

Olive Downs Coking Coal Project Draft Environmental Impact Statement

> Appendix M Soil and Land Suitability Assessment

Soil and Land Suitability Assessment

Olive Downs Coking Coal Project

Draft Version 6

Pembroke Olive Downs Pty Ltd 10 July 2018



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TABLE OF CONTENTS

EXEC	Ουτιν	E SUN	IMARY	1			
1	INTR	TRODUCTION					
	1.1	.1 PROJECT DETAILS					
	1.2	SCOP	E OF REPORT	1			
2	BACKGROUND						
	2.1	REGU	LATORY REQUIREMENTS	3			
	2.2	LOCA	L SETTING	3			
		2.2.1	Land Use and Vegetation	3			
		2.2.2	Topography and Hydrology	4			
		2.2.3	Regional Geology	4			
3	MET	HODO	DLOGY	5			
	3.1	DESK	TOP REVIEW	5			
		3.1.1	Regional Soils Reports and Available Documentation	5			
		3.1.2	Aerial Photography	5			
		3.1.3	Preliminary Soils Mapping	6			
	3.2	FIELD	WORK	7			
		3.2.1	Survey Timing	7			
		3.2.2	Survey Techniques	7			
		3.2.3	Laboratory Analysis	8			
	3.3	LAND	SUITABILITY ASSESSMENT	11			
	3.4	REGIO	DNAL PLANNING INTERESTS ASSESSMENT	11			
	3.5	ACID	SULFATE SOILS ASSESSMENT	11			
4	RESU	JLTS		12			
	4.1	SOIL	MAPPING UNITS	12			
		4.1.1	Soils of flat to gently undulating plains: Soil Mapping Unit C1	14			
		4.1.2	Clay soils of flat to gently undulating plains: Soil Mapping Unit C2	20			
		4.1.3	Gently undulating plains of sandy earths: Soil Mapping Unit S1	27			
		4.1.4	Gently undulating plains of sandy earths: Soil Mapping Unit S2	32			
		4.1.5	Gently undulating plains of sandy earths: Soil Mapping Unit R1	36			
		4.1.6	Gently undulating plains of sandy earths: Soil Mapping Unit R2	41			
		4.1.7	Gently undulating plains of sandy earths: Soil Mapping Unit L1	46			
		4.1.8	Gently undulating plains of sandy earths: Soil Mapping Unit L2	51			
		4.1.9	Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B1	56			
		4.1.10	Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B2	61			

		4.1.11	. Soils of recent alluvial floodplains and active drainage channels: Soil Mapping A1	g Unit 66
		4.1.12	Soils of recent alluvial floodplains and active drainage channels: Soil Mapping A2	g Unit 70
5	LAN	D SUI	TABILITY AND AGRICULTURAL LAND ASSESSMENT	75
	5.1	PREV	IOUS SOILS REPORT, LAND SUITABILITY AND LIMITATIONS REVIEW	75
		5.1.1	Land Suitability and Limitations (Burgess 2003)	75
		5.1.2	Lands of Isaac-Comet Area, Queensland (Gunn et al. 1967)	75
	5.2	LAND	O SUITABILITY CLASSES	76
	5.3	LAND	SUITABILITY LIMITATIONS ASSESSMENT	77
		5.3.1	Rainfed Broadacre Cropping	77
		5.3.2	Grazing	81
		5.3.3	Land Suitability Limitations Summary	81
	5.4	REVIE	EW AND SUMMARY OF PRE-MINE LAND SUITABILITY AREAS	82
	5.5	AGRI	CULTURAL LAND CLASSES	83
		5.5.1	Agricultural Land Classes Assessment	84
		5.5.2	Regional Frameworks Assessment	85
6	ТОР	SOIL, S	SUBSOIL REVIEW, RECOMMENDATIONS AND STRIPPING DEPTH	88
		6.1.1	Topsoil and Subsoil Management	88
		6.1.2	Specific Soil Mapping Unit Recommendations	88
		6.1.3	Summary of Recommended Soil Stripping Depths and Volumes Available	93
		6.1.4	Double Stripping Depths for Increased Topsoil Volumes	93
		6.1.5	Recommended Topsoil Application Depths for Rehabilitation	94
7	REG	IONAL	PLANNING INTERESTS ASSESSMENT	95
	7.1	ASSE	SSMENT OF STRATEGIC CROPPING LAND	95
	7.2	ASSE	SSMENT OF PRIORITY AGRICULTURAL AREAS	96
8	ACIE) SULF	ATE SOILS ASSESSMENT	97
	8.1	ASSE	SSMENT OF ACTUAL AND POTENTIAL ACID SULFATE SOILS	97
9	LAN	D USE	IMPACTS AND FINAL LAND USE	99
	9.1	DIST	URBANCE TYPES REQUIRING REHABILITATION	99
	9.2	POST	MINING LAND USE SUITABILITY	99
		9.2.1	Significantly Disturbed Areas	102
		9.2.2	Areas with No or Minor Disturbance	102
		9.2.3	General Rehabilitation Strategy	102
10	CON	ICLUS	ION	105
11	REFE		ES	106

12	GLOSSAR	/ OF TERMS
13	FIGURES	
	FIGURE 1	PROJECT LOCATION
	FIGURE 2	PROJECT LAYOUT
	FIGURE 3	SOIL MAPPING UNITS
	FIGURE 4	TOPSOIL STRIPPING DEPTHS
	FIGURE 5	PRE MINE - RAINFED BROADACRE CROPPING
	FIGURE 6	PRE MINE - BEEF CATTLE GRAZING
	FIGURE 7	AGRICULTURAL LAND CLASSES
	FIGURE 8	SCL TRIGGER MAP
	FIGURE 9	POST MINE – RAINFED BROADACRE CROPPING
	FIGURE 10	POST MINE – BEEF CATTLE GRAZING
14	ATTACHM	IENTS
	АТТАСНМЕ	INT 1 CONTAMINATED LAND SITE INSPECTION
15	APPENDIC	ES113
	APPENDIX	A DETAILED SITE DESCRIPTIONS
	APPENDIX	B OBSERVATION SITE DESCRIPTIONS
	APPENDIX	C LABORATORY CERTIFICATES

EXECUTIVE SUMMARY

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke Olive Downs Pty Ltd to complete a soil and land suitability assessment of the Olive Downs Coking Coal Project (the Project).

The Project includes a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres south-east of Moranbah, Queensland. The Project is comprised of the Olive Downs South domain (Mining Lease Application [MLA] 700032 and 700033) and Willunga domain (MLA 700034), associated linear infrastructure (MLA 700035) and waste dump (MLA 700036).

Guidelines and standards of McKenzie et al. (2008) were developed to provide a consistent approach to soil survey methodology across Australia. This approach has been applied by GTE to the description and classification of soils for the Project in line with best practice as recommended by the Queensland Department of Natural Resources and Mines.

The following conclusions have been made:

- Twelve soil mapping units (SMUs), were identified across the Project on the basis of 1010 investigation sites, incorporating 192 detailed sites and 818 observation sites.
- Twelve SMUs are present within the Project site; C1, C2, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2.
- The Project site includes areas of flat to gently undulating plains dominated by uniform and gradational clays (C1 and C2), gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2), relic alluvial plains and low-lying plains (B1 and B2) and recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2).
- Land use suitability assessment of the twelve SMUs reported for rainfed cropping, Class 4: C1, S1, S2, R1, R2 and B1, and Class 5: C2, S1, L1, L2, B2, A1 and A2. Assessment of beef cattle grazing reported Class 3: C1 and S2 and Class 4: C2, S1, R1, R2, L1, L2, B1, B2, A1 and A2. Review of Regional Frameworks for the Inland Fitzroy and Southern Burdekin area assessed SMU C1 having marginal cropping potential for dryland cropping and SMU S2 moderately suitable for dryland cropping with Barley, Chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.
- The majority of topsoil from the loamy sand and clayey sand SMUs (S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2) would be suitable for rehabilitation use in supporting native vegetation and grasses with application preferred on level surface to sloped backfill batters. Topsoils consisting of clay (C1 and C2) would be preferable on level to very gently undulating areas with slopes <1%.

- Six SMUs (S2, R1, R2, B1, B2 [0.20-0.50 metres below ground level] and A1) may be suitable for rehabilitation situations and limited natural vegetation growth with additional soil fertility conditioning on level surface to sloped backfill batters. Five SMUs (C1, S1, L1, L2 and A2) were suitable for use as buried supporting subsoils for topsoil. The remaining SMU (C2) is recommended as capping material over waste rock.
- The Project site is not located within Regional Planning Interests Areas of Strategic Cropping Land and Priority Agricultural Areas.
- The majority of the Project site is shown as 'No Known Occurrence' with respect to Acid Sulfate Soils (ASS). Field observations reported very low indicators in ten SMUs of neutral and neutral to alkaline pH. It is assessed as highly unlikely the SMUs contain soils impacted by actual acid sulphate soils and potential acid sulphate soils however, environmental management plans should include procedures to monitor and identity ASS during the life of the Project.
- The proposed post mine final land use for the majority of the Project site will be a return to beef cattle grazing activities. Final void areas have been assessed as unsuitable for post mine land use and will be fenced off as required to prevent fauna access. Existing infrastructure that is not planned to be decommissioned such as railway lines will be unsuitable for cropping and grazing land uses. It is expected that undisturbed areas of the Project site will remain the same classes identified pre-mine.

1 INTRODUCTION

1.1 **Project Details**

Pembroke Olive Downs Pty Ltd (Pembroke) proposes to develop the Olive Downs Coking Coal Project (the Project), a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland (Figure 1). The Project provides an opportunity to develop an open cut metallurgical coal resource within the Bowen Basin mining precinct that can deliver up to 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke to complete a soil and land suitability assessment of the Project Mining Lease Application areas (MLAs) MLA 700032, MLA 700033, MLA 700034, MLA 700035 and MLA 700036. The Project would cover parts of Mineral Development Licences 277, 3012 and 3013, and Exploration Permits for Coal 649, 676, 688, 721 755, 850, 1949 and 1951.

The Project comprises the Olive Downs South and Willunga domains and associated linear infrastructure corridors, including a rail spur connecting to the Norwich Park Branch Railway, a water pipeline connecting to the Eungella pipeline network, an electricity transmission line (ETL) and access roads (Figure 2). The ETL is not included as part of this soil and land suitability assessment.

The coal resource would be mined by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal. Up to 20 Mtpa of ROM coal would be extracted over the anticipated Project operational life of approximately 79 years.

The Project covers an area of approximately 26,000 hectares (ha), of which 16,300 ha is proposed as active mining disturbance from infrastructure and mining activities.

1.2 Scope of Report

This report provides a baseline assessment of the soil and land suitability for the Project site and includes:

- a description of the regulatory requirements relevant to the Project;
- a review of available background material;
- identification and description of soil mapping units (SMUs) and their distribution across the Project site;
- assessment of the suitability of each SMU for reuse in mine rehabilitation activities including determination of soil stripping volumes;
- assessment of the potential for acid sulphate soils;
- land suitability for rainfed broadacre cropping, beef cattle grazing and Agricultural Land Classes (ALC);

- Priority Agricultural Areas (PAA) and Strategic Cropping Land (SCL) review and assessment; and
- proposed final land use following completion of mining.

A Contaminated Land Site Inspection of the Project was also conducted as part of the Soil and Land Suitability Assessment and is included as Attachment 1.

2 BACKGROUND

2.1 Regulatory Requirements

This soil survey was scoped and conducted in accordance with the *Guidelines for Surveying Soils and Land Resources* (McKenzie et al 2008). These Guidelines were developed to provide for a consistent approach to soil survey methodology across Australia. Soil characteristics, profiles and survey have been described in accordance with the *Australian Soil and Land Survey Handbook* (National Committee on Soil and Terrain 2009) and *Australian Soil and Land Survey: Guidelines for Conducting Surveys*, (Gunn et al. 1988).

The proposed water pipeline and access road will include guidance provided by Forster (2011) *Draft for Discussion: Soil Survey Methodology along Linear Features* and Soil Science Australia (2015) *Guidelines for Soil Survey along Linear Features*. These documents provide information about the assessment of linear features for the purpose of a soil surveys. In addition, GTE have participated in recent discussions with the Queensland Department of Natural Resources and Mines (DNRM) (now Department of Natural Resources, Mines and Energy) regarding their requirements for soils surveys of linear features.

Soils have been grouped according to their parent material and position in the landscape and classified in accordance with the *Australian Soil Classification* (Isbell 2002). Soils have also been correlated to soils identified within key regional soil assessments, the major assessment being *Lands of Isaac-Comet Area, Queensland* (Gunn et al 1967).

Collection of soil samples for laboratory analysis was undertaken in line with *Land Suitability Assessment Techniques* (LSAT) within the Department of Minerals and Energy (DME) guideline *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

Furthermore, the preparation of this Soils and Land Suitability Assessment has been conducted in accordance with *Application requirements for activities with impacts to land* (Department of Environment and Heritage Protection [EHP] 2013), *EIS information guidelines* – *Land* (EHP, accessed 2017) and the Terms of Reference provided by the Coordinator-General.

2.2 Local Setting

2.2.1 Land Use and Vegetation

Grazing is the primary activity undertaken across the Project site on the Olive Downs South and Willunga Domains. No agriculture activities were observed to be undertaken within, or in the vicinity of, the Project site.

The land within and surrounding the Project site comprises natural bushland, consisting of tall woodlands of Poplar Box, Bloodwood and Ironbark; medium to sparse shrub land of Brigalow and native grasses.

2.2.2 Topography and Hydrology

The landscape of the Project site includes level plains to gently undulating plains with elevations of approximately 200 metres (m) Australian Height Datum (AHD). The overall elevation of the Project site ranges from 150 m in the low-lying southeast of the Project to 250 m in the higher areas to the north of the Project site (Queensland Government 2016).

The Project is bordered by a cluster of small mountains to the north-east, approximately 400 m high, as well as a range of low-lying mountains ranging from 300-400 m high, 10 km to the south-west of the Project.

The Olive Downs South domain is located to the south and west of the Isaac River. The Willunga Domain is located to the north and east of the Isaac River, further downstream of the Olive Downs South domain.

2.2.3 Regional Geology

Regional mapping of the Project shows the Fair Hill and Rangal formations in the north of the Project, and Rewan and Blackwater formations in the south and east of the Project site.

Broad scale geology undertaken by the Department of Environment and Resource Management (DERM) in 2011, indicates the Project region is dominated by Tertiary sediments, the Project site predominantly containing Cainozoic alluvium, as well as mesozonic sediments (Raymond and McNeil 2011).

Soils mapping of the Land of Isaac Comet (Gunn et al. 1967) details substrate geology as tertiary sandstone, weathered tertiary clays and clay plains.

3 METHODOLOGY

The methodology for the baseline soil assessment, which involved a desktop review and field surveys, is described below.

3.1 Desktop Review

GTE reviewed the available soils and land resources information for the Project site to develop preliminary SMUs and distribution, and to inform the development of the field survey program.

3.1.1 Regional Soils Reports and Available Documentation

The following references were utilised for reviewing previous soils and land suitability fieldwork, recommendations and determining potential field sampling locations:

The following references were utilised for reviewing previous soils and land suitability fieldwork and recommendations:

• Burgess J.W. (2003) Land Resource Assessment of the Windeyers Hill Area Isaac-Connors and Mackenzie River Catchment, Central Queensland;

The Windeyers Hill study provides a comprehensive baseline dataset of representative soil and landscape information that is suitable for future reinterpretation and modelling across almost 300,000 ha, 250 km south-west of Mackay. The data from the study assists in future assessments of cropping suitability, grazing productivity, fertility decline and landscape salinity hazard within the Isaac-Connors and Mackenzie River catchments.

• Gunn et al. (1967) Lands of Isaac Comet (1:500,000);

Commonwealth Scientific and Industrial Research Organisation land system boundaries are landscape patterns identified from air photo interpretation with few field descriptions. Based on Gunn et al. (1967) the Project site is described as low stony hills and ridgelines into undulating sandy duplex plains and recent alluvial areas.

• Northcote et al. (1960-1968) Atlas of Australian Soils;

The indicated soil classifications of the Project site, as contained in the *Atlas of Australian Soils*, include Kandosols, Dermosols, Sodosols and Vertosols. Although these classifications are mapped at a very broad scale (1:2,000,000), they are useful for identifying specific variants of these soil classes.

3.1.2 Aerial Photography

Aerial photography was utilised from Google Earth[™] and the Queensland Government which were reviewed as part of the desktop evaluations. Initial map units and boundaries were identified using Google Earth imagery.

3.1.3 Preliminary Soils Mapping

After the detailed review of reports and aerial photography, prior to field work, a preliminary soils map was created. This preliminary mapping provided an initial understanding of the different types of soil and landscapes likely to occur across the Project site and provided a basis for planning the field work and determining survey locations.

Table 1 lists the land systems and soil types that were anticipated to be found on site.

Gunn et al. (1967)	Concept	Major expected land and soil types
Humboldt (Hu)	Undulating plains with Tertiary clay and sands	25% cracking Brigalow, Blackbutt clay – Rolleston
		45% thin duplex and texture contrast – Poplar Box. Taurus, Broadmeadow
		10% gilgaied Brigalow clay. Pegunny
		20% mosaic of all above units
Somerby (So)	Gilgaied clay plains with soils	60% gilgaied clay with acid subsoils Brigalow. Pegunny,
	on weathered tertiary clay	Rolleston
		10% alluvial flats with Brigalow clay. Vermont
		30% Texture contrast Blackbutt, Box, and Brigalow. Retro,
		Taurus
Monteagle (Mo)	Plains with sandy duplex	80% Texture contrast. Poplar Box- Taurus
	soils	20% non and cracking clays - Rolleston
Blackwater (Bl)	Brigalow clay plains on	70% cracking clay Brigalow - Rolleston
		10% gilgaied clay – Pegunny
		30% duplex – Taurus, Wyseby – Poplar Box
Junee (J)	Ridgelines of red sandy soils.	70% - loamy red earths. Ironbark, bloodwood, Dunrobin, Annandale
		30% - texture contrast soils Luxor, Broadmeadow
Connors (Co)	Higher and lower (recent)	70% - duplex soils with alkaline subsoil , Poplar Box –
		Springwooa, Luxor
		10% clay – Vermont. Mixed Brigalow
		20% alluvial Ioam, deep sandy alluvia Clematis, Davy – Mixed Poplar Box

 Table 1: Expected Land Systems and Soil Types (Gunn et al. 1967)

3.2 Field Work

3.2.1 Survey Timing

A detailed field survey was undertaken over the dates 17 to 26 June 2017, 7 to 16 July 2017, 27 July to 5 August 2017 and 24 to 26 November 2017.

3.2.2 Survey Techniques

Survey techniques were based upon pre-determined sampling locations derived from the desktop review of background information, existing available soils information and an examination of aerial photography patterns. The specific locations of the survey sites were further refined in the field based on available site access, and the location being a sound representation of the soil unit being described.

The sampling used free survey techniques (McKenzie et al. 2008 and Gunn et al. 1988) to verify proposed SMUs and assign boundaries to each. Free survey is a commonly used method in broader scale land assessment as it enables flexibility in site selection (over grid mapping techniques), to achieve a more accurate and time effective result. It is suited to detailed-scale surveys and has been the method used in most developed countries.

Sampling along linear features such as pipelines and transport corridors were conducted by utilising existing soils information, aerial photography review and free survey techniques. This determined intervals along the linear feature at which SMUs would be surveyed.

Two types of site were surveyed, detailed sites and surface observation sites, these are described below. Detailed site descriptions and observation site descriptions are presented within Appendix A and Appendix B, respectively.

Detailed Sites

Detailed sites were undertaken at 192 locations (Figures 3.1-3.4). These sites were used to describe the range of soil profile morphological attributes as per the *National Committee on Soil and Terrain guidelines* (2009) (including soil colour as per *Munsell Soil Colour Charts* 2009), in addition to landforms, slope, surface conditions, rock cover and major vegetation. At each detailed site an assessment was made of the quality, depth and quantities of reusable topsoil that may be excavated in the future.

Soil profiles were primarily sampled using 50 millimetres (mm) hand augers. The hand auger method is a technically suitable method and was undertaken in accordance with the *Guidelines for Surveying Soil and Land Resources* (McKenzie et al. 2008).

Soil samples were collected from twelve of the detailed sites for laboratory analysis. Soil sampling of profiles was conducted as per McKenzie et al. (2008), with samples taken at standard depths incorporating the surface and every horizon change within the soil profile (typically at depths of 0.0-0.10 m, 0.30-0.40 m, 0.60-0.70 m and 0.90-1.00 m) based upon specimen collection as per *Guidelines for Surveying Soil and Land Resources* (McKenzie et al. 2008).

These depths were modified for sites in which field observations revealed soil horizons intersecting at these nominated depths, to ensure samples were collected within each separate horizon, and not across multiple horizons or in sub-horizon boundaries.

The initial water pipeline design consists of pipe of 350 mm to 400 mm in diameter being buried a minimum of 600 mm to the top of the pipe. Final design depths are being finalised, however based on the soil survey work completed to date within the Project site and information available, a soil profile to 1 metre below ground level (mbgl) was assessed as suitable. The access road was assessed as predominantly surface disturbance and a soil profile to one metre below ground level was assessed as suitable.

The information recorded from detailed sites included:

- location (GDA94) and type of soil observation (e.g. erosion exposed cutting or hand auger);
- major vegetation types;
- landform type, position of the site and slope gradient;
- surface condition (e.g. presence of cracks, surface crust, rocks, stones and cobbles, erosion status, microrelief);
- types and vertical extent of soil horizons;
- colour (per Munsell Soil Colour Charts 2009) and mottling of each horizon;
- for each horizon, observations of field texture, pH, presence and abundance of segregations, coarse fragments, structure, consistence, pedality and moisture content;
- presence of organic matter, roots and prevalence of biological activity;
- presence of gleyed horizons, iron staining, jarosite presence and field pH; and
- photographs of the soil profile and surrounding landscape.

Observation Sites

Observation sites were undertaken at 818 locations (Figures 3.1-3.4). These sites were used to confirm SMU types and refine mapped soil boundaries. Where necessary, auger boring was undertaken within surface soils to determine the SMU (e.g. surface texture, depth to clay, B horizons).

Basic soil attributes were recorded to confirm the SMU, and surface conditions, which can include rock, slope percentage, landform type and position, major vegetation and land condition, were also noted.

3.2.3 Laboratory Analysis

Soil samples were collected from the 12 sites considered to be the most representative of the SMUs found within the Project site were submitted for laboratory analysis.

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

Samples were supplied to E.S.S.A, which supervised the laboratory analysis at Phosyn EAL, National Association of Testing Authorities (NATA) accredited and certified by Australasian Soil and Plant Analysis Council (ASPAC). For each SMU, the surface soil horizon was sampled and analysed for the following parameters

- pH (1:5);
- Electrical Conductivity (EC [1:5]);
- Chloride;
- Bicarbonate extractable P;
- Exchangeable Cations (Calcium [Ca], Magnesium [Mg], Sodium [Na], Potassium [K]);
- Cation Exchange Capacity (CEC);
- Calcium/Magnesium (Ca/Mg) Ratio;
- Exchangeable Sodium Percentage (ESP);
- Total N, Nitrates;
- Organic matter content;
- Particle Size Analysis (PSA) Hydrometer Method (Coarse Sand [CS], Fine Sand [FS], Silt, Clay);
- R1 Dispersion;
- Air Dry Moisture Content (ADMC);
- Sulfate; and
- Metals Total (Manganese [Mn], Boron [B], Copper [Cu], Iron [Fe], Zinc [Zn], Aluminium [Al]).

Subsequent samples lower in the soil profile were also analysed for a limited suite of parameters (pH, EC, chloride, exchangeable ions, CEC, Ca/Mg Ratio, and ESP) sufficient to determine reuse potential for rehabilitation of disturbed areas. The rationale for the selection of individual analyses is presented in Table 2.

The laboratory analytical results were used in conjunction with the field assessment results to determine the depth of soil material that is suitable for stripping and reuse during rehabilitation.

The laboratory results are summarised in Section 4 and detailed in Appendix C (Laboratory Certificates).

Test	Number of Samples Tested	Application	Justification		
In situ measurements: Field pH	Field pH – 631 Meter pH/EC -39	Indication of possible limitations from pH and salinity	Used for 'on the spot' estimates of possible pH and salinity problems and to confirm the effective soil depth.		
рН	57	Nutrient availability, nutrient fixation, toxicities (Al, Mn), liming, sodicity and correlation with other physical, chemical and biological properties	Measurement of pH is a useful indicator of various soil properties (e.g. values >8.5 usually indicate high exchangeable sodium levels and the presence of carbonates and nutrient availability limitations).		
EC	57	Appraisal of salinity hazard in soil substrates or groundwater and total soluble salts	The measure of EC is used as a means of appraising soil salinity. The electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.		
Chloride Content	57	The concentration of chloride is usually an indicator of the severity of potential salinity	The chloride anion is usually present in soil associated with sodium. It is highly mobile making it a valuable indicator of salt and water movement. It provides additional confirmation of salinity risk.		
Bicarbonate Extractable Phosphorus	icarbonate 14 Measurement of the total phosphorus While both acid extract ktractable in the soil While both acid extract extractable P (Bicarb. extractable P (Bicarb. extr. P has been Bicarb. extr. P test proviacross a wide range of strongly alkaline; it is far		While both acid extractable P (acid extr. P) and bicarbonate extractable P (Bicarb. extr. P) are routinely measured, only Bicarb. extr. P has been used to assess P fertility. Because the Bicarb. extr. P test provides reliable and consistent data across a wide range of pH values from strongly acid to strongly alkaline; it is far more useful than the acid extr. P.		
CEC, Exchangeable Cations, Ca/MG ratio, ESP57Fertile soils have moderate to high Infertile soils have low CEC. Nutriel status, calculation of ESP, assessme other physical and chemical prope dispersivity, shrink – swell, water movement and aeration		Fertile soils have moderate to high CEC. Infertile soils have low CEC. Nutrient status, calculation of ESP, assessment of other physical and chemical properties, dispersivity, shrink – swell, water movement and aeration	In a mounts and relative proportions of the exchangeable cations in soil have important effects on both physical and chemical properties. High levels of exchangeable sodium cause dispersion and increased swelling, reducing water movement and affecting near surface aeration whereas exchangeable calcium flocculates colloids and will reduce swelling tendencies. Excessively high or low concentrations of one or the other of the cations may impact buffering capacity and as a result, soil nutrient availability.		
Available Nitrogen	14	Presence of nitrogen in an available form for plant uptake	Testing provides an indication of the general fertility of soils and thus their suitability as a topdressing agent.		
Organic Matter 14 Soil organic accumulation and decomp residues and synthesized decay occurs a substantial mineralizable nutrients.		Soil organic matter comprises an accumulation of partially disintegrated and decomposed plant and animal residues and other organic compounds synthesized by the soil microbes as the decay occurs. Soil organic matter forms a substantial reserve of potentially mineralizable nitrogen, sulfur and other nutrients.	Testing for soil organic matter provides an indication of the general fertility of soils and thus suitability as a topdressing agent. It also provides information on stored potential nutrients which may not yet be accessible to plants but may become available in the future.		
PSA (<2 mm) 14 Nutrient retention, exchange properties, erodibility, doughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil qualities		Nutrient retention, exchange properties, erodibility, doughtiness, workability, permeability, sealing, drainage, interpretation of most other physical and chemical properties and soil qualities	Particle size distribution data provides an assessment of the composition of a soil (based upon the dominant grain size within a soil). This assists with confirmation of field observations as well as providing better grounds for identification of soil mapping unit and water holding capacity.		
R1 Dispersion	14	Measurement of the amount of silt and clay that disperses during testing as a percent	The measure of R1 dispersion is useful when used in conjunction with ESP and the Ca/Mg ratio for predicting soil physical behaviour.		
Selected Metals	14	Detection of heavy metals	The analysis of aluminum, copper, zinc, manganese and iron will assess potential natural concentrations of these select heavy metals in the soil as well as any phytotoxicity issues that may exist.		
Sulfate	14	Measurement of total sulfur in soil	Total levels of sulfur help identify whether organic matter or gypsum are present in a profile.		

Table 2: Analytical Program and Number of Samples

3.3 Land Suitability Assessment

Land suitability is primarily based upon classifications provided within the LSAT Guidelines within the DME's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

Guidelines for agricultural land evaluation in Queensland (Department of Science, Information Technology and Innovation [DSITI] and DNRM 2015) and *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) were also reviewed for relevant SMUs in conjunction with ALC assessment.

3.4 Regional Planning Interests Assessment

The *Regional Planning Interests Act 2014* (RPI Act) and *Regional Planning Interests Regulation 2014* (RPI Regulation) identifies and protects areas of Queensland that are of regional interest. The RPI Act protects Priority Living Areas (PLAs), Strategic Environmental Areas (SEAs), PAAs and SCL. The Project site was assessed against the SCL and PAAs.

3.5 Acid Sulfate Soils Assessment

Review of the Australian Soil Resource Information System (ASRIS) including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken. The Acid Sulfate Soils (ASS) mapping is classified with a national consistent legend that includes a risk assessment.

4 **RESULTS**

4.1 Soil Mapping Units

Twelve SMUs were identified across the Project site on the basis of 1010 investigation sites, incorporating 192 detailed sites and 818 observation sites (Figures 3.1-3.4). Descriptions of the detailed and observation sites are presented within Appendix A and Appendix B respectively.

The SMUs are summarised in Table 3, and have been grouped according to basic soil morphology, position in the landscape, and parent material. Individual SMUs have been classified in accordance with the *Australian Soil Classification* (Isbell 2002). Land systems where SMUs are located, as described by Gunn et al. (1967), are also provided in Table 3.

Figures 3.1-3.4 illustrates the spatial distribution of all SMUs within the Project site and detailed descriptions of each SMU are provided in Sections 4.1.1 to 4.1.12.

SMU	Concept	Land Systems (Gunn et al. 1967)	Major Vegetation	Detailed sites (*Lab site)			
Flat to gently undulating plains dominated by uniform and gradational clays							
C1	Brown light clays with melon hole microrelief	Somerby, Monteagle, Connors, Humboldt, Blackwater	Brigalow	12a/12b*, 13, 14, 18, 19, 20, 21, 22, 63, 75, 122, 127, 133, 134, 135, 136, 138, 139, 140, 141, 142, 143, 144, 146, 148, 149, 150, 159, 160, 162, 164, 166			
C2	Grey to brown light to medium clay with normal gilgai microrelief	Somerby, Monteagle, Connors, Humboldt, Blackwater	Brigalow and associated Blackbutt and Poplar Box	25a/25b*, 26, 34, 35, 36, 37, 38, 39, 40, 41, 42, 46, 55, 56,71, 75, 80, 81, 83, 84, 86, 87, 88, 89, 94, 97, 99, 102, 103, 105, 114, 117, 118, 153, 154, 155, 157, 183			
Gently ur	idulating plains dominated by sa	ndy duplex with	gradational sandy loams incor	porated			
S1	Brown shallow to deep duplex loamy sands to clay loam sandy earths	Somerby, Monteagle, Connors, Humboldt, Blackwater	Poplar box	1, 2*, 3, 4, 5, 6, 15, 32, 33, 44, 45, 47, 48, 53, 57, 58, 59, 67, 72, 73, 76, 92, 98, 130, 158, 163, 170, 171, 172, 180, 181, 182, 185, 189, 190, 191, 192			
S2	Brown gradational sands, loamy to clayey sands	Somerby, Monteagle, Connors, Humboldt, Blackwater	Blackbutt, Eucalypts	7, 8*, 9, 10, 11, 23, 31, 51, 54, 65, 66, 90, 107, 108, 109, 110 119, 120, 121, 123, 126, 128, 132, 161, 165, 167, 168, 174, 179, 184, 186, 188			
R1	Light red loamy sands to reddish loamy/clayey sands	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Blackbutt, Poplar Box	49*, 50, 52, 64, 95, 124, 125, 129, 145, 156			

Table 3: Summary of Project Site Soils

SMU	Concept	Land Systems (Gunn et al. 1967)	Major Vegetation	Detailed sites (*Lab site)
R2	Brown to reddish brown loamy sands to sandy clay loams	Somerby, Monteagle, Humboldt, Blackwater, Junee	Poplar Box	131*, 137, 147, 151, 152,
L1	Shallow (0.20 m) loamy sands to deep light clay	Monteagle, Connors, Humboldt, Blackwater	Poplar Box, Ironbark	68*, 69, 70, 85, 113,
L2	Deeper (0.40-0.60 m) loamy sands to light clay	Monteagle, Connors, Humboldt, Blackwater	Poplar Box, Ironbark	60*, 78, 79, 82, 91, 93, 115,
Relic allu	vial plains and low-lying plains			
B1	Black, to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams	Somerby, Monteagle, Humboldt	Poplar box, Ironbark, Blackbutt, minor Moreton Bay Ash	16, 17*, 24, 27, 28, 29, 30, 43, 169
B2	Brown silty loams to light clays with cracking surface on lower flat plains	Somerby, Connors,	Poplar Box, minor Brigalow	61, 106*, 111, 112, 116, 173, 175, 177, 178, 187
B2-DV	Drainage Variant of B2, surface horizon removed by stream bank erosion.	Humboldt, Blackwater	Poplar Box, Brigalow	176
Recent al	luvial floodplain and active chan	nels with stratifie	ed loamy sands	
A1	Loam to loamy sands within active channels	Monteagle, Connors, Blackwater	Moreton Bay Ash, Paperbark Eucalypts	62*, 74, 77
A2	Clayey sands to light medium clay within alluvial depression	Somerby, Monteagle, Connors, Humboldt, Blackwater	Moreton Bay Ash, Eucalypts	96*, 100, 104

4.1.1 Soils of flat to gently undulating plains: Soil Mapping Unit C1

Overview

This SMU is located within the north east and south-east areas of the Project site. The SMU is associated with flat to gently undulating clay plains with prominent melon hole microrelief. Vegetation includes medium to tall Brigalow. C1 soils in depression positions are firm, with a cracking and crusting surface, featuring uniform dark clays extending 1.0 m below the surface.

Soils associated with mound and inter-gilgai positions are similar but with higher likelihood of poorer quality subsoils from increased salt, sodium and sodic qualities.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- very high clay content with hard coarse pedal conditions which suggests poorly structured and aerated medium throughout the mound and depression profile;
- pH is alkaline to slightly alkaline;
- EC is very low to high throughout profile;
- moderate CEC;
- non-sodic within the topsoil profile to strongly sodic subsoils;
- Ca to Mg ratios very high within topsoil profile to moderate within subsoil;
- low dispersive qualities increasing in subsoils; and
- overall fertility is moderate.

Representative Site

Site 12 was chosen as the representative site of this SMU for chemical analysis.

A site description is presented in Table 4, and a soil profile morphology summary is presented in Table 5 and Table 6 for the Site 12a 'depression' and 12b 'mound and inter-gilgai'. The soil chemistry results for Sites 12a and 12b are presented in Table 7 and Table 8.

SMU	C1	Representative Site Number	Site 12
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Brigalow, Brigalow with scrub
Location (GDA94)	640307 mE 7546621 mN	Disturbance	No effective disturbance
Landform pattern/ element	Flat plain, level	Micro relief	Melon holes, approximately 4.0 m diameter, 0.4 m deep at 50% coverage.
		Permeability	Slowly permeable
Slope (%)	0.0	Drainage	Depression Position – Imperfectly drained Mound Position - Moderately-Well drained
Surface coarse fragments	2%, 2-5 mm coarse fragments and manganese	Surface condition	Surface is firm, cracking with crust, peds >2 mm
ASC Order (s)	Endohypersodic Brown Vertosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Humboldt, Somerby, Monteagle, Blackwater, Junee, Connors	Substrate	Tertiary, weathered tertiary clays and clay plains.
Soils (Gunn et al. 1967)	Pegunny	Principal Profile Form (Northcote 1974)	Ug5.16, Ug5.24, Ug5.34, Ug5.38
Land suitability summary	Effective rooting depth Estimated soil water stor Soil water storage is base rooting depth and sodicit PAWC 75-100 mm (Table LSAT, January 1995).	: 0.40 mbgl o rage: Id upon the Burgess (2003 ty limitations of the SMU e 2.3 Surrogate field prope) Indicus Melonhole phase (IdMp) soil, effective exhibited across both gilgai positions. rties for estimating plant available water capacity,

 Table 4: Land Summary for Representative Site 12

	Rain fed Cropping class: 4					
	Beef Cattle Grazing of Native Pastures class: 3					
	Agricultural Land Class: B					
	Regional Frameworks: Group A:4, Group B:4, Group C:5					
Erosion potential	This SMU is located on long, flat plains and undulating sloping areas with a firm clay surface. It has a low water erosion hazard in situ.					
	Laboratory results indicated for the mound and depression locations;					
	Mound					
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil soil profile; 					
	• ESP (sodicity) rating indicates that the topsoil profile is low steadily increasing to sodic levels by 0.60 m to strongly sodic at 0.90 m depth					
	• The high Ca/Mg ratio results throughout indicate aggregation of clay particles throughout the profile.					
	Depression					
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate low to moderate dispersion ratings (0.6-0.8) within the topsoil soil profile;					
	• ESP (sodicity) rating indicates that the topsoil profile is low increasing to sodic and extremely sodic levels from 0.30 m to 0.90 m;					
	 Very high Ca/Mg ratio results for topsoil decrease to moderate levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. 					
	Erosion potential for the SMU takes into account the results for both the mound and depression locations. Topsoil erosive qualities are assessed as low however, subsoils have moderate to high dispersive qualities and must be managed appropriately when stockpiling and for reuse of this SMU for rehabilitation activities.					
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.10 mbgl					
rehabilitation	Potential topsoil double stripping depth: 0.00-0.20 mbgl					
	Recommended topsoil use: Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope)					
	Recommended subsoil strip depth: 0.10/0.20–1.00 mbgl					
	Recommended subsoil use: Buried supporting subsoils for topsoil					
ASS/PASS Field Assessment	No field indication of AASS/PASS.					
Land condition	Good condition					
Total area (ha)	7,631					

PAWC = plant available water capacity.

Site 12a – Depression	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m), Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.00 – 0.09 Boundary: Abrupt	Colour: 10YR3/2 Very dark greyish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry Depth: 0.05 Field pH: 6.5 Meter pH/EC: 7.9 / 0.05	<i>Texture:</i> Light Clay <i>Structure:</i> Weak, 3-10 mm sub-angular <i>Strength:</i> Firm	Coarse Fragments: 2% coarse fragments and manganese, 2- 5 mm Roots: Very few, fine down to 0.05 m
	Horizon: B2 Horizon Depth: 0.09-1.00	Colour: 10YR3/3 Dark brown <i>Mottle:</i> No mottling <i>Bleach:</i> No bleaching	Moisture: Dry Depth: 0.30, 0.60, 0.90 Field pH: 7.0, 7.0, 7.0 Meter pH/EC: 8.1 / 0.03	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, 20-50 mm sub-angular <i>Strength:</i> Firm	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

Table 6: Soil Profile Morphology Summary for Representative Site 12b

Site 12b – Mound	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.0 – 0.10 Boundary: Abrupt	Colour: 10YR3/2 Very dark greyish brown <i>Mottle</i> : No mottles <i>Bleach</i> : No bleaching	Moisture: Dry Depth: 0.05 Field pH: 6.5 Meter pH/EC: 7.8 / 0.03	Texture: Light Clay Structure: Weak, 3-10 mm sub-angular Strength: Firm	Coarse Fragments: 2% coarse fragments and manganese, 2- 5 mm <i>Roots:</i> Very few, fine down to 0.05 m
	Horizon: B2 Horizon Depth: 0.10-1.00	Colour: 10YR3/3 Dark brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry Depth: 0.30, 0.60, 0.90 Field pH: 7.0, 7.0, 7.0 Meter pH/EC: 8.2 / 0.65	Texture: Light clay Structure: Moderate, 20-50 mm sub-angular Strength: Firm	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.80 - 0.90	
Soil pH	8.2	8.2	8.9	8.8	
Soil EC (dS/m)	0.08	0.05	0.13	0.29	
Soil Cl (mg/kg)	16	21	59	275	
P (Olsen) (mg/kg)	16	1			
Exch.Ca (meq/100g)	17.74	13.51	12.5	10.31	
Exch. Mg (meq/100g)	3.25	3.75	5.26	5.86	
Exch. Na (meq/100g)	0.1	0.4	1.7	2.83	
Exch.K (meq/100g)	0.83	0.45	0.4	0.38	
CEC (meq/100g)	22.0	18.1	19.9	19.4	
Ca/Mg	5.5	3.6	2.4	1.8	
ESP (%)	0	2	9	15	
Total N (mg/kg)	0.113				
Nitrate N (mg/kg)	3.1				
Organic Matter (%)	2.3				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	26				
PSA-Fine Silt (%)	10				
PSA-Silt (%)	19				
PSA-Gravel (%)	45				
Disp Ratio (%)	0.88				
ADMC (%)	3.7	3.9	3.8	3.3	
Total S	0.02				
Sulfate-S (%)	3				
Manganese (mg/kg)	8.7				
Boron (mg/kg)	0.3				
Copper (mg/kg)	1.2				
lron (mg/kg)	25				
Zinc (mg/kg)	0.4				
Aluminium (meq/100g)	0.07	0.03	0.03	0.03	

Table 7: Soil Chemistry Results for Representative Site 12a

1. '---' indicates laboratory analysis was not conducted for this sample.

dS/m = deciSiemens per metre

mg/kg = milligrams per kilogram meq/100g = milliequivalents per 100 grams of soil

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00	
Soil pH	8	8.8	8.6	8.6	
Soil EC (dS/m)	0.04	0.48	0.72	0.81	
Soil Cl (mg/kg)	20	362	611	846	
P (Olsen) (mg/kg)	6	1			
Exch.Ca (meq/100g)	13.47	10.69	8.02	7.44	
Exch. Mg (meq/100g)	6.3	8.23	8.66	8.76	
Exch. Na (meq/100g)	0.18	3.53	4.21	5.08	
Exch.K (meq/100g)	0.56	0.39	0.37	0.39	
CEC (meq/100g)	20.6	22.9	21.3	21.7	
Ca/Mg	2.1	1.3	0.9	0.9	
ESP (%)	1	15	20	23	
Total N (mg/kg)	0.116				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	3.1				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	29				
PSA-Fine Silt (%)	7				
PSA-Silt (%)	15				
PSA-Gravel (%)	49				
Disp Ratio (%)	0.72				
ADMC (%)	4.3	3.3	3.4	3.3	
Total S	0.02				
Sulfate-S (%)	3				
Manganese (mg/kg)	7.9				
Boron (mg/kg)	0.8				
Copper (mg/kg)	1.1				
Iron (mg/kg)	10				
Zinc (mg/kg)	0.3				
Aluminium (meq/100g)	0.05	0.05	0.03	0.02	

Table 8: Soil Chemistry Results for Representative Site 12b

1. '---' indicates laboratory analysis was not conducted for this sample.

4.1.2 Clay soils of flat to gently undulating plains: Soil Mapping Unit C2

Overview

This SMU is located across the north-west and transects south-east of the Project site within multiple soil polygons. The SMU is associated with flat to gently undulating clay plains with normal gilgai microrelief. Vegetation includes sparse medium to tall Brigalow. Soils are firm, cracking dark clays to gradational extending 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- clay texture throughout the profile;
- pH is strongly alkaline;
- EC is low in topsoil profiles increasing to extremely high to 1.00 m depth;
- high CEC;
- non-sodic within the topsoil profile to strongly sodic subsoils;
- very high to high Ca to Mg ratios;
- dispersive qualities increasing in subsoils; and
- overall fertility is high.

Representative Site

Site 25 was chosen as the representative site of this SMU for chemical analysis.

A site description is presented in Table 9, and a soil profile morphology summary is presented in Table 10 and Table 11 for the Site 25a 'depression' and 25b 'mound and inter-gilgai'. The soil chemistry results for Sites 25a and 25b are presented in Table 12 and Table 13.

SMU	C2	Representative Site Number	Site 25
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Brigalow
Location (GDA94)	644923 mE 7542220 mN	Disturbance	Slight to extensive clearing
Landform pattern/ element	Level, Flat Plain	Micro relief	Gilgai, approximately 3.0 m diameter, 0.3 m deep at 20-30% coverage.
		Permeability	Slowly permeable
Slope (%)	0.0	Drainage	<u>Depression Position</u> Poorly to imperfect drained <u>Mound Position</u> Moderately-well drained
Surface coarse fragments	2%, <5mm coarse fragments	Surface condition	Surface is firm, cracking, peds >2 mm
ASC Order (s)	Brown Vertosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains.
Soils (Gunn et al. 1967)	Pegunny	Principal Profile Form (Northcote 1974)	Ug5.16, Ug5.24, Ug5.34, Ug5.38
Land suitability summary	Effective rooting depth: Estimated soil water stor Soil water storage is base salinity limitations of the PAWC 50-75 mm (Table 2 LSAT, January 1995). Rain fed Cropping class Beef Cattle Grazing of N Agricultural Land Class:	: <0.30 mbgl orage: ed upon the Burgess (2003) SMU exhibited within the b 2.3 Surrogate field properti : 5 Jative Pastures class: 3 C2	Pomegranate melonhole phase (PgMp) soil, the both the mound and depression positions. es for estimating plant available water capacity,

Table 9: Land Summary for Representative Site 25

Erosion potential	The SMU is generally located on long, flat plains and undulating sloping areas with a firm clay surface. It has a low water erosion hazard in situ.					
	Laboratory results indicated for the mound and depression locations;					
	Mound					
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate high dispersion ratings (0.8-0.95) within the topsoil soil profile; 					
	 ESP (sodicity) rating indicates the topsoil profile is low increasing sodic (0.30 m) and strongly sodic levels (0.60m) to depth; and 					
	 Very high Ca/Mg ratio results throughout indicate aggregation of clay particles throughout the profile. 					
	Depression					
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil soil profile; 					
	 ESP (sodicity) rating indicates that the topsoil profile is low increasing to strongly sodic and extremely sodic levels from 0.30 m to 0.90 m; and 					
	 Very high Ca/Mg ratio results for topsoil decrease to high levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. 					
	Erosion potential for the SMU takes into account the results for both the mound and depression locations. Topsoil erosive qualities are assessed low to moderate with, subsoils showing preferred high levels of calcium to magnesium, however, ESP indicates poor physical conditions and strong to extremely high levels of sodicity.					
	Subsoils must be managed appropriately when stockpiling and rehabilitation reuse to reduce their dispersive and erosive qualities.					
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.20 mbgl					
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope)					
	Recommended subsoil strip depth: 0.20 -1.00 mbgl					
	Recommended subsoil use: Capping material over waste rock.					
ASS/PASS Field Assessment	No field indication of AASS/PASS.					
Land condition	Good condition					
Total area (ha)	5,528					

Site 25a – Depression	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Depth: 0 – 0.21 Boundary: Abrupt	Colour: 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.10 Field pH: 8.0 Meter pH/EC: 8.4 / 0.08	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <10 mm peds, <i>Strength:</i> Firm	Coarse Fragments: <2% calcium carbonate Roots: Fine, few
	Horizon: B21 Depth: 0.21 – 0.68 Boundary: Clear	Colour: 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Moderately moist, well drained Depth: 0.30, 0.60 Field pH: 7.5, 8.0 Meter pH/EC: 8.7 / 0.32 8.6 / 1.03	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <20 mm peds, <i>Strength:</i> Firm	Coarse Fragments: <2% black nodules <5 mm Roots: Very fine, few
	Horizon: B22 Depth: 0.68 – 1.00	Colour: 10YR4/4 Dark yellow brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Moderately moist, well drained Depth: 0.90 Field pH: 8.0 Meter pH/EC: 8.4 / 0.95	Texture: Light clay Structure: Moderate, <20 mm peds, Strength: Firm	Coarse Fragments: <2% black nodules <5 mm Roots: No roots observed

Table 10: Soil Profile Morphology Summary for Representative Site 25a

Table 11: Soil Profile Morpholog	/ Summary for Representative Site 25b
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Site 25b – Mound	Horizon, Depth (m), Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Depth: 0 – 0.21 Boundary: Abrupt	Colour: 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.10 Field pH: 8.0 Meter pH/EC: 8.2 / 0.08	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <10 mm peds <i>Strength:</i> Firm	Coarse Fragments: <2% calcium carbonate Roots: Fine, few
	Horizon: B21 Depth: 0.21 – 0.76 Boundary: Clear	Colour: 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Moderately moist, well drained <i>Depth:</i> 0.30, 0.60 <i>Field pH:</i> 7.5, 8.0 <i>Meter pH/EC:</i> 8.7 / 0.98 8.6 / 1.84	<i>Texture:</i> Light clay <i>Structure:</i> Weak, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> Very fine, few
	<i>Horizon:</i> B22 <i>Depth:</i> 0.76 – 1.00	Colour: 10YR4/4 Dark yellow brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Moderately moist, well drained Depth: 0.90 Field pH: 8.0 Meter pH/EC: 8.5 / 1.88	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, <20 mm peds, <i>Strength:</i> Firm	<i>Coarse Fragments:</i> <2% black nodules <5 mm <i>Roots:</i> No roots observed

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00	
Soil pH	8.6	8.8	8.6	8.7	
Soil EC (dS/m)	0.1	0.38	1.11	1	
Soil Cl (mg/kg)	21	274	1330	944	
P (Olsen) (mg/kg)	17	1			
Exch.Ca (meq/100g)	23.29	19.68	17.1	15.88	
Exch. Mg (meq/100g)	5.98	9.33	9.29	9.15	
Exch. Na (meq/100g)	0.33	2.86	5.46	5.42	
Exch.K (meq/100g)	1.26	0.82	0.9	0.78	
CEC (meq/100g)	30.9	32.7	32.8	31.2	
Ca/Mg	3.9	2.1	1.8	1.7	
ESP (%)	1	9	17	17	
Total N (mg/kg)	0.128				
Nitrate N (mg/kg)	2				
Organic Matter (%)	4.1				
Ammonia (mg/kg)	<20		40		
PSA-Clay (%)	18				
PSA-Fine Silt (%)	2				
PSA-Silt (%)	31				
PSA-Gravel (%)	49				
Disp Ratio (%)	0.87				
ADMC (%)	4.3	3.8	3.5	3.3	
Total S	0.02				
Sulfate-S (%)	9				
Manganese (mg/kg)	7.7				
Boron (mg/kg)	0.4				
Copper (mg/kg)	1.2				
Iron (mg/kg)	13				
Zinc (mg/kg)	0.5				
Aluminium (meq/100g)	0.04	0.04	0.03	0.02	

Table 12: Soil Chemistry Results for Representative Site 25a

1. '---' indicates laboratory analysis was not conducted for this sample.

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00		
Soil pH	8.6	8.7	8.6	8.6		
Soil EC (dS/m)	0.11	1.19	2.13	2.32		
Soil Cl (mg/kg)	19	1654	2678	2690		
P (Olsen) (mg/kg)	13	1				
Exch.Ca (meq/100g)	23.47	17.85	15.32	14.75		
Exch. Mg (meq/100g)	5.27	9.55	10.22	10.61		
Exch. Na (meq/100g)	0.39	6.12	9.97	12.16		
Exch.K (meq/100g)	1.37	1.35	1.74	1.9		
CEC (meq/100g)	30.5	34.9	37.3	39.5		
Ca/Mg	4.5	1.9	1.5	1.4		
ESP (%)	1	18	27	31		
Total N (mg/kg)	0.256					
Nitrate N (mg/kg)	2					
Organic Matter (%)	5					
Ammonia (mg/kg)	<20					
PSA-Clay (%)	11					
PSA-Fine Silt (%)	14					
PSA-Silt (%)	27					
PSA-Gravel (%)	48					
Disp Ratio (%)	0.79					
ADMC (%)	4.2	3.6	3.7	3.7		
Total S	0.02					
Sulfate-S (%)	5					
Manganese (mg/kg)	9.1					
Boron (mg/kg)	1					
Copper (mg/kg)	0.9					
Iron (mg/kg)	12					
Zinc (mg/kg)	0.5					
Aluminium (meq/100g)	0.02	0.02	0.03	0.05		

Table 13: Soil Chemistry Results for Representative Site 25b

1. '---' indicates laboratory analysis was not conducted for this sample.

4.1.3 Gently undulating plains of sandy earths: Soil Mapping Unit S1

Overview

The majority of this SMU is located within the Olive Downs South domain with four small polygons located within the Willunga domain. The SMU is associated with gently undulating plains with duplex sand to clay loam sand earths.

Vegetation predominantly is tall woodlands of Poplar Box. Soils are hard setting, dark yellow brown loamy sands to brown clay loam sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- high sand content with texture increase to clay loam sandy subsoils;
- pH is acidic increasing to strongly alkaline within subsoils;
- EC is very low throughout;
- very low CEC;
- non-sodic topsoil profile to strongly sodic within subsoils;
- very high to moderate Ca to Mg ratios with depth;
- low dispersive qualities within topsoil increasing to moderate in subsoils; and
- overall fertility is very low to low.

Representative Site

Site 2 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 14, and a soil profile morphology summary is presented in Table 15. The soil chemistry results for this site are presented in Table 16.

SMU	S1	Representative Site Number	Site 2
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Ironbark, Bloodwood, Blackbutt
Location (GDA94)	638862 mE 7548002 mN	Disturbance	No effective disturbance
Landform pattern/	Gently undulating	Micro relief	None
element	Plain, Upper slope	Permeability	Highly to slowly permeable
Slope (%)	<2.0	Drainage	Rapid to imperfect
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting
ASC Order (s)	Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting dep Estimated soil water Soil water storage is b poorer growth mediur PAWC 50-75 mm (Tab LSAT, January 1995) Rain fed Cropping cla Beef Cattle Grazing of Agricultural Land Cla	oth: 0.40 mbgl storage: ased upon subsoil below 0.35 m : n le 2.3 Surrogate field properties f ass: 4 of Native Pastures class: 3 iss: C2	structure increasing to hard strength and for estimating plant available water capacity,

 Table 14: Land Summary for Representative Site 2
Erosion potential	The SMU is generally located on gently undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ.					
	Laboratory results indicated for the mound and depression locations;					
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate high dispersion ratings (0.8-0.95) within the topsoil soil profile;					
	 ESP (sodicity) rating indicates that the topsoil profile is very low increasing to sodic and strongly sodic levels from 0.60 m to 0.90 m; 					
	 Very high Ca/Mg ratio results for topsoil decrease to moderate levels within subsoils indicating soil physical structure and behaviour promoting dispersion clay particles. 					
	Erosion potential through dispersion is assessed low within topsoil with minor dispersive qualities. Subsoils are considered moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio which will promote dispersion qualities. Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.					
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.30 mbgl					
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.					
	Recommended subsoil strip depth: 0.30–1.00 mbgl					
	Recommended subsoil use: Buried supporting subsoils for topsoil					
ASS/PASS Field	Very low field indication of PASS.					
Assessment	No field indicators of AASS.					
Land condition	Good condition					
Total area (ha)	3,278					

Site 2	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0.00 – 0.20 Boundary: Abrupt Horizon:	Colour: 10YR3/4 Dark yellow brown <i>Mottle:</i> No mottles <i>Bleach:</i> None <i>Colour:</i>	Moisture: Dry Depth: 0.10 Field pH: 6.5 Meter pH/EC: 6.3 / 0.01 Moisture:	Texture: Loamy sand Structure: Massive Strength: Loose Texture:	Coarse Fragments: No coarse fragments Roots: Very fine, few Coarse Fragments:
	A12 Horizon Depth: 0.20 – 0.60 Boundary: Abrupt	10YR4/3 Brown <i>Mottle:</i> No mottles <i>Bleach:</i> None	Dry Depth: 0.30 Field pH: 7.0 Meter pH/EC: 6.8 / 0.00	Loamy sand Structure: Massive Strength: Very weak	No coarse fragments <i>Roots:</i> No roots observed
	Horizon: B21 Horizon Depth: 0.60 – 1.00	Colour: 10YR4/3 Brown <i>Mottle:</i> 5% 10YR5/8 Yellowish brown <i>Bleach:</i> None	Moisture: Dry Depth: 0.60 / 0.90 Field pH: 7.5 / 7.5 Meter pH/EC: 7.6 / 0.03	<i>Texture:</i> Clay loam sandy <i>Structure:</i> Strong structure, sub angular peds <10 mm <i>Strength:</i> Very firm	Coarse Fragments: <2% manganese nodules Roots: No roots observed

Table 15: Soil Profile Morphology Summary for Representative Site 2

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00		
Soil pH	6.3	6.9	8.1	8.6		
Soil EC (dS/m)	0.01	<0.01	0.04	0.11		
Soil Cl (mg/kg)	10	14	97	108		
P (Olsen) (mg/kg)	5	1				
Exch.Ca (meq/100g)	1.19	0.63	2.3	2.77		
Exch. Mg (meq/100g)	0.34	0.25	2.97	4.1		
Exch. Na (meq/100g)	<0.08	<0.08	0.73	1.35		
Exch.K (meq/100g)	0.16	0.12	0.26	0.26		
CEC (meq/100g)	1.7	1.1	6.4	8.5		
Ca/Mg	3.5	2.5	0.8	0.7		
ESP (%)	<1	1	11	16		
Total N (mg/kg)	0.033					
Nitrate N (mg/kg)	1.4					
Organic Matter (%)	1					
Ammonia (mg/kg)	<20					
PSA-Clay (%)	75					
PSA-Fine Silt (%)	13					
PSA-Silt (%)	6					
PSA-Gravel (%)	6					
Disp Ratio (%)	0.81					
ADMC (%)	0.4	0.3	1.8	2.5		
Total S	0.02					
Sulfate-S (%)	3					
Manganese (mg/kg)	21.8					
Boron (mg/kg)	<0.1					
Copper (mg/kg)	0.2					
Iron (mg/kg)	22					
Zinc (mg/kg)	0.3					
Aluminium (meq/100g)	0.03	0.1	0.14	0.06		

Table 16: Soil Chemistry Results for Representative Site 2

4.1.4 Gently undulating plains of sandy earths: Soil Mapping Unit S2

Overview

The majority of this SMU is located along the Isaac River. Four minor areas are located within the Olive Downs South domain and one within the Willunga domain. The SMU is associated with gently undulating plains with gradational sandy earths.

Vegetation is predominantly tall woodlands of Blackbutt and associated Eucalypts. Soils are firm with no coarse fragments, dark brown clayey sands to loamy sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- high sand content throughout the profile;
- pH is neutral throughout;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high to high Ca to Mg ratios;
- low dispersive qualities; and
- overall fertility is very low.

Representative Site

Site 8 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 17, and a soil profile morphology summary is presented in Table 18. The soil chemistry results for this site are presented in Table 19.

SMU	S2	Representative Site Number	Site 8
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Blackbutt, Assorted Eucalyptus
Location (GDA94)	640823 mE 7547668 mN	Disturbance	No effective disturbance
Landform pattern/	Very gently undulating plain, Upper slope	Micro relief	None
element		Permeability	Highly permeable
Slope (%)	<1.0	Drainage	Well drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is firm, no coarse fragments
ASC Order (s)	Haplic Brown Dermosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Clematis	Principal Profile Form (Northcote 1974)	Um5.5, Uf6.31
Land suitability summary	Effective rooting dep Estimated soil water PAWC 75-100 mm (Ta LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla Regional Framework	oth: 0.60 mbgl storage: ble 2.3 Surrogate field properties ass: 4 of Native Pastures class: 3 ss: B s: Group A:3, Group B:4, Group C:	for estimating plant available water capacity,

 Table 17: Land Summary for Representative Site 8

Erosion potential	The SMU is generally located on very gently undulating sloping areas with a sandy surface. It has a lot to medium water erosion hazard in situ.					
	Laboratory results indicated;					
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile;					
	• ESP (sodicity) rating indicates very low to low levels; and					
	 the high Ca/Mg ratio results throughout promotes aggregation of clay particles and low dispersive qualities. 					
	Erosion potential through dispersion is assessed as low throughout the soil profile.					
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.50 mbgl					
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.					
	Recommended subsoil strip depth: 0.50–1.00 mbgl					
	<u>Potential subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil					
ASS/PASS Field	Very low field indication of PASS.					
Assessment	No field indicators of AASS.					
Land condition	Good condition					
Total area (ha)	3,373					

Table 18: Soil Profile Morphology Summary for Representative Site 8

Site 8	Horizon, Depth (m)	Colour, Mottles,	Moisture, Depth (m)	Texture, Structure,	Coarse Fragments,
	Boundary	Bleaching	Field pH	Strength	KOOTS
	Horizon: A1 Horizon Depth: 0 – 0.23 Boundary: Abrupt Horizon: B21 Horizon Depth: 0.23 – 0.57 Boundary: Gradual	Colour: 10YR3/2 Dark brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching <i>Colour:</i> 10YR3/3 Dark brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.1 Field pH: 6.5 Meter pH/EC: 6.6 / 0.01 Moisture: Dry, humid Depth: 0.3 Field pH: 6.5 Meter pH/EC: 6.7 / 0.01	Texture: Clayey sand Structure: Weak, peds <10 mm Strength: Very weak, Texture: Loamy sand Structure: Weak, peds <10 mm Strength: Very weak	Coarse Fragments: No coarse fragments Roots: Very fine, few Coarse Fragments: No coarse fragments Roots: No roots observed
	Horizon: B21 Horizon Depth: 0.57 – 1.00	Colour: 7.5YR4/4 Dark brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, humid Depth: 0.6, 0.9 Field pH: 7.0, 6.5 Meter pH/EC: 7.1 / 0.00	Texture: Loamy sand Structure: Moderate, peds 5-20 mm Strength: Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed

	Sample Depth (m)					
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00		
Soil pH	6.7	6.8	7.1	7.3		
Soil EC (dS/m)	0.02	0.01	<0.01	<0.01		
Soil Cl (mg/kg)	24	24	53	39		
P (Olsen) (mg/kg)	11	1				
Exch.Ca (meq/100g)	3.05	1.86	1.61	1.69		
Exch. Mg (meq/100g)	0.97	0.56	0.71	0.97		
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08		
Exch.K (meq/100g)	0.37	0.2	0.16	0.16		
CEC (meq/100g)	4.4	2.7	2.6	3.0		
Ca/Mg	3.2	3.3	2.3	1.7		
ESP (%)	<1	1	1	1		
Total N (mg/kg)	0.081					
Nitrate N (mg/kg)	7.4					
Organic Matter (%)	1.3					
Ammonia (mg/kg)	<20					
PSA-Clay (%)	65					
PSA-Fine Silt (%)	18					
PSA-Silt (%)	7					
PSA-Gravel (%)	11					
Disp Ratio (%)	0.77					
ADMC (%)	1.0	0.6	0.6	0.7		
Total S	0.02					
Sulfate-S (%)	3					
Manganese (mg/kg)	20.8					
Boron (mg/kg)	0.1					
Copper (mg/kg)	0.3					
Iron (mg/kg)	21					
Zinc (mg/kg)	0.4					
Aluminium (meq/100g)	0.02	0.04	0.12	0.11		

Table 19: Soil Chemistry Results for Representative Site 8

4.1.5 Gently undulating plains of sandy earths: Soil Mapping Unit R1

Overview

This SMU is located within four minor areas within the Olive Downs South domain and three areas within the Willunga domain. The SMU is associated with gently undulating plains with uniform sandy earths.

Vegetation predominantly is tall woodlands of Blackbutt, blue gum and associated Eucalypts. Soils are soft with no coarse fragments, reddish loamy sands extending to approximately 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- high sand content throughout the profile;
- pH is slightly acidic to neutral to depth;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high Ca to Mg ratios;
- low dispersive qualities; and
- overall fertility is very low.

Representative Site

Site 49 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 20, and a soil profile morphology summary is presented in Table 21. The soil chemistry results for this site are presented in Table 22.

SMU	R1	Representative Site Number	Site 49
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Assorted Eucalypts and Wattle spp.
Location (GDA94)	643862 mE 7535154 mN	Disturbance	Limited clearing
Landform pattern/	Very gently	Micro relief	None
element	Upper slope	Permeability	Highly permeable
Slope (%)	2.0	Drainage	Rapid
Surface coarse fragments	No coarse fragments	Surface condition	Surface is soft, no coarse fragments
ASC Order (s)	Red Rudosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Annandale	Principal Profile Form (Northcote 1974)	Gn1.12, Gn2.11, Gn2.12
Land suitability summary	Effective rooting dep Estimated soil water PAWC 75-100 mm (Ta LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla	oth: 0.80 mbgl storage: ble 2.3 Surrogate field properties ass: 4 of Native Pastures class: 3 ss: C2	for estimating plant available water capacity,

Table 20: Land Summary for Representative Site 49

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ.				
	Laboratory results indicated;				
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate low to moderate dispersion ratings (0.6) within the topsoil;				
	• ESP (sodicity) rating indicates very low to low levels; and				
	 very high Ca/Mg ratio results throughout promotes aggregation of clay particles and low dispersive qualities. 				
	Erosion potential through dispersion is assessed as low throughout the soil profile. Appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.				
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.35 mbgl				
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.				
	Recommended subsoil strip depth: 0.35–1.00 mbgl				
	<u>Potential subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.				
ASS/PASS Field	Very low field indication of PASS.				
Assessment	No field indicators of AASS				
Land condition	Good condition				
Total area (ha)	1,191				

Table 21: Soil Profile Morphology Summa	ry for Representative Site 49
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Site 49	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0.00 – 0.10 Boundary: Abrupt	Colour: 2.5YR3/3 Dark reddish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, rapid Depth: 0.05 Field pH: 6.5 Meter pH/EC: 6.4 / 0.00	Texture: Loamy sand Structure: Massive Strength: Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	Horizon: A12 Horizon Depth: 0.10 – 0.37 Boundary: Abrupt	Colour: 2.5YR3/4 Dark reddish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, rapid Depth: 0.30 Field pH: 6.5	Texture: Loamy sand Structure: Massive Strength: Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	Horizon: A21 Horizon Depth: 0.37 – 0.80 Boundary: Abrupt	Colour: 2.5YR2.5/3 Very dusky red <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.60 Field pH: 6.5 Meter pH/EC: 6.5 / 0.00	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak, rounded peds <20 mm <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	Horizon: A22 Horizon Depth: 0.80 – 1.00	Colour: 2.5YR2.5/3 Very dusky red <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.90 Field pH: 6.5	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak, rounded peds <20 mm <i>Strength:</i> Weak	Coarse Fragments: <5% Manganese nodules Roots: No roots observed

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.25-0.35	0.60-0.70	0.90-1.00	
Soil pH	6.4	6.5	6.6	6.7	
Soil EC (dS/m)	0.01	<0.01	<0.01	<0.01	
Soil Cl (mg/kg)	2	3	13	15	
P (Olsen) (mg/kg)	4	1			
Exch.Ca (meq/100g)	1.31	1.03	1.08	2.91	
Exch. Mg (meq/100g)	0.4	0.28	0.32	0.83	
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08	
Exch.K (meq/100g)	0.16	0.15	0.1	0.09	
CEC (meq/100g)	1.9	1.6	1.7	4.2	
Ca/Mg	3.3	3.6	3.4	3.5	
ESP (%)	0	1	1	1	
Total N (mg/kg)	0.045				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	1.4				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	75				
PSA-Fine Silt (%)	9				
PSA-Silt (%)	7				
PSA-Gravel (%)	9				
Disp Ratio (%)	0.60				
ADMC (%)	0.5	0.5	0.5	0.7	
Total S	0.02				
Sulfate-S (%)	3				
Manganese (mg/kg)	26.1				
Boron (mg/kg)	<0.1				
Copper (mg/kg)	0.3				
Iron (mg/kg)	8				
Zinc (mg/kg)	0.3				
Aluminium (meq/100g)	0.07	0.11	0.22	0.3	

Table 22: Soil Chemistry Results for Representative Site 49

4.1.6 Gently undulating plains of sandy earths: Soil Mapping Unit R2

Overview

This SMU is located within the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy earths.

Vegetation is predominantly tall woodlands of Poplar Box and Blackbutt. Soils are dark brown to reddish brown loamy sands to reddish sandy clay loams extending 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- high sand content within topsoil to increased clay content in subsoils to 1.0 m depth;
- pH is slightly acidic to neutral to 1.0m depth;
- EC is very low throughout;
- very low CEC;
- non-sodic profile;
- very high Ca to Mg ratios;
- very low dispersive qualities increasing slightly in subsoils; and
- overall fertility is very low.

Representative Site

Site 131 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 23, and a soil profile morphology summary is presented in Table 24. The soil chemistry results for this site are presented in Table 25.

SMU	R2	Representative Site Number	Site 131
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Blackbutt, Eucalypts and wattles
Location (GDA94)	656738 mE 7527426 mN	Disturbance	No effective disturbance
Landform pattern/	Very gently	Micro relief	None
element	mid-slope	Permeability	Highly permeable
Slope (%)	1.0	Drainage	Rapid to well drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is firm, no coarse fragments
ASC Order (s)	Haplic Red Chromosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Humboldt, Blackwater, Junee	Substrate	Tertiary sandstone and weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,
Land suitability summary	Effective rooting dep Estimated soil water PAWC 75-100 mm (Ta LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla	oth: 0.60 mbgl storage: ble 2.3 Surrogate field properties ass: 4 of Native Pastures class: 3 ss: C2	for estimating plant available water capacity,

Table 23: Land Summary for Representative Site 131

Erosion potential	The SMU is generally located on very undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ.			
	Laboratory results indicated;			
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile; 			
	 ESP (sodicity) rating indicates that the topsoil profile is very low to low levels. Subsoils are assessed as non-sodic; 			
	• Very high to high Ca/Mg ratio results throughout indicate aggregation of clay particles.			
	Erosion potential through dispersion is considered low however, appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.			
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.50 mbgl			
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.			
	Recommended subsoil strip depth: 0.50–1.00 mbgl			
	<u>Potential subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.			
ASS/PASS Field	Very low field indication of PASS.			
Assessment	No field indicators of AASS.			
Land condition	Good condition			
Total area (ha)	1,063			

Site 131	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0.00 – 0.09 Boundary: Abrupt	<i>Colour:</i> 10YR4/3 Brown <i>Mottle:</i> No mottles	Moisture: Dry, rapid Depth: 0.05 Field pH: 7.0 Meter pH/EC: 6.4 / 0.00	Texture: Loamy sand Structure: Massive Strength: Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very fine, very few
	Horizon: A12 Horizon Depth: 0.09 – 0.60 Boundary: Diffuse	<i>Colour:</i> 5YR3/3 Dark reddish brown <i>Mottle:</i> No mottles	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.30, 0.60 <i>Field pH:</i> 7.0, 7.0	<i>Texture:</i> Loamy sand <i>Structure:</i> Massive <i>Strength:</i> Weak	Coarse Fragments: No coarse fragments Roots: Very fine, very few
	Horizon: B2 Horizon Depth: Boundary: 0.60 – 1.00	<i>Colour:</i> 2.5YR3/3 Dark reddish brown <i>Mottle:</i> No mottles	Moisture: Dry, well drained Depth: 0.90 Field pH: 7.0 Meter pH/EC: 6.8 / 0.00	Texture: Sandy clay loam Structure: Moderate rounded peds 10-30mm Strength: Weak	Coarse Fragments: No coarse fragments <i>Roots:</i> No roots observed

Table 24: Soil Profile Morphology Summary for Representative Site 131

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00
Soil pH	6.5	6.7	6.8	6.6
Soil EC (dS/m)	0.01	0.02	<0.01	0.01
Soil Cl (mg/kg)	8	23	22	18
P (Olsen) (mg/kg)	4	1		
Exch.Ca (meq/100g)	1.58	1.62	1.65	2.1
Exch. Mg (meq/100g)	0.41	0.41	0.61	1.61
Exch. Na (meq/100g)	<0.08	<0.08	<0.08	<0.08
Exch.K (meq/100g)	0.15	0.26	0.26	0.15
CEC (meq/100g)	2.1	2.3	2.6	3.9
Ca/Mg	3.8	3.9	2.7	1.3
ESP (%)		0	0	1
Total N (mg/kg)	0.059			
Nitrate N (mg/kg)	<1			
Organic Matter (%)	1.3			
Ammonia (mg/kg)	<20			
PSA-Clay (%)	76			
PSA-Fine Silt (%)	9			
PSA-Silt (%)	8			
PSA-Gravel (%)	8			
Disp Ratio (%)	0.55			
ADMC (%)	0.4	0.5	0.6	1.0
Total S	0.02			
Sulfate-S (%)	3			
Manganese (mg/kg)	31.4			
Boron (mg/kg)	<0.1			
Copper (mg/kg)	0.3			
Iron (mg/kg)	10			
Zinc (mg/kg)	0.6			
Aluminium (meq/100g)	0.02	0.02	0.05	0.04

Table 25: Soil Chemistry Results for Representative Site 131

4.1.7 Gently undulating plains of sandy earths: Soil Mapping Unit L1

Overview

This SMU is located in two areas, the south-eastern portion of the Olive Downs South domain and northern area of the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy/clay earths.

Vegetation is predominantly tall woodlands of Poplar Box and Ironbark. Soils are shallow grey brown sands to brown light clays extending 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- sand content within topsoil to clay content in subsoils to 1.0 m depth;
- pH is slightly acidic within topsoils to alkaline and strongly alkaline to 1.0 m depth;
- EC is very low within topsoil profile but increasing with depth. and high from 0.35 m to 1.0 m depth;
- low to moderate CEC;
- non-sodic topsoils increasing to strongly sodic subsoils;
- very high decreasing to moderate/high Ca to Mg ratios;
- low dispersive topsoils with dispersive subsoils; and
- overall fertility is low.

Representative Site

Site 68 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 26, and a soil profile morphology summary is presented in Table 27. The soil chemistry results for this site are presented in Table 28.

SMU	L1	Representative Site Number	Site 68
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Poplar Box, Ironbark
Location (GDA94)	641301 mE 7533293 mN	Disturbance	No effective disturbance
Landform pattern/	Flat plain, level	Micro relief	None
element		Permeability	Rapid to slowly permeable
Slope (%)	0.5	Drainage	Rapid to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting, very minor cracking, no coarse fragments
ASC Order (s)	Mesonatric Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting dep Estimated soil water PAWC 50-75 mm (Tab LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla	oth : 0.20 mbgl storage: le 2.3 Surrogate field properties f ass: 5 of Native Pastures class: 3 lss: C2	or estimating plant available water capacity,

Table 26: Land Summary for Representative Site 68

Erosion potential	The SMU is generally located level to very gently undulating sloping areas with a sandy surface. It has a low water erosion hazard in situ.
	Laboratory results indicated;
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile;
	 ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as strongly sodic; and
	 high Ca/Mg ratio within topsoil results throughout, indicates aggregation of clay particles. Moderate to high levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities.
	Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities.
	Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.10 mbgl
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.
	Recommended subsoil strip depth: 0.10–0.35 mbgl
	<u>Recommended subsoil use</u> : Buried supporting subsoils for topsoil. Soils below 0.35 m are not recommended to be reused however may be marginally suitable with possible use as capping material over waste rock.
ASS/PASS Field	Very low field indication of PASS.
Assessment	No field indicators of AASS.
Land condition	Good condition
Total area (ha)	591

Table 27: Soil Profile Morpho	logy Summary for Represen	tative Site 68
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Site 68	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.00 – 0.18 Boundary: Abrupt	Colour: 10YR4/2 Dark greyish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, rapid Depth: 0.10 Field pH: 6.5 Meter pH/EC: 6.5 / 0.01	<i>Texture:</i> Clayey sand <i>Structure:</i> Massive <i>Strength:</i> Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine
	Horizon: B21 Horizon Depth: 0.18 – 0.35 Boundary: Abrupt	Colour: 10YR3/3 Dark brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.30 Field pH: 6.5 Meter pH/EC: 7.4 / 0.27	Texture: Light clay Structure: Moderate sub- angular peds 10-20 mm Strength: Firm	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> No roots observed
	Horizon: B22 Horizon Depth: 0.35 – 0.75 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.60 Field pH: 7.5 Meter pH/EC: 8.3 / 0.71	Texture: Light clay Structure: Hard. Moderate sub-angular peds 10-20 mm, Strength: Strong	Coarse Fragments: <2% calcium carbonate Roots: No roots observed
	Horizon: B23 Horizon Depth: 0.75 – 1.00	Colour: 7.5YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.90 Field pH: 7.5 Meter pH/EC: 8.4 / 0.72	Texture: Light clay Structure: Moderate sub- angular peds 10-20 mm, very Strength: Strong	Coarse Fragments: <2% calcium carbonate Roots: No roots observed

Site, Horizon,	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.3-0.4	0.60-0.70	0.90-1.00
Soil pH	6.5	8	9.2	9.3
Soil EC (dS/m)	0.03	0.32	0.79	0.78
Soil Cl (mg/kg)	16	394	898	864
P (Olsen) (mg/kg)	8	1		
Exch.Ca (meq/100g)	4.06	4.92	9.84	9.23
Exch. Mg (meq/100g)	1.84	5.99	6.89	5.8
Exch. Na (meq/100g)	<0.08	3.34	5.46	5.4
Exch.K (meq/100g)	0.44	0.27	0.29	0.29
CEC (meq/100g)	6.4	14.6	22.5	20.8
Ca/Mg	2.2	0.8	1.4	1.6
ESP (%)	1	23	24	26
Total N (mg/kg)	0.131			
Nitrate N (mg/kg)	1			
Organic Matter (%)	3.9			
Ammonia (mg/kg)	<20			
PSA-Clay (%)	46			
PSA-Fine Silt (%)	19			
PSA-Silt (%)	20			
PSA-Gravel (%)	16			
Disp Ratio (%)	0.7			
ADMC (%)	1.3	2.5	2.3	2.3
Total S	<0.01			
Sulfate-S (%)	4			
Manganese (mg/kg)	46.8			
Boron (mg/kg)	0.4			
Copper (mg/kg)	0.6			
Iron (mg/kg)	40			
Zinc (mg/kg)	1			
Aluminium (meq/100g)	0.03	0.03	0.03	0.03

Table 28: Soil Chemistry Results for Representative Site 68

4.1.8 Gently undulating plains of sandy earths: Soil Mapping Unit L2

Overview

This SMU is located in two areas, the western portion of the Olive Downs South domain and northern area of the Willunga domain. The SMU is associated with gently undulating plains with duplex sandy/clay earths.

Vegetation is predominantly tall woodlands of Poplar Box and Ironbark. Soils are duplex grey brown sands to brown light clays extending 1.0 m below the surface.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic within topsoils to alkaline and strongly alkaline to 1.0 m depth;
- EC is very low within topsoils increasing from low to high with subsoil depth;
- low increasing to moderate CEC with subsoil depth;
- non-sodic topsoils increasing to extremely strongly sodic subsoils;
- very high to high Ca to Mg ratios;
- low dispersive topsoils with dispersive subsoils; and
- overall fertility is low.

Representative Site

Site 60 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 29, and a soil profile morphology summary is presented in Table 30. The soil chemistry results for this site are presented in Table 31.

SMU	L2	Representative Site Number	Site 60
Representative Site photograph			
Site survey type	Detailed. 50 mm hand auger.	Vegetation within the SMU	Poplar Box, Ironbark
Location (GDA94)	640162 mE 7535256 mN	Disturbance	No effective disturbance
Landform pattern/	Gently undulating	Micro relief	None
element	plain, mid slope	Permeability	Rapid to slowly permeable
Slope (%)	1.5	Drainage	Rapid to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is hard setting, very minor cracking, no coarse fragments
ASC Order (s)	Mesonatric Brown Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Broadmeadow	Principal Profile Form (Northcote 1974)	Db1.23, Db1.13, Dr2.13, Dy3.23, Dy3.43
Land suitability summary	Effective rooting dep Estimated soil water PAWC 50-75 mm (Tab LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla	oth:: 0.30 mbgl storage: le 2.3 Surrogate field properties f ass: 5 of Native Pastures class: 3 ass: C2	or estimating plant available water capacity,

Table 29: Land Summary for Representative Site 60

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low to medium water erosion hazard in situ.
	Laboratory results indicated;
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile;
	 ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as strongly sodic; and
	 high Ca/Mg ratio within topsoil throughout indicates aggregation of clay particles. High levels within subsoils indicate the subsoils may have poor physical conditions with dispersive qualities.
	Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities.
	Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.30 mbgl
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.
	Recommended subsoil strip depth: 0.30–1.00 mbgl
	Recommended subsoil use: Capping material over waste rock.
ASS/PASS Field	Very low field indication of PASS.
Assessment	No field indicators of AASS
Land condition	Good condition
Total area (ha)	585

Site 60	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0 – 0.12 Boundary: Abrupt	Colour: 10YR3/3 Dark Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.05 <i>Field pH:</i> 6.5 <i>Meter</i> <i>pH/EC:</i> 6.7 / 0.00	Texture: Clayey sand Structure: Massive Strength: Loose	Coarse Fragments: No coarse fragments <i>Roots:</i> Fine, very few
	Horizon: A12 Horizon Depth: 0.12 – 0.42 Boundary: Abrupt	Colour: 10YR3/3 Dark brown <i>Mottle</i> : No mottle <i>Bleach</i> : No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.2 <i>Field pH:</i> 6.5	Texture: Clayey sand Structure: Massive to weak, <10% peds <10 mm Strength: Weak	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Fine, very few
	Horizon: B21 Horizon Depth: 0.42 – 0.60 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.6 Field pH: 7.5 Meter pH/EC: 7.3 / 0.11	<i>Texture:</i> Clay loam sandy <i>Structure:</i> Moderate peds 10-30 mm sub angular <i>Strength:</i> Weak	Coarse Fragments: No coarse fragments <i>Roots:</i> No roots observed
	Horizon: B22 Horizon Depth: 0.60 – 0.73 Boundary: Abrupt	Colour: 7.5YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained	<i>Texture:</i> Light clay <i>Structure:</i> Moderate peds 10-30 mm sub angular <i>Strength:</i> Weak	Coarse Fragments: No coarse fragments Roots: No roots observed
	Horizon: B23 Horizon Depth: 0.73 – 1.00	Colour: 10YR3/3 Dark brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.9 Field pH: 7.5	Texture: Light clay Structure: Moderate peds 10-30 mm sub angular Strength: Weak	Coarse Fragments: No coarse fragments <i>Roots:</i> No roots observed

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.30-0.40	0.60-0.70	0.90-1.00	
Soil pH	6.4	6.9	7.8	8.9	
Soil EC (dS/m)	0.02	0.03	0.18	0.61	
Soil Cl (mg/kg)	12	80	212	622	
P (Olsen) (mg/kg)	8	1			
Exch.Ca (meq/100g)	2.36	1.49	3.6	6.79	
Exch. Mg (meq/100g)	0.56	0.77	3.28	5.15	
Exch. Na (meq/100g)	<0.08	0.29	2.07	5.14	
Exch.K (meq/100g)	0.19	0.1	0.21	0.35	
CEC (meq/100g)	3.2	2.7	9.2	17.5	
Ca/Mg	4.2	1.9	1.1	1.3	
ESP (%)	1	11	23	30	
Total N (mg/kg)	0.079				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	2.1				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	61				
PSA-Fine Silt (%)	16				
PSA-Silt (%)	7				
PSA-Gravel (%)	16				
Disp Ratio (%)	0.66				
ADMC (%)	0.7	0.6	1.7	2.8	
Total S	0.02				
Sulfate-S (%)	5				
Manganese (mg/kg)	24.3				
Boron (mg/kg)	0.1				
Copper (mg/kg)	0.3				
Iron (mg/kg)	16				
Zinc (mg/kg)	0.6				
Aluminium (meq/100g)	0.05	0.06	0.05	0.02	

Table 31: Soil Chemistry Results for Representative Site 60

4.1.9 Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B1

Overview

This SMU is associated with the relic alluvial drainage pathways and low-lying plains within the Olive Downs South domain. Landforms are flat to gently undulating plains with soils that are dark brown with a hard setting surface. Soils throughout profile area are massive loamy sands to silty clay loams with rapid to well drained within the first metre.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is neutral;
- EC is very low:
- low CEC;
- non-sodic topsoils increasing to sodic subsoils;
- very high to moderate Ca to Mg ratios;
- low dispersive qualities increasing slightly with deeper subsoils; and
- overall fertility is very low.

Representative Site

Site 17 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 32, and a soil profile morphology summary is presented in Table 33. The soil chemistry results for this site are presented in Table 34.

Table 52: Land Sumi	hary for Representa	tive Site 17			
Representative site number	B1 Re Ni	epresentative Site umber	Site 17		
Representative Site photograph					
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, and minor skeletal soils vegetation		
Location (GDA94)	640643 mE 7544470 mN	Disturbance	No effective disturbance		
Landform pattern/	Gently undulating	Micro relief	Nil		
element		Permeability	Highly permeable		
Slope (%)	2.5	Drainage	Rapid to well drained		
Surface coarse fragments	<2% black nodules and coarse fragments 2-6 mm diameter	Surface condition	Surface is hard setting and dry		
ASC Order (s)	Subnatric Brown Sodosol	Land use	Grazing		
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Humboldt,	Substrate	Weathered tertiary clays and clay plains		
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,		
Land suitability summary	Effective rooting dep Estimated soil water s PAWC 75-100 mm (Tal LSAT, January 1995). Rain fed Cropping cla Beef Cattle Grazing o Agricultural Land Cla	nth: 0.60 mbgl storage: ble 2.3 Surrogate field ass: 4 of native pastures clas ss: C2	properties for estimating plant available water capacity, s: 3		

Table 32: Land Summary for Representative Site 17

Erosion potential	The SMU is generally located on crests and undulating sloping areas with a sandy surface. It has a low water erosion hazard in situ.			
	Laboratory results indicated;			
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile.			
	 ESP (sodicity) rating indicates that the profile to 0.46 m is non-sodic. Subsoils from this depth are assessed as sodic. 			
	 Very high Ca/Mg ratio within topsoil is results throughout indicates aggregation of clay particles. Moderate levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. 			
	Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities.			
	Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.			
Soil quality for mine	Recommended topsoil strip depth: 0.00-0.30 mbgl			
rehabilitation	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.			
	Recommended subsoil strip depth: 0.30–1.00 mbgl			
	<u>Recommended subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves for level plains Buried supporting subsoils for topsoil.			
ASS/PASS Field	Very low field indication of PASS.			
Assessment	No field indicators of AASS.			
Land condition	Good condition			
Total area (ha)	1,336			

Site 17	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) <i>/</i> Field pH	Texture, Structure, Strength	Coarse Fragments, Roots.
	Horizon: A11 Horizon Depth: 0.0 – 0.36 Boundary: Abrupt	Colour: 10YR3/2 Very dark brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, rapid Depth: 0.10 Field pH: 7.0 Meter pH/EC: 6.8 / 0.00	<i>Texture:</i> Loamy Sand <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine roots
	Horizon: A12 Horizon Depth: 0.36 – 0.47 Boundary: Abrupt	Colour: 10YR4/2 Dark greyish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.36 Field pH: 6.5	Texture: Loamy sand Structure: Weak 1-10 mm peds, sub- angular, Strength: Weak	Coarse Fragments: <2% black nodules Roots: No roots observed
	Horizon: B2 Horizon Depth: 0.47 – 1.0	Colour: 10YR4/4 Dark yellowish brown <i>Mottle:</i> Mottles: <5% 10YR6/8 Brownish yellow <2% 2.5YR4/6 Red <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.60, 0.90 <i>Field pH:</i> 6.5, 7.0 <i>Meter pH/EC:</i> 6.5 / 0.00	Texture: Silty clay loam Structure: Weak 1-10 mm peds, Strength: Weak to firm	Coarse Fragments: <5% black nodules and coarse fragments <i>Roots:</i> No roots observed

 Table 33: Soil Profile Morphology for Representative Site 17

	Sample Depth (m)			
Analysis (Unit)	0.00-0.10	0.36-0.46	0.60-0.70	0.90-1.00
Soil pH	6.7	6.7	6.6	7
Soil EC (dS/m)	0.01	<0.01	0.02	0.03
Soil Cl (mg/kg)	11	16	9	16
P (Olsen) (mg/kg)	5	1		
Exch.Ca (meq/100g)	1.74	0.83	1.89	1.95
Exch. Mg (meq/100g)	0.65	0.8	2.32	2.38
Exch. Na (meq/100g)	<0.08	<0.08	0.28	0.47
Exch.K (meq/100g)	0.21	0.22	0.17	0.1
CEC (meq/100g)	2.7	2.0	4.7	5.0
Ca/Mg	2.7	1.0	0.8	0.8
ESP (%)	1	3	6	10
Total N (mg/kg)	0.05			
Nitrate N (mg/kg)	<1			
Organic Matter (%)	1.4			
Ammonia (mg/kg)	<20		<20	
PSA-Clay (%)	75			
PSA-Fine Silt (%)	9			
PSA-Silt (%)	10			
PSA-Gravel (%)	7			
Disp Ratio (%)	0.66			
ADMC (%)	0.6	0.6	1.6	1.7
Total S	<0.01			
Sulfate-S (%)	3			
Manganese (mg/kg)	27			
Boron (mg/kg)	0.2			
Copper (mg/kg)	0.3			
Iron (mg/kg)	25			
Zinc (mg/kg)	0.2			
Aluminium (meq/100g)	0.03	0.07	0.07	0.05

Table 34: Soil Chemistry Results for Representative Site 17

4.1.10 Soils of relic alluvial plains and low-lying plains: Soil Mapping Unit B2

Overview

This SMU is associated with the relic alluvial drainage pathways and low-lying plains within the central portion of the Project site, Landforms are flat plains to gently undulating plains with soils that are brown with a cracking surface. Soils throughout profile area are massive silty loams to moderately structured light clays that are well drained within the first metre.

A variant of B2 (B2-DV) was observed at detailed site 176 where the alluvial plain has an active drainage line. Visual inspection of the area shows the topsoil horizon (Silty Loam) removed through water erosion with the subsoil horizons (clay) remaining.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- Silt content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic increasing to neutral throughout profile;
- EC is very low increasing to moderate within subsoils:
- low CEC increasing to moderate levels within clay subsoils;
- non sodic topsoils increasing to strongly sodic subsoils;
- overall high Ca to Mg ratios throughout;
- low dispersive qualities in topsoil increasing with subsoils; and
- overall fertility is low.

Representative Site

Site 106 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 35, and a soil profile morphology summary is presented in Table 36. The soil chemistry results for this site are presented in Table 37.

Table 55: Land Sumi	nary for Represe	ntative Site 106	
Representative site number	B2	Representative Site Number	Site 106
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Tall open woodland with Poplar Box and minor Brigalow regrowth
Location (GDA94)	651192 mE 7531738 mN	Disturbance	No effective disturbance
Landform pattern/	Flat plain, level	Micro relief	Nil
element		Permeability	Moderately to slowly permeable
Slope (%)	0.5	Drainage	Well to moderately well-drained
Surface coarse fragments	No coarse fragments	Surface condition	Surface is cracking and dry. Fine self mulch and peds <10 mm
ASC Order	Mesonatric Grey Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Luxor	Principal Profile Form (Northcote 1974)	Dy3.21, Dy3.42, Dy5.22, Dy5.21, Dr4.22,
	Effective rooting	depth: 0.40 mbgl	
Land suitability summary	Est. soil water sto Soil water storage profile and margin PAWC 50-75 mm (LSAT, January 1995 Rain fed Cropping Beef Cattle Grazin Agricultural Land	rage: is based upon the effective al sodicity levels within 0.6 Table 2.3 Surrogate field p 5). g class: 5 ng of Native Pastures class Class: C2	e rooting depth, poor structure as observed in the soil 50m of the SMU. properties for estimating plant available water capacity, ss: 3

Table 35: Land Summary for Representative Site 106

	The SMU is generally located on flat plains and very undulating sloping areas with a silty loam surface. It has a very low to low water erosion hazard in situ. Laboratory results indicated:				
Erosion potential	 Dispersion Ratio (R1) (Baker et al. 1993) indicates moderate dispersion ratings (0.6-0.8) within the topsoil profile. 				
	• ESP (sodicity) rating indicates that the profile to 0.26m is non-sodic. Subsoils from this depth are assessed as sodic to strongly sodic (0.90 m).				
	 Very high to high Ca/Mg ratio within topsoil profile A11 and A12 indicates aggregation of clay particles. Moderate levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. 				
	Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities.				
	Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.				
	Recommended topsoil strip depth: 0.00-0.20 mbgl				
	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.				
Soil quality for mine	<u>Recommended subsoil strip depth</u> : 0.20–0.50 mbgl (but poor quality due to structural attributes of hard setting and sealing)				
rehabilitation	<u>Recommended subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves.				
	Subsoil below 0.5 m would not be favourable for supporting native vegetation growth due to poorly structured, poor water holding and fertility attributes. It would be recommended as buried supporting soils for SMUs within this category.				
ASS/PASS Field	Very low field indication of PASS.				
Assessment	No field indicators of AASS.				
Land condition	Good condition				
Total area (ha)	675 (including B2-DV 30ha)				

Site 106	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A11 Horizon Depth: 0.0 – 0.26 Boundary: Abrupt	Colour: 10YR4/2 Dark grayish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, well drained <i>Depth:</i> 0.05, 0.20 <i>Field pH:</i> 6.0, 6.0 <i>Meter pH/EC</i> : 6.1 / 0.00	<i>Texture:</i> Silty Ioam <i>Structure:</i> Massive <i>Strength:</i> Loose	Coarse Fragments: No coarse fragments <i>Roots</i> : Very few, very fine roots
	Horizon: A12 Horizon Depth: 0.26 – 0.56 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, well drained Depth: 0.40 Field pH: 6.0	<i>Texture:</i> Silty loam <i>Structure:</i> Massive <i>Strength:</i> Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Very few, very fine roots
	Horizon: B2 Horizon Depth: 0.56 – 1.00	Colour: 10YR4/3 Brown <i>Mottle:</i> No mottle <i>Bleach:</i> No bleaching	Moisture: Dry, moderately well-drained Depth: 0.60, 0.90 Field pH: 6.5, 7.0 Meter pH/EC: 6.8 / 0.25 7.2 / 0.36	<i>Texture:</i> Light clay <i>Structure:</i> Moderate, <10 mm peds, sub-angular <i>Strength:</i> Firm	Coarse Fragments: No coarse fragments <i>Roots</i> : No roots observed
	Sample Depth (m)				
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Analysis (Unit)	0.00-0.10	0.20-0.30	0.40-0.50	0.60-0.70	0.90-1.00
Soil pH	6.3	6.5	6.2	7	7.9
Soil EC (dS/m)	0.01	0.02	0.06	0.31	0.41
Soil Cl (mg/kg)	18	18	90	398	537
P (Olsen) (mg/kg)	10	1			
Exch.Ca (meq/100g)	3.21	3.01	3.23	7.38	6.75
Exch. Mg (meq/100g)	1.67	0.86	2.42	6.1	5.65
Exch. Na (meq/100g)	<0.08	<0.08	0.57	2.22	2.6
Exch.K (meq/100g)	0.27	0.25	0.21	0.46	0.44
CEC (meq/100g)	5.2	4.2	6.5	16.2	15.5
Ca/Mg	1.9	3.5	1.3	1.2	1.2
ESP (%)	<1	1	9	14	17
Total N (mg/kg)	0.09				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	2.2				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	39				
PSA-Fine Silt (%)	32				
PSA-Silt (%)	13				
PSA-Gravel (%)	16				
Disp Ratio (%)	0.72				
ADMC (%)	1.1	0.6	1.3	2.8	2.3
Total S	0.02				
Sulfate-S (%)	2				
Manganese (mg/kg)	24.7				
Boron (mg/kg)	<0.1				
Copper (mg/kg)	0.5				
Iron (mg/kg)	28				
Zinc (mg/kg)	0.9				
Aluminium (meq/100g)	0.02	0.02	0.02	0.02	0.02

Table 37: Soil Chemistry Results for Representative Site 106

1 '---' indicates laboratory analysis was not conducted for this sample.

4.1.11 Soils of recent alluvial floodplains and active drainage channels: Soil Mapping Unit A1

Overview

This SMU is associated with the active drainage channel located within the Olive Downs South domain, transecting west to south east. Landforms are a drainage channel with soils that are very dark greyish brown sands to dark brown loamy sandy loams with a firm surface. Soils throughout profile area are massive near apedal with rapid drainage within the first metre.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- Loam to sandy loam texture to 1.0 m depth;
- pH is neutral throughout profile;
- EC is very low;
- low CEC;
- non-sodic profile;
- very high Ca to Mg ratios throughout;
- low dispersive profile; and
- overall fertility is low.

Representative Site

Site 62 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 38, and a soil profile morphology summary is presented in Table 39. The soil chemistry results for this site are presented in Table 40.

Poprosontativo sito		Poprosontativo Sito	Site 62
number	AI	Number	510 02
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, Moreton Bay Ash, Paperbark and various Eucalypts.
Location (GDA94)	641685 mE 7533763 mN	Disturbance	Gully erosion
Landform pattern/	Drainage line	Micro relief	Nil
element		Permeability	Highly permeable
Slope (%)	<1.0	Drainage	Rapid
Surface coarse fragments	<1 % 1-3 mm coarse fragments	Surface condition	Surface is firm and dry
ASC Order (s)	Haplic Grey Kandosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Monteagle, Connors, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Davy	Principal Profile Form (Northcote 1974)	Uc5.11
Land suitability summary	Effective rooting Estimated soil wa PAWC 100-125 mr LSAT, January 1995 Rain fed Cropping Beef Cattle Grazir Agricultural Land	depth: 1.00 mbgl ter storage: n (Table 2.3 Surrogate field 5). g class: 5 ng of native pastures clas Class: C3	d properties for estimating plant available water capacity, ss: 4

Table 38: Land Summary for Representative Site 62

	An open depression area with loam surface predisposes a moderate to high water erosion hazard in situ.				
	Laboratory results indicated:				
	 Dispersion Ratio (R1) (Baker et al. 1993) indicate low dispersion ratings (<0.6) within the topsoil profile. 				
Erosion potentiai	• ESP (sodicity) rating indicates that the soil profile is non-sodic.				
	 Very high Ca/Mg ratio results throughout indicate favourable conditions with aggregation of clay particles. 				
	Erosion potential through dispersion is considered low however, appropriate management of bare earths must be considered when stockpiling and rehabilitation reuse.				
	Recommended topsoil strip depth: 0.00-0.40 mbgl				
Soil quality for mine	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.				
rehabilitation	Recommended subsoil strip depth: 0.40–1.00 mbgl				
	<u>Recommended subsoil use</u> : Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.				
ASS/PASS Field	Very low field indication of PASS.				
Assessment	No field indicators of AASS.				
Land condition	Good condition				
Total area (ha)	124				

Table 39: Soil Profile Morphology for Representative Site 62

Site 62	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots.
	Horizon: A1 Horizon Depth: 0 – 0.55 Boundary: Abrupt	Colour: 10YR3/2 Very dark greyish brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.1, 0.4 <i>Field pH:</i> 6.5, 6.5 <i>Meter pH/EC</i> : 6.9 / 0.01	Texture: Loam Structure: Massive Strength: Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Fine, few roots
	Horizon: B2 Horizon Depth: 0.55 – 1.00	Colour: 10YR3/3 Dark brown <i>Mottle:</i> No mottles <i>Bleach:</i> No bleaching	<i>Moisture:</i> Dry, rapid <i>Depth:</i> 0.6, 0.9 <i>Field pH:</i> 6.5, 6.5 <i>Meter pH/EC:</i> 7.0 / 0.01	Texture: Sandy loam Structure: Massive Strength: Loose	<i>Coarse Fragments:</i> No coarse fragments <i>Roots:</i> Fine, few roots

	Sample Depth (m)				
Analysis (Unit)	0.00-0.10	0.3-0.4	0.6-0.7	0.9-1.0	
Soil pH	7.2	7.5	7.3	7.5	
Soil EC (dS/m)	0.03	0.03	0.02	0.03	
Soil Cl (mg/kg)	11	32	34	26	
P (Olsen) (mg/kg)	3	1			
Exch.Ca (meq/100g)	5.5	3.29	4.85	4.64	
Exch. Mg (meq/100g)	1.85	1.64	1.86	1.97	
Exch. Na (meq/100g)	<0.08	0.14	0.19	0.13	
Exch.K (meq/100g)	0.29	0.23	0.25	0.29	
CEC (meq/100g)	7.7	5.4	7.2	7.1	
Ca/Mg	3.0	2.0	2.6	2.4	
ESP (%)	1	3	3	2	
Total N (mg/kg)	0.099				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	2.8				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	67				
PSA-Fine Silt (%)	16				
PSA-Silt (%)	9				
PSA-Gravel (%)	9				
Disp Ratio (%)	0.62				
ADMC (%)	1.2	0.9	1.3	1.1	
Total S	0.02				
Sulfate-S (%)	3				
Manganese (mg/kg)	14.9				
Boron (mg/kg)	0.4				
Copper (mg/kg)	0.5				
Iron (mg/kg)	19				
Zinc (mg/kg)	0.5				
Aluminium (meq/100g)	0.03	0.1	0.04	0.07	

Table 40: Soil Chemistry Results for Representative Site 62

1 '---' indicates laboratory analysis was not conducted for this sample.

4.1.12 Soils of recent alluvial floodplains and active drainage channels: Soil Mapping Unit A2

Overview

This SMU is associated with the active drainage channels and floodplains located within both the Olive Downs South domain and the Willunga domain. Landforms include a drainage channel and numerous open depressions/floodplains within gently undulating plains. Soils are weak to moderate, very dark grey sands to brown mottled light medium clays with rapid to imperfect drainage.

Soil Characteristics and Chemistry

The major characteristics from the available data indicate that this SMU has:

- sand content within topsoil, increasing clay content in subsoils to 1.0 m depth;
- pH is slightly acidic increasing to strongly alkaline with subsoil depth;
- EC is very low;
- very low CEC increasing to low within subsoils;
- non-sodic topsoil profile increasing significantly to extremely sodic within subsoils;
- very high decreasing to high Ca to Mg ratios with subsoil depth;
- low dispersive topsoil increasing in subsoils; and
- overall fertility is low.

Representative Site

Site 96 was chosen as representative of this SMU for chemical analysis.

A site description is presented in Table 41, and a soil profile morphology summary is presented in Table 42. The soil chemistry results for this site are presented in Table 43.

Table 41. Land Sum	naly for Represe	intative site so	
Representative site number	A2	Representative Site Number	Site 96
Representative Site photograph			
Site type	Detailed. 50 mm hand auger.	Main vegetation	Mid to high open woodland, Moreton Bay Ash and various Eucalypts.
Location (GDA94)	644069 mE 7534469 mN	Disturbance	Gully erosion
Landform pattern/	Gently	Micro relief	Nil
element	undulating plain, open depression	Permeability	Highly permeable
Slope (%)	<2.0	Drainage	Rapid to imperfect
Surface coarse fragments	No coarse fragments	Surface condition	Surface is soft and moist
ASC Order (s)	Subnatuc Grey Sodosol	Land use	Grazing
Land Systems (Gunn et al. 1967)	Somerby, Monteagle, Connors, Humboldt, Blackwater	Substrate	Weathered tertiary clays and clay plains
Soils (Gunn et al. 1967)	Taurus	Principal Profile Form (Northcote 1974)	Dy2.23, Dy3.23, Db1.23, Db1.43, Db1.13, Dy2.43
Land suitability summary	Effective rooting Estimated soil wa PAWC 50-75 mm (LSAT, January 1995 Rain fed Cropping Beef Cattle Grazin Agricultural Land	depth: 0.25 mbgl ter storage: Table 2.3 Surrogate field p 5). g class: 5 ng of native pastures class Class: C3	broperties for estimating plant available water capacity, ss: 4

Table 41: Land Summary for Representative Site 96

	Gently undulating areas with sandy surface predisposes a high water erosion hazard in situ.				
	Laboratory results indicated:				
	• Dispersion Ratio (R1) (Baker et al. 1993) indicate moderate dispersion ratings (0.6-0.8) within the topsoil profile.				
	 ESP (sodicity) rating indicates the topsoil profile is non-sodic. Subsoils are assessed as extremely sodic. 				
Erosion potential	 Very high Ca/Mg ratio within topsoil indicates aggregation of clay particles. Moderate to high levels within subsoils indicate the subsoils have poor physical conditions with dispersive qualities. 				
	Erosion potential through dispersion is assessed as low within topsoil. Subsoils are assessed as moderate to high with an increase in sodicity levels and a reduction in Ca/Mg ratio promoting dispersion qualities.				
	Subsoils are not recommended for surface rehabilitation due to poor structure and binding capacity when wet. Appropriate management of exposed earths and stockpiling of subsoils is recommended.				
	Recommended topsoil strip depth: 0.00-0.15 mbgl				
Soil quality for mine	<u>Recommended topsoil use</u> : Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.				
renabilitation	Recommended subsoil strip depth: 0.15–1.00 mbgl				
	Recommended subsoil use: Capping material over waste rock.				
ASS/PASS Field	Very low field indication of PASS.				
Assessment	No field indicators of AASS.				
Land condition	Good condition				
Total area (ha)	801				

Table 42: Soil Pr	ofile Morpholog	v for Representativ	e Site 96
	onic morpholog	y for hepresentativ	e site so

Site 96	Horizon, Depth (m) Boundary	Colour, Mottles, Bleaching	Moisture, Depth (m) Field pH	Texture, Structure, Strength	Coarse Fragments, Roots
	Horizon: A1 Horizon Depth: 0.0 – 0.04 Boundary: Abrupt	Colour: 10YR4/1 Dark grey <i>Mottle:</i> No mottles <i>Bleaching:</i> No <i>Bleaching</i>	Moisture: Moderately moist, rapid Depth: 0.02 Field pH: 6.5 Meter pH/EC: 6.6 / 0.01	Texture: Clayey sand Structure: Weak sub- angular, Strength: Weak	Coarse Fragments: No coarse fragments <i>Roots:</i> Very fine, very few roots
	Horizon: A2 Horizon Depth: 0.04 – 0.25 Boundary: Abrupt	Colour: 10YR4/4 Dark yellowish brown <i>Mottle:</i> No mottles Bleaching No Bleaching:	<i>Moisture:</i> Moderately moist, rapid	<i>Texture:</i> Loamy sand <i>Structure:</i> Weak sub- angular <i>Strength:</i> Weak	Coarse Fragments: 10% coarse fragments 2-4 mm <i>Roots:</i> Very fine, very few roots
	Horizon: B2 Horizon Depth: 0.25 – 1.00	Colour: 10YR4/3 Brown <i>Mottle:</i> Mottles 5% 10YR54 Yellowish brown <i>Bleaching:</i> No Bleaching	Moisture: Moist, imperfect Depth: 0.3, 0.6, 0.9 Field pH: 6.5, 6.5, 6.5 Meter pH/EC: 7.7 / 0.24 8.6 / 0.63 8.8 / 0.66	Texture: Light medium clay Structure: Moderate, sub- angular 30-60 mm Strength: Firm	Coarse Fragments: 10% coarse fragments 2-4 mm <i>Roots:</i> No roots observed

	Sample Depth (m)				
Analysis (Unit)	0.00-0.04 ¹	0.15-0.25	0.40-0.50	0.90-1.00	
Soil pH	6.2	6.6	7.3	7.3	
Soil EC (dS/m)	0.03	<0.01	0.03	0.07	
Soil Cl (mg/kg)	23	24	175	82	
P (Olsen) (mg/kg)	6	1			
Exch.Ca (meq/100g)	1.61	0.41	2.65	1.67	
Exch. Mg (meq/100g)	0.49	0.21	4	2.66	
Exch. Na (meq/100g)	<0.08	<0.08	1.24	1.17	
Exch.K (meq/100g)	0.24	0.09	0.64	0.3	
CEC (meq/100g)	2.4	0.7	8.7	5.9	
Ca/Mg	3.3	2.0	0.7	0.6	
ESP (%)	1	3	14	20	
Total N (mg/kg)	0.101				
Nitrate N (mg/kg)	<1				
Organic Matter (%)	3.2				
Ammonia (mg/kg)	<20				
PSA-Clay (%)	52				
PSA-Fine Silt (%)	19				
PSA-Silt (%)	20				
PSA-Gravel (%)	11				
Disp Ratio (%)	0.61				
ADMC (%)	0.8	0.3	2.2	1.4	
Total S	<.02				
Sulfate-S (%)	4				
Manganese (mg/kg)	17.4				
Boron (mg/kg)	0.4				
Copper (mg/kg)	0.5				
Iron (mg/kg)	144				
Zinc (mg/kg)	0.6				
Aluminium (meq/100g)	0.02	0.02	0.18	0.07	

Table 43: Soil Chemistry Results for Representative Site 96

Laboratory sample is for 0.00 to 0.04, not 0.00 to 0.4 as listed within the laboratory certificates.
 '---' indicates laboratory analysis was not conducted for this sample.

5 LAND SUITABILITY AND AGRICULTURAL LAND ASSESSMENT

Determination of land suitability at the Project has been conducted in accordance with Bruce et al. (1982, 1984), Gunn et al. (1988), DME (1995) with reference to *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) and *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013).

The land suitability assessment produced in the following section follows LSAT (DME 1995) for assessment of SMUs. This included the review of existing land suitability information available.

5.1 Previous Soils Report, Land Suitability and Limitations Review

Previous land use suitability assessments for the Project site and surrounding SMUs have been completed. This includes the major assessment, Land of Isaac Comet (Gunn et al. 1967) and Windeyers Hill Area, Burgess (2003).

5.1.1 *Land Suitability and Limitations* (Burgess 2003)

Burgess (2003) assessed the land use suitability of the Windeyers Hill Area, Isaac-Connors and Mackenzie River Catchments in Central Queensland. A set of land use requirements for plant growth, machinery use, land preparation irrigation and prevention of land degradation has been defined for agricultural land use in Queensland. Methods and terminology are consistent with the *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) (Land Resources Branch Staff [1990], McDonald et al. [1990] and Isbell [2002]).

Volume 2, Appendix 9 of Burgess (2003) details the methods of assessment and *Appendix 10* of Burgess (2003) details results. Where appropriate, information was reviewed against the Project site SMUs.

5.1.2 *Lands of Isaac-Comet Area, Queensland* (Gunn et al. 1967)

Gunn et al. (1967) addresses the land capability of the Lands of Isaac-Comet area. Land capability is an eight class system from broad scale mapping.

The present land use over the greater part is grazing of natural pastures for the production of beef cattle. An attempt is made to interpret some of the data within the report in terms of potential land use. Limitations including erosion, fertility, salinity and other aspects are discussed. Figure 14 within Gunn et al. (1967) presents the estimated potential land use. The Project site is assessed as Class IV - Limited cultivation and/or improved pastures.

5.2 Land Suitability Classes

Land suitability for the Project site is primarily based upon classifications provided within the LSAT Guidelines within the DME's *Technical Guidelines for Environmental Management of Exploration and Mining in Queensland* (DME 1995).

The *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) were utilised to assess land suitability classes and ALCs. The *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) and *Regional Land Suitability Frameworks* (DSITI and DNRM 2013) for various regions of Queensland could give specific information for appropriate land uses and their associated limitations.

The land suitability classes as outlined in *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015) are in Table 44.

Class	Suitability	Limitations	Definition
1	Suitable	Negligible	Highly productive land requiring only simple management practices to maintain economic production.
2	Suitable	Minor	Land with limitations that either constrain production, or require more than the simple management practices of class 1 land to maintain economic production.
3	Suitable	Moderate	Land with limitations that either further constrain production, or require more than those management practices of class 2 land to maintain economic production.
4	Unsuitable	Severe	Currently unsuitable land. The limitations are so severe that the sustainable use of the land in the proposed manner is precluded. In some circumstances, the limitations may be surmountable with changes to knowledge, economics or technology.
5	Unsuitable	Extreme	Land with extreme limitations that preclude any possibility of successful sustained use of the land in the proposed manner.

Table 44: Land Suitability Classes

Source: Definitions from Guidelines for Agricultural Land Evaluation in Queensland (DSITI and DNRM 2015).

The review of the *Regional Land Suitability Frameworks*. (DSITI and DNRM 2013) was undertaken in conjunction with *Guidelines for Agricultural Land Evaluation in Queensland* (DSITI and DNRM 2015). Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) for the Inland Fitzroy and Southern Burdekin area was undertaken once the DME (1995) broadacre rainfed cropping and beef cattle grazing limitations assessment and ALCs were established.

The LSAT Guidelines also provide general criteria and threshold values for assessment of a range of soil limitations to rainfed broadacre cropping and beef cattle grazing land use. Only major limiting factors have been considered, including:

- plant available water capacity (PAWC) (m);
- nutrient deficiency (n);
- soil physical factors (p);
- salinity (s);
- rockiness (r);
- microrelief (g);

- topography (t);
- susceptibility to water erosion (e); and
- flooding (f).

Grazing suitability used the same approach as cropping but with varied interpretation of the severity of limiting factors.

Field and laboratory data collected was used to assess the severity of any limitations and the land suitability class of each soil unit against the LSAT Guidelines. Methods from Burgess (2003) and Shields and Williams (1991) have been used to support the land suitability classification of soils mapped at the Project site.

5.3 Land Suitability Limitations Assessment

The land suitability assessment includes the SMU identified characteristics, chemistry and suitability classes of the LSAT Guidelines.

5.3.1 Rainfed Broadacre Cropping

Plant Available Water Capacity (m)

PAWC is a significant soil property in this locality as cropping is based on fallow storage of moisture in the soil profile. Effective rooting depth is defined as the depth to which approximately 90% of plant roots will extract water. It is normally limited either by the presence of underlying rock or other hard materials or by chemical or physical attributes within the subsoil that restrict root growth (Department of Primary Industries Land Resources Branch 1990).

Field morphology observations and chemical data used included soil texture and barriers to root growth such as high sodium, bedrock, poor soil structure, high electrical conductivity and chloride. PAWC is classically defined as the moisture present between field capacity and permanent wilting point (15 bars). Additionally, field assessments of effective soil depth, and subsequently soil water storage, were undertaken which followed the method used by Burgess (2003). This involved estimates of field texture combined with field pH, EC and depths to hard soil horizons.

Table 45 shows the criteria which Shields and Williams (1991) proposed for assessment of the moisture availability limitation for crops in the Kilcummin area which was reviewed alongside PAWC and effective rooting depth. Table 46 shows PAWC limitation severity for each SMU.

Limitation Level	PAWC (mm)	Effective Rooting Depth (mm)	Predicted Cropping Success (%)
2	>130	900	70-75
3	100-130	600	40-70
4	75-100	400	<40
5	<75	<400	<30

Table 45: Criteria for PAWC limitations for cropping (Shields and Williams 1991)

Soil Unit	Concept	Estimated ERD (m)	PAWC (mm) ¹	Dryland cropping Limitation level	Grazing limitation level
C1	Brown light clays with melon hole microrelief	0.40	75-100	4	3
C2	Grey to brown light to medium clay with normal gilgai microrelief	<0.30	50-75	5	4
S1	Brown shallow to deep duplex loamy sands to clay loam sandy earths	0.40	50-75	4	4
S2	Brown gradational sands, loamy to clayey sands	0.60	75-100	4	3
R1	Light red loamy sands to reddish loamy/clayey sands	0.80	75-100	4	3
R2	Brown to reddish brown loamy sands to sandy clay loams	0.60	75-100	4	3
L1	Shallow (0.20m) loamy sands to deep light clay	0.20	50-75	5	4
L2	Deeper (0.40-0.60m) loamy sands to light clay	0.30	50-75	5	4
B1	Black, to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams	0.60	75-100	4	3
B2	Brown silty loams to light clays with cracking surface on lower flat plains	0.40	50-75	5	4
A1	Loam to loamy sands within active channels	1.00	100-125	3	2
A2	Clayey sands to light medium clay within alluvial depression	0.25	50-75	5	4

Table 46: PAWC limitation levels for SMUs

1- Water availability values obtained from Table 2.3 Surrogate field properties for estimating plant available water capacity (PAWC), Land Suitability Assessment Techniques, January 1995 have been assessed.

The effective rooting depth (ERD) and PAWC for SMUs C1 and C2 were also assessed against Burgess (2003) Indicus melonhole phase (IdMp) and Pomegranate melonhole phase (PgMp) as their attributes were representative of the vertosol soils encountered.

SMU C1 exhibits attributes similar to IdMp including high salinity (chloride) levels in mounds (611 mg/kg at 0.60 m) and reduced levels at depth for depressions (275 mg/kg at 0.90 m). Review of the SMU C1 with respect to IdMp, salinity and sodic levels between the representative sites mound and depression, GTE assess the ERD at 0.40 m with a PAWC to be 75-100 mm.

SMU C2 exhibits attributes similar to PgMp with high salinity levels in mounds (<0.30 m) and in depressions (<0.60 m). Burgess states that regular seasonal ponding in depressions results in leaching and downward movement of the salt bulge, as seen at SMU C2. Burgess (2003) continues to state 'Even where deeper mound profiles occur (ERD >0.25 m) maximum PAWC levels (70-100 mm) are rarely achieved on a regular basis because of restricted infiltration (hard setting, fine sandy, clay surface, surface sealing and dispersive behaviour)'.

Review of the SMU C2 with respect to PgMp, salinity and sodic levels between the representative sites mound and depression, GTE assess the ERD at <0.30 m with a PAWC to be 50-75 mm. SMU C2 exhibits higher EC and chloride levels than PgMp at these mound and depression depths.

Nutrient deficiency (n)

Laboratory data shows slight variations in some nutrient attributes, particularly phosphorus (P) and exchangeable potassium (K) and calcium (Ca). According to DME (1995), levels of nutrient deficiency reported range between favourable in clay SMU profiles to not favourable for agricultural activities with most sandy earths, excluding SMU S1.

SMUs C2 and S2 reported the highest level of Bicarbonate P at 17 and 11 mg/kg for cropping and grazing with classes of 1/1 and 1/2.

SMUs R1, R2, and A1 reported the least favourable levels of nutrient deficiency with LSAT classes of 4 for rainfed cropping and class 4 grazing.

Soil Physical Factors (p)

This limitation deals with conditions which determine sufficient seed contact with moist soil to prevent desiccation prior to germination and establishment. It was found that nine SMUs C1, C2, S2, R1, R2, B1, B2, A1 and A2 had favourable factors due to consisting of rigid soils with a loose soft or firm surface when dry.

Three SMUs, S1, L1 and L2 presented hard setting surfaces as a limiting factor.

Salinity (s)

This refers to the reduction in dry matter yield as a result of soluble salt in the soil profile. It also contributes to reduced water availability limitation.

Salinity (chloride) levels for SMU C2 were assessed at 1654 mg/kg within 0.30-0.40 m of the mound and 1330 mg/kg within 0.60-0.70 m of the depression. With reference to Burgess (2003), in determining the mean average, the two salinity results were averaged at 964 mg/kg.

The topsoil profile for the depression (0.00-0.10 m – 21 mg/kg, 0.30-0.40 m – 274 mg/kg) and mound (0.00-0.10 – 19 mg/kg) depths show very low salinity levels. Taking into account the average salinity level and the rootzone (based upon the profile and ERD), SMU C2 is assessed to have a land suitability class 4 (rootzone CL 900-1500).

Salinity levels across the remaining eleven SMUs were low with LSAT Class 1 for rainfed cropping and grazing. SMU L1 did exhibit increased chloride levels within 0.50 m of the surface, however, these levels were not considered within the rootzone of the soil profile.

Rockiness (r)

This refers to the amount of coarse fragments located on the surface of the soil profile, the size and percentage. All twelve SMUs did not exhibit surface coarse gravel equal to or greater than 10% or any rocky outcrops.

Microrelief (g)

Microrelief (commonly referred to as gilgai or melon holes) refers to localised depressions along the land surface (McDonald et al. 1990).

Two SMUs, C1 and C2 reported normal gilgai and melon holes. SMU C1 consists of melon holes approximately 4.0 m diameter, 0.4 m deep at 50% coverage. The LSAT classes for SMU C1 are 3/3.

SMU C2 consists of shallow to normal gilgai, approximately 3.0 m diameter, 0.3 m at their deepest at 20-30% coverage. The LSAT classes for SMU C2 are 3/2.

Gilgai and melon holes were not recorded at the remaining SMUs.

Topography (t)

Topography is assessed in terms of slope and micro-relief. Slope may limit the effective and safe use of machinery and contribute to erosion hazard.

Topography limitations were only evident in the alluvial areas of SMU A1 and A2 where abundant deep gullies would prevent any practical cultivation. The rainfed and grazing classes for SMU A1 and A2 were 4/4 and 2/4.

Susceptibility to Water erosion (e)

The risk of soil loss from water erosion magnifies with increased water velocity when land is devoid of vegetation for cropping. Such effects are directly proportional to slope gradient.

SMUs S1, L2, B1 and A2 report the highest LSAT classes for water erosion. SMUs S1, L2 and A2 reported slopes under 2% on sodic rigid soils and SMU B1 reported slopes under 3% on non-sodic rigid soils. LSAT classes for the SMUs were 3/1 for cropping and grazing. If subsoils of S1, L2, B1 and A2 are exposed they pose an erosion threat due to sodicity and dispersion tendency.

SMUs R1 and R2 reported LSAT classes of 2/1 for cropping and grazing with slopes less than 2% on non-sodic rigid soils.

The remaining SMUs C1, C2, S2, L1, S2 and A1 reported flat plains to slopes with a gradient of less than 1.0% for LSAT classes of 1.

Flooding (f)

Flooding only influenced SMUs A1 and A2 as these are located within active drainage lines. Areas were observed where rare flooding may occur across the Project site including the variant of B2, B2DV, however these areas were considered a small percentage compared to the dominant SMUs.

5.3.2 Grazing

Grazing land limitations in general, are one class lower than the rainfed cropping limitation classes. Major observations of the limitations for grazing are present below.

Plant Available Water Capacity (m)

SMUs S1, L1, L2 and A2 will be the least productive due to some limitations with the soil profile texture reducing soil water availability.

Nutrient deficiency (n)

Nutrient deficiency impacts across all SMUs with limitation levels of 3 and 4 with SMUs R1, R2, B1 and A1 reporting the least favourable attributes.

Salinity (s)

SMU C2, salinity was assessed at rootzone CL 900-1500, for a land suitability class of 4.

Topography (t)

Topography limitations of alluvial areas and drainage lines of SMUs A1 and A2 prevent adequate management of grazing stock.

5.3.3 Land Suitability Limitations Summary

The suitability assessment of each SMU for rainfed cropping and beef cattle grazing have been assessed and presented in Table 47.

	LSAT Criteria: Rainfed / Grazing									
SMU	Limiting factors (refer 5.3.1 & 5.3.2)									
	m¹	n	р	S	r	rs (refer 5.3.1 & 5.3.2) r g t² e 1/1 3/3 1/- 1/1 1/ 1/1 3/3 1/- 1/1 1/ 1/1 3/3 1/- 1/1 1/ 1/1 3/2 1/- 1/1 1/ 1/1 1/1 1/- 3/1 1 1/1 1/1 1/- 3/1 1 1/1 1/1 1/- 2/1 1 1/1 1/1 1/- 2/1 1 1/1 1/1 1/- 2/1 1 1/1 1/1 1/- 3/1 1 1/1 1/1 1/- 3/1 1 1/1 1/1 1/- 3/1 1 1/1 1/1 1/- 3/1 1	f			
C1	4/3	2/3	2/2	1/1	1/1	3/3	1/-	1/1	1/1	
C2	5/4	1/1	2/2	4/4	1/1	3/2	1/-	1/1	1/1	
S1	4/4	3/3	3/2	1/1	1/1	1/1	1/-	3/1	1/1	
S2	4/3	1/2	1/1	1/1	1/1	1/1	1/-	1/1	1/1	
R1	4/3	4/4	1/1	1/1	1/1	1/1	1/-	2/1	1/1	
R2	4/3	4/4	1/1	1/1	1/1	1/1	1/-	2/1	1/1	
L1	5/4	2/3	3/2	1/1	1/1	1/1	1/-	1/1	1/1	
L2	5/4	3/3	3/2	1/1	1/1	1/1	1/-	3/1	1/1	
B1	4/3	3/4	1/2	1/1	1/1	1/1	1/-	3/1	1/1	
B2	5/4	3/3	2/2	1/1	1/1	1/1	1/-	1/1	1/1	
A1	3/2	4/4	1/1	1/1	1/1	1/1	4/4	1/1	5/2	
A2	5/4	2/3	1/1	1/1	1/1	1/1	2/4	3/1	4/2	

Table 47: Suitability classes for rainfed broadacre crops and grazing for SMUs

1 Water availability values obtained from Table 2.3 Surrogate field properties for estimating plant available water capacity (PAWC), Land Suitability Assessment Techniques, January 1995 and Burgess (2003).

2 '-' No suitable limitation factor available.

5.4 Review and Summary of Pre-Mine Land Suitability Areas

Review of the SMUs indicates that overall, they are marginal to unsuitable for broadacre rainfed cropping. In general, this is due to limitations in PAWC and nutrients, with some SMU specific limitations including salinity, topography and flooding,

Beef cattle grazing is assessed as marginally to suitable land with moderate limitations. Limitations such as moisture, nutrients and salinity may be considered to have less impact on maintaining native pastures compared with establishing cropping lands. Observations of the Project site vegetation and current agricultural land use displayed successful beef cattle grazing activities already established onsite.

The Department of Environment and Science (formerly known as EHP) consider that nutrients limitation may be viewed as readily rectified with fertiliser and pasture management. Limitation levels may be viewed as marginal when assessing as between unsuitable and suitable for a land use.

As the overall suitability class is usually determined by the most severe suitability subclass that applies in a particular SMU, moisture, nutrients and salinity limitations for SMUs C2, S1, R1, R2, L1, L2, B1 and B2 of grazing class four will be re-reviewed as marginal compared with other favourable attributes.

This will increase the grazing class to three, which reflects the SMUs beef cattle grazing potential in line with the definition in Table 44.

Table 48 shows the land suitability class for each SMUs and their area (ha). These classes are based upon the most significant limitation presented in Table 47. Figures 5.1-5.4 and 6.1-6.4 present the pre-mine land suitability across the Project site.

Land Su	uitability – Croppin	g	Land Suitability – Grazing			
Class	SMU	Area (Ha)	Class	SMU	Area (Ha)	
1	-	-	1	-	-	
2	-	-	2	-	-	
3	-	-	3	C1, S2, C2, S1, R1, R2, L1, L2, B1, B2	15,796	
4	C1, S1, S2, R1, R2, B1	8,985	4	A1, A2	471	
5	C2 L1, L2, B2, A1, A2	7,283	5	-	-	

 Table 48: SMUs Suitability Assessment and Areas (ha) for classes of cropping and grazing

5.5 Agricultural Land Classes

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

ALCs for the Project site are defined as part of the Isaac Region Shire Planning Scheme, due for completion in 2018 based upon the existing Belyando, Broadsound and Nebo Planning Schemes. ALCs assessment guidelines are shown below in Table 49.

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

Table 49: Agricultural Land Classes

¹ Sourced from Guidelines for agricultural land evaluation in Queensland (DSITI and DNRM 2015).

² Land suitability classes are a guide to assess ALC. Class 3/4 and 4/5 thresholds may be reviewed as either crisp (clear or distinct) boundaries or if results are marginal and show gradational characteristics, attributes are assessed as such. ³ A wide range of crops is four or more crop types of local commercial significance.

⁴ Horticulture includes intensively grown small crops (e.g. vegetables) as well as tree crops (e.g. grown for nuts, seeds or fruit). Silviculture (plantation forestry) is not included.

⁵ A narrow range of crops is three or fewer crop types (broadacre or horticulture) of local commercial significance. Silviculture (plantation forestry) may be included. Crops with similar agronomic requirements e.g. maize and grain sorghum, peaches and nectarines are not generally regarded as different crop types. Different management regimes (including irrigation strategies) for the same crop do not increase the number of crops.

⁶ Non-agricultural land includes land that cannot be placed in any of the other land classes and includes land such as urban areas and stream channels.

⁷ In cases where two or more land classes are equally dominant and none are greater than 50%, judgement is used to identify the most appropriate agricultural land class/es for the unit.

5.5.1 Agricultural Land Classes Assessment

The factors used to assess agricultural land suitability are soil results including the LSC assessment, field observations, topographic and professional experience. The revised marginal limitations as discussed within Section 5.4, would be taken into account to assess the suitable pasture land ALC for each SMU.

The summary assessment and results for each class is below and presented in Table 50. These ALCs are presented in Figures 7.1-7.4.

Agricultural Land Assessment							
Class	SMU	Area (Ha)					
А	-	-					
В	C1, S2	6,114					
C1	-	-					
C2	C2, S1, R1, R2, L1, L2, B1, B2	9,680					
C3	A1, A2	472					

Table 50: SMUs Suitability Assessment and Areas (ha) for Agricultural Land

Class A (A1, A2) - Crop Land

• No SMUs were assessed within this class.

Class B - Limited Crop Land

- SMU C1 increasing sodic attributes and microrelief may be considered least favourable for wide range of cropping activities, however favourable attribute such as nutrients and salinity promote highly suitable conditions for pasture grazing and narrow range of potential cropping.
- SMU S2 reported more favourable conditions with attributes remaining consistent throughout the profile. It is highly suitable for grazing and a narrow range of cropping.

Engineering and/or agronomic improvements would be required for potential limited cropping for either SMU. These SMUs have been re-assessed against the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) in Section 5.5.2.

Class C – Pasture Land C1

• No SMUs were assessed within this class.

Class C – Pasture Land C2

• SMU C2 presented favourable attributes such as high fertility soils; however reduced PAWC and salinity limitations reduce the recommended class of the SMU as a Class C2.

- SMU S1 main limitations were PAWC, sodicity and soil physical attributes within subsoils. All remaining attributes remained favourable to grazing of native pastures with no ground disturbance to establish pastures.
- SMUs R1 and R2 had favourable attributes with classes of rainfed and grazing classes of 4 and 3, however review of low fertility nutrient values are marginal to prevent recommendation of limited cropping land and sown pastures. The SMUs are assessed as Class C2.
- SMU L1 reported PAWC limitations with favourable LSAT criteria throughout. Review of the laboratory data, specifically physical attributes and sodicity levels, it is recommended the SMU be assessed as suitable for grazing while not suitable for ground disturbance to establish pastures.
- SMU L2, like SMU L1 reported PAWC limitations with favourable LSAT criteria throughout. The SMU has a deeper, non-sodic A horizon than L1, however nutrient levels are less favourable. It is it is recommended the SMU be assessed as suitable Class C2 rather than Class C1 due to this limitation.
- SMU B1 and B2 have favourable attributes for grazing, however are not considered to have high fertility soils for limited cropping or sown pastures. They are assessed as Class C2 due to this limitation.

Class C – Pasture Land C3

• SMUs A1 and A2 are located within active drainage lines and alluvial floodplains, which is considered an accessibility limitation. The SMUs are considered suitable only for light grazing of native pastures.

Class D – Non-agricultural Land

• No SMUs were assessed within this class.

5.5.2 Regional Frameworks Assessment

The land suitability assessment has determined the final suitability for each SMU and agricultural land use. Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) for the Inland Fitzroy and Southern Burdekin area indicates limitations relating to cropping land activities. As assessed within the LSAT guidelines, two SMUs C1 and S2 may be considered for limited crop land. All other SMUs identified are considered for beef cattle grazing activities, and therefore not considered for review.

The limitations covered for dryland and irrigated cropping land uses include;

- Erosion (E);
- Soil Water availability (M);
- Narrow moisture range (Pm);
- Surface Condition (Ps);
- Rockiness (R);

- Microrelief (Tm); and
- Wetness (W).

Review of the *Regional Land Suitability Frameworks for Queensland* (DSITI and DNRM 2013) indicates the following suitable subclasses for various land management options for the two SMUs summarised in Table 51 and 52.

<u></u>		Limitation Value and Suitability Subclasses for different land uses				
SIMO	Limitation Categories	Group A	itation Value and Suitability Subclasses for dGroup AGroup B2-1343-3-3-	Group C		
C1	Erosion (E, Es)	2	_1	-		
	Soil Water Availability (M)	3	4	5		
	Narrow Moisture Range (Pm)	3	-	-		
	Surface Condition (Ps)	3	-	-		
	Rockiness (R)	1	1	-		
	Microrelief (Tm)	3	-	-		
	Wetness (W)	4	4	4		
Overall Suitability Class		4	4	5		

Table 51: Regional Frameworks Assessment – SMU C1

1. No suitability subclass for the land management option.

Table 52: Regional Frameworks Assessment – SMU S2

CMU	Limitation Catomonias	Limitation Value and Suitability Subclasses for different land uses				
SIVIO	Limitation Categories	Group A	Group B	Group C		
S2	Erosion (E, Es)	2	_1	-		
	Soil Water Availability (M)	3	4	5		
	Narrow Moisture Range (Pm)	1	-	-		
	Surface Condition (Ps)	2	-	-		
	Rockiness (R)	1	1	-		
	Microrelief (Tm)	1	-	-		
	Wetness (W)	1	1	1		
Overall Sui	tability Class	3	4	5		

1 No suitability subclass for the land management option.

Land management options for SMU C1 is assessed as currently marginally to unsuitable for land uses outlined within the regional frameworks for the Project site with limitation wetness being the most severe. This limitation was based upon the SMU depression attributes with mound attributes indicating slightly better conditions. Marginal cropping land uses may include Maize, Millet, Oat, Sorghum, Triticale and Wheat. As discussed within Section 5.5.1, through the use of additional engineering and/or agronomic improvements, potential limited broadacre and horticultural cropping may be considered improved.

Land management options for SMU S2 is assessed as currently suitable with moderate limitations for Group A land uses outlined within the regional frameworks for the Project site with limitation soil water availability being the most severe. Group B and C are considered unsuitable without the use of engineering and/or agronomic improvements, potential limited broadacre and horticultural cropping may be considered viable. Dryland cropping land uses may include Barley, chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.

6 TOPSOIL, SUBSOIL REVIEW, RECOMMENDATIONS AND STRIPPING DEPTH

6.1.1 Topsoil and Subsoil Management

Areas to be disturbed as a result of open cut mining activities, construction of a rail spur connection, water pipeline, ETL, access roads and associated infrastructure will require stripping of the topsoil and possibly subsoil for reuse in rehabilitation programs.

Therefore, all soils within the Project site have been assessed to determine their suitability for stripping and reuse for rehabilitation purposes.

6.1.2 Specific Soil Mapping Unit Recommendations

The Project site contains soils from uniform to gradational sandy earths to duplex clay soils. The sections below give specific recommendations for each of the soils identified. A summary of the topsoil and subsoil recommendations is provided below in Table 53.

Soil	ASC Soil Type	Topsoil Recommended Rehabilitation Use	Subsoil Recommended Rehabilitation Use
C1	Endohypersodic Brown Vertosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope).	Buried supporting subsoils for topsoil.
C2	Brown Vertosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope).	Capping material over waste rock.
S1	Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Buried supporting subsoils for topsoil.
S2	Haplic Brown Dermosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
R1	Red Rudosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
R2	Haplic Red Chromosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
L1	Mesonatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Buried supporting subsoils for topsoil. <u>Subsoils 0.35-1.00 mbgl</u> Soils below 0.35m are not recommended to be reused however may be marginally suitable with possible use as capping material over waste rock.
L2	Mesonatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are	Capping material over waste rock.

Table 53: Topsoil and Subsoil Recommendations Summary

Soil	ASC Soil Type	Topsoil Recommended Rehabilitation Use	Subsoil Recommended Rehabilitation Use
		relatively flat to sloped areas such as backfill batters.	
В1	Subnatric Brown Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves for level plains Buried supporting subsoils for topsoil.
В2	Mesonatric Grey Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. <u>Subsoils 0.50-1.00 mbgl</u> Subsoil below 0.5 m would not be favourable for supporting native vegetation growth due to poorly structured, poor water holding and fertility attributes. It would be recommended as buried supporting soils for SMUs within this category.
A1	Haplic Grey Kandosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves. Buried supporting subsoils for topsoil.
A2	Subnatric Grey Sodosol	Support native vegetation and grasses. For rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.	Capping material over waste rock.

Flat to gently undulating plains dominated by uniform and gradational clays (C1, C2)

This SMU includes uniform to gradational cracking clays.

• These soils are moderate (C1) to high (C2) in fertility status and low dispersive qualities. Topsoil stripping depths are shallow due to the sodic conditions within subsoils of 0.00-0.10 mbgl (C1) and 0.00-0.20 mbgl (C2).

This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat and very gently undulating areas (less than 3.0% slope) due to potential compaction of clay texture and firm setting tendencies.

These depths allow the maximum retention of suitable quality clay soils across the two SMUs. Double stripping of topsoil for SMU C1 may be considered for an additional 0.10mbgl if suitable topsoil volumes are not assessed as sufficient. This would allow additional lower fertility clay soils to be stockpiled with minimum risk of including sodic clays deeper within the B horizon.

Subsoils within both SMUs are prone to dispersion due to sodicity (C1) and salinity (C2) depth. SMU C2 although the least favorable with these two attributes, stripping depths have been recommended at the depths of 0.10 mbgl and 0.20 mbgl to retain the higher topsoil fertility soils.

SMU C1 subsoils are recommended for rehabilitation use as buried soils for clay topsoils. SMU C2 subsoils are not recommended for rehabilitation use due to the elevated salinity limitations however may be suitable with possible use as capping material over waste rock.

Gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2)

These SMUs include brown, reddish brown to light red sands of gradational sands and duplex clay soils.

 SMU S1 topsoil is acidic, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include an increase in pH to alkaline levels, low fertility status, strongly sodic conditions and moderate dispersive qualities and a stripping depth to 1.00 mbgl. It would be recommended as buried supporting soils for SMUs.

 SMU S2 topsoil is neutral, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.50 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It would be recommended for natural vegetation growth assistance with additional soil fertility conditioning and could potentially increase topsoil reserves and supporting subsoils.

• SMU R1 topsoil is slightly acidic pH, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.35 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It is recommended for natural vegetation growth assistance with additional soil fertility conditioning and could potentially increase topsoil reserves and supporting subsoils.

• SMU R2 topsoil is slightly acidic pH, very low in fertility status, has non-sodic conditions, very low dispersive qualities and a stripping depth to 0.50 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with neutral pH, very slight increase in dispersive qualities, and a stripping depth to 1.00 mbgl. It is recommended for natural vegetation growth assistance with additional soil fertility conditioning and potentially increase topsoil reserves and supporting subsoils. SMU L1 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.10 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include high clay content, an increase in pH to strongly alkaline levels, low fertility status, strongly sodicity conditions and dispersive qualities with a stripping depth to 0.35 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.35 mbgl are not recommended for rehabilitation use however may be suitable with possible use as capping material over waste rock.

 SMU L2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include high clay content, an increase in pH to strongly alkaline levels, low fertility status, strongly sodic conditions and dispersive qualities with a stripping depth to 1.00 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.30 mbgl are not recommended for rehabilitation use however may be suitable for use as capping material over waste rock.

Relic alluvial plains and low-lying plains (B1 and B2)

These SMUs include brown loamy sand and silty loams to duplex clay soils.

 SMU B1 topsoil is neutral, very low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.30 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes include an increase in clay content, sodic conditions, slightly increased dispersive qualities with a stripping depth to 1.00 mbgl.

The subsoil may be recommended as supportive additional natural vegetation growth assistance as per the topsoil with additional soil fertility and soil conditioning on level plains due to its increased dispersive qualities and supporting subsoils.

 SMU B2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.20 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters. Subsoil attributes include an increase in clay content, neutral pH, sodic conditions, and moderate dispersive qualities with a stripping depth to 0.50 mbgl. It would be recommended as supporting subsoils for SMU topsoils within this category. Subsoils below 0.50 mbgl are recommended not for rehabilitation use due to poorly structured, poor water holding and fertility attributes.

Subsoils would be recommended as buried supporting soils for SMUs within this category.

SMU variant, B2DV presents the soil profile without the topsoil. Therefore, topsoil stripping is not considered with subsoils below 0.5 mbgl remaining. The subsoil recommendations for SMU B2 apply.

Recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2)

These SMUs include brown loamy sand and silty loams to duplex clay soils.

 SMU A1 topsoil is neutral, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.40 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters.

Subsoil attributes are consistent with the topsoil with a stripping depth to 1.00 mbgl. It would be recommended as additional natural vegetation growth as per the topsoil with additional soil fertility conditioning and potentially increase topsoil reserves and supporting subsoils.

 SMU A2 topsoil is slightly acidic, low in fertility status, has non-sodic conditions, low dispersive qualities and a stripping depth to 0.15 mbgl. This topsoil is suited to support native vegetation and grasses and should be utilised for rehabilitation of areas that are relatively flat to sloped areas such as backfill batters

Subsoil attributes include an increase in clay content, alkaline pH, extremely strongly sodic conditions, and dispersive qualities with a stripping depth to 1.00 mbgl. The subsoil would not be favorable for supporting native vegetation growth due to poorly structured, aerated and dispersive qualities.

Soils below 0.15 mbgl are not recommended for rehabilitation use however may be suitable with possible use as capping material over waste rock.

6.1.3 Summary of Recommended Soil Stripping Depths and Volumes Available

Table 54 provides the recommended stripping depths for each SMU and total estimated available topsoil and subsoil reserves within the proposed Project site. These stripping depths are shown in Figures 4.1 to 4.4.

SMU	Recommended Topsoil Stripping Depth (mbgl)	Recommended Subsoil Stripping Depth (mbgl)	Soil Mapping Unit Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³) Rehabilitation Use and Supporting Buried Soils	Approximate Subsoil Volume (m ³) Only Supporting Buried Soils	Approximate Subsoil Volume (m ³) Capping over Waste Rock
C1	0.00-0.10	0.10-1.00	4,540.3	4,540,300	-	40,862,700	-
C2	0.00-0.20	0.20-1.00	3,081.1	6,162,260	-	-	24,649,040
S1	0.00-0.30	0.30-1.00	2,888.7	8,665,950	-	20,220,550	-
S2	0.00-0.50	0.50-1.00	1,572.0	7,859,900	7,859,900	-	-
R1	0.00-0.35	0.35-1.00	892.0	3,121,825	5,797,675	-	-
R2	0.00-0.50	0.50-1.00	783.1	3,915,550	3,915,550	-	-
L1	0.00-0.10	0.10-0.35	178.3	178,280	-	445,700	-
L2	0.00-0.30	0.30-1.00	272.0	815,910	-	-	1,903,790
B1	0.00-0.30	0.30-1.00	1,178.6	3,535,650	8,249,850	-	-
B2	0.00-0.20	0.20-0.50	469.7	939,440	1,409,160	-	-
B2- DV ²	0.00-0.00	0.20-0.50	30.1	0	90,300	-	-
A1	0.00-0.40	0.40-1.00	92.1	368,320	552,480	-	-
A2	0.00-0.15	0.15-1.00	379.7	569,550	-	-	3,227450
	TOTAL FOR PRO.	JECT SITE	16,358	40,672,935	27,874,915	61,528,950	29,780,280

 Table 54: Recommended Stripping Depths and Volumes Available

¹Area shown in Table 54 for B2 for purposes of topsoil stripping does not include B2-DV

²Variant of B2, B2DV topsoil resource isn't available due to stream bank erosion, therefore topsoil volume for this 30 ha area is not included.

6.1.4 Double Stripping Depths for Increased Topsoil Volumes

As discussed above in Section 6.1.2, double stripping of SMU C1 to 0.20mbgl may be an option if current proposed topsoil stripping depths are calculated as insufficient. This would allow additional lower fertility clay soils to be stockpiled with minimum risk of including sodic clays deeper within the B horizon.

As a result, subsoils volume for the SMU would be reduced. The revised volumes are summarised below in Table 55.

Tuble bbille										
SMU	Double Stripping Topsoil Depth (mbgl)	Double Stripping Subsoil Depth (mbgl)	Soil Mapping Unit Area (ha)	Approximate Topsoil Volume (m ³)	Approximate Subsoil Volume (m ³)					
C1	0.00-0.20	0.20-1.00	4,540.86	9,080,600	45,408,600					

Table 55: Recommended Double Stripping Depths and Volumes

6.1.5 **Recommended Topsoil Application Depths for Rehabilitation**

It is recommended that the minimum placement depth of topsoil be 0.2m with a preferred placement depth of 0.30m.

If topsoil volumes are insufficient to meet the recommended placement depths, placing suitable subsoils of up to 0.50m may be suitable to cap with 0.20m topsoil. Providing subsoils selected are suitable, another recommendation may be mixing of suitable subsoils with quality topsoils to create slightly reduced quality topsoil.

It is recommended a waste rock characterisation database is maintained to assist with the management of rehabilitation planning.

7 REGIONAL PLANNING INTERESTS ASSESSMENT

The RPI Act and RPI Regulation identify and protect areas of Queensland that are of regional interest. The RPI Act protects PLAs, PAAs, SEAs and SCL. The Project site was assessed against SCL and PAA requirements.

7.1 Assessment of Strategic Cropping Land

The RPI Act repealed the *Strategic Cropping Land Act 2011*. The repealed policies were migrated into the new legislation through the declaration of the SCL as an area of regional interest.

Identification of SCL was undertaken for the Project site. Desktop review of the Project site was compared to the SCL Trigger Map (Figure 8). SCL was not identified within the Project site and was located to the south, approximately 150m at its closest point. It was assessed that no further assessment would be required, however identified SMU field and laboratory observations were also compared to the SCL criteria.

The RPI Act Guideline 08/14 (Queensland Government 2017) *How to demonstrate that land in the strategic cropping area does not meet the criteria for strategic cropping land* was used as a guide. The Project site was assessed against the Western Cropping Zone criteria for the twelve SMUs, based on field and laboratory information.

The criteria for the Western Cropping zone included;

- Slope (SI) Equal to or less than 3%;
- Rockiness (Rk) Equal to or less than 20% for rocks greater than 60 mm in dia;
- Gilgai (G) Less than 50% of land surface being gilgai of greater than 500 mm in depth;
- Soil Depth (Sd) Equal to or greater than 600 mm;
- Soil Wetness (Sw) Has favourable drainage;
- Soil pH (Sp) Rigid Soils 0.30-0.60, pH within 5.1-8.9 and Non-rigid Soils 0.30-0.60, pH greater than 5.0;
- Salinity (SI) Chloride is less than 800 mg/kg at 0.6 m depth; and
- Soil Water Storage (Sws) Equal to or greater than 100 mm to a soil depth or soil physio-chemical limitation of equal to or less than 1000 mm.

	Western Cropping Zone									
SMU		Pass/Fail Threshold								
	SI	Rk	G	Sd	Sw	Sp	SI	Sws		
C1	Р	Р	F	-	-	-	-	-		
C2	Р	Р	Р	Р	Р	Р	F	-		
S1	Р	Р	Р	Р	F	-	-	-		
S2	Р	Р	Р	Р	Р	Р	Р	F		
R1	Р	Р	Р	Р	Р	Р	Р	F		
R2	Р	Р	Р	Р	Р	Р	Р	F		
L1	Р	Р	Р	Р	Р	F	-	-		
L2	Р	Р	Р	Р	Р	Р	Р	F		
B1	Р	Р	Р	Р	F	-	-	-		
B2	Р	Р	Р	Р	Р	Р	Р	F		
A1	Р	Р	Р	Р	Р	Р	Р	F		
A2	Р	Р	Р	Р	F	-	-	-		

The SCL assessment of the twelve SMUs is summarised below in Table 56.

Table 56: SCL Assessment of Project	t Site SMUs
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The SMUs were assessed against the Western Cropping Zone criteria with all SMUs failing on criteria such as gilgai, soil wetness, soil pH and soil water storage. Based upon this assessment for the Project site, no SMU could be demonstrated to meet the requirements for SCL.

It is noted that the assessment of SCL requires a comprehensive survey to be completed as per the RPI Act requirements. This includes additional field observations and additional laboratory results per SMU mapping polygon unit than what is acceptable for this soils and land suitability assessment.

7.2 Assessment of Priority Agricultural Areas

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

Identification of PAAs was undertaken for the Project site. Desktop review of the Project site compared to Queensland Government Development Assessment Mapping System confirmed that no PAA was located within the Project site, and the nearest areas were situated approximately 100 km to the south.

8 ACID SULFATE SOILS ASSESSMENT

As stated in Section 3.5, a review of the ASRIS including the *Atlas of Australian Acid Sulfate Soils* mapping was undertaken. It was identified that the majority of the Project site is shown as 'No Known Occurrence'.

The north-west portions of the Iffley property, Vermont Park properties and the western portion of the water pipeline include low probability areas of Acid Sulfate Soils occurring in mapping units of the Project site (Fitzpatrick et al. 2008).

Field observations of SMUs were undertaken during the soils and land suitability assessment. These observations have been reviewed against the *State Planning Policy 2/02, Planning and Managing Development involving Acid Sulfate Soils* (Queensland Government 2002) *Appendix 2: Soil and Water Field Indicators.*

8.1 Assessment of Actual and Potential Acid Sulfate Soils

Assessment of Project Site SMUs for AASS and PASS included the following indicators;

- Field pH;
 - AASS, field $pH_F ≤ 4$, when field pHF > 4 but <5 may indicate some existing acidity;
 - \circ PASS, field pH_F >4 and commonly neutral;
- Presence of corroded shell (AASS) or shell (PASS);
- Jarositic horizons or substantial iron oxide mottling in surface (AASS);
- A sulfurous smell, e.g hydrogen sulphide or 'rotten egg' gas; and
- Dead, dying, stunted vegetation scalded or bare low-lying areas (AASS).

Field pH was initially conducted using a pH indictor kit and meter. Laboratory pH analysis was also reviewed. All other indicators were visually inspected within the soil profile and field as part of the soils and land suitability survey.

A summary of the SMU assessment is shown in Table 57.

SMU	AASS / PASS Assessment	Overall Assessment	
C1	pH is alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	No field indication of AASS/PASS.	
C2	pH is alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	No field indication of AASS/PASS.	
S1	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
S2	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
R1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
R2	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
L1	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
L2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
B1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
B2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
A1	pH is neutral, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils.	Very low field indication of PASS. No field indicators of AASS.	
A2	pH is neutral to alkaline, no observations of corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell. Soil profile is moderately moist but not observed as water logged.	Very low field indication of PASS. No field indicators of AASS.	

Table 57: Assessment of Field Indicators for AASS/PASS

Ten of the twelve SMUs, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2 reported neutral or neutral to alkaline pH and the remaining indicators (corroded shell, jarosite horizons, iron oxide mottling, sulphurous smell or water logged soils) were not observed at any SMUs. Therefore the SMUs with neutral or neutral to alkaline pH were assessed as having a very low field indication of PASS and no field indication of AASS. SMUs C1 and C2 (with alkaline pH) had no field indications of AASS and/or PASS.

This result (i.e. very low to no field indicators) is consistent with the desktop review against the Atlas of Australian Acid Sulfate Soils mapping which showed the Project site as "No Known Occurrence". It is assessed as highly unlikely the Project site includes AASS and/or PASS, however environmental management plans should include procedures to monitor and identity ASS during the Project's lifespan.

9 LAND USE IMPACTS AND FINAL LAND USE

9.1 Disturbance Types Requiring Rehabilitation

The Project will require mine rehabilitation programs for areas which are disturbed by mining and related activity. As an open cut operation is being planned, surface disturbance requiring rehabilitation will form a significant proportion of the overall Project site. Current mine planning indicates that changes in pre-mining land use and suitability will involve approximately 10,500 ha of the Project site.

Key activities at the Project site that will require significant rehabilitation works as a result of direct surface disturbance will include (Figure 2):

- Open cut mine areas;
- Coal handling and preparation plant (CHPP);
- Rail spur connection;
- Water pipeline;
- Waste dump area;
- Access roads; and
- Associated infrastructure including mine offices, crib facilities, bathhouse, warehouse, workshops and re-fueling facilities.

The remainder of the Project site (15,500 ha) will either not be disturbed or will have altered local topography from local impacts such as access roads or other minor infrastructure.

9.2 Post Mining Land Use Suitability

Post mine land use suitability is influenced by various factors including physical, biological and chemical changes of soil, depth of soil and slope gradient and length in the final landform design. Open cut mining activities are expected to change the nature of the final land form and suitability for land use activities.

Land disturbed by open cut mining may be able to be restored to its previous pre-mining land suitability or reduced to limited grazing based upon available waste rock relocation volumes and final landform design. However, disturbed areas such as CHPP, workshops, waste dump areas and sediment dams will require more intensive rehabilitation to retain the initial LSAT class.

It is expected that only higher risk areas and permanent infrastructure such as final voids and railway lines will not revert to a grazing suitability potential due to the slope of land and unusable linear features.

It is therefore expected that the majority of the Project site will revert to the pre-mining land suitability class. Rehabilitation methods and post mining land suitability shall be refined in an Environmental Management Plan for the Project site, however overall concepts envisaged for specific disturbance types are summarised in Table 58.

Disturbance	Specific Facilities	Proposed Rehabilitation Strategy Recommendations	Proposed Post
Туре			Mining Land Suitability Class
Open Cut Mining	- Open cut mining pits	Open cut mining areas will be backfilled with suitable waste rock including subsoil and topsoil rehabilitation reserves.	Slope >70% of the land is <10% slope of land surface
Waste Dump Area / ILF Cells	Waste Dump - Access tracks Final landform design will be suitable soil attributes, depth suitable soil attributes, depth on highwall and battered do No areas will exceed 20% slo possible is for landforms to the land surface is <10% slo	Final landform design will be developed in consideration of suitable soil attributes, depths and slopes.	
		pen cut mining areas would be backfilled up to the pre-mining rface level or higher with batters to be graded to 15%/8 ⁰ slope	Class 3 – Grazing Class 5 - Cropping
		on highwall and battered down. No areas will exceed 20% slope. The overall goal wherever possible is for landforms to be regraded where at least 70% of the land surface is <10% slope.	Slope >30% of the land has slope in the range 10-15% with <10% of the land exceeding 15% slope
		Areas throughout the landform (e.g ramp or pit batters), where the proportion of land with <10% slope will be less than 70%; will have reduced grazing land suitability potential.	
		Implementation of practical drainage designs will ensure that any area affected by settling will be sufficiently drained to ensure that pre-existing productive uses can be returned. This may include targeted earthworks programs in areas of excessive cracking or to produce a desirable surface topography.	Class 4 – Grazing Class 5 - Cropping
		Rehabilitated areas will be topsoiled and seeded with native grasses.	
		Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas	
		Coal rejects will be capped/buried within the open cut mine pits, with at least or equal to 15.0 m of benign waste rock encapsulating the material from the surface and walls.	
		Coal rejects will be capped with inert material and topsoil with vegetation will be established.	
		The coal rejects capping will be constructed such that water does not infiltrate and will be shed while ensuring surface stability.	
		An ongoing, post mining management plan will be documented.	
Elevated waste dump areas	- Areas of waste rock or other materials from open pit excavation, access tracks or other sources	No areas will exceed 20% slope. The overall goal wherever possible is for landforms to be regraded where at least 70% of the land surface is <10% slope.	Slope >70% of the land is <10% slope of land surface
		Areas throughout the landform (e.g ramp or pit batters), where the proportion of land with <10% slope will be less than 70%;	Class 3 – Grazing
		Pehabilitated areas will be topsoiled and socied with pative	Class 5 - Cropping
		grasses.	Slope >30% of the land has
		Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas.	slope in the range 10-15% with <10% of the land exceeding 15% slope
			- Class 4 – Grazing
			Class 5 - Cropping

Table 58: Rehabilitation Methods and Post Mine Land Use for Specific Disturbance Types
Disturbance Type	Specific Facilities	Proposed Rehabilitation Strategy Recommendations	Proposed Post Mining Land Suitability Class
Final Voids	- Areas remaining after final backfilling has occurred of open voids below the existing ground surface	Highwall and low-wall slopes will be seeded. Area will be fenced off on highwall sides to prevent access by fauna. If water ponds from surrounding surface and groundwater, initial environmental monitoring will assess the risk to cattle and native wildlife. If deemed unsuitable for consumption by fauna, the area will be fully fenced off.	Class 5 – Cropping/Grazing
General infrastructure including potentially contaminated areas	General infrastructure: - Mine offices; - Crib facilities; - Bath house; - Warehouse; - Accommodation camp; - Conveyors; - Electrical substations; and - Power lines. Potentially contaminated areas: - Coal Preparation plant; - Workshops; - Vehicle servicing and -wash-down; and - Rail spur and rail- loadout facility	Infrastructure will be assessed on an individual basis for possible removal or whether it can be retained for future land owners. Infrastructure will be removed, and areas prepared and re- seeded if necessary. Location of all such areas will be recorded on the mine Disturbance Plan. Potentially contaminated areas will undergo Stage 1 and 2 Contaminated land assessments. A Remediation Plan for potentially contaminated areas will be prepared. Remediation works to remove contaminated material or rip, cap and topsoil inert areas. Areas will be seeded with native grasses. Aim is to assess and remediate any residual contaminated areas. Monitoring will assess remediation success for an appropriate period of time. The Environmental Management Plan will detail methods, success criteria and management of all rehabilitation areas.	Same classes as pre-mining
Coal material Laydown areas	- ROM and product coal stockpiles. - Surface conveyors.	Coal material and stockpile base will be removed. Areas will be capped and topsoiled, ripped and seeded with pasture grasses. It is anticipated that these areas will return to grazing lands similar to pre-mining suitability.	Same classes as pre-mining
Water management structures	- Sediment, raw and mine water dams	Water management structures will be individually assessed as they may provide future benefit to agricultural activities prior to being decommissioned. If no value in retaining the water management structures is assessed, the water management structures will be dewatered, capped and rehabilitated using topsoil and pasture grasses.	Same classes as pre-mining
Creek Diversions	- Existing and new creek and drainage lines	Areas will be graded to design and rehabilitated using topsoil reserves and pasture grasses.	Same classes as pre-mining
Linear Infrastructure	- Water pipeline - Railway line - ETL - Access Road	Areas will be assessed, and if rehabilitation is required, the infrastructure will be decommissioned, and the area will be rehabilitated to previous land forms. The railway may be considered a permanent feature and therefore not suitable for any other use. It has been assessed as such.	Pipeline and Access Road Same classes as pre-mining Railway Class 5 – Cropping/Grazing

9.2.1 Significantly Disturbed Areas

The major objective of significantly disturbed areas is their rehabilitation to a stable and self-sustaining vegetation community using appropriate native tree, shrub and grass species. These areas form a major proportion of the overall Project. A review and downgrading from pre-mining land suitability may be needed in some areas to ensure that long term stability is ensured, and risks of potential downstream impact are minimal. The proposed disturbed areas will be assessed on the impact of the disturbance type and proposed rehabilitation strategies for those areas.

9.2.2 Areas with No or Minor Disturbance

This type of disturbance makes up approximately 35% of the area within the Project MLAs. The rehabilitation objective is to return all such areas to its pre-disturbance land suitability potential.

Table 58 summarises rehabilitation methods for disturbed and minor disturbed areas and presented on Figures 9.1-9.4 and 10.1-10.4.

9.2.3 General Rehabilitation Strategy

All disturbances will be recorded on mine plans and updated on a regular basis. The rehabilitation objective is to return all disturbed areas to their pre-disturbance land suitability potential or to an acceptable level as per the Environmental Management Plan for the Project site.

Stable landforms will be established following mining, using soils capable of supporting vegetation communities adapted to the local environment. Topsoil and subsoils will be assessed for quality and will be retrieved and managed according to a Topsoil Management Plan during the life of the Project.

The stability of the post-mine landform will be achieved by applying sound rehabilitation practices based on industry knowledge and science.

The disturbed land will be rehabilitated to a condition that is self-sustaining or to a condition where the maintenance requirements are consistent with the post mining land use.

Rehabilitation strategies for the Project will include all areas of disturbance and will be reviewed on a regular basis in order to take into account any changes to mine operations, changes in legislative requirements and/or results of ongoing studies and monitoring.

The rehabilitation strategies have been developed after consideration of the Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland (DME 1995). In particular, the following guidelines will be considered:

- Progressive Rehabilitation which describes the advantages of and opportunities and strategies for progressive rehabilitation;
- Assessment and Management of Acid Drainage which addresses the identification, evaluation and management of solid waste materials with potential to generate acid drainage and/or heavy metal toxicity;
- Erosion Control which addresses the prediction, control and measurement of soil erosion on mining lease areas;
- Growth Media Management which outlines the selection, handling, storage, treatment and replacement of soils and other media to be used for establishing and growing vegetation on land following mining;
- Mine site Decommissioning which addresses the closure and decommissioning of areas, works and facilities used for mining;
- Site Water Management which discusses the management of water on Project sites so as to reduce the amount of contaminated water that may need to be handled;
- Water Discharge Management which addresses the management of water discharged from Project sites to ensure compliance with statutory requirements and protection of downstream uses;
- Progressive rehabilitation of disturbed areas, using rehabilitation procedures for appropriate to the type of disturbance;
- A rehabilitation monitoring program to assess the success of rehabilitation;
- A corrective action program to address areas of failed rehabilitation; and
- Preparation of final rehabilitation report prior to surrender of the mining leases.

Table 59 summarises the expected changes in agricultural land suitability following mining and Figures 9.1-9.4 and 10.1-10.4 show the distribution of post-mining land suitability classes.

Land Suitability – Cropping			Land Suitability – Grazing		
Class	Pre-mining (ha)	Post mining (ha)	Class	Pre-mining (ha)	Post mining (ha)
1	-	-	1	-	-
2	-	-	2	-	-
3	-	-	3	15,755	14,635
4	8,983	2,571	4	472	472
5	7,244	12,638	5	-	102
Total	16,227	15,209	-	16,227	15,209

Table 59: Post Mine Land Suitability Changes

Note: Mapping did not include the ETL corridor.

10 CONCLUSION

The following conclusions have been made:

- Twelve SMUs are present within the Project site, C1, C2, S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2.
- The Project site includes areas of flat to gently undulating plains dominated by uniform and gradational clays (C1 and C2), gently undulating plains dominated by sandy duplex with gradational sandy loams (S1, S2, R1, R2, L1 and L2), relic alluvial plains and low-lying plains (B1 and B2) and recent alluvial floodplain and active channels with stratified loamy sands (A1 and A2).
- Land use suitability assessment of the twelve SMUs reported for rainfed cropping, Class 4: C1, S1, S2, R1, R2 and B1, and Class 5: C2, S1, L1, L2, B2, A1 and A2. Assessment of beef cattle grazing reported Class 3: C1 and S2 and Class 4: C2, S1, R1, R2, L1, L2, B1, B2, A1 and A2. Review of Regional Frameworks for the Inland Fitzroy and Southern Burdekin area assessed SMU C1 having marginal cropping potential for dryland cropping and SMU S2 moderately suitable for dryland cropping with Barley, Chickpea, Maize, Millet, Oat, Sorghum, Triticale and Wheat.
- The majority of topsoil from the loamy sand and clayey sand SMUs (S1, S2, R1, R2, L1, L2, B1, B2, A1 and A2) would be suitable for rehabilitation use in supporting native vegetation and grasses with application preferred on level surface to sloped backfill batters. Topsoils consisting of clay (C1 and C2) would be preferable on level to very gently undulating areas <1%.
- Six SMUs (S2, R1, R2, B1, B2 (0.20-0.50 mbgl and A1) may be suitable for rehabilitation situations and limited natural vegetation growth with additional soil fertility conditioning on level surface to sloped backfill batters. Five SMUs (C1, S1, L1, L2 and A2) were suitable for buried supporting subsoils for topsoil. The remaining SMU (C2) is recommended as capping material over waste rock.
- The Project site is not located within Regional Planning Interests Areas of SCL or PAAs.
- The majority of the Project site is shown as 'No Known Occurrence' with respect to ASS. Field observations reported very low indicators in ten SMUs of neutral and neutral to alkaline pH. It is assessed as highly unlikely the SMUs contain soils impacted by AASS and PASS however, environmental management plans should include procedures to monitor and identity ASS during the Project's lifespan.
- The proposed post mine final land use for the majority of the Project site will be beef cattle grazing activities. Final void areas have been assessed as unsuitable and will be fenced off as required to prevent fauna access. Existing infrastructure that is not planned to be decommissioned such as railway lines will be rated as unsuitable for cropping and grazing land uses. It is expected that undisturbed areas of the Project will remain the same classes identified pre-mine.

11 REFERENCES

Baker, D.E. and Eldershaw, V.J. (1993) Interpreting Soil Analysis for agricultural use in Queensland. QDPI QO93014. Brisbane.

Bruce, R.C. and Rayment, G.F. (1982) Analytical Methods and interpretations used by the Agricultural Chemical Branch, QDPI, for soil and land use surveys. QDPI Bulletin QB82004. Brisbane

Bruce, R.C. and Rayment, G.F. (1984) Soil Testing and Some Test Interpretations used by the QDPI. QDPI Bulletin QI84029. Brisbane.

Burgess, J.W. (2003) Land Resource Assessment of the Windeyers Hill Area, Isaac-Connors and Mackenzie River catchments, Central Queensland, QNRM 02189 Queensland Department of Natural Resources & Mines. Brisbane.

Commonwealth Scientific and Industrial Research Organisation (2007) Australian Soil Resource Information System - National Acid Sulphate Soils Atlas., Accessed 1 July 2017, <www.asris.csiro.au>

Department of Environment and Heritage Protection (2013) EIS information guidelines – Land.

Department of Minerals and Energy (1995) Technical Guidelines for the Environmental Management of Exploration and Mining in Queensland – Land Suitability Assessment Techniques. Environmental Protection Agency. Brisbane.

Department of Infrastructure, Local Government and Planning (2017) Development Assessment Mapping System, Queensland Government accessed 2017 Google Earth (2017), Landsat / Copernicus Image, 7580573mS 608606mE (GDA94 Zone 55), Accessed 1 July 2017, <http://www.google.com/earth/index.html>

Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines (2013) Regional Land Suitability Frameworks for Queensland. Brisbane, Queensland.

Department of Science, Information Technology and Innovation and Department of Natural Resources and Mines (2015) Guidelines for agricultural land evaluation in Queensland (Second Edition). Brisbane, Queensland.

Forster (2011) Draft for Discussion: Soil Surveys Methodology along Linear Features.

Fitzpatrick, R., Marvanek, S. and Powell, B. (2008) Atlas of Australian Acid Sulfate Soils, LEGEND for Australian Atlas of Acid Sulfate Soils1 (ASS) ma, Australia.

Fitzpatrick, R. and Shand, P. (2008) CRC LEME Open File Report No. 248 - Inland acid sulphate soil systems across Australia. CRC LEME. Perth: CRC LEME.

Gunn, R.H. Story, R., Galloway, R.W. and Fitzpatrick, E.A. (1967) Lands of the Isaac-Comet Area, Queensland. Land Research Series No.19. CSIRO Publishing, Collingwood, Victoria.

Gunn, R.H., Beattie, J.A., Reid, R.E. and van de Graff, R. (1988) Australian Soil and Land Survey: Guidelines for Conducting Surveys. Inkata Press. Melbourne.

Isbell, R.F. (2002) The Australian Soil Classification. CSIRO Publishing. Collingwood, Victoria.

Department of Primary Industries Land Resources Branch (1990) Guidelines for agricultural land evaluation in Queensland. Queensland Department of Primary Industries. QI9005.

McDonald, R.C., Isbell, R.F., Speight, J.G., Walker, J. and Hopkins, M.S. (1990) Australian Soil and Land Survey: Field Handbook, 2nd Edition. Inkata Press, Melbourne.

McKenzie, N.J., Grundy, M.J., Webster. R. And Ringrose-Voase, A.J. (2008) Guidelines for Surveying Soils and Land Resources. Second Edition. CSIRO Publishing.

Munsell Color (Firm). (2009) Munsell soil color charts: with genuine Munsell color chips. Grand Rapids, MI. Munsell Color.

National Committee on Soil and Terrain (2009) Australian Soil and Land Survey: Field Handbook. Third Edition, CSIRO Publishing. Melbourne.

Northcote, K.H., Beckmann, G.G., Bettenay, E., Churchward, H.M., Van Dijk, D.C., Dimmock, G.M., Hubble, G.D., Isbell, R.F., McArthur, W.M., Murtha, G.G., Nicolls, K.D., Paton, T.R., Thompson, C.H., Webb, A.A. and Wright, M.J. (1960-1968) Atlas of Australian Soils, Sheets 1 to 10. CSIRO Australia and Melbourne University Press, Melbourne.

Northcote, K.H. (1974) A Factual Key for Recognition of Australian Soils. Glenside, South Australia.

Rayment, G.E. and Higginson, F.R. (1992) Australian Soil and Land Survey Handbook – Australian Laboratory Handbook of soil and water chemical methods. Inkata Press, Melbourne.

Rayment, G.E. and Lyons, D.J. (2011) Soil Chemical Methods – Australasia, CSIRO Publishing, Collingwood, Victoria.

Raymond, M. A. A. and McNeil, V. H. (2011) *Regional Chemistry of the Fitzroy Basin Groundwater*. Brisbane: Department of Environment and Resource Management, Queensland Government.

Queensland Government (2002) State Planning Policy 2/02, Planning and Managing Development involving Acid Sulfate Soils.

Queensland Government (2017) Regional Planning Interests Act Guideline 08/14 2017.

Queensland Government (2016) Queensland Globe. Accessed via Google Earth.

Shields, P.G. and Williams B.M. (1991) Land resource survey and evaluation of the Kilcummin area, Queensland. QDPI bulletin QV 91001.

Soil Science Australia (2015) Guidelines for Soil Survey along Linear Features.

12 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

Acid Sulfate Soils. Acid sulfate soil is the common name for soils that contain metal sulfides. In an undisturbed and waterlogged state, these soils may pose no or low risk. However, when disturbed or exposed to oxygen, acid sulfate soils undergo a chemical reaction known as oxidation. Oxidation produces sulfuric acid which has led to these soils being called acid sulfate soils.

ASC. Australian soil class

Alluvial. Describes material deposited by, or in transit in, flowing water.

Apedal. Describes a soil in which none of the soil material occurs in the form of peds or soil aggregates in the moist state.

Cation Exchange Capacity (CEC). The maximum positive charge required to balance the negative charge on colloids (clays and other charged particles). The units are milli-equivalents per 100 grams of material or centimoles of charge per kilogram of exchanger. CEC is often used as a measure of soil fertility and nutrient retention capacity.

Chromosol. Soils other than Hydrosols with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is not sodic and not strongly acid. Soils with strongly subplastic upper B2 horizons are also included even if they are sodic.

Clay. A soil material composed of particles finer than 0.002 mm. When used as a soil texture group such soils contain at least 35% clay.

Dermosol. Soils with structured B2 horizon and lacking strong texture contrast between A and B horizons.

Dia. Diameter.

Dispersion. A process by which species in solution mix with a second solution, thus reducing in concentration. In the case of sodic soils it will predispose the soil material to lose structure and disseminate into the solution.

Effective Soil Depth. The depths of which vegetation roots may readily penetrate the soil profile and have access to water and nutrients.

Electrical Conductivity (EC). The EC of water is a measure of its ability to conduct an electric current. The EC of soils will vary depending on the texture and amount of moisture held by the soil particles. Electrical conductance increases with soluble salt content and thus allows simple interpretation of salinity.

EIS. Environmental Impact Statement.

Endohypersodic. Other soils in which some sub horizon of the solum below 0.5m has an ESP pf 15 or greater.

ESP. The amount of sodium as a proportion of all cations in a soil is termed the Exchangeable Sodium Percentage. It is calculated by dividing the exchangeable sodium by the cation exchange capacity (CEC), multiplied by 100. ESP values greater than 6% are considered sodic, with values greater than 15% considered very sodic. ESP = (Exchangeable sodium (meq/100g)/Cation exchange capacity (meq/100g)) x 100

Field pH. The measurement of the pH in the field by utilising Manutec Pty Ltd, Soil pH Test Kit. This kit consists of pH dye indicator, Barium Sulphate and reference colour chart.

Gradational. The lower boundary between soil layers (horizons) has a gradual transition to the next layer. The solum (soil horizon) becomes gradually more clayey with depth.

Gradient. The rate of inclination of a slope. The degree of deviation from the horizontal.

Gully erosion. The displacement of soil by running water that forms clearly defined, narrow channels that generally carry water only during or after heavy rain.

Haplic. Other soils in which the major part of the B2 horizon is whole coloured.

Horizon. An individual soil layer, based on texture and colour, which differs from those above and below.

Kandosols. Soils that have well-developed B2 horizons in which the major part if massive or has only a weak grade of structure (compare with tenic B horizon and cemented pans) and have a maximum clay content in some part of the B2 horizon which exceeds 15% (i.e heavy sand loam, SL+).

Loam. A medium textured soil of approximate composition 10-25% clay, 25-50% silt and >50% sand.

Massive. Refers to the condition of the soil layer in which the layer appears to be as a coherent or solid mass which is largely devoid of peds.

Mbgl. Metre below ground level.

Mesonatric. Other soils in which the major part of the upper 0.2m of the B2 horizon has an ESP of between 15 and 25.

Meter pH/EC The measurement of the pH and EC in the field by utilising a TPS Aqua-CP/A meter.

Mottles. Areas of contrasting colour within the overall soil colour which are caused by anerobic conditions as a result of poor aeration. Usually an indicator of poor drainage and retention of water.

Ped. An individual natural soil aggregate. In an undisturbed state peds will group together to form larger aggregates.

Pedal. Describes a soil in which some or all of the soil material occurs in the form of peds in the moist state.

pH. A logarithmic index for the concentration of hydrogen ions in an aqueous solution, which is used as a measure of acidity.

Profile. The solum. This includes the soil A and B horizons and is basically the depth of soil to weathered rock.

Representative Site. A location deemed very representative of the soil mapping unit for which detailed characterisation is to be done.

Rudosol. Soil with negligible (rudimentary) pedologic organisation apart from (a) minimal development of an Al horizon or (b) the presence of less than 10% of B horizon material (including pedogenic carbonate) in fissures in the parent rock or saprolite. The soils are apedal or only weakly structured in the A1 horizon and show no pedological colour changes apart from the darkening of an A1 horizon. There is little or no texture or colour change with depth unless stratified or buried soils are present.

SMU. Soil Mapping Unit. Soils grouped into a single management unit on the basis of similar morphology, position on the landscape, substrate and chemistry.

Sodic. Also commonly referred to as a non-saline alkali soil. It is a soil that contains sufficient exchangeable sodium and does not contain appreciable quantities of soluble salts. A term given to soil with a level of exchangeable sodium cations greater than 10-15% of the soils cation exchange capacity (CEC), or soluble sodium cations greater than 10-15 times the square root of soluble calcium and magnesium cations.

Sodosol. Soils with a clear or abrupt textural B horizon and in which the major part of the upper 0.2 m of the B2 horizon (or the major part of the entire B2 horizon if it is less than 0.2 m thick) is sodic and is not strongly subplastic.

Subsoil. Subsurface material comprising the B and C horizons of soils with distinct profiles. They often have brighter colours and higher clay content than topsoils.

Subnatric. Other soils in which the major part of the upper 0.2m of the B2 horizon has an ESP pf between 6 and <15.

Texture. The size of particles in the soil. Texture is divided into six groups, depending on the amount of coarse sand, fine sand, silt and clay in the soil.

Topsoil. Part of the soil profile, typically the A1 horizon, containing material which is usually darker, more fertile and better structured than the underlying layers.

Vertosol. Soils that have a clay field texture of 35% or more clay throughout the solum except for thin, surface crusty horizons 0.03m or less thick, have open cracks at some time in most years that are at least 5mm wide and extend upward to the surface or to the base of any plough layer, self-mulching horizon, or thin, surface crusty horizon and at some depth in the solum have slicken sides and/or lenticular peds.

13 FIGURES

Figure 1	Project Location
Figure 2	Project Layout
Figure 3	Soil Mapping Units
Figure 4	Topsoil Stripping Depths
Figure 5	Pre Mine - Rainfed Broadacre Cropping
Figure 6	Pre Mine - Beef Cattle Grazing
Figure 7	Agricultural Land Classes
Figure 8	SCL Trigger Map
Figure 9	Post Mine – Rainfed Broadacre Cropping
Figure 10	Post Mine – Beef Cattle Grazing



Figure 1: Project Location

Revision 3 09/07/2018

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend



Coordinated, Major and Other Relevant Project

Source: Geoscience Australia - Topographical Data 250K (2006)



Figure 2: Project Layout

Revision 3 09/07/2018

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend



Approved/Operating Coal Mine Eungella Pipeline Network Railway Nearby Dwelling Open Cut Extent (including In-pit Waste Rock Emplacement) Out-of Pit Waste Rock Emplacement Infrastructure Proposed Access Road Proposed Electricity Transmission Line

Olive Downs Mining Lease Application Boundary

- Proposed Rail
- Proposed Water Pipeline
- Proposed Creek Diversion _____

Source: Geoscience Australia - Topographical Data 250K (2006) Department of Natural Resources and Mines (2016) Orthophotography: Google Image (2016)



- Figure 3.1: Soil Mapping Units
- Revision 5 03/07/2018 Original Metres Projection: GDA94 Zone 55



- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
 - A1 Loam to loamy sands within active channels
 - A2 Clayey sands to light medium clay within alluvial depression





- Figure 3.2: Soil Mapping Units
- Revision 5 03/07/2018 Projection: GDA94 Zone 55

Legend Project Area Detailed Site Observation Site

96.15

- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
 - A1 Loam to loamy sands within active channels
 - A2 Clayey sands to light medium clay within alluvial depression





- Figure 3.3: Soil Mapping Units
- **Revision 5** 03/07/2018 Projection: GDA94 Zone 55



- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
 - A1 Loam to loamy sands within active channels
 - A2 Clayey sands to light medium clay within alluvial depression





- Figure 3.4: Soil Mapping Units
- **Revision 5** 03/07/2018 Projection: GDA94 Zone 55

Legend Project Area Detailed Site

Observation Site

- L2 Deeper (0.40-0.60m) loamy sands to light clay
- B1 Black to brown grey duplex soils with loamy sands, silty clay loams to clayey sands, mottled silty clay loams and clay loams
- B2 Brown silty loams to light clays with cracking surface on lower flat plains
- B2-DV Drainage Variant of B2, surface horizon removed by stream bank erosion
 - A1 Loam to loamy sands within active channels
 - A2 Clayey sands to light medium clay within alluvial depression





Figure 4.1: Topsoil Stripping Depths



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT









Figure 4.2: Topsoil Stripping Depths



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Legend







Figure 4.3: Topsoil Stripping Depths



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0.15 metres

0.20 metres







Figure 4.4: Topsoil Stripping Depths



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



0.20 metres

Legend







Figure 5.1: Pre Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Class 5





Figure 5.2: Pre Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 4 Class 5





Figure 5.3: Pre Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT







Figure 5.4: Pre Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Legend

Project Area Class 4 Class 5





Figure 6.1: Pre Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 3 Class 4





Figure 6.2: Pre Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 3 Class 4





Figure 6.3: Pre Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 3 Class 4





Figure 6.4: Pre Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT









Figure 7.1: Agricultural Land Classes



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend





Figure 7.2: Agricultural Land Classes

Revision 5 03/07/2018 Metres Projection: GDA94 Zone 55

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend

Class B

Class C2





Figure 7.3: Agricultural Land Classes



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend

Class C2





Figure 7.4: Agricultural Land Classes



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Legend





Figure 8: SCL Trigger Map



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area
SCL Trigger Map





Figure 9.1: Post Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 4 Class 5





Figure 9.2: Post Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 4 Class 5




Figure 9.3: Post Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 4 Class 5





Figure 9.4: Post Mine - Rainfed Broadacre Cropping



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT



Project Area Class 4 Class 5





Figure 10.1: Post Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT





Open cut mining and waste dump areas

Class 3 - Slope >70% of the land is <10% slope of land surface





Figure 10.2: Post Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT





Open cut mining and waste dump areas

Class 3 - Slope >70% of the land is <10% slope of land surface





Figure 10.3: Post Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT





Open cut mining and waste dump areas Class 3 - Slope >70% of the land is <10% slope of land surface





Figure 10.4: Post Mine - Beef Cattle Grazing



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT





Open cut mining and waste dump areas

Class 3 - Slope >70% of the land is <10% slope of land surface



14 ATTACHMENTS

Attachment 1 Contaminated Land Site Inspection

Contaminated Land Site Inspection

Olive Downs Coking Coal Project

Version 6

Pembroke Olive Downs Pty Ltd 10 July 2018



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TABLE OF CONTENTS

EXE	Ουτιν	/E SUMMARY	1
1	ΙΝΤΙ	RODUCTION	3
	1.1	PROJECT DETAILS	3
	1.2	SCOPE OF REPORT	3
2	SITE	E DESCRIPTION	4
	2.1	SITE IDENTIFICATION AND DESCRIPTION	4
		2.1.1 Surrounding Land Use	4
		2.1.2 Topography and Hydrology	5
		2.1.3 Regional Geology	5
3	DES	KTOP REVIEW	6
	3.1	REGULATORY RECORDS SOURCES	6
	3.2	AERIAL PHOTOGRAPH REVIEW	6
	3.3	PREVIOUS ENVIRONMENTAL INVESTIGATIONS	6
4	SITE	E INSPECTION	7
	4.1	SITE INSPECTION	7
		4.1.1 Point of Interest: CL1	8
		4.1.2 Point of Interest: CL2	9
		4.1.3 Point of Interest: CL3	10
		4.1.4 Point of Interest: CL4	11
		4.1.5 Point of Interest: CL5	12
		4.1.6 Point of Interest: CL6	13
		4.1.7 Point of Interest: CL7	14
		4.1.8 Point of Interest: CL8	15
		4.1.9 Point of Interest: CL9	16
		4.1.10 Point of Interest: CL10	17
		4.1.11 Point of Interest: CL11	18
		4.1.12 Point of Interest: CL12	19
		4.1.13 Point of Interest: CL13	20
		4.1.14 Point of Interest: CL14	21
		4.1.15 Point of Interest: CL15	22
5	ENV	/IRONMENTAL ASSESSMENT	23
	5.1	PROJECT SITE CONTAMINATED LAND SITE INSPECTION	23
	5.2	PROJECT SITE DISTURBANCE AND FURTHER ASSESSMENT	23
	5.3	PROJECT SITE AREAS OUTSIDE OF GTE SITE INSPECTION	24

	5.4	PREL	IMINARY RISK ASSESSMENT	24
		5.4.1	Preliminary Risk Matrix	25
		5.4.2	Preliminary Risk Assessment Review and Recommendations	26
		5.4.3	Review of Preliminary Risk Assessment	27
		5.4.4	Description of Environmental Site Assessments	28
6	CON	CLUS	ON	30
7	REFE	RENC	ES	31
8	GLO	SSAR	OF TERMS	32
9	FIGU	RE		33
	FIGU	RE 1	CONTAMINATED LAND POINTS OF INTEREST	33
10	APP		ES	34
	APPE	NDIX	A EMR/CLR SEARCHES	34

EXECUTIVE SUMMARY

GT Environmental Pty Ltd was commissioned by Pembroke Olive Downs Pty Ltd (Pembroke) to complete a Contaminated Land Site Inspection of the Olive Downs Coking Coal Project (the Project).

The Project includes a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres south-east of Moranbah, Queensland. The Project is comprised of the Olive Downs South domain (Mining Lease Application [MLA] 700032 and MLA 700033) and Willunga domain (MLA 700034), associated linear infrastructure (MLA 700035), waste dump (MLA 700036) and an electricity transmission line.

This Contaminated Land Site Inspection focused on the Olive Downs South, Willunga domains and associated linear infrastructure however, excluded Old Bombandy property located at the south of the Project.

The following conclusions were made:

- A search of the regulatory records; Environmental Management Register (EMR) and Contaminated Land Register (CLR) on 15 March 2017, 31 January 2018 and 1 February 2018, reported that the eleven properties associated with the Project are not included on the EMR or CLR.
- Fifteen points of interest were identified which included a cattle dip, a cattle yard with potential spray race unit, gas extraction wells, retention ponds, unlabelled and labelled drums, generators and above ground storage tanks. A risk assessment was conducted on points of interest located within or nearby proposed disturbance areas with the following recommended:
 - Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling is conducted. Stage 2 and 3 Environmental Site Assessments (ESAs) are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling is conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling if staining is observed. Identification and potential preliminary water samples for appropriate discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.

- The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.
- The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental assessments (i.e. prior to disturbance).

1 INTRODUCTION

1.1 **Project Details**

Pembroke Olive Downs Pty Ltd (Pembroke) proposes to develop the Olive Downs Coking Coal Project (the Project), a metallurgical coal mine and associated infrastructure within the Bowen Basin, located approximately 40 kilometres (km) south-east of Moranbah, Queensland. The Project provides an opportunity to develop an open cut metallurgical coal resource within the Bowen Basin mining precinct that can deliver up to 20 million tonnes per annum (Mtpa) of run-of-mine (ROM) coal.

The Project comprises the Olive Downs South (Mining Lease Application [MLA] 700032 and MLA 700033) and Willunga (MLA 700034) domains, associated linear infrastructure corridors (MLA 700035), waste dump (MLA 700036) and an electricity transmission line (ETL). The ETL is not included as part of this Contaminated Land Site Inspection.

The coal resource would be mined by conventional open cut mining methods, with product coal to be transported by rail to the Dalrymple Bay Coal Terminal. Up to 20 Mtpa of run-of-mine (ROM) coal would be extracted over the anticipated Project operational life of approximately 79 years.

GT Environmental Pty Ltd (GTE) was commissioned by Pembroke to complete a Contaminated Land Site Inspection including an on-site inspection to identify potential contaminated land points of interest.

This Contaminated Land Site Inspection focused on the Olive Downs South and Willunga domains, linear infrastructure. The Old Bombandy property was excluded due to access restrictions at the time of fieldworks.

1.2 Scope of Report

The report provides a desktop and site inspection for potentially contaminated land at the Project and includes:

- Search and review of historical and current information relating to the site from the following sources:
 - Review of information held by Pembroke which includes State Government Environmental Management and Contaminated Land Registers (EMR/CLR).
 - Google earth aerial imagery of the Project.
- Site inspection including the identification of potential on and off-site sources of contamination, assess the nature and location of buildings and infrastructure, condition of the property, adjoining areas, interview of site personnel and current conditions; and
- Detailing the findings of the site inspection and recommendations, for further works.

2 SITE DESCRIPTION

2.1 Site Identification and Description

The site comprises of eleven lots and plans over seven properties within the Isaac Regional Council area, formerly Broadsound Shire Council area. The site details are summarised below in Table 1.

Table	1: Site	Details	

Details	Data	Comment
Site Titles	Lot 11 Plan KL135	Iffley
	Lot 9 Plan CNS98	Vermont Park
	Lot 8 Plan KL95	Willunga
	Lot 7 Plan KL96	Seloh Nolem
	Lot 9 Plan KL97	Old Bombandy
	Lot 4 Plan CNS15	Wynette
	Lot 5 Plan CNS90	Wynette, Winchester Downs
	Lot 15 Plan CNS111	Wynette
	Lot 8 Plan SP277384	Winchester Downs
	Lot 9 Plan GV33	Reserve
	Lot 2 Plan CNS77	Railway
Mineral Development Licences	277, 3012, 3013 and 3014	-
Adjacent Mineral Development Licences	183, 429, 519 and 3001	These MDLs are not within the site area but are adjacent to the Project.
Exploration Permit for Coal	649, 676, 688, 721, 755, 850, 1949 and 1951	-
Petroleum Lease	488	-
Authority to Prospect	759, 1031 and 1103	-
Local Government	Isaac Regional Council	-
Site Area	25,300 hectares	-

2.1.1 Surrounding Land Use

The surrounding land uses are broadly summarised in Table 2 below.

Detail	Comment
North	Grazing properties, woodlands and mining operations (Moorvale Mine)
East	Grazing properties and woodlands
South	Grazing properties, woodland and mining operations (Lake Vermont Mine)
West	Grazing properties, woodland and mining operations (Peak Downs Mine and Saraji Mine)

2.1.2 Topography and Hydrology

The landscape of the Project includes level plains to gently undulating plains with elevations of approximately 200 metres (m) Australian Height Datum (AHD). The overall elevation of the Project ranges from 150m AHD in the low-lying southeast of the Project to 250m AHD in the higher areas to the north of the Project (Queensland Government 2016).

The Project is bordered by a cluster of small mountains to the north-east, approximately 400m high, as well as a range of low-lying mountains ranging from 300-400m high, 10km to the south-west of the Project.

The Olive Downs South domain is located to the south and west of the Isaac River. The Willunga Domain is located to the north and east of the Isaac River, further downstream of the Olive Downs South domain.

The Project is located in the Isaac Connors Groundwater Management Area defined under the *Water Resource (Fitzroy Basin) Plan, 2011* under the *Queensland Water Act, 2000*. The hydrogeological conceptualisation suggests that the coal resource is consistent with previous studies in the region, and is a confined and semi-confined porous rock groundwater system.

2.1.3 Regional Geology

Regional mapping of the Project shows the Fair Hill and Rangal formations in the north of the Project, and Rewan and Blackwater formations in the south and east of the Project.

Broad scale geology undertaken by the superseded Department of Environment and Resource Management (DERM) in 2011 indicates the Project is dominated by Tertiary sediments, Cainozoic alluvium, as well as Mesozoic sediments (Raymond and McNeil 2011).

Soils mapping of the Land of Isaac Comet (Gunn et al. 1967) details substrate geology as tertiary sandstone, weathered tertiary clays and clay plains.

3 DESKTOP REVIEW

The following desktop review was undertaken for the Project.

3.1 Regulatory Records Sources

In accordance with the requirements of the Queensland *Environmental Protection Act 1994*, the Department of Environment and Science (DES) maintains registers of sites identified as having previous or current notifiable activities or contaminated by a hazardous contaminant.

The EMR identifies *low-risk* sites that have been used for an activity which is likely to cause land contamination, while the CLR identifies 'risk' sites; land identified by the Environment Protection Authority (EPA) as requiring remediation.

Table 3 summaries the searches conducted on 15 March 2017, 31 January 2018 and 1 February 2018, for the following eleven sites associated with the Project. Searches are included in Appendix A.

Site	EMR	CLR
Lot 11 Plan KL135	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan CNS98	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 8 Plan KL95	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 7 Plan KL96	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan KL97	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot4 Plan CNS15	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot5 Plan CNS90	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 15 Plan CNS111	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 8 Plan SP277384	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 9 Plan GV33	The site is NOT included on the EMR	The site is NOT included on the CLR
Lot 2 Plan CNS77	The site is NOT included on the EMR	The site is NOT included on the CLR

Table 3: Project EMR and CLR Search Results

3.2 Aerial Photograph Review

Aerial imagery of the site was sourced from Google Imagery (Google EarthTM) (2017). The imagery was reviewed to highlight any residential or grazing facilities, structures, water sources, discolouration of landforms, vegetation loss and/or significant development prior to arriving onsite.

It was noted that several cleared areas and water dams were visible with access roads throughout the Project.

3.3 Previous Environmental Investigations

GTE have not been provided with existing environmental reports relating to the Project. No further desktop assessment was undertaken prior to arriving on-site.

4 SITE INSPECTION

A site inspection was carried out by GTE during the Soils and Land Suitability Assessment inspections over the dates 17 to 26 June 2017, 7 to 16 July 2017, 27 July to 5 August 2017 and 24 to 26 November 2017. The purpose of the inspection was to document the environmental condition of the site, review historical and current activities, and identify points of interest of potential contaminated land.

4.1 Site Inspection

The Project site is used predominantly for beef cattle grazing across all properties. Land has been largely cleared, with some areas of limited to no clearing as evidenced by the type and density of vegetation. All points of interest highlighted within the aerial photography review were accessed.

Anecdotal evidence supplied by Pembroke and contractors Zeewood highlighted an early settlement immediately outside the Project boundary within the property Seloh Nolem.

A total of fifteen (15) points of interest were identified during the desktop and site inspection and were inspected, field notes recorded and photographed. These are summarised in Table 4 below, detailed in Section 4.1.1 to Section 4.1.15 and locations are presented in Figure 1.

Site	Date Inspected	Main Point of Interest
CL1	7/7/2017	Cattle yard, Cattle dip
CL2	8/7/2017	Cattle yard
CL3	10/7/2017	Old 205L drums
CL4	12/7/2017	Old 205L drum
CL5	13/7/2017	Gas extraction wells
CL6	13/7/2017	Retention pond, gas extraction well, generator
CL7	14/7/2017	Water tank, small petrol pump, fuel, old 205L drums
CL8	14/7/2017	Cattle yard
CL9	14/7/2017	Gas extraction well
CL10	14/7/2017	Water dam, combustible liquid above ground storage tank, power generator
CL11	14/7/2017	Test well location
CL12	14/7/2017	4 inch petrol pump
CL13	28/7/2017	Cattle yard with potential spray race unit
CL14	2/8/2017	Historic residence
CL15	25/11/2017	Generator

Table 4: Summary of Points of Interest

4.1.1 Point of Interest: CL1

Table 5 summarises point of interest CL1.

Table 5: Point of Interest: CL1

Site	CL1	Location (GDA94)	639544 mE 7535383 mS
Main Observations / Nature of Activities	Cattle yard containing a cattle dip an Three (3) unlabelled empty 205L dru Several holding pens.	pproximately a quarter full. ms.	
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs	<image/>		<image/>

4.1.2 Point of Interest: CL2

Table 6 summarises point of interest CL2.

Table 6: Point of Interest: CL2

Site	CL2	Location (GDA94)	645302 mE 7535143 mS
Main Observations / Nature of Activities	Cattle yards containing cattle crush. Two (2) unlabelled empty 205L drum Several holding pens.	S.	
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs	<image/>		

4.1.3 Point of Interest: CL3

Table 7 summarises point of interest CL3.

Table 7: Point of Interest: CL3

Main Observations / Two (2) labelled empty 205L drums (20W40). Nature of Activities Two (2) labelled empty 205L drums (20W40).	
Staining Surface staining was not observed. Odours Odours were not present.	
Vegetation Cleared, no visible signs of vegetation distress. Surface Unsealed surface.	
Above Ground Storage TanksOne above ground storage tank. Contents unknown, appears to be a water tank.Presence of Underground Storage TanksNot observed.	
Chemical Storage None observed. Waste Disposal No waste disposal observed.	
Service on Plant and Equipment None observed. Fill present None observed.	

4.1.4 Point of Interest: CL4

Table 8 summarises point of interest CL4.

Table 8: Point of Interest: CL4

Site	CL4	Location (GDA94)	638285 mE 7536088 mS
Main Observations / Nature of Activities	One (1) unlabelled 1/8 205L drum.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
photographs			

4.1.5 Point of Interest: CL5

Table 9 summarises point of interest CL5.

Table 9: Point of Interest: CL5

Site	CL5	Location (GDA94)	648404 mE
			7532876 mS
Main Observations / Nature of Activities	Two gas extraction wells.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			



4.1.6 Point of Interest: CL6

Table 10 summarises point of interest CL6.

Table 10: Point of Interest: CL6

Site	CL6	Location (GDA94)	649082 mE
			7532200 mS
Main Observations / Nature of Activities	Retention pond. Gas extraction well. Generator. Unable to enter site as per signage, observations were based upon the photographed position.		
Staining	Surface staining was not observed	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.7 Point of Interest: CL7

Table 11 summarises point of interest CL7.

Table 11: Point of Interest: CL7

Site	CL7	Location (GDA94)	648523 mE
			7536304 mS
Main Observations / Nature of Activities	Disused above ground storage tank. Small capacity petrol generator. Fuel container (20L). Three (3) unlabelled 205L drums.		
Staining	Surface staining was observed at the generator.	Odours	Hydrocarbon odours were present.
Vegetation	Semi-cleared, no visible signs of vegetation distress.	Surface	Unsealed surface with a small concrete pad
Above Ground Storage Tanks	Disused, partially deconstructed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	Delo 400 20L container observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.8 Point of Interest: CL8

Table 12 summarises point of interest CL8.

Table 12: Point of Interest: CL8

Site	CL8	Location (GDA94)	646176 mE 7540302 mS
Main Observations / Nature of Activities	Cattle yards and cattle crush. No cattle dip or spray race observed One (1) unlabelled empty 205L drum. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			<image/>

4.1.9 Point of Interest: CL9

Table 13 summarises point of interest CL9.

Table 13: Point of Interest: CL9

Site	CL9	Location (GDA94)	643189 mE	
			7542966 mS	
Main Observations / Nature of Activities	Gas extraction well.			
Staining	Surface staining was not observed.	Odours	Odours were not present.	
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.	
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.	
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.	
Service on Plant and Equipment	None observed.	Fill present	None observed.	
Representative Site photographs				

4.1.10 Point of Interest: CL10

Table 14 summarises point of interest CL10.

Table 14: Point of Interest: CL10

Site	CL10	Location (GDA94)	643364 mE
			7543350 mS
Main Observations / Nature of Activities	Dam (water). Combustible liquid above ground storage tank.		
	Power generator.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	Combustible liquid above ground storage tank.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs	and a second		



4.1.11 Point of Interest: CL11

Table 15 summarises point of interest CL11.

Table 15: Point of Interest: CL11

Site	CL11	Location (GDA94)	643407 mE
			7544940 mS
Main Observations / Nature of Activities	Test well location.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.12 Point of Interest: CL12

Table 16 summarises point of interest CL12.

Table 16: Point of Interest: CL12

Site	CL12	Location (GDA94)	646328 mE
			7538794 mS
Main Observations / Nature of Activities	Four inch petrol pump. Two (2) x above ground storage containers (water). One (1) x disused tank.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	Two (2) large modern water containers. One (1) disused tank.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			

4.1.13 Point of Interest: CL13

Table 17 summarises point of interest CL13.

Table 17: Point of Interest: CL13

Site	CL13	Location (GDA94)	659655 mE 7524911 mS
Main Observations / Nature of Activities	Cattle yard, potentially used with a spray race unit and cattle crush. Four (4) unlabelled empty 205L drums. Several holding pens.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			<image/>

4.1.14 Point of Interest: CL14

Table 18 summarises point of interest CL14.

Table 18: Point of Interest: CL14

Site	CL14	Location (GDA94)	652310 mE
			7529877 mS
Main Observations / Nature of Activities	Historic Residence. Historic Water tank <100m nearby.		
Staining	Surface staining was not observed.	Odours	Odours were not present.
Vegetation	Cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.
Service on Plant and Equipment	None observed.	Fill present	None observed.
Representative Site photographs			



4.1.15 Point of Interest: CL15

Table 19 summarises point of interest CL15.

Table 19: Point of Interest: CL15

Site	CL15	Location (GDA94)	634066 mE	
			7550414 mS	
Main Observations /	Generator / Water pump.			
Nature of Activities	One (1) 205L drum.			
Staining	Surface staining was not observed.	Odours	Odours were not present.	
Vegetation	Semi-cleared, no visible signs of vegetation distress.	Surface	Unsealed surface.	
Above Ground Storage Tanks	None observed.	Presence of Underground Storage Tanks	Not observed.	
Chemical Storage	None observed.	Waste Disposal	No waste disposal observed.	
Service on Plant and Equipment	None observed.	Fill present	None observed.	
Representative Site photographs				

5 ENVIRONMENTAL ASSESSMENT

5.1 **Project Site Contaminated Land Site Inspection**

The inspection of the Project presented various areas of potential contamination related to beef cattle grazing, associated agricultural activities and existing infrastructure, including:

- a cattle dip;
- a cattle yard with potential spray race unit;
- gas extraction wells;
- retention ponds.
- unlabelled/labelled 205L drums;
- generators and associated fuel sources; and
- above-ground storage tanks.

Contaminates of concern relating to these points of interest may include, but are not limited to:

- heavy metals including, arsenic (As), cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), nickel (Ni), lead (Pb) and zinc (Zn);
- chemicals/pesticides (such as DDD/DDT/DDE);
- organochlorine pesticides (OC's) and organophosphorus pesticides (OP's); and
- benzene, toluene, ethylbenzene and xylene (BTEX) chemicals and hydrocarbons.

5.2 **Project Site Disturbance and Further Assessment**

Table 20 assesses if points of interest based on their position are within the Project disturbance footprint and if further assessment is required.

Site	Area Proposed to be Disturbed	Recommendation		
CL1	Yes (infrastructure)	Further investigation recommended		
CL2	Yes (open cut)	Further investigation recommended		
CL3	Yes (open cut) Further investigation recommende			
CL4	Yes (open cut)	Further investigation recommended		
CL5	No	No further investigation required.		
CL6	No No further investigation required.			
CL7	No No further investigation required.			
CL8	No	No further investigation required.		
CL9	Yes (open cut)	Further investigation recommended		
CL10	Yes (open cut)	Further investigation recommended		
CL11	Yes (out of pit waste rock emplacement)	Further investigation recommended		

Table 20: Points of Interest within Disturbance Areas

Site	Area Proposed to be Disturbed	Recommendation		
CL12	No	No further investigation required.		
CL13	Yes (open cut)	Further investigation recommended		
CL14	No	No further investigation required.		
CL15	Yes (infrastructure)	Further investigation recommended		

Review of the current disturbance plan highlights that nine (9) points of interest (CL1, CL2, CL3, CL4, CL9, CL10, CL11, CL13 and CL15) are within the Project disturbance footprint.

The points of interest identified above within disturbed areas were assessed against a preliminary risk assessment based upon the Australian and New Zealand Standard (AS/NZS) ISO 31000:2009 *Risk management – Principles and guidelines*. These guidelines consider the source, the likelihood of exposure and the potential receptors. This is outlined within Section 5.4.

Sites that are not predicted to be disturbed will be kept on a register of potentially contaminated sites. Prior to undertaking work that may impact these sites, further investigation would be undertaken.

5.3 **Project Site Areas outside of GTE Site Inspection**

The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental inspections (i.e. prior to disturbance).

5.4 Preliminary Risk Assessment

Assessing the available information gathered through the site inspection, the preliminary risk assessment identifies the likelihood of the hazard causing harm (injury and/or environmental damage) and the severity of that harm. In order to assess this, the following was undertaken;

- Evaluation of the likelihood and the severity of harm occurring using the risk matrix to assign a risk rating. The following risk matrix assigns a risk category from 1 to 5 (Minor to Catastrophic) to indicate the potential risk to human health or the environment;
- Identify factors that may contribute to the risk; and
- Where applicable, review health and safety information that is relevant to the particular hazard.

The preliminary risk assessment considered the potential contaminating activity, the quantities of potentially contaminated materials observed and the condition of the points of interest. As outlined in Section 5.2, points of interest within the disturbance areas are considered primarily for review with remaining points of interest outside of disturbance areas not assessed. Consideration of the likelihood of harm from the potential contamination and potential receptors (local waterways, groundwater aquifers, workforce and nearby residents) were also considered.

The contaminant to pathway to receptor model is shown below in Table 21 to inform preliminary risk assessment.

Source		Pathway		Receptor	
Cattle dip Cattle yard with potential				Groundwater	
spray race unit 205L Container drums	>	Leaching Migration Dermal Inhalation	>	Surface water	
Gas extraction wells				Fauna Flora	
Retention ponds				Workforce	
Above ground storage tanks				Residents	

Table 21: Contaminant Pathway to Receptor Model

5.4.1 Preliminary Risk Matrix

The following risk matrix presented in Table 22 is based upon AS/NZS ISO31000:2009 to assess the risk ratings for the preliminary risk assessment in Section 5.4.2.

Table 22: Preliminary Risk Matrix

Potential Consequence or Impacts		Likelihood				
		Almost Certain (A)	Highly Likely (B)	Likely (C)	Possible (D)	Very Unlikely (E)
Hazard Severity		Several times per month	Once per month	Once per year	Once every 10-20 years	Once every 100 years
Minor (1)	Near miss with minor potential consequence.	Medium	Medium	Low	Low	Low
Significant (2)	Doctor treatment injury. Short term environmental damage.	High / Medium	Medium	Medium	Low	Low
Serious (3)	Lost time injury or non-life threatening health issue. Serious environmental damage.	High	High / Medium	Medium	Medium	Low
Major (4)	Single fatality or extreme injury or permanent health issue. High level environmental damage.	High	High	High / Medium	Medium	Medium
Catastrophic (5)	Multiple fatalities, long term environmental damage. High level prosecution expected.	High	High	High	High / Medium	Medium
5.4.2 Preliminary Risk Assessment Review and Recommendations

A preliminary risk assessment was conducted for the points of interest outlined in Section 5.2 that required further investigation using the preliminary risk matrix (Table 22). The results of the preliminary risk assessment are summarised in Table 23.

This review (based upon the desktop and field observations of the site inspection), will recommend whether further works, including Environmental Site Assessments (ESAs) (i.e. Stage 1 Preliminary Site Investigation, Stage 2 Detailed Site Investigation) and potential remediation plans are required. Detailed descriptions of recommendations are provided in Section 5.4.4.

Point of Interest	Potential Contamination Source	Potential Pathway/s	Potential Receptor/s	Risk Rating Severity/ Likelihood	Recommendation
CL1	Cattle Dip	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	4/C – High/ Medium	Stage 1 Preliminary Site Investigation including preliminary soil and water sampling. Stage 2 and 3 ESAs if significant contamination is identified and potential Stage 4 remediation action plan for the area would be prepared, if required.
CL2	Cattle Yard 205L Drums	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	1/D – Low	Interview with land owner/caretaker to identify chemical used (if any) onsite. Field observations during decommissioning of site. Stage 1 Preliminary Site Investigation and preliminary soil sampling if contamination is suspected.
CL3	Labelled 205L drums	Leaching, Migration.	Groundwater Surface water Flora, Fauna.	3/C Medium	Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling. Stage 2 and 3 ESAs if significantly contaminated and potentially Stage 4 remediation action plan for the area, would be prepared, if required.
CL4	Unlabelled 205L drum	Leaching, Migration.	Groundwater Surface water Flora, Fauna.	1/D Low	Stage 1 Preliminary Site Investigation inspection and if staining is observed beneath drum, preliminary soil sampling.
CL9	Gas extraction well	Leaching, Migration.	Groundwater Surface water.	1/D Low	Inspection of site during decommissioning of wells. Interviews with land owner/caretaker with respect to recorded environmental incidents onsite (i.e. hydraulic spills during construction).
CL10	Combustible liquid above ground storage tank Generator Water dam	Leaching, Migration, Dermal, Inhalation.	Groundwater Surface water Flora, Fauna, Workforce, Residents.	3/C Medium	 Stage 1 Preliminary Site Investigation inspection and preliminary borehole soil sampling if staining is observed. Identification and potential preliminary water sampling for appropriate discharge of water (if present). Stage 2 and 3 ESAs if significantly contaminated and potentially Stage 4 remediation action plan for the area would be prepared, if required.

 Table 23: Preliminary Risk Assessment of Points of Interest

Point of Interest	Potential Contamination Source	Potential Pathway/s	Potential Receptor/s	Risk Rating Severity/ Likelihood	Recommendation
CL11	Test extraction well	Leaching, Migration.	Groundwater, Surface water.	1/D Low	Inspection of site during decommissioning of wells. Interviews with land owner/caretaker with respect to recorded environmental incidents onsite (i.e. hydraulic spills during construction).
CL13	Cattle yard with potential spray race unit	Leaching, Migration.	Groundwater, Surface water, Flora, Fauna.	1/D Low	Interviews with land owner/caretaker with respect to activities undertaken onsite. Stage 1 Preliminary Site Inpreliminary soils samples if cattle spray race activities were conducted at point of interest.
CL15	Generator 205L Drum	Leaching, Migration, Dermal.	Groundwater, Surface water, Flora, Fauna, Workforce.	1/D Low	Inspection of generator area for staining. If staining is observed, Stage 1 Preliminary Site Investigation and preliminary soil sampling to be undertaken.

5.4.3 Review of Preliminary Risk Assessment

A review of the nine (9) points of interest conducted in Section 5.4.2 within or nearby proposed disturbance areas assessed the following:

- Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling are conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
- Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1
 Preliminary Site Investigation and preliminary borehole soil sampling are conducted.
 Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a
 Stage 4 remediation action plan for the area would be prepared, if required.
- Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1
 Preliminary Site Investigation and preliminary borehole soil sampling are conducted if
 staining observed. Identification and potential preliminary water samples for appropriate
 discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly
 contaminated and potentially a Stage 4 remediation action plan for the area would be
 prepared, if required.
- The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.

5.4.4 Description of Environmental Site Assessments

This section of the report will provide descriptions of the stages of ESAs. The recommendations provided in Section 5.4.2 determine which ESA stage is required prior to the disturbance of the point of interest.

Stage 1 – Preliminary Site Investigation

A Stage 1 Preliminary Site Investigation would build on the information contained in this report and include:

- development of a site history including aerial photographs, available borehole logs, cadastral maps, regional surface water, geology, topography, hydrogeology, historical titles, local government records, heritage listed items, interviews with land owners, caretakers.
- basic sampling program to determine if contamination is present; and
- summary of sampling program results.

Stage 2 – Detailed Site Investigation

A Stage 2 Detailed Site Investigation is required when the results of the Stage 1 Preliminary Site Investigation indicate potential or actual contamination (i.e. levels above investigation threshold values as described in *National Environment Protection (Assessment of Site Contamination) Measure* [National Environment Protection Council 1999] or other relevant guidelines). The detailed site investigation should delineate the lateral and vertical extent of contamination and provide the following:

- maximum and average concentrations of the various contaminants;
- volumes of soil requiring remediation;
- leachability and mobility of contaminants;
- potential for groundwater contamination; and
- possibility of off-site migration through soil, surface water or groundwater.

Stage 3 – Health and Environmental Assessment and Determination of Remediation Plan

The results obtained from the Stage 2 Detailed Site Investigation should be used to determine the potential human and environmental impact of the contaminants on the current and proposed land uses. If the landuse would result in unacceptable levels of human exposure or unacceptable environmental effects, than a remediation plan to manage the contamination must prepared by a Suitably Qualified Person.

The remediation plan is to include site-specific remediation criteria, to be developed based on a risk assessment.

Stage 2 and 3 ESAs are usually incorporated in one report for review before proceeding with Stage 4.

Stage 4 – Implementation of a remediation plan and validation sampling

The remediation plan is to be implemented prior to the site being impacted by the Project activities. Validation sampling is to be conducted to confirm that the site has been satisfactorily remediated as part of the remediation plan.

Statistical analyses of results should be provided in validation reports to confirm the site is no longer contaminated, or no longer poses an unacceptable health or environmental risk. Australian Standard (AS) 4482.1-2005 *Guide to the Sampling and Investigation of Potentially Contaminated Soil* and the *National Environment Protection (Assessment of Site Contamination) Measure* (National Environment Protection Council 1999) guideline on data collection are useful references to establish the sampling pattern and density required.

6 CONCLUSION

The following conclusions have been made:

- A search of the regulatory records; EMR and CLR on 15 March 2017, 31 January 2018 and 1 February 2018, reported that the eleven properties associated with the Project are not included on the EMR or CLR.
- Fifteen points of interest were identified including a cattle dip, a cattle yard with potential spray race unit, gas extraction wells, retention ponds, unlabelled and labelled drums, generators and above ground storage tanks. A preliminary risk assessment was conducted on the points of interest located within or nearby proposed disturbance areas with the following recommendations:
 - Point of interest CL1 was assessed to be a High/Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation including preliminary soil and water sampling are conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for the area would be prepared, if required.
 - Point of interest CL3 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling is conducted. Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - Point of interest CL10 was assessed to be Medium Risk site. It is recommended a Stage 1 Preliminary Site Investigation and preliminary borehole soil sampling are conducted if staining is observed. Identification and potential preliminary water samples for appropriate discharge of water (if present). Stage 2 and 3 ESAs are recommended if significantly contaminated and potentially a Stage 4 remediation action plan for area would be prepared, if required.
 - The remaining points of interest within disturbance areas of the Project, namely CL2, CL4, CL9, CL11, CL13 and CL15, were assessed as low risk, requiring field observation during disturbance works, discussing site history with land owners/caretakers and potential sampling if contamination is observed.
- The Old Bombandy property was not included as part of the Contaminated Land Site Inspection of the Project. It is recommended that this area be inspected as part of further environmental assessments (i.e. prior to disturbance).

7 **REFERENCES**

- Department of Environment, Queensland (1998). Draft Guidelines for the Assessment and Management of Contaminated Land in Queensland. Brisbane.
- Gunn, R.H., Story, R., Galloway, R.W. and Fitzpatrick, E.A. (1967) *Lands of the Isaac-Comet Area, Queensland*. Land Research Series No.19. CSIRO Publishing, Collingwood, Victoria.
- Google Earth[™], Google Earth: Map Data Sciences Pty Ltd 2017.
- National Environment Protection Council (1999) National Environment Protection (Assessment of Site Contamination) Measure.
- Queensland Government (2016) Queensland Globe. Accessed via Google Earth.
- Raymond, M. A. A. and McNeil, V. H. (2011) *Regional Chemistry of the Fitzroy Basin Groundwater*. Brisbane: Department of Environment and Resource Management, Queensland Government.

8 GLOSSARY OF TERMS

The following descriptions are of terms used in the text of this report.

BTEX. Chemicals including benzene, toluene, ethylbenzene and xylene.

CLR. Contaminated Land Register. It is a public register which contain information about contaminated land in Queensland. Contaminated land is moved from the EMR to CLR where it is necessary to take action to remediate the land to prevent serious environmental harm and protect human health or other aspect of the environment.

DDD. Dichlorodiphenyldichloroethane, a breakdown product of DDT.

DDE. Dichlorodiphenyldichloroethylene a breakdown product of DDT.

DDT. Dichlorodiphenyltrichloroethane, an organochlorine pesticide once used to control insects.

DERM. Department of Environment and Resource Management.

DES. Department of Environment and Science.

EMR. Environmental Management Register. It is a public register which contain information about contaminated land in Queensland. Land listed on the EMR if certain types of activities have been, or are being, carried out on the land, or if the land is contaminated land.

EPC Exploration Permit for Coal.

ESA. Environmental Site Assessment.

ETL. Electricity Transmission Line.

MLA. Mineral Lease Application.

MDL. Mineral Development Licence.

9 FIGURE

Figure 1 Contaminated Land Points of Interest



Figure 1: Contaminated Land Points of Interest

/M



Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Legend

Project Area Land Parcel Boundaries

• Contaminated Land Site Inspection



10 APPENDICES

Appendix A

EMR/CLR Searches



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363394 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 11 Plan: KL135 1208 IFFLEY CONNECTION Road VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363393 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 9 Plan: CNS98 PEAK DOWNS Highway DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363392 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 8 Plan: KL95 FITZROY DEVELOPMENTAL Road VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363391 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 7 Plan: KL96 937 IFFLEY CONNECTION Road VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363390 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 9 Plan: KL97 38877 FITZROY DEVELOPMENTAL Road VALKYRIE

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas MacKillop Suite 2 Level 3 24 McDougall Street Milton QLD 4064

Transaction ID: 50363389 Cheque Number: Client Reference:

EMR Site Id:

15 March 2017

This response relates to a search request received for the site: Lot: 4 Plan: CNS15 ANNANDALE Road DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop 3/24 McDougall Street Milton QLD 4064

Transaction ID: 50433685 Cheque Number: Client Reference: EMR Site Id:

31 January 2018

This response relates to a search request received for the site: Lot: 15 Plan: CNS111 ANNANDALE Road DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop 3/24 McDougall Street Milton QLD 4064

Transaction ID: 50433684 Cheque Number: Client Reference: EMR Site Id:

31 January 2018

This response relates to a search request received for the site: Lot: 8 Plan: SP277384 831 PEAK DOWNS MINE Road WINCHESTER

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop 3/24 McDougall Street Milton QLD 4064

Transaction ID: 50433683 Cheque Number: Client Reference: EMR Site Id:

31 January 2018

This response relates to a search request received for the site: Lot: 9 Plan: GV33 POITREL Road COPPABELLA

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Thomas F Mackillop 3/24 McDougall Street Milton QLD 4064

Transaction ID: 50433682 Cheque Number: Client Reference: EMR Site Id:

31 January 2018

This response relates to a search request received for the site: Lot: 2 Plan: CNS77 NORWICH PARK BRANCH RAILWAY DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)



SEARCH RESPONSE ENVIRONMENTAL MANAGEMENT REGISTER (EMR) CONTAMINATED LAND REGISTER (CLR)

Tomas F MacKillop 3/24 McDougall Street Milton QLD 4064

Transaction ID: 50433934 Cheque Number: Client Reference: EMR Site Id:

01 February 2018

This response relates to a search request received for the site: Lot: 5 Plan: CNS90 ANNANDALE Road DYSART

EMR RESULT

The above site is NOT included on the Environmental Management Register.

CLR RESULT

The above site is NOT included on the Contaminated Land Register.

ADDITIONAL ADVICE

All search responses include particulars of land listed in the EMR/CLR when the search was generated. The EMR/CLR does NOT include:-

- 1. land which is contaminated land (or a complete list of contamination) if EHP has not been notified
- 2. land on which a notifiable activity is being or has been undertaken (or a complete list of activities) if EHP has not been notified

If you have any queries in relation to this search please phone 13QGOV (13 74 68)

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15 APPENDICES

Appendix A

Detailed site descriptions

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
S1	Somerby, Monteagle, Connors,	638828 mE 7548435 mN	Brown Sodosol	Detailed - 50mm hand auger	18/06/2017	
	Humboldt, Blackwater					

Surface



Land use		Managelia	Surface condition, surface rock					Soil Profile	Description				
Pattern, Element, Slope Grazing, 2%	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, 2% gently undulating plains	azing, 2% Poplar Box Nil ntly regrowth dulating ains	Box Nil Hard setting, 10-20% coarse fragments, 0- 50mm diameter	Hard setting, 10-20% coarse fragments, 0- 50mm	A1 0 – 0.14 Abrupt	Clayey Sand	Massive, loose	<5% coarse fragments	10YR3/2 Very dark greyish brown	Dry, rapid	Nil	0.05 / 7.0	No samples taken	Refusal at 0.53m BGL, two attempts
			diameter	B2 0.14 – 0.53	Sandy clay loam	Angular, firm	2% coarse fragments, 10 - 20 mm diameter	10YR3/2 Very dark greyish brown	Dry, well drained	Nil	0.4 / 7.5	-	at 0.05m

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class:	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	638862 mE 7548002 mN	Brown Sodosol	Detailed - 50mm hand auger	18/06/2017
	Humboldt, Blackwater				

Surface



Land use		Managelia	Conferen					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, upper slope, 1.5%	Poplar Box	Nil	Hard setting, no coarse fragments	A11 0 – 0.2 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/4 Dark yellow brown	Dry, rapid	Very fine, very few	0.05 / 6.5	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7	No additional observations
				A12 0.2 – 0.6 Gradual	Loamy sand	Massive, very weak	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 7.0	0.9 – 1.0	
				B2 0.6 – 1.0	Clay loam sandy	Subangular, very firm, 10mm	<2% manganese nodules	10YR4/3 Brown Mottle: 10YR5/8 30% Yellowish brown	Dry, imperfect	Nil	0.6 / 7.5 0.9 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	638715 mE 7547488 mN	Brown Sodosol	Detailed - 50mm hand auger	18/6/2014

Surface



Land use			Gurdense					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, <2%	Morton Bay Ash, occasional Poplar Box	Nil	Soft, no coarse fragments	A11 0.0 – 0.20 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.20 – 0.52 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.3 / 7.0		
				B2 0.52 – 1.0	Clay loam sandy	Sub angular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 Yellowish brown, 20%	Dry, imperfect	Nil	0.8 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	639550 mE 7547598 mN	Brown Sodosol	Detailed - 50mm hand auger	18/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, upper slope, 2%	Poplar Box	Nil	Firm, no coarse fragments	A1 0 – 0.21 Diffuse	Loamy sand	Massive loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, very few	0.1 / 6.5	No samples taken	lsolated small area of Brigalow
				B21 0.21 – 0.74 Abrupt	Sandy clay loam	Subangular, peds smaller than site 3, Very firm	<5% coarse fragments 2- 10mm diameter	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 6.5 0.6 / 7.5		100m away to the west
				B23 0.74 – 1.0	Clay loam sandy	Subangular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 2% Yellowish brown	Dry, rapid	Nil	0.9 / 8.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	638652 mE 7546697 mN	Brown Sodosol	Detailed - 50mm hand auger	18/6/2017
	Humboldt, Blackwater				

Landscape



Land use		Minnelief	Gurdense					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, <2%	Morton Bay Ash, occasional Poplar Box	Nil	Soft, no coarse fragments	A11 0.0 – 0.22 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
				A12 0.22 – 0.52 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.3 / 7.0		
				B2 0.52 – 1.0	Clay loam sandy	Sub angular, very firm	Nil	10YR4/3 Brown Mottle: 10YR5/8 Yellowish brown, 20%	Dry, imperfect	Nil	0.9 / 7.0		

Surface

Soil Profile

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	639484 mE 7545992 mN	Brown Sodosol	Detailed - 50mm hand auger	18/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, 3% gently undulating plains	Poplar Box regrowth	Nil	Hard setting, 10-20% coarse fragments, 0- 50mm	A1 0 – 0.26 Abrupt	Sandy Ioam	Massive, loose	<5% coarse fragments	10YR3/2 Very dark grayish brown	Dry, rapid	Nil	0.05 / 7.0	No samples taken	Refusal at 0.5m, with refusal at a
			diameter	B21 0.26 – 0.35 Abrupt	Sandy clay loam	Angular, firm	2% coarse fragments, 10 - 20 mm diameter	10YR3/2 Very dark grayish brown	Dry, well drained	Nil	0.3 / 7.0		further two attempts; 0.53m and
				B22 0.35 – 0.5	Clay loam sandy	Sub angular, firm	Nil	10YR4/3 Brown	Dry, imperfect	Nil	0.4 / 7.5		U.35M

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	639705 mE 7547057 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	19/6/2017

Landscape







Land use		M issionalise	Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Undulating plain, midslope 3%	Poplar box 95%, Moreton Bay Ash 5%, <40%	Semi cleared	Soft to firm, no coarse fragments	A1 0 – 0.30 Abrupt	Clayey sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, fine	0.05 / 6.5	No samples taken	Refusal on root at 0.9m
	coverage			B21 0.3 – 0.5 Abrupt	Loamy sand	Massive, 90% peds, very weak	<5% coarse fragments & white nodules 2- 6mm	10YR3/3 Dark brown	Dry, rapid	Nil	0.4 / 7.0		
				B22 0.5 – 0.9	Loamy sand	Moderate, peds 2- 10mm, weak	<2% black nodules & coarse fragments 2-15mm	10YR3/6 Mottle: 10YR5/8 20% Yellowish brown	Dry, imperfect	Nil	0.8 / 7.0		

Soil Profile

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	640823 mE 7547668 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	19/6/2017

Surface



Land use		Minnelief	Gurdense					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating, upper slope,	Sparse tall trees, gums, Blackbutt	Semi cleared	Firm, no coarse fragments	A1 0 – 0.23 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown No mottles	Dry, well drained	Very fine, few	0.1 – 6.5	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7 0.9 - 1.0	No additional observations
<1%				B21 0.23 – 0.57 Gradual	Loamy sand	Weak to moderate, very weak, peds <10mm	Nil	10YR3/3 Dark brown No mottles	Dry, humid	Nil	0.3 / 6.5		
				B22 0.57 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	7.5YR4/4 Dark Brown No mottles	Dry, humid	Nil	0.6 / 7.0 0.9 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	641896 mE 7547883 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	19/6/2017

Surface



Land use		Minnelief	Conference of the second					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently inclined 1%	lronbark white gums	Cleared area backing onto bushland	Firm, no coarse fragments	A1 0.0 – 0.2 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
				B21 0.2 – 0.4 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.4 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	7.5YR4/4 Brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	641130 mE 7547096 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	19/6/2017

Surface



Land use		Minnellief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, upper slope 2%	Various tall trees; Moreton Bay Ash,	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
	Poplar Box, Gums.			B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	642402 mE 7546766 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	19/6/2017
	Humboldt, Blackwater				

Surface



Land use		Microrelief	Surface -					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Sparse, tall woodlands - White gums,	Semi cleared	Soft, no coarse fragments	A1 0.0 – 0.21 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, fine	0.1 – 6.5	No samples taken	No additional observations
plains, upper slope 2%	Moreton Bay Ash			B21 0.21 – 0.53 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.3 / 6.5		
				B22 0.53 – 1.0	Clayey sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	One medium root 5mm think found	0.6 / 7.0 0.9 / 7.0		

SITE 12a

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
C1	Somerby, Monteagle, Connors,	640307 mE 7546621 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	19/6/2017	
	Humboldt, Blackwater, Junee					

Landscape



Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat Brigalow plain regrowth, 70%+ coverage	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions at 50%	holes Cracking with x 4m crust tter, deep, ssions 6	A1 0.00 – 0.09 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7 0.8 - 0.9	- 0.1 - 0.4 - 0.7 - 0.9 - 0.9 Site located in depression
		coverage.		B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Profile

SITE 12b

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	640307 mE 7546621 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	19/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Soil Profile Description									
				Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions at 50% coverage	on holes Cracking with rox 4m crust neter, n deep, ressions 0% erage	A1 0.00 – 0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7 0.9 - 1.0	Site located in melon hole mount, 3 metres from 12a
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		
Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:								
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C1	Somerby, Monteagle, Connors,	640848 mE 7545856 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	20/6/2017								
	Humboldt, Blackwater, Junee												









Land use	Land use Landform Natural Microrelief Surface							Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat Brigalow plain regrowth 70%+ coverage	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions at 50%	oles Cracking with 4m crust r, ep, ons	A1 0.00– 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
		coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

SITE 14

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	641257 mE 7545271 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	20/6/2017
	Humboldt, Blackwater, Junee				

Surface

Landscape



Land use	Land use Landform Natural Microrelief Surface							Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Moderate, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located on melon hole mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	639357 mE 7545231 mN	Brown Sodosol	Detailed - 50mm hand auger	20/6/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating plains, 1%	Very Sparse, Moreton Bay Ash, Blackbutt	Semi cleared	Firm, no coarse fragments	A11 0.0 – 0.22 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.1 / 6.5	No samples taken	No additional observations
				A12 0.22 – 0.7 Abrupt	Clayey sand	Weak subangular peds 20mm, weak	Nil	10YR4/4 Dark yellowish brown	Humid, well drained	Few, very fine	0.3 / 7.0 0.6 / 7.0		
				B2 0.7 – 1.0	Sandy clay loam	Weak subangular peds 40mm, weak	2% coarse fragments, 2- 10mm	7.5YR4/4 Brown Mottle: 2.5YR4/6 Red	Dry, imperfectly drained	Nil	0.9 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	640064 mE 7545157 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	20/6/2017

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Blackbutt, Ironbark, white gums	Semi cleared	Firm, no coarse fragments,	A1 0.0 – 0.45 Diffuse	Silty loam	Massive, very weak	<2%, 0.5 – 1mm coarse fragments	10YR2/1 Black	Dry, well drained	Very fine, very few to 0.15m	0.0 / 7.0 0.3 / 7.0	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7	No additional observations
plains, wide depression			light grey colour compared with light yellow grey surface 50m to the north and south	B2 0.45 – 1.0	Clayey sand	Weak, 1- 20mm peds, weak	Black nodules <2% and coarse fragments <5%	10YR4/2 Dark greyish brown Mottle: <5% 10YR5/2 greyish brown And <2% 10YR4/6 Dark yellow brown	Dry, Imperfectly drained		0.6 / 7.0 0.9 / 7.0	0.9 – 1.0	

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt,	640643 mE 7544470 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	20/6/2017

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plain, 2.5%	Mostly Ironbark and Bloodwood, <5% Moreton	Nil	Hard setting, <2% black nodules and coarse	A11 0.0 – 0.36 Abrupt	Loamy Sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown No mottle	Dry, rapid	Very few, very fine	0.10 / 7.0	0.00 - 0.10 0.36 - 0.46 0.60 - 0.70 0.90 - 100	No additional observations
mid-slope	Bay Ash		fragments 2- 6mm diameter	A12 0.36 – 0.47 Abrupt	Loamy sand	Weak 1- 10mm peds, subangular, Weak strength	<2% black nodules	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.36 / 6.5		
				B2 0.47 – 1.0	Silty clay loam	Weak 1- 10mm peds, moderate strength	<5% black nodules and coarse fragments	10YR4/4 Dark yellowish brown Mottles: <5% 10YR6/8 Brownish yellow <2% 2.5YR4/6 Red	Dry, well drained	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	641888 mE 7546236 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	20/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minunglief	Configure					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.1m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
		at 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	641954 mE 7545569 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	20/6/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep, depressions at 50% coverage	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.05m	0.05 – 6.5	No samples taken	Site located in melon hole depression,
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	642873 mE 7545626 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	21/6/2017
	Humboldt, Blackwater, Junee				

Landscape



Surface





Land use Landform		Minnelief	Gundara					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, opening depression / swamp conditions due to	Brigalow / tall sparse woodlands	<20% minor normal gilgai	Cracking, poached	A1 0.00 – 0.27 Diffuse	Light clay	Weak, peds 1-10mm, sub- angular, strength – firm	<2% black nodules 1-5mm	10YR3/2 Very dark greyish brown	Dry, well drained	Few, very fine	0.00 / 6.5	No samples taken	No additional observations
landform				B2 0.27 – 1.00	Light clay	Moderate, peds 1- 20mm, sub- angular, strength- Very firm	<2% black nodules 1-5mm	10YR3/2 Very dark greyish brown	Slightly moist, well drained	Few, very fine	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	642493 mE 7544291 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	21/6/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use			Surface	Soil Profile Description										
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep,	Cracking with crust	A1 0.00– 0.10 Abrupt	Light clay	Weak, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.85m	0.05 – 6.5	No samples taken	No recovery at 0.85m	
		depressions at 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		depression,	

Surface

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Soil Profile

SITE 22

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	643330 mE 7542927 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	21/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use			Surface	Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow regrowth, 70%+ coverage	Melon holes approx 4m diameter, 0.4m deep,	Cracking with crust	A1 0.00 – 0.10 Abrupt	Light clay	Moderate, angular, Strong	2% coarse fragments and black nodules, 2- 5mm	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, fine down to 0.1m	0.0 – 6.5	No samples taken	Site located in melon hole depression,
		depressions at 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	644793 mE 7544494 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	21/6/2017

Surface



Land use		Managelia	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0% slope	Blackbutt, minor Poplar Box &	Nil	Soft, no coarse fragments	A1 0.0 – 0.22 Abrupt	Clayey sand	Weak, weak	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, very fine	0.1 – 6.5	No samples taken	No additional observations
	Moreton Bay Ash, long grass			B21 0.22 – 0.49 Abrupt	Loamy sand	Weak, very weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.3 / 6.5		
				B22 0.49 – 1.00	Clayey sand	Moderate, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.6 / 7.0 0.9 / 6.5		

Soil Profile

SITE 24

	Гуре:	Survey Date:
B1 Somerby, Monteagle, Humboldt 645525 mE 7543737 mN Subnatric Brown Sodosol Detailed - 50	mm hand auger	21/6/2017

Surface



Land use		Minnellief	Gurdana					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0% slope	Moreton Bay Ash, Blackbutt, gums, long	Nil	Soft, no coarse fragments	A1 0.00 – 0.30 Abrupt	Silty loam	Weak, weak	Nil	10YR2/1 Black	Dry, rapid	Very fine, few	0.1 – 6.5	0.00 - 0.10 0.30 - 0.40 0.60 - 0.70	No additional observations
	grass			B21 0.30 – 0.58 Abrupt	Clay loam	Moderate, weak	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	0.3 / 6.5	0.90 – 1.00	
				B22 0.58 – 1.00	Clay loam	Moderate, weak	<2% black nodules	7.5YR2.5/3 Very dark brown	Dry, well drained	Nil	0.7 / 7.0 0.9 / 6.5		

SITE 25a

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	644923 mE 7542220 mN	Brown Vertosol	Detailed - 50mm hand auger	21/6/2017

Surface



Land use		M isson list	Gurlan					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain <1.0%	Sparse regrowth – Brigalow and	Shallow linear gilgai, approx. 3m	Cracking, <2% coarse fragments	A1 0 – 0.21 Abrupt	Light clay	Weak, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	0.00 - 0.10 0.30 - 0.40 0.70 - 0.80	Site located in gilgai
	other	diameter x 0.3m deep, 20-30%	<5mm diameter	B21 0.21 – 0.68 Clear	Light clay	Weak, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0	0.90 – 1.00	depression
		coverage Mound		B22 0.68 - 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

SITE 25b

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	644923 mE 7542220 mN	Brown Vertosol	Detailed - 50mm hand auger	21/6/2017

Surface



Land use		Minnellief	Gurdana					Soil Profile	Description				
Eandform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain <1.0%	Sparse regrowth – Brigalow and	Shallow linear gilgai, approx. 3m	Cracking, <2% coarse fragments	A1 0 – 0.21 Abrupt	Light clay	Weak, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	0.00 - 0.10 0.30 - 0.40 0.60 - 0.70	Site located on gilgai
	other	diameter x 0.3m deep, 20-30%	<5mm diameter	B21 0.21 – 0.76 Clear	Light clay	Weak, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0	0.90 – 1.00	mound
		coverage Depression		B22 0.76 – 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

SITE 26a

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	640146 mE 7543555 mN	Brown Vertosol	Detailed - 50mm hand auger	22/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating plain, <1% slope	Tall Brigalow and Brigalow regrowth, semi sparse, limited clearing 20- 30% coverage	Normal gilgai, 30% coverage, <0.3m deep	Cracking, <5mm cracks, 5% coarse fragments <5mm	A1 0.00 – 0.19 Abrupt	Light medium clay	Weak, <10mm peds, subangular, strength- firm	2% coarse fragments	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.00 / 6.5	0.00 - 0.10 0.30 - 0.40 0.60 - 0.70 0.90 - 1.00	Site located in gilgai depression
				B2 0.19 – 1.00	Medium clay	Strong structure <20mm, very firm strength	<2% black nodules <5mm <1% calcium carbonate	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 6.5 0.60 / 7.0 09.0 / 7.0		

SITE 26b

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
C2	Somerby, Monteagle, Connors,	640146 mE 7543555 mN	Brown Vertosol	Detailed - 50mm hand auger	22/6/2017	
	Humboldt, Blackwater, Junee					

Surface



Land use		Minnerslief	Carlos		Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, very gently undulating plain, <1% slope	Tall Brigalow and Brigalow regrowth, semi sparse, limited clearing 20- 30% coverage	Normal gilgai, 30% coverage, <0.3m deep	Cracking, <5mm cracks, 5% coarse fragments <5mm	A1 0.00 – 0.25 Abrupt	Light medium clay	Moderate, <10mm peds, subangular, strength- firm	2% coarse fragments	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.00 / 6.5	0.00 – 0.10	Site located on gilgai mound		
				B2 0.25 – 1.00	Medium clay	Strong structure <20mm, very firm strength	<2% black nodules <5mm <1% calcium carbonate	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 09.0 / 7.0	0.30 - 0.40 0.60 - 0.70 0.90 - 1.00			

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	641169 mE 7543418 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	22/6/2017



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Ironbark, Poplar Box, Moreton Bay	Nil	Hard setting, <5% coarse fragments	A11 0.00 – 0.27 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plain, mid slope 1-2%	Ash		<10mm	A12 0.27 – 0.51 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.51 – 1.00	Silty clay Ioam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

B1Somerby, Monteagle, Humboldt639637 mE 7542190 mNSubnatric Brown SodosolDetailed - 50mm hand auger22/6/2017	Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
	B1	Somerby, Monteagle, Humboldt	639637 mE 7542190 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	22/6/2017

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Ironbark, Poplar Box, Moreton Bay	Nil	Hard setting, <5% coarse fragments	A11 0.00 – 0.30 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plain, mid slope 1-2%	Ash		<10mm	A12 0.30 – 0.55 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.55 – 1.00	Silty clay Ioam	Weak subangular, Moderate 6-10mm peds	<2% manganese nodules	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

SITE 29

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	642137 mE 7542156 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	22/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	lronbark, Poplar Box, Moreton Bay	Nil	Hard setting, <5% coarse fragments	A11 0.00 – 0.29 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken.	No additional observations
plain, mid slope 1-2%	Ash		<10mm	A12 0.29 – 0.52 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.52 – 1.00	Silty clay loam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	641607 mE 7541014 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	22/6/2017

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Ironbark, Poplar Box, Moreton Bay	Semi cleared	Hard setting, <5% coarse fragments	A11 0.00 – 0.23 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Few, medium	0.10 / 6.5	No samples taken	No additional observations
plain, nearby gully mid slope 2%	Ash		<10mm	A12 0.23 – 0.45 Clear	Loamy sand	Weak 0- 10mm peds subangular, Weak	<2% black/white nodules	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.45 – 1.00	Silty clay Ioam	Weak subangular, Moderate 6-10mm peds	<5% manganese nodules	10YR4/4 Dark yellowish brown	Humid, well drained	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 639834 mE 7541276 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 22/6/2017
	Landscape	Surface		Soil Profile	

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Very sparse Blackbutt and Ironbark	Extensive clearing	Firm, no coarse fragments	A1 0.00 – 0.13 Abrupt	Clayey sand	Weak, peds 2-10mm, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, very fine	0.00 / 7.0	No samples taken	No additional observations
plain, upper slope 1.5%				B21 0.13 – 0.37 Clear	Loamy sand	Weak subangular peds 5- 20mm, weak	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.37 – 1.00	Loamy sand	Weak subangular peds 10- 30mm, weak	<2% Coarse fragments 2- 5mm and red nodules	10YR4/4 Dark yellowish brown	Moderately moist, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	640566 mE 7540061 mN	Brown Sodosol	Detailed - 50mm hand auger	22/6/2017

Surface



Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Gently undulating	Very sparse Poplar Box 100m+ away,	Extensive clearing	Hard settling, trampled surface, no	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.1 / 6.5	No samples taken	No additional observations	
plains, upper slope 2.5%	Blackbutt, Gums		coarse fragments	A12 0.25 – 0.68 Abrupt	Loamy sand	Weak, very weak	Nil	10YR4/3 Brown	Dry, rapid	Very fine, very few	0.3 / 6.5 0.6 / 7.5			
				B2 0.68 – 1.00	Clay loam sandy	Moderate, subangular peds <20mm, firm	<2% coarse fragments 2- 5mm, black nodules	10YR4/4 Dark yellowish brown Mottle: 10YR5/8 Strong brown	Moderately moist, imperfectly drained	Nil	0.9 / 8.0			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	643054 mE 7539958 mN	Brown Sodosol	Detailed - 50mm hand auger	23/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, ridge, upper slope 1%	Sparse tall woodland, limited	Semi cleared	Hard setting, coarse fragments 5%	A11 0.00 – 0.27 Diffuse	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	0.00 / 6.5	Very fine, few	No samples taken	No recovery at 0.75m, hard to
	clearing with Poplar Box regrowth		5mm diameter	A12 0.27 – 0.49 Abrupt	Loamy sand	Weak subangular peds <10mm, weak	<2% manganese nodules	10YR4/2 Dark grayish brown	Dry, well drained	0.30 / 6.5	Nil		auger
				B2 049 – 0.75	Clay loam sandy	Weak subangular peds <15mm, weak	<5% manganese nodules	10YR4/3 Brown Mottle: 10YR4/6	Dry, well- moderately drained	0.60 / 6.5	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	639343 mE 7540015 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope, very gently undulating plain, 1.5%	Brigalow regrowth	Extensive clearing, previously blade ploughed	Hard setting, cracking – fine to moderate cracks, <5% coarse	A1 0.00 – 0.18 Clear	Light clay	Weak angular peds <10mm, firm	<2% coarse fragments 2- 6mm	10YR3/1 Very dark gray	Humid – moderately moist, well drained	Very fine, few	0.00 / 6.5	0.00 - 0.10 0.30 - 0.40 0.60 - 0.70 0.90 - 1.00	No additional observations
			fragments 2- 4mm	B21 0.18 – 0.70 Diffuse	Medium clay	Moderate angular peds <20mm, firm	<5% coarse fragments 2- 6mm and black nodules	10YR3/1 Very dark gray	Moderately moist, well drained	Very fine, few	0.30 / 6.5		
				B22 0.70 – 0.81 Abrupt	Medium clay	Moderate angular peds <20mm, firm	Nil	10YR3/2 Very dark grayish brown	Moderately moist, well to moderately drained	Nil	0.60 / 7.0		

											OLIVEDON		ONETROJECT		
Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.		Soil Profile Description										
				B23 0.81 – 1.05	Silty clay Ioam	Weak angular peds <10mm, firm	-	10YR4/2 Dark grayish brown	Dry, moderately moist	-	0.90 / 7.0				

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	640332 mE 7538899 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017

Surface



Land use Landform Natural								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, mid slope, very gently undulating plain, 1.5%	Brigalow regrowth	Normal gilgai, 10% coverage	Hard setting, cracking – fine to moderate cracks, <5% coarse	A1 0.00 – 0.20 Clear	Light clay	Weak angular peds <10mm, firm	<2% coarse fragments 2- 6mm	10YR3/1 Very dark gray	Humid – moderately moist, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
			fragments 2- 4mm	B21 0.20 – 0.66 Diffuse	Medium clay	Moderate angular peds <20mm, firm	<5% coarse fragments 2- 6mm and black nodules	10YR3/1 Very dark gray	Moderately moist, well drained	Very fine, few	0.30 / 6.5		
				B22 0.66 – 0.80 Abrupt	Medium clay	Moderate angular peds <20mm, firm	Nil	10YR3/2 Very dark grayish brown	Moderately moist, well to moderately drained	Nil	0.60 / 7.0		Continued over page >>

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Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.		Soil Profile Description									
				B23 0.80 – 1.05	Silty clay loam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, moderately moist	Nil	0.90 / 7.0			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	642009 mE 7538199 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use Landform								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <10% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 - 0.18 Abrupt B21 0.18 - 0.70 Abrupt	Light clay Light clay	Weak subangular peds <10mm. weak Moderate angular peds <20mm,	Nil <5% black nodules	10YR3/2 Very dark grayish brown 10YR4/3 Brown	Dry, well drained Dry, well drained	Very fine, few Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B22 0.70 – 1.00	Silty clay loam	firm Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	640780 mE 7538332 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <20% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 - 0.18 Abrupt B21 0.18 - 0.70 Abrupt	Light clay	Weak subangular peds <10mm. weak Moderate angular peds <20mm, firm	Nil Nil	10YR3/2 Very dark grayish brown 10YR4/3 Brown	Dry, well drained Dry, well drained	Very fine, few Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B22 0.70 - 1.00	Silty clay Ioam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	642345 mE 7538845 mN	Brown Vertosol	Detailed - 50mm hand auger	23/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, mid slope <1%	Minor Brigalow regrowth	Extensive clearing, <20% crabhole gilgai	Hard setting, fine-medium cracking, no coarse fragments	A1 0.00 – 0.17 Abrupt B21 0.17 – 0.70 Abrupt	Light clay Light clay	Weak subangular peds <10mm. weak Moderate angular peds <20mm, firm	Nil <5% black nodules	10YR3/2 Very dark grayish brown 10YR4/3 Brown	Dry, well drained Dry, well drained	Very fine, few Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B22 0.70 – 1.00	Silty clay Ioam	Weak angular peds <10mm, firm	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	645889 mE 7539715 mN	Brown Vertosol	Detailed - 50mm hand auger	24/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain <0.5%	Mixed regrowth	Normal gilgai 30% coverage	Firm, cracking 5-15mm, thick crust	A1 0.00 - 0.17 Diffuse B21 0.17 - 0.60 Abrupt	Light clay	Weak subangular peds <10mm. weak Moderate angular peds <20mm, firm	Nil <2% black nodules	10YR3/2 Very dark grayish brown 10YR4/3 Brown	Dry, well drained Dry, well drained	Very fine, few Very fine, few	0.00 / 6.5	No samples taken	No recovery at 0.80m
				B22 0.60 - 0.80	Light clay	Weak angular peds <10mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	644357 mE 7539882 mN	Brown Vertosol	Detailed - 50mm hand auger	24/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain <1.0%	Sparse regrowth – Brigalow and	Shallow linear gilgai, approx. 3m	Cracking, <2% coarse fragments	A1 0.00 – 0.21 Abrupt	Light clay	Moderate, <10mm peds, firm	<2% calcium carbonate	10YR4/3 Brown	Dry, well drained	Fine, few	0.10 / 8.0	No samples taken	No additional observations
	other	diameter x 0.3m deep, 20-30%	<5mm diameter	B21 0.21 – 0.68 Clear	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/3 Brown	Moderately moist, well drained	Very fine, few	0.30 / 7.5 0.60 / 8.0	-	
		coverage		B22 0.68 – 1.00	Light clay	Moderate, <20mm peds, firm	<2% black nodules <5mm	10YR4/4 Dark yellowish brown	Moderately moist, well drained	Nil	0.90 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	646290 mE 7537672 mN	Brown Vertosol	Detailed - 50mm hand auger	24/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow and various regrowth	Melon holes 0.3-0.8m deep, 50% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	A1 0.00 – 0.17 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No recovery at 0.85m
				B2 0.17 – 0.85	Light clay	Moderate angular peds <20mm, firm	<2% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	646209 mE 7539072 mN	Brown Vertosol	Detailed - 50mm hand auger	24/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow and various regrowth	Melon holes 0.3-0.8m deep, 50% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	A1 0.00 – 0.20 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				B2 0.20 – 1.00	Light clay	Moderate angular peds <20mm, firm	Nil	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	647284 mE 7537230 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	24/6/2017

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Mixed woodland, Brigalow and	Nil	Hard setting, no coarse fragments	A11 0.00 – 0.14 Abrupt	Silty loam	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very fine, few	0.10 / 6.0	0.00 - 0.10 0.20 - 0.30 0.50 - 0.60	No recovery at 0.67m
plains, upper slope	Poplar Box			A12 0.14 – 0.36 Abrupt	Silty loam	Weak subangular, weak	Nil	7.5YR3/4 Dark reddish brown	Dry, well drained	Nil	0.30 / 6.5		
				B2 0.36 – 0.67	Loam	Weak subangular peds <10mm, weak	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.60 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	645284 mE 7536971 mN	Brown Sodosol	Detailed - 50mm hand auger	24/6/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar Box	Nil	Firm, no coarse fragments	A11 0.00 – 0.24 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, mid slope 2%				A12 0.24 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.89 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.89 – 1.00	Clay loam sandy	Subangular, very firm	Very hard, 10% red & white nodules and coarse fragments	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		
Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 643930 mE 7538329 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type:SurveyDetailed - 50mm hand auger25/6/20									
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	Landscape	Surface		Soil Profile									

Land use								Soil Profile	Description				
Eandform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Various regrowth	Extensive cleared	Hard setting, coarse fragments 2-	A11 0.00 – 0.14 Abrupt	Loamy sand	Massive loose	<5% coarse fragments, 2-6mm	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.5	No samples taken	Refusal after three attempts
plains <2%			5mm – 10- 20% coverage	A12 0.14 – 0.45	Loamy sand	Massive loose	<10% coarse fragments, 2-6mm	10YR4/2 Dark grayish brown	Dry, moderately well drained	Nil	0.30 / 6.5		at 0.45m

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	647017 mE 7536252 mN	Brown Vertosol	Detailed - 50mm hand auger	25/6/2017

Surface



Land use		M isson list	Gurlan					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain	Brigalow and various regrowth	Normal gilgai <0.3m deep 30% coverage	Firm, cracking 5-10m, 15mm+ in isolated areas, crusting	0.00 – 0.12 Abrupt	Light clay	Weak subangular peds <10mm. weak	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very fine, few	0.00 / 6.5	No samples taken	No additional observations
				0.12 - 1.00	Light clay	Moderate angular peds <20mm, firm	<2% black nodules	10YR4/3 Brown	Dry, well drained	Very fine, few	0.30 / 6.5 0.60 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	645420 mE 7536076 mN	Brown Sodosol	Detailed - 50mm hand auger	25/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar Box	Nil	Firm, no coarse fragments	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, mid slope 2%				A12 0.25 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.92 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.92 - 1.00	Clay loam sandy	Subangular, very firm	<2% coarse fragments 2-6mm	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	645024 mE 7535576 mN	Brown Sodosol	Detailed - 50mm hand auger	25/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar Box, some Moreton Bay Ash	Nil	Firm, no coarse fragments	A11 0.00 – 0.25 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, mid slope 2%				A12 0.25 – 0.50 Abrupt	Loamy sand	Massive, very weak	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	0.30 / 6.5		
				B21 0.50 – 0.88 Abrupt	Clay loam sandy	Subangular, very firm	<2% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, well drained	Nil	0.60 / 7.0		
				B22 0.88 – 1.00	Clay loam sandy	Subangular, very firm	<2% coarse fragments 2-6mm	10YR3/3 Dark brown Mottle: 10YR5/8 Strong brown	Dry, imperfectly drained	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	643862 mE 7535154 mN	Red Rudosol	Detailed - 50mm hand auger	25/6/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, mid	Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.10 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown No mottles	Dry, rapid	Very fine, very few	0.05 / 6.5	0.00 - 0.05 0.25 - 0.35 0.60 - 0.70 0.90 - 1.00	No additional observations
slope 2%				A12 0.10 – 0.37 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 No mottles	Dry, rapid	Very fine, very few	0.30 / 6.5		
				A21 0.37 – 0.80 Abrupt	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown No mottles	Dry, well drained	Very fine, very few	0.60 / 6.5		
				A22 0.80 – 1.00	Loamy sand	Weak, rounded peds <20mm, Weak	<5% Manganese nodules	2.5YR2.5/3 Dark reddish brown No mottles	Dry, well drained	Nil	0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	643672 mE 7535697 mN	Red Rudosol	Detailed - 50mm hand auger	25/6/2017
	Humboldt, Blackwater, Junee				

Surface



		~ ~	Soil Profile Description									
Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.10 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
			A12 0.10 – 0.36 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Very fine, very few	0.30 / 6.5		
			A21 0.36 – 0.82 Abrupt	Loamy sand	Weak, rounded peds <20mm,	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Very fine, very few	0.60 / 6.5		
			A22 0.82 – 1.00	Loamy sand	Weak Weak, rounded peds <20mm,	<5% Manganese nodules	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 6.5		
Bla	Natural /egetation ackbutt, Blue im	Natural /egetation Initial function Disturbance Erosion ackbutt, Blue im Limited clearing	Natural /egetation Interventer Disturbance Erosion Data Condition, surface rock ackbutt, Blue Im Limited clearing Soft, no coarse fragments	Natural /egetation Instruction Disturbance Erosion Condition, surface rock Horizon Depth (m), Boundary ackbutt, Blue Im Limited clearing Soft, no coarse fragments A11 0.00 - 0.10 Abrupt A12 0.10 - 0.36 Abrupt A21 0.36 - 0.82 Abrupt A21 0.36 - 0.82 Abrupt A22 0.82 - 1.00	Natural /egetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureackbutt, Blue umLimited clearingSoft, no coarse fragmentsA11 0.00 – 0.10 AbruptLoamy sandA12 0.10 – 0.36 AbruptLoamy sandA21 0.36 – 0.82 AbruptLoamy sandA21 0.36 – 0.82 AbruptLoamy sandA22 0.82 – 1.00Loamy sand	Natural /egetation Disturbance Erosion Condition, surface rock Horizon Depth (m), Boundary Texture Structure, Strength ackbutt, Blue Im Limited clearing Soft, no coarse fragments A11 Loamy Massive, Ioose A12 Loamy Massive, Ioose Ioose A12 Loamy Massive, Ioose A21 Loamy Weak, rounded Sofd, no coarse Abrupt Sofd, no coarse A21 Loamy Weak, rounded A22 Loamy Sand rounded peds <20mm, Weak Comm, Weak Sofd, no coarse A22 Loamy Weak, rounded	Natural /egetationInstruction Disturbance ErosionJonation surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions Segregationsackbutt, Blue ImmediationLimited clearingSoft, no coarse fragmentsA11 0.00 – 0.10 AbruptLoamy sandMassive, looseNilA12 0.10 – 0.36 AbruptLoamy sandMassive, looseNilA21 0.36 – 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNilA22 0.82 – 1.00Loamy sandSoft Manganese nodules	Natural /egetationDisturbance ErosionDisturbance surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, Mottleackbutt, Blue umLimited clearingSoft, no coarse fragmentsA11 0.00 - 0.10 AbruptLoamy sandMassive, looseNil2.5YR3/3 Dark reddish brownA12 0.10 - 0.36 AbruptLoamy sandMassive, looseNil2.5YR3/4 Dark reddish brownA12 0.36 - 0.82 AbruptLoamy sandMassive, looseNil2.5YR3/4 Dark reddish brownA21 0.36 - 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownA22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brown	Natural /egetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, Drainageackbutt, Blue imLimited clearingSoft, no coarse fragmentsA11 0.00 - 0.10 AbruptLoamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidA12 0.10 - 0.36 AbruptLoamy A12 0.36 - 0.82 AbruptMassive, sandNil2.5YR3/4 Dark reddish brownDry, rapidA21 0.36 - 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedA22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakSith coales condition coalesDry, well drainedA22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakSith coales coalesSith coales peds coalesSith coales peds coalesDry, well drainedA22 0.82 - 1.00Loamy weakWeak, rounded peds coalesSith coales coalesSith coales peds coalesSith coales peds coalesSith coales peds coalesDry, well drainedA22 0.82 - 1.00Loamy weakWeak, rounded peds coalesSith coales peds coalesSith coales peds coalesSith coales peds coalesDry, well drainedA21 Dark reddish brownLoamy weakWeak, <br< td=""><td>Natural /egetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, DrainageRootsackbutt, Blue imLimited clearingSoft, no coarse fragmentsA11 0.00 - 0.10Loamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidVery fine, very fewA12 0.10 - 0.36 AbruptLoamy A12Massive, looseNil2.5YR3/4 Dark reddish brownDry, rapidVery fine, very fewA21 0.36 - 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very fewA22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakStructure, sandNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very fewA22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakStructure, sandStructure, sandStructure, sandStructure, sandNil2.5YR2.5/3 Dark reddish brownDry, well drainedNilMassive, peds <20mm, WeakCoamy weakWeak, rounded peds <20mm, WeakStructure, sandStructure, sandStructure, sandNilStructure, sandNilMassive, weakNilWeak, weakStructure, sandNilNilStructure,<br <="" td=""/><td>Natural /egetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, Dark reddish brownRootsDepth (m) / Field phackbutt, Blue imLimited clearingSoft, no coarse fragmentsA11 AbruptLoamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidVery fine, very few0.05 / 6.5A12 0.10 - 0.36 AbruptLoamy sandMassive, looseNil2.5YR3/4 Dark reddish brownDry, rapidVery fine, very few0.30 / 6.5A21 0.36 - 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very few0.60 / 6.5A22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very few0.60 / 6.5A22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5Motional drainedA22 dom WeakLoamy weakWeak, rounded peds <20mm, Weak<5% Manganese nodules2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5</br></td><td>Natural /degetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, DrainageRootsDepth (m) / FieldSample (m)ackbutt, Blue mLimited (clearing)Limited (clearing)Soft, no coarse fragmentsA11 (a)0 - 0.10 (b)0 - 0.36Loamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidVery fine, very few0.05 / 6.5No samples takenA12 (a)10 - 0.36 (b)10 - 0.36 (b)10 - 0.36 (b)10 - 0.36Loamy sandMassive, looseNil2.5YR3/4 Dark reddish brownDry, rapidVery fine, very few0.30 / 6.5No samples takenA21 (a)26 - 0.82 (b)26 - 0.82 (b)26 - 0.82 (b)26 - 0.82Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very few0.60 / 6.5A22 (b)28 - 1.00Loamy (b)28 - 1.00Weak, rounded peds <20mm, Weak<5% Manganese nodules2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5A22 (b)28 - 1.00Loamy (b)28 - 1.00Weak, veak<5% Manganese nodules2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5</td></td></br<>	Natural /egetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, DrainageRootsackbutt, Blue imLimited clearingSoft, no coarse fragmentsA11 0.00 - 0.10Loamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidVery fine, very fewA12 0.10 - 0.36 AbruptLoamy A12Massive, looseNil2.5YR3/4 Dark reddish brownDry, rapidVery fine, very fewA21 0.36 - 0.82 AbruptLoamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very fewA22 0.82 - 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1.00Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedVery fine, very few0.60 / 6.5A22 0.82 - 1.00Loamy sandWeak, rounded peds <20mm, WeakNil2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5Motional drainedA22 dom WeakLoamy weakWeak, rounded peds <20mm, Weak<5% Manganese nodules2.5YR2.5/3 Dark reddish brownDry, well drainedNil0.90 / 6.5</br></td> <td>Natural /degetationDisturbance ErosionCondition, surface rockHorizon Depth (m), BoundaryTextureStructure, StrengthInclusions SegregationsColour, MottleMoisture, DrainageRootsDepth (m) / FieldSample (m)ackbutt, Blue mLimited (clearing)Limited (clearing)Soft, no coarse fragmentsA11 (a)0 - 0.10 (b)0 - 0.36Loamy sandMassive, looseNil2.5YR3/3 Dark reddish brownDry, rapidVery fine, very few0.05 / 6.5No samples takenA12 (a)10 - 0.36 (b)10 - 0.36 (b)10 - 0.36 (b)10 - 0.36Loamy sandMassive, looseNil2.5YR3/4 Dark reddish brownDry, rapidVery fine, very few0.30 / 6.5No samples takenA21 (a)26 - 0.82 (b)26 - 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Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt,	Location (GDA ZONE 55): 644257 mE 7536493 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 25/6/2017
	Landscape	Surface		Soil Profile	

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Blackbutt, gums	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
plains, mid slope 1%				B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	643169 mE 7536162 mN	Red Rudosol	Detailed - 50mm hand auger	25/6/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Blackbutt, Blue Gum	Limited clearing	Soft, no coarse fragments	A11 0.00 – 0.12 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
plains, upper slope 1-2%				A12 0.10 – 0.38 Abrupt	Loamy sand	Massive, loose	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Very fine, very few	0.30 / 6.5		
				A21 0.38 – 0.82 Abrupt	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Very fine, very few	0.60 / 6.5		
				A22 0.82 - 1.00	Loamy sand	Weak, rounded peds <20mm, Weak	Nil	2.5YR2.5/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	644557 mE 7534788 mN	Brown Sodosol	Detailed - 50mm hand auger	26/6/2017
	Humboldt, Blackwater				

Surface



Land use			Surface	Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Mixed rall woodlands; Poplar Box,	Nil	Firm / Hard setting, no coarse	A11 0.00 – 0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, upper slope 2%	White Gums, Blackbutt		fragments	A12 0.14 – 0.58 Diffuse	Loamy sand	Massive, loose	<5% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.58 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<10% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	642671 mE 7536617 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	26/6/2017

Surface



Land use			Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Blackbutt, gums	Nil	Firm, no coarse fragments	A1 0 – 0.26 Abrupt	Clayey sand	Weak, very weak, peds <10mm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, few	0.1 – 6.5	No samples taken	No additional observations
plains, mid slope 2%				B21 0.26 – 0.49 Abrupt	Loamy sand	Weak, very weak, peds <10mm	Nil	10YR3/4 Dark yellowish brown	Dry, humid	Nil	0.3 / 6.5		
				B22 0.49 – 1.0	Loamy sand	Moderate, weak, peds 5-20mm	Nil	10YR4/4 Dark yellowish brown	Dry, humid	Nil	0.6 / 7.0 0.9 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	647922 mE 7535666 mN	Brown Vertosol	Detailed - 50mm hand auger	26/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Mid slope 1.5%	Sparse shrubs, short grass	Minimal gilgai visible, complete clearing	Firm, some cracking, no coarse fragments	0.00 – 0.18 Abrupt 0.18 – 0.80 Abrupt	Light clay Medium clay	Weak peds 1-5mm, firm Moderate sub angular peds 5- 30mm, strong	Nil Nil	10YR3/2 Very dark greyish brown 10YR3/3 Dark brown	Dry, well drained Dry, well drained	Fine, few Fine, few	0.05 / 7.0 0.30 / 7.0 0.60 / 7.5	No samples taken	No recovery at 0.80m Difficult augering between 0.70 – 0.80
				0.80 – 0.90	Light clay	Strong subangular <10mm, firm	Nil	10YR3/3 Dark brown	Dry, well drained	Very fine, very few	0.90 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	645865 mE 7535219 mN	Brown Vertosol	Detailed - 50mm hand auger	26/6/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Brigalow regrowth, tall Brigalow	Extensive clearing	Firm, fine cracking, <10% coarse	A1 0.00 – 0.11 Abrupt	Sandy clay Ioam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.05 / 6.5	No samples taken	Similar to site 55, but
plains, lower slope 2% into water body	nearby, extensive clearing		fragments and black nodules	B21 0.11 – 0.38 Graduate	Clay loam sandy	Moderate, subangular peds <20mmm, firm	<5% manganese nodules	10YR4/3 Brown	Dry, well drained	Fine, few	0.30 / 6.5		due to proximity to SMU boundary
				B22 0.38 - 1.00	Light clay	Moderate, subangular peds <30mmm, firm	<5% manganese nodules	10YR3/3 Dark brown Mottle: 10YR5/8 <2% 0.8 – 1.0m	Dry, well drained	Very fine, very few	0.60 / 6.5 0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	645115 mE 7534838 mN	Brown Sodosol	Detailed - 50mm hand auger	26/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently	Mixed rall woodlands; Poplar Box	Nil	Firm / Hard setting, no	A11 0.00 – 0.12 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, upper slope 2%	White Gums, Blackbutt		fragments	A12 0.12 – 0.61 Diffuse	Loamy sand	Massive, loose	<2% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.61 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<5% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	643464 mE 7534654 mN	Brown Sodosol	Detailed - 50mm hand auger	26/6/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Mixed rall woodlands; Poplar Box,	Nil	Firm / Hard setting, no coarse	A11 0.00 – 0.13 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very fine, few	0.10 / 6.0	No samples taken	No additional observations
plains, upper slope 2%	White Gums, Blackbutt		fragments	A12 0.13 – 0.57 Clear	Loamy sand	Massive, loose	<5% coarse fragments and manganese nodules	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.30 / 6.0		
				B2 0.57 – 1.00	Clay loam sandy	Weak subangular peds <10mm, weak	<10% coarse fragments, manganese and red nodules	10YR4/3 Brown	Dry, moderately well drained	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	642373 mE 7534439 mN	Brown Sodosol	Detailed - 50mm hand auger	7/07/2017
	Humboldt, Blackwater				

Surface

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, 2% gently undulating plains,	Poplar Box regrowth	Nil	Firm, <5% coarse fragments, 0- 10mm	A11 0 – 0.08 Abrupt	Loamy sand	Massive, loose	<2% coarse fragments, 2- 6mm	10YR4/3 Brown	Dry, rapid	Very fine, very few	0.05 / 6.5	No samples taken	No additional observations
midslope			diameter	A12 0.08 – 0.60 Abrupt	Loamy sand	Massive, loose, peds <10%, 10mm, rounded, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very fine, very few	0.3 / 6.5 0.6 / 7.0		
				B2 0.60 -1.00	Clay loam sandy	Massive, very weak	<20% coarse fragments, 2- 6mm	10YR5/4 Yellow brown	Dry, well drained	Nil	0.9 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt,	640162 mE 7535256 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	7/07/2017
	Blackwater				

Landscape









Soil Profile

Land use		Minneria	Gunfaar					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, mid	Poplar Box with various woodlands such as	Access track nearby	Hard setting with minor cracking, no coarse	A11 0 – 0.12 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/3 Dark Brown No mottle	Dry, rapid	Fine, very few	0.05 / 6.5	0.0 - 0.1 0.3 - 0.4 0.5 - 0.6 0.6 - 0.7	No additional observations
slope, 1.5%	Blackbutt		fragments	A12 0.12 – 0.42 Abrupt	Clayey sand	Massive to weak, weak, <10% peds <10mm	Nil	10YR3/3 Dark brown No mottle	Dry, rapid	Fine, very few	0.2 / 6.5	0.9 – 1.0	
				B21 0.42 – 0.60 Abrupt	Clay loam sandy	Moderate, weak, peds 10- 30mm subangular	Nil	10YR4/4 Dark yellowish brown No mottle	Dry, well drained	Nil	0.6 / 7.5		
				B22 0.60 – 0.73 Abrupt	Light clay	Moderate, weak, peds 10- 30mm subangular	Nil	7.5YR4/3 Brown No mottle	Dry, well drained	Nil	Nil		

					Soil Profile Description									
Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.		Soil Profile Description									
				B22 0.73 – 1.00	Light clay	Moderate, weak, peds 10- 30mm subangular	Nil	10YR3/3 Dark brown No mottle	Dry, well drained	Nil	0.9 / 7.5			

Soil Profile

SITE 61

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Connors, Humboldt, Blackwater,	639679 mE 7535396 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	18/6/2014

Surface



Land use		Missionalise	Gurdena					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Spare Morton Bay Ash, occasional other	Shallow gilgai, extensive clearing	Cracking, surface crust, no coarse fragments	A11 0.0 – 0.08 Abrupt	Silty loam	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, fine	0.05 / 6.5	No samples taken	No additional observations
	Eucalypts spp.	5		A12 0.08 – 0.19 Abrupt	Silty loam	Massive, weak	<2% coarse fragments, 2- 6mm	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, fine	0.1 / 6.5		
				B21 0.19 – 0.6 Abrupt	Light clay	Moderate, very firm, <20mm subangular	Nil	10YR3/1 Dark grey	Dry, well drained	Very few, fine	0.3 / 6.5		
				B22 0.6 – 0.7 Abrupt	Light clay	Moderate, very firm, <20mm subangular	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 7.5		

Land use Landform	Natural Vegetation	Microrelief Disturbance	Surface condition.					Soil Profile	Description			
				0.7 – 0.95	Light clay	Moderate, firm, <10mm subangular	<2% manganese nodules	10YR4/3 Brown	Dry, well drained	Nil	0.8 / 7.5	

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
A1	Monteagle, Connors, Blackwater	641685 mE 7533763 mN	Haplic Grey Kandosol	Detailed - 50mm hand auger	7/7/2017









Land use		Missourchief	Surface	Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Drainage line <1%	Moreton Bay Ash, Paperbark and various eucalyptus	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0 – 0.55 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown No mottles	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	Cutting, open face	
				B2 0.55 – 1.00	Sandy Ioam	Massive loose	Nil	10YR3/3 Dark brown No mottles	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5			

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Soil Profile

SITE 63

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	642716 mE 7535827 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	7/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow plus regrowth 40% cover	Melon holes 5-10m wide 0.5m deep, 20% cover.	Cracking 3- 10mm, crusting	A1 0.00 – 0.12 Abrupt	Light clay	Moderate, strong 5- 15mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.1 / 7.5	No samples taken	Check aerial imagery
				B2 0.12 - 1.00	Light clay	Moderate, strong 10- 40mm sub- angular	<1% Calcium carbonate	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.3 / 7.5 0.6 / 7.5 0.9 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	641517 mE 7536522 mN	Red Rudosol	Detailed - 50mm hand auger	8/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, 1% Very gently undulating plains	Blackbutt, minor Moreton Bay Ash	Nil microrelief Extensive clearing	Firm to soft, no coarse fragments	A1 0 – 0.13 Abrupt	Loamy sand	Massive, loose	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Fine, few	0.05 / -	No samples taken	No additional observations
		No erosion		A21 0.13 – 0.5 Abrupt	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	5YR4/3 Reddish brown	Dry, rapid	Fine, very few	0.3 / -		
				A22 0.5 – 1.0	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	2.5YR4/4 Reddish brown	Dry, rapid	Nil	0.6 / - 0.9 / -		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	640759 mE 7536657 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	8/7/2017

Surface



Land use	Land use Landform Natural Microrelief Surface				Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, 2% Very gently undulating plain.	Blackbutt	Nil microrelief Slightly clearing	Firm to soft, no coarse fragments	A1 0 – 0.14 Abrupt	Clayey sand	Massive, loose	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Fine, few	0.05 / -	No samples taken	No additional observations	
downslope		No erosion		B21 0.14 – 0.52 Abrupt	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	5YR4/3 Reddish brown	Dry, rapid	Fine, very few	0.3 / -			
				B22 0.52 – 1.0	Loamy sand	Moderate, very weak peds, 5- 20mm angular	Nil	2.5YR4/4 Reddish brown	Dry, rapid	Nil	0.6 / - 0.9 / -			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	641596 mE 7536037 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	8/7/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating, mid-slope, <1.5%	Moreton Bay Ash, Poplar Box	Nil	Hard setting, no coarse fragments	A1 0 - 0.10 Abrupt B21 0.10 - 0.45 Abrupt	Clayey sand Clayey sand	Massive, loose Weak, strong, sub- angular peds	<1% coarse fragments, <2mm <10% coarse fragments, <2mm	10YR3/2 Very dark greyish brown 10YR3/1 Very dark grey	Dry, rapid Dry, rapid	Fine, few Fine, few	0.1 / -	0.0 - 0.1 0.3 - 0.4 0.6 - 0.7	Boundary 150m to the south east, eucalyptus
				B22 0.45 – 0.8	Clayey sand	Weak, strong, sub- angular peds <10mm	Nil	10YR4/1 Dark grey	Dry, rapid	Nil	0.6 / -		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
S1	Somerby, Monteagle, Connors,	641184 mE 7534924 mN	Brown Sodosol	Detailed - 50mm hand auger	8/7/2017	
	Humboldt, Blackwater					

Surface



Land use Landform			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Flat plain 0.5%	Poplar Box	Minor clearing	Hard setting, no coarse fragments	A11 0.00 – 0.26 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very fine, very few	0.10 / 6.0	No samples taken	No recovery at 0.80m
				A12 0.26 – 0.48 Abrupt	Clay loam sandy	Weak <10mm subangular peds, firm	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.30 / 7.0		
				B2 0.48 - 0.80	Clay loam sandy	Weak <10mm subangular peds, firm	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Nil	0.60 / 7.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L1	Monteagle, Connors, Humboldt,	641301 mE 7533293 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	8/7/2017
	Blackwater				

Landscape







Soil Profile

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0.5%	Poplar Box, Ironbark, various regrowth	Nil	Hard setting, some very minor cracking, no	A1 0.00 – 0.18 Abrupt	Clayey sand	Massive weak	Nil	10YR4/2 Dark greyish brown No mottle	Dry, rapid	Very few, very fine	0.10 / 6.5	0.00 - 0.10 0.30 - 0.40 0.60 - 0.70 0.90 - 1.00	No additional observations
			coarse fragments	B21 0.18 – 0.35 Abrupt	Light clay	Moderate subangular peds 10- 20mm, firm	Nil	10YR3/3 Dark brown No mottle	Dry, moderately well- drained	Nil	0.30 / 6.5		
				B22 0.35 – 0.75 Abrupt	Light clay	Moderate subangular peds 10- 20mm, strong	<2% calcium carbonate	10YR4/4 Dark yellowish brown No mottle	Dry, moderately well- drained	Nil	0.60 / 7.5		
				B23 0.75 – 1.00	Light clay	Moderate subangular peds 10- 20mm, very strong	<2% calcium carbonate	7.5YR4/3 Brown No mottle	Dry, moderately well- drained	Nil	0.90 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L1	Monteagle, Connors, Humboldt, Blackwater	639657 mE 7533857 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	8/7/2017

Surface



Land use		Managelia	Configure					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0.5%	Poplar Box	Nil	Hard setting, <5% coarse fragments, minor cracking	A11 0.00 - 0.06 Abrupt A12 0.06 - 0.21	Loamy sand Loamy sand	Massive, weak Massive, weak	Nil Nil	10YR4/2 Dark greyish brown 10YR5/2 Greyish brown	Dry, rapid Dry, rapid	Very fine, very few Very fine, very few	0.10 / 6.5	No samples taken	No additional observations
				Abrupt B2 0.21 – 1.00	Light clay	Moderate, subangular peds 10- 20mm, firm	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	fine, very few, very coarse 0.22-0.34m	0.60 / 7.5 0.90 / 8.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
L1	Monteagle, Connors, Humboldt,	642876 mE 7532061 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	8/7/2017
	Blackwater				

Surface









Land use		Missourlief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating plain, 0.5%	Poplar Box	Gully erosion	Hard setting, coarse fragments <2% 2-5mm	A1 0.00 – 0.27 Abrupt	Loamy sand	Weak, peds 5-20mm, firm	10% Coarse fragments 5mm diameter – high due to cutting location	10YR4/2 Dark greyish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	Exposed cutting
				B2 0.27 – 1.00	Light clay	Weak, peds 10-30mm, strong	<5% manganese nodules	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 6.5 0.60 / 7.0 0.60 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	641112 mE 7533281 mN	Brown Vertosol	Detailed - 50mm hand auger	9/7/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow nearby	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1- 3mm	A1 0.00 - 0.13 Abrupt B21 0.13 - 0.60 Abrupt	Light clay	Weak subangular peds 2- 10mm, firm Moderate subangular peds 5- 50mm, firm	Nil Nil	10YR3/3 Dark brown 10YR4/4 Dark yellowish brown	Dry, well drained Dry, well drained	Very few, very fine	0.00 / 7.5	No samples taken	No additional observations
				B22 0.60 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR5/3 Brown	Dry, well drained	Nil	0.65 / 7.5 0.90 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	638941 mE 7536129 mN	Brown Sodosol	Detailed - 50mm hand auger	9/7/2017
	Humboldt, Blackwater				

Surface



Land use		Minner	Conference of					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar box, minor Moreton Bay	Nil	Hardsetting, minor fine cracking	A1 0.00 – 0.29 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Fine, few	Nil	No samples taken	No additional observations
plains,	Ash			B2 0.29 - 1.00	Clay loam sand	Weak, firm <10mm subangular	0.90-1.00 - <5% Calcium Carbonate	10YR4/4 Dark yellowish brown	Dry, Rapid	Fine, few to 0.40m	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	638343 mE 7536301 mN	Brown Sodosol	Detailed - 50mm hand auger	9/7/2017

Landscape



Land use		Minneria	Conference of					Soil Profile	Description				
Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar box, minor Moreton Bay	Nil	Hardsetting, minor fine cracking	A1 0.00 – 0.29 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Fine, few	Nil	No samples taken	No additional observations
plains,	Ash			B2 0.29 - 1.00	Clay loam sand	Weak, firm <10mm subangular	0.90-1.00 - <5% Calcium Carbonate	10YR4/4 Dark yellowish brown	Dry, Rapid	Fine, few to 0.40m	Nil		

Surface

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
A1	Monteagle, Connors, Blackwater	637205 mE 7536563 mN	Haplic Grey Kandosol	Detailed - 50mm hand auger	9/7/2017









Land use		Misusuelief	Guntana					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Drainage line	Moreton Bay Ash, Paperbark and various	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0.00 – 0.40 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	No additional observations
	eucalyptus			B2 0.40 - 1.00	Sandy Ioam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	638118 mE 7537230 mN	Brown Vertosol	Detailed - 50mm hand auger	9/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow plus regrowth 40% cover	Normal gilgai 5-10m wide <0.3m deep, 20% cover.	Cracking 3- 10mm, crusting	A1 0.0 – 0.11 Abrupt	Light clay	Moderate, strong 5- 15mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.1 / 7.5	No samples taken	Cracking surface begins 200m to south
				B2 0.11 – 1.00	Light clay	Moderate, strong 10- 40mm sub- angular	<1% Calcium carbonate	10YR3/2 Very dark grayish brown	Dry, well drained	Few, fine	0.3 / 7.5 0.6 / 7.5 0.9 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt Blackwater	638988 mE 7537849 mN	Brown Sodosol	Detailed - 50mm hand auger	9/7/2017

Surface



Land use								Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Upper slope 2%	Eucalypts, Blackbutt, Ironbark	Nil	Firm, no coarse fragments	A11 0.00-0.10 Abrupt	Loamy sand	Massive, loose	Nil	7.5YR3/2 Dark brown	Dry, Rapid	Fine, very few	0.1 / 6.5	No samples taken	No additional observations
				A12 0.10-0.60 Abrupt	Loamy sand	Massive, loose	Nil	7.5YR4/2 Brown	Dry, Rapid	Fine, very few	0.3 / 6.5		
				B21 0.60-0.90 Abrupt	Clay loamy sand	Moderate, sub angular peds 5- 15mm, weak	Nil	7.5YR4/3 Brown Mottle 10YR5/8 Yellowish brown 10%	Dry, Well drained	Nil	0.6 / 6.5		
				B22 0.90-1.00	Clay loamy sand	Moderate, sub angular peds 5- 15mm, weak	Nil	7.5YR4/4 Brown Mottle 2% 2.5YR3/6 Dark red 30% 10YR5/8	Moderately moist, Well drained	Nil	0.9 / 6.5		

Soil Mapping Unit: A1	CSIRO Land Systems (Gunn et al 1967): Monteagle, Connors, Blackwater	Location (GDA ZONE 55): 639075 mE 7535363 mN	Aust. Soil Class. : Haplic Grey Kandosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 10/7/2017
	Landscape	Surface		Soil Profile	

Land use		Minunuliaf	Gundana	Soil Profile Description									
Pattern, Element, Slope	Natural Disturbance c Vegetation Erosion su	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Drainage line	Moreton Bay Ash, Paperbark and various	Gully erosion	Firm, <1 % 1- 3mm coarse fragments	A1 0.00 – 0.40 Abrupt	Loam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.1 / 6.5 0.4 / 6.5	No samples taken	No additional observations
	eucalyptus			B2 0.40 - 1.00	Sandy Ioam	Massive loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Fine, few	0.6 / 6.5 0.9 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt, Blackwater	637975 mE 7535725 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	10/7/2017

Surface



Land use								Soil Profile	Description				
Pattern, Natu Element, Slope Grazing, Poplar I	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Semi-cleared	Nil	A11 0.00-0.08 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope				A12 0.08-0.39 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, Rapid	Very few, very fine	0.30 / 6.5		
				B21 0.39-0.81 Abrupt	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments	10YR5/3 Brown	Wet, well drained	Very few, very fine	0.60 / 7.0		
				B22 0.81-1.00	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments / manganese	10YR4/3 Brown	Wet, well drained	Very few, very fine	0.90 / 7.0		
Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt, Blackwater	636803 mE 7536266 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Semi-cleared	Nil	A11 0.00-0.10 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope				A12 0.10-0.35 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, Rapid	Very few, very fine	0.30 / 6.5		
				B21 0.35-0.80 Abrupt	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments	10YR5/3 Brown	Wet, well drained	Very few, very fine	0.60 / 7.0		
				B22 0.80-1.00	Light clay	Moderate, firm <10mm sub angular	<2% <5mm coarse fragments / manganese	10YR4/3 Brown	Wet, well drained	Very few, very fine	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	636281 mE 7535894 mN	Brown Vertosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1-	A1 0.00 – 0.10 Abrupt B21	Light clay Light clay	Weak subangular peds 3- 10mm, firm Moderate	Calcium carbonate 2% Nil	10YR3/3 Dark brown 10YR4/3	Dry, well drained Dry, well	Very few, very fine	0.00 / 8.0	No samples taken	No additional observations
	nearby		3mm	0.10 – 0.35 Abrupt		subangular peds 10- 40mm, firm		Brown	drained				
				B22 0.35 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 8.0 0.90 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	635795 mE 7535541 mN	Brown Vertosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating plains, flat plain 0.5%	Open area, various occasional regrowth, some Brigalow	Very minor normal gilgai	Hard setting, cracking 1- 3mm, <1% coarse fragments 1-	A1 0.00 – 0.10 Abrupt B21	Light clay	Weak subangular peds 3- 10mm, firm Moderate	Calcium carbonate 2% Nil	10YR3/3 Dark brown 10YR4/3	Dry, well drained Dry, well	Very few, very fine	0.00 / 8.0	No samples taken	No additional observations
	nearby		3mm	0.10 – 0.35 Abrupt		subangular peds 10- 40mm, firm		Brown	drained				
				B22 0.35 – 1.00	Light clay	Moderate subangular peds 5- 50mm, firm	Nil	10YR4/2 Dark greyish brown	Dry, well drained	Nil	0.65 / 8.0 0.90 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt,	637217 mE 7535832 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	/7/2017
	Blackwater				

Surface



Land use							Soil Profile	Description					
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Nil	Hard setting, cracking 1- 3mm, <1%	A11 0.00-0.09 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, Rapid	Very few, very fine	0.10 / 6.0	No samples taken	Difficulty augering past
plains, mid slope 1.0%			coarse fragments 1- 3mm	A12 0.09-0.58 Abrupt	Loamy Sand	Massive, loose	Nil	10YR4/3 Brown	Dry, Rapid	Nil	0.30 / 6.0		0.60m
				B21 0.58-0.75 Abrupt	Light clay	Moderate, strong 5-20mm sub angular	<30% 2-4mm coarse fragments	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 6.5		
				B22 0.75-1.00	Light clay	Moderate, strong 20- 50mm sub angular	10% 2-4mm coarse fragments	10YR3/4 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 635670 mE 7534393 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: /7/2017
	Landscape	Surface		Soil Profile	



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0.5%	Brigalow regrowth	Extensive clearing, very minor	Cracking, surface crust, no coarse	A1 0.00-0.09 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Depression
		shallow gilgai	fragments	B21 0.09-0.70 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.70-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	635021 mE 7534371 mN	Brown Vertosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use		Minnenlief	Conferen					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat	Brigalow	Extensive	Cracking,	A1	Light clay	Weak, firm,	<1% coarse	10YR3/2	Dry, well	Few, very fine	Nil	No samples	
plain 0.5%	regrowth	clearing,	surface crust,	0.00-0.10		<10mm	fragments	Very dark grey	drained			taken	Mound
		very minor	no coarse	Abrupt		sub-angular		brown					
		shallow gilgai	fragments	B21	Light clay	Moderate,	Nil	10YR3/1	Dry, well	Nil	Nil		
				0.10-0.70		firm,		Very dark grey	drained				
				Abrupt		<10mm							
						sub-angular							
				B22	Light clay	Moderate,	Nil	10YR4/2	Dry, well	Nil	Nil		
				0.70-1.00		firm,		Dark grayish	drained				
						<10mm		brown					
						sub-angular							

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L1	Monteagle, Connors, Humboldt,	634851 mE 7533622 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	11/7/2017
	Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Eucalypts	Limited clearing, Nil	Firm, no coarse fragments,	A1 0.00-0.12 Abrupt	Loamy Sand	Massive, very weak	Nil	10YR2/2 Very dark brown	Dry, Rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
plains, lower slope 2%		microrelief Nil Erosion	minor cracking	B21 0.12-0.22 Abrupt	Light clay	Moderate, weak 5-20mm sub angular	<2% 2-5mm coarse fragments	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B22 0.22-0.57 Abrupt	Light clay	Moderate, firm 20-60mm sub angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.50 / 6.5		
				B23 0.57-1.00	Light clay	Moderate, firm 20-60mm sub angular	<2% 2-5mm coarse fragments	7.5YR4/3 Brown Mottle 7.5YR2/3 Pink	Dry, imperfect	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	634354 mE 7533735 mN	Brown Vertosol	Detailed - 50mm hand auger	11/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat plain 0.5%	Brigalow regrowth	Extensive clearing, verv minor	Cracking, surface crust, no coarse	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	<1% coarse fragments	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	Nil	No samples taken	Depression
		shallow gilgai	fragments	B21 0.10-0.68 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Nil	Nil		
				B22 0.68-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Nil	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	634228 mE 7535114 mN	Brown Vertosol	Detailed - 50mm hand auger	11/7/2017

Surface



Land use		M isson list	Conferen					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, flat	Brigalow	Extensive	Cracking,	A1	Light clay	Weak, firm,	<1% coarse	10YR3/2	Dry, well	Few, very fine	Nil	No samples	Dennasion
plain 0.5%	regrowth	clearing,	surface crust,	0.00-0.12		<10mm	fragments	Very dark grey	drained			taken	Depression
		very minor	no coarse	Abrupt		sub-angular		brown					
		shallow gilgai	fragments	B21	Light clay	Moderate,	Nil	10YR3/1	Dry, well	Nil	Nil		
				0.12-0.71		firm,		Very dark grey	drained				
				Abrupt		<10mm							
						sub-angular							
				B22	Light clay	Moderate,	Nil	10YR4/2	Dry, well	Nil	Nil		
				0.71-1.00		firm,		Dark grayish	drained				
						<10mm		brown					
						sub-angular							

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	634520 mE 7536198 mN	Brown Vertosol	Detailed - 50mm hand auger	11/7/2017

Surface



Land use		M isson list	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Regrowth, shrubs	Shallow gilgai, Extensive	Cracking, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope, 1.0%		clearing		B2 0.10-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	635087 mE 7535166 mN	Brown Vertosol	Detailed - 50mm hand auger	11/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minnerstief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Regrowth, shrubs	Shallow gilgai, Extensive	Cracking, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope, 1.0%		clearing		B2 0.10-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	635264 mE 7536132 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	11/7/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.32	Clayey sand	Weak, weak/loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.10 / 7.5 0.30 / 7.5	No samples taken	Refusal at 0.95m
plains, upper slope, 0.5%			ragments	B21 0.32-0.60 Abrupt	Clayey sand	Moderate, firm, <10mm	<5% 2- 6mmcoarse fragments	10YR4/2 Dark greyish brown	Dry, rapid	Nil	0.60 / 7.5		
				B22 0.60-0.95	Clayey sand	Moderate, firm, <10mm sub-angular	<20% 2- 6mmcoarse fragments	7.5YR4/3 Brown Mottle 2% 10YR5/8 Yellowish brown	Dry, rapid	Nil	0.90 / 7.5	•	

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt,	634095 mE 7537118 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	12/7/2017
	Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Firm, No coarse fragments	A11 0.00-0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	0.0-0.1 0.3-0.4 0.6-0.7	No additional observations
plains, upper slope, 0.5%				A12 0.14-0.45 Abrupt	Loamy sand	Weak, weak, 5- 20mm sub- angular	<2% 2-6mmcoarse fragments	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 6.5	0.9-1.0	
				B2 0.45-1.00	Light clay	Moderate, firm, 5- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 7.5 0.90 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	635679 mE 7536839 mN	Brown Sodosol	Detailed - 50mm hand auger	12/7/2017

Surface



Land use			Surface	Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.44 Abrupt	Loamy sand	Massive, loose	<10% 2-6mmcoarse fragments	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
plains, upper slope, 0.5%				B2 0.44-1.00	Clay loamy sand	Moderate, firm, 5- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.30 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt,	636775 mE 7538190 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	/7/2017
	Blackwater				

Surface

Landscape







Soil Profile

Land use		Microrelief	ef Surface					Soil Profile Description									
Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations				
Grazing, Very gently undulating	Poplar box	Nil	Firm, No coarse fragments	A1 0.00-0.52 Abrupt	Loamy sand	Massive, loose	< 10% 2-6mmcoarse fragments	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations				
plains, upper slope, 0.5%				B2 0.52-0.45	Light clay	Moderate, firm, 5- 30mm sub- angular	Nil	7.5YR4/4 Brown	Dry, well drained	Very few, very fine	0.30 / 6.5						

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	636346 mE 7538814 mN	Brown Vertosol	Detailed - 50mm hand auger	12/7/2017

Surface



Land use		Minnerslief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Regrowth, shrubs	Shallow gilgai, Extensive	Cracking, No coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, <10mm sub-angular	Nil	10YR3/2 Very dark grey brown	Dry, well drained	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope, 1.0%		clearing		B2 0.10-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR3/1 Very dark grey	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	639736 mE 7537440 mN	Red Rudosol	Detailed - 50mm hand auger	12/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box, Blackbutt	Nil	Firm, <3% <10mm coarse	A11 0.00-0.18 Abrupt	Loamy Sand	Massive, very weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
plains, upper slope, 2.5%			fragments	A12 0.18-0.39 Abrupt	Loamy Sand	Massive, very weak	Nil	5YR4/3 Reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				A21 0.39-0.64 Abrupt	Loamy Sand	Weak, weak <20mm sub angular	Nil	2.5YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.5		
				A22 0.64-1.10	Loamy Sand	Weak, weak <20mm sub angular	Nil	2.5YR4/8 Red	Dry, rapid	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
A2	Somerby, Monteagle, Connors,	644069 mE 7534469 mN	Subnatric Grey Sodosol	Detailed - 50mm hand auger	12/7/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Large open depression	Eucalypts	Nil	Soft, moist, no coarse fragments	A1 0.00-0.04 Abrupt	Clayey sand	Weak, weak	Nil	10YR4/1 Dark grey	Moist, rapid	Very few, very fine	0.02 / 6.5	0.0-0.04 0.15-0.25 0.40-0.50	No additional observations
				A2 0.04-0.25 Abrupt	Loamy Sand	Weak, weak	< 10% 2-4mmcoarse fragments	10YR4/4 Dark yellowish brown	Moist, rapid	Very few, very fine		0.90-1.00	
				B2 0.25-1.00	Light medium clay	Moderate, weak 30-60mm sub angular	<10% 2-4mmcoarse fragments	10YR4/3 Brown Mottle 10YR5/6 Yellowish brown	Moist, imperfect	Nil	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	643376 mE 7533082 mN	Brown Vertosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use		Minneliaf	Conference in the second					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Regrowth,	Normal gilgai	Cracking,	A1	Light clay	Weak, firm,	Nil	10YR3/2	Dry, well	Few, very fine	0.10 / 6.5	No samples	Mound
gently	Brigalow	0.10-0.30	No coarse	0.00-0.10		<10mm		Very dark grey	drained			taken	Wound
undulating		depth, 50%	fragments	Abrupt		sub-angular		brown					
plains, upper		coverage		B2	Light clay	Moderate,	Nil	10YR3/1	Dry, well	Very few,	0.30 / 6.5		
slope, 0.5%				0.10-1.00		firm,		Very dark grey	drained	very fine	0.60 / 6.0		
						<20mm				-	0.90 / 6.0		
						sub-angular							

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class:	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	644747 mE 7533749 mN	Brown Sodosol	Detailed - 50mm hand auger	12/7/2017
	Humboldt, Blackwater				

Landscape



Land use			Surface condition, surface rock					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently	Poplar box	Nil	Hard setting, no coarse	A1 0.00-0.61	Clayey Sand	Apedal, loose	Nil	10YR3/2 Very dark grayish	Dry, rapid	Very few, very fine	0.10 / 6.5 0.30 / 6.5	No samples taken	No additional
undulating plains, mid- slope, 3.0%			fragments	Abrupt B21 0.61-0.84 Abrupt	Sandy clay Ioam	Weak, weak <10mm	Nil	brown 10YR4/3 Brown	Dry, rapid	Nil	0.60 / 6.5 Nil	-	ODSELVATIONS
				B22 0.84-1.96	Clay loam sand	Veak, weak <10mm peds	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Nil	0.90 / 6.5		

Surface

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	646568 mE 7534581 mN	Brown Vertosol	Detailed - 50mm hand auger	13/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow regrowth	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse	A1 0.00-0.18 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
			fragments	B2 0.18-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
A2	Somerby, Monteagle, Connors,	648469 mE 7534176 mN	Subnatric Grey Sodosol	Detailed - 50mm hand auger	13/7/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Poplar box, Brigalow, edge of Eucalypts,	Creek nearby	Soft, No coarse fragments	A1 0.00-0.22 Abrupt	Sandy Loam	Weak/ massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				B21 0.22-0.48 Abrupt	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR2.5/2 Very dark brown	Dry, well drained	Nil	0.30 / 6.5 0.60 / 6.5		
				B22 0.48-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR3/4 Dark brown	Dry, well drained	Nil	0.90 / 6.5		

Soil Profile

SITE 101

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
		647484 mE 7533515 mN		Detailed - 50mm hand auger	13/7/2017

Surface



Land use		N diana malia f	Surface	Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Flat plain, <0.5%	Brigalow regrowth	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse	0.00-0.19 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations	
			fragments	0.19-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	648525 mE 7532703 mN	Brown Vertosol	Detailed - 50mm hand auger	13/7/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow regrowth	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse	A1 0.00-0.20 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
			fragments	B2 0.20-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 648058 mE 7532086 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 13/7/2017			
	Landscape	Surface		Soil Profile				

Land use		M isson list	Surface	Soil Profile Description									
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow regrowth	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse	A1 0.00-0.18 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
			fragments	B2 0.18-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
A2	Somerby, Monteagle, Connors,	650766 mE 7533194 mN	Subnatric Grey Sodosol	Detailed - 50mm hand auger	13/7/2017
	Humboldt, Blackwater				

Landscape



Surface





Land use	Land use				Soil Profile Description								
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Eucalypts	Gully erosion nearby	Hard setting, minor cracking, no	A1 0.00-0.16 Abrupt	Clay Loam	Weak, firm, 5-10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, well drained	Very few, very fine	0.10 / 6.0	0.0-0.10 0.30-0.40 0.60-0.70	No additional observations
plains, lower slope, wide depression with water			coarse fragments	B21 0.16-0.60 Abrupt	Medium clay	Moderate, very firm, 5- 40mm sub- angular	Nil	7.5YR4/1 Dark grey	Dry, well drained	Nil	0.30 / 6.0 0.60 / 6.0	0.90-1.00	
				B22 0.60-1.00	Medium clay	Moderate, very firm, 5- 40mm sub- angular	Nil	5YR3/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 7.0		

Soil Profile

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
C2	Somerby, Monteagle, Connors,	650016 mE 7531034 mN	Brown Vertosol	Detailed - 50mm hand auger	13/7/2017	
	Humboldt, Blackwater, Junee					

Landscape



Land use	Land use Microre		Microrelief Surface	Soil Profile Description									
Pattern, Element, Slope	Natural Vegetation Interviewent Disturbance Erosion Surface surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Flat plain, <0.5%	Brigalow regrowth	Normal gilgai, <0.3m 40% coverage	Cracking, 5- 20mm peds, no coarse	A1 0.00-0.20 Abrupt	Light clay	Weak, firm, 3-15mm sub-angular	Nil	7.5YR3/2 Dark brown	Dry, well drained	Very few, very fine	0.10 / 7.5	No samples taken	No additional observations
			fragments	B2 0.20-1.00	Light clay	Moderate, firm, 3- 15mm sub- angular	Nil	7.5YR4/2 Brown	Dry, well drained	Nil	0.30 / 7.5 0.60 / 7.5 0.90 / 7.5		

Surface

Soil Profile

SITE 106

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Connors, Humboldt, Blackwater,	651192 mE 7531738 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	14/7/2017

Surface



Land use					Soil Profile Description								
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.`5%	Poplar box, Minor Brigalow	Minor to no disturbance	Cracking, 5- 20mm peds, no coarse	A11 0.00-0.26 Abrupt	Silty loam	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, well drained	Very few, very fine	0.05 / 6.0 0.20 / 6.0	0.00-0.05 0.40-0.50 0.60-0.70	No additional observations
	regrowth		fragments	A12 0.26-0.56 Abrupt	Silty loam	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.40 / 6.0 0.60 / 6.5	0.90-1.00	
				B2 0.56-1.00	Light clay	Moderate, firm, <10mm sub-angular	Nil	10YR4/3 Brown	Dry, moderately well- drained	Very few, very fine	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	649633 mE 7536125 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	14/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Tall woodland Eucalypts, Ironbark,	200m from an active drainage line	Firm, no coarse fragments	A1 0.00-0.15 Abrupt	Clayey sand	Weak, massive	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.10 / 6.5	0.00-0.10 0.20-0.30 0.40-0.50	No additional observations
plains, <1.0%	Moreton Bay ash			B21 0.15-0.32 Abrupt	Loamy sand	Weak, weak	Nil	7.5YR2.5/2 Very dark brown	Dry, rapid	Very few, very fine	0.25 / 6.5	0.70-0.80	
				B22 0.32-0.58 Abrupt	Loamy sand	Weak, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B23 0.56-1.00	Sandy Ioam	Moderate, weak, 10- 40mm sub- angular	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.80 / 7.0		

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 651186 mE 7534542 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type:Survey Date:Detailed - 50mm hand auger14/7/2017			
	Landscape	Surface		Soil Profile			



Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	652513 mE 7530172 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	14/7/2017
	Humboldt, Blackwater				

Landscape



Surface

Land use		Minnellief	Surface condition, surface rock					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Nil	Soft, no coarse fragments	A1 0.00-0.27 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark grayish brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
plains, upper slope <2.0%				B21 0.27-0.52 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	Nil		
				B22 0.52-1.00	Loamy sand	Weak, very weak <10mm sub- rounded	Nil	7.5YR4/3 Brown	Dry, rapid	Very few, very fine	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	652119 mE 7531776 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	15/7/2017

Surface



Land use		Minnerslief	Surface condition, surface rock					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very gently undulating	Poplar box, Eucalypts, Moreton Bay	Nil	Firm, no coarse fragments	A1 .00-0.10 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
plains, upper slope <0.5%	Ash			B21 0.10-0.38 Abrupt	Loamy sand	Massive, loose	Nil	10YR42/2 Very dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				B22 0.38-1.00	Loamy sand	Weak, very weak <10mm sub- rounded	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.0 0.90 / 6.0		

Soil Profile

SITE 111

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Connors, Humboldt, Blackwater,	652028 mE 7529155 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	15/7/2017

Surface



Land use			Surface condition, surface rock					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plains, Upper slope, <2.0%	Long native grass, various sparse regrowth, surrounding eucalypts	Extensive clearing	Cracking, no coarse fragments	A1 0.00-0.11 Abrupt	Silty clay Ioam	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
				A2 0.11-0.25 Abrupt	Clay loam	Weak, firm, <5mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B21 0.25-0.45 Abrupt	Light clay	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Nil	0.30 / 6.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Strong, very firm, <5mm sub-angular	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.80 / 7.0		

Soil Profile

SITE 112

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Connors, Humboldt, Blackwater,	653059 mE 7529089 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	15/7/2017

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Long native grass, various sparse	Extensive clearing	Cracking, no coarse fragments	A1 0.00-0.10 Abrupt	Silty clay Ioam	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
plains, Upper slope, <2.0%	regrowth, surrounding eucalypts		5	A2 0.10-0.26 Abrupt	Clay loam	Weak, firm, <5mm sub- angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.20 / 6.0		
				B21 0.26-0.45 Abrupt	Light clay	Weak, firm, <5mm sub- angular	<2% <10mm coarse fragments	10YR3/1 Very dark gray	Dry, well drained	Nil	0.30 / 6.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Strong, very firm, <5mm sub-angular	Nil	10YR4/3 Brown	Dry, well drained	Nil	0.80 / 7.0		

Surface

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
L1	Monteagle, Connors, Humboldt,	653777 mE 7530076 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	15/7/2017
	Blackwater				

Surface



Land use			Surface condition, surface rock					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Long native grass, various sparse	Extensive clearing	Firm, no coarse fragments	A1 0.00-0.10 Abrupt	Loamy sand	Weak, firm, <5mm sub- angular	Nil	10YR3/1 Very dark grey	Dry, rapid	Very few, very fine	0.05 / 7.0	No samples taken	No additional observations
plains, Upper slope, <2.0%	regrowth		5	A2 0.10-0.28 Abrupt	Clay loam	Moderate, firm, 5- 15mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.20 / 8.0		
				B21 0.28-0.45 Abrupt	Light clay	Moderate, firm, 10- 30mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.30 / 8.0		
				B22 0.45-1.00 Abrupt	Light medium clay	Moderate, firm, 10- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown Mottle 10YR6/3 2% Pale brown	Dry, imperfect	Nil	0.80 / 8.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	654298 mE 7529141 mN	Brown Vertosol	Detailed - 50mm hand auger	15/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minnenlief	Surface condition, surface rock					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plains, Lower	Long native grass, various sparse regrowth	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.09 Abrupt	Sandy clay Ioam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
slope, <2.0%	5			B2 0.09-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		
Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
L2	Monteagle, Connors, Humboldt, Blackwater	655184 mE 7528626 mN	Mesonatric Brown Sodosol	Detailed - 50mm hand auger	15/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Long native grasses	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.14 Abrupt	Loamy sand	Massive, loose	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, Upper slope, <2.0%				A12 0.14-0.40 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, very fine	0.30 / 6.5		
				A13 0.40-0.63 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 6.5		
				B2 0.63-1.00	Light medium clay	Moderate, firm, 10- 40mm sub- angular	Nil	7.5YR5/4 Brown Mottle 10YR5/8 10% Yellowish brown	Dry, imperfect	Nil	0.90 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Connors, Humboldt, Blackwater,	653456 mE 7528398 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	16/7/2017

Surface

Landscape







Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Long native grasses	Extensive clearing	Hard setting, minor cracking,	A11 0.00-0.11 Abrupt	Silty loam	Massive, loose	Nil	10YR4/3 Brown	Dry, well drained	Very few, very fine	0.05 / 6.0	No samples taken	No additional observations
			no coarse fragments	A12 0.11-0.42 Abrupt	Silty loam	Massive, weak	Nil	7.5YR3/2 Brown	Dry, well drained	Nil	0.20 / 6.0		
				A2 0.42-0.56 Abrupt	Silty loam	Weak, firm, <10mm sub-angular	Nil	7.5YR4/4 Brown	Dry, well drained	Nil	0.30 / 6.0		
				B2 0.56-1.00 Abrupt	Light clay	Moderate, firm, <10mm sub-angular	Nil	5YR4/4 Brown	Dry, well drained	Nil	0.80 / 7.0		

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 654086 mE 7527936 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 16/7/2017
	Landscape	Surface		Soil Profile	

Land use			Surface	Soil Profile Description											
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Flat plain <0.5%	Native grass	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.10 Abrupt	Sandy clay Ioam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations		
				B2 0.10-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5				

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors,	654513 mE 7527525 mN	Brown Vertosol	Detailed - 50mm hand auger	16/7/2017
	Humboldt, Blackwater, Junee			1	l

Surface



Land use		Minnellief	Guilean		Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, gently	Eucalypts, Blackbutt	Shallow gilgai,	Cracking, no coarse	A1 0.00-0.10	Sandy clay Ioam	Moderate, very firm,	Nil	10YR4/2 Dark grayish	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional	
undulating	regrowth,	extensive	fragments	Abrupt		<10mm		brown					observations	
plains, lower	boundary of	clearing				sub-angular								
slope /	Brigalow			B2	Light clay	Moderate,	Nil	10YR3/2	Dry, well	Very few, very	0.30 / 6.5			
Depression				0.10-1.00		very firm,		Very dark grayish	drained	fine	0.60 / 6.5			
creek						<10mm		brown			0.90 / 6.5			
						sub-angular								

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	655807 mE 7527774 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	/7/2017

Surface

Landscape







Land use								Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Eucalypts,	Depression	Poached,	A1	Loamy	Massive,	Nil	10YR3/3	Moderately	Very few, very	0.10 / 7.0	No samples	Ne edditionel
gently	Moreton Bay		moist, nearby	0.00-0.12	sand	loose		Dark brown	moist, rapid	fine		taken	No additional
undulating	Ash		cracking, no	Abrupt									observations
plains,			coarse	B21	Clayey	Moderate,	Buried ash 30%	10YR3/2	Moderately	Nil	0.30 / 7.0		
Depression			fragments	0.12-0.40	loam	10-30mm,		Very dark greyish	moist, rapid				
				Abrupt		firm		brown					
				B22	Clayey	Moderate,	Nil	10YR4/3	Moderately	Nil	0.60 / 7.5		
				0.40-1.00	sand	weak		Brown	moist, rapid		0.90 / 7.5		
								Mottle					
								10YR5/8 2%					
								Yellowish brown					

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 656167 mE 7528401 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type:Survey Date:Detailed - 50mm hand auger16/7/2017				
	Landscape	Surface		Soil Profile				

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Native grasses	Extensive clearing	Soft, no coarse fragments	A11 0.00-0.09 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
plains, mid- slope <1%				A12 0.09-0.48 Abrupt	Clayey sand	Massive, loose	Nil	7.5YR3/2 Brown	Dry, rapid	Nil	0.30 / 6.5		
				B21 0.48-0.69 Abrupt	Loamy sand	Weak, weak, <20mm sub-angular	Nil	7.5YR4/4 Brown	Dry, rapid	Nil	0.60 / 6.5		
				B22 0.69-1.00 Abrupt	Clayey sand	Moderate, weak, <20mm sub-angular	Nil	5YR4/4 Brown	Dry, rapid	Nil	0.90 / 7.5		

Appendix A – Detailed Site Descriptions

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	655685 mE 7529620 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	16/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Nil	Soft, no coarse fragments	A11 0.00-0.04 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
plains, mid- slope <1.0%				A12 0.04-0.25 Abrupt	Clayey sand	Massive, loose	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.30 / 6.5		
				B21 0.25-0.65 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 6.5		
				B23 0.65-1.00	Clayey sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.90 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	657450 mE 7529247 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	16/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		M isson list	Curtan					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plains, Lower	Long native grass, various sparse regrowth	Normal gilgai, extensive clearing	Cracking, no coarse fragments	A1 0.00-0.09 Abrupt	Sandy clay Ioam	Moderate, very firm, <10mm sub-angular	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
slope, <2.0%				B2 0.09-1.00	Light clay	Moderate, very firm, <10mm sub-angular	Nil	10YR3/2 Very dark grayish brown	Dry, well drained	Very few, very fine	0.30 / 6.5 0.60 / 6.5 0.90 / 6.5		

Soil Profile

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 655379 mE 7525271 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 27/7/2017

Surface



Land use	Land use Landform Natural Microrelief Surfa							Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box	Minor clearing, nearby track	Firm, no coarse fragments	A1 0.00-0.18 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, lower slope 1.0%				B21 0.18-0.38 Abrupt	Loamy sand	Weak, very weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0		
				B22 0.38-1.00	Loamy sand	Weak, very weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	656402 mE 7525687 mN	Red Rudosol	Detailed - 50mm hand auger	27/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use								Soil Profile	Description				
Eandform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, very	Blackbutt, very	Nil	Firm, no	A11	Loamy	Massive,	Nil	2.5YR3/3	Dry, rapid	Very few, very	0.10 / 6.5	No samples	No additional
wide crest	minor poplar		coarse	0.00-0.20	sand	loose,		Dark reddish		fine		taken	obconvotions
1.0%	box, very		fragments	Abrupt		single grain		brown					observations
	minor			A12	Loamy	Weak, very	Nil	2.5YR3/4	Dry, rapid	Nil	0.40 / 6.5		
	Moreton Bay			0.20-0.55	sand	weak 5-		Dark reddish					
	Ash			Diffuse		20mm		brown					
				A2	Clayey	Moderate,	Nil	2.5YR3/4	Dry, rapid	Nil	0.60 / 6.5		
				0.55-1.00	sand	weak 10-		Dark reddish			0.90 / 7.0		
						30mm sub-		brown					
						angular							

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	657459 mE 7525340 mN	Red Rudosol	Detailed - 50mm hand auger	/7/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Blackbutt	Limited clearing	Firm, no coarse fragments	A11 0.00-0.18 Abrupt	Loamy sand	Massive, loose, single grain	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plain, upper slope 1.5%				A12 0.18-0.57 Diffuse	Loamy sand	Weak, very weak 5- 20mm	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A2 0.57-1.00	Clayey sand	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	656603 mE 7523809 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	27/7/2017

Surface



Land use			Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box, Blackbutt	Nil	Firm to hard setting, no coarse	A1 0.00-0.08 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plain, mid- slope 1.5%			fragments	B21 0.08-0.70 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B22 0.70-1.00	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

SITE 127

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
C1	Somerby, Monteagle, Connors,	657120 mE 7522945 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	27/7/2017	
	Humboldt, Blackwater, Junee					

Surface

Landscape



Land use		Minneria	Configure					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Brigalow	Melon holes	Hard setting,	A1	Light clay	Moderate,	Nil	10YR3/2	Dry, well	Very few, very	0.10 / 6.5	No samples	No additional
gently	regrowth	0.30-0.40	cracking,	0.00-0.08		weak, 5-		Very dark grayish	drained	fine		taken	observations
		deep, 50%	no coarse	Abrupt	L'alat also	Tomm peas	N.C.		David	Manufacture	0.20 / 6 5	-	
plain, lower		coverage 2.0-	iragments	BZ	Light clay	woderate,	INII	10YR3/3	Dry, well	very few, very	0.30 / 6.5		
slope 0.5%		4.0m wide		0.08-1.00		weak, 5-		Dark brown	drained	tine	0.60 / 6.5		
						30mm peds					0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	658079 mE 7524200 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	27/7/2017

Surface



Land use		Minnenlief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, gently undulating	Poplar box, Blackbutt	Nil	Firm, no coarse fragments	A1 0.00-0.10 Abrupt	Clayey sand	Massive, loose	Nil	10YR4/2 Dark grayish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plain, simple slope 1.5%				B21 0.10-0.68 Abrupt	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.40 / 6.5		
				B22 0.68-1.00	Loamy sand	Massive, loose	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	659506 mE 7524898 mN	Red Rudosol	Detailed - 50mm hand auger	27/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use			Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Blackbutt	Nil	Firm, no coarse fragments	A11 0.00-0.20 Abrupt	Loamy sand	Massive, loose, single grain	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
plains, upper slope 1.0%				A12 0.20-0.55 Diffuse	Loamy sand	Weak, very weak 5- 20mm	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A2 0.55-1.00	Clayey sand	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/4 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt, Blackwater	658711 mE 7526388 mN	Brown Sodosol	Detailed - 50mm hand auger	28/7/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Regrowth, native grasses	Extensive clearing	Soft, no coarse fragments	A11 0.00-0.11 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	Brigalow regrowth 100-
plains, mid slope 2.0%				A12 0.11-0.38 Diffuse	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.40 / 7.0		200m to north and south.
				B2 0.38-1.00	Clay loam sand	Moderate, weak 10- 30mm sub- angular	Nil	10YR4/6 Dark yellowish brown Mottle < 10% 10YR4/4 Dark yellowish brown, <5% 7.5YR3/6 Dark red	Dry, well drained	Very few, very fine	0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
R2	Somerby, Monteagle, Humboldt,	656738 mE 7527426 mN	Haplic Red Chromosol	Detailed - 50mm hand auger	28/7/2017	
	Blackwater, Junee					

Surface



Land use		Managelia	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Poplar box, Blackbutt, various mixed	Nil	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.05 / 7.0	0.00-0.10 0.30-0.40 0.60-0.70	No additional observations
plains, mid slope 1.0%	vegetation			A12 0.09-0.60 Diffuse	Loamy sand	Massive, weak	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 7.0	0.90-1.00	
				B2 0.60-1.00	Sandy clay Ioam	Moderate, weak 10- 30mm sub- angular	Nil	2.5YR3/3 Dark reddish brown	Dry, well drained	Nil	0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	656306 mE 7526757 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	28/7/2017
	Humboldt, Blackwater				

Landscape

Surface





Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing,	Poplar box,	Nil	Firm, no	A1	Clayey	Massive,	Nil	10YR4/2	Dry, rapid	Very few, very	0.10 / 7.0	No samples	No additional	
Gently	Blackbutt,		coarse	0.00-0.11	sand	weak		Dark greyish		fine		taken		
undulating	various mixed		fragments	Abrupt				brown					observations	
plains, mid	vegetation			B21	Loamy	Massive,	Nil	10YR4/3	Dry, rapid	Very few, very	0.30 / 7.0			
slope 1.5%				0.11-0.52	sand	weak		Brown		fine				
				Abrupt										
				B22	Clayey	Weak, very	Nil	10YR4/4	Dry, rapid	Nil	0.60 / 7.0			
				0.52-1.00	sand	weak		Dark yellowish			0.90 / 7.0			
						<10mm		brown						
						sub-angular								

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	657814 mE 7526575 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	28/7/2017
	Humboldt, Blackwater, Junee				









Land use Landform			Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plains, mid	Brigalow regrowth	Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
slope < 1.0%				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	658493 mE 7525489 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	28/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minner	Surface	Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Gently undulating plains, mid	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression	
slope < 1.0%		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

SITE 135

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	657256 mE 7528300 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	29/7/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Minnelief	Surface	Soil Profile Description											
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression		
		3-6m 50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0				



Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	658578 mE 7527872 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	29/7/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Missionalise	Surface	Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound	
		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			

Surface

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 659839 mE 7526642 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type:Survey Date:Detailed - 50mm hand auger29/7/2017				
	Landscape	Surface		Soil Profile				

Land use	Land use Landform Natural Microrelief Surface				Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Very gently undulating	Regrowth	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations	
plains, lower slope 1.0%				A12 0.09-0.48 Abrupt	Loamy sand	Weak, very weak peds, <10mm rounded	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	Nil			
				B2 0.48-1.00	Sandy clay loam	Moderate, very weak peds, <10mm rounded	Nil	2.5YR3/3 Dark reddish brown Mottle <10% grey	Dry, rapid	Nil	Nil			

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	661441 mE 7526760 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	29/7/2017
	Humboldt, Blackwater, Junee				

Landscape



Surface



Land use			Surface condition, surface rock	Soil Profile Description									
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
		3-6m 50% coverage	-	B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	660286 mE 7528127 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	29/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minnelief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, mid-	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
slope 1.0%		3-6m 50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	660936 mE 7529367 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, mid-	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.13 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
slope 1.0%		3-6m 50% coverage		B2 0.13-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	661978 mE 7528566 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	29/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Minnelief	Surface					Soil Profile	Description				
Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, mid	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
slope < 1.0%		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	662807 mE 7529517 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	30/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, mid	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
slope < 1.0%		3-6m 50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	663668 mE 7529201 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	30/7/2017
	Humboldt, Blackwater, Junee				



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, mid	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
slope < 1.0%		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		



Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	664015 mE 7527856 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	30/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Balana na lia f	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, lower	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
slope 1.0%		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors, Humboldt Blackwater Junee	664274 mE 7527288 mN	Red Rudosol	Detailed - 50mm hand auger	30/7/2017

Surface



Land use		Microrelief	Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Native grasses	Limited to extensive clearing,	Soft, no coarse fragments	A11 0.00-0.09 Abrupt	Loamy sand	Massive, weak	Nil	5YR5/3 Reddish brown	Dry, rapid	Very few, very fine	0.10 / 6.5	No samples taken	No additional observations
				A12 0.09-0.50 Abrupt	Loamy sand	Massive, weak	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Nil	0.40 / 6.5		
				A13 0.50-1.00	Loamy sand	Massive, weak	Nil	2.5YR3/3 Dark reddish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 7.0		

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

SITE 146

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	662583 mE 7526662 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	/7/2017

Landscape



Land use		M isson list	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Sparse Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R2	Somerby, Monteagle, Humboldt, Blackwater, Junee	661088 mE 7525448 mN	Haplic Red Chromosol	Detailed - 50mm hand auger	30/7/2017
	Diackwater, Juliee				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Very sparse mixed regrowth	Limited clearing	Firm, no coarse fragments	A1 0.00-0.12 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR2.5/2 Very dark brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
				A2 0.12-0.50 Abrupt	Clayey sand	Weak, very weak peds, <10mm rounded	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.50-1.00	Sandy clay loam	Moderate, very weak peds, <10mm rounded	Nil	5YR4/6 Yellowish brown	Dry, rapid	Very few, very fine	Nil		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	661208 mE 7524699 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	31/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use		Misusuelief	Curfees					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plains, upper	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
slope 1.0%		3-6m 50% coverage		B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	662277 mE 7523306 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	/7/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Minunglief	Surface	Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Very gently undulating plains, mid-	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound	
slope 1.0%		3-6m 50% coverage		B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			



Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	663573 mE 7523798 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	31/7/2017
	Humboldt, Blackwater, Junee				

Surface



Land use					Soil Profile Description										
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Very gently undulating plains, mid-	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression		
slope 1.0%		3-6m 50% coverage		B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0				
Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 661705 mE 7521700 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 31/7/2017										
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	Landscape	Surface		Soil Profile											

Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing,	Poplar Box	Extensive	Soft, no coarse	A11	Loamy	Massive,	Nil	10YR4/3	Dry, rapid	Very few, very	Nil	No samples	No additional	
Very gently		clearing	fragments	0.00-0.18	sand	weak		Brown		fine		taken	observations	
undulating				Diffuse									observations	
plain 1.0%				A12	Loamy	Weak, very	Nil	5YR3/3	Dry, rapid	Very few, very	Nil			
				0.18-0.56	sand	weak peds,		Dark reddish		fine				
				Abrupt		<10mm		brown						
						rounded								
				B2	Sandy clay	Moderate,	Nil	2.5YR3/3	Dry, rapid	Nil	Nil			
				0.56-1.00	loam	very weak		Dark reddish						
						peds,		brown						
						<10mm		Mottle						
						rounded		<10% grey						

Soil Mapping Unit: R2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660701 mE 7520607 mN	Aust. Soil Class. : Haplic Red Chromosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 31/7/2017
	Landscape	Surface		Soil Profile	

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Moreton Bay Ash, Blackbutt, Poplar Box	Limited clearing	Firm, no coarse fragments	A11 0.00-0.22 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	Nil	No samples taken	No additional observations
plain, wide crest				A12 0.22-0.62 Abrupt	Loamy sand	Weak, very weak peds, <10mm rounded	Nil	5YR3/3 Dark reddish brown	Dry, rapid	Very few, very fine	Nil		
				B2 0.62-1.00	Sandy clay Ioam	Moderate, very weak peds, <10mm rounded	Nil	2.5YR3/3 Dark reddish brown Mottle <10% grey	Dry, rapid	Nil	Nil		

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 658969 mE 7520534 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 31/7/2017
	Landscape	Surface		Soil Profile	

Land use		Misusuelief	Curtan		Soil Profile Description										
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Melon holes, 0.40m deep,	Firm, cracking 2-10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations		
		3-6m 50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0				

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 659548 mE 7521648 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 1/8/2017
	Landscape	Surface		Soil Profile	

Land use					Soil Profile Description										
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations		
Grazing, Very gently undulating plain1.0%	Brigalow regrowth	Extensive clearing, Gilgai, 0.30m deep, 3-6m	Firm, cracking 2-10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound		
		50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0				

Soil Mapping Unit: C2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	Location (GDA ZONE 55): 660283 mE 7522488 mN	Aust. Soil Class. : Brown Vertosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 1/8/2017			
	Landscape	Surface		Soil Profile				
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Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Very gently undulating plain1.0%	Brigalow regrowth	Extensive clearing, Gilgai, 0.30m deep, 3-6m	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression	
		50% coverage		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
R1	Somerby, Monteagle, Connors,	660027 mE 7523667 mN	Red Rudosol	Detailed - 50mm hand auger	1/8/2017
	Humboldt, Blackwater, Junee				

Surface



Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Very gently undulating	Poplar Box, Blackbutt	Limited clearing	Soft, no coarse fragments	A11 0.00-0.08 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations	
plain, wide crest				A12 0.08-0.36 Abrupt	Loamy sand	Massive, weak	Nil	5YR4/3 Reddish brown	Dry, rapid	Very few, very fine	0.30 / 7.0			
				A13 0.36-1.00	Loamy sand	Massive, weak	Nil	2.5YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.60 / 6.5 0.90 / 6.5			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater, Junee	658904 mE 7524056 mN	Brown Vertosol	Detailed - 50mm hand auger	1/8/2017

Surface



Land use					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Flat plain <0.5%	Brigalow regrowth	Gilgai, 0.30m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound	
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			

Soil Mapping Unit: S1	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 658542 mE 7523742 mN	Aust. Soil Class. : Brown Sodosol	Site Survey Type: Survey Date Detailed - 50mm hand auger 1/8/2017						
	Landscape	Surface		Soil Profile						

Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar Box, Blackbutt	Nil	Firm, no coarse fragments	A11 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
plain, mid- slope				A12 0.30-0.70 Abrupt	Loamy sand	Weak, 2- 10mm weak sub-angular	2% coarse fragments 2- 6mm	10YR4/3 Brown	Dry, rapid	Nil	0.30 / 7.0 0.60 / 6.5		
				B2 0.70-1.00	Clay loam sand	Weak, 10- 20mm weak sub-angular	Nil	10YR4/4 Dark yellowish Brown Mottle 2% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	664687 mE 7526519 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	2/8/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Minnelia	Surface	Soil Profile Description									
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Melon holes, 0.40m deep, 3-6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.10 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound
				B2 0.10-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
C1	Somerby, Monteagle, Connors,	663710 mE 7525434 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	2/8/2017	
	Humboldt, Blackwater, Junee					

Landscape



Land use			Surface	Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.09 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.09-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Profile

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 666641 mE 7529563 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 2/8/2017
	Landscape	Surface		Soil Profile	
<u>And</u>					

Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, lower	Poplar Box, native grasses	Extensive clearing	Soft, no coarse fragments	A1 0.00-0.07 Abrupt	Clayey sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
slope <2%				B21 0.07-0.32 Abrupt	Loamy sand	Weak, 5- 10mm weak sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 6.5		
				B22 0.32-0.66	Clayey sand	Weak, 5- 10mm weak sub-angular	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Very few, very fine	0.90 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	665391 mE 7525740 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	2/8/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Missionalise	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Profile

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors, Humboldt Blackwater	666679 mE 7527163 mN	Brown Sodosol	Detailed - 50mm hand auger	2/8/2017

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, lower	Sparse shrubs, buffel grass	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.20 Diffuse	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
slope <2%				A12 0.20-0.60 Abrupt	Clayey sand	Weak, 10- 20mm weak sub-angular	Nil	7.5YR4/3 Brown	Dry, rapid	Very few, very fine	0.30 / 7.0 0.60 / 6.5		
				B2 0.60-1.00	Sandy clay Ioam	Moderate, 10-30mm weak sub- angular	Nil	7.5YR4/4 Brown Mottle 5% 10R4/6 Red	Dry, moderate to well drained	Nil	0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	667067 mE 7527683 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	3/8/2017
	Humboldt, Blackwater, Junee				

Surface



Land use Landform Natural Microrelief Surface					Soil Profile Description									
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Very gently undulating plains, lower	Brigalow regrowth	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.11 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Mound	
slope <1.5%				B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	668188 mE 7528861 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	3/8/2017
	Humboldt, Blackwater				

Surface



Land use		Managelia	Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar Box	Semi-cleared, trampled nearby	Soft, no coarse fragments	A1 0.00-0.19 Abrupt	Clayey sand	Massive, weak/ Apedal	Nil	10YR4/3 Brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
plain, lower slope <2.0%				B21 0.19-0.52 Abrupt	Loamy sand	Massive, Apedal	Nil	10YR5/2 Grayish brown	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.52-1.00	Loamy sand	Massive, weak	Nil	10YR5/3 Brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C1	Somerby, Monteagle, Connors,	665456 mE 7529384 mN	Endohypersodic Brown Vertosol	Detailed - 50mm hand auger	3/8/2017
	Humboldt, Blackwater, Junee				

Landscape



Land use		Missionalise	Surface	Soil Profile Description									
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Melon holes, 0.5m deep, 3- 6m 50% coverage	Cracking 2- 10mm, no coarse fragments	A1 0.00-0.08 Abrupt	Light clay	Moderate, firm, 3- 10mm sub- angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	Depression
				B2 0.08-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Surface

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	665246 mE 7527938 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	3/8/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar Box	Extensive clearing	Soft to firm, no coarse fragments	A1 0.00-0.14 Abrupt	Clayey sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
plain, lower slope <2.0%				B21 0.14-0.50 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 7.0		
				B22 0.50-1.00	Clayey sand	Weak, peds, 10-30mm weak	Nil	10YR4/4 Dark yellowish brown Mottle 10YR5/8 Yellowish brown	Dry, rapid	Nil	0.60 / 6.5 0.90 / 6.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	646122 mE 7540417 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	3/8/2017
	Humboldt, Blackwater				

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Blackbutt, Eucalypts	Extensive clearing	Firm, no coarse fragments	A11 0.00-0.09 Abrupt	Clayey sand	Massive, weak	Nil	7.5YR3/2 Dark brown	Dry, rapid	Very few, fine	0.05 / 7.0	No samples taken	No additional observations
plain, mid- slope 1.0%			5	A12 0.09-0.10 Abrupt	Clayey sand	Massive, weak	Nil	7.5YR3/3 Dark brown	Dry, rapid	Very few, fine	Nil		
				B2 0.1 0-1.00	Loamy sand	Moderate, weak, 10- 30mm sub- angular	Nil	7.5YR3/4 Dark brown	Dry, rapid	Nil	0.30 / 7.0 0.60 / 6.5 0.90 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B1	Somerby, Monteagle, Humboldt	638672 mE 7549660 mN	Subnatric Brown Sodosol	Detailed - 50mm hand auger	3/8/2017

Landscape





Soil Profile



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, upper	Eucalypts, Moreton Bay Ash	Nil	Soft to firm, no coarse fragments	A1 0.00-0.10 Abrupt	Loam	Massive, weak	Nil	10YR3/2 Very dark greyish brown	Dry, rapid	Very few, very fine	0.05 / 6.0	No samples taken	Alluvial
slope 1.0%				A2 0.10-0.30 Abrupt	Silty loam	Massive, weak	Nil	10YR3/1 Very dark brown	Dry, rapid	Very few, very fine	Nil		
				B21 0.30-0.52 Abrupt	Loam	Weak, weak, 10- 30mm sub- angular	Nil	10YR3/1 Very dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				B22 0.52-1.00	Loamy sand	Weak, weak, 10- 30mm sub- angular	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.60 / 6.0 0.90 / 7.5		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	637680 mE 7547045 mN	Brown Sodosol	Detailed - 50mm hand auger	4/8/2017
	Humboldt, Blackwater				

Surface



Land use		Minnerslief	Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Poplar box,	Nil	Soft to firm,	A1	Loamy	Massive,	Nil	10YR3/3	Dry, rapid	Very fine, very	0.10 / 6.5	No samples	No additional
Gently	minor Ironbark		no coarse	0.00-0.38	sand	weak		Dark brown		few	0.30 / 6.5	taken	observations
undulating			fragments	Diffuse									observations
plain, mid-				B2	Clay loam	Moderate,	<2% coarse	10YR4/3	Dry, well	Nil	0.60 / 7.5		
slope 1.0%				0.38-1.00	sand	angular, 5-	fragments 2mm	Brown	drained		0.90 / 7.5		
						20 weak	-	Mottle 5%					
								10YR5/8					
								Yellowish brown					

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	637940 mE 7547836 mN	Brown Sodosol	Detailed - 50mm hand auger	4/8/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Poplar box,	Nil	Soft to firm,	A1	Loamy	Massive,	Nil	10YR3/3	Dry, rapid	Very fine, very	0.10 / 6.5	No samples	NU LUCC L
Gently	minor Ironbark		no coarse	0.00-0.40	sand	weak		Dark brown		few	0.30 / 6.5	taken	No additional
undulating			fragments	Diffuse									observations
plain, mid-				B2	Clay loam	Moderate,	<2% coarse	10YR4/3	Dry, well	Nil	0.60 / 7.5		
slope 1.0%				0.40-1.00	sand	angular, 5-	fragments 2mm	Brown	drained		0.90 / 7.5		
						20 weak	-	Mottle 5%					
								10YR5/8					
								Yellowish brown					

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	641398 mE 7532215 mN	Brown Sodosol	Detailed - 50mm hand auger	4/8/2017
	Humboldt, Blackwater				

Surface



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Soft, no coarse fragments	A11 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
plain, lower slope <1.5%				A12 0.30-0.47 Abrupt	Loamy sand	Massive, weak	<10% coarse fragments <5mm	10YR6/3 Dark brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.47-1.00	Sandy clay loam	Moderate, weak, <10mm sub-angular	Nil	10YR4/4 Dark yellow brown Mottle <2% 10YR5/8 Yellowish brown	Dry, well drained	Very few, fine	0.60 / 6.0 0.90 / 6.0		

Soil Mapping Unit: B2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 644245 mE 7545543 mN	Aust. Soil Class. : Mesonatric Grey Sodosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 24/11/2017
	Landscape	Surface		Soil Profile	

Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating plain, lower	Poplar box	Extensive cleared	Firm, Fine cracking, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
slope <2.0%				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:	
S2	Somerby, Monteagle, Connors,	642897 mE 7546691 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	24/11/2017	
	Humboldt, Blackwater					

Surface



Land use			Surface					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Eucalypts, Blackbutt regrowth	Access track nearby	Frim, No coarse fragments	A11 0.00-0.10 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
plain, lower slope <1.5%				A12 0.10-0.35 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Few, fine	0.30 / 6.0		
				A13 0.35-1.00	Loamy sand	Massive, weak	Nil	10YR3/6 Dark yellowish brown	Dry, rapid	Nil	0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class.	Site Survey Type:	Survey Date:
B2	Somerby, Monteagle, Connors,	643999 mE 7547737 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	24/11/2017
	Humboldt, Blackwater				

Landscape



Land use			Surface					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Brigalow, Eucalypt regrowth	Extensive clearing, No microrelief,	Cracking, soft to firm, no coarse fragments	A1 0.00-0.22 Abrupt	Silty loam	Weak, weak, <10mm sub rounded	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
		No erosion		B2 0.22-1.00	Light clay	Moderate, Weak to firm, <20mm sub-angular	Nil	10YR3/3 Dark brown	Dry, Well drained	Nil	0.30 / 6.0 0.60 / 6.5 0.90 / 7.0		

Surface

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2-DV	Somerby, Monteagle, Connors, Humboldt,	643734 mE 7547624 mN	Sodosol	Detailed - 50mm hand auger	24/11/2017
	Blackwater				











Land use			Surface condition, surface rock					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion		Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, Open depression	Brigalow	Gully erosion, no micro relief, No	Cracking, Soft to firm, no coarse fragments	A1 0.00-0.60 Abrupt	Silty loam	Weak, weak, <10mm sub rounded	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
< 1.5%		disturbance		B2 0.60-1.00	Light clay	Moderate, Weak to firm, <20mm sub-angular	Nil	10YR3/3 Dark brown	Dry, Well drained	Nil	0.30 / 6.0 0.60 / 6.5 0.90 / 7.0		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Monteagle, Connors,	643285 mE 7547142 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	24/11/2017
	Humboldt, Blackwater				

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating plain, lower	Poplar box, Eucalypts	Semi-cleared, No microrelief, No erosion	Soft, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
slope <2.0%				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

Surface

Soil Profile

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Monteagle, Connors, Humboldt, Blackwater	642897 mE 7548610 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	24/11/2017

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain, <0.5%	Poplar box, Blackbutt	Semi-cleared	Soft, no coarse fragments	A11 0.00-0.30 Gradual	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
				A12 0.30-0.38 Abrupt	Silty loam	Weak,, weak <10mm sub-angular	Nil	10YR4/3 Brown	Dry, rapid	Few, fine	0.30 / 6.0		
				B2 0.38-1.00	Light clay	Moderate, firm, <20mm sub-angular	Nil	10YR4/2 Dark grayish brown No mottle	Dry, well drained	Nil	0.60 / 6.0 0.90 / 6.0		

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 645013 mE 7549539 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 24/11/2017
	Landscape	Surface		Soil Profile	







Land use		Mi marilia f	Gurfana					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Predominantly Blackbutt, Iron Bark	Semi-cleared	Firm, no coarse fragments	A1 0.00-0.30 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
plain, lower slope <2.0%			Ĵ	B2 0.30-0.70	Clayey sand	Massive, weak	Nil	10YR4/4 Dark brown	Dry, rapid	Very few, very fine	0.30 / 6.0 0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	638448 mE 7545811 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing,	Poplar box,	Nil	Soft, loose,	A11	Loamy	Massive,	Nil	10YR3/2	Dry, rapid	Few, fine	0.10 / 6.5	No samples	No additional
Gently	minor		no coarse	0.00-0.12	sand	weak		Very dark brown				taken	
undulating	Eucalypts		fragments	Abrupt									observations
plain, lower				A12	Loamy	Massive,	Nil	10YR4/4	Dry, rapid	Few, fine	0.30 / 6.5		
slope < 2.0%				0.12-0.32	sand	weak		Dark yellowish					
				Abrupt				brown					
				A13	Loamy	Massive,	Nil	10YR4/6	Dry, rapid	Very few, very	0.60 / 6.5		
				0.32-0.70	sand	weak		Dark yellowish		fine			
				Abrupt				brown					
				B2	Clay loamy	Weak,	Nil	10YR4/3	Dry, Well	Nil	0.90 / 7.0		
				0.70-0.85	sand	weak,		Brown	drained				
						<5mm sub-							
						angular							

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	636937 mE 7547191 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Sparse Poplar box	Nil	Firm, no coarse fragments	A1 0.00-0.10 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No recovery from 0.80m
plain, mid-slope <2.0%				A2 0.10-0.44 Abrupt	Clayey sands	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Nil	0.30 / 6.5		
				A2 0.47-0.70 Abrupt	Clayey sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.60 / 6.5		
				B2 0.70-0.80	Clay loam sand	Weak, weak, <5mm sub- angular	Nil	10YR4/3 Brown	Dry, rapid	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	635944 mE 7548438 mN	Brown Sodosol	Detailed - 50mm hand auger	25/11/2017
	Humboldt, Blackwater				

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Poplar box, Ironbark	Semi cleared, No microrelief	Soft to firm, no coarse fragments	A1 0.00-0.27 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
plain, lower slope <1.5%		No Erosion		B21 0.27-0.86 Abrupt	Clay loam sand	Moderate, weak <10mm sub-angular	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 6.0 0.60 / 6.5		
				B22 0.86-1.00	Clay loam sand	Moderate, weak, <10mm sub-angular	<2% calcium carbonate	10YR4/4 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

Surface

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
C2	Somerby, Monteagle, Connors, Humboldt, Blackwater	634838 mE 7549412 mN	Brown Vertosol	Detailed - 50mm hand auger	25/11/2017

Surface



Land use		Minnelia	Configure					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Brigalow regrowth	Extensive clearing, Minor normal gilgai <20%	Cracking, firm	A1 0.00-0.11 Abrupt	Light clay	Weak, firm, 3-10mm sub-angular	Nil	10YR3/2 Very dark greyish brown	Dry, well drained	Very few, very fine	0.10 / 7.0	No samples taken	No additional observations
		coverage 3- 5m wide and <0.30m in depth		B2 0.11-1.00	Light clay	Moderate, firm, 20- 50mm sub- angular	Nil	10YR3/3 Dark brown	Dry, well drained	Nil	0.30 / 7.0 0.60 / 7.0 0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors,	633712 mE 7550670 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	25/11/2017
	Humboldt, Blackwater				

Surface



Land use								Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Gently undulating	Eucalypts Poplar box, minor	Nil	Firm, no coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
plain, lower slope 2.0%	Moreton Bay Ash			A12 0.15-0.50 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				A13 0.50-1.00	Loamy sand	Massive, weak	Nil	10YR3/6 Dark yellowish brown	Dry, rapid	Nil	0.60 / 6.0 0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	619052 mE 7553183 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Surface



Land use		Missionalia	Gurdense					Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very wide crest.	Poplar box, minor Ironbark	Semi to extensive cleared.	Soft, no coarse fragments	A11 0.00-0.05 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations
Upper slope <2.0%		No microrelief No Erosion		A12 0.05-0.33 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.30 / 6.0		
				A13 0.33-0.65 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Nil	0.60 / 6.0		
				B21 0.65-0.80 Abrupt	Sandy clay Ioam	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown	Dry, well drained	Nil	0.70 / 6.5		
				B22 0.80-1.00	Clay loam sand	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/6 Strong brown	Dry, well drained	Nil	0.90 / 7.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S2	Somerby, Monteagle, Connors, Humboldt, Blackwater	621083 mE 7553263 mN	Haplic Brown Dermosol	Detailed - 50mm hand auger	26/11/2017

Surface



Land use		Managelia	Configure 1					Soil Profile	Description				
Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Creek, gully / open depression	Eucalypts	Gully erosion, No microrelief No erosion	Soft, loose, no coarse fragments	Nil	Loamy sand	Massive, weak	Nil	10YR5/2 Grayish brown	Dry, rapid	Few, fine	Nil	No samples taken	No additional observations
Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
B2	Somerby, Monteagle, Connors,	632756 mE 7551848 mN	Mesonatric Grey Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Surface

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Mixed vegetation, Brigalow	Nil	Firm to hard setting, minor fine cracking,	A11 0.00-0.10 Abrupt	Silty loam	Weak, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.05 / 6.5	No samples taken	No additional observations
plain, lower slope <1.0%	regrowth and Poplar Box		no coarse fragments	A12 0.10-0.60 Abrupt	Silty loam	Moderate, weak, 5-20mm	Nil	10YR2/2 Very dark brown	Dry, rapid	Very few, very fine	0.30 / 6.5		
				B2 0.60-1.00	Light clay	Firm, sub- angular 10- 30mm	<2% calcium carbonate nodules	10YR2/2 Very dark brown Mottle 10YR3/6 Dark yellowish brown 10-20%	Dry, Imperfect	Nil	0.60 / 7.0 0.90 / 7.5		

Soil Mapping Unit: S2	CSIRO Land Systems (Gunn et al 1967): Somerby, Monteagle, Connors, Humboldt, Blackwater	Location (GDA ZONE 55): 631308 mE 7552792 mN	Aust. Soil Class. : Haplic Brown Dermosol	Site Survey Type : Detailed - 50mm hand auger	Survey Date: 26/11/2017
	Landscape	Surface		Soil Profile	

Land use			Surface	Soil Profile Description										
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations	
Grazing, Open Depression	Eucalypts, minor Brigalow	Gully erosion, No microrelief	Loose, <5% <5mm coarse	A11 0.00-0.40 Abrupt	Loamy sand	Massive, weak	Nil	10YR2/2 Very dark brown	Dry, rapid	Few, fine	0.05 / 6.0	No samples taken	No additional observations	
·	-	No disturbance	fragments	A12 0.30-1.00 Abrupt	Loamy sand	Massive, weak	<10% coarse fragments <5mm	10YR6/3 Dark brown	Dry, rapid	Few, fine	0.30 / 6.0			

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	629781 mE 7553506 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Surface

Landscape



Land use					Soil Profile Description								
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Firm, no coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
plain, lower slope <1.0%				A12 0.28-0.54 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR4/4 Brown	Dry, rapid	Very few, fine	0.30 / 6.5		
				B2 0.54-1.00	Clay loam sandy	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown Mottle <2% 10YR5/8 Dark yellowish brown	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	627807 mE 7553767 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Landscape



Surface





Land use	Land use Landform Natural Microrelief Surface							Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Microrelief Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Flat plain <0.5%	Poplar box	Nil	Firm, no coarse fragments	A11 0.00-0.28 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.10 / 6.0	No samples taken	No additional observations
				A12 0.28-0.54 Abrupt	Loamy sand	Massive, weak	Nil	7.5YR4/4 Brown	Dry, rapid	Very few, fine	0.30 / 6.5		
				B2 0.54-1.00	Clay loam sandy	Moderate, weak, <10mm sub-angular	Nil	7.5YR4/4 Brown Mottle <2% 10YR5/8 Dark yellowish brown	Dry, Imperfect	Nil	0.60 / 6.5 0.90 / 6.5		

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	625603 mE 7553409 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Landscape

Surface









Land use					Soil Profile Description								
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Firm, no coarse fragments	A11 0.00-0.15 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.10 / 6.0	No samples taken	No additional observations
plain, lower slope <1.0%				A12 0.15-0.70 Abrupt	Loamy sand	Massive, weak	Nil	10YR4/4 Dark yellowish brown	Dry, rapid	Very few, very fine	0.30 / 6.5 0.60 / 6.5		
				B2 0.70-1.00	Clay loam sandy	Moderate, weak, 10- 30mm sub-angular	Nil	10YR5/4 Yellowish brown Mottle <5% 10YR5/8 Yellowish brown	Dry, well drained	Nil	0.90 / 6.0		

Soil Profile

Soil Mapping Unit:	CSIRO Land Systems (Gunn et al 1967):	Location (GDA ZONE 55):	Aust. Soil Class. :	Site Survey Type:	Survey Date:
S1	Somerby, Monteagle, Connors,	623381 mE 7553646 mN	Brown Sodosol	Detailed - 50mm hand auger	26/11/2017
	Humboldt, Blackwater				

Surface

Landscape



Land use								Soil Profile	Description				
Landform Pattern, Element, Slope	Natural Vegetation	Disturbance Erosion	Surface condition, surface rock	Horizon Depth (m), Boundary	Texture	Structure, Strength	Inclusions Segregations	Colour, Mottle	Moisture, Drainage	Roots	Depth (m) / Field pH	Sample (m)	Observations
Grazing, Very gently undulating	Poplar box	Nil	Firm, no coarse fragments	A11 0.00-0.04 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Very few, very fine	0.04 / 6.0	No samples taken	No additional observations
plain, mid- slope <1.5%				A12 0.04-0.22 Gradual	Loamy sand	Massive, weak	Nil	10YR3/3 Dark brown	Dry, rapid	Few, fine	0.20 / 6.5		
				A13 0.22-0.44 Abrupt	Loamy sand	Massive, weak	Nil	10YR3/4 Dark yellowish brown	Dry, rapid	Nil	0.30 / 6.5		
				B21 0.44-0.70 Abrupt	Clay loam Sandy	Moderate, weak, 5-20mm sub-angular	Nil	10YR4/6 Dark yellowish brown	Dry, rapid	Nil	0.60 / 7.0		
				B22 0.70-1.00	Clay loam sandy	Moderate, weak, 5-20mm sub-angular	Nil	10YR3/6 Dark yellowish brown	Dry, well drained	Nil	0.90 / 7.0		

Appendix B Observation site descriptions

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob1	638752 mE 7548118 mN	S1	Poplar Box, light brown firm surface
Ob2	639159 mE 7548139 mN	S1	Poplar Box all around, with very small patch of Brigalow nearby.
Ob3	639339 mE 7548097 mN	S1	Very small patch of Brigalow <20m wide, Poplar Box to the west, Poplar Box and other mix vegetation to the East
Ob4	639375 mE 7547774 mN	S1	Minor Brigalow patch in small depression, Poplar Box all around area.
Ob5	639449 mE 7547743 mN	S1	Various mix vegetation all around, but only Poplar Box in immediate area of site, some minor depressions nearby

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob6	638723 mE 7547859 mN	S1	Poplar Box only to north, towards south various mixed vegetation, Moreton Bay Ash, Poplar Box, and Gums

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob7	638617 mE 7547036 mN	S1	<image/>
Ob8	639214 mE 7546993 mN	S1	Firm, light brown surface with Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob9	638569 mE 7546676 mN	Boundary S1 / C2	Surface cracking to south, Poplar Box to the north
Ob10	638561 mE 7546535 mN	C2	Various regrowth, very minor Poplar Box, Brigalow, small cracks in surface
Ob11	639065 mE 7546449 mN	Boundary S1 / C2	Cracking surface to the south
Ob12	639039 mE 7546320 mN	C2	Cracking surface, Brigalow regrowth
Ob13	639706 mE 7547373 mN	S1	Poplar Box
Ob14	639823 mE 7547230 mN	Boundary S1 / S2	Very gradual boundary due to difference soil profiles are nearby detailed sites in S1 and S2 soil mapping units
Ob15	640083 mE 7547286 mN	C1	Brigalow with melon holes starting towards the south
Ob16	639964 mE 7547147 mN	Boundary S2 / C1	Melon holes starting towards east
Ob17	640322 mE 7547043 mN	Boundary S2 / C1	Melon holes starting towards west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob18	639963 mE 7546770 mN	52	<image/>
Ob19	640195 mE 7546733 mN	Boundary C2 / C1	Cracking surface with melon holes beginning to the east, Brigalow
Ob20	640430 mE 7546417 mN	Boundary C2 / C1	Cracking surface with melon holes beginning to the north, Brigalow

Site No.	Location	Soil Mapping Unit	Comments / Pictures
	(GDA94 Zone 53)		
Ob21	639519 mE	S1	Poplar Box
	7546438 mN		
Ob22	639844 mE	C2	Cracking surface
	7546269 mN		
Ob23	639520 mE	C2	Large open depression, inundated
	7546195 mN		

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob24	642279 mE 7547774 mN	52	

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob25	642525 mE	S2	Firm surface, Ironbark, White Gums
	7547379 mN		
Ob26	642039 mE 7547577 mN	S2	Poplar Box
Ob27	641406 mE 7547677 mN	S2	Moreton bay Ash

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob28	641655 mE 7546982 mN	S2	Loamy sand surface, light brown, with Poplar Box
Ob29	641133 mE 7547074 mN	S2	Moreton Bay Ash
Ob30	640468 mE 7547102 mN	52	Loamy sand surface, light brown, Poplar Box
Ob31	640509 mE 7546304 mN	C2	Minor drainage line, cracking surface
Ob32	640602 mE 7546188 mN	C2	Brigalow, cracking surface
Ob33	640646 mE 7546122 mN	Boundary C2 / C1	Gilgai getting deeper towards south (Melon Holes)
Ob34	641180 mE 7546807 mN	Boundary S2 / C1	Cracking surface with melon holes to south, Poplar Box with firm surface to north
Ob35	641417 mE 7546713 mN	Boundary S2 / C2	Cracking surface to south, Poplar Box with firm surface to north
Ob36	642192 mE 7546532 mN	C2	Dam, surrounded by cracking surface with very minor gilgai
Ob37	641289 mE 7546413 mN	Boundary C2 / C1	Gilgai getting deeper (0.3m+) towards south (Melon Holes)

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob38	641966 mE 7546043 mN	C1	Melon holes approx. 4m diameter, 0.4m deep, depressions at 50% coverage, cracking surface
Ob39	639287 mE 7546017 mN	Boundary S1 / C2	Cracking surface start to north, inundated area to north east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob40	639340 mE 7545650 mN	S1	Firm light brown surfaces, Poplar Box
Ob41	639710 mE 7545620 mN	Boundary S1 / B1	Very diffused boundary, Blackbutt to the south
Ob42	640498 mE 7545947 mN	Boundary C1 / B1	Cracking to the east
Ob43	641454 mE 7545839 mN	C1	Melon holes approx. 4m diameter, 0.4m deep, depressions at 50% coverage, cracking surface
Ob44	642858 mE 7545859 mN	C2	Brigalow
Ob45	642688 mE 7545775 mN	Boundary C1 / C2	Cracking, minor gilgai to the north, melon holes start to the south
Ob46	642251 mE 7545825 mN	C1	Melon holes approx. 4m diameter, 0.4m deep
Ob47	642494 mE 7545445 mN	C1	Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob48	641940 mE 7545190 mN	C1	Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob49	641379 mE 7545137 mN	C1	Brigalow, starts to change to Poplar Box toward south west
Ob50	641458 mE 7545027 mN	C1	Melon Holes, cleared, cracking surface
Ob51	641538 mE 7544887 mN	Boundary C1 / B1	Brigalow, cracking surface to the north east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob52	643072 mE 7545168 mN	C1	Melon Holes, cleared, cracking surface
Ob53	642617 mE 7544828 mN	C1	Melon Holes, cleared, cracking surface
Ob54	642194 mE 7544493 mN	C1	Dam, inundated
Ob55	643573 mE 7545088 mN	52	Poplar Box, light brown sandy surface
Ob56	643225 mE 7544831 mN	C1, near a C1/C2 Boundary	Sparse Brigalow, Melon Holes
Ob57	642749 mE 7544477 mN	C1	Brigalow Regrowth, Melon holes 0.3 – 0.4 m deep, 50% coverage
Ob58	640424 mE 7544720 mN	B1	Silty loam surface, yellow red surface north to grey surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob59	639673 mE 7544810 mN	В1	Poplar Box, Ironbark, silty Ioam surface, land use grazing
Ob60	639497 mE 7544482 mN	B1	Poplar Box, silty loam surface
Ob61	639794 mE 7544376 mN	B1/C2 Boundary	Cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob62	640283 mE 7544309 mN	C2	Cracking surface, normal gilgai 0.25m deep, 30% coverage
Ob63	639479 mE 7544206 mN	C2	Cracking surface, normal gilgai
Ob64	639321 mE 7543726 mN	C2	Cracking surface, normal gilgai
Ob65	639944 mE 7543965 mN	C2	Cracking surface, normal gilgai – deeper ($0.2 - 0.3m$) to the north, < $0.2m$ to the south
Ob66	640756 mE 7544038 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob67	640645 mE 7543776 mN	C2	Cracking surface, normal gilgai
Ob68	641111 mE 7543707 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob69	641544 mE 7544162 mN	B1	Poplar Box, Blackbutt, firm surface with no coarse fragments
Ob70	641895 mE 7544431 mN	B1	Poplar Box, Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob71	642282 mE 7543922 mN	B1	<image/>

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob72	641817 mE 7543722 mN	B1	
Ob73	641496 mE 7543181 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting, <5% coarse fragments <10mm
Ob74	641009 mE 7543022 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob75	640710 mE 7543411 mN	B1	Poplar Box, Blackbutt, some Brigalow starting 100m to north
Ob76	640599 mE 7542888 mN	B1	Poplar Box and Blackbutt, with isolated patch of Brigalow nearby
Ob77	640421 mE 7542761 mN	B1/C2 Boundary	Brigalow and cracking surface starts to the west
Ob78	640250 mE 7542631 mN	C2	Cracking surface, minor normal gilgai
Ob79	640137 mE 7542544 mN	B1/C2 Boundary	Brigalow and cracking surface starts to the east
Ob80	639921 mE 7542386 mN	B1	70% Poplar Box, 30% Blackbutt
Ob81	639693 mE 7542920 mN	C2	Cracking surface, minor normal gilgai
Ob82	639308 mE 7543232 mN	C2	Cracking surface, minor normal gilgai
Ob83	639389 mE 7542297 mN	C2	Brigalow regrowth and cracking surface starts to the north and west
Ob84	639291 mE 7541919 mN	B1	Poplar Box and Blackbutt
Ob85	639588 mE 7541646 mN	B1/S2 Boundary	Poplar Box to the north, cleared to the south
Ob86	640411 mE 7541931 mN	B1	Poplar Box and Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob87	641311 mE 7542587 mN	B1	Poplar Box and Blackbutt
Ob88	641736 mE 7542972 mN	B1	Ironbark, Poplar Box, Moreton Bay Ash, Surface hard setting, <5% coarse fragments <10mm
Ob89	642123 mE 7543231 mN	B1	Blackbutt mostly, with some Poplar Box
Ob90	642116 mE 7542370 mN	B1	Ironbark, Poplar Box, Surface hard setting, <5% coarse fragments <10mm
Ob91	641241 mE 7541929 mN	B1	Ironbark, Poplar Box and Blackbutt
Ob92	641640 mE 7540923 mN	B1/S1 Boundary	Firm light brown surface, Poplar Box
Ob93	640635 mE 7541353 mN	B1	Blackbutt, firm light brown surface with no coarse fragments

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob94	642565 mE 7541626 mN	B1	
Ob95	643114 mE 7542067 mN	B1/C1 Boundary	Melon holes and cracking surface to the east, Poplar Box and Blackbutt to the west
Ob96	642791 mE 7543229 mN	C1	Clay starting toward east, very gradual boundary

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob97	643220 mE 7543467 mN	C1	Brigalow, melon holes, cracking surface
Ob98	643286 mE 7544087 mN	C1	Melon holes, 0.3-0.4m deep, 50% coverage

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob99	643495 mE 7544624 mN	C2	<image/>
Ob100	644039 mE 7544684 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob101	644449 mE 7544448 mN	S2	Loamy sand surface texture, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob102	644379 mE 7544229 mN	C2	Cracking surface, normal gilgai <0.2m deep, 30% coverage
Ob103	645180 mE 7544108 mN	S2	Loamy sand surface texture, Poplar Box
Ob104	645344 mE 7543602 mN	C2	Cracking surface, normal gilgai
Ob105	645322 mE 7543293 mN	C1/C2 Boundary	Gilgai becomes deeper (Melon holes) towards west, 0.3m + deep
Ob106	644798 mE 7543388 mN	C1	Cracking surface, melon holes 0.4m deep
Ob107	643797 mE 7543732 mN	C1	Cracking surface, melon holes 0.4m deep
Ob108	645610 mE 7543021 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob109	645454 mE 7542942 mN	C2	Dam, cracking surface
Ob110	644927 mE 7542918 mN	C1	Cracking surface, melon holes 0.4m deep
Ob111	644148 mE 75428 mN	C1	Cracking surface, melon holes 0.4m deep
Ob112	643449 mE 7542325 mN	C1	Cracking surface, melon holes 0.4m deep
Ob113	643399 mE 7543239 mN	C1	Very minor patch of Poplar Box, cracking all around

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob114	645500 mE 7542622 mN	S2/C2 Boundary	Cracking surface starts towards west
Ob115	645850 mE 7542503 mN	52	Gums to east, Poplar Box to west, sandy surface
Ob116	645333 mE 7542509 mN	C2	<image/>

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob117	644630 mE 7541998 mN	C2	Normal gilgai <0.3m deep, 40% coverage
Ob118	644183 mE 7542115 mN	C2	Normal gilgai <0.3m deep, cracking surface
Ob119	644183 mE 7541667 mN	C1/C2 Boundary	Normal gilgai (<0.3m) to east, melon holes (0.3- 0.4m deep) to west
Ob120	643790 mE 7541387 mN	C1	Melon Holes
Ob121	643302 mE 7541022 mN	C1/B1 Boundary	Melon holes with cracking surface to east, Poplar Box and firm surface to west
Ob122	642799 mE 7540658 mN	B1	Dams, firm light brown surface (non-cracking)
Ob123	642342 mE 7540560 mN	C1/S1 Boundary	Poplar Box to west, cracking / Brigalow to east
Ob124	642087 mE 7540784 mN	S1	Poplar Box
Ob125	641741 mE 7540015 mN	S1	Poplar Box, firm light brown surface, no cracking and no coarse fragments
Ob126	640052 mE 7540046 mN	C2/S1 Boundary	Cracking surface starts towards west
Ob127	639797 mE 7540050 mN	C2/S1 Boundary	Cracking surface starts towards east
Ob128	639596 mE 7540157 mN	S1	Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob129	(GDA94 Zone 53) 639315 mE 7540373 mN	S2	

Location

640866 mE

(GDA94 Zone 53)

Site No.

Ob130

Ob131

Ob132

Soil Mapping Unit

C2

7540195 mN		
640993 mE 7540393 mN	C2	Brigalow areas towards east
641154 mE 7540564 mN	C2	Cracking surface, Brigalow nearby, changing to firm surface <100m to west

Comments / Pictures

Cracking surface, dam

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob133	641293 mE 7540695 mN	C2/S2 Boundary	Cracking to south
Ob134	640893 mE 7540659 mN	S2	Firm non-cracking surface, cleared
Ob135	640460 mE 7540542 mN	S2	Firm non-cracking surface, cleared
Ob136	640471 mE 7541197 mN	S2	Firm non-cracking surface, cleared
Ob137	643149 mE 7539809 mN	S1	Isolated brigalow patch, narrow wet gully, all areas surrounding non cracking surface
Ob138	643063 mE 7539714 mN	S1	Crest, firm surface
Ob139	642469 mE 7539069 mN	C2/S1 Boundary	Cracking surface towards south, non-cracking to north
Ob140	642066 mE 7538851 mN	C2	Cracking surface, normal gilgai <0.2m deep, 20% coverage
Ob141	641170 mE 7538865 mN	C2	Cracking surface, normal gilgai <0.2m deep, 20% coverage
Ob142	640430 mE 7538932 mN	C2	Cracking surface, with diffused interfingering boundary of non-clay/cracking surface areas
Ob143	639433 mE 7538949 mN	C1	Cracking surface, normal gilgai <0.2m deep, 20% coverage, melon holes observed to the west
Ob144	639623 mE 7539560 mN	C1	Cracking surface, normal gilgai <0.2m deep, 20% coverage

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob145	640939 mE 7539291 mN	C1/S1 Boundary	Cracking surface to the south, non-cracking firm surface to the north
Ob146	641199 mE 7539488 mN	S1	Poplar Box, Blackbutt, firm light brown surface
Ob147	642074 mE 7539461 mN	S1	Frim to hard setting, non- cracking surface, extensive clearing
Ob148	643630 mE 7539909 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob149	644078 mE 7540295 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob150	643662 mE 7540907 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob151	644710 mE 7541125 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage
Ob152	645155 mE 7540789 mN	52	Poplar Box, Blackbutt, firm sandy surface
Ob153	645407 mE 7540162 mN	52	Poplar Box, Blackbutt, firm sandy surface. Cracking surface observed to the west.
Ob154	645004 mE 7540003 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes observed to the west.
Ob155	644941 mE 7539851 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes observed to the south.
Ob156	645314 mE 7539941 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob157	646683 mE 7540275 mN	52	Blackbutt, Eucalypts, firm sandy surface.
Ob158	646943 mE 7539762 mN	S2	Wide isolated depression, Eucalypts with minor Moreton Bay Ash, Poplar Box Black butt
Ob159	646630mE 7539414 mN	S2	Blackbutt, Eucalypts, firm sandy surface.
Ob160	646036 mE 7539624 mN	S2 – S2/C2 Boundary	Poplar Box, Blackbutt, firm sandy surface with cracking clays to the immediate west.
Ob161	645725 mE 7538968 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Melon holes to the west
Ob162	645377 mE 7538707 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob163	644823 mE 7538319 mN	C1	Cracking surface, melon holes <0.40 deep, <50% coverage, Brigalow
Ob164	644310 mE 7537833 mN	C2	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Poplar box observed to the east.
Ob165	644402 mE 7537847 mN	S1	Frim to hard setting, isolated Brigalow patch
Ob166	644132 mE 7538041 mN	C2 – C2/S1 Boundary	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Poplar Box to the north/east.
Ob167	643739 mE 7538575 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob168	644478 mE 7538905 mN	C1	Cracking surface, melon holes <0.40 deep, <50% coverage, Brigalow
Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
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Ob169	643485 mE 7538923 mN	S1	Frim to hard setting sandy surface. Cracking clay surfaces observed to the south.
Ob170	643165 mE 7539350 mN	S1	Frim to hard setting sandy surface.
Ob171	643923 mE 7539477 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob172	642867 mE 7538013 mN	S1	Frim to hard setting sandy surface. Cracking surface to the west.
Ob173	642046 mE 7538256 mN	C2 – C2/S1 Boundary	Cracking surface, normal gilgai <0.2m deep 20-30% coverage. Red sandy surface north with Black Butt than clay surface returns.
Ob174	640351 mE 7538345 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob175	639764 mE 7538448 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow
Ob176	639211 mE 7538555 mN	C1/C2/S1 Boundary	Dam, melon holes to the north, normal gilgai to the east and Poplar Box to the west
Ob177	638861 mE 7538520 mN	S1	Hard setting brown sandy surface, Poplar Box
Ob178	638042 mE 7538570 mN	52	Firm – hard setting sandy surface, Black butt
Ob179	638202 mE 7538826 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob180	638554 mE 7538939 mN	C1	Cracking surface, melon holes <0.60 deep, <50% coverage, Brigalow

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob181	637408 mE 7538705 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob182	636917 mE 7538763 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob183	636507 mE 7539040 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage.
Ob184	635799 mE 7538890 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage. Brigalow regrowth
Ob185	635851 mE 7538289 mN	C2	Cracking surface, normal gilgai <0.2m deep <20% coverage. Brigalow regrowth
Ob186	635829 mE 7538054 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob187	636670 mE 7537857 mN	A1	Drainage line, depression, Paperbark
Ob188	636551 mE 7538527 mN	C2	Cracking surface to the north
Ob189	637020 mE 7537712 mN	L2	Poplar Box wood land observed

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob190	637357 mE 7537472mN	C2	Cracking surface, Brigalow regrowth
Ob191	637209 mE 7537353 mN	L2	Dense Poplar Box wood lands
Ob192	636859 mE 7537329 mN	A1	Drainage line, depression
Ob193	637411 mE 7536481 mN	S1	Poplar Box wood land observed
Ob194	637905 mE 7537190 mN	S1/C2 Boundary	Cracking surface to the north, poplar box to the south
Ob195	637764 mE 7537804mN	C2	Minor cracking clay surface, Brigalow
Ob196	637714 mE 7537977 mN	C2/S1 Boundary	Cracking surface to the south and Poplar Box to the north
Ob197	637680 mE 7538138 mN	C2/S1 Boundary	Cracking surface to the north and Poplar Box to the north
Ob198	637651 mE 7538362 mN	C2	Cracking surface, Brigalow woodlands
Ob199	638272 mE 7537344 mN	C2/S2 Boundary	Boundary Depression and cracking to the south west, Blackbutt to the north east
Ob200	638400 mE 7537435 mN	S2	Poplar Box and Blackbutt
Ob201	639534 mE 7537534 mN	R1/S1/S2 Boundary	Red surface to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob202	639423mE 7538056 mN	S1	Poplar Box, Blackbutt and Ironbark
Ob203	639784 mE 7537993 mN	R1/ C2	Firm no cracking surface to the south, cracking clay surface to the north
Ob204	639941 mE 7537488 mN	R1/ C2	Firm no cracking surface to the west, cracking clay surface to the east
Ob205	640463 mE 7537726 mN	C2	Cracking surface, minor gilgai observed
Ob206	641283 mE 7537652 mN	C2	Cracking surface, normal gilgai observed
Ob207	640562 mE 7537335 mN	C2	Cracking surface, normal gilgai observed to the north
Ob208	642075 mE 7537481 mN	C2	Cracking surface, normal gilgai observed
Ob209	642313 mE 7536589 mN	C2	Cracking surface, normal gilgai observed
Ob210	642109 mE 7536460 mN	S2/R1	Red sandy surface to the west, brown sandy surface to the east
Ob211	641923 mE 7536231 mN	C1/R1	Melon holes to the east, red sandy surface to the west
Ob212	641734 mE 7536093 mN	R1/S2	Red surface to the north, brown surface to the south
Ob213	641330 mE 7536067 mN	C2	Isolated Brigalow patch with clay surface

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob214	641160 mE 7535666 mN	R1/S2 Boundary	Red surface to the north, brown sandy surface to the south.
Ob215	640768 mE 7535197 mN	S1	Poplar Box, sandy surface
Ob216	641052 mE 7534837 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob217	640546 mE 7535223 mN	S1	Poplar Box woodlands present, creek/depression to the south
Ob218	640416 mE 7535259 mN	A2	Body of water leading to the dam
Ob219	640412 mE 7535476 mN	A2	Swamp/Depression, Eucalypts
Ob220	640892 mE 7535976 mN	R1	Red sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob221	640153 mE 7535160 mN	L2	Sparse regrowth, Poplar Box and Moreton Bay Ash
Ob222	640000 mE 7535342 mN	L2	Minor depression with Brigalow
Ob223	640079 mE 7535059 mN	A1	Drainage line, depression

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob224	639890 mE 7535353 mN	S1	Poplar Box woodlands, firm to hard setting sandy surface
Ob225	639535 mE 7535376 mN	В2	Cattle Yard
Ob226	639431 mE 7535246 mN	B2/ S1 Boundary	Minor depression with cracking surface and Brigalow. Areas outside are firm with Poplar Box
Ob227	639273 mE 7535208 mN	S1	Poplar Box, firm sandy surface
Ob228	639340 mE 7535437 mN	B2	Wide Depression with Dam
Ob229	638931 mE 7535381 mN	L2	Poplar Box, firm loamy sand surface
Ob230	638829 mE 7535664 mN	S1	Poplar Box, Blackbutt, Loamy sand surface
Ob231	638965 mE 7535884 mN	B2	Alluvial depression
Ob232	638574 mE 7535447 mN	A2/ L2 Boundary	Drainage line to the north with Paperbark and Eucalypts
Ob233	638568 mE 7535364 mN	L2	Poplar Box woodlands to the east
Ob234	638270 mE 7535766 mN	A1	Drainage line
Ob235	638438 mE 7535978 mN	C2	Isolated Brigalow patch with clay surface

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Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob236	638311 mE 7536066 mN	S1/C2 Boundary	Brigalow to the east, sandy surface to the west
Ob237	637799 mE 7535433 mN	L2	Tall woodlands of Poplar Box
Ob238	637707 mE 7536050 mN	A1	Drainage line, Moreton Bay Ash
Ob239	637142 mE 7535864 mN	L2	Tall woodlands of Poplar Box
Ob240	637145 mE 7535389 mN	L2/C2 Boundary	Poplar Box to the east, cracking clay surfaces to the west
Ob241	636773 mE 7535693 mN	L2	Poplar Box wood lands, hard setting with minor cracking
Ob242	636289 mE 7535417 mN	L2	Poplar Box wood lands
Ob243	636314 mE 7535783 mN	C2	Extensive cleared, cracking clay surface
Ob244	636127 mE 7535780 mN	S2	Poplar Box wood lands present with cracking soils to the north
Ob245	635750 mE 7535297 mN	L2	Poplar box woodland
Ob246	635712 mE 7533914 mN	C2	Minor gilgai, Brigalow regrowth
Ob247	635668 mE 7533610 mN	L1	Poplar box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob248	635160 mE 7533591 mN	L1	Hard setting surface, Poplar box
Ob249	635370 mE 7533716 mN	L1/C2 Boundary	Clay surface and minor gilgai to the north
Ob250	634883 mE 7533770 mN	C2	Normal gilgai, cracking clay surface
Ob251	634532 mE 7533634 mN	L1/C2 Boundary	Light sandy surface to the south, clay with shrubs to the north
Ob252	634082 mE 7533937 mN	C2	Normal gilgai, Brigalow regrowth
Ob253	634211 mE 7534505 mN	C2	Normal gilgai, Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob254	(GDA94 Zone 53) 635054 mE 7534753 mN	C2	Normal gilgai, Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob255	634506 mE 7535378 mN	52	<image/>
Ob256	634063 mE 7535925 mN	S2/C2 Boundary	Poplar Box to the south, cracking clay to the north
Ob257	634093 mE 7536291 mN	C2	Cracking clay surface, minor gilgai.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob258	634657 mE 7536638 mN	L2	
Ob259	634757 mE 7536245 mN	C2/S2 Boundary	Cracking clay to the south
Ob260	634549 mE 7535854 mN	C2	Cracking clay surface, minor gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob261	634970 mE 7535802 mN	C2	Cracking clay surface to the west, minor gilgai
Ob262	635182 mE 7535677 mN	C2/S2 Boundary	Poplar Box to the north and clay, minor gilgai to the south
Ob263	635424 mE 7536341 mN	S1	Poplar Box woodlands
Ob264	635564 mE 7537080 mN	S1	Poplar Box woodlands
Ob265	635485 mE 7537098 mN	L2	Dense Poplar Box woodlands
Ob266	634813 mE 7537171 mN	L2	Bloodwood, Ironbark to the east, Poplar Box to the west
Ob267	636005 mE 7537468 mN	S1	Poplar box woodlands
Ob268	636275 mE 7537753 mN	S1/L2 Boundary	Poplar box woodlands, thinner to the west
Ob269	636241 mE 7537361 mN	L2	Poplar box
Ob270	636769 mE 7537289 mN	L2/C2 Boundary	Cracking clay surface to the south
Ob271	636575 mE 7536882 mN	C2	Cracking clay surface, minor gilgai.
Ob272	636802 mE 7536547 mN	C2	Cracking clay surface to the north.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob273	636213 mE 7536564 mN	L2	<image/>
Ob274	636216 mE 7536282 mN	L2/C2 Boundary	Poplar box to north, cracking clay to the south
Ob275	637172 mE 7536479 mN	A1	Edge of drainage line

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob276	637533 mE 7536800 mN	C2	Cracking clay surface, minor gilgai
Ob277	637696 mE 7536464 mN	S1/C2 Boundary	Cracking clays to the north, poplar box to the south
Ob278	637752 mE 7536951 mN	S1	Poplar box woodlands
Ob279	638020 mE 7536314 mN	C2	Cracking clay surface
Ob280	638713 mE 7536204 mN	C2/S2 Boundary	Cracking clay surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob281	638873 mE 7536754 mN	C2	<image/>
Ob282	639027 mE 7537001 mN	S2	Brown, firm clayey sand surface
Ob283	639232 mE 7536823 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob284	639609 mE 7536609 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south
Ob285	640042 mE 7536247 mN	S2/C2 Boundary	Poplar box to the north, cracking surface to the south
Ob286	639939 mE 7535946 mN	C2	Cracking clays, minor gilgai microrelief
Ob287	639886 mE 7535860 mN	S1/C2 Boundary	Poplar box to the south, cracking clays to the north
Ob288	640571 mE 7536256 mN	R1	Red loamy sand surface to the south
Ob289	640009 mE 7537024 mN	52	Cracking clay surface to the north
Ob290	640547 mE 7537132 mN	S2/R1 Boundary	Red loamy sandy surface to the east
Ob291	640836 mE 7536628 mN	S2/R1 Boundary	Red loamy sandy surface to the east
Ob292	641318 mE 7537090 mN	C2/R1 Boundary	Red loamy sandy surface to the south, clay surface to the north
Ob293	643789 mE 7536987 mN	C2	Patch of Brigalow, minor gilgai
Ob294	644519 mE 7537219 mN	C2	Cracking clays, normal gilgai microrelief
Ob295	645953 mE 7537683 mN	C2	Cracking clays, normal gilgai microrelief extending to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob296	646717 mE 7538082 mN	C2/B1 Boundary	Cracking clays to the west
Ob297	646670 mE 7538320 mN	C2	Sparse Brigalow to the west, <30% normal gilgai
Ob298	646182 mE 7538055 mN	C2	Normal gilgai microrelief
Ob299	646558 mE 7537448 mN	C2	Cracking clay, normal gilgai microrelief
Ob300	645209 mE 7537461 mN	S1	Poplar box, tall woodlands, new regrowth to the west
Ob301	644872 mE 7536503 mN	R1	Red surface to the south
Ob302	645765 mE 7536749 mN	C2/S1 Boundary	Clay surface starts to the west, sandy surface to the east
Ob303	645391 mE 7536210 mN	S1	Poplar box woodlands with sandy firm to hard setting surface
Ob304	645559 mE 7535815 mN	C2/S1 Boundary	Clay surface starts to the west, sandy surface to the east
Ob305	645321 mE 7535662 mN	S1	Poplar box woodlands with sandy firm to hard setting surface
Ob306	644283 mE 7535402 mN	S2	Poplar box woodlands with clayey sand firm to hard setting surface
Ob307	643788 mE 7535356 mN	R1	Red loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob308	643713 mE 7535359 mN	A2	Swamp, open depression of water, Eucalypts
Ob309	643344 mE 7535045 mN	A2	Swamp, open depression of water to the east, Eucalypts
Ob310	642785 mE 7535003 mN	R1	<image/>

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob311	641867 mE 7535387 mN	R1/S2 Boundary	Red surface to the north
Ob312	642740 mE 7535710 mN	R1/C1 Boundary	Poplar box/red surface to the south, cracking clays to the north
Ob313	643098 mE 7535992 mN	R1/S1 Boundary	Red surface to north, brown to the north.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob314	642944 mE 7536282 mN	C1	Brigalow, cracking clays with melon hole relief, boundary with start of Poplar Box 100M= away at the east
Ob315	643586 mE 7536222 mN	R1	Red firm loamy sand surface
Ob316	643775 mE 7536259 mN	R1	Red firm loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob317	643358 mE 7535654 mN	A2	Wide depression, moist/wet surface, Eucalypts
Ob318	644681 mE 7536133 mN	R1	Red firm loamy sand surface
Ob319	644031 mE 7536500 mN	R1/S2 Boundary	Red firm loamy sand surface to the south, brown sandy surface to the north
Ob320	645881 mE 7535125 mN	C2	Brigalow, minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob321	645881 mE 7535125 mN	C2	Brigalow, minor normal gilgai
Ob322	645632 mE 7534621 mN	S1/C2 Boundary	Brigalow to the east, Poplar box to the west
Ob323	645428 mE 7534309 mN	S1	Poplar box wood lands

Location

(GDA94 Zone 53)

Site No.

Soil Mapping Unit

egrowth to the east, Poplar box to the west
lm deep
wood lands
lays, minor gilgai observed to the south west

Ob324	645909 mE 7533983 mN	S1/C2 Boundary	Brigalow regrowth to the east, Poplar box to the west
Ob325	646332 mE 7533575 mN	C2	Gilgai <0.2m deep
Ob326	645603 mE 7533537 mN	S1	Poplar box wood lands
Ob327	644511 mE 7533499 mN	C2	Cracking clays, minor gilgai observed to the south west
Ob328	644307 mE 7532844 mN	C2	Cracking clay surface, minor gilgai
Ob329	643943 mE 7533311 mN	C2	Cracking clay surface, minor gilgai
Ob330	643366 mE 7533339 mN	S1/C2 Boundary	Poplar box and Brigalow vegetation interfingering
Ob331	642914 mE 7533273 mN	C2	Brigalow regrowth, cracking gilgai
Ob332	644164 mE 7532647 mN	A1	Drainage line, gradually comes to an end
Ob333	643415 mE 7532732 mN	A1	Drainage line
Ob334	642542 mE 7533239 mN	A1	Drainage line
Ob335	642329 mE 7533667 mN	C2	Brigalow regrowth, cracking gilgai
	-		

Comments / Pictures

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob336	643340 mE 7533622 mN	S1	Poplar box wood lands
Ob337	643017 mE 7534198 mN	S1	Poplar box wood lands
Ob338	643885 mE 7534095 mN	S1	Poplar box wood lands
Ob339	643949 mE 7534459 mN	A2/S1 Boundary	Poplar box to the west, Eucalypts and moist surface to the east
Ob340	644173 mE 7534488 mN	A2/S1 Boundary	Poplar box to the east, Eucalypts and moist surface to the west
Ob341	644738 mE 7534618 mN	S1	Poplar Box, starting to change to red surface to the west
Ob342	643847 mE 7534654 mN	R1/A2 Boundary	Depression, Gums, Moreton Bay Ash, long grass with moist surface, Poplar Box to the north
Ob343	644182 mE 7534685 mN	R1/S1 Boundary	Red surface to the north, light brown to the south, poplar Box all around area
Ob344	641995 mE 7534017 mN	S1	Poplar Box, hard setting surface
Ob345	642228 mE 7534342 mN	A2	Depression, swamp with white gums

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob346	641617 mE 7534316 mN	A1	<image/>
Ob347	641536 mE 7534375 mN	A1/A2 Boundary	Area prone to flooding, moist surface
Ob348	641713 mE 7534721 mN	A2	Very wide depression, gums, moist surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob349	641840 mE 7534826 mN	S1	Poplar Box, Brigalow patch 100m to west, gums 100m to south
Ob350	641417 mE 7534841 mN	S1	Isolated small Brigalow patch, <30 x 30m, Poplar Box all around this area
Ob351	641886 mE 7533241 mN	C2	Cracking surface (cracks <5mm)
Ob352	641492 mE 7532741 mN	S1/L1 Boundary	Very gradual boundary, only Poplar Box all around area
Ob353	641398 mE 7532349 mN	S1	Lower slope, gums and Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob354	641433 mE 7531699 mN	S1	<image/>
Ob355	642723 mE 7532496 mN	C2	Cracking surface, cleared, minimal microrelief
Ob356	644333 mE 7532134 mN	C2	Cracking surface, minimal microrelief

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob357	644259 mE 7531930 mN	L1	Loamy sand surface, Poplar Box
Ob358	643516 mE 7531698 mN	L1	Eroded area, minor drainage line, loamy sand surface, Poplar Box
Ob359	640670 mE 7533043 mN	C2	Brigalow patch starts to the north

Location

641211 mE

(GDA94 Zone 53)

Site No.

Ob360

	7533224 mN		
Ob361	640560 mE 7533218 mN	C2/S1 Boundary	Cracking surface to the east
Ob362	640929 mE 7533548 mN	C2/L1 Boundary	Cracking surface to the west, mixed vegetation

Comments / Pictures

Soil Mapping Unit

C2/L1 Boundary

Depression, clay soils with cracking surface, some Brigalow regrowth nearby

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob363	641639 mE 7533640 mN	A1/L1 Boundary	Poplar Box starts towards south west, drainage line to north east
Ob364	641327 mE 7533759 mN	C2/L1 Boundary	Cracking surface to the north, Poplar Box to the south
Ob365	640982 mE 7533991 mN	C2	Cracking surface, minor gilgai <0.2m deep
Ob366	639761 mE 7533701 mN	R1/L1 Boundary	Poplar Box, red surface colour towards south, light brown to the north
Ob367	639292 mE 7533567 mN	R1	Red surface, firm, sandy, Poplar Box
Ob368	639238 mE 7533828 mN	R1/L1 Boundary	Poplar Box, red surface colour towards south, light brown to the north
Ob369	640013 mE 7534158 mN	C2	Cracking surface, Brigalow regrowth
Ob370	639673 mE 7534382 mN	L1	Poplar Box, wide depression
Ob371	639271 mE 7534330 mN	L1	Poplar Box, sandy firm surface
Ob372	639208 mE 7534816 mN	C2	Cleared, some Brigalow regrowth in area
Ob373	639190 mE 7535008 mN	A1	Drainage line, Gums
Ob374	639841 mE 7534632 mN	C2/L1 Boundary	Cracking surface to the west, Poplar Box to the east

7535812 mN

646220 mE 7535437 mN

646251 mE

647147 mE

7535387 mN

7535197 mN

C2

C2

C2

Soil Mapping Unit

Site No.

Ob375

Ob376

Ob377

Ob378

Ob379

Ob380

Ob381

Ob382

Ob383

Ob384

Ob385

Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
640437 mE 7534580 mN	L1	Poplar Box
640492 mE 7534350 mN	C2/L1 Boundary	Cracking surface to the west, Poplar Box to the east
647006 mE 7536728 mN	C2	Cracking surface, normal gilgai 0.2m deep
647219 mE 7536532 mN	B1	Firm light brown surface – loamy sand
647533 mE 7536361 mN	C2/B1 Boundary	Cracking surface starts to the south, minor depression
646354 mE 7536071 mN	C2	Cracking surface, normal gilgai 0.3m deep
648164 mE 7536309 mN	S2	Poplar Box
647645 mE 7535812 mN	C2	Cracking surface, normal gilgai 0.2m deep, Brigalow regrowth

Cracking surface, normal gilgai 0.2m deep

Cracking surface, normal gilgai 0.2m deep

Cracking surface, normal gilgai 0.2m deep, Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob386	648239 mE 7534928 mN	A2	<image/>
Ob387	648499 mE 7534135 mN	A2	Inundated depression
Ob388	648492 mE 7533859 mN	A2	Poplar Box to east, mixed veg and Paperbark to west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob389	648733 mE 7533489 mN	A2	Poplar Box to the east, Blackbutt and some Paperbark to west
Ob390	648676 mE 7533483 mN	A2	Surface cracking, gums, depression
Ob391	648446 mE 7533499 mN	C2/A2 Boundary	Cracking surface to the west
Ob392	648162 mE 7533363 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth
Ob393	647857 mE 7534102 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth, cleared
Ob394	647857 mE 7534671 mN	C2	Normal gilgai 0.2 – 0.3m deep, 30% coverage, cracking surface
Ob395	647054 mE 7534178 mN	C2	Cracking surface, normal gilgai, Brigalow regrowth, cleared
Ob396	646366 mE 7534567 mN	C2	Cracking surface
Ob397	648557 mE 7535811 mN	S2	Firm sandy surface, Blackbutt and Poplar Box
Ob398	648596 mE 7535664 mN	A2	Firm surface with minor cracking
Ob399	648772 mE 7534738 mN	A2	Brigalow regrowth, minor cracking, nearby Poplar Box
Ob400	649149 mE 7534004 mN	A2	Some small surface cracking
Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
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Ob401	649569 mE 7533815 mN	A2	Some small surface cracking and crusting, Poplar Box
Ob402	649894 mE 7533990 mN	A2	<image/>
Ob403	650184 mE 7534146 mN	S2/A2 Boundary	Poplar Box only and non-cracking surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob404	650714 mE 7534358 mN	S2/C2 Boundary	Brigalow starts towards east
Ob405	650786 mE 7534114 mN	C2	Brigalow and cracking surface
Ob406	650630 mE 7533886 mN	A2	Depression, gums, cracking surface
Ob407	650953 mE 7533634 mN	C2	Brigalow and cracking surface, small area
Ob408	650907 mE 7534438 mN	S2/C2 Boundary	Brigalow starts to west, Poplar Box to east
Ob409	650604 mE 7534812 mN	S2	Very small isolated area of Brigalow, Poplar Box in surrounding areas
Ob410	650316 mE 7534976 mN	S2	Poplar Box only
Ob411	651629 mE 7534947 mN	S2	Poplar Box only

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob412	651590 mE 7535098 mN	52	<image/>
Ob413	651076 mE 7535957 mN	S2	Gums, sandy surface
Ob414	649422 mE 7536276 mN	S2	Ironbark, Blackbutt, Gums, sandy light brown surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob415	648911 mE 7536218 mN	S2	Blackbutt, Gums, sandy light brown surface
Ob416	649115 mE 7533129 mN	A2	Gums, depression, moist surface
Ob417	649239 mE 7533052 mN	A2	Gums, Blackbutt, depression, moist surface
Ob418	649371 mE 7533153 mN	A2	Cracking surface, gums, depression
Ob419	649445 mE 7533037 mN	B2	sandy surface with some minor cracking to east
Ob420	650355 mE 7533169 mN	B2/A2 Boundary	Poplar Box starts towards east, small cracks in surface towards west
Ob421	650524 mE 7533438 mN	B2	Poplar Box, gently undulating plain, light brown firm surface non-cracking
Ob422	650760 mE 7533509 mN	A2	Depression, cracking surface, tall Gums
Ob423	650933 mE 7532627 mN	B2/A2 Boundary	Alluvial, wide depressions to north, Poplar Box and firm non-cracking surface to south
Ob424	650237 mE 7532997 mN	A2	Cracking, wide depression, area prone to flooding, some Polar Box and mainly Gums
Ob425	651503 mE 7532930 mN	S2	Poplar Box with gums appearing to the east, firm sandy surface
Ob426	651540 mE 7532303 mN	S2	Some gums, lots of Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob427	651849 mE 7532131 mN	S2	Gums starting to the east, mainly Poplar Box though, light brown non-cracking sandy surface
Ob428	650779 mE 7532109 mN	A2	Cracking, wide depression, area prone to flooding, mainly Gums
Ob429	651397 mE 7531570 mN	B2	Gums, Poplar Box, Moreton bay Ash, top 50mm soil profile is Clayey Sand
Ob430	651208 mE 7531360 mN	B2	Poplar Box
Ob431	651564 mE 7530942 mN	B2	Surface soil texture – Silty Loam, Poplar Box only
Ob432	651952 mE 7530335 mN	S2	Poplar Box, firm light brow surface, non-cracking
Ob433	651896 mE 7530053 mN	A2	Alluvial area, wide depression, prone to flooding, minor surface cracking, Gums
Ob434	651347 mE 7530096 mN	B2/A2 Boundary	Depressions with Gums to the south, Poplar Box to the north
Ob435	650970 mE 7530074 mN	B2/C2 Boundary	Cracking surface to the north, non-cracking surface to the south
Ob436	650614 mE 7530143 mN	B2/C2 Boundary	Cracking surface to the north, non-cracking surface to the south
Ob437	650444 mE 7530754 mN	C2	Cracking surface, normal gilgai 0.2m deep, 20% coverage
Ob438	651166 mE 7530604 mN	B2/C2 Boundary	Cracking surface to the south, Poplar Box to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob439	650834 mE 7530892 mN	B2/C2 Boundary	Cracking surface to the south, non-cracking surface to the north with Poplar Box
Ob440	650275 mE 7531260 mN	B2/C2 Boundary	Cracking surface to the south with normal gilgai 0.1 – 0.2m deep 30% coverage, non-cracking surface to the north with Poplar Box
Ob441	650083 mE 7531475 mN	B2/C2 Boundary	Cracking surface to the west, non-cracking surface to the east with Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob442	650354 mE 7531677 mN	B2	Mixed vegetation, silty loam texture for surface soil horizon
Ob443	650265 mE 7531683 mN	B2	Cracking surface with Poplar Box
Ob444	649875 mE 7531765 mN	B2	Cracking surface to the south, Poplar Box to north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob445	649817 mE 7531850 mN	C2	Land cleared, with normal gilgai 40% coverage 0.25m deep, some Brigalow regrowth in area
Ob446	649189 mE 7531595 mN	C2	Land cleared, with normal gilgai 30% coverage 0.2m deep, some Brigalow regrowth in area
Ob447	649709 mE 7532348 mN	C2	Land cleared, with normal gilgai 30% coverage 0.2m deep, some Brigalow regrowth in area
Ob448	649954 mE 7532534 mN	B2/C2 Boundary	Cracking surface to the south west, very minor cracking surface to the north east with Poplar Box
Ob449	649429 mE 7532806 mN	B2/C2 Boundary	Cracking surface to the south, Poplar Box to the north
Ob450	647839 mE 7532936 mN	C2	Cracking surface with minor normal gilgai <20% coverage
Ob451	648693 mE 7532907 mN	B2/C2 Boundary	Surface features thick (5mm+) cracks to the south and minor <3mm cracks to the north
Ob452	648950 mE 7532358 mN	C2	Cracking surface with minor normal gilgai <20% coverage
Ob453	648132 mE 7532172 mN	C2	Depression with long green grass, cracking surface with minor normal gilgai <20% coverage
Ob454	647823 mE 7531778 mN	C2	Cracking surface with minor normal gilgai 40% coverage
Ob455	648395 mE 7531796 mN	C2	Cracking surface with minor normal gilgai 40% coverage
Ob456	652372 mE 7531880 mN	L1	Sandy firm surface, cleared

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob457	651720 mE 7531430 mN	S2	Gums, sandy surface
Ob458	651901 mE 7530856 mN	52	Gums, sandy surface
Ob459	652356 mE 7531100 mN	52	Gums and some Poplar Box, sandy surface
Ob460	652953 mE 7531209 mN	L1	Sandy firm surface, cleared
Ob461	652668 mE 7530777 mN	L1	Sandy firm surface, cleared
Ob462	652631 mE 7530405 mN	S2/C2 Boundary	Cracking surface starting towards south east
Ob463	653359 mE 7530665 mN	L1	Firm sandy firm surface, cleared
Ob464	652778 mE 7530016 mN	C2	Hard setting, cracking surface with very minor normal gilgai present

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob465	653229 mE 7530049 mN	L1	Firm light brown surface, non-cracking
Ob466	653551 mE 7529879 mN	L1/C1 Boundary	Cracking surface and melon holes 0.4-0.5m deep (50% coverage) start towards south
Ob467	652841 mE 7529653 mN	C2	Cracking surface with minor gilgai to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob468	652446 mE 7529359 mN	B2	Surface texture silty loam, with fine cracking
Ob469	652394 mE 7529669 mN	B2	Surface texture silty loam, with fine cracking
Ob470	651959 mE 7529616 mN	S2	Sandy firm surface with no cracks, gums and Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob471	651447 mE 7529708 mN	52	Sandy soft surface, gums and Poplar Box
Ob472	651047 mE 7529419 mN	52	Light brown sandy surface, gums
Ob473	651786 mE 7529295 mN	S2	Sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob474	651631 mE 7529525 mN	52	Surface texture loamy sand, with Polar Box only
Ob475	651968 mE 7529457 mN	B2	Surface texture – silty loam
Ob476	652238 mE 7528843 mN	B2	Surface texture – silty loam, with fine cracking <2mm
Ob477	652615 mE 7528607 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob478	652623 mE 7528966 mN	В2	Sity loam surface, uncleared area to the south with mixed vegetation
Ob479	653085 mE 7528870 mN	B2	Silty loam surface, uncleared area to the south with mixed vegetation
Ob480	653214 mE 7528689 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob481	653236 mE 7528397 mN	B2	Surface texture – silty loam, moist, area prone to flooding due to proximity to creek to the west
Ob482	653574 mE 7529653 mN	C1	Cracking surface and melon holes 0.4-0.5m deep (50% coverage)
Ob483	654130 mE 7529775 mN	C2	Cracking surface, 20% normal gilgai 0.1-0.3m deep
Ob484	654111 mE 7529194 mN	C1	Melon Holes, 0.35m deep
Ob485	653375 mE 7529141 mN	C2	Normal gilgai 0.2m deep, 40% coverage, cracking surface
Ob486	653709 mE 7529049 mN	C1	Melon holes, mostly 0.3m deep, some up to 0.5m deep, 50% coverage
Ob487	653386 mE 7528963 mN	C2	Slight depression with Brigalow
Ob488	653913 mE 7528699 mN	C1/C2 Boundary	Melon Holes to the north
Ob489	654013 mE 7528608 mN	C2	Cracking surface
Ob490	654332 mE 7528661 mN	C2	Mostly normal gilgai <0.3m deep
Ob491	653640 mE 7528217 mN	C2	Brigalow, cracking surface, minor gilgai 0.1m deep, 20% coverage
Ob492	653781 mE 7528116 mN	C2	Cracking surface, very minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob493	653637 mE 7527781 mN	C2	Cracking surface, very minor normal gilgai, Brigalow
Ob494	654443 mE 7528027 mN	C2	Cracking surface, 50% coverage of normal gilgai 0.2m deep
Ob495	654783 mE 7527702 mN	C2	Cracking surface, very minor normal gilgai
Ob496	654449 mE 7527419 mN	C2	Cracking surface, very minor normal gilgai, Brigalow
Ob497	655367 mE 7527283 mN	C2	Cracking surface
Ob498	654414 mE 7529620 mN	L2/C2 Boundary	Firm light brown surface to east, cracking surface to west
Ob499	655056 mE 7529629 mN	S2	Firm light brown surface, texture clayey sand
Ob500	655348 mE 7529612 mN	S2	Poplar Box, firm non-cracking surface
Ob501	655324 mE 7529315 mN	52	Poplar Box, firm non-cracking surface
Ob502	655007 mE 7529088 mN	52	Poplar Box, firm non-cracking surface
Ob503	654621 mE 7528606 mN	S2	Depression, loamy sand surface texture, soft, gums and Poplar Box
Ob504	654447 mE 7529012 mN	S2	Depression, soft loamy sand surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob505	654859 mE 7528460 mN	L2	Firm light brown sandy surface, non-cracking
Ob506	654957 mE 7528101 mN	S2	Firm loamy sand surface
Ob507	655040 mE 7527857 mN	C2	Cracking surface with occasional normal gilgai <0.2m deep
Ob508	655301 mE 7527813 mN	S2	Sandy non-cracking surface
Ob509	655500 mE 7527722 mN	52	Lower slope, loamy sand surface with Poplar Box and gums
Ob510	655950 mE 7527949 mN	L2/S2 Boundary	Very diffused boundary, interfingering subsoils
Ob511	656138 mE 7528098 mN	S2	Firm light brown sandy surface, no coarse fragments, cleared
Ob512	655469 mE 7528010 mN	L2	Loamy sand surface, light brown, lower slope leading into open depression
Ob513	655437 mE 7528596 mN	52	Poplar Box
Ob514	655703 mE 7528771 mN	C1/S2 Boundary	Melon holes and cracking surface to the north, firm non-cracking surface to the south
Ob515	655616 mE 7529156 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, firm non-cracking surface to the north
Ob516	656128 mE 7529421 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob517	656669 mE 7529106 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob518	656777 mE 7529569 mN	C1	Melon holes, 50% coverage 0.5m + deep, 3-5m wide, Brigalow
Ob519	657284 mE 7529615 mN	C1	Melon holes, 50% coverage 0.4m deep, 3m wide

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob520	657853 mE 7529592 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob521	657081 mE 7528927 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 7-15m wide
Ob522	656706 mE 7528612 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 7-15m wide to the north and east
Ob523	656058 mE 7527590 mN	S2/R2 Boundary	Loamy sand, red surface to the east
Ob524	655544 mE 7527075 mN	52	Firm, sandy surface with no cracking, Poplar box woodlands
Ob525	655752 mE 7526458 mN	52	Firm, sandy surface with no cracking, Poplar box woodlands
Ob526	655326 mE 7525970 mN	52	Firm, sandy surface with no cracking, Poplar box woodlands
Ob527	656163 mE 7525777 mN	R1	Wide depression with minor water
Ob528	656082 mE 7525641 mN	R1	Swamp, water starts to the north
Ob529	656270 mE 7525645 mN	R1	Dark reddish loamy sand, Eucalypts
Ob530	655875 mE 7525481 mN	S2	Poplar boxwood lands
Ob531	656931 mE 7525770 mN	R1	Red loamy sand surface to the south, Eucalypts

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob532	656585 mE 7526079 mN	S2/R1 Boundary	Red surface to the south, light brown to the north
Ob533	657426 mE 7526064 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob534	657147 mE 7526375 mN	R2	Loamy sand surface, reddish brown
Ob535	657441 mE 7526649 mN	C1	Brigalow and melon holes to the south
Ob536	657644 mE 7526687 mN	R2	Minor patch of Poplar box, cracking clays to the south.
Ob537	657432 mE 7526892 mN	R2	Loamy sand surface, reddish brown
Ob538	658199 mE 7526909 mN	R2	Loamy sand surface, reddish brown to the west and south
Ob539	657075 mE 7527192 mN	C1/R2 Boundary	Loamy sand surface, reddish brown to the west, cracking clays to the east
Ob540	657469 mE 7527264 mN	C1	Melon holes, 50% coverage 0.5m+ deep, 3-5m wide
Ob541	656820 mE 7527390 mN	R2	Poplar box woodlands, firm loamy red sand surface
Ob542	657450 mE 7527758 mN	C1	Cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob543	658242 mE 7528625 mN	C1	Cracking clays, melon holes, 50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob544	658761 mE 7529218 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob545	659908 mE 7529508 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob546	660561 mE 7528805 mN	C1	Brigalow regrowth, cracking clays, melon holes, 50% coverage 0.5m+ deep
Ob547	661505 mE 7528937 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob548	659524 mE 7527815 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob549	659798 mE 7527296 mN	R2/C1 Boundary	Melon holes and cracking surface to north west, firm to hard setting non0cracking surface to south east
Ob550	658835 mE 7527273 mN	C1	Cracking clays, melon holes, <50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob551	658520 mE 7526807 mN	C1	<image/>
Ob552	658904 mE 7526748 mN	S1/C1 Boundary	Cracking clays to the north, sands to the south
Ob553	659133 mE 7526224 mN	S1	Firm loamy sand surface, Blackbutt

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob554	659254 mE 7526080 mN	S1/R2 Boundary	Diffused boundary, red surface to the east.
Ob555	658699 mE 7525940 mN	S1	Brown loamy sand surface, Blackbutt
Ob556	658333 mE 7526018 mN	S1	Brown loamy sand surface, Blackbutt, Melon holes to the west
Ob557	658089 mE 7526341 mN	S1/C1 Boundary	Melon holes to the south west, firm non-cracking surface to north east
Ob558	658068 mE 7525755 mN	C1/C2 Boundary	Melon holes to the north, gilgai to the south
Ob559	658384 mE 7525354 mN	C1/C2 Boundary	Melon holes to the north, gilgai to the south
Ob560	658661 mE 7525138 mN	C1	Cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob561	658277 mE 7525026 mN	C2	Cracking surface with occasional normal gilgai <0.2m deep
Ob562	657812 mE 7525046 mN	S2	Light brown surface, upper slope, 2.5%, Moreton bay Ash and Poplar Box
Ob563	657591 mE 7525339 mN	R1/C2 Boundary	Red surface to west, cracking light brown surface to east
Ob564	657482 mE 7524364 mN	R1	Small open depression, reddish brown surface with Paperbark and Poplar Box nearby
Ob565	657213 mE 7524182 mN	S2/R1 Boundary	Red surface starts to the north

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob566	656946 mE 7524022 mN	S2	Light brown, firm sandy surface with Poplar Box
Ob567	656770 mE 7524508 mN	R1	Red surface, Poplar Box
Ob568	657054 mE 7524940 mN	R1	Red surface, Poplar Box
Ob569	656325 mE 7524870 mN	R1	Red surface, Poplar Box
Ob570	655890 mE 7524514 mN	S2	Light brown, firm sandy surface with Poplar Box
Ob571	659741 mE 7526693 mN	R2/C1 Boundary	Reddish brown firm surface to the east, cracking surface with melon holes to the west
Ob572	659597 mE 7526770 mN	C1	Brigalow regrowth, cracking clays, melon holes, <40% coverage 0.4m+ deep
Ob573	659961 mE 7527224 mN	R2	Red-brown firm non-cracking surface, mixed vegetation
Ob574	660196 mE 7527439 mN	C1	Brigalow regrowth, cracking clays, melon holes, <40% coverage 0.4m+ deep
Ob575	659888 mE 7526142 mN	R2	Reddish brown firm surface, non-cracking, cleared
Ob576	661933 mE 7527518 mN	C1	Melon holes 50% coverage, 0.3-0.5m deep, <3m wide
Ob577	661505 mE 7528937 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob578	662088 mE 7529331 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.5m+ deep
Ob579	662774 mE 7528857 mN	C1	Cracking surface and melon holes - 50% coverage
Ob580	662198 mE 7528410 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south
Ob581	662293 mE 7528147 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the south, red firm non-cracking surface to the north
Ob582	662380 mE 7528266 mN	R1	Interfingering boundary, becoming red surface colour to the south east
Ob583	662506 mE 7528268 mN	R1	Completely red surface colour
Ob584	662647 mE 7528066 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the south, red firm non-cracking surface to the north
Ob585	663154 mE 7527953 mN	R1	Red firm non-cracking sandy surface, Poplar Box
Ob586	663644 mE 7527945 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob587	662794 mE 7527799 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob588	663518 mE 7527613 mN	R1	Red sandy surface
Ob589	663816 mE 7527596 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob590	664631 mE 7527556 mN	R1/C1 Boundary	Melon holes and cracking surface starts to the north, red firm non-cracking surface to the south
Ob591	665094 mE 7527745 mN	R1/S2 Boundary	Light brown surface to east, red sandy surface to west
Ob592	665654 mE 7527963 mN	S2	Firm, light brown surface
Ob593	665120 mE 7528147 mN	C1/S2 Boundary	Melon holes and cracking surface to the north
Ob594	665637 mE 7528530 mN	C1/S2 Boundary	Melon holes and cracking surface to the north
Ob595	666273 mE 7528676 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob596	665942 mE 7528929 mN	52	Firm light brown non-cracking sandy surface, melon holes start approx. 100m to the north
Ob597	665968 mE 7529073 mN	C1/S2 Boundary	Firm light brown non-cracking sandy surface, melon holes start to the north
Ob598	666307 mE 7529263 mN	52	Firm light brown non-cracking sandy surface
Ob599	666205 mE 7529927 mN	S2	Firm light brown non-cracking sandy surface
Ob600	665736 mE 7530245 mN	52	Firm light brown non-cracking sandy surface
Ob601	665377 mE 7530094 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob602	665850 mE 7529826 mN	C1/S2 Boundary	Firm light brown non-cracking sandy surface to the east, melon holes start to the west
Ob603	664905 mE 7529433 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob604	665451 mE 7528716 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob605	664451 mE 7528561 mN	C1	Isolated area of 20% coverage of melon holes, all around area coverage is uniformly 50%, 0.3-0.5m deep
Ob606	664307 mE 7528997 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.4m+ deep
Ob607	663944 mE 7529531 mN	C1	Brigalow regrowth, cracking clays, melon holes, <50% coverage 0.4m+ deep
Ob608	662985 mE 7528547 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob609	666741 mE 7529236 mN	S2	Minor depression, firm sandy surface, light brown, cleared
Ob610	667412 mE 7529172 mN	S2	Firm sandy surface, light brown, cleared
Ob611	668042 mE 7528803 mN	52	Wide depression, loamy sand light brown surface
Ob612	667581 mE 7528655 mN	S2	Firm sandy surface, light brown, cleared
Ob613	666862 mE 7528689 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob614	667179 mE 7528367 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob615	666486 mE 7527873 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep
Ob616	666228 mE 7528320 mN	C1	Brigalow medium height, cracking clays, melon holes, <50% coverage 0.3m+ deep, 2-5m wide
Ob617	665879 mE 7527858 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob618	665468 mE 7527166 mN	R1/C1 Boundary	Red sandy firm surface to the south, cracking surface with 3m wide melon holes to the north
Ob619	663945 mE 7527278 mN	R1	Red sandy surface, non-cracking, poplar Box
Ob620	664972 mE 7526896 mN	R1	Red sandy surface, non-cracking, poplar Box
Ob621	660322 mE 7526826 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob622	658346 mE 7524917 mN	C1/C2 Boundary	Cracking surface, normal gilgai <0.2m deep to west, melon holes 0.3m+ deep to the east
Ob623	663225 mE 7527182 mN	R1	Red sandy surface, non-cracking
Ob624	662950 mE 7526960 mN	R1/C1 Boundary	Red surface to the east, cracking surface with melon holes to the west
Ob625	663659 mE 7527017 mN	R1/C1 Boundary	Red surface to the east, cracking surface with melon holes to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob626	663746 mE 7526611 mN	C1	Melon holes 0.4m deep, 4m wide
Ob627	664166 mE 7526554 mN	R1	Red sandy surface, non-cracking to the north
Ob628	664985 mE 7527269 mN	R1	Red sandy surface, non-cracking
Ob629	665676 mE 7526950 mN	R1	Red sandy surface, non-cracking
Ob630	665740 mE 7526817 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob631	665485 mE 7526463 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob632	665608 mE 7526428 mN	R1	Red sandy surface, non-cracking
Ob633	665911 mE 7526308 mN	R1/C1 Boundary	Melon holes to the north/north east, red sandy non- cracking surface to the south/ south west
Ob634	665819 mE 7526222 mN	R1	Red sandy surface, non-cracking
Ob635	665709 mE 7526106 mN	R1/C1 Boundary	Melon holes to the south, red sandy non- cracking surface to the north
Ob636	666135 mE 7526563 mN	C1	Melon holes <0.5m deep, Brigalow
Ob637	665844 mE 7527086 mN	R1/S1 Boundary	Diffused boundary, red sandy surface to the west, brown sandy surface to the east.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob638	666299 mE 7527266 mN	S1	Light brown firm sandy surface
Ob639	666364 mE 7527476 mN	C1	Melon holes <0.5m deep, Brigalow regrowth
Ob640	666497 mE 7526960 mN	C1/S1 Boundary	Light brown firm sandy surface to north, melon holes to the south.
Ob641	666842 mE 7527339 mN	C1	Melon holes begin to the north east
Ob642	667210 mE 7527741 mN	C1/S1 Boundary	Light brown firm sandy surface to east, melon holes to the west.
Ob643	667332 mE 7527878 mN	S1	Light brown firm sandy surface
Ob644	667525 mE 7528102 mN	C1	Melon holes begin to the north
Ob645	667654 mE 7528218 mN	C1	Melon holes begin north west
Ob646	667839 mE 7528427 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, firm light brown surface to the north
Ob647	667745 mE 7529072 mN	S1	Light brown firm sandy surface
Ob648	667154 mE 7528924 mN	C1/S2 Boundary	Melon holes and cracking surface to the south, interfingering boundary
Ob649	664996 mE 7525308 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob650	(GDA94 Zone 53) 664594 mE 7524854 mN	C1	
Ob651	664022 mE 7524237 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface
Ob652	663029 mE 7523145 mN	C1	Melon holes <0.5m deep, Brigalow, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob653	662362 mE 7522424 mN	C1	Melon holes <0.4 m deep, Brigalow, cracking clay surface
Ob654	662012 mE 7522032 mN	C1	Melon holes <0.4 m deep, Brigalow, cracking clay surface
Ob655	661851 mE 7521859 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands to the south.
Ob656	661376 mE 7521339 mN	R2	Frim dark reddish brown loamy sand surface with Poplar box woodlands.
Ob657	661197 mE 7521139 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob658	660925 mE 7520845 mN	R2	Wide shallow depression, frim dark brown loamy sand surface with Poplar box woodlands.
Ob659	660367 mE 7520246 mN	R2	Lower slope, frim dark brown loamy sand surface with Poplar box woodlands.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob660	660040 mE 7519880 mN	C2	
Ob661	659827 mE 7520193 mN	C2	Cracking clay surface with minor gilgai
Ob662	660155 mE 7520737 mN	C2	Cracking clay surface with minor gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob663	659364 mE 7520299 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the west and dark brown to the east.
Ob664	658990 mE 7520225 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob665	658781 mE 7520161 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the east and dark brown to the west.
Ob666	658788 mE 7520529 mN	R2	Frim dark brown loamy sand surface with Poplar box woodlands.
Ob667	659573 mE 7520686 mN	R2	Frim dark reddish brown loamy sand surface with Poplar box woodlands.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob668	659017 mE 7521390 mN	C2	Cracking clay surface with minor normal gilgai
Ob669	660107 mE 7521687 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the north and dark brown to the south.
Ob670	660279 mE 7521217 mN	C2	Cracking clay surface with minor normal gilgai

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob671	660631 mE 7522128 mN	C2	Cracking clay surface with minor normal gilgai
Ob672	660786 mE 7521453 mN	C2/R2 Boundary	Cracking clay surface with minor gilgai to the north and dark brown to the south.
Ob673	661065 mE 7522112 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands.
Ob674	661203 mE 7522427 mN	C1/R2 Boundary	Cracking clay surface with melon holes to the east and dark brown to the west.
Ob675	660727 mE 7522584 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands.
Ob676	660584 mE 7523031 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands, minor Moreton Bay Ash
Ob677	660412 mE 7523366 mN	A2/R2 Boundary	Depression/water body to the west with Moreton Bay Ash, dark reddish brown loamy sands to the east.
Ob678	660880 mE 7523453 mN	C2/R2 Boundary	Cracking clay surface with melon holes to the east and dark brown to the west.
Ob679	660525 mE 7523781 mN	R2	Dark reddish brown loamy sand surface with Poplar box woodlands, minor Moreton Bay Ash
Ob680	660877 mE 7523899 mN	C1/R2 Boundary	Minor gilgai to the east and dark brown surface to the west.
Ob681	660894 mE 7524387 mN	C1/R2 Boundary	Minor gilgai to the east and dark brown surface to the west.
Ob682	661491 mE 7524187 mN	C1	Small dam, cracking clay surface with melon holes
Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
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Ob683	662055 mE 7524327 mN	C1	Melon holes present
Ob684	662857 mE 7524631 mN	C1	Melon holes present
Ob685	664079 mE 7525831 mN	C1	Melon holes <0.4 m deep, 2-4m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob686	662871 mE 7525822 mN	C1	Melon holes < 0.4 m deep, 2-4m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob687	661693 mE 7525450 mN	C1	Melon holes 0.3+ m deep, 2m wide, 50% coverage, Brigalow regrowth, cracking clay surface
Ob688	661322 mE 7525633 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob689	661288 mE 7525237 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob690	660905 mE 7525002 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob691	660631 mE 7525946 mN	C1/R2 Boundary	Cracking surface with melon holes to the east, reddish light brown sandy non-cracking surface to the west
Ob692	660762 mE 7525662 mN	R2	Firm light brown surface, changing to reddish brown 3-5cm below surface
Ob693	660440 mE 7525492 mN	R2	Firm light brown surface, changing to reddish brown 3-5cm below surface
Ob694	660274 mE 7525313 mN	R1	Firm dark reddish brown sandy surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob695	660434 mE 7525264 mN	A2	Large wide-open depression with water present, Eucalypts
Ob696	660297 mE 7525893 mN	C1	Cracking surface, melon holes
Ob697	660179 mE 7525684 mN	C1	Lower slope, wide depression, cracking surface
Ob698	660202 mE 7524695 mN	R1	Sandy firm red surface
Ob699	659624 mE 7524373 mN	R1	Sandy firm red surface, Poplar Box
Ob700	658554 mE 7524242 mN	C1	Melon holes
Ob701	658776 mE 7524117 mN	C1/C2/S1 Boundary	Clay to the east with gilgai, melon holes to the west and firm sand surface to the south.
Ob702	658748 mE 7524074 mN	S1	Firm light brown sand surface
Ob703	659354 mE 7524056 mN	R1/C2 Boundary	Reddish brown sandy surface to the east, clay surface to the west.
Ob704	659244 mE 7523871 mN	C2	Normal gilgai, Brigalow
Ob705	658326 mE 7523404 mN	C1	Melon holes, Brigalow
Ob706	659258 mE 7523295 mN	S1/C2 Boundary	Cracking clays to the east and light brown sandy surface to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob707	659108 mE 7522988 mN	S1/A2 Boundary	Inundated areas to the west and south west.
Ob708	659491 mE 7522787 mN	S1	Firm light brown loamy sandy surface
Ob709	659665 mE 7522276 mN	S1/C2 Boundary	Firm light brown loamy sands to the north, cracking clays to the south.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob710	659761 mE 7522174 mN	C2	Cracking clays and normal gilgai
Ob711	659340 mE 7521968 mN	A2/C2 Boundary	Wetland area to the west, Brigalow and clays to the east.
Ob712	658662 mE 7521599 mN	A2	Dam adjacent to alluvial plain

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob713	658540 mE 7522477 mN	A2	Inundated wetland area
Ob714	658016 mE 7522760 mN	A2	Inundated wetland area
Ob715	657745 mE 7523036 mN	C1/A2 Boundary	Inundated wetland area to the south east, cracking clays to the north west.

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Site No.	Location (GDA94 Zone 53) 657293 mE 7522377 mN	C2	Comments / Pictures Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob717	656838 mE 7522708 mN	52	Poplar box woodlands
Ob718	657041 mE 7523412 mN	S2	Poplar box woodlands, loamy sand surface
Ob719	657757 mE 7523470 mN	C2	Cracking clays, melon holes Brigalow regrowth

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob720	658475 mE 7523630 mN	S1/C1 Boundary	Cracking clays to the west, Blackbutt woodlands to the east, depression with water body
Ob721	657677 mE 7523865 mN	S2/C1 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob722	662017 mE 7520619 mN	R2#	No melon holes observed, dark brown loamy surface
Ob723	663885 mE 7520208 mN	R2#	No melon holes observed, dark brown loamy surface
Ob724	664996 mE 7520378 mN	C2#	Clay surface with gilgai, no large melon holes visible in aerial
Ob725	665967 mE 7521003 mN	C1#	Melon holes visible in aerial
Ob726	663250 mE 7521159 mN	C2#	Shape of area where site is located does not contain melon holes
Ob727	664279 mE 7521585 mN	C1#	Melon holes visible in aerial
Ob728	662561 mE 7521742mN	C2#	Shape of area where site is located does not contain melon holes
Ob729	663641 mE 7522783 mN	C1#	Melon holes visible in aerial
Ob730	666133 mE 7522384 mN	C2#	Clay with minor gilgai, no melon holes visible
Ob731	665311 mE 75224 mN	C1#	Melon holes visible in aerial

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob732	665351 mE 7523396 mN	C1#	Melon holes visible in aerial
Ob733	665730 mE 7523880 mN	C2#	Clay with minor gilgai, no melon holes visible
Ob734	664768 mE 7524040 mN	C1/C2# Boundary	Aerial imagery shows melon holes to the west, gilgai to the east.
Ob735	665843 mE 7524756 mN	C1#	Melon holes visible in aerial
Ob736	666470 mE 7526105 mN	C1#	Melon holes visible in aerial
Ob737	638787 mE 7548615 mN	B1/S2 Boundary	Poplar box to the south, Eucalypts to the north
Ob738	638708 mE 7549074 mN	B2	Skinny white Eucalypts
Ob739	638460 mE 7549815 mN	B2	Skinny white Eucalypts
Ob740	637960 mE 7549710 mN	B2	Silty loam surface, Eucalypts
Ob741	637752 mE 7549565 mN	B2/S1 Boundary	Poplar box to the south, Eucalypts to the east.
Ob742	638229 mE 7549381 mN	B2/S1 Boundary	Poplar box to the south, Eucalypts to the east.
Ob743	637772 mE 7548972 mN	S1	Poplar box woodlands

S	ite No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
С)b744	638362 mE 7548711 mN	S1	Poplar box woodlands
С)b745	637698 mE 7548516 mN	S1	Poplar box woodlands
С)b746	638321 mE 7548057 mN	S1	Poplar box woodlands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob747	637980 mE 7547441 mN	S1	<image/>
Ob748	638047 mE 7546985 mN	S1	Poplar box woodlands
Ob749	638016 mE 7546880 mN	S1	Poplar box woodlands

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob750	638275 mE 7546551 mN	C2	Minor gilgai, cracking clay surface
Ob751	638237 mE 7546752 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob752	637937 mE 7546647 mN	C2	Minor gilgai, cracking clay surface
Ob753	637656 mE 7546475 mN	C2	Minor gilgai, cracking clay surface
Ob754	637599 mE 7546675 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob755	637583 mE 7547045 mN	S1	Poplar Box, firm surface
Ob756	643868 mE 7537650 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob757	645132 mE 7537351 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob758	643605 mE 7537960 mN	C2	<image/>
Ob759	643638 mE 7537095 mN	S1/C2 Boundary	Cracking clays to the south east, Poplar box woodlands to the west
Ob760	642658 mE 7537588 mN	S2/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob761	643153 mE 7538266 mN	S1/C2 Boundary	Cracking clays to the north, Poplar box woodlands to the south
Ob762	645202 mE 7538166 mN	S1/C1 Boundary	Cracking clays and melon holes to the north, Poplar box woodlands to the south
Ob763	642687 mE 7537168 mN	C2	Normal gilgai, cracking clay surface
Ob764	642338 mE 7536982 mN	S2/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob765	642499 mE 7538628 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob766	642736 mE 7538459 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob767	640575 mE 7539651 mN	S1/C2 Boundary	Cracking clays to the east, Poplar box woodlands to the west
Ob768	639285 mE 7540134 mN	S1/C2 Boundary	Cracking clays to the south, Poplar box woodlands to the north
Ob769	641301 mE 7540199 mN	S1/C2 Boundary	Cracking clays to the north, Poplar box woodlands to the south
Ob770	641615 mE 7540407 mN	S1/C2 Boundary	Cracking clays to the west, Poplar box woodlands to the east
Ob771	643397 mE 7543387 mN	C1	Dam location
Ob772	643498 mE 7542953 mN	C1	Wide shallow depression, cracking clay surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob773	643522 mE	C1/C2 Boundary	Inundated depression, melon holes to the west, gilgai to the east
	7544500 mN		<image/>

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob774	642855 mE 7545593 mN	C1	<image/>
Ob775	642409 mE 7544171 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west
Ob776	640826 mE 7545315 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob777	643272 mE 7541641 mN	C1/B1 Boundary	Cracking clays, melon holes to the east, loamy sand to the west
Ob778	645277 mE 7542107 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob779	645272 mE 7541519 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob780	645173 mE 7543890 mN	C2/S2 Boundary	Cracking clays to the west, loamy sand to the east
Ob781	639735 mE 7547887 mN	S1	Tall Eucalypt wood lands
Ob782	642482 mE 7540275 mN	S1/C1 Boundary	Cracking clays and melon holes to the east, Poplar box woodlands to the west
Ob783	643674 mE 7546234 mN	B2	Poplar Box, trampled surface with fine cracking
Ob784	644426 mE 7545432 mN	B2	Fining cracks in surface, firm, Poplar Box nearby, mostly cleared
Ob785	643879 mE 7545259 mN	52	Gums, firm sandy surface, creek nearby
Ob786	643172 mE 7545715 mN	S2	Gums, firm sandy surface, creek nearby
Ob787	642755 mE 7547337 mN	S2	Gums, firm sandy surface, creek nearby
Ob788	644384 mE 7548098 mN	B2	Dam, cracking surfaces all around

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob789	644225 mE 7548165 mN	В2	Cracking surface, fine cracks, adjacent to dam
Ob790	643501 mE 7547722 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away
Ob791	643672 mE 7547526 mN	B2	Gums, and nearby Brigalow in depressions

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob792	643587 mE 7547438 mN	B2-DV / B2 Boundary	
Ob793	644011 mE 7546650 mN	B2	Firm, fine cracking surface, field texture – silty loam
Ob794	644001 mE 7546966 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob795	644400 mE 7546620 mN	B2-DV	Cracking surface, thicker cracks than in adjacent B2 SMU, Brigalow, slight drainage line, appears as per B2 except top layer of silty loam has been washed away
Ob796	642498 mE 7548108 mN	B2	Firm, fine cracking surface, field texture – silty loam
Ob797	643095 mE 7548215 mN	B2	Firm, fine cracking surface

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob798	643475 mE 7548823 mN	B2	
Ob799	644113 mE 7549117 mN	B2	Land form moves uphill abruptly toward the east

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob800	644378 mE 7549246 mN	52	<image/>
Ob801	644680 mE 7549387 mN	S2	4% slope, Ironbark, Blackbutt, some Poplar Box
Ob802	645317 mE 7549694 mN	S2	Firm, loamy sand surface, light brown, Poplar Box and Ironbark

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob803	639154 mE 7545082 mN	52	Firm sandy surface, Poplar Box only
Ob804	637213 mE 7546895 mN	52	Firm sandy surface, some Poplar Box
Ob805	636992 mE 7547131 mN	52	20 x 20m depression with cracking surface, appears S2 with top sandy layer washed away – cracking surface
Ob806	636039 mE 7548170 mN	52	Firm sandy surface, Poplar Box
Ob807	635148 mE 7549147 mN	C2 / S2 Boundary	Cracking surface to north west, firm non-cracking sandy surface to south east
Ob808	634294 mE 7550076 mN	52	Poplar Box, Gums, firm loamy sand surface, creek nearby
Ob809	632117 mE 7552418 mN	B2	Very fine cracking surface with Poplar Box, field texture – silty loam

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob810	631352 mE 7552744 mN	B2	Fine cracking surface, small area of very rocky surface
Ob811	630901 mE 7553420 mN	S1	Firm sandy surface, Poplar Box
Ob812	630227 mE 7553749 mN	S1	Firm sandy surface, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob813	628563 mE 7553666 mN	S1	Firm sandy surface, Poplar Box
Ob814	626215 mE 7553524 mN	S1	Polar Box and gums, loamy sand surface
Ob815	623846 mE 7553563 mN	S1	Firm sandy surface, Poplar Box

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob816	623304 mE 7553655 mN	S1	
Ob817	621023 mE 7553233 mN	S2	Drainage line, creek bed coarse sandy, soil profile on cuttings loamy sand throughout, gums

Soils and Land Suitability Assessment OLIVE DOWNS COKING COAL PROJECT

Site No.	Location (GDA94 Zone 53)	Soil Mapping Unit	Comments / Pictures
Ob818	619185 mE 7552267 mN	S2	Drainage line with 6m+ drop-off, creek bed coarse sandy, soil profile on cuttings loamy sand throughout, gums

Appendix C

Laboratory Certificates

ESSA Pty Ltd /Phosyn EAL NATA (ASPAC certified)

For Info Refer ESSA Pty Ltd PO Box 442 Sunnybank Q 4109

Phone: 0403245560

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

Reference: B98961

Sheet 1 of 4

 Date Received:
 17/08/2017

 Date Completed:
 01/09/2017

FINAL REPORT

Project:

Project - Olive Downs

All results in this report relate only to the items tested. Results are expressed on an "as received basis".

Client Name: GTEnvironmental

Contact: Mr Reece Mc Cann

Sample Type: Soil

Number of samples: 57

Soil Analysis Report Batch Number: B98961

Date Received: 17/08/2017 Date Completed:09/09/2017

Client: GTE Olive Downs- Results Page 1 of 2

ESSA Ref	field ref	Soil pH	Soil EC	Soil CI	P(Olsen)	Exch.Ca	Exch. Mg	Exch.Na	Exch. K	CEC	Ca/Mg	ESP	Total N	Nitrate N	OrgMatter	Ammonia
	depth (m)		dS/m	mg/kg	mg/kg	meq/100g	meq/100g	meq/100g	meq/100g	meq/100g	Ratio	%Na/CEC	%	Mg/Kg	(%)	Mg/Kg
SCB0016	2-0.00-0.10 (18/6/17)	6.3	0.01	10	5	1.19	0.34	<0.08	0.16	1.7	3.5	<1	0.033	1.4	1	<20
SCB0017	2-0.3-0.4 (18/6/17)	6.9	<0.01	14		0.63	0.25	<0.08	0.12	1.1	2.5	1				
SCB0018	2-0.6-0.7 (18/6/17)	8.1	0.04	97		2.3	2.97	0.73	0.26	6.4	0.8	11				
SCB0019	2-0.9-1.0 (18/6/17)	8.6	0.11	108		2.77	4.1	1.35	0.26	8.5	0.7	16				
SCB0020	8-0.00-0.10 (19/6/17)	6.7	0.02	24	11	3.05	0.97	<0.08	0.37	4.4	3.2	<1	0.081	7.4	1.3	<20
SCB0021	8-0.3-0.4 (19/6/17)	6.8	0.01	24		1.86	0.56	<0.08	0.2	2.7	3.3	1				
SCB0022	8-0.6-0.7 (19/6/17)	7.1	<0.01	53		1.61	0.71	<0.08	0.16	2.6	2.3	1				
SCB0023	8-0.9-1.0 (19/6/17)	7.3	<0.01	39		1.69	0.97	<0.08	0.16	3.0	1.7	1				
SCB0024	12A-0.00-0.10 (19/6/17)	8.2	0.08	16	16	17.74	3.25	0.1	0.83	22.0	5.5	0	0.113	3.1	2.3	<20
SCB0025	12A-0.3-0.4 (19/6/17)	8.2	0.05	21		13.51	3.75	0.4	0.45	18.1	3.6	2				
SCB0026	12A-0.6-0.7 (19/6/17)	8.9	0.13	59		12.5	5.26	1.7	0.4	19.9	2.4	9				
SCB0027	12A-0.8-0.9 (19/6/17)	8.8	0.29	275		10.31	5.86	2.83	0.38	19.4	1.8	15				
SCB0028	12B-0.00-0.10 (19/6/17)	8	0.04	20	6	13.47	6.3	0.18	0.56	20.6	2.1	1	0.116	<1	3.1	<20
SCB0029	12B-0.3-0.4 (19/6/17)	8.8	0.48	362		10.69	8.23	3.53	0.39	22.9	1.3	15				
SCB0030	12B-0.6-0.7 (19/6/17)	8.6	0.72	611		8.02	8.66	4.21	0.37	21.3	0.9	20				
SCB0031	12B-0.9-1.0 (19/6/17)	8.6	0.81	846		7.44	8.76	5.08	0.39	21.7	0.9	23				
SCB0032	17-0.00-0.10 (20/6/17)	6.7	0.01	11	5	1.74	0.65	<0.08	0.21	2.7	2.7	1	0.05	<1	1.4	<20
SCB0033	17-0.36-0.46 (20/6/17)	6.7	<0.01	16		0.83	0.8	<0.08	0.22	2.0	1.0	3				
SCB0034	17-0.6-0.7 (20/6/17)	6.6	0.02	9		1.89	2.32	0.28	0.17	4.7	0.8	6				<20
SCB0035	17-0.9-1.0 (20/6/17)	7	0.03	16		1.95	2.38	0.47	0.1	5.0	0.8	10				
SCB0036	25A0.00-0.10(21/6/17)	8.6	0.1	21	17	23.29	5.98	0.33	1.26	30.9	3.9	1	0.128	2	4.1	<20
SCB0037	25A-0.3-0.4 (21/6/17)	8.8	0.38	274		19.68	9.33	2.86	0.82	32.7	2.1	9				
SCB0038	25A-0.7-0.8 (21/6/17)	8.6	1.11	1330		17.1	9.29	5.46	0.9	32.8	1.8	17				40
SCB0039	25A-0.9-1.0 (21/6/17)	8.7	1	944		15.88	9.15	5.42	0.78	31.2	1.7	17				
SCB0040	25B-0.00-0.10 (21/6/17)	8.6	0.11	19	13	23.47	5.27	0.39	1.37	30.5	4.5	1	0.256	2	5	<20
SCB0041	25B-0.3-0.4 (21/6/17)	8.7	1.19	1654		17.85	9.55	6.12	1.35	34.9	1.9	18				
SCB0042	25B-0.6-0.7 (21/6/17)	8.6	2.13	2678		15.32	10.22	9.97	1.74	37.3	1.5	27				
SCB0043	25B-0.9-1.0 (21/6/17)	8.6	2.32	2690		14.75	10.61	12.16	1.9	39.5	1.4	31				
SCB0044	49-0.00-0.10 (25/6/17)	6.4	0.01	2	4	1.31	0.4	<0.08	0.16	1.9	3.3	0	0.045	<1	1.4	<20
SCB0045	49-0.25-0.35(25/6/17)	6.5	<0.01	3		1.03	0.28	<0.08	0.15	1.6	3.6	1				
SCB0046	49-0.6-0.7 (25/6/17)	6.6	<0.01	13		1.08	0.32	<0.08	0.1	1.7	3.4	1				
SCB0047	49-0.9-1.0 (25/6/17)	6.7	< 0.01	15		2.91	0.83	<0.08	0.09	4.2	3.5	1	0.080			
SCB0048	60-0.00-0.10 (7/7/17)	6.4	0.02	12	8	2.36	0.56	<0.08	0.19	3.2	4.2	1	0.079	<1	2.1	<20
SCB0049	60-0.3-0.4 (7/7/17)	0.9	0.03	80		1.49	0.77	0.29	0.1	2.7	1.9	11				
SCB0051	60-0.0-0.7 (7/7/17)	7.0	0.10	622		6.70	5.20	2.07	0.21	9.2	1.1	20				
SCB0052	62-0.00-0.10 (7/7/17)	7.2	0.01	11	3	5.5	1.85	<0.08	0.33	77	3.0	1	0.099	<1	28	-20
SCB0053	62-0.3-0.4 (7/7/17)	7.5	0.03	32	Ū	3.29	1.64	0.14	0.23	5.4	2.0	3	0.000		2.0	-20
SCB0054	62-0.6-0.7 (7/7/17)	7.3	0.02	34		4.85	1.86	0.19	0.25	7.2	2.6	3				
SCB0055	62-0.9-1.0 (7/7/17)	7.5	0.03	26		4.64	1.97	0.13	0.29	7.1	2.4	2				
SCB0056	68-0 00-0 10 (8/7/17)	6.5	0.03	16	8	4.06	1.84	<0.08	0.44	6.4	2.2	1	0.131	1	3.9	<20
SCB0057	68-0.3-0.4 (8/7/17)	8	0.32	394	-	4.92	5.99	3.34	0.27	14.6	0.8	23				
SCB0058	68-0 6-0 7 (8/7/17)	9.2	0.79	898		9.84	6.89	5.46	0.29	22.5	1.4	24				
SCB0059	68-0.9-1.0 (8/7/17)	9.3	0.78	864		9.23	5.8	5.4	0.29	20.8	1.6	26				
SCB0060	96-0.00-0.4 (12/7/17)	6.2	0.03	23	6	1.61	0.49	<0.08	0.24	2.4	3.3	1	0.101	<1	3.2	<20
SCB0061	96-0.15-0.25 (12/7/17)	6.6	< 0.01	24		0.41	0.21	<0.08	0.09	0.7	2.0	3				
SCB0062	96-0.4-0.5 (12/7/17)	7.3	0.03	175		2.65	4	1.24	0.64	8.7	0.7	14				
SCB0063	96-0.9-1.0 (12/7/17)	7.3	0.07	82		1.67	2.66	1.17	0.3	5.9	0.6	20				
SCB0064	106-0.00-0.10(14/7/17)	6.3	0.01	18	10	3.21	1.67	<0.08	0.27	5.2	1.9	<1	0.09	<1	2.2	<20
SCB0065	106-0.2-0.3 (14/7/17)	6.5	0.02	18		3.01	0.86	<0.08	0.25	4.2	3.5	1				
SCB0066	106-0.4-0.5 (14/7/17)	6.2	0.06	90		3.23	2.42	0.57	0.21	6.5	1.3	9				
SCB0067	106-0.6-0.7 (14/7/17)	7	0.31	398		7.38	6.1	2.22	0.46	16.2	1.2	14				
SCB0068	106-0.9-1.0 (14/7/17)	7.9	0.41	537		6.75	5.65	2.6	0.44	15.5	1.2	17				
SCB0069	131-0.00-0.1 (28/7/17)	6.5	0.01	8	4	1.58	0.41	<0.08	0.15	2.1	3.8		0.059	<1	1.3	<20
SCB0070	131-0.3-0.4 (28/7/17)	6.7	0.02	23		1.62	0.41	<0.08	0.26	2.3	3.9	0				
SCB0071	131-0.6-0.7 (28/7/17)	6.8	<0.01	22		1.65	0.61	<0.08	0.26	2.6	2.7	0				
SCB0072	131-0.9-1.0 (28/7/17)	6.6	0.01	18		2.1	1.61	<0.08	0.15	3.9	1.3	1				

Client: GTE Olive Downs - Results Page 2 of 2

Lab No	Sample No	PSA-CS	PSA-FS	PSA-Silt	PSA-Clay	Disp Ratio	ADMC	Total S	Sulfate-S	Mn	Boron	Copper	Iron	Zinc	Al	AI/CEC(%)
	Depth (m)	%	%	%	%	R1	%	%	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	meq/100g	%
SCB0016	2-0.00-0.10 (18/6/17)	75	13	6	6	0.81	0.4	0.02	3	21.8	<0.1	0.2	22	0.3	0.03	2
SCB0017	2-0.3-0.4 (18/6/17)						0.3								0.1	9
SCB0018	2-0.6-0.7 (18/6/17)						1.8								0.14	2
SCB0019	2-0.9-1.0 (18/6/17)						2.5								0.06	1
SCB0020	8-0.00-0.10 (19/6/17)	65	18	7	11	0.77	1.0	0.02	3	20.8	0.1	0.3	21	0.4	0.02	1
SCB0021	8-0.3-0.4 (19/6/17)						0.6								0.04	2
SCB0022	8-0.6-0.7 (19/6/17)						0.6								0.12	5
SCB0023	8-0.9-1.0 (19/6/17)						0.7								0.11	4
SCB0024	12A-0.00-0.10 (19/6/17)	26	10	19	45	0.88	3.7	0.02	3	8.7	0.3	1.2	25	0.4	0.07	0
SCB0025	12A-0.3-0.4 (19/6/17)						3.9								0.03	0
SCB0026	12A-0.6-0.7 (19/6/17)						3.8								0.03	0
SCB0027	12A-0.8-0.9 (19/6/17)						3.3								0.03	0
SCB0028	12B-0.00-0.10 (19/6/17)	29	7	15	49	0.72	4.3	0.02	3	7.9	0.8	1.1	10	0.3	0.05	0
SCB0029	12B-0.3-0.4 (19/6/17)						3.3								0.05	0
SCB0030	12B-0.6-0.7 (19/6/17)						3.4								0.03	0
SCB0031	12B-0.9-1.0 (19/6/17)						3.3								0.02	0
SCB0032	17-0.00-0.10 (20/6/17)	75	9	10	7	0.66	0.6	<0.01	3	27	0.2	0.3	25	0.2	0.03	1
SCB0033	17-0.36-0.46 (20/6/17)						0.6								0.07	4
SCB0034	17-0.6-0.7 (20/6/17)						1.6								0.07	2
SCB0035	17-0.9-1.0 (20/6/17)						1.7								0.05	1
SCB0036	25A-0.00-0.10 (21/6/17)	18	2	31	49	0.87	4.3	0.02	9	7.7	0.4	1.2	13	0.5	0.04	0
SCB0037	25A-0.3-0.4 (21/6/17)						3.8								0.04	0
SCB0038	25A-0.7-0.8 (21/6/17)						3.5								0.03	0
SCB0039	25A-0.9-1.0 (21/6/17)						3.3								0.02	0
SCB0040	25B-0.00-0.10 (21/6/17)	11	14	27	48	0.79	4.2	0.02	5	9.1	1	0.9	12	0.5	0.02	0
SCB0041	25B-0.3-0.4 (21/6/17)						3.6								0.02	0
SCB0042	25B-0.6-0.7 (21/6/17)						3.7								0.03	0
SCB0043	25B-0.9-1.0 (21/6/17)						3.7								0.05	0
SCB0044	49-0.00-0.10 (25/6/17)	75	9	7	9	0.60	0.5	0.02	3	26.1	<0.1	0.3	8	0.3	0.07	4
SCB0045	49-0.25-0.35 (25/6/17)	-					0.5								0.11	7
SCB0046	49-0.6-0.7 (25/6/17)						0.5								0.22	13
SCB0047	49-0.9-1.0 (25/6/17)						0.7								0.3	7
SCB0048	60-0.00-0.10 (7/7/17)	61	16	7	16	0.66	0.7	0.02	5	24.3	0.1	0.3	16	0.6	0.05	2
SCB0049	60-0.3-0.4 (7/7/17)						0.6								0.06	2
SCB0050	60-0.6-0.7 (7/7/17)						1.7								0.05	1
SCB0051	60-0.9-1.0 (7/7/17)				_		2.8		-						0.02	0
SCB0052	62-0.00-0.10 (7/7/17)	6/	16	9	9	0.62	1.2	0.02	3	14.9	0.4	0.5	19	0.5	0.03	0
SCB0053	62-0.3-0.4 (7/7/17)						0.9								0.1	2
SCB0054	62-0.6-0.7 (7/7/17)						1.3								0.04	1
SCB0055	62-0.9-1.0 (7/7/17)	10	10		10	0.7	1.1	0.01		40.0	0.1	0.0	10	-	0.07	1
SCB0056	68-0.00-0.10 (8/7/17)	46	19	20	16	0.7	1.3	<0.01	4	46.8	0.4	0.6	40	1	0.03	1
SCB0057	68-0.3-0.4 (8/7/17)						2.5								0.03	0
SCB0058	68-0.6-0.7 (8/7/17)						2.3								0.03	0
SCB0059	68-0.9-1.0 (8/7/17)	50	10		14	0.01	2.3	0.00		17.4	0.1	0.5	144	0.0	0.03	U
SCB0060	96-0.00-0.4 (12/7/17)	52	19	20	11	U.61	0.0	0.02	4	17.4	U.4	U.5	144	U.6	0.02	U
SCB0061	96-0.15-0.25 (12/7/17)						0.3								0.02	
SCB0062	96-0.4-0.5 (12/7/17)	L		<u> </u>			2.2		<u> </u>			<u> </u>			0.18	4
SCB0063	96-0.9-1.0 (12/7/17)	20	20	10	10	0.70	1.4	0.00		047	-0.1	0.5		0.0	0.07	
SUB0064	106-0.00-0.10 (14/7/17)	39	32	13	16	0.72	1.1	0.02	2	24./	<0.1	U.5	28	0.9	0.02	U
SCB0065	106-0.2-0.3 (14/7/17)						0.6								0.02	0
SCBUUDS	106-0.4-0.5 (14/7/17)	L		<u> </u>			1.3		<u> </u>			<u> </u>			0.02	0
20B006/	106-0.6-0.7 (14/7/17)						2.8								0.02	U
SCBUU68	106-0.9-1.0 (14/7/17)	76	0			0.55	2.3	0.02		21.4	-0.1	0.2	10	0.6	0.02	0
SCB0059	131-0.00-0.1 (28/7/17)	76	Э	8	8	U.55	0.4	0.02	3	31.4	<0.1	0.3	10	U.6	0.02	U 1
SCB0070	131-0.3-0.4 (28/7/17)	L		<u> </u>			0.5		<u> </u>			<u> </u>			0.02	1
SCB0071	131-0.6-0.7 (28/7/17)						1.0								0.05	∠ 1
3000072	131-0.9-1.0 (28/7/17)			1	1		1.0		1		1	1	1	1	0.04	

METHOD DESCRIPTIONS

Soil

Reference: B98961

Page 3 of 4

Methods used to Analyse Samples						
Analyte	ALHS*	Uncertainty %	LOQ	Unit	Name	Method Description
рН	4A1	1.1	0.1	pН	рН	1:5 water extr, pH meter
EC	3A1	5.4	0.01	dS/m	Electrical conductivity	1:5 water extr, EC meter
CI	5A2	10.0	10.0	mg/kg	Chloride	1:5 water extr, (AA) colorimetric
NO3-N	7C2	6.7	1.0	mg/kg	Nitrate-nitrogen	1:5 water extr, (AA) colorimetric
NH4-N	7C2	7.8	0.6	mg/kg	Ammonium-nitrogen	1M KCI extr, (AA) colorimetric
Bicarb.P	9B2	16.8	1.0	mg/kg	Bicarb.ext.phosphorus	0.5M NaHCO3 @ pH 8.5, (AA) colorimetric
Exch.Ca	15C1	7.2	0.18	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.Mg	15C1	4.7	0.31	meq/100g	Exchangeable magnesium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.Na	15C1	9.6	0.09	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
Exch.K	15C1	4.8	0.02	meq/100g	Exchangeable calcium	1M NH4OAc @ pH 7.0 leach, AAS
CEC	15 3	5.7	1.0	meq/100g	Cation Exchange Capacity	KNO3 + Ca(NO3)2 extr, (AA) colorimetric
DTPA-Cu	12A1	17.1	0.26	mg/kg	DTPA ext. copper	DTPA extraction, AAS
DTPA-Zn	12A1	16.4	0.10	mg/kg	DTPA ext. zinc	DTPA extraction, AAS
DTPA-Mn	12A1	9.0	0.32	mg/kg	DTPA ext. manganese	DTPA extraction, AAS
DTPA-Fe	12A1	13.0	0.23	mg/kg	DTPA ext. iron	DTPA extraction, AAS
ADMC	2A1	11.9	0.4	%	Air Dried Moisture Content	Gravimetric oven dry @ 105C
R1	NA	20.2	NA		Dispersion Ratio	Ratio [Aqueous dispersible (Silt + Clay):Total (Silt + Clay)]
SO4-S	10B3	11.5	0.6	mg/kg	Sulfate sulfur	Ca(H2PO4)2 @ pH 4.0 extractable sulfate-sulfur, ICPOES
Sand	no ref	22.1	1.0	%	Particle size, sand	Hydrometer, gravimetric & Sieve
Silt	no ref	16.6	1.0	%	Particle size, silt	Hydrometer, gravimetric
Clay	no ref	12.7	1.0	%	Particle size, clay	Hydrometer, gravimetric
TN	7A2	12.9	0.01	%	Total Kjeldahl Nitrogen	Sulphuric acid digest, (AA) colorimetric
TS	ED042S		0.01	%	Total Sulfur	Leco

* Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)

For Manager **D E Baker** Analytical Services:

D E Baker BSc MASSSI

QUALITY CONTROL DATA

Soil

Reference: B98961 Page: 4 of 4

* Australian Laboratory Handbook of Soil and Water Chemical Methods (1992)

			Actual Value	Acceptance Criteria
Test Method	Units			[Range]
рН	pН	В		5.0 - 5.3
EC	dS/m	В		0.27 - 0.32
CI	mg/kg	В		10 - 35
NO3-N	mg/kg	В		10 - 16
NH4-N	mg/kg	NA		NA
Bicarb.P	mg/kg	В		51 -75
Total Kjeldahl N	%	ASPAC 34	0.110	.100120
Total P	%	ASPAC 34	0.02	.019021
Organic Carbon	%	В		1.82 - 2.3
Ca (Exch. cations)pH7	meq/100g	В		6.96 - 8.04
Mg (Exch. cations)pH7	meq/100g	В		1.88 - 2.22
Na (Exch. cations)pH7	meq/100g	В		.057182
K (Exch. cations)pH7	meq/100g	В		1.209 - 1.411
Exch. Acidity	meq/100g			NA
ECEC	meq/100g	A		NA
CEC	meq/100g	S12		58 - 73
ESP	%	A		NA
Coarse sand	%	В	17.0	17.3 - 22.4
Fine Sand	%	В	22.0	20.0 - 25.7
Silt	%	В	16.0	10.5 - 19.8
Clay	%	В	44.0	37.9 - 48.9
R1		В	•	0.23 - 0.38

			Actual Value	Acceptance Criteria
Test Method	Units	Test Soil		[Range]
DTPA-Cu	mg/kg	SB		2.37 - 3.25
DTPA-Zn	mg/kg	SB		3.15 - 3.81
DTPA-Mn	mg/kg	SB		97.7 - 149.0
DTPA-Fe	mg/kg	SB		24.3 - 32.6
0.33 Bar	%	G		32 - 51
15 Bar	%	G		23 - 30
Ca (Exch. cations)pH8.5	meq/100g	S12		27.7 - 35.4
Mg (Exch. cations)pH8.5	meq/100g	S12		22.88 - 24.5
Na (Exch. cations)pH8.5	meq/100g	S12		2.0 - 2.28
K (Exch. cations)pH8.5	meq/100g	S12		1.64 - 2.09

Data EAL, B98961 Phosyn, EB1717553

EALG2670

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