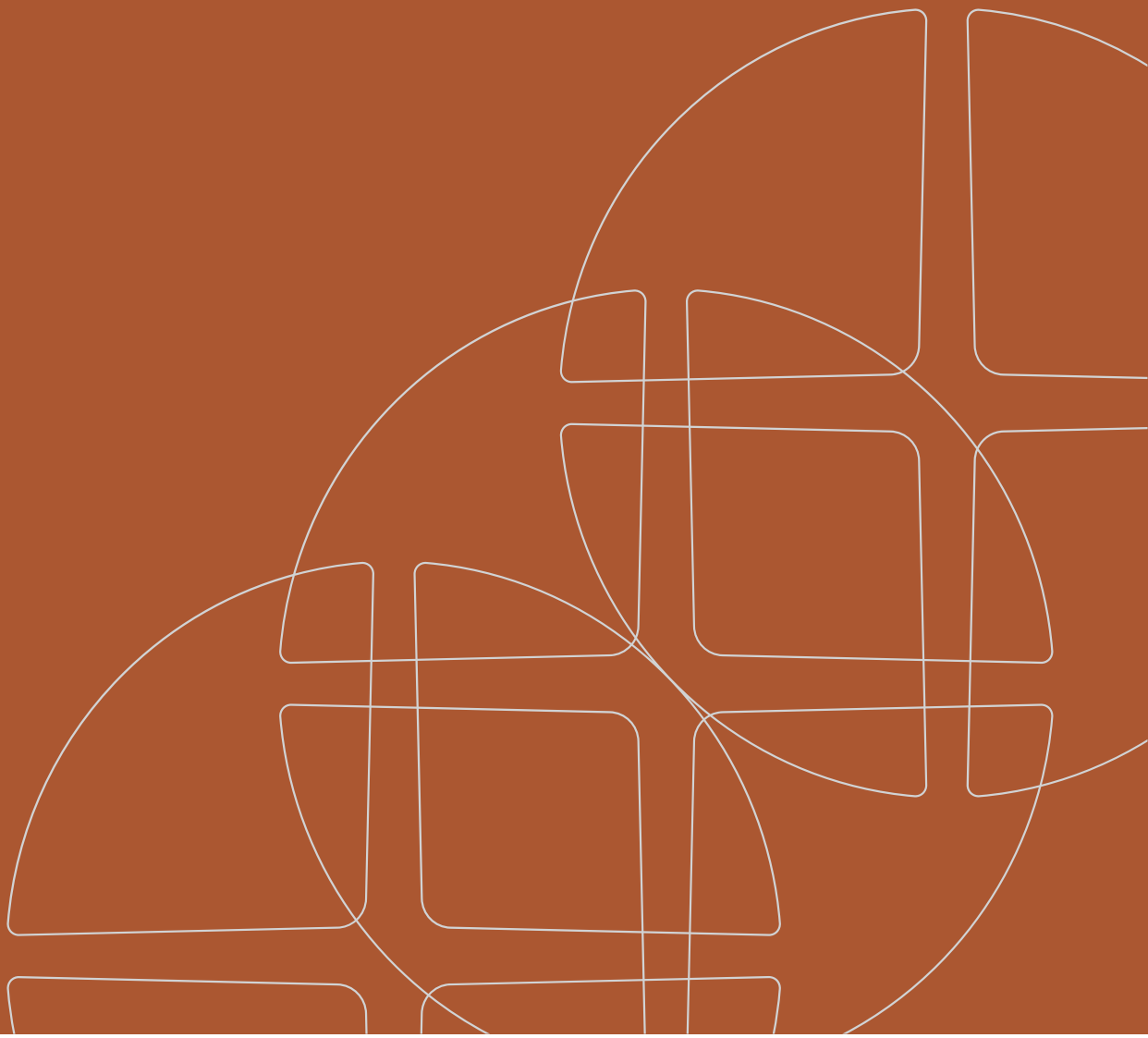
Sample ID	Depth (cm)	SLA	As	Cd	Cr	Co	Pb	Mo	Se
YIN-01	0-10	Undulating Low Hills	**3,264**	**280**	75,848	18,543	12,435	752	**1,781**
	10-20		**5,127**	**122**	86,236	**32,779**	13,107	669	**1,515**
	90-100		451	**130**	55,702	20,937	2,416	169	**856**
YIN-02	0-10	Undulating Low Hills	**1,931**	**122**	78,594	18,688	11,740	538	**1,757**
	10-20		**5,555**	36	106,998	20,818	**19,179**	733	**1,732**
	40-50		**3,028**	28	94,965	**25,491**	10,375	966	**3,827**
	90-100		1,098	10	87,027	23,234	4,882	**1,540**	**3,446**
YIN-03	0-10	Undulating Low Hills	**2,650**	67	93,013	22,196	10,004	533	**2,128**
	10-20		**2,374**	54	76,129	17,474	8,063	378	**1,276**
YIN-04	0-10	Undulating Low Hills	**3,140**	25	56,564	9,226	**130,215**	732	**1,377**
	10-20		**3,269**	42	62,216	9,732	**109,236**	1,017	**1,867**
	40-50		1,464	22	15,974	3,232	**79,436**	509	**1,384**
YIN-05	0-10	Undulating Low Hills	**4,876**	65	82,246	**34,927**	**15,315**	**1,103**	**1,492**
	10-20		**6,541**	51	65,572	23,377	13,934	760	**1,337**
YIN-06	0-10	Undulating Low Hills	**2,741**	50	75,102	22,399	10,440	424	**2,378**
	10-20		**3,812**	52	67,024	21,247	9,101	277	**1,686**
	40-50		**2,618**	27	57,193	21,651	4,837	188	**4,484**
YIN-07	0-10	Undulating Low Hills	**3,805**	85	81,180	23,489	**15,350**	363	**2,183**
	10-20		**5,810**	**109**	92,834	**30,967**	**19,308**	503	**1,234**
	90-100		**5,506**	**255**	31,139	**35,051**	11,626	324	**1,112**
YIN-09	0-10	Undulating Low Hills	**2,579**	42	86,285	21,767	12,903	576	**1,922**
	10-20		**4,025**	27	99,954	21,360	**14,878**	491	**1,548**
YIN-10	0-10	Undulating Low Hills	**3,032**	46	97,908	**29,668**	**16,296**	484	**821**
	10-20		**4,950**	**111**	97,070	**30,323**	**15,047**	392	**1,427**
	40-50		**4,794**	90	116,949	**24,894**	14,053	488	**1,725**

Sample ID	Depth (cm)	SLA	As	Cd	Cr	Co	Pb	Mo	Se
	90-100		**3,824**	66	92,624	19,462	11,304	369	**1,320**
YIN-08	0-10	Undulating Stony plain	**4,391**	49	79,621	**24,083**	**18,472**	578	**1,717**
	10-20		**5,167**	73	90,407	22,724	**17,905**	551	**1,784**
	40-50		**2,679**	35	64,866	**24,980**	10,368	434	**2,098**
	90-100		1,262	18	55,900	22,690	5,195	131	**1,233**
YIN-11	0-10	Undulating Stony plain	**2,960**	86	112,722	**27,245**	11,977	**2352**	**1,960**
	10-20		**4,974**	33	74,097	**24,524**	**21,760**	776	**1,582**
	40-50		**7,960**	33	86,468	21,232	**31,225**	762	**1,182**
	90-100		**7,790**	60	51,477	14,404	**18,347**	**2119**	**1,329**
YIN-12	0-10	Undulating Stony plain	**8,286**	21	52,585	14,262	**19,308**	**2745**	**1,008**
	10-20		**4,203**	85	66,261	13,366	**29,995**	977	**1,618**
	40-50		**4,542**	94	70,489	14,727	**21,565**	612	**1,544**
	90-100		**9,502**	**101**	75,533	**25,847**	**110,306**	776	**1,348**
YIN-13	0-10	Undulating Stony plain	**6,041**	54	96,176	21,207	**45,198**	877	**1,417**
	10-20		**4,615**	61	79,688	13,163	**40,763**	707	**740**
YIN-14	0-10	Undulating Stony plain	1,438	46	41,053	6,177	**15,565**	207	**686**
YIN-15	0-10	Undulating Stony plain	**3,068**	21	67,894	14,682	14,148	506	**910**
	10-25		**6,149**	23	65,656	13,852	**16,999**	553	**753**
YIN-16	0-10	Undulating Stony plain	**2,428**	52	29,983	6,993	7,556	215	**549**
	10-25		**1,777**	57	33,078	8,562	7,324	285	**421**
YIN-19	0-10	Undulating Stony plain	**4,495**	65	56,155	15,177	**16,761**	383	**850**
	10-25		**3,783**	64	51,402	14,839	11,636	319	**482**
YIN-23	0-10	Undulating Stony plain	**2,912**	92	44,798	**44,629**	7,835	360	**1,019**
	10-20		**5,152**	89	48,348	**26,324**	9,084	417	**932**
YIN-26B	0-10	Undulating Stony plain	1,152	24	33,442	6,293	9,363	164	**786**
	10-25		**1,867**	19	36,255	7,281	9,453	199	**960**
YIN-24	0-10	Undulating Stony plain	**7,627**	72	79,067	**26,236**	10,773	819	**1,105**
	10-25		**7,404**	52	64,455	**18,460**	8,825	805	**1,685**
YIN-28	0-10	Undulating Stony plain	**5,152**	**118**	45,442	15,265	11,921	156	**1,253**
YIN-29	0-10	Undulating Stony plain	1,404	45	40,784	9,828	8,741	276	**828**
	10-20		**3,264**	**280**	75,848	18,543	12,435	752	**1,781**
YIN-18	0-10	Outcropping Low Rises	**1,831**	14	25,923	3,976	10,205	610	**772**
	10-20		**2,054**	11	34,855	5,243	13,280	846	**1,151**
YIN-20	0-10		1,561	11	32,773	6,582	9,437	174	**449**

Sample ID	Depth (cm)	SLA	As	Cd	Cr	Co	Pb	Mo	Se
	10-20	Outcropping Low Rises	**3,585**	17	50,076	10,269	13,794	327	**830**
YIN-25	0-10	Outcropping Low Rises	**1,860**	29	26,364	5,705	11,815	878	**711**
	10-20		**1,715**	11	23,537	5,353	**20,937**	666	**622**
YIN-26	0-10	Major drainage	367	10	4,941	912	2,313	39	**284**
YIN-27	0-10	Major drainage	1,568	13	28,865	5,369	13,092	307	**720**
	10-20		**2,697**	35	36,197	8,185	10,493	307	**920**
Average Crustal Abundance[1].			**1,700**	**100**	**126,000**	**24,000**	**14,800**	**1,100**	**120**

1. (Reimann, C. and de Caritat, P, 1998)

Soil Management and Handling Recommendations



5. Soil Management and Handling Recommendations

5.1 Suitability for rehabilitation

Soils from within the Undulating Low Hills SLA consisted of loams (sandy, silty and clay loams) with some loamy sands, were typically non-saline to slightly saline, typically non-sodic, potentially dispersive upon severe disturbance, typically had a low propensity to hard-set, had a moderate to moderately slow hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.

Soils from the Undulating Stony Plain SLA were typically loams (sandy, silty and clay loams) with some loamy sands and clays, ranged from non-saline to extremely saline, ranged from non-sodic to highly sodic, ranged from being dispersive to potentially dispersive upon severe disturbance, typically had a low propensity to hard-set, typically had a moderately slow to moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.

Soils from within the Outcropping Low Rises SLA included sands, loams and clays, were mostly non-saline, ranged from non-sodic to sodic, were mostly dispersive, had a low propensity to hard-set, had a moderately slow to moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.

Soils from the Major Drainage Tracts SLA were loamy, non-saline, non-sodic, ranged from being dispersive to potentially dispersive upon severe disturbance, had a low propensity to hard-set, moderate hydraulic conductivity and were typically low in organic carbon and plant-available nutrients.

Sediments from the Major Channels SLA were sandy, non-sodic, non-saline, with a very rapid hydraulic conductivity and low in organic carbon and plant-available nutrients. The Major Channels will not be disturbed.

The topsoil (0 to 20 cm) from the Undulating Low Hills SLA is considered suitable as a surface rehabilitation material. The erodibility of these topsoils is likely to be relatively low, unless subject to concentrated surface water flow. This topsoil should be used preferentially on slopes of waste rock landforms.

The topsoil (0 to 20 cm) from the Undulating Stony Plain, Outcropping Low Rises and Major Drainage Tracts SLAs is potentially more saline, clay rich, sodic and dispersive than the topsoil from the Undulating Low Hills, and is likely to be more erodible. It is recommended that this topsoil be stockpiled separately, with application as a surface rehabilitation medium restricted to flat areas, where possible. There is currently no disturbance planned in the Outcropping Low Rises and Major Drainage Tracts SLAs

Where salvaged soils are utilised as a surface rehabilitation medium on the slopes of waste rock landforms, the soils will require ripping into underlying competent waste rock to armour the surface and minimise erosion as far as practicable. Adequate surface water management on constructed landforms will be required to minimise the potential for surface water concentration and flow.

Weathered / transitional rock was present at varying depths within the undulating low hills and undulating stony plain SLA. The more competent of these materials may be a useful surface / near-surface rehabilitation material and should be salvaged and stockpiled from pit areas, particularly if competent, benign waste rock is unavailable or limited, as a source of surface armour.

A hardpan layer was identified at numerous sampling locations within the undulating stony plain SLA, present at approximately 25 to 30 cm across the study area. This material may be useful as a source of near-surface rehabilitation / surface armour material if required. While this investigation did not sample the hardpan material, experience at other mine sites with similar materials indicates that the hardpan can be a useful surface / near-surface rehabilitation material

It is recommended that further investigations are conducted, as the Project is developed, into the volumes of near-surface competent rock and hardpan material likely to be available and to confirm suitability as a rehabilitation and closure resource, if required.

5.2 Soil management and handling

Specific topsoil management and handling recommendations which can optimise soil resource salvaging and the success of future rehabilitation are as follows:

- It is recommended that the upper 0.2m (topsoil) of the soil profiles within all of the proposed disturbance areas is stripped (where possible) and stockpiled for use as a surface rehabilitation medium. Soils from the Undulating Hills SLA should be stockpiled separately to the soils from the Undulating Stony Plain SLA. If future disturbance is planned in the Outcropping Low Rises and Major Drainage Tracts SLAs these soils should be stockpiled separately from the Undulating Hills SLA.
- Any rock fragments and surface vegetation litter present within the soil profiles should be collected and stockpiled with the topsoil.
- Machinery operators should minimise the frequency and intensity of topsoil disturbance, to minimise degradation to the structural integrity of the material.
- Soil stripping should occur as close as possible to the time when the proposed disturbance is scheduled to commence.
- Where possible, stripped topsoil should be paddock-dumped into piles no greater than two metres in height. The piles should have adequate distance between them to create a series of mounds and troughs to capture surface water and organic matter.
- Excessive traffic and disturbance of the stockpiles should be minimised to minimise erosion and degradation of soil structure. Care should be taken to minimise the handling of the soils where possible, particularly when wet.
- As a general rule, topsoil rehabilitation materials should not be placed at depths greater than 0.2m on rehabilitated areas. This is particularly the case for sloped areas of rehabilitation.
- Where topsoil is placed on the batters of constructed waste rock landforms, it should be incorporated into underlying competent waste rock via contour ripping, to armour the surface and mitigate erosion as far as practicable.
- Consideration should be given to salvage and stockpile of weathered rock from 0.2 m to 1m from within pit footprints.
- If additional rehabilitation material is required for rehabilitation and closure, consideration should be given to salvage and stockpile of hardpan materials present from within the pit footprints within the Undulating Stony Plains SLA as a source of surface rehabilitation material.

5.3 Preliminary soil resource inventory

A preliminary soil resource inventory has been developed to provide an indicative volume of topsoil and subsoil materials likely to be available for salvage from the major proposed disturbance areas (Table 8). The volumes have been calculated based on the information derived from the soil survey conducted, aerial and landscape photography, site topography and the conceptual project disturbance layout. The approximate areas of outcropping rock and minor drainage channels within each proposed disturbance area have been taken into consideration, with a nominal stripping depth of 0.2 m utilised for topsoil calculations. A nominal value of 10% soil loss during stripping and stockpiling has also been applied. Disturbance is currently only planned within the Undulating Low Hills and Undulating Stony Plain SLAs.

It is recommended that the inventory is updated as the Project footprints are finalised and the actual volume of topsoil salvaged from each disturbance area is identified. This should then be updated within the inventory and balanced against the volume of soil required for rehabilitation works, to facilitate optimal application of soil resources to rehabilitation areas.

Table 8 Preliminary soil resource inventory

Conceptual disturbance area	SLA area within current planned disturbance	Proposed Disturbance Footprint (ha)	Approximate percentage of footprint area with salvageable soil (%)[1]	Topsoil volume (m^3)[2]
Proposed pits	Undulating Stony Plain	98	95	186,200
	Undulating Low Hills	89		169,100
Totals		**187**		**355,300**
WRL	Undulating Stony Plain	202	95	383,300
	Undulating Low Hills	61		115,900
Totals		**263**		**499,200**
Grand total				**854,500**

1. The percentage of topsoil available based on the SLA characteristics and estimated area of outcropping rock/drainage lines

2. Assumes average topsoil salvage depth of 0.2m and 10% soil loss factor during salvage / stockpiling operations.

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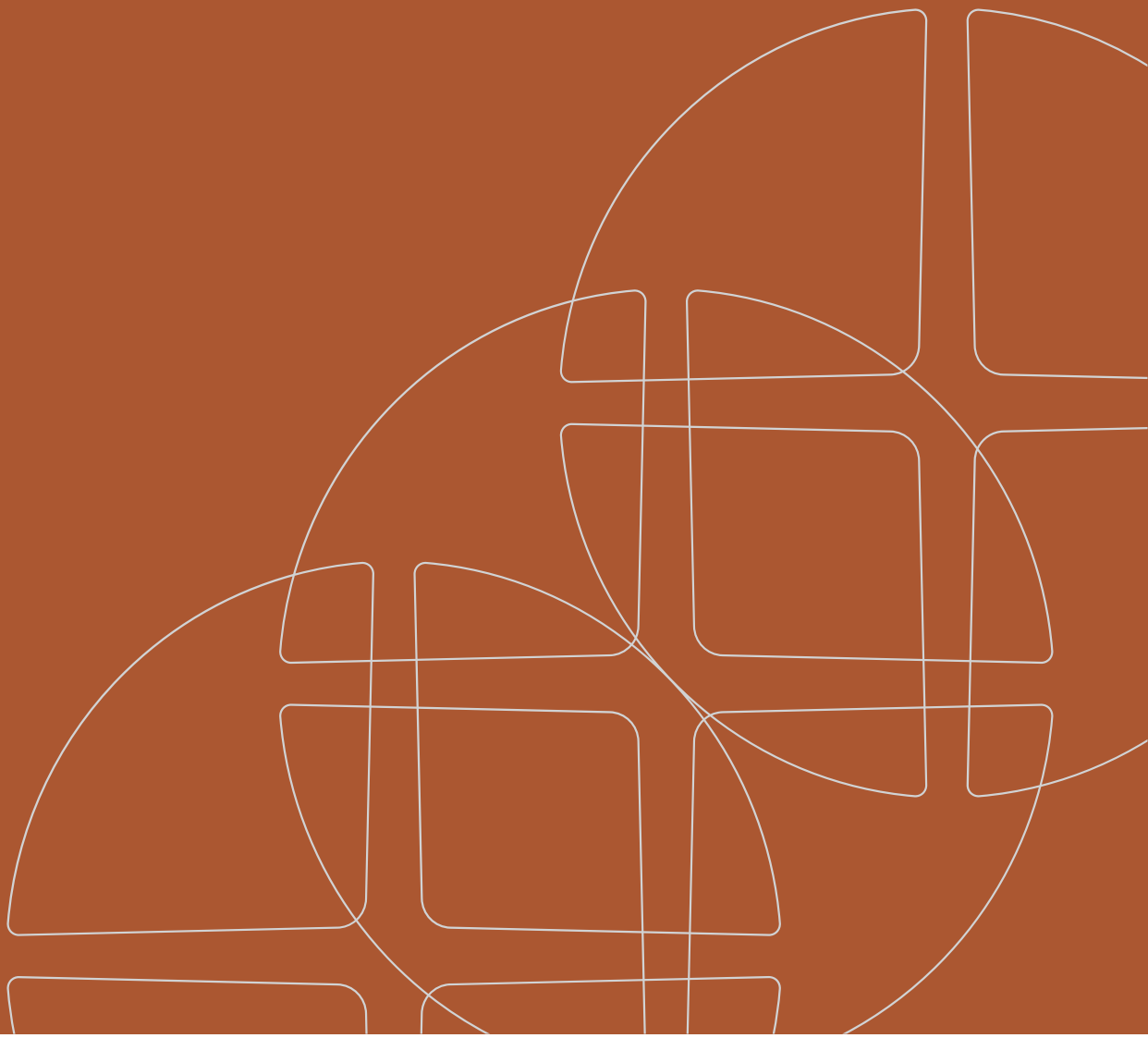
Appendix A

Soil Profile Descriptions



MINE EARTH

Undulating Low Hills SLA

MINE EARTH

Site reference: Site YIN01
Site description: Top of stony rise, with sparse mulga. Nearby dense tree pockets.
Soil landform association: Undulating Low Hills
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426924
Northing: 7288837

Plate 1 Surface soil profile at Site YIN01

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown loamy sand/sandy loam soil with approximately 70% sub-rounded to angular coarse fragments, approximately 2 to 150 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

10 to 30 cm: Massive, grey/white gravelly/loamy sand with approximately 90% sub-rounded to sub-angular coarse fragments, approximately 2 to 100 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

30 to 100 cm: Weathered rock with mica and no coarse fragments.

Soil surface: No crust with approximately 80% sub-rounded to angular coarse fragments, approximately 2 to 40 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Shrubs and sparse mulga

Plate 2 Soil surface / vegetation at Site YIN01

Site reference: Site YIN02
Site description: Slightly undulating stony rise, area disturbed by exploration
Soil landform association: Undulating Low Hills
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426579
Northing: 7288900

Plate 3 Surface soil profile at Site YIN02

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown sandy loam/sandy clay soil with approximately 30% sub-rounded to sub-angular coarse fragments, approximately 2 to 60 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

10 to 20 cm: Red/brown soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

20 to 40 cm: Moderately structured, red/brown/white gravelly/sandy loam soil with approximately 80% sub-rounded to sub-angular coarse fragments, approximately 2 to 100 mm in size. Soil has moderately weak consistence with root growth classed as 'none'.

40 to 130 cm: Weathered rock with layers of schist.

Soil surface: No crust with approximately 80% sub-rounded to sub-angular coarse fragments, approximately 2 to 100 mm in size and approximately 15% vegetation / litter cover.

Vegetation: Sparse mulga woodland, denser woodland down slope

Plate 4 Soil surface / vegetation at Site YIN02

Site reference: Site YIN03

Site description: Lower slopes of rocky rise near well vegetated drainage line, sparse shrubs on slope. Near exploration disturbance

Soil landform association: Undulating Low Hills

Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50

Easting: 0426267

Northing: 7288955

Plate 5 Surface soil profile at Site YIN03

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown/grey loamy sand soil with approximately 60% sub-rounded to angular coarse fragments, approximately 2 to 120 mm in size. Soil has moderately weak consistence with root growth classed as 'none'. Mica Schist fragments present.

10 to 25 cm: Single grained/weakly structured, red/brown/grey loamy sand soil with approximately 50% sub-rounded to angular coarse fragments, approximately 2 to 110 mm in size. Soil has moderately weak consistence with root growth classed as 'none'. Mica Schist fragments present.

25 to 30 cm: Massive, grey/red/brown loamy sand soil with approximately 80% angular to sub-angular coarse fragments, approximately 2 to 200 mm in size. Soil has moderately weak consistence with root growth classed as 'none'. Weathered Mica Schist.

30 to 60 cm: Weathered Schist rock.

Soil surface: No crust with approximately 95% sub-rounded to angular coarse fragments, approximately 2 to 180 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse mulga and shrubs near drainage line

Plate 6 Soil surface / vegetation at Site YIN03

Site reference: Site YIN04

Site description: Upper slope of stony rise. Sparse shrubs and grasses. Quartz surface lag

Soil landform association: Undulating Low Hills

Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50

Easting: 0425432

Northing: 7288976

Plate 7 Surface soil profile at Site YIN04

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown loamy sand soil with approximately 50% sub-rounded to sub-angular coarse fragments, approximately 2 to 90 mm in size. Soil has a weak consistence. Large Coarse frags from surface quartz lag.

10 to 30 cm: White gravelly/sandy loam soil with approximately 30% coarse fragments. Soil has a firm consistence with root growth classed as 'none'.

30 to 55 cm: Brown/white loamy sand/sandy loam soil with no coarse fragments.

>55 cm: Weathered rock.

Soil surface: No crust with approximately 85% sub-rounded to angular coarse fragments, approximately 2 to 50 mm in size and approximately 2% vegetation / litter cover.

Vegetation: Sparse shrubs and grasses

Plate 8 Soil surface / vegetation at Site YIN04

Site reference: Site YIN05
Site description: Lower slope of stony rise, sparse shrub and mulga.
Soil landform association: Undulating Low Hills
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0425696
Northing: 7289433

Plate 9 Surface soil profile at Site YIN05

Soil profile description:

0 to 10 cm: Single grained/moderately structured, red/brown loamy sand/sandy loam soil with approximately 70% sub-rounded to sub-angular coarse fragments, approximately 2 to 50 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

10 to 20 cm: Weakly structured / moderately structured, red/brown loamy sand/sandy loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 50 mm in size. Soil has loose consistence with root growth classed as 'none'.

20 to 50 cm: Weakly structured / moderately structured, red/brown loamy sand/sandy loam soil with approximately 60% sub-rounded to sub-angular coarse fragments, approximately 2 to 60 mm in size. Soil has loose consistence with root growth classed as 'none'.

>50 cm: Weathered rock

Soil surface: No crust with approximately 70% sub-rounded to sub-angular coarse fragments, approximately 2 to 120 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga

Plate 10 Soil surface / vegetation at Site YIN05

Site reference: Site YIN06

Site description: Lower slopes of stony rise / hill. Near exploration disturbance

Soil landform association: Undulating Low Hills

Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50

Easting: 0426282

Northing: 7289334

Plate 11 Surface soil profile at Site YIN06

Soil profile description:

0 to 20 cm: Weakly structured/moderately structured, red/brown/grey soil with approximately 40-50% sub-angular to angular coarse fragments, approximately 2 to 120 mm in size. Soil has moderately weak consistence with root growth classed as 'few'.

>20 cm: Weathered / transitional schist rock.

Soil surface: No crust with approximately 80% sub-rounded coarse fragments, approximately 2 to 200 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse mulga shrubs

Plate 12 Soil surface / vegetation at Site YIN06

Site reference: Site YIN07
Site description: Bottom of sloped area, near existing disturbance
Soil landform association: Undulating Low Hills
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0425976
Northing: 7289792

Plate 13 Surface soil profile at Site YIN07

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown sandy loam/loamy sand soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size. Soil has a moderately weak consistence with root growth classed as 'few'.

10 to 30 cm: Single grained/weakly structured, red/brown loamy sand/sandy loam soil with approximately 30% sub-rounded to angular coarse fragments, approximately 2 to 150 mm in size. Soil has a weak consistence with root growth classed as 'none'.

30 to 50 cm: Weakly structured/single grained, red/brown gravelly/loamy sand soil with approximately 70% sub-angular to angular large coarse fragments, approximately 2 to 250 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

50 to 100 cm: Single grained/weakly structured, red/brown/white loamy sand/sandy loam soil with approximately 40% sub-rounded to sub-angular coarse fragments, approximately 2 to 80 mm in size. Soil has moderately weak consistence with root growth classed as 'none'.

Soil surface: Weak crust with approximately 80% sub-rounded to angular coarse fragments, approximately 2 to 120 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga

Plate 14 Soil surface / vegetation at Site YIN07

Site reference: Site YIN09

Site description: Slightly undulating stony plain, with sparse grasses and mulga trees near vegetated drainage line. Outcropping rock nearby

Soil landform association: Undulating Low Hills

Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50

Easting: 0427013

Northing: 7289454

Plate 17 Surface soil profile at Site YIN09

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown/orange sandy loam/loamy sand soil with approximately 30% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size. Soil has moderately weak consistence with root growth classed as 'none'.

10 to 30 cm: Massive, red/orange/white loamy sand/sandy loam soil with approximately 30% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has moderately weak consistence with root growth classed as 'none'.

>30 cm: Weathered / transitional rock

Soil surface: No crust with approximately 80% sub-rounded to angular coarse fragments, approximately 2 to 300 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse mulga

Plate 18 Soil surface / vegetation at Site YIN09

Site reference: Site YIN10
Site description: Slightly sloped stony plain
Soil landform association: Undulating Low Hills
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0427376
Northing: 7289351

Plate 19 Surface soil profile at Site YIN10

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, brown/red loamy sand/sandy loam soil with approximately 30-40% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

10 to 50 cm: Weakly structured/moderately structured, red/brown loamy sand/sandy loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 15 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

50 to 80 cm: Strongly structured, red/brown/white loamy sand/sandy clay soil with approximately 30% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Root growth classed as 'none'.

>80 cm: Weathered / transitional rock

Soil surface: No crust with approximately 90% sub-rounded to sub-angular coarse fragments, approximately 2 to 90 mm in size and approximately 10% vegetation / litter cover.

Vegetation: Sparse mulga near vegetated drainage line

Plate 20 Soil surface / vegetation at Site YIN10

Undulating stony plain SLA

MINE EARTH

Site reference: Site YIN08

Site description: Rocky plain, sparse shrubs with pockets of open woodland and nearby outcropping rock.

Soil landform association: Undulating stony plain

Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50

Easting: 0426445

Northing: 7289574

Plate 15 Surface soil profile at Site YIN08

Soil profile description:

0 to 10 cm: Single grained / moderately structured, red / brown / orange loamy sand/clay loam soil with approximately 40% sub-rounded to sub-angular coarse fragments, approximately 2 to 60 mm in size. Soil has a moderately firm consistence with root growth classed as 'none'. Soil aggregates have mixed consistency.

10 to 30 cm: Weakly structured / moderately structured, red / brown loamy sand / clay loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 40 mm in size. Soil has firm consistence with root growth classed as 'none'.

30 to 50 cm: Weakly structured / moderately structured, red / brown / white loamy sand / sandy loam soil with approximately 50% sub-rounded to sub-angular coarse fragments, approximately 2 to 50 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

>50 cm: Weathered / transitional rock

Soil surface: Thin weak crust with approximately 70% sub-rounded to angular coarse fragments, approximately 2 to 300 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse mulga

Plate 16 Soil surface / vegetation at Site YIN08

Site reference: Site YIN11
Site description: Stony plain
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426279
Northing: 7290180

Plate 21 Surface soil profile at Site YIN11

Soil profile description:

0 to 10 cm: Weakly structured / single grained, red/brown sandy loam/loamy sand soil with approximately 50% sub-rounded to sub-angular coarse fragments, approximately 2 to 80 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

10 to 40 cm: Moderately structured / strongly structured, red/brown loamy sand/sandy loam soil with approximately 30% sub-rounded to angular coarse fragments, approximately 2 to 80 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

40 to 65 cm: Massive / strongly structured, white/red/brown sandy loam/sandy clay soil with approximately 70% sub-rounded to sub-angular coarse fragments, approximately 2 to 100 mm in size. Soil has firm consistence with root growth classed as 'none'.

>65 cm: Weathered / transitional rock

Soil surface: No crust with approximately 95% sub-rounded to sub-angular coarse fragments, approximately 2 to 150 mm in size and approximately 2% vegetation / litter cover.

Vegetation: Sparse mulga shrubs, nearby vegetated drainage lines

Plate 22 Soil surface / vegetation at Site YIN11

Site reference: Site YIN12
Site description: Stony plain, sparse vegetation. Drainage line with dense vegetation.
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426955
Northing: 7290550

Plate 23 Surface soil profile at Site YIN12

Soil profile description:

0 to 10 cm: Single grained/weakly structure red/brown loamy sand/sandy loam soil wi approximately 60% sub-rounded to sub-angul coarse fragments, approximately 2 to 50 mm size. Soil has a moderately weak consistence wi root growth classed as 'few'.

10 to 30 cm: Weakly structured/moderately structured, red/brown loamy sand/sandy loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size. Soil has a weak consistence with root growth classed as 'few'.

30 to 100 cm: Single grained/weakly structured, red/brown gravelly/loamy sand soil with approximately 70% sub-rounded to sub-angular coarse fragments, approximately 2 to 120 mm in size. Soil has a moderately weak consistence with root growth classed as 'none'.

100 to 120 cm: Massive, grey/red/brown loamy sand soil with no coarse fragments.

>120 cm: Weathered / transitional rock

thSoil surface: No crust with approximately 90% sub-rounded to angular coarse fragments, approximately 2 to 100 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga

Plate 24 Soil surface / vegetation at Site YIN12

Site reference: Site YIN13 **Datum:** GDA 1994 z50

Site description: Stony plain, open shrubland and mulga area **Easting:** 0429778

Soil landform association: Undulating stony plain **Northing:** 7285674

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 25 Surface soil profile at Site YIN13

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown loamy sand/sandy loam soil with approximately 40% coarse fragments, approximately 2 to 40 mm in size. Soil has a weak consistence with root growth classed as 'none'.

10 to 25 cm: Weakly structured /moderately structured, red/brown clay loam/sandy loam soil with approximately <5% sub-rounded to sub-angular coarse fragments, approximately 2 to 5 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

>25 cm: Hardpan

Soil surface: No crust with approximately 90% sub-rounded to sub-angular coarse fragments, approximately 2 to 120 mm in size and approximately 1% vegetation / litter cover.

Vegetation: Open mulga

Plate 26 Soil surface / vegetation at Site YIN13

Site reference: Site YIN14
Site description: Stony plain, with nearby woodland
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426860
Northing: 7286323

Plate 27 Surface soil profile at Site YIN14

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown/orange sandy loam/clay loam soil with approximately 40% sub-rounded to angular coarse fragments, approximately 2 to 30 mm in size. Soil has moderately firm consistence.

10 to 25 cm: Weakly structured /moderately structured, red/brown/orange sandy loam/clay loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 15 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

>25 cm: Hardpan

Soil surface: Weak crust with approximately 60% sub-rounded to sub-angular coarse fragments, approximately 2 to 110 mm in size and approximately 10% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga, with woodland pocket

Plate 28 Soil surface / vegetation at Site YIN14

Site reference: Site YIN15
Site description: Stony plain
Soil landform association: Undulating stony plain
Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Datum: GDA 1994 z50
Easting: 0424317
Northing: 7285737

Plate 29 Surface soil profile at Site YIN15

Soil profile description:

0 to 10 cm: Moderately structured/weakly structured, indurated red/brown/orange sandy loam/sandy clay soil with approximately 30% sub-rounded to angular coarse fragments, approximately 2 to 40 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

10 to 25 cm: Moderately structured /strongly structured, red/brown/orange sandy loam/clay loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 5 mm in size. Soil has firm consistence with root growth classed as 'none'.

>25 cm: Hardpan

Soil surface: No crust with approximately 95% sub-rounded to sub-angular coarse fragments, approximately 20 to 120 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse shrubs and grasses, occasional woodland pockets of mulga

Plate 30 Soil surface / vegetation at Site YIN15

Site reference: Site YIN16
Site description: Stony plain, with open mulga, shrubs and brushes
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0421734
Northing: 7285883

Plate 31 Surface soil profile at Site YIN16

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown sandy loam/loamy sand soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 15 mm in size. Soil has moderately firm consistence with root growth classed as 'few'.

10 to 25 cm: Weakly structured /moderately structured, red/brown/orange sandy loam/loamy sand soil with approximately 15% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size. Soil has weak consistence with root growth classed as 'few'.

> 25 cm: Hardpan

Soil surface: No crust with approximately 60% sub-rounded to angular coarse fragments, approximately 2 to 200 mm in size and approximately 5% vegetation / litter cover. Sheet wash evident.

Vegetation: Open mulga woodland, shrub, brushes, sparse

Plate 32 Soil surface / vegetation at Site YIN16

Site reference: Site YIN19
Site description: Stony plain with sparse shrubs and mulga trees
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0424109
Northing: 7290062

Plate 35 Surface soil profile at Site YIN19

Soil profile description:

0 to 10 cm: Single grained/weakly structured, red/brown/orange loamy sand/sandy loam soil with approximately 60% sub-rounded to sub-angular large coarse fragments, approximately 2 to 110 mm in size. Soil has loose consistence with root growth classed as 'none'.

10 to 25 cm: Single grained, red/brown/orange loamy sand/sandy loam soil with approximately 60% sub-rounded to sub-angular coarse fragments, approximately 2 to 60 mm in size. Soil has loose consistence with root growth classed as 'none'.

Soil surface: Stony surface with approximately 85% sub-rounded to sub-angular coarse fragments, approximately 2 to 80 mm in size and approximately 5% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga trees

Plate 36 Soil surface / vegetation at Site YIN19

Site reference: Site YIN23 **Datum:** GDA 1994 z50

Site description: Slightly sloping stony plain, with sparse mulga **Easting:** 0424793

Soil landform association: Undulating stony plain **Northing:** 7291613

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 39 Surface soil profile at Site YIN23

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown loamy sand soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has moderately weak consistence with root growth classed as 'few'.

10 to 25 cm: Weakly structured /moderately structured, red/brown loamy sand/sandy loam soil with approximately 10% sub-rounded to sub-angular coarse fragments, approximately 2 to 15 mm in size. Soil has weak consistence with root growth classed as 'few'.

>25 cm: Hardpan.

Soil surface: Thin weak crust with approximately 80% sub-rounded to angular coarse fragments, approximately 2 to 300 mm in size and approximately 5% vegetation / litter cover. Channelling nearby.

Vegetation: Sparse mulga

Plate 40 Soil surface / vegetation at Site YIN23

Site reference: Site YIN24
Site description: Quartz stone plain
Soil landform association: Undulating stony plain
Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Datum: GDA 1994 z50
Easting: 0425740
Northing: 7291825

Plate 41 Surface soil profile at Site YIN24

Soil profile description:

0 to 10 cm: Single grained/moderately structured, red/brown sandy clay/sandy loam soil with approximately 40% sub-rounded to sub-angular coarse fragments, approximately 5 to 50 mm in size. Soil has loose consistence with root growth classed as 'none'.

10 to 25 cm: Single grained/weakly structured, red/brown sandy clay/clayey sand soil with approximately 15% sub-rounded to sub-angular coarse fragments, approximately 5 to 30 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

> 25 cm: Hardpan

Soil surface: No crust with approximately 98% sub-rounded to sub-angular coarse fragments, approximately 2 to 120 mm in size and approximately 5% vegetation / litter cover. Nearby channels.

Vegetation: Sparse low mulga shrubs and grasses

Plate 42 Soil surface / vegetation at Site YIN24

Site reference: Site YIN28
Site description: Drainage depression with cracking surface
Soil landform association: Undulating stony plain
Soil group: Red shallow loam (WA Soil Group 522)

Datum: GDA 1994 z50
Easting: 0426447
Northing: 7291559

Plate 49 Surface soil profile at Site YIN28

Soil profile description:

0 to 10 cm: Moderately structured/strongly structured, red/brown sandy loam/clay loam soil with approximately 10% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has a moderately firm consistence with root growth classed as 'none'.

10 to 30 cm: Weakly structured /moderately structured, red/brown sandy loam/clay loam soil with approximately 10% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size. Soil has a moderately firm consistence with root growth classed as 'none'.

Soil surface: Strong cracking loamy crust with approximately 5% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size and approximately 5% vegetation / litter cover.

Plate 50 Soil surface / vegetation at Site YIN28

Site reference: Site YIN29 **Datum:** GDA 1994 z50

Site description: Slightly sloping stony plain, with sparse mulga **Easting:** 0421815

Soil landform association: Undulating stony plain **Northing:** 7286848

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 51 Surface soil profile at Site YIN29

Soil profile description:

0 to 10 cm: Weakly structured, red/brown sandy loam/loamy sand soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 50 mm in size. Soil has a weak consistence with root growth classed as 'few'.

10 to 30 cm: Weakly structured /moderately structured, red/brown loamy sand soil with approximately 15% sub-rounded to sub-angular coarse fragments, approximately 2 to 5 mm in size. Soil has weak consistence with root growth classed as 'few'.

>30 cm: Hardpan.

Soil surface: Thin weak crust with approximately 60% sub-rounded to angular coarse fragments, approximately 2 to 170 mm in size and approximately 20% vegetation / litter cover.

Vegetation: Sparse shrubs and mulga

Plate 52 Soil surface / vegetation at Site YIN29

Site reference: Site YIN26B
Site description: Near to floodplain area from fluvial land system
Soil landform association: Undulating stony plain

Datum: GDA 1994 z50
Easting: 0419804
Northing: 7285676

Soil group: Red loamy earth (WA soil group 544)

Plate 53 Surface soil profile at Site YIN26B

Soil surface: Thin weak crust with approximately 10% sub-rounded to angular coarse fragments, approximately 2 to 10 mm in size and approximately 15% vegetation / litter cover. Sheet erosion evident.

Vegetation: Open mulga woodland, sparse grasses and shrubs.

Soil profile description:

0 to 10 cm: Massive, brown/red clay loam soil with approximately <5% sub-rounded to angular coarse fragments, approximately 2 to 5 mm in size. Soil has firm consistence with root growth classed as 'few'.

10 to 30 cm: Massive, red/brown clay loam soil with approximately <5% sub-rounded to sub-angular coarse fragments, approximately 2 to 5 mm in size. Soil has moderately firm consistence with root growth classed as 'none'.

Plate 54 Soil surface / vegetation at Site YIN26B

Outcropping low rise SLA

MINE EARTH

Site reference: Site YIN18 **Datum:** GDA 1994 z50

Site description: Gravelly / stony plain, with sparse shrubs and grasses **Easting:** 0423436

Soil landform association: Outcropping Low Rises **Northing:** 7288081

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 33 Surface soil profile at Site YIN18

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown sandy loam/sandy clay soil with approximately 40% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has moderately firm consistence with root growth classed as 'few'.

10 to 20 cm: Weakly structured /moderately structured, red/brown clayey sand/sandy loam soil with approximately 20% sub-rounded to sub-angular coarse fragments, approximately 2 to 30 mm in size. Soil has moderately firm consistence with root growth classed as 'few'.

>20 cm: Hardpan.

Soil surface: Small shrubs, grasses with approximately 60 -70% sub-rounded to sub-angular coarse fragments, approximately 2 to 200 mm in size and approximately 5% vegetation / litter cover. Channelling and outcropping rock nearby.

Vegetation: Sparse shrubs and grasses

Plate 34 Soil surface / vegetation at Site YIN18

Site reference: Site YIN20 **Datum:** GDA 1994 z50

Site description: Stony plain with nearby outcropping rock. **Easting:** 0423209

Soil landform association: Outcropping Low Rises **Northing:** 7289553

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 37 Surface soil profile at Site YIN20

Soil profile description:

0 to 10 cm: Weakly structured, red/brown gravelly/clay loam soil with approximately 50% sub-angular to sub-rounded quartz coarse fragments, approximately 2 to 60 mm in size. Soil has a moderately firm consistence with root growth classed as 'few'.

10 to 25 cm: Moderately structured /strongly structured, red/brown clayey/clay loam soil with approximately <5% coarse fragments. Soil has a firm consistence with root growth classed as 'none'.

>25 cm: Hardpan

Soil surface: No crust with approximately 80% sub-rounded to sub-angular quartz coarse fragments, approximately 2 to 150 mm in size and approximately 5% vegetation / litter cover. Channel erosion nearby.

Vegetation: Sparse shrubs and mulga woodland

Plate 38 Soil surface / vegetation at Site YIN20

Site reference: Site YIN25 **Datum:** GDA 1994 z50

Site description: Slightly sloping sandy plain with large, rounded rock outcrop **Easting:** 0422753

Soil landform association: Outcropping Low Rises **Northing:** 7288280

Soil group: Red-brown hardpan shallow loam (WA Soil Group 523)

Plate 43 Surface soil profile at Site YIN25

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown gravelly/loamy sand soil with approximately 60% sub-rounded to sub-angular coarse fragments, approximately 2 to 20 mm in size. Soil has a moderately weak consistence with root growth classed as 'common'.

10 to 25 cm: Weakly structured /moderately structured, red/brown gravelly/sandy loam soil with approximately 30% sub-rounded to angular coarse fragments, approximately 2 to 30 mm in size. Soil has a moderately firm consistence with root growth classed as 'none'.

>25 cm: Hardpan

Soil surface: Thin weak crust with approximately 90% sub-rounded to angular coarse fragments, approximately 2 to 60 mm in size and approximately 5% vegetation / litter cover. Some channel erosion nearby.

Vegetation: Sparse small shrubs

Plate 44 Soil surface / vegetation at Site YIN25

Major Channels SLA

MINE EARTH

Site reference: Site YIN26 **Datum:** GDA 1994 z50
Site description: Alluvial channel **Easting:** 0419334
Soil landform association: Major Channels **Northing:** 7285952
Soil group: No suitable group (dry river bed) (WA Soil Group 703)

Plate 45 Surface soil profile at Site YIN26

Soil profile description:

0 to 10 cm: Single grained, yellow sandy soil with approximately 30% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size. Soil has loose consistence with root growth classed as 'none'.

Soil surface: In middle of channel. No crust with approximately 40% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size and approximately 10% vegetation / litter cover.

Vegetation: Eucalyptus and mulga, open woodland with grasses and shrubs

Plate 46 Soil surface / vegetation at Site YIN26

Major Drainage Tracts SLA

MINE EARTH

Site reference: Site YIN27
Site description: Low lying area through stony plain with minor drainage lines
Soil landform association: Major Drainage Tracts
Soil group: Red loamy earth (WA soil group 544)

Datum: GDA 1994 z50
Easting: 0421002
Northing: 7285089

Plate 47 Surface soil profile at Site YIN27

Soil profile description:

0 to 10 cm: Weakly structured/moderately structured, red/brown sandy loam/clay loam soil with approximately 5% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size. Soil has a moderately firm consistence with root growth classed as 'few'.

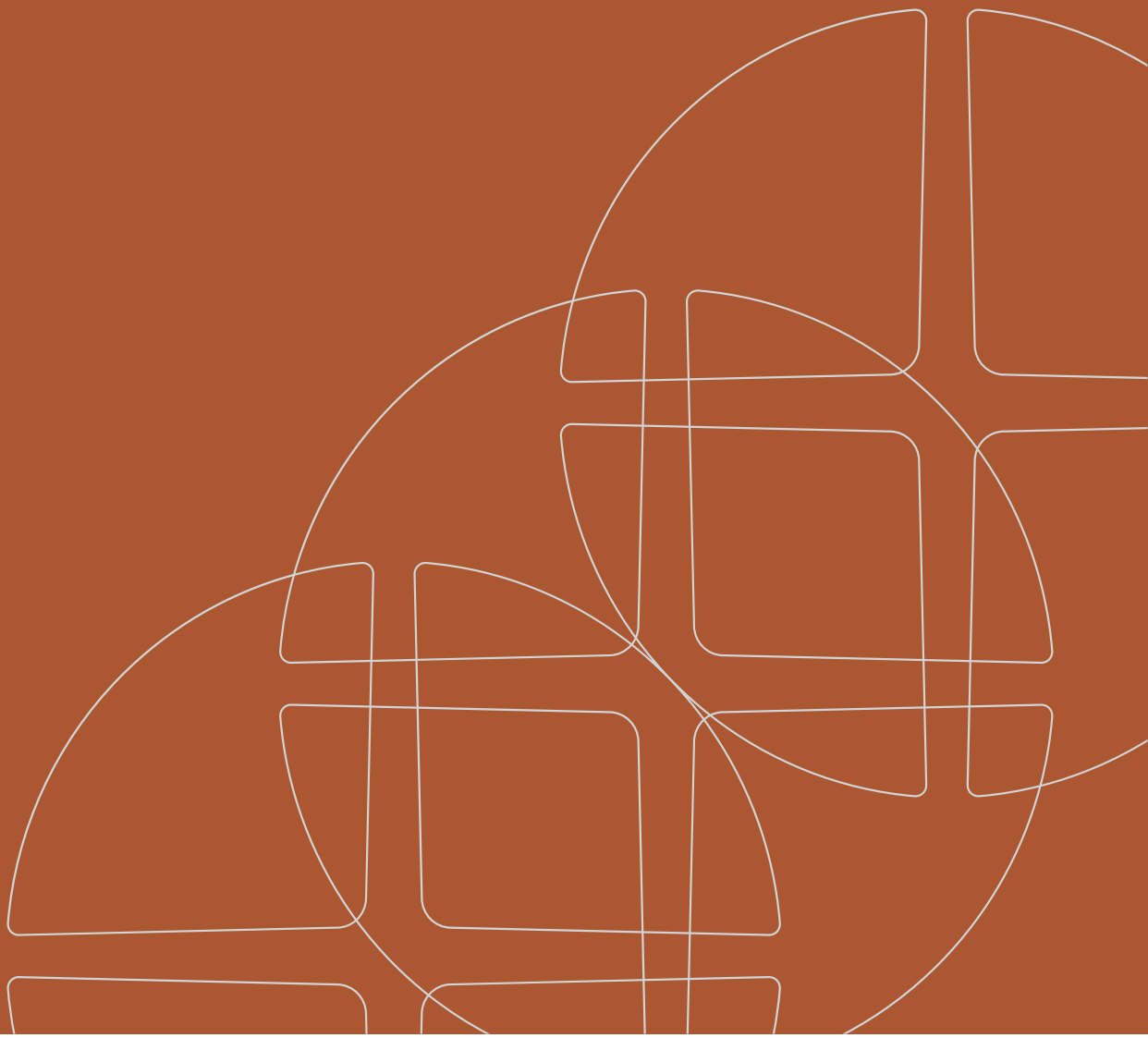
10 to 25 cm: Weakly structured /moderately structured, red/brown sandy loam/clay loam soil with approximately 5% sub-rounded to sub-angular coarse fragments, approximately 2 to 10 mm in size. Soil has a moderately firm consistence with root growth classed as 'few'.

Soil surface: Thick weak crust with approximately 5% sub-rounded to sub-angular coarse fragments, approximately 2 to 5 mm in size and approximately 15% vegetation / litter cover. Channel erosion.

Vegetation: Open mulga and sparse shrubs

Plate 48 Soil surface / vegetation at Site YIN27

Appendix B
Soil Classifications



MINE EARTH

Emerson Dispersion Test Classes (Moore 1998)

Class	Description
Class 1	Dry aggregate slakes and completely disperses
Class 2	Dry aggregate slakes and partly disperses
Class 3a	Dry aggregate slakes but does not disperse; remoulded soil disperses completely
Class 3b	Dry aggregate slakes but does not disperse; remoulded soil partly disperses
Class 4	Dry aggregate slakes but does not disperse; remoulded soil does not disperse; carbonates and gypsum are present
Class 5	Dry aggregate slakes but does not disperse; remoulded soil does not disperse; carbonates and gypsum are absent; 1: suspension remains dispersed
Class 6	Dry aggregate slakes but does not disperse; remoulded soil does not disperse; carbonates and gypsum are absent; 1:5 suspension remains flocculated
Class 7	Dry aggregate does not slake; aggregate swells
Class 8	Dry aggregate does not slake; aggregate does not swell

Soil Electrical conductivity classes (based on standard USDA and CSIRO categories)

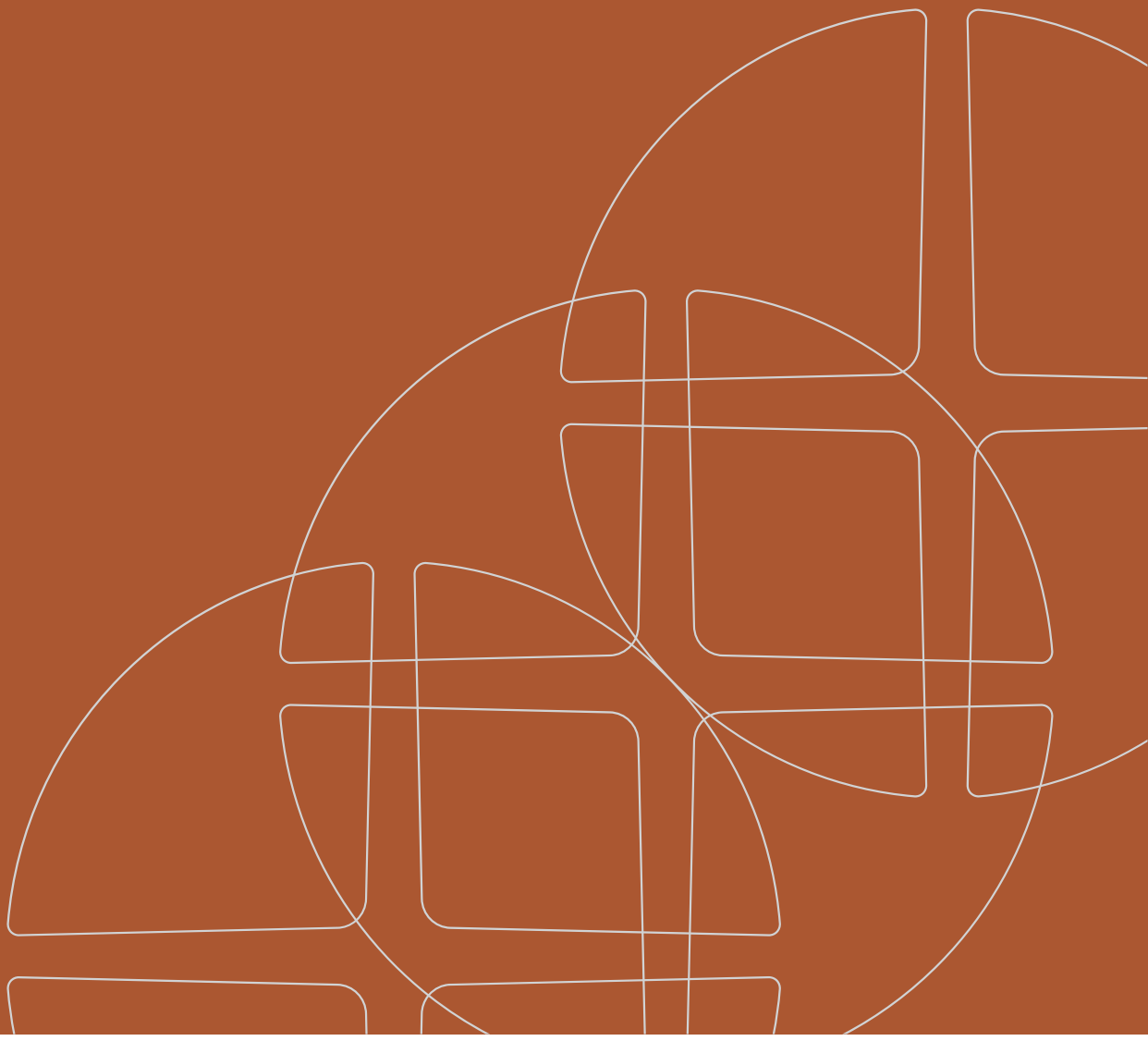
EC (1:5) (dS/m)						
Salinity class	**Sand**	**Sandy loam**	**Loam**	**Clay loam**	**Light / medium clay**	**Heavy clay**
Non-saline	<0.13	<0.17	<0.20	<0.22	<0.25	<0.33
Slightly saline	0.13 – 0.26	0.17 – 0.33	0.20 – 0.40	0.22 – 0.44	0.25 – 0.50	0.33 – 0.67
Moderately saline	0.26 – 0.52	0.33 – 0.67	0.40 – 0.80	0.44 – 0.89	0.50 – 1.00	0.67 – 1.33
Very saline	0.52 – 1.06	0.67 – 1.33	0.80 – 1.60	0.89 – 1.78	1.00 – 2.00	1.33 – 2.67
Extremely saline	>1.06	>1.33	>1.60	>1.78	>2.00	>2.67

Soil pH classes

	Soil pH rating						
	Very strongly acid (Vsac)	**Strongly acid (Sac)**	**Moderately acid (Mac)**	**Slightly acid (Slac)**	**Neutral (N)**	**Moderately alkaline (Malk)**	**Strongly alkaline (Salk)**
pH_w	<5.3	5.3 – 5.6	5.6 – 6.0	6.0 – 6.5	6.5 – 8.0	8.0 – 9.0	>9.0
pH_{Ca}	<4.2	4.2 – 4.5	4.5 – 5.0	5.0 – 5.5	5.5 – 7.0	7.0 – 8.0	>8.0

Appendix C

CSBP Laboratory Results



MINE EARTH

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24086	2JPS24087	2JPS24088	2JPS24089	2JPS24090	2JPS24091	2JPS24092	2JPS24093
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-01	YIN-03	YIN-05	YIN-07	YIN-09	YIN-14	YIN-28	YIN-29
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	40-50	40-50	40-50	40-50	40-50	10-25	10-25	10-20
Colour		BRGR	BRWH	BR	DKBR	BR	BRWH	BRRD	BR
Gravel	%	5-10	15-20	0	20-25	20-25	15-20	5-10	20-25
Texture		2.5	3.0	3.0	3.0	3.0	2.5	2.5	2.5
Ammonium Nitrogen	mg/kg	< 1	< 1	4	3	2	1	1	1
Nitrate Nitrogen	mg/kg	2	8	7	1	2	10	1	1
Phosphorus Colwell	mg/kg	8	13	8	3	6	8	7	6
Potassium Colwell	mg/kg	22	94	40	29	32	115	125	306
Sulfur	mg/kg	1866.7	18.3	24.1	2.1	60.5	3.6	2.8	44.2
Organic Carbon	%	0.08	0.15	0.12	0.14	0.10	0.21	0.09	0.19
Conductivity	dS/m	2.489	0.402	0.777	0.081	0.816	0.127	0.063	1.753
pH Level (CaCl2)		7.5	7.7	7.3	7.4	7.7	7.6	7.9	7.0
pH Level (H2O)		8.0	8.5	8.1	8.9	8.2	8.6	9.0	7.6
Prewash exch. Ca	meq/100g	5.70	5.74	9.19	14.18	4.21	8.90	4.17	2.84
Prewash exch. K	meq/100g	0.05	0.12	0.06	0.05	0.06	0.21	0.14	0.41
Prewash exch. Mg	meq/100g	0.76	0.53	1.84	1.61	3.16	0.30	0.93	1.25
Prewash exch. Na	meq/100g	0.24	< 0.10	0.24	< 0.10	0.23	< 0.10	< 0.10	0.24

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24020	2JPS24021	2JPS24022	2JPS24023	2JPS24024	2JPS24025	2JPS24026	2JPS24027
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-01	YIN-01	YIN-01	YIN-02	YIN-02	YIN-02	YIN-02	YIN-03
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	0-10	10-20	90-100	0-10	10-20	40-50	90-100	0-10
Colour		BROR	BR	GR	LTBR	BR	LTBR	BRGR	LTBR
Gravel	%	5-10	5-10	10-15	35-40	15-20	25-30	55-60	35-40
Texture		2.5	2.5	2.5	2.5	3.0	2.5	2.5	2.5
Ammonium Nitrogen	mg/kg	2	2	< 1	2	2	< 1	< 1	< 1
Nitrate Nitrogen	mg/kg	9	15	< 1	4	8	2	1	< 1
Phosphorus Colwell	mg/kg	8	3	5	9	4	9	12	10
Potassium Colwell	mg/kg	94	40	20	158	78	24	20	151
Sulfur	mg/kg	35.7	73.8	6170.2	178.1	72.8	148.1	1145.6	3.4
Organic Carbon	%	0.20	0.27	0.11	0.16	0.17	0.08	0.13	0.10
Conductivity	dS/m	1.940	3.330	2.528	1.892	4.127	1.505	2.432	0.067
pH Level (CaCl2)		6.0	6.5	6.3	6.4	6.3	7.3	7.1	7.7
pH Level (H2O)		6.6	6.8	7.0	6.9	7.0	7.9	7.8	8.7
% Clay	%	20.58	23.11	3.88	8.93	20.20	15.18	7.27	9.75
% Course Sand	%	42.47	25.25	57.27	44.77	29.16	44.31	49.01	49.22
% Fine Sand	%	24.17	34.52	31.00	34.32	23.29	30.04	37.32	34.16
% Sand	%	66.64	59.77	88.27	79.09	52.45	74.35	86.33	83.38
% Silt	%	12.77	17.12	7.85	11.98	27.34	10.47	6.40	6.86
Prewash exch. Ca	meq/100g	3.65	3.82	17.22	2.66	7.85	5.85	7.70	5.46
Prewash exch. K	meq/100g	0.11	0.06	0.05	0.12	0.15	0.03	0.02	0.21
Prewash exch. Mg	meq/100g	2.80	3.06	0.24	0.64	3.58	1.27	0.87	0.70

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24028	2JPS24029	2JPS24030	2JPS24031	2JPS24032	2JPS24033	2JPS24034	2JPS24035
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-03	YIN-04	YIN-04	YIN-04	YIN-05	YIN-05	YIN-06	YIN-06
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	10-20	0-10	10-20	40-50	0-10	10-20	0-10	10-20
Colour		BRGR	BR	BROR	BRGR	BR	BR	BRGR	BRGR
Gravel	%	45-50	15-20	15-20	65-70	35-40	55-60	45-50	45-50
Texture		2.5	3.0	2.5	3.0	3.0	3.0	2.5	2.5
Ammonium Nitrogen	mg/kg	1	3	1	2	< 1	2	2	1
Nitrate Nitrogen	mg/kg	1	2	1	3	8	10	2	8
Phosphorus Colwell	mg/kg	12	5	10	10	11	3	9	4
Potassium Colwell	mg/kg	166	115	171	56	113	41	211	158
Sulfur	mg/kg	4.2	3.5	2.6	4.1	4.2	7.0	3.9	6.4
Organic Carbon	%	0.16	0.08	0.13	0.08	0.11	0.10	0.13	0.12
Conductivity	dS/m	0.082	0.065	0.019	0.065	0.068	0.211	0.082	0.095
pH Level (CaCl2)		7.6	6.8	6.1	6.8	6.3	7.5	7.4	7.8
pH Level (H2O)		8.8	7.6	7.8	7.4	7.6	8.2	8.5	8.7
% Clay	%	11.07	22.18	14.83	17.28	16.96	16.87	10.28	17.31
% Course Sand	%	46.95	49.72	49.28	66.71	49.60	52.69	46.81	40.99
% Fine Sand	%	30.86	25.20	29.94	15.04	24.43	22.49	32.59	29.15
% Sand	%	77.81	74.92	79.22	81.75	74.03	75.18	79.40	70.14
% Silt	%	11.12	2.90	5.95	0.96	9.00	7.96	10.32	12.54
Prewash exch. Ca	meq/100g	6.64	5.07	1.64	4.01	5.75	7.19	3.74	5.20
Prewash exch. K	meq/100g	0.24	0.16	0.21	0.06	0.21	0.09	0.31	0.23
Prewash exch. Mg	meq/100g	0.56	1.97	1.26	1.51	3.00	1.75	0.81	0.44

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24037	2JPS24038	2JPS24039	2JPS24040	2JPS24041	2JPS24042	2JPS24043	2JPS24044
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-06	YIN-07	YIN-07	YIN-07	YIN-08	YIN-08	YIN-08	YIN-08
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	40-50	0-10	10-20	90-100	0-10	10-20	40-50	90-100
Colour		BRWH	BR	DKBR	BRGR	LTBR	DKBR	BR	GRBR
Gravel	%	50-55	15-20	15-20	35-40	35-40	15-20	45-50	50-55
Texture		2.5	2.5	3.0	3.0	2.5	3.0	3.0	3.0
Ammonium Nitrogen	mg/kg	< 1	< 1	< 1	1	1	1	1	< 1
Nitrate Nitrogen	mg/kg	9	< 1	2	< 1	5	36	33	13
Phosphorus Colwell	mg/kg	4	13	4	5	11	3	4	5
Potassium Colwell	mg/kg	36	164	115	19	156	77	40	39
Sulfur	mg/kg	11.4	1.6	2.9	4.0	4.7	17.4	108.2	322.4
Organic Carbon	%	< 0.05	0.11	0.23	< 0.05	0.07	0.11	0.10	0.07
Conductivity	dS/m	0.115	0.042	0.070	0.117	0.269	1.524	1.778	1.266
pH Level (CaCl2)		7.9	6.5	7.9	7.6	7.2	7.0	7.2	7.3
pH Level (H2O)		9.0	8.0	8.9	9.1	8.1	7.4	8.2	8.4
% Clay	%	8.52	12.54	12.84	13.30	13.92	22.48	8.50	4.78
% Course Sand	%	49.74	55.47	53.88	40.07	31.46	37.68	51.95	66.56
% Fine Sand	%	28.42	25.20	25.34	33.29	33.66	23.19	31.01	22.87
% Sand	%	78.16	80.67	79.22	73.36	65.12	60.87	82.96	89.43
% Silt	%	13.33	6.78	7.93	13.35	20.96	16.65	8.54	5.79
Prewash exch. Ca	meq/100g	5.45	4.62	9.92	15.16	3.97	5.86	4.80	4.28
Prewash exch. K	meq/100g	0.05	0.27	0.24	0.10	0.19	0.15	0.05	0.03
Prewash exch. Mg	meq/100g	0.30	1.52	1.10	3.07	1.45	3.36	1.69	1.25

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24045	2JPS24046	2JPS24047	2JPS24048	2JPS24049	2JPS24050	2JPS24051	2JPS24052
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-09	YIN-09	YIN-10	YIN-10	YIN-10	YIN-10	YIN-11	YIN-11
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	0-10	10-20	0-10	10-20	40-50	90-100	0-10	10-20
Colour		BROR	DKBR	BROR	BR	BR	BRGR	BR	DKBR
Gravel	%	35-40	15-20	25-30	25-30	15-20	20-25	25-30	20-25
Texture		2.5	3.0	3.0	3.0	3.0	3.0	2.5	3.0
Ammonium Nitrogen	mg/kg	1	2	1	1	1	1	2	5
Nitrate Nitrogen	mg/kg	3	5	5	8	5	1	39	78
Phosphorus Colwell	mg/kg	12	3	12	6	10	16	17	13
Potassium Colwell	mg/kg	136	61	259	120	46	21	275	305
Sulfur	mg/kg	2.0	17.3	9.0	49.9	195.5	293.6	32.6	779.5
Organic Carbon	%	0.23	0.12	0.11	0.18	0.11	< 0.05	0.16	0.40
Conductivity	dS/m	0.061	0.667	0.738	2.926	2.310	1.500	4.326	8.862
pH Level (CaCl2)		7.2	7.1	7.2	7.5	7.8	7.6	6.8	7.1
pH Level (H2O)		7.9	7.9	7.6	7.8	8.3	8.6	6.9	7.6
% Clay	%	13.88	31.17	14.72	15.68	21.43	23.18	19.36	2.96
% Course Sand	%	42.86	33.72	36.76	33.69	29.53	33.18	30.22	24.30
% Fine Sand	%	32.11	23.77	31.78	30.70	31.66	26.46	28.97	18.47
% Sand	%	74.97	57.49	68.54	64.39	61.19	59.64	59.19	42.77
% Silt	%	11.14	11.35	16.74	19.93	17.39	17.17	21.46	54.27
Prewash exch. Ca	meq/100g	2.21	5.76	5.30	7.58	8.37	10.79	2.88	4.69
Prewash exch. K	meq/100g	0.15	0.11	0.35	0.18	0.08	0.05	0.40	0.54
Prewash exch. Mg	meq/100g	1.72	7.07	1.36	1.44	1.74	2.86	2.29	2.96

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24053	2JPS24054	2JPS24055	2JPS24056	2JPS24057	2JPS24058	2JPS24059	2JPS24060
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-11	YIN-11	YIN-12	YIN-12	YIN-12	YIN-12	YIN-13	YIN-13
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	40-50	90-100	0-10	10-20	40-50	90-100	0-10	10-20
Colour		LTBR	LTBR	BROR	BR	BR	BR	LTBR	LTBR
Gravel	%	45-50	25-30	20-25	20-25	25-30	35-40	25-30	20-25
Texture		3.0	3.0	2.5	2.5	3.0	3.0	2.5	2.5
Ammonium Nitrogen	mg/kg	2	< 1	< 1	2	2	3	2	4
Nitrate Nitrogen	mg/kg	24	11	< 1	3	7	2	79	127
Phosphorus Colwell	mg/kg	7	5	4	< 2	2	< 2	10	6
Potassium Colwell	mg/kg	103	85	140	96	61	82	294	214
Sulfur	mg/kg	348.6	5247.0	4.0	10.9	54.3	161.9	47.3	248.1
Organic Carbon	%	0.14	0.08	< 0.05	0.08	0.08	0.08	0.11	0.17
Conductivity	dS/m	5.171	5.653	0.028	0.398	0.989	1.307	2.450	4.287
pH Level (CaCl2)		7.7	7.7	6.9	6.9	7.4	7.3	7.1	7.5
pH Level (H2O)		8.3	8.1	7.9	7.4	8.4	8.3	7.5	7.7
% Clay	%	18.60	20.99	10.66	21.80	20.36	15.73	17.00	17.30
% Course Sand	%	39.18	34.02	41.23	37.17	38.75	29.36	32.24	34.05
% Fine Sand	%	20.64	26.95	39.35	30.62	26.31	36.17	31.72	26.18
% Sand	%	59.82	60.97	80.58	67.79	65.06	65.53	63.96	60.23
% Silt	%	21.59	18.04	8.76	10.41	14.58	18.74	19.05	22.46
Prewash exch. Ca	meq/100g	5.61	9.57	1.23	2.89	7.74	10.34	5.30	8.30
Prewash exch. K	meq/100g	0.19	0.12	0.17	0.20	0.17	0.21	0.43	0.34
Prewash exch. Mg	meq/100g	1.92	1.16	0.93	1.94	4.62	7.14	2.03	1.92

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24061	2JPS24062	2JPS24063	2JPS24064	2JPS24065	2JPS24066	2JPS24068	2JPS24069
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-14	YIN-15	YIN-15	YIN-16	YIN-16	YIN-18	YIN-18	YIN-19
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	0-10	0-10	10-25	0-10	10-25	0-10	10-20	0-10
Colour		BRWH	LTBR	BR	LTBR	LTBR	BR	BR	BR
Gravel	%	10-15	55-60	5	15-20	20-25	15-20	5-10	15-20
Texture		3.0	2.5	3.0	2.5	2.5	3.0	2.5	3.0
Ammonium Nitrogen	mg/kg	1	1	3	< 1	< 1	< 1	< 1	< 1
Nitrate Nitrogen	mg/kg	< 1	7	48	3	7	2	6	2
Phosphorus Colwell	mg/kg	10	14	7	9	5	6	2	16
Potassium Colwell	mg/kg	211	170	148	240	141	117	90	264
Sulfur	mg/kg	3.3	5.1	109.7	6.0	19.3	5.1	13.6	2.2
Organic Carbon	%	0.17	0.10	0.16	0.16	0.23	0.12	0.08	0.17
Conductivity	dS/m	0.068	0.692	3.083	0.295	0.811	0.063	0.066	0.028
pH Level (CaCl2)		7.7	6.8	7.0	7.7	7.5	7.2	6.0	6.3
pH Level (H2O)		8.8	7.9	7.3	8.9	8.6	7.7	7.2	7.8
% Clay	%	14.00	17.10	19.90	11.13	13.90	8.96	13.92	14.73
% Course Sand	%	49.36	38.33	29.39	57.34	52.95	49.69	53.29	26.50
% Fine Sand	%	25.60	30.27	24.79	23.40	23.18	33.34	25.79	41.03
% Sand	%	74.96	68.60	54.18	80.74	76.13	83.03	79.08	67.53
% Silt	%	11.04	14.29	25.93	8.13	9.97	8.01	6.99	17.73
Prewash exch. Ca	meq/100g	7.22	0.70	1.83	5.76	6.35	1.84	1.75	2.96
Prewash exch. K	meq/100g	0.35	0.19	0.31	0.30	0.18	0.15	0.13	0.44
Prewash exch. Mg	meq/100g	0.64	0.63	3.20	0.45	0.46	1.15	1.38	2.33

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24070	2JPS24071	2JPS24072	2JPS24073	2JPS24074	2JPS24075	2JPS24076	2JPS24077
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-19	YIN-20	YIN-20	YIN-23	YIN-23	YIN-24	YIN-24	YIN-25
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	10-25	0-10	10-20	0-10	10-20	0-10	10-25	0-10
Colour		LTBR	BROR	BR	LTBR	LTBR	DKBR	DKBR	LTBR
Gravel	%	60-65	35-40	10-15	10-15	5-10	10-15	5	15-20
Texture		3.0	3.0	3.0	2.5	3.0	3.0	3.0	2.5
Ammonium Nitrogen	mg/kg	1	2	2	1	2	3	3	2
Nitrate Nitrogen	mg/kg	10	2	8	6	65	15	35	2
Phosphorus Colwell	mg/kg	11	9	4	12	10	8	4	11
Potassium Colwell	mg/kg	187	150	125	425	380	198	99	135
Sulfur	mg/kg	5.0	5.4	49.0	3.1	13.0	309.3	6019.3	4.0
Organic Carbon	%	0.14	0.14	0.19	0.09	0.18	0.21	0.26	0.13
Conductivity	dS/m	0.411	0.428	1.993	0.052	0.376	6.072	16.160	0.019
pH Level (CaCl2)		6.7	6.2	7.0	6.4	7.1	6.5	6.9	5.8
pH Level (H2O)		7.4	6.6	7.8	7.5	8.1	7.4	7.2	7.1
% Clay	%	26.58	14.07	38.72	9.90	11.90	49.13	53.69	11.91
% Course Sand	%	32.70	42.78	31.25	48.57	43.90	17.37	10.91	55.18
% Fine Sand	%	27.90	38.11	23.90	31.59	32.25	25.47	27.44	26.93
% Sand	%	60.60	80.89	55.15	80.16	76.15	42.84	38.35	82.11
% Silt	%	12.82	5.04	6.12	9.95	11.95	8.03	7.97	5.98
Prewash exch. Ca	meq/100g	3.92	1.60	6.47	3.73	7.34	0.97	7.86	1.07
Prewash exch. K	meq/100g	0.27	0.19	0.29	0.57	0.57	0.43	0.15	0.15
Prewash exch. Mg	meq/100g	3.21	1.09	4.40	1.42	0.69	7.72	6.46	0.84

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24078	2JPS24079	2JPS24080	2JPS24081	2JPS24082	2JPS24083	2JPS24084	2JPS24085
	Date Received	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024	02/09/2024
	Sample Name 1	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403	YIN-2403
	Sample Name 2	YIN-25	YIN-26	YIN-26B	YIN-26B	YIN-27	YIN-27	YIN-28	YIN-29
	Sample Name 3	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd	Mine Earth Pty Ltd
	Depth	10-20	0-10	0-10	10-25	0-10	10-20	0-10	0-10
Colour		BR	OR	LTBR	BR	LTBR	BR	BR	BR
Gravel	%	30-35	30-35	5	5	5	5-10	15-20	30-35
Texture		2.5	1.0	2.0	2.0	2.0	2.5	3.0	2.0
Ammonium Nitrogen	mg/kg	1	< 1	< 1	< 1	< 1	1	5	1
Nitrate Nitrogen	mg/kg	2	< 1	< 1	< 1	2	4	4	1
Phosphorus Colwell	mg/kg	6	3	12	11	8	6	11	12
Potassium Colwell	mg/kg	116	43	237	267	175	276	194	278
Sulfur	mg/kg	2.6	0.7	1.0	2.8	1.8	3.2	4.5	1.9
Organic Carbon	%	0.06	0.06	0.07	0.10	0.10	0.13	0.30	0.10
Conductivity	dS/m	0.011	< 0.010	0.020	0.132	0.021	0.093	0.056	0.145
pH Level (CaCl2)		5.9	6.5	6.2	6.8	6.5	7.1	6.9	6.9
pH Level (H2O)		7.0	6.9	7.3	7.5	7.7	7.8	8.0	7.4
% Clay	%	11.80	4.76	10.91	16.79	13.01	23.68	20.70	9.05
% Course Sand	%	54.32	94.02	59.50	47.51	60.73	49.15	35.49	54.64
% Fine Sand	%	27.96	1.23	26.60	31.74	23.25	19.26	30.33	27.21
% Sand	%	82.28	95.25	86.10	79.25	83.98	68.41	65.82	81.85
% Silt	%	5.92	< 0.01	2.99	3.96	3.01	7.91	13.49	9.10
Prewash exch. Ca	meq/100g	1.50	0.47	1.64	2.79	2.25	4.09	4.52	1.30
Prewash exch. K	meq/100g	0.10	0.03	0.28	0.40	0.27	0.47	0.26	0.36
Prewash exch. Mg	meq/100g	0.86	0.16	1.49	1.87	1.24	2.07	2.34	0.60

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24020	2JPS24021	2JPS24022	2JPS24023	2JPS24024	2JPS24025	2JPS24026	2JPS24027
Prewash exch. Na	meq/100g	0.29	0.44	< 0.10	0.22	0.92	0.42	0.99	< 0.10
Arsenic	ug/kg	3264.34	5127.17	451.94	1931.30	5555.32	3028.77	1098.41	2650.00
Cadmium	ug/kg	280.39	122.35	130.67	122.41	36.01	28.58	9.95	67.72
Chromium	ug/kg	75848.43	86236.30	55702.78	78594.70	106998.75	94965.71	87027.80	93013.28
Cobalt	ug/kg	18543.92	32779.57	20937.14	18688.92	20818.86	25491.15	23234.72	22196.49
Lead	ug/kg	12435.04	13107.25	2416.25	11740.05	19179.03	10375.86	4882.72	10004.59
Molybdenum	ug/kg	752.7	669.3	169.1	538.8	733.1	966.8	1540.6	533.4
Selenium	ug/kg	1781.83	1515.45	856.87	1757.09	1732.64	3827.87	3446.33	2128.31

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24028	2JPS24029	2JPS24030	2JPS24031	2JPS24032	2JPS24033	2JPS24034	2JPS24035
Prewash exch. Na	meq/100g	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Arsenic	ug/kg	2374.18	3140.01	3269.92	1464.69	4876.30	6541.75	2741.11	3812.47
Cadmium	ug/kg	54.33	25.94	42.45	22.56	65.30	51.69	50.55	52.86
Chromium	ug/kg	76129.84	56563.96	62216.37	15974.74	82245.95	65572.59	75101.96	67024.58
Cobalt	ug/kg	17474.78	9226.73	9732.14	3232.28	34926.98	23377.50	22399.21	21247.25
Lead	ug/kg	8063.49	130215.26	109236.75	79436.10	15315.91	13934.68	10439.95	9101.61
Molybdenum	ug/kg	378.7	732.2	1017.4	509.5	1103.3	760.3	424.1	277.4
Selenium	ug/kg	1276.67	1377.41	1867.54	1384.54	1492.86	1336.95	2378.91	1686.04

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24037	2JPS24038	2JPS24039	2JPS24040	2JPS24041	2JPS24042	2JPS24043	2JPS24044
Prewash exch. Na	meq/100g	< 0.10	< 0.10	< 0.10	0.23	0.24	0.41	0.29	0.39
Arsenic	ug/kg	2618.63	3805.91	5810.86	5506.29	4391.22	5167.47	2679.84	1262.32
Cadmium	ug/kg	27.48	85.33	109.67	255.91	49.75	72.98	35.15	18.79
Chromium	ug/kg	57192.98	81180.28	92834.16	31139.45	79621.27	90407.83	64866.24	55900.28
Cobalt	ug/kg	21651.08	23489.84	30967.13	35051.81	24083.02	22724.82	24980.11	22690.41
Lead	ug/kg	4837.11	15350.35	19308.42	11626.53	18472.50	17905.72	10368.24	5195.03
Molybdenum	ug/kg	188.7	363.0	503.8	324.8	578.5	551.0	434.9	131.8
Selenium	ug/kg	4484.32	2182.98	1234.75	1112.25	1717.01	1784.35	2098.25	1233.72

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24045	2JPS24046	2JPS24047	2JPS24048	2JPS24049	2JPS24050	2JPS24051	2JPS24052
Prewash exch. Na	meq/100g	< 0.10	0.45	0.18	0.39	0.46	0.92	0.65	0.88
Arsenic	ug/kg	2579.77	4025.02	3032.80	4950.33	4794.20	3824.86	2960.66	4974.22
Cadmium	ug/kg	42.21	27.87	45.95	111.09	90.90	66.10	86.07	33.77
Chromium	ug/kg	86285.72	99954.06	97908.21	97069.98	116949.04	92624.72	112722.73	74097.00
Cobalt	ug/kg	21767.57	21360.38	29668.48	30323.32	24894.03	19462.01	27244.97	24524.77
Lead	ug/kg	12903.74	14878.08	16296.23	15047.34	14053.73	11304.58	11977.76	21760.81
Molybdenum	ug/kg	576.4	491.2	484.0	392.7	488.3	369.8	2352.1	776.2
Selenium	ug/kg	1922.43	1548.44	821.85	1427.40	1725.13	1320.19	1960.88	1582.74

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24053	2JPS24054	2JPS24055	2JPS24056	2JPS24057	2JPS24058	2JPS24059	2JPS24060
Prewash exch. Na	meq/100g	0.82	0.73	< 0.10	0.14	0.47	1.40	0.42	0.41
Arsenic	ug/kg	7959.98	7790.59	8286.53	4203.59	4542.84	9502.64	6041.28	4615.91
Cadmium	ug/kg	33.50	60.00	21.51	85.77	94.48	101.91	54.04	61.65
Chromium	ug/kg	86468.47	51477.18	52585.31	66261.10	70489.57	75533.69	96176.52	79688.52
Cobalt	ug/kg	21232.90	14404.67	14262.56	13366.41	14727.81	25847.49	21207.03	13162.99
Lead	ug/kg	31225.75	18347.90	19308.78	29995.71	21565.01	110306.25	45198.56	40762.95
Molybdenum	ug/kg	762.3	2119.6	2745.2	977.4	612.4	776.1	877.1	707.3
Selenium	ug/kg	1182.22	1329.64	1008.12	1617.95	1544.75	1348.67	1417.20	740.22

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24061	2JPS24062	2JPS24063	2JPS24064	2JPS24065	2JPS24066	2JPS24068	2JPS24069
Prewash exch. Na	meq/100g	< 0.10	1.55	3.52	< 0.10	0.15	< 0.10	0.17	0.13
Arsenic	ug/kg	1438.74	3068.59	6149.81	2428.01	1777.05	1831.17	2053.98	4495.06
Cadmium	ug/kg	46.47	21.23	23.05	52.61	57.15	14.84	11.61	65.15
Chromium	ug/kg	41053.16	67894.83	65656.79	29983.94	33078.69	25923.42	34855.10	56155.02
Cobalt	ug/kg	6177.12	14681.97	13852.11	6993.59	8562.70	3976.67	5243.09	15177.71
Lead	ug/kg	15565.31	14148.83	16999.71	7556.79	7323.99	10205.20	13280.21	16761.50
Molybdenum	ug/kg	207.1	506.5	553.1	215.5	285.0	610.9	846.1	383.9
Selenium	ug/kg	686.40	910.26	753.01	549.17	421.42	772.41	1151.22	850.32

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24070	2JPS24071	2JPS24072	2JPS24073	2JPS24074	2JPS24075	2JPS24076	2JPS24077
Prewash exch. Na	meq/100g	0.59	0.27	2.89	< 0.10	< 0.10	5.37	2.40	< 0.10
Arsenic	ug/kg	3783.36	1561.73	3585.06	2912.87	5152.78	7627.77	7404.85	1859.95
Cadmium	ug/kg	64.78	11.27	17.09	92.35	89.41	72.68	52.45	29.15
Chromium	ug/kg	51402.52	32773.45	50076.36	44797.98	48348.27	79067.33	64455.88	26364.73
Cobalt	ug/kg	14839.18	6582.72	10269.85	44629.18	26324.80	26236.72	18460.46	5705.30
Lead	ug/kg	11636.00	9437.87	13794.46	7835.60	9084.67	10773.01	8825.50	11815.68
Molybdenum	ug/kg	319.6	174.1	327.9	360.4	417.1	819.3	805.9	878.6
Selenium	ug/kg	482.61	449.33	829.99	1019.65	932.90	1105.76	1685.87	711.08

CSBP Lab. Extract Value.

Analysis Results

CSBP Soil and Plant Analysis Laboratory

Customer: Mine Earth Pty Ltd (90423)
PO/Job Name: YIN-2403
Dates Rec'd: 02/09/2024

	Lab Number	2JPS24078	2JPS24079	2JPS24080	2JPS24081	2JPS24082	2JPS24083	2JPS24084	2JPS24085
Prewash exch. Na	meq/100g	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10	< 0.10
Arsenic	ug/kg	1715.48	366.99	1152.42	1867.59	1568.93	2697.27	5152.33	1404.25
Cadmium	ug/kg	11.20	10.83	24.49	19.34	13.00	35.06	118.40	45.13
Chromium	ug/kg	23537.77	4940.96	33442.43	36255.63	28865.71	36197.54	45442.19	40784.56
Cobalt	ug/kg	5353.38	912.50	6293.25	7281.77	5369.92	8184.99	15265.31	9828.47
Lead	ug/kg	20937.17	2313.41	9363.24	9453.74	13092.64	10493.09	11921.29	8741.77
Molybdenum	ug/kg	666.6	39.5	164.7	199.1	307.7	307.0	156.8	276.4
Selenium	ug/kg	622.03	284.01	786.70	959.99	720.21	920.23	1253.41	828.27

CSBP Lab. Extract Value.