WAMBO COAL PTY LIMITED

WAMBO COAL MINE
LONGWALL 24 TO 26 MODIFICATION

MODIFICATION REPORT

For the Modification of DA 305-7-2003 (MOD 19)
Optimisation and Continued Operation
of the Approved South Bates Extension Underground Mine

APPENDIX G

Agricultural Resource Assessment

Peabody

WAMBO COAL MINE
LONGWALL 24-26 MODIFICATION

Agricultural Resource Assessment

Prepared for:

Wambo Coal Pty Ltd

SLR Ref: 630.30259
Version No: -v0.1
July 2022 Final

PREPARED BY

SLR Consulting Australia Pty Ltd
ABN 29 001 584 612
10 Kings Road
New Lambton NSW 2305 Australia
(PO Box 447 New Lambton NSW 2305)
T: +61 2 4037 3200
E: newcastleau@slrconsulting.com www.slrconsulting.com

BASIS OF REPORT

This report has been prepared by SLR Consulting Australia Pty Ltd (SLR) with all reasonable skill, care and diligence, and taking account of the timescale and resources allocated to it by agreement with Wambo Coal Pty Ltd (the Client). Information reported herein is based on the interpretation of data collected, which has been accepted in good faith as being accurate and valid.

This report is for the exclusive use of the Client. No warranties or guarantees are expressed or should be inferred by any third parties. This report may not be relied upon by other parties without written consent from SLR.

SLR disclaims any responsibility to the Client and others in respect of any matters outside the agreed scope of the work.

DOCUMENT CONTROL

Reference	Date	Prepared	Checked	Authorised
630.30259	July 2022	Murray Fraser	Rod Masters	Murray Fraser

DOCUMENT REFERENCES

TABLES

FIGURES

APPENDICES

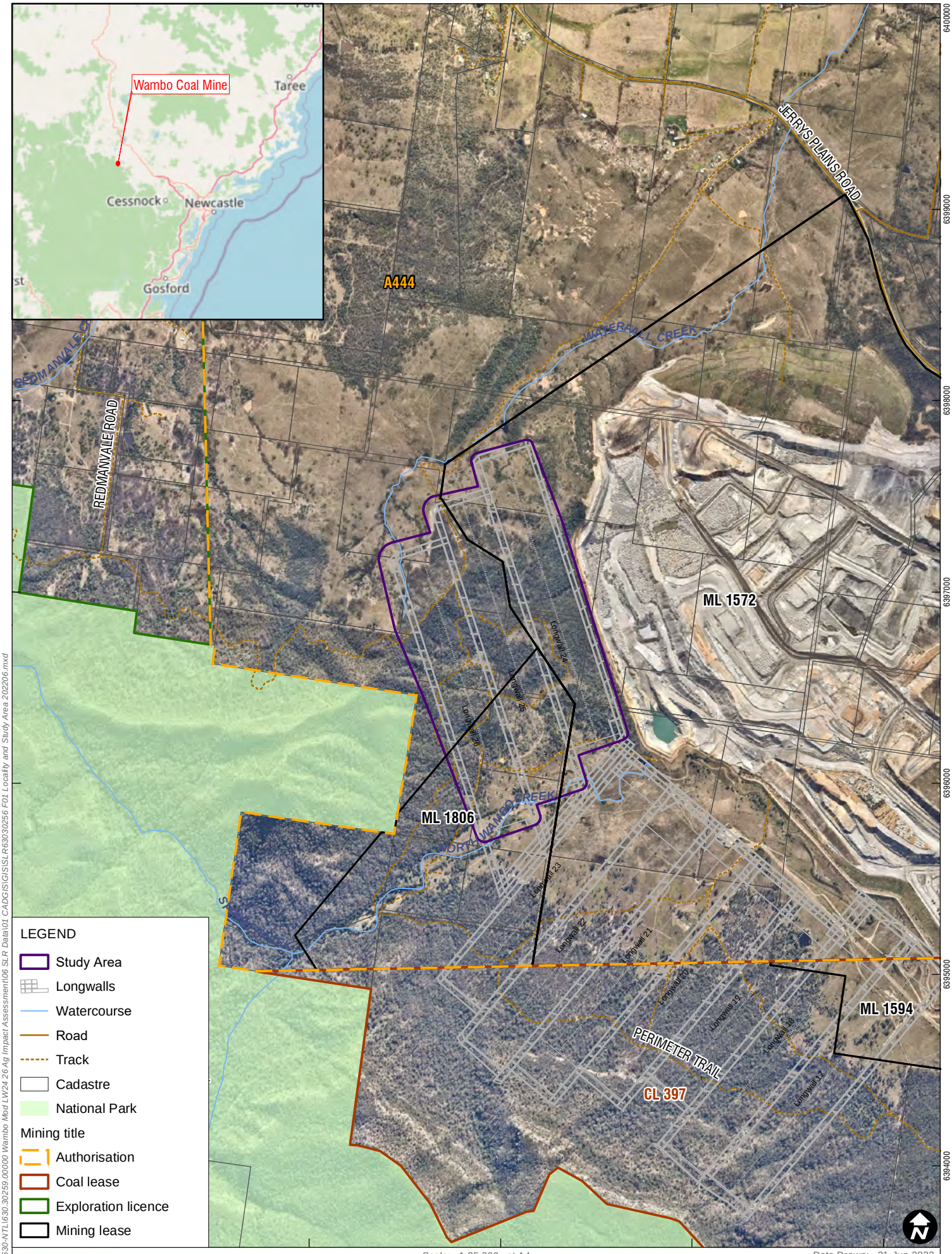
1 Introduction

The Wambo Coal Mine is an underground coal mining operation located approximately 15 kilometres (km) west of Singleton, near the village of Warkworth, New South Wales (NSW) (**Figure 1**). The Wambo Coal Mine is owned and operated by Wambo Coal Pty Ltd (WCPL), a subsidiary of Peabody Energy Australia Pty Limited.

Development Consent (DA 305-7-2003) for the Wambo Coal Mine was granted on 4 February 2004 by the then NSW Minister for Urban Affairs and Planning under Part 4 of the NSW *Environmental Planning and Assessment Act 1979*. A range of open cut and underground mine operations have been conducted at the Wambo Coal Mine since mining operations commenced in 1969. Mining under the Development Consent (DA 305-7-2003) commenced in 2004, with both open cut and underground operations conducted until 2020. From 1 December 2020, the Wambo Coal Mine transitioned into Phase 2 operations which includes underground mining and coal handling and processing.

The South Bates Extension Underground Mine is a component of the approved Wambo Coal Mine Phase 2 operations comprising Longwalls (LWs) 17 to 25 in the Whybrow Seam. WCPL proposes a Modification to Development Consent (DA 305-7-2003) to allow for the reorientation of LWs 24 and 25, and the addition of LW 26 (the Modification). The Modification would require an additional mining lease over a component of Authorisation (A) 444.

SLR Consulting Australia Pty Ltd (SLR) has been commissioned by WCPL to complete an Agricultural Resource Assessment (ARA) to support the Modification application.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Wambo Coal Mine
Taree
Cessnock
Newcastle
Gosford
A444
JERRYS PLAINS ROAD
WATERFALL CREEK
REDMANVALE ROAD
ML 1572
ML 1806
ML 1594
CL 397
NORTH WAMBO CREEK
PERIMETER TRAIL
Longwall 24
Longwall 25
Longwall 26
Longwall 23
Longwall 22
Longwall 21
Longwall 20
Longwall 19
Longwall 18
Longwall 17
LEGEND
Study Area
Longwalls
Watercourse
Road
Track
Cadastre
National Park
Mining title
Authorisation
Coal lease
Exploration licence
Mining lease
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Scale: 1:25,000 at A4
Coordinate System: GDA 1994 MGA Zone 56
Date Drawn: 21-Jun-2022
Project Number: 630.30259
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Locality
& Study Area
FIGURE 1
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1.1 Study Requirements

The purpose of this ARA is to assess and report on the potential impacts of the Modification on agricultural resources and/or industries within and surrounding the Modified LW panels (Study Area). The term 'agricultural resource' is used to describe the land on which agriculture is dependent and the associated water resources (quality and quantity) that are linked to that land.

A Biophysical Strategic Agricultural Land (BSAL) Assessment (SLR, 2022) for the Modification was completed over areas outside existing WCPL tenements. A Site Verification Certificate was issued on by the NSW Department of Planning and Environment, confirming there is no BSAL in those areas.

1.2 Study Area

The Study Area for this assessment is the land above the proposed LW 24-26 and includes the 26.5° subsidence angle of draw surrounding LW 24-26. and comprises 162 hectares (**Figure 1**).

1.3 Methodology

This ARA was assessed using the methodology set out below:

- A desktop review of all publicly available information relating to the Modification.
- Field visits and site inspections in July 2020 by SLR's Principal Agronomist, Murray Fraser.
- Description of the biophysical environment for the Modification Area and surrounding locality.
- A review of other relevant technical studies which also form part of the Modification application.
- Assessment of potential impacts on agricultural resources and industry, including mitigation measures for any identified impacts.

1.4 Assessment Guidelines & Standards

The key standards for this assessment include:

- *The Land and Soil Capability Assessment Scheme; Second Approximation* (Office of Environment and Heritage [OEH], 2012).
- *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (NSW Government, 2013).
- *Australian Soil Classification* (ASC) system (Isbell, 2002).
- *Guidelines for Surveying Soil and Land Resources* (National Committee on Soil and Terrain [NCST], 2008).
- *Australian Soil and Land Survey Field Handbook* (NCST, 2009).

2 Existing Biophysical Environment

2.1 Climate

Representative climate data for the Modification Area has been obtained from the nearest Bureau of Meteorology (BOM) weather station located at Jerrys Plains Post Office, approximately 5 kilometres to the northwest of the Study Area (BOM Station 061086, Monthly Climate Statistics) (BOM, 2022).

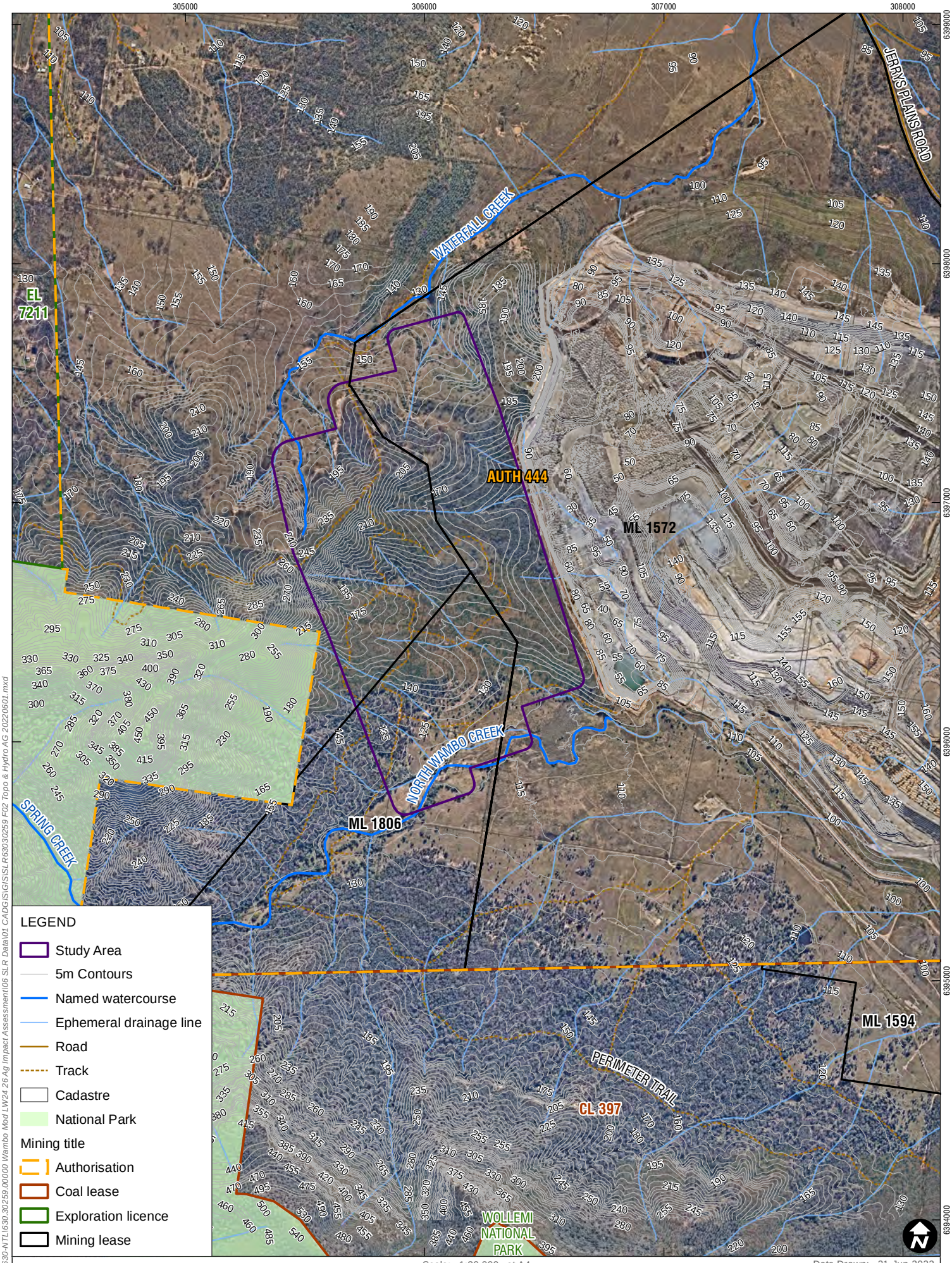
The Jerrys Plains Post Office BOM Station has recorded an average annual precipitation of 642 millimetres (mm), with the highest precipitation from November to March. Mean temperature range between 10.9 and 24.8 degrees Celsius (°C), with January being the warmest month. **Table 1** illustrates the variation in the average yearly precipitation measured at the station. The average annual precipitation ranged from 219 mm to 1,191 mm per annum.

Table 1 Climate Data at the Jerrys Plains Post Office BOM Station

Climate Factor	Average (mean)
Temperature (1957 – 2014)	
Average annual minimum temperature	10.9°C
Average annual maximum temperature	24.8°C
Precipitation (1884 – 2014)	
Average annual precipitation	642 mm
Average annual wettest month	January 78 mm
Average annual driest month	August 36 mm

2.2 Topography

The Study Area is located at the foothills of the Wollemi National Park. The terrain generally dips to the north and south-east, and steepens towards the western and southern boundary lines, drainage gullies and creek banks. Sections of North Wambo Creek and Waterfall Creek intersect the Study Area (**Figure 2** and **Figure 3**).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WATERFALL CREEK
NORTH WAMBO CREEK
SPRING CREEK
JERRYS PLAINS ROAD
PERIMETER TRAIL
WOLLEMI NATIONAL PARK
LEGEND
Study Area
5m Contours
Named watercourse
Ephemeral drainage line
Road
Track
Cadastre
National Park
Mining title
Authorisation
Coal lease
Exploration licence
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Date Drawn: 21-Jun-2022
Project Number: 630.30259
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Topography & Hydrology
FIGURE 2
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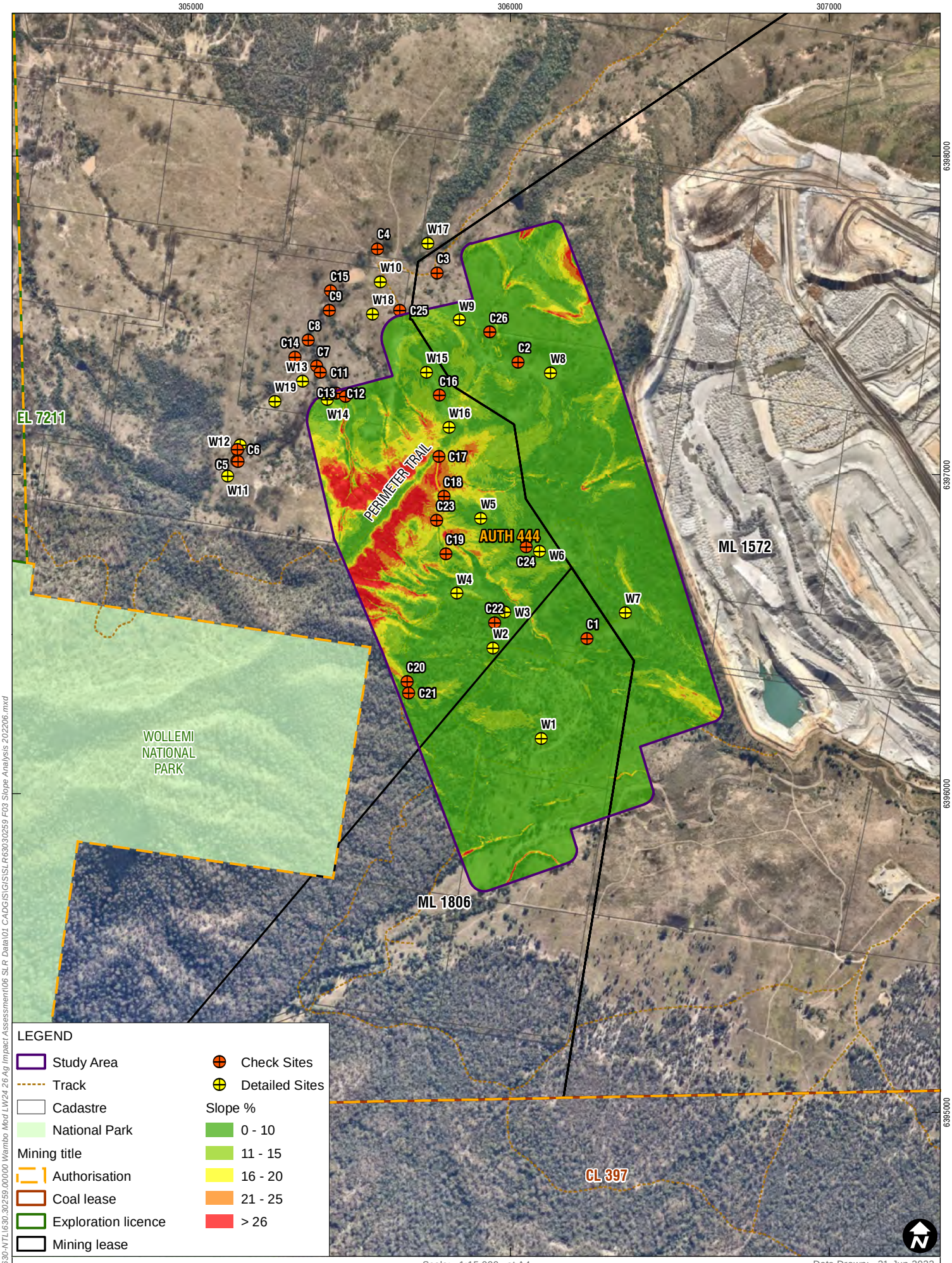

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Slope Analysis

FIGURE 3

2.3 Hydrology

2.3.1 Surface Water

The Surface Water Assessment (Alluvium Consulting, 2022) for the Modification identified two named ephemeral watercourses which transect the Study Area, North Wambo Creek in the south and Waterfall Creek in the north, which both flow towards the east, north-east (**Figure 2**). All watercourses and drainage lines within the Study Area are classed as ephemeral.

North Wambo Creek Western Tributaries

Several western tributaries flow from the sandstone escarpment of the range to the west into North Wambo Creek. These tributaries transition from steep deeply incised bedrock-controlled gullies to broad alluvial flood-outs with no defined channel progressing downstream before entry to North Wambo Creek. These systems are all presently in dynamic equilibrium with relative stability. There are small farm dams on some of these tributaries in the grazing areas.

North Wambo Creek Northern Tributaries

To the north of North Wambo Creek several tributaries flow from the ridge towards the upstream reach of North Wambo Creek. These tributaries transition from steep deeply incised gullies to broader gullies but do not become alluvial flood-outs as observed with the western tributaries. Riparian vegetation is dense in the upper catchment with significant tree and ground cover. In the lower end of the tributaries the tree cover became less dense however dense ground cover remained. These systems appear to be in dynamic equilibrium with relative stability

Waterfall Creek

Waterfall Creek tributaries are steep and relatively incised gullies which run though the northern side of LW24 to 26, with similar characteristics to those seen in the Northern Tributaries. Downstream of the panel extents, the tributaries broaden but with an incised main channel.

Both the North Wambo and Waterfall systems have undergone some natural adjustment post clearing and some localised instabilities remain, though the extents of these are limited by bedrock.

2.3.2 Licenced Surface Water Users

The NSW Water Register indicates there are no Water Access Licences (WALs) associated with the Study Area.

2.4 Groundwater

2.4.1 User Extraction Points

There are no privately owned registered groundwater bores identified within the Study Area (Mine Subsidence Engineering Consultants [MSEC], 2022).

2.5 Geology

The Study Area lies in the Hunter Coalfield, within the Northern Sydney Basin and comprises the Narrabeen Group, Newcastle Coal Measures and the Wittingham Coal Measures. The Whybrow Seam lies within the Jerrys Plains Subgroup of the Wittingham Coal Measures. The rocks of the Wittingham Coal Measures mainly comprise frequently interbedded sandstones and siltstones, but also include isolated thinner beds of conglomerate and tuff. The formations are generally less than 10 metres (m) in thickness.

The Denman Formation marks the top of the Wittingham Coal Measures, which is overlain by the Newcastle Coal Measures. The Newcastle Coal Measures comprise the Watts Sandstone and the Appletree Flat, Horseshoe Creek, Doyles Creek and Glen Gallic Subgroups.

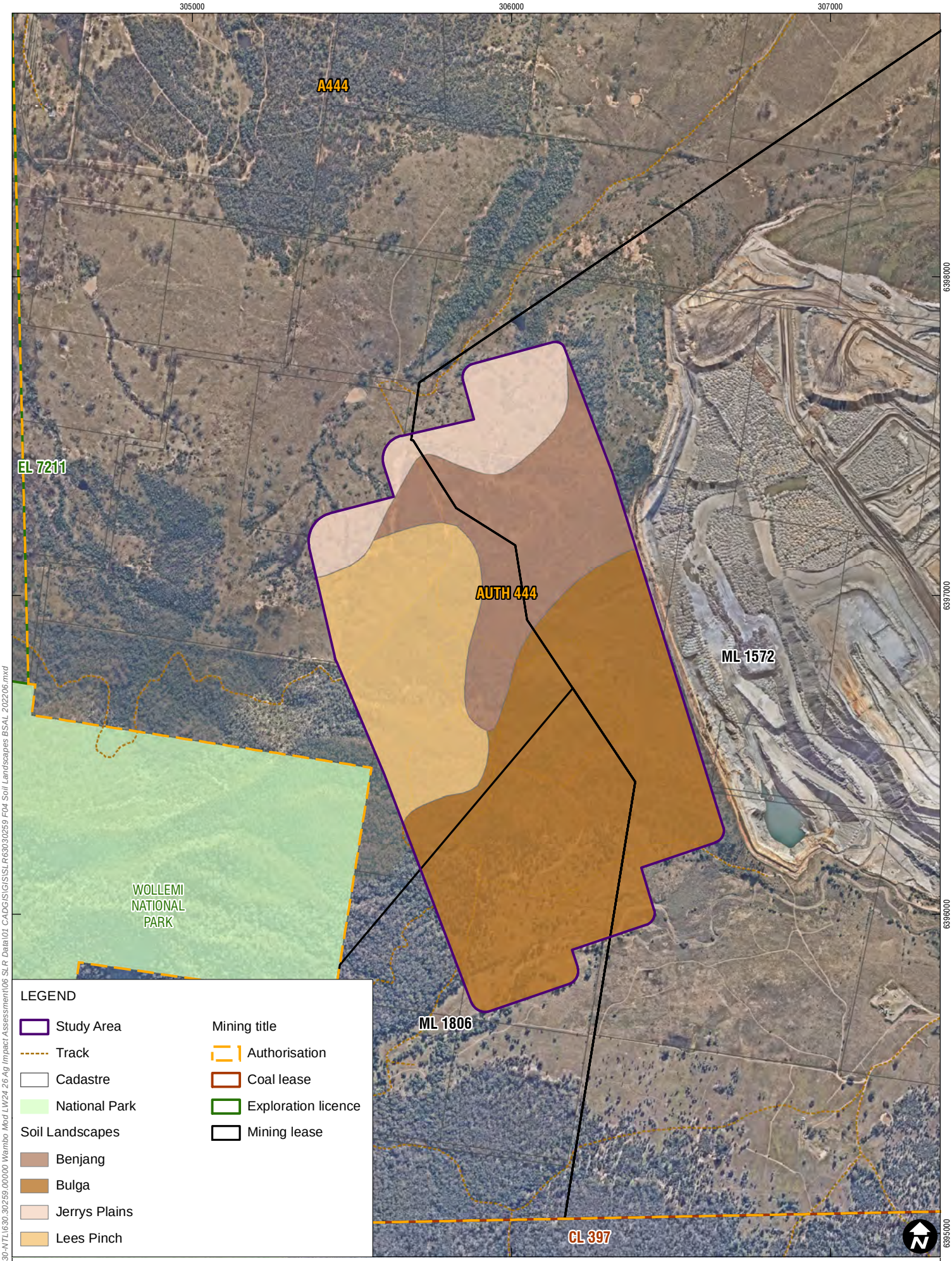
2.6 Soil Landscape Units

The soil landscapes units within the Study Area have been mapped by the former NSW Department of Land and Water Conservation, incorporating the NSW Soil Conservation Service (now part of NSW Department of Primary Industries (DPI)), on the *Soil Landscapes of the Singleton 1:250,000 Sheet* (Kovac & Lawrie, 1991) as shown on **Figure 4**. Descriptions of the four mapped soil landscape units follows:

Benjang

The Benjang soil landscape unit consists of rolling hills, ranging in elevation from 240 to 440 m which are generally rounded with frequent outcrops of sandstone or conglomerate on the summits, with slopes between 10-25%. It occurs on the Singleton Coal Measures geological unit consisting of shale, sandstone, conglomerate, mudstone, coal, tuff and some basalt.

The main soils are Sodosols on the steeper benched country with hard rocks where the near horizontal bedding has resulted in poor soil drainage. Kurosols occur on upper slopes, with Chromosols on the lower portions of longer flat slopes. Tenosols occur mid-slope on quartz sandstone. Limitations to the soil landscape unit are localised steep slopes, high to very high soil erosion hazard and low soil fertility.



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Soil Landscapes

FIGURE 4

Jerrys Plains

The Jerrys Plains landscape unit consists of undulating low hills ranging in elevation from 80 to 180 m, with a slope range from 2-10%. It occurs on the Jerry Plains subgroup of the Wittingham Coal Measures geological unit consisting of lithic sandstone, mudstone, some siltstone lenses and polymictic conglomerates. The main soils are Kurosols on the crests to mid-slopes with Sodosols on the lower slopes and in drainage depressions. Vertosols occur in mid-slope depressions and Sodosols occur on slopes where drainage is severely impeded by bedrock. Areas of severe salting occur in many of the drainage lines. Other soils found in this landscape unit include Chromosols on upper slopes with some Ferrosol- Sodosol intergrades. Limitations to the soil landscape unit are slight to very high soil erosion hazard and low soil fertility.

Lees Pinch

The Lees Pinch landscape unit consists of rolling hills to steep mountains with rounded summits, some edges by sandstone cliffs with elevations from 180 to 800 m and steep slopes to 90% with irregular benches and boulder littered slopes from minor rockfalls. Large sandstone outcrops occur on many hills. It occurs on the Narrabeen Group geological unit consisting of lithic and quartz sandstone, conglomerate, green and red claystone, shale and siltstone.

The main soils are shallow Tenosols with shallow loams on local occurrences of finer textured rocks. Some Chromosols occur on foot slopes, with Sodosols at slope breaks and in mid-slope positions.

Bulga

The Bulga landscape unit consists of smooth slopes forming undulating rises with elevations from 80 to 160 m and slopes up to 10%. The landscape covers the colluvial slopes of the area bounding the steep Lees Pinch and Watagan soil units. Much of the landscape has been cleared for grazing, with some horticulture. It occurs on the Narrabeen Group and Singleton Coal Measures geological group consisting of sandstone, conglomerate, red and green claystone, shale, mudstone and coal. The main soils consist of Sodosols and some Kurosols.

2.6.1 Soil Landscape Agricultural Limitations

As listed in **Table 2** four soil landscapes occur in the Study Area. Major points regarding the dominant soil landscape units are shown below:

- The majority of the Study Area (90%) is highly to severely constrained for cultivation (cropping) enterprises.
- Agricultural land best suited to grazing enterprises includes the Benjang, Jerrys Plains and Bulga soil landscape units, which cover 79% of the Study Area.
- Lees Pinch soil landscape unit has high limitations for grazing and severe limitations for cultivation and covers 21% of the Study Area.

Table 2 Soil Landscape Units

Soil Landscape	Study Area		Agricultural Limitation Rating	
Unit	Hectares	%	Grazing	Cultivation
Benjang	33	20	Moderate	High
Jerrys Plains	17	10	Low	Moderate
Lees Pinch	33	21	High	Severe
Bulga	79	49	Moderate	High
Total	**162**	**100**		

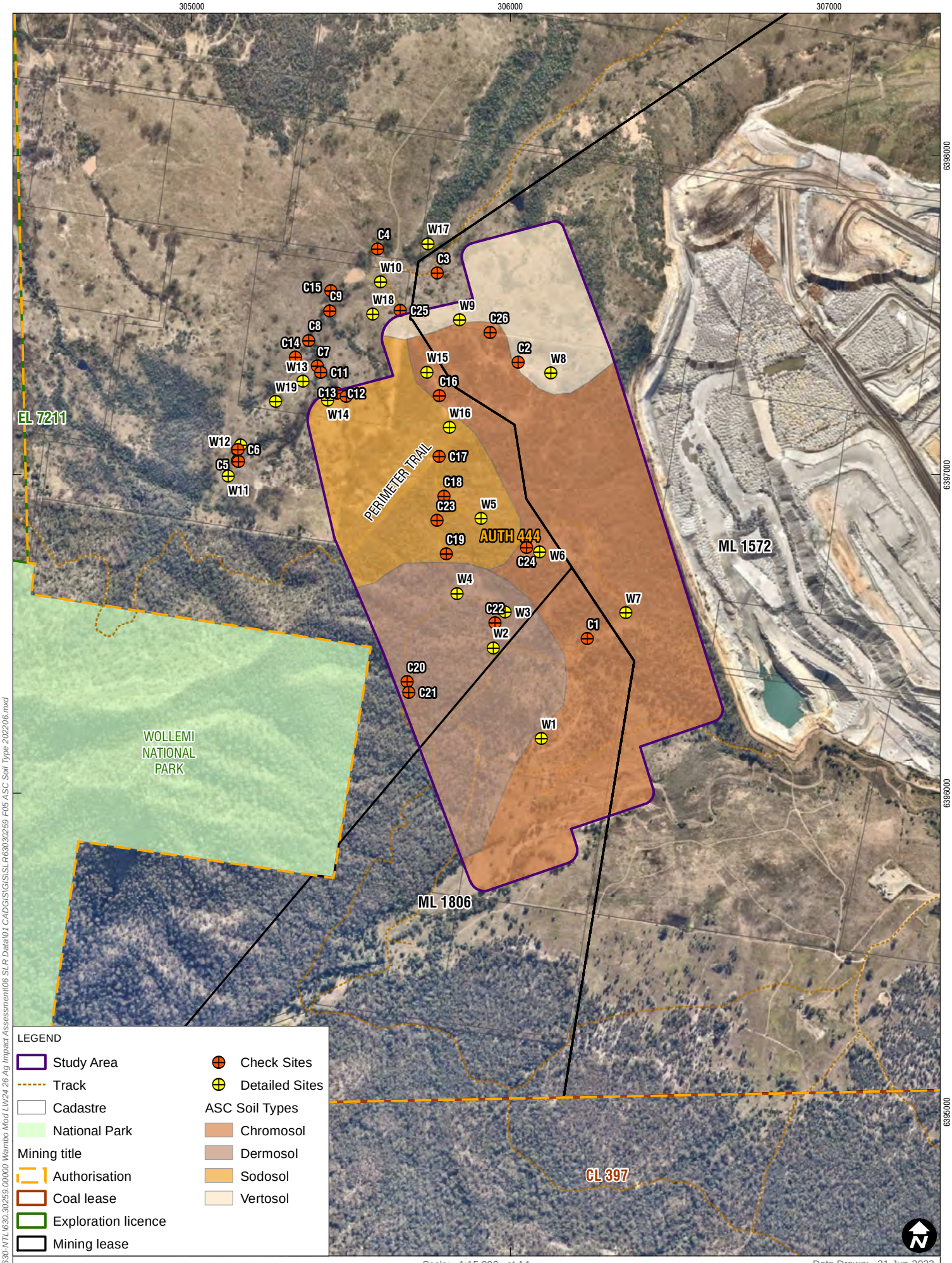
2.7 Acid Sulfate Soils

The likelihood of acid sulfate soils occurring within the Study Area is very low due to its position away from the coast and potential acid sulfate landform type. Furthermore, none of the Soil Landscape Units mapped within the Study Area have acid sulfate soil potential.

2.8 Dominant Soil Types and Inherent Fertility

The dominant ASC soil types were assessed and mapped according to the dominant ASC soil type as shown on **Figure 5**. The soil types present in the Study Area are dominated by Chromosols in the eastern portion of the Study Area with the remainder comprising Vertosols, Sodosols and Dermosols. These soil map units (SMUs) are summarised in **Table 3** with all soil types shown in **Table 4**, with the major soil type characteristics listed below:

- Chromosols are soils with a strong texture contrast between the A and B horizons, where the B horizon is not strongly acidic or sodic.
- Dermosols are soils with structured B2 horizons and lacking strong texture contrast between the A and B horizons.
- Sodosols are soils with a strong texture contrast between the A horizons and a sodic B horizon which are not strongly acidic (pH is greater than 5.5).
- Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates.



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ASC Soil Types

FIGURE 5

Table 3 Soil Map Unit Summary

SMU	ASC Soil Type	Detailed Site	Check Site	Hectares
1	Eutrophic Brown Dermosol	W2, W3, W4	C20, C21, C22	35
2	Eutrophic Brown Chromosol	W1, W6, W7, W15	C1, C16, C24, C26	78
3	Epipedal Black Vertosol	W8, W9	C2	18
4	Subnatric Brown Sodosol	W5, W14, W16	C12, C13, C17, C18, C19, C23	31
N/A	Sites Mapped Outside ARA Study Area	W10, W11, W12, W13, W17, W18, W19	C3, C4, C5, C6, C7, C8, C9, C11, C14, C15, C25	Nil
			Total	**162**

Table 4 ASC Soil Types per Soil Map Unit

SMU	ASC Soil Type	Soil Type Group	Detailed Site	Check Site	Hectares
1	Eutrophic Brown Dermosol	Dominant	W3	C20, C21, C22	35
	Eutrophic Black Dermosol	Sub-Dominant	W2	Nil	
	Epipedal Brown Vertosol		W4	Nil	
2	Eutrophic Brown Chromosol	Dominant	W1, W6, W15	C1, C16, C24	78
	Subnatric Brown Sodosol	Sub-Dominant	W7	C26	
3	Epipedal Black Vertosol	Dominant	W8, W9	C2	18
4	Subnatric Brown Sodosol	Dominant	W5	C13, C17, C18, C19, C23	31
	Subnatric Grey-Black Sodosol	Sub-Dominant	W14	C12	
	Epipedal Grey Vertosol		W16	Nil	
N/A	Sites Mapped Outside ARA Study Area		W10, W11, W12, W13, W17, W18, W19	C3, C4, C5, C6, C7, C8, C9, C11, C14, C15, C25	Nil
				Total	**162**

A description of one detailed representative site from each SMU follows **Figure 5**, with the remaining detailed soil profile descriptions are shown in **Appendix A** and check site descriptions in **Appendix B**. Laboratory certificates of analysis are shown in **Appendix C**.

Soil types in relation to their inherent fertility are shown below in **Table 5**.

Table 5 Dominant Soil Types & Inherent Fertility

ASC Soil Type	Inherent Fertility	Modification Area Hectares	Modification Area %
Vertosol	High	18	11
Chromosol	Moderately High	78	48
Dermosol		35	21
Sodosol	Moderately Low	31	20
	Total	**162**	**100**

In summary, the majority of the Study Area is comprised of soils with moderately high to high inherent fertility (80%). The remainder of the Study Area comprises Sodosols of moderately low inherent fertility.

2.8.1 Soil Unit 1: Eutrophic Brown Dermosol

Dermosols are soils that do not have strong texture contrast between the A and B horizons. They have a well-structured B2 horizon containing low levels of free iron.

Table 6 Summary: Eutrophic Brown Dermosol (Site W3)

Overview	
	
ASC Name	Eutrophic Brown Dermosol
Representative Site	Site W3
Other Mapped Sites	W2, W4
Survey Type	Detailed lab
Dominant Topography	Midslope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	7%
Surrounding Slope (%)	0-10%
Aspect	East
Verified	Non-BSAL (Drainage, pH, ECe & Exchangeable Sodium Percentage [ESP])
LSC Class	4

Table 7 Profile: Eutrophic Brown Dermosol (Site W3)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) loam, weak structure of 2-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.20	Brown (7.5YR 4/3) loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.10 – 0.20.
	B21 0.20 – 0.40	Brown (7.5YR 4/4) light clay, moderate structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. 20% distinct grey mottling; nil stone content; nil segregations; no roots; poorly drained with a gradual and even boundary. Sampled 0.30 – 0.40.
	B22 +0.40	Brown (7.5YR 4/3) light-medium clay, massive structure with a rough fabric and strong consistence. 20% distinct yellow mottling; 25% gravel 5-25mm; nil segregations; no roots; poorly drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75.

Table 8 Chemical Parameters: Eutrophic Brown Dermosol (Site W3)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.0	Slightly Acidic	0.4	Non-Sodic	0.4	Non-Saline	2.9	Ca Low
A2	6.6	Neutral	0.6	Non-Sodic	0.2	Non-Saline	2.3	Ca Low
B21	7.8	Mildly Alkaline	8.4	Marginally Sodic	0.8	Non-Saline	0.9	Ca Deficient
B22	9.3	Very Strongly Alkaline	22.0	Strongly Sodic	5.7	Moderately Saline	0.7	Ca Deficient

2.8.2 Soil Unit 2: Eutrophic Brown Chromosol

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

Table 9 Summary: Eutrophic Brown Chromosol (Site W6)

Overview	
	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site W6
Other Mapped Sites	W1, W7, W15
Survey Type	Detailed lab
Dominant Topography	Hillcrest
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	2%
Surrounding Slope (%)	0-10%
Aspect	East
Verified	Non-BSAL (Physical Barrier)
LSC Class	4

Table 10 Profile: Eutrophic Brown Chromosol (Site W6)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Brown (7.5YR 4/2) silty clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained well drained with a clear and even boundary. Sampled 0.0-0.10.
	B21 0.20 – 0.40	Strong brown (7.5YR 5/6) heavy clay, strong structure of 10-30 mm sub angular blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.20-0.30.
	B22 0.40 – 0.60	Brown (7.5YR 5/4) silty clay, strong massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; coarse roots common, moderately drained with a clear and even boundary. Sampled 0.50-0.60.
	BC 0.60 – 0.70	Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled.
	C +0.70	Sandstone bedrock. Not sampled.

Table 11 Chemical Parameters: Eutrophic Brown Chromosol (Site W6)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.9	Moderately Acidic	1.2	Non-Sodic	0.6	Non-Saline	2.7	Ca Low
B21	7.0	Neutral	1.6	Non-Sodic	0.3	Non-Saline	1.5	Ca Low
B22	8.5	Strongly Alkaline	1.9	Non-Sodic	1.8	Non-Saline	2.7	Ca Low

2.8.3 Soil Unit 3: Epipedal Black Vertosol

Vertosols are clay soils with shrink-swell properties that exhibit strong cracking when dry and at depth have slickensides and/or lenticular structural aggregates.

Table 12 Summary: Epipedal Black Vertosol (Site W8)

Overview	
	
ASC Name	Epipedal Black Vertosol
Representative Site	Site W8
Other Mapped Sites	W9
Survey Type	Detailed lab
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	High
Slope (%)	1%
Surrounding Slope (%)	0-10%
Aspect	West
Verified	Non-BSAL (pH & ECe)
LSC Class	3

Table 13 Profile: Epipedal Black Vertosol (Site W8)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark grey (7.5YR 3/1) medium clay, moderate structure of 10-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.35	Very dark grey (7.5YR 3/1) Heavy Clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30.
	B22 0.35 – 0.50	Very dark greyish brown (10YR 3/2) heavy clay, massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; 20% soft calcium nodules; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.40 – 0.50.
	B23 +0.50	Brown (10YR 4/3) heavy clay, massive structure with a rough fabric and strong consistence. Nil mottling; nil stone content; 20% soft calcium nodules; few fine roots. Well drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75

Table 14 Chemical Parameters: Epipedal Black Vertosol (Site W8)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.2	Neutral	1.0	Non-Sodic	0.7	Non-Saline	1.8	Ca Low
B21	8.2	Moderately Alkaline	6.0	Marginally Sodic	0.8	Non-Saline	0.9	Ca Deficient
B22	8.9	Strongly Alkaline	11.6	Sodic	4.7	Moderately Saline	1.0	Ca Deficient
B23	9.0	Strongly Alkaline	14.4	Strongly Sodic	6.8	Moderately Saline	0.9	Ca Deficient

2.8.4 Soil Unit 4: Subnatric Brown Sodosol

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

Table 15 Summary: Subnatric Brown Sodosol (Site W5)

Overview	
	
ASC Name	Subnatric Brown Sodosol
Representative Site	Site W5
Other Mapped Sites	W14, W16
Survey Type	Detailed lab
Dominant Topography	Midslope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	3%
Surrounding Slope (%)	0-15%
Aspect	Southeast
Verified	Non-BSAL (Fertility, Physical Barrier & Drainage)
LSC Class	4

Table 16 Profile: Subnatric Brown Sodosol (Site W5)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Brown (7.5YR 4/2) clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; few fine roots; well drained with a clear and even boundary. Sampled 0.0-0.10.
	B21 0.10 – 0.50	Strong brown (7.5YR 5/6) heavy clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. 10% distinct yellow mottling; nil stone content; nil segregations; few fine roots; poorly drained with a gradual and even boundary. Sampled 0.30-0.40.
	B22 0.50 – 0.70	Brown (7.5YR 5/4) heavy clay, strong structure of 15-25 mm sub angular blocky peds with a rough fabric and weak consistence. 20% distinct yellow mottling; nil stone content; nil segregations; few coarse roots; poorly drained with an abrupt and even boundary. Sampled 0.60-0.70.
	BC +0.70	Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled.

Table 17 Chemical Parameters: Subnatric Brown Sodosol (Site W5)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.9	Neutral	1.4	Non-Sodic	0.6	Non-Saline	2.8	Ca Low
B21	5.8	Moderately Acidic	6.5	Marginally Sodic	1.2	Non-Saline	0.9	Ca Deficient
B22	6.3	Slightly Acidic	9.1	Marginally Sodic	1.5	Non-Saline	0.9	Ca Deficient

2.9 Vegetation

Vegetation within the Study Area was mapped as Central Hunter Valley Eucalypt Forest & Woodland (Ecological, 2022), which contains the following vegetation communities:

- Hunter Valley Weeping Myall Woodland.
- Central Hunter Ironbark—Spotted Gum—Grey Box Forest.
- Hunter Valley Footslopes Slaty Gum Woodland.
- Hunter Lowland Redgum Forest.

Approximately one third of the Study Area has been cleared of native vegetation for grazing of cattle on grass pasture.

2.10 Agricultural Land Use

Based on the findings of site inspections by SLR's Principal Agronomist, there is approximately 60 hectares (37%) of the Study Area suitable for agricultural production (grazing) in its current state, as shown on **Figure 6**. The only agricultural land use observed within and surrounding the Study Area was cattle grazing.

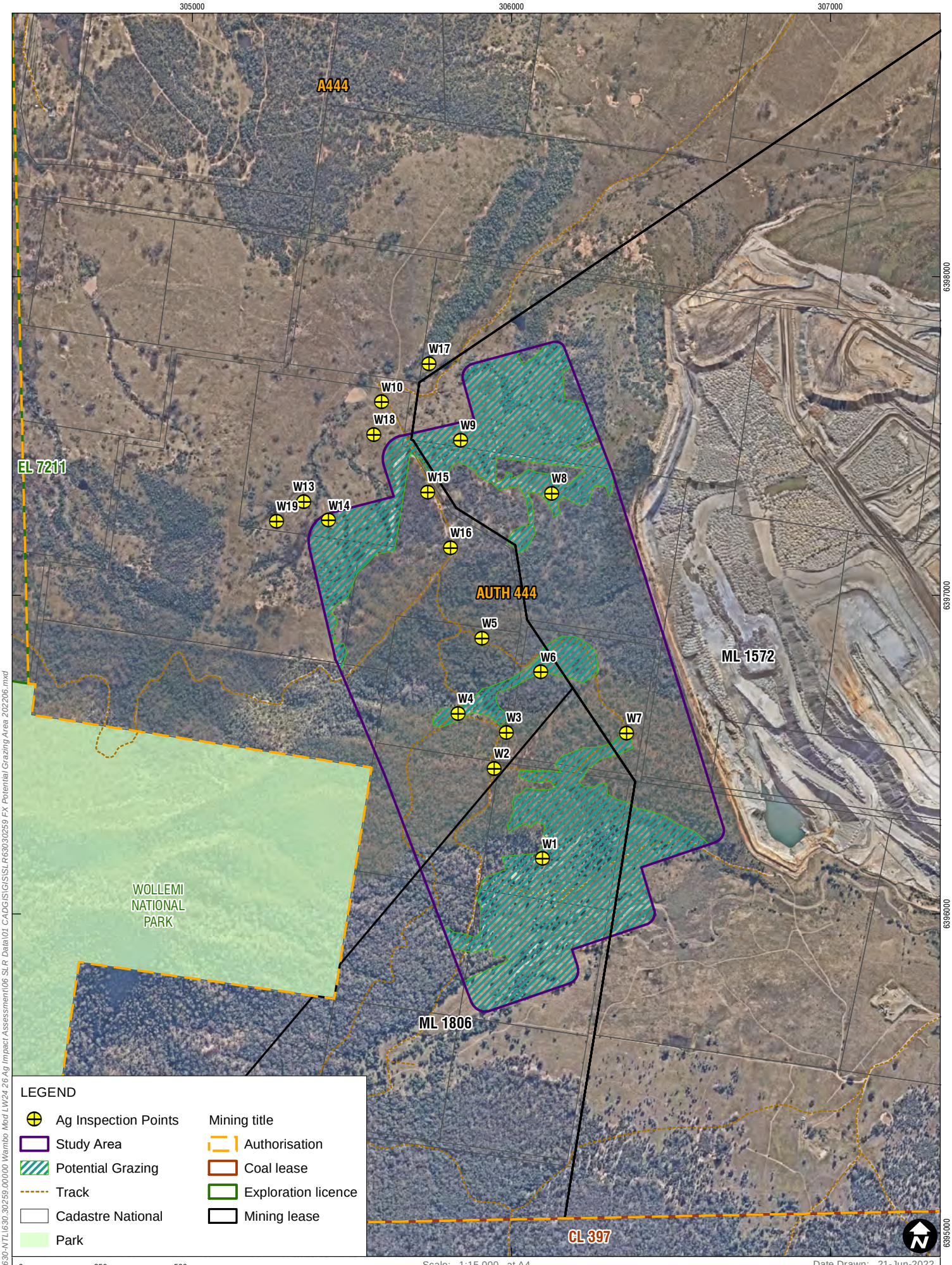
Whilst the remaining 63% of the Study Area is fenced within these cattle paddocks, there is very little grazing value for cattle due to the dense native vegetation and/or steep slopes.

There was no evidence of recent or historical cultivation having been undertaken within or adjacent to the Study Area.

2.11 Strategic Agricultural Land

There is no Strategic Agricultural Land within or in the vicinity of the Study Area.

The closest mapped BSAL mapped in the mining SEPP associated with the Hunter River and is located approximately 1 km to north of the Modification area.



SLR

Potential Grazing Area

FIGURE 6

2.12 Land & Soil Capability

The LSC classification applied to the Study Area is in accordance with the OEH guideline: *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes are described in **Table 18** and their definition has been based on two considerations:

- The biophysical features of the land to derive the LSC classes associated with various hazards; and
- The management of the hazards including the level of inputs, expertise and investment required to manage the land sustainably.

Table 18 Land and Soil Capability Classification

Class	Land and Soil Capability
Land capable of a wide variety of land uses (cropping, grazing, horticulture, forestry, conservation)	
1	**Extremely high capability land**: Land has no limitations. No special land management practices required. Land capable of all rural land uses and land management practices.
2	**Very high capability land**: Land has slight limitations. These can be managed by readily available, easily implemented management practices. Land is capable of most land uses and land management practices, including intensive cropping with cultivation.
3	**High capability land**: Land has moderate limitations and is capable of sustaining high-impact land uses, such as cropping with cultivation, using more intensive, readily available and widely accepted management practices. However, careful management of limitations is required for cropping and intensive grazing to avoid land and environmental degradation.
Land capable of a variety of land uses (cropping with restricted cultivation, pasture cropping, grazing, some horticulture, forestry, nature conservation)	
4	**Moderate capability land**: Land has moderate to high limitations for high-impact land uses. Will restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. These limitations can only be managed by specialised management practices with a high level of knowledge, expertise, inputs, investment and technology.
5	**Moderate–low capability land**: Land has high limitations for high-impact land uses. Will largely restrict land use to grazing, some horticulture (orchards), forestry and nature conservation. The limitations need to be carefully managed to prevent long-term degradation.
Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)	
6	**Low capability land**: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.
Land generally incapable of agricultural land use (selective forestry and nature conservation)	
7	**Very low capability land**: Land has severe limitations that restrict most land uses and generally cannot be overcome. On-site and off-site impacts of land management practices can be extremely severe if limitations not managed. There should be minimal disturbance of native vegetation.
8	**Extremely low capability land**: Limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation.

LSC Soil Survey Density

To satisfy LSC and BSAL mapping requirements, the field soil survey program included areas both outside and inside the Study Area with a total of 44 sites assessed, comprising 19 detailed sites and 25 check sites within the Study Area, of these 7 detailed and 11 check sites surround the Study Area, as shown on **Figure 5**. A breakdown of the soil survey density within the Study Area is provided in **Table 19**.

Table 19 Assessment of Soil Survey Density

Category	Study Area
Total Study Area Hectares	162
1:100,000 Survey Density Target	Minimum 2 Required Sites
Actual Sites Surveyed	12 Detailed and 14 Check Sites
Laboratory Analysed Sites	12

Soil Survey Observation Types

Soil profiles were assessed at 44 sites in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was excavated by a backhoe to either a depth of 1.2 m, to equipment refusal, or to bedrock.

Detailed soil profile morphological descriptions were recorded for the major parameters specified in **Table 20**. Global Positioning System readings was taken for all sites where soil descriptions are recorded. Vegetation type, landform and aspect were also noted. Soil exposures from pits were photographed during field operations.

Table 20 Field Assessment Parameters

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

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 21**.

Table 21 Laboratory Analysis Parameters

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

Soil salinity in the samples from the detailed sites was determined through measurement of the electrical conductivity (EC) of soil:water (1:5) suspensions. These values were converted to the EC of a saturated extract (ECe) based on soil texture.

2.12.2 LSC Classes

LSC Classes were determined according to the *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012), with the hazard criteria assessment and final LSC Class for each detailed site shown below in **Table 22**.

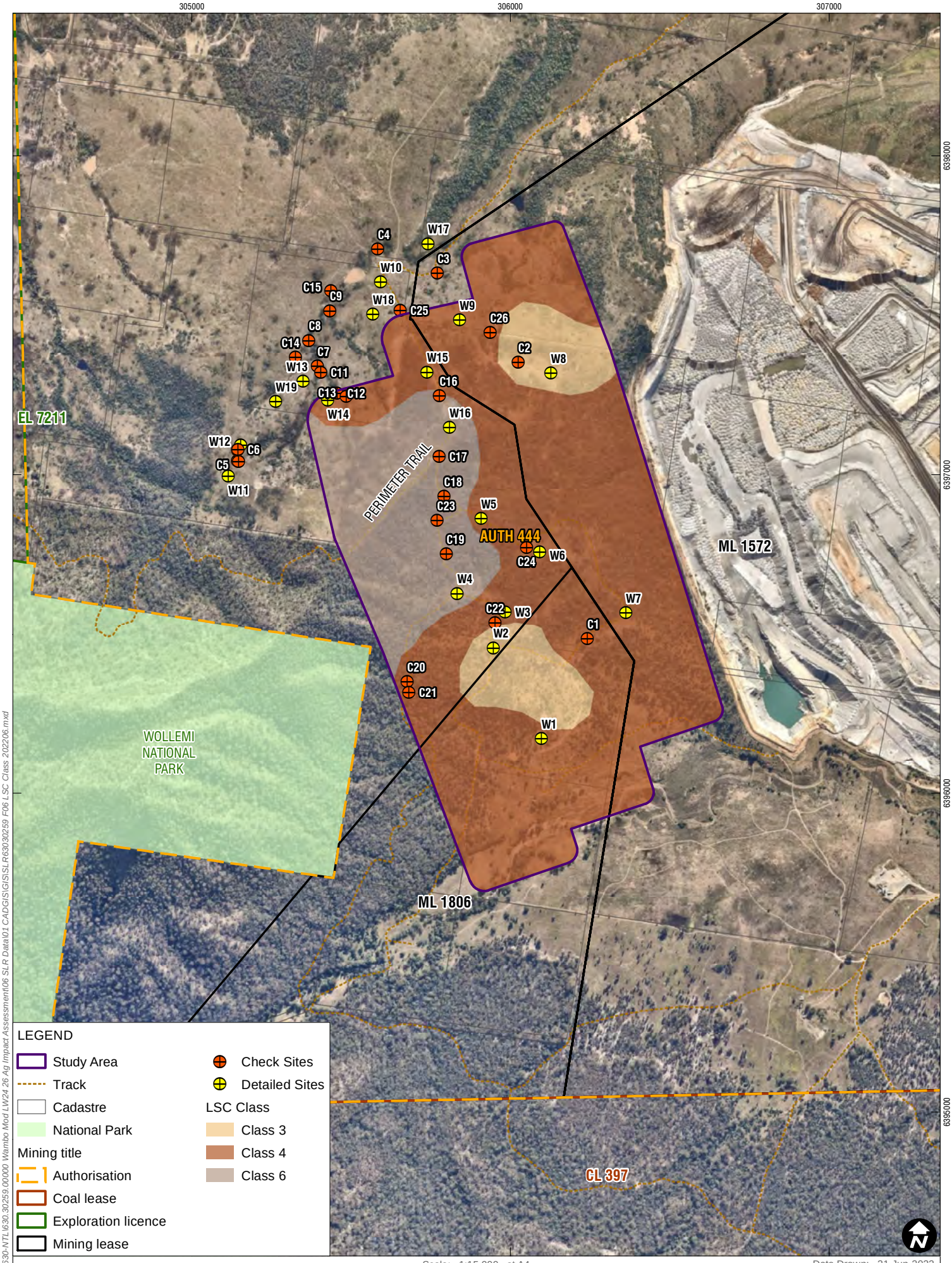
Table 22 LSC Hazard Criteria Assessment

Site	Soil Type	Hazard Criteria								LSC
	ASC Great Group	1	2	3	4	5	6	7	8	
W1	Eutrophic Brown Chromosol	3	2	4	3	3	2	4	1	**4**
W2	Eutrophic Black Dermosol	3	2	3	2	3	2	2	1	**3**
W3	Eutrophic Brown Dermosol	3	2	3	2	3	4	2	1	**4**
W4	Epipedal Brown Vertosol	3	2	3	2	3	2	6	1	**6**
W5	Subnatric Brown Sodosol	3	2	3	3	3	4	4	1	**4**
W6	Eutrophic Brown Chromosol	3	2	3	3	3	2	4	1	**4**
W7	Subnatric Brown Sodosol	3	2	3	3	3	2	4	1	**4**
W8	Epipedal Black Vertosol	3	2	3	1	3	2	2	1	**3**
W9	Epipedal Black Vertosol	3	2	3	2	3	2	4	1	**4**
W14	Subnatric Grey-Black Sodosol	4	2	3	3	3	4	2	1	**4**
W15	Eutrophic Brown Chromosol	3	2	3	3	3	2	4	1	**4**
W16	Epipedal Grey Vertosol	3	2	3	3	3	2	6	1	**6**

Three LSC Classes were identified within the Study Area, as shown below in **Table 23** and on **Figure 7**. The majority of the Study Area is rated as LSC Class 4 (70%).

Table 23 LSC Classes

Land & Soil Capability	Agricultural Capability	Modification Area	
Class	Rating	Hectares	%
3	High capability land	17	10
4	Moderate capability land	113	70
6	Low capability land	32	20
	Total	**162**	**100**



SLR

LSC Class

FIGURE 7

2.12.3 Potential Agricultural Production Value of the Study Area

Potential agricultural productivity was determined using NSW DPI agricultural gross margin productivity data for agricultural enterprises suitable for each of the LSC classes (see **Section 2.12**) that are present within the Study Area. This analysis has been undertaken on the potential capability of the land rather than current land use. If potential agricultural production values were to be pursued, significant investment in land management and agricultural infrastructure would be required. However, this information can be used to approximate potential farm incomes.

The *Beef Cattle Gross Margin Budget Inland Store Weaners* (DPI, 2019) (**Table 24**) has been applied to this assessment to determine potential agricultural income for the Study Area. The *NSW Department of Primary Industries Beef Stocking Rates & Farm Size* (DPI, 2006) was used to determine stocking rates in Dry Sheep Equivalents (DSE) for the three LSC's mapped within the Study Area. Full agricultural gross margin information is contained in **Appendix D**. The Singleton LGA is in the 600 to 700 millimetre per annum rainfall zone and DSE for each LSC Class were calculated accordingly

Table 24 Gross Margin per LSC Class

LSC	Stocking Rate	Cow Calf Unit	Revenue	Variable Costs	Gross Margin
Class	DSE	Per Hectare	Per Hectare	Per Hectare	Per Hectare
3	10	0.60	$470	$100	$370
4	8	0.48	$376	$80	$296
6	4	0.24	$188	$40	$148

Based on the nominated gross margins and stocking rates, the Study Area has the capacity to generate an estimated gross margin of $44,474 per annum (**Table 25**). It is important to note that these figures are derived from the optimum potential uses and are likely to be much higher than the actual incomes being achieved at the time of publication, and to achieve these outcomes would require significant investment in livestock, pasture, fertiliser and agricultural infrastructure.

Table 25 Annual Gross Margins per LSC Class

LSC	Gross Margin	Study Area	
Class	Per Hectare	Hectares	Gross Margin
3	$370	17	$6,290
4	$296	113	$33,448
6	$148	32	$4,736
	Total	**162**	**$44,474**

As discussed in **Section 2.10**, there is 60 hectares of land available for agricultural production within the Study Area in its current guise. Using a conservative assessment and assuming this total area is LSC Class 3 land this area has the potential to generate a gross margin of $22,200 per annum from beef cattle production.

3 Assessment of Potential Impacts

As the Modification would not include any additional surface development areas, the primary potential impact to agricultural resources is from subsidence. MSEC (2022) predicts maximum vertical subsidence to be 1,950 mm over LW 26. Maximum predicted tilt is 75 mm per metres over LW 25 and LW 26, which is small when compared to the natural surface grade of slopes within the Study Area.

A comparison of the maximum predicted total subsidence effects for the approved and modified South Bates Extension Underground Mine layout is provided in **Table 26**. The values represent the maximum predicted accumulated movements due to the extraction of all LWs for the respective layouts.

Table 26 Comparison of maximum predicted total subsidence effects

Layout	Maximum predicted total vertical subsidence (mm)	Maximum predicted total tilt (mm/m)	Maximum predicted total hogging curvature (km-1)	Maximum predicted total sagging curvature (km-1)
Existing/Approved LWs 17 to 23	1,950	80	> 3.0	> 3.0
Modified LWs 24 to 26	1,950	75	> 3.0	> 3.0

The predicted vertical subsidence, maximum predicted tilt and curvatures above the modified LWs 24 to 26 are similar to those predicted for the existing/approved LWs 17 to 23 and therefore the potential impacts to natural vegetation in the modified LWs 24 to 26 would be similar to the existing/approved LWs 17 to 23 (MSEC, 2022).

3.1.1 Land Permanently Removed from Agriculture

There is no land which will be permanently removed from agriculture as a result of the Modification.

3.1.2 Impact on Biophysical Strategic Agricultural Land

There is no Biophysical Strategic Agricultural Land within or adjacent to the Study Area. The Modification will not impact any Biophysical Strategic Agricultural Land.

3.1.3 Acid Sulfate Soils

As outlined in **Section 2.7** there are no Soil Landscape Units associated with the Study Area with acid sulfate potential. The Modification therefore would not impact upon acid sulfate soils.

3.2 Water Resources

3.2.1 Surface Water

Given that drainage channels within the Study Area are considered ephemeral and there are no WALs associated with the Study Area, any impact on agricultural users dependent on flows from these watercourses is negligible.

3.2.2 Groundwater

There are no registered privately-owned groundwater bores identified within, and surrounding the Study Area (MSEC, 2022), as such there no agricultural enterprises which rely on groundwater extraction that will be impacted by the Modification.

3.2.3 Water Reallocation

The Modification would not require WCPL to obtain alluvial WALs or allocations.

3.2.4 Water Resource Impacts on Agricultural Productivity

Given the impacts described previously, longwall subsidence will result in negligible impact on water resources relied upon by agricultural enterprises and will not result in impacts on agricultural productivity.

3.3 Impact on Agricultural Resources from Biodiversity Offsets

No biodiversity offsets associated with the Modification are proposed, as such there would be no impacts on agriculture due to biodiversity offsets.

3.3.1 Cumulative Impacts

Given the previously described impacts are of a minor nature and readily managed through application of appropriate mitigation measures and management strategies, any cumulative impacts on agricultural resources and enterprises are also expected to be minor and readily mitigated.

4 Mitigation Measures

This section describes the proposed mitigation measures and management strategies recommended to minimise potential agricultural impacts. Whilst the majority of impacts on agricultural enterprises and resources have been assessed as negligible, as a matter of best practice, WCPL has adopted a number of mitigation measures to further minimise these impacts. A summary of key measures specifically in relation to potential agricultural impact is provided below.

4.1 Review of Project Design

The proposed longwall mine plan has been reviewed and revised by WCPL in order to mitigate potential subsidence impacts. The final mine plan has been developed to minimise impacts from underground workings on land and surface infrastructure within the Modification Area.

The nature of underground longwall mining avoids significant disturbance to productive agricultural land, especially when compared to open cut mining methods.

4.2 Soil Resources

Whilst there is no surface development proposed as part of the Modification, in the unlikely event they would be required, it is recommended that gypsum be applied for any remediation earthworks where sodic subsoils (ESP is greater than 5%) are exposed. The application of gypsum would minimise the potential for tunnel erosion to occur on disturbed subsoil. The recommended application rates are shown in Table **27**.

Table 27 Gypsum Application Rates

Exchangeable Sodium (ESP)	Gypsum Rate per Hectare	Gypsum Rate per Square Metre
5 to 10%	2 to 5 tonnes	0.2 to 0.5 kilograms
Greater than 10%	5 tonnes	0.5 kilograms

It is noted that there are no soil stripping or stockpiling activities anticipated within the Study Area associated with the Modification.

5 Key Findings

The purpose of this ARA is to assess and report on the potential impacts of the Modification on agricultural resources and/or industries within and surrounding the Study Area.

The key findings of the ARA are listed below.

- There is no land which has been, or is currently used for agriculture, which would be permanently removed from agricultural production.
- There is no land which has been, or is currently used for agriculture, which will be temporarily removed from agricultural production.
- The Study Area contains no areas of verified BSAL.
- Post-mining agricultural economic activity in the Modification Area is expected to be similar to pre-mining activity as there are negligible changes predicted between the pre- and post-mining LSC classifications.
- The Modification would have negligible impact on surface water resources relied upon by agriculture.
- The Modification would have negligible impact on groundwater resources relied upon by agriculture.
- Any other impacts to agricultural resources or enterprises from mine induced subsidence are expected to be minor and readily mitigated.
- The Modification would provide considerable positive economic benefits to the local and broader communities.
- Stakeholder and community consultation has not revealed any issues regarding agricultural resources or enterprises and will be ongoing throughout the life of the Modification.

In summary, the Modification would have negligible impacts on surrounding agricultural resources, enterprises and dependent industries.

6 References

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APPENDIX A

Detailed Site Descriptions

Soil Unit 1: Eutrophic Brown Dermosol

Sub-Dominant Soil Type: Eutrophic Black Dermosol

Table 1 Summary: Eutrophic Black Dermosol (Site W2)

Overview	
Landscape Site W2 	
ASC Name	Eutrophic Black Dermosol
Representative Site	Site W2
Other Mapped Sites	W3, W4
Survey Type	Detailed lab
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	6%
Surrounding Slope (%)	0-10%
Aspect	South
Verified	BSAL
LSC Class	3

Table 2 Profile: Eutrophic Black Dermosol (Site W2)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark grey (7.5YR 3/1) clay loam, weak structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; abundant fine roots; moderately drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.30	Very dark grey (7.5YR 3/1) clay loam, moderate structure of 5-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.10 – 0.20.
	B21 0.30 – 0.60	Very dark grey (7.5YR 3/1) light clay, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Dark brown (7.5YR 3/2) clay loam, weak structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 20% gravel 10-30mm; nil segregations; many fine roots. Well drained. Layer continues beyond sampling depth. Sampled 0.65 – 0.75.

Table 3 Chemical Parameters: Eutrophic Black Dermosol (Site W2)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.7	Neutral	0.2	Non-Sodic	0.4	Non-Saline	4.7	Balanced
A2	6.9	Neutral	0.2	Non-Sodic	0.3	Non-Saline	4.3	Balanced
B21	7.4	Mildly Alkaline	0.4	Non-Sodic	0.2	Non-Saline	3.1	Ca Low
B22	7.6	Mildly Alkaline	0.7	Non-Sodic	0.2	Non-Saline	3.1	Ca Low

Soil Unit 1: Eutrophic Brown Dermosol

Sub-Dominant Soil Type: Epipedal Brown Vertosol

Table 4 Summary: Epipedal Brown Vertosol (Site W4)

Overview	
Landscape Site W4 	
ASC Name	Epipedal Brown Vertosol
Representative Site	Site W4
Other Mapped Sites	W2, W3
Survey Type	Detailed lab
Dominant Topography	Midslope
Dominant Land Use	Native vegetation
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	9%
Surrounding Slope (%)	0-10%
Aspect	East
Verified	Non-BSAL (Physical Barrier)
LSC Class	6

Table 5 Profile: Epipedal Brown Vertosol (Site W4)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) heavy clay, moderate structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained; gradual and even boundary. Sampled 0.0 – 0.10
	B2 0.20 – 0.40	Brown (10YR 5/3) silty clay, weak structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; many coarse roots, well drained with a clear and even boundary. Sampled 0.20 – 0.30
	BC 0.40 – 0.65	Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.50 m depth. Not sampled.
	C +0.65	Sandstone bedrock. Not sampled.

Table 6 Chemical Parameters: Epipedal Brown Vertosol (Site W4)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.5	Mildly Alkaline	0.6	Non-Sodic	0.5	Non-Saline	3.5	Ca Low
B21	8.7	Strongly Alkaline	0.4	Non-Sodic	1.2	Non-Saline	3.5	Ca Low

Soil Unit 2: Eutrophic Brown Chromosol

Eutrophic Brown Chromosol

Table 7 Summary: Eutrophic Brown Chromosol (Site W1)

Overview	
Landscape Site W1 	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site W1
Other Mapped Sites	W6, W7, W15
Survey Type	Detailed lab
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	7%
Surrounding Slope (%)	0-10%
Aspect	South
Verified	Non-BSAL (Physical Barrier)
LSC Class	4

Table 8 Profile: Eutrophic Brown Chromosol (Site W1)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Brown (7.5YR 4/3) silty clay loam, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.30	Brown (7.5YR 4/4) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 0.30 – 0.50	Brown (7.5YR 4/4) heavy clay, strong massive structure with a rough fabric and strong consistence. 20% distinct yellow mottling; 10% gravel 5-10 mm; nil segregations; common fine roots. Poorly drained with a clear and even boundary. Sampled 0.40 – 0.50.
	C +0.50	Sandstone bedrock with nil roots beyond 0.50 m depth. Not sampled

Table 9 Chemical Parameters: Eutrophic Brown Chromosol (Site W1)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.3	Slightly Acidic	2.0	Non-Sodic	0.4	Non-Saline	1.3	Ca Low
B21	6.5	Slightly Acidic	4.8	Non-Sodic	0.4	Non-Saline	0.7	Ca Deficient
B22	7.1	Neutral	5.2	Non-Sodic	0.8	Non-Saline	0.7	Ca Deficient

Soil Unit 2: Eutrophic Brown Chromosol

Sub-Dominant Soil Type: Subnatric Brown Sodosol

Table 10 Summary: Subnatric Brown Sodosol (Site W7)

Overview	
Landscape Site W7 	
ASC Name	Subnatric Brown Sodosol
Representative Site	Site W7
Other Mapped Sites	W1, W6, W15
Survey Type	Detailed lab
Dominant Topography	Hillcrest
Dominant Land Use	Native vegetation
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	5%
Surrounding Slope (%)	0-10%
Aspect	South
Verified	Non-BSAL (Fertility, Physical Barrier & pH)
LSC Class	4

Table 11 Profile: Subnatric Brown Sodosol (Site W7)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark greyish brown (10YR 3/2) clay loam, weak structure of <10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 - 0.10.
	B21 0.10 – 0.30	Brown (10YR 4/3) heavy clay, weak structure of 5-15 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 0.30 – 0.50	Olive brown (2.5Y 4/3) Heavy Clay, massive peds with a rough fabric. 30% distinct grey mottling; Nil stone content; nil segregations; many fine roots; poorly drained with an abrupt and even boundary Sampled 0.40 – 0.50.
	C +0.50	Sandstone bedrock, with nil roots beyond 0.50 m depth. Not sampled

Table 12 Chemical Parameters: Subnatric Brown Sodosol (Site W7)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	1.4	Non-Sodic	0.6	Non-Saline	1.4	Ca Low
B21	7.4	Mildly Alkaline	5.1	Non-Sodic	0.3	Non-Saline	0.3	Ca Deficient
B22	9.0	Strongly Alkaline	7.0	Marginally Sodic	1.5	Non-Saline	0.4	Ca Deficient

Soil Unit 2: Eutrophic Brown Chromosol

Eutrophic Brown Chromosol

Table 13 Summary: Eutrophic Brown Chromosol (Site W15)

Overview	
Landscape Site 15 	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site W15
Other Mapped Sites	W1, W6, W7
Survey Type	Detailed lab
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	8%
Surrounding Slope (%)	0-15%
Aspect	Southwest
Verified	Non-BSAL (Physical Barrier)
LSC Class	4

Table 14 Profile: Eutrophic Brown Chromosol (Site W15)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Brown (7.5YR 4/2) clay loam, weak structure of 10-15 mm blocky peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.20	Brown (7.5YR 4/3) loam, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; few fine roots; well drained with an abrupt and even boundary. Sampled 0.10 – 0.20.
	B21 0.20 – 0.40	Strong brown (7.5YR 5/6) heavy clay, strong structure of 10-30 mm blocky peds and strong consistence. nil mottling; nil stone content; nil segregations; few fine roots; well drained with a gradual and even boundary. Sampled 0.30 – 0.40.
	B22 0.40 – 0.60	Yellowish-brown (10YR 5/4) silty clay, massive structure and strong consistence. nil mottling; nil stone content; 40% soft calcium nodules few coarse roots; well drained with an abrupt and even boundary Sampled 0.50 – 0.60.
	BC +0.60	Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.60 m depth. Not sampled.

Table 15 Chemical Parameters: Eutrophic Brown Chromosol (Site W15)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	2.1	Non-Sodic	0.6	Non-Saline	1.9	Ca Low
A2	6.4	Slightly Acidic	3.5	Non-Sodic	0.6	Non-Saline	2.1	Ca Low
B21	7.4	Mildly Alkaline	3.3	Non-Sodic	1.0	Non-Saline	1.8	Ca Low
B22	8.8	Strongly Alkaline	1.7	Non-Sodic	1.5	Non-Saline	3.4	Ca Low

Soil Unit 3: Epipedal Black Vertosol

Epipedal Black Vertosol

Table 16 Summary: Epipedal Black Vertosol (Site W9)

Overview	
Landscape Site W9 	
ASC Name	Epipedal Black Vertosol
Representative Site	Site W9
Survey Type	Detailed lab
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	High
Slope (%)	7%
Surrounding Slope (%)	0-10%
Aspect	Northeast
Verified	Non-BSAL (Physical Barrier)
LSC Class	4

Table 17 Profile: Epipedal Black Vertosol (Site W9)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark greyish brown (10YR 3/2) silty clay, moderate structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.40	Very dark greyish brown (10YR 3/2) heavy clay, moderate structure of 10-30 mm blocky peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Dark brown (7.5YR 3/2) silty clay, massive structure with a rough fabric. Nil mottling; nil stone content; 20% soft calcium nodules; coarse roots common; well drained with an abrupt and wavy boundary. Sampled 0.40 – 0.50
	BC +0.60	Weathered sandstone with >50% gravel content 10-50 mm and nil roots beyond 0.70 m depth. Not sampled.

Table 18 Chemical Parameters: Epipedal Black Vertosol (SiteW9)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	1.3	Non-Sodic	0.5	Non-Saline	1.7	Ca Low
B21	7.1	Neutral	2.6	Non-Sodic	0.3	Non-Saline	1.1	Ca Low
B22	8.7	Strongly Alkaline	3.5	Non-Sodic	1.9	Non-Saline	1.6	Ca Low

Soil Unit 4: Subnatric Brown Sodosol

Sub-Dominant Soil Type: Subnatric Grey-Black Sodosol

Table 19 Summary: Subnatric Grey-Black Sodosol (Site W14)

Overview	
Landscape Site W14 	
ASC Name	Subnatric Grey-Black Sodosol
Representative Site	Site W14
Other Mapped Sites	W5, W16
Survey Type	Detailed lab
Dominant Topography	Lower slope spur
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	10%
Surrounding Slope (%)	5-25%
Aspect	Northwest
Verified	Non-BSAL (Slope, Fertility, Drainage, ECe & ESP)
LSC Class	4

Table 20 Profile: Subnatric Grey-Black Sodosol (Site W14)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Very dark brown (10YR 2/2) clay loam, weak structure of <10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 10% gravel 10-20mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.20	Dark brown (7.5YR 3/2) clay loam, moderate structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 40% gravel 5-10mm; nil segregations; many fine roots; well drained with a clear and even boundary. Sampled 0.10 – 0.20.
	B21 0.20 – 0.50	Brown (7.5YR 4/2) heavy clay, massive structure and strong consistence. 20% distinct grey mottling; <5% gravel 5-10mm; Nil segregations; many fine roots; poorly drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.50	Dark brown (7.5YR 3/3) Light-medium Clay, massive structure and strong consistence. 20% distinct grey mottling; 40% gravel 10-40mm; Nil segregations; few fine roots; poorly drained with layer continuing beyond sampling depth. Sampled 0.65 – 0.75.

Table 21 Chemical Parameters: Subnatric Grey-Black Sodosol (Site W14)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	1.9	Non-Sodic	0.9	Non-Saline	2.6	Ca Low
A2	6.2	Slightly Acidic	1.5	Non-Sodic	0.4	Non-Saline	1.8	Ca Low
B21	8.1	Moderately Alkaline	12.8	Sodic	2.5	Slightly Saline	0.5	Ca Deficient
B22	8.3	Moderately Alkaline	24.3	Strongly Sodic	7.4	Moderately Saline	0.4	Ca Deficient

Soil Unit 4: Subnatric Brown Sodosol

Sub-Dominant Soil Type: Epipedal Grey Vertosol

Table 22 Summary: Epipedal Grey Vertosol (Site W16)

Overview	
Landscape Site W16 	
ASC Name	Epipedal Grey Vertosol
Representative Site	Site W16
Other Mapped Sites	W5, W14
Survey Type	Detailed
Dominant Topography	Upper slope ridge
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	7%
Surrounding Slope (%)	0-20%
Aspect	West
Verified	Non-BSAL (Physical Barrier)
LSC Class	6

Table 23 Profile: Epipedal Grey Vertosol (Site W16)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Brown (7.5 YRY 5/2) light-medium clay; weak structure of 5-15 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.0 – 0.10.
	B2 0.10 – 0.25	Grey (10YYR 6/1) silty clay; moderate structure of 10-20 mm sub angular blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; well drained with a clear and wavy boundary. Sampled 0.20 – 0.30.
	BC 0.30 – 0.60	Weathered sandstone with >60% gravel content 10-50 mm and nil roots beyond 0.50 m depth. Not sampled.
	C 0.60	Sandstone bedrock. Not sampled.

Table 24 Chemical Parameters: Epipedal Grey Vertosol (Site W16)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	8.3	Moderately Alkaline	0.7	Non Sodic	2.2	Slightly Saline	7.2	Mg Low
B2	8.7	Strongly Alkaline	1.0	Non Sodic	1.3	Non-Saline	6.7	Mg Low

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 25 Summary: Epipedal Black Vertosol (Site W10)

Overview	
Landscape Site W10 	
ASC Name	Epipedal Black Vertosol
Representative Site	Site W10
Survey Type	Detailed lab
Dominant Topography	Lower slope bench
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	High
Slope (%)	6%
Surrounding Slope (%)	0-10%
Aspect	North
Verified	Non-BSAL (pH & ECe)

Table 26 Profile: Epipedal Black Vertosol (Site W10)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) light clay, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.0-0.10.
	B21 0.20 – 0.40	Dark brown (7.5YR 3/2) heavy clay, strong structure of 20-30 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20-0.30.
	B22 0.40 – 0.60	Brown (10YR 4/3) heavy clay, massive structure. Nil mottling; nil stone content; 20% soft calcium nodules; many fine roots; well drained with a gradual and wavy boundary. Sampled 0.40-0.50.
	B23 +0.60	Yellowish-brown (10YR 5/4) heavy clay, massive structure. Nil mottling; nil stone content; 40% soft calcium nodules; nil roots; well drained with layer continuing beyond sampling depth. Sampled 0.65-0.75.

Table 27 Chemical Parameters: Epipedal Black Vertosol (Site W10)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.4	Slightly Acidic	2.3	Non-Sodic	0.4	Non-Saline	1.1	Ca Low
B21	7.0	Neutral	6.1	Marginally Sodic	0.5	Non-Saline	0.7	Ca Deficient
B22	8.9	Strongly Alkaline	10.4	Sodic	3.9	Slightly Saline	0.9	Ca Deficient
B23	9.1	Very Strongly Alkaline	13.4	Sodic	5.2	Moderately Saline	0.7	Ca Deficient

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 28 Summary: Eutrophic Black Chromosol (Site W11)

Overview	
Landscape Site W11 	
ASC Name	Eutrophic Black Chromosol
Representative Site	Site W11
Survey Type	Detailed lab
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	7%
Surrounding Slope (%)	0-15%
Aspect	Southwest
Verified	Non-BSAL (pH & ECe)

Table 29 Profile: Eutrophic Black Chromosol (Site W11)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark brown (7.5YR 2.5/2) clay loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.40	Dark brown (7.5YR 3/2) heavy clay, moderate structure of 30-40 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30
	B22 0.40 – 0.60	Brown (10YR 4/3) silty clay, strong structure of 30-50 mm lenticular peds with a smooth fabric and strong consistence. Nil mottling; nil stone content; nil segregations; few fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50
	B23 0.60-0.75	Brown (10YR 5/3) silty clay, massive structure. Nil mottling; <5% gravel 5-10 mm; 20% soft calcium nodules; no roots; well drained with a clear and even boundary. Sampled 0.65 – 0.75
	BC +0.75	Weathered sandstone. Not sampled

Table 30 Chemical Parameters: Eutrophic Black Chromosol (Site W11)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	2.4	Non-Sodic	1.2	Non-Saline	1.5	Ca Low
B21	8.6	Strongly Alkaline	5.3	Non-Sodic	0.9	Non-Saline	0.6	Ca Deficient
B22	9.3	Very Strongly Alkaline	8.7	Marginally Sodic	3.9	Slightly Saline	1.0	Ca Deficient
B23	9.3	Very Strongly Alkaline	13.9	Sodic	7.5	Moderately Saline	1.1	Ca Low

Detailed Sites Outside AIS Study Area

Eutrophic Brown Chromosol

Table 31 Summary: Eutrophic Brown Chromosol (Site W12)

Overview	
Landscape Site W12 	
ASC Name	Eutrophic Brown Chromosol
Representative Site	Site W12
Survey Type	Detailed laboratory
Dominant Topography	Upper slope bench
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	4%
Surrounding Slope (%)	0-20%
Aspect	North-West
Verified	Non-BSAL (Physical Barrier & Drainage)

Table 32 Profile: Eutrophic Brown Chromosol (Site W12)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) clay loam, weak structure of 10-20 mm crumb peds with a rough fabric and weak consistence. Nil mottling; 20% cobbles 50-100mm; nil segregations; abundant fine roots; well drained; with clear and even boundary. Sampled 0.0-0.10.
	B2 0.20 – 0.40	Strong brown (7.5YR 5/6) heavy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 20% distinct grey mottling; 20% cobbles 50-100mm; nil segregations; many fine roots; poorly drained with an abrupt and even boundary Sampled 0 20-0.30.
	C +0.40	Sandstone bedrock, with nil roots beyond 0.40 m depth. Not sampled.

Table 33 Chemical Parameters: Eutrophic Brown Chromosol (Site W12)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.1	Slightly Acidic	1.0	Non-Sodic	0.6	Non-Saline	2.7	Ca Low
B2	7.3	Neutral	1.2	Non-Sodic	0.3	Non-Saline	0.9	Ca Deficient

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 34 Summary: Epipedal Black Vertosol (Site W13)

Overview
Landscape Site W13


ASC Name	Epipedal Black Vertosol
Representative Site	Site W13
Survey Type	Detailed lab
Dominant Topography	Lower slope bench
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	High
Slope (%)	4%
Surrounding Slope (%)	0-15%
Aspect	North
Verified	Non-BSAL (pH, ECe & ESP)

Table 35 Profile: Epipedal Black Vertosol (Site W13)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark brown (7.5YR 3/2) light-medium clay, moderate structure of 5-10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; 10% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.50	Very dark grey (7.5YR 3/1) heavy clay, strong structure of 40-50 mm lenticular peds with a rough fabric and strong consistence. Nil mottling; nil stone content; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 +0.50	Dark brown (7.5YR 3/2) heavy clay, massive structure. Nil mottling; nil stone content; 5% soft calcium nodules; few fine roots; well drained with layer continuing beyond sample depth. Sampled 0.40 – 0.50 & 0.65 – 0.75.

Table 36 Chemical Parameters: Epipedal Black Vertosol (Site W13)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.5	Slightly Acidic	2.7	Non-Sodic	0.6	Non-Saline	1.1	Ca Low
B21	8.0	Moderately Alkaline	7.4	Marginally Sodic	0.8	Non-Saline	0.8	Ca Deficient
B22	8.9	Strongly Alkaline	12.1	Sodic	3.3	Slightly Saline	1.2	Ca Low
B22	9.0	Strongly Alkaline	15.6	Strongly Sodic	5.9	Moderately Saline	1.2	Ca Low

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 37 Summary: Eutrophic Black Chromosol (Site W17)

Overview	
Landscape Site W17 	
ASC Name	Eutrophic Black Chromosol
Representative Site	Site W17
Survey Type	Detailed lab
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	4%
Surrounding Slope (%)	0-10%
Aspect	Southeast
Verified	BSAL

Table 38 Profile: Eutrophic Black Chromosol (Site W17)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark brown (10YR 2/2) loam, weak structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; moderately drained with a clear and wavy boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.30	Very dark brown (7.5YR 2.5/2) clay loam, moderate structure of 5-15 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a gradual and wavy boundary. Sampled 0.20 – 0.30.
	B22 0.30 – 0.50	Very dark greyish brown (10YR 3/2) clay loam, moderate structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; 25% gravel 5-10 mm; nil segregations; many fine roots; well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B23 +0.50	Black (10YR 2/1) clay loam, moderate structure of 20-40 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; <5% gravel 10-30mm; nil segregations; many coarse roots. Well drained. Layer continues beyond sampling depth. Sampled 0.65 – 0.75.

Table 39 Chemical Parameters: Eutrophic Black Chromosol (Site W17)

Layer	pH (1:5 water)		ESP		EC_e		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.3	Slightly Acidic	1.9	Non Sodic	0.5	Non-Saline	3.9	Ca Low
B21	6.6	Neutral	1.2	Non Sodic	0.2	Non-Saline	3.0	Ca Low
B22	6.9	Neutral	1.3	Non Sodic	0.2	Non-Saline	2.6	Ca Low
B23	7.2	Neutral	1.5	Non Sodic	0.2	Non-Saline	2.4	Ca Low

Detailed Sites Outside AIS Study Area

Epipedal Black Vertosol

Table 40 Summary: Epipedal Black Vertosol (Site W18)

Overview	
Landscape Site W18 	
ASC Name	Epipedal Black Vertosol
Representative Site	Site W18
Survey Type	Detailed lab
Dominant Topography	Midslope
Dominant Land Use	Cattle grazing
Vegetation	Grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	7%
Surrounding Slope (%)	0-10%
Aspect	South
Verified	Non-BSAL (pH)

Table 41 Profile: Epipedal Black Vertosol (Site W18)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Very dark brown (7.5YR 2.5/2) medium clay, moderate structure of <10 mm crumb peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; abundant fine roots; moderately drained; gradual and even boundary. Sampled 0 – 0.10.
	B21 0.20 – 0.40	Very dark brown (7.5YR 2.5/2) heavy clay, strong structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; many fine roots, well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 0.40 – 0.60	Very dark brown (7.5YR 2.5/2) medium clay, moderate structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; nil stone content; nil segregations; coarse roots common, well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B23 +0.60	Dark brown (7.5YR 3/4) sandy loam, weak structure of 10-20 mm blocky peds with a rough fabric and weak consistence. Nil mottling; 20% gravel 5-10 mm; nil segregations; few coarse roots, well drained. Layer continues beyond sampling depth Sampled 0.65 – 0.75.

Table 42 Chemical Parameters: Epipedal Black Vertosol (Site W18)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	7.0	Neutral	1.4	Non Sodic	0.4	Non-Saline	0.9	Ca Deficient
B21	7.7	Mildly Alkaline	2.2	Non Sodic	0.3	Non-Saline	0.8	Ca Deficient
B22	8.7	Strongly Alkaline	3.6	Non Sodic	1.4	Non-Saline	1.0	Ca Deficient
B23	9.2	Very Strongly Alkaline	6.7	Marginally Sodic	2.7	Slightly Saline	0.8	Ca Deficient

Detailed Sites Outside AIS Study Area

Eutrophic Black Chromosol

Table 43 Summary: Eutrophic Black Chromosol (Site W19)

Overview	
Landscape Site W19 	
ASC Name	Eutrophic Black Chromosol
Representative Site	Site W19
Survey Type	Detailed lab
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	11%
Surrounding Slope (%)	10-15%
Aspect	Southwest
Verified	Non-BSAL (Slope)

Table 44 Profile: Eutrophic Black Chromosol (Site W19)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Black (10YR 2/1) clay loam, weak structure of 5-10 mm crumb peds with a rough fabric and weak consistence. Nil mottling; <5% gravel 5-10 mm; nil segregations; abundant fine roots; well drained with a clear and even boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.40	Very dark greyish brown (10YR 3/2) heavy clay, strong structure of 10-20 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; few fine common; well drained with gradual and even boundary. Sampled 0.20 – 0.30.
	B22 0.40 – 0.60	Brown (10YR 4/3) light-medium clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. nil mottling; nil stone content; nil segregations; coarse roots common; well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B23 +0.60	Light yellowish brown 2.5Y 6/3) silty clay, moderate structure of 10-30 mm blocky peds with a rough fabric and moderate consistence. Nil mottling; nil stone content; nil segregations; few coarse roots, well drained. Layer continues beyond sampling depth Sampled 0.65 – 0.75

Table 45 Chemical Parameters: Eutrophic Black Chromosol (Site W19)

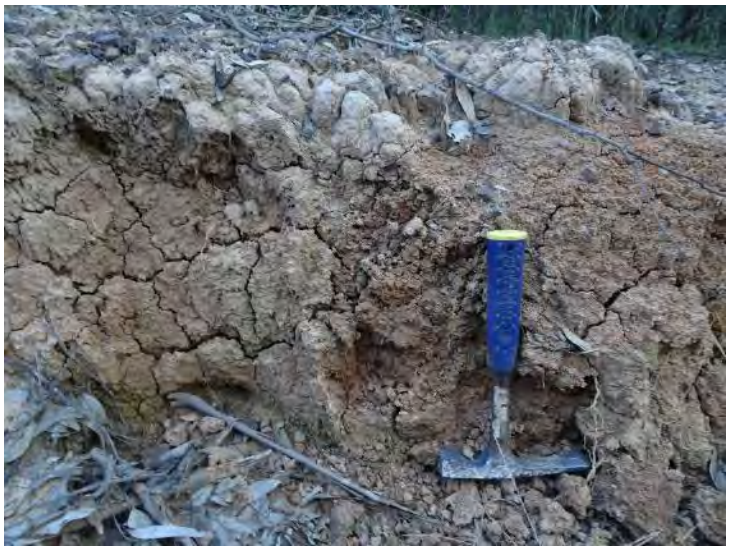
Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.8	Neutral	1.0	Non Sodic	0.6	Non-Saline	1.9	Ca Low
B21	7.0	Neutral	2.9	Non Sodic	0.3	Non-Saline	1.1	Ca Low
B22	8.0	Moderately Alkaline	6.6	Marginally Sodic	0.7	Non-Saline	0.8	Ca Deficient
B23	8.8	Strongly Alkaline	11.0	Sodic	1.4	Non-Saline	0.7	Ca Deficient

APPENDIX B

Check Site Descriptions

Soil Unit 1: Eutrophic Brown Dermosol

Table 1 Site C20 Brown Dermosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Clay loam with a gradual and even boundary
	B2 +0.20	Heavy clay, strong structure, 7.5YR 5/6 (strong brown)

ASC Name	Brown Dermosol
Representative Site	Site C20
Other Mapped Detailed Sites	W2, W3, W4
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	16
Aspect	South

Soil Unit 1: Eutrophic Brown Dermosol

Table 2 Site C21 Brown Dermosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Clay loam with a gradual and even boundary
	B2 +0.20	Light clay, strong structure, 7.5YR 5/6 (strong brown)

ASC Name	Brown Dermosol
Representative Site	Site C21
Other Mapped Detailed Sites	W2, W3, W4
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately high
Slope (%)	11
Aspect	South

Soil Unit 1: Eutrophic Brown Dermosol

Table 3 Site C22 Brown Dermosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a gradual and even boundary
	B2 +0.10	Light clay, moderate structure, 7.5YR 4/4 (brown)

ASC Name	Brown Dermosol
Representative Site	Site C22
Other Mapped Detailed Sites	W2, W3, W4
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	8
Aspect	East

Soil Unit 2: Eutrophic Brown Chromosol

Table 4 Site C1 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Light clay, strong structure, 10YR 4/4 (brown)

ASC Name	Brown Chromosol
Representative Site	Site C1
Other Mapped Detailed Sites	W1, W6, W7, W15
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately low
Slope (%)	5
Aspect	Southeast

Soil Unit 2: Eutrophic Brown Chromosol

Table 5 Site C16 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 7.5YR 5/8 (strong brown)

ASC Name	Brown Chromosol
Representative Site	Site C16
Other Mapped Detailed Sites	W1, W6, W7, W15
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	7
Aspect	South

Soil Unit 2: Eutrophic Brown Chromosol

Table 6 Site C24 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 10YR 4/3 (brown)

ASC Name	Brown Chromosol
Representative Site	Site C24
Other Mapped Detailed Sites	W1, W6, W7, W15
Survey Type	Check site
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	5
Aspect	East

Soil Unit 2: Eutrophic Brown Chromosol

Table 7 Site C26 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Clay loam with a clear and even boundary
	B2 +0.15	Medium clay, strong structure, 7.5YR 4/6 (strong brown)

ASC Name	Brown Sodosol
Representative Site	Site C26
Other Mapped Detailed Sites	W1, W6, W7, W15
Survey Type	Check site
Dominant Topography	Drainage line
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	4
Aspect	North

Soil Unit 3: Epipedal Black Vertosol

Table 8 Site C2 Black Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.25	Light clay with a gradual and even boundary
	B2 +0.25	Heavy clay, strong structure, 7.5YR 3/1 (very dark grey)

ASC Name	Black Vertosol
Representative Site	Site C2
Other Mapped Detailed Sites	W8, W9
Survey Type	Check site
Dominant Topography	Drainage line
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	High
Slope (%)	3
Aspect	Northeast

Soil Unit 4: Subnatric Brown Sodosol

Table 9 Site C12 Black Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Clay loam with a clear and even boundary
	B2 +0.15	Medium clay, strong structure, 7.5YR 3/1 (very dark grey)

ASC Name	Black Sodosol
Representative Site	Site C12
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Upper slope
Dominant Land Use	Cattle Grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately low
Slope (%)	5
Aspect	West

Soil Unit 4: Subnatric Brown Sodosol

Table 10 Site C13 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 7.5YR 5/8 (strong brown)

ASC Name	Brown Sodosol
Representative Site	Site C13
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Upper slope
Dominant Land Use	Cattle Grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately low
Slope (%)	16
Aspect	West

Soil Unit 4: Subnatric Brown Sodosol

Table 11 Site C17 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Silty loam with a clear and even boundary
	B2 +0.15	Medium clay, strong structure, 7.5YR 4/4 (brown)

ASC Name	Brown Sodosol
Representative Site	Site C17
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	24
Aspect	Northwest

Soil Unit 4: Subnatric Brown Sodosol

Table 12 Site C18 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 7.5YR 4/2 (brown)

ASC Name	Brown Sodosol
Representative Site	Site C18
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	15
Aspect	Northwest

Soil Unit 4: Subnatric Brown Sodosol

Table 13 Site C19 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 7.5YR 4/6 (strong brown)

ASC Name	Brown Sodosol
Representative Site	Site C19
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	12
Aspect	Southeast

Soil Unit 4: Subnatric Brown Sodosol

Table 14 Site C23 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Loam with a clear and even boundary
	B2 +0.20	Medium clay, strong structure, 7.5YR 5/6 (strong brown)

ASC Name	Sodosol
Representative Site	Site C23
Other Mapped Detailed Sites	W5, W14, W16
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native vegetation
Inherent Soil Fertility	Moderately low
Slope (%)	11
Aspect	Northwest

Check Sites Outside BSAL Study Area

Table 15 Site C3 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Clay loam with a clear and even boundary
	B2 +0.15	Medium clay, strong structure, 10YR 5/4 (yellowish brown)

ASC Name	Brown Chromosol
Representative Site	Site C3
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	7
Aspect	East

Check Sites Outside BSAL Study Area

Table 16 Site C4 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 10YR 4/3 (brown)

ASC Name	Brown Chromosol
Representative Site	Site C4
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	2
Aspect	Northeast

Check Sites Outside BSAL Study Area

Table 17 Site C5 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.05	Clay loam with a clear and even boundary
	B2 +0.05	Heavy clay, strong structure, 7.5YR 4/3 (brown)

ASC Name	Brown Chromosol
Representative Site	Site C5
Survey Type	N/A
Dominant Topography	Upper slope bench
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	5
Aspect	Northwest

Check Sites Outside BSAL Study Area

Table 18 Site C6 Brown Chromosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Heavy clay, strong structure, 7.5YR 4/3 (brown)

ASC Name	Brown Chromosol
Representative Site	Site C6
Survey Type	N/A
Dominant Topography	Upper slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	5
Aspect	South

Check Sites Outside BSAL Study Area

Table 19 Site C7 Black Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Clay loam with a clear and even boundary
	B2 +0.15	Heavy clay, strong structure, 7.5YR 3/2 (dark brown)

ASC Name	Black Sodosol
Representative Site	Site C7
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle Grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately low
Slope (%)	14
Aspect	Northeast

Check Sites Outside BSAL Study Area

Table 20 Site C8 Black Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Light clay with a gradual and even boundary
	B2 +0.10	Heavy clay, strong structure, 7.5YR 3/2 (black)

ASC Name	Black Vertosol
Representative Site	Site C8
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	High
Slope (%)	3
Aspect	Northeast

Check Sites Outside BSAL Study Area

Table 21 Site C9 Brown Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Light clay with a gradual and even boundary
	B2 +0.15	Heavy clay, strong structure, 10YR 4/3 (brown)

ASC Name	Brown Vertosol
Representative Site	Site C9
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	5
Aspect	Northeast

Check Sites Outside BSAL Study Area

Table 22 Sire C11 Brown Sodosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Clay loam with a clear and even boundary
	B2 +0.10	Medium clay, strong structure, 7.5YR 5/4 (brown)

ASC Name	Brown Sodosol
Representative Site	Site C11
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Mid slope
Dominant Land Use	Cattle Grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately low
Slope (%)	9
Aspect	North

Check Sites Outside BSAL Study Area

Table 23 Site C14 Brown Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Silty clay with a gradual and even boundary
	B2 +0.20	Heavy clay, strong structure, 7.5YR 5/4 (brown)

ASC Name	Brown Vertosol
Representative Site	Site C14
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Lower slope
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	14
Aspect	North

Check Sites Outside BSAL Study Area

Table 24 Site C15 Brown Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Light clay with a gradual and even boundary
	B2 +0.20	Heavy clay, strong structure, 10YR 4/4 (brown)

ASC Name	Brown Vertosol
Representative Site	Site C15
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Drainage line
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	6
Aspect	Northeast

Check Sites Outside BSAL Study Area

Table 25 Site C25 Brown Vertosol

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Light clay with a gradual and even boundary
	B2 +0.10	Heavy clay, strong structure, 10YR 4/6 (strong brown)

ASC Name	Brown Vertosol
Representative Site	Site C25
Other Mapped Detailed Sites	N/A
Survey Type	Check site
Dominant Topography	Drainage line
Dominant Land Use	Cattle grazing
Vegetation	Native grass pasture
Inherent Soil Fertility	Moderately high
Slope (%)	8
Aspect	Northwest

APPENDIX C

Laboratory Certificates of Analysis

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 1 W1 0-10 27/7/2020 Soil Wambo J6517/1	Sample 2 W1 20-30 27/7/2020 Soil Wambo J6517/2	Sample 3 W1 40-50 27/7/2020 Soil Wambo J6517/3	Sample 4 W2 0-10 27/7/2020 Soil Wambo J6517/4	Sample 5 W2 10-20 27/7/2020 Soil Wambo J6517/5
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.31	6.45	7.07	6.68	6.90
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.051	0.076	0.137	0.048	0.037
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.3	5.8	7.2	13	13
		(kg/ha)		2,379	2,607	3,212	5,945	5,868
		(mg/kg)		1,062	1,164	1,434	2,654	2,620
	Exchangeable Magnesium	(cmol$_+$/kg)		4.2	8.6	11	2.8	3.0
		(kg/ha)		1,136	2,354	2,968	774	823
		(mg/kg)		507	1,051	1,325	346	368
	Exchangeable Potassium	(cmol$_+$/kg)		0.66	0.42	0.51	0.88	0.74
		(kg/ha)		579	367	446	769	651
		(mg/kg)		258	164	199	343	291
	Exchangeable Sodium	(cmol$_+$/kg)		0.21	0.76	1.0	<0.065	<0.065
		(kg/ha)		107	391	526	<33	<33
		(mg/kg)		48	175	235	<15	<15
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	0.04	0.02	0.01	0.01
		(kg/ha)		4.2	7.6	4.1	2.7	2.3
		(mg/kg)		1.9	3.4	1.9	1.2	1.0
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.14	0.08	<0.01	<0.01	<0.01
		(kg/ha)		3.0	1.9	<1	<1	<1
		(mg/kg)		1.4	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10	16	20	17	17
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	50	37	36	78	77
	Magnesium (%)			40	55	56	17	18
	Potassium (%)			6.3	2.7	2.6	5.2	4.4
	Sodium - ESP (%)			2.0	4.8	5.2	0.33	0.30
	Aluminium (%)			0.20	0.24	0.10	0.08	0.07
	Hydrogen (%)			1.3	0.53	0.00	0.00	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.3	0.67	0.66	4.7	4.3
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.8	5.4	6.5	6.0	6.0
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 4/3 Brown	7.5 YR 4/4 Brown	7.5 YR 4/4 Brown	7.5 YR 3/1 Very Dark Grey	7.5 YR 3/1 Very Dark Grey
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
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	Parameter		Method reference	Sample 6 W2 40-50 27/7/2020 Soil Wambo J6517/6	Sample 7 W2 65-75 27/7/2020 Soil Wambo J6517/7	Sample 8 W3 0-10 27/7/2020 Soil Wambo J6517/8	Sample 9 W3 10-20 27/7/2020 Soil Wambo J6517/9	Sample 10 W3 30-40 27/7/2020 Soil Wambo J6517/10
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.40	7.61	6.01	6.58	7.79
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.028	0.025	0.038	0.020	0.094
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	12	8.8	5.3	3.4	4.4
		(kg/ha)		5,515	3,931	2,365	1,537	1,981
		(mg/kg)		2,462	1,755	1,056	686	884
	Exchangeable Magnesium	**(cmol$_+$/kg)**		4.0	2.8	1.8	1.5	4.7
		(kg/ha)		1,082	763	496	404	1,284
		(mg/kg)		483	341	221	181	573
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.78	0.41	0.75	0.50	0.61
		(kg/ha)		687	362	661	440	530
		(mg/kg)		307	162	295	197	237
	Exchangeable Sodium	**(cmol$_+$/kg)**		0.07	0.08	<0.065	<0.065	0.89
		(kg/ha)		34	41	<33	<33	460
		(mg/kg)		15	18	<15	<15	205
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	0.01	0.01	0.01	<0.01	<0.01
		(kg/ha)		2.5	2.4	2.9	1.1	<1
		(mg/kg)		1.1	1.1	1.3	<1	<1
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.14	<0.01	<0.01
		(kg/ha)		<1	<1	3.0	<1	<1
		(mg/kg)		<1	<1	1.4	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	17	12	8.0	5.5	11
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	72	73	66	62	42
	Magnesium (%)			23	23	23	27	44
	Potassium (%)			4.6	3.4	9.4	9.2	5.7
	Sodium - ESP (%)			0.38	0.66	0.53	1.2	8.4
	Aluminium (%)			0.07	0.10	0.18	0.10	0.02
	Hydrogen (%)			0.00	0.00	1.7	0.00	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.1	3.1	2.9	2.3	0.94
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.5	6.7	5.2	5.5	6.7
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 3/1 Very Dark Grey	7.5 YR 3/2 Dark Brown	7.5 YR 3/2 Dark Brown	7.5 YR 4/3 Brown	7.5 YR 4/4 Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

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	Parameter		Method reference	Sample 11 W3 65-75 27/7/2020 Soil Wambo J6517/11	Sample 12 W4 0-10 27/7/2020 Soil Wambo J6517/12	Sample 13 W4 20-30 27/7/2020 Soil Wambo J6517/13	Sample 14 W5 0-10 27/7/2020 Soil Wambo J6517/14	Sample 15 W5 30-40 27/7/2020 Soil Wambo J6517/15
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.26	7.50	8.73	6.88	5.75
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.666	0.082	0.138	0.074	0.206
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.0	20	29	8.0	5.4
		(kg/ha)		2,710	8,886	12,844	3,611	2,417
		(mg/kg)		1,210	3,967	5,734	1,612	1,079
	Exchangeable Magnesium	**(cmol$_+$/kg)**		8.6	5.7	8.3	2.9	6.2
		(kg/ha)		2,336	1,556	2,254	792	1,684
		(mg/kg)		1,043	695	1,006	354	752
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.82	1.3	0.54	0.81	0.81
		(kg/ha)		715	1,145	469	705	708
		(mg/kg)		319	511	209	315	316
	Exchangeable Sodium	**(cmol$_+$/kg)**		4.4	0.16	0.15	0.17	0.88
		(kg/ha)		2,243	80	80	88	452
		(mg/kg)		1,001	36	36	39	202
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	0.11
		(kg/ha)		<1	<1	<1	<1	21
		(mg/kg)		<1	<1	<1	<1	9.6
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	0.20
		(kg/ha)		<1	<1	<1	<1	4.5
		(mg/kg)		<1	<1	<1	<1	2.0
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	20	27	38	12	14
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	31	73	76	67	40
	Magnesium (%)			43	21	22	24	46
	Potassium (%)			4.1	4.8	1.4	6.7	6.0
	Sodium - ESP (%)			22	0.58	0.41	1.4	6.5
	Aluminium (%)			0.01	0.01	0.01	0.03	0.79
	Hydrogen (%)			0.00	0.00	0.00	0.00	1.5
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.70	3.5	3.5	2.8	0.87
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.6	7.0	8.0	6.4	5.0
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 4/3 Brown	7.5 YR 3/2 Dark Brown	10 YR 5/3 Brown	7.5 YR 4/2 Brown	7.5 YR 5/6 Strong Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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	Parameter		Method reference	Sample 16 W5 60-70 27/7/2020 Soil Wambo J6517/16	Sample 17 W6 0-10 27/7/2020 Soil Wambo J6517/17	Sample 18 W6 20-30 27/7/2020 Soil Wambo J6517/18	Sample 19 W6 50-60 27/7/2020 Soil Wambo J6517/19	Sample 20 W7 0-10 27/7/2020 Soil Wambo J6517/20
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.31	5.91	7.01	8.52	6.14
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.255	0.067	0.044	0.206	0.065
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.7	7.4	8.0	13	5.2
		(kg/ha)		2,576	3,304	3,577	5,723	2,314
		(mg/kg)		1,150	1,475	1,597	2,555	1,033
	Exchangeable Magnesium	(cmol$_+$/kg)		6.5	2.7	5.3	4.8	3.7
		(kg/ha)		1,780	748	1,440	1,296	1,012
		(mg/kg)		795	334	643	578	452
	Exchangeable Potassium	(cmol$_+$/kg)		0.65	0.88	0.81	0.50	0.87
		(kg/ha)		568	773	711	437	765
		(mg/kg)		253	345	318	195	342
	Exchangeable Sodium	(cmol$_+$/kg)		1.3	0.13	0.23	0.34	0.14
		(kg/ha)		669	68	119	176	74
		(mg/kg)		299	30	53	78	33
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.01	0.01	<0.01	<0.01	<0.01
		(kg/ha)		2.4	2.0	1.1	<1	<1
		(mg/kg)		1.1	<1	<1	<1	<1
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.07	0.18	<0.01	<0.01	0.16
		(kg/ha)		1.5	4.1	<1	<1	3.6
		(mg/kg)		<1	1.8	<1	<1	1.6
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	14	11	14	18	10
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	40	65	56	69	51
	Magnesium (%)			46	24	37	26	37
	Potassium (%)			4.5	7.8	5.7	2.7	8.7
	Sodium - ESP (%)			9.1	1.2	1.6	1.9	1.4
	Aluminium (%)			0.08	0.09	0.04	0.02	0.04
	Hydrogen (%)			0.47	1.6	0.00	0.00	1.6
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.88	2.7	1.5	2.7	1.4
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.6	5.2	6.1	8.0	5.3
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 5/4 Brown	7.5 YR 4/2 Brown	7.5 YR 5/6 Strong Brown	7.5 YR 5/4 Brown	10 YR 3/2 Very Dark Greyish Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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	Parameter		Method reference	Sample 21 W7 20-30 27/7/2020 Soil Wambo J6517/21	Sample 22 W7 40-50 27/7/2020 Soil Wambo J6517/22	Sample 23 W8 0-10 27/7/2020 Soil Wambo J6517/23	Sample 24 W8 20-30 27/7/2020 Soil Wambo J6517/24	Sample 25 W8 40-50 27/7/2020 Soil Wambo J6517/25
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.42	8.97	7.21	8.21	8.86
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.052	0.265	0.098	0.135	0.814
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	3.0	6.9	16	13	20
		(kg/ha)		1,358	3,116	7,275	6,023	9,036
		(mg/kg)		606	1,391	3,248	2,689	4,034
	Exchangeable Magnesium	(cmol$_+$/kg)		9.0	17	8.8	15	21
		(kg/ha)		2,459	4,518	2,385	3,967	5,654
		(mg/kg)		1,098	2,017	1,065	1,771	2,524
	Exchangeable Potassium	(cmol$_+$/kg)		0.75	0.55	1.8	1.2	1.1
		(kg/ha)		660	486	1,597	1,039	994
		(mg/kg)		295	217	713	464	444
	Exchangeable Sodium	(cmol$_+$/kg)		0.69	1.8	0.28	1.9	5.5
		(kg/ha)		353	933	146	963	2,835
		(mg/kg)		158	416	65	430	1,266
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	14	26	27	31	48
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	22	27	60	43	42
	Magnesium (%)			67	64	32	47	44
	Potassium (%)			5.6	2.1	6.7	3.8	2.4
	Sodium - ESP (%)			5.1	7.0	1.0	6.0	12
	Aluminium (%)			0.01	0.01	0.02	0.02	0.01
	Hydrogen (%)			0.00	0.00	0.00	0.00	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.33	0.42	1.8	0.92	0.97
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.1	8.2	6.6	7.2	8.3
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/3 Brown	2.5 Y 4/3 Olive Brown	7.5 YR 3/1 Very Dark Grey	7.5 YR 3/1 Very Dark Grey	10 YR 3/2 Very Dark Greyish Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

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	Parameter		Method reference	Sample 26 W8 65-75 27/7/2020 Soil Wambo J6517/26	Sample 27 W9 0-10 27/7/2020 Soil Wambo J6517/27	Sample 28 W9 20-30 27/7/2020 Soil Wambo J6517/28	Sample 29 W9 40-50 27/7/2020 Soil Wambo J6517/29	Sample 30 W10 0-10 27/7/2020 Soil Wambo J6517/30
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.96	6.22	7.12	8.67	6.39
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	1.180	0.053	0.052	0.223	0.051
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	21	10	16	27	8.2
		(kg/ha)		9,208	4,625	7,053	12,214	3,660
		(mg/kg)		4,111	2,065	3,149	5,453	1,634
	Exchangeable Magnesium	**(cmol$_+$/kg)**		22	5.9	14	17	7.4
		(kg/ha)		5,880	1,615	3,752	4,496	2,018
		(mg/kg)		2,625	721	1,675	2,007	901
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.99	1.3	1.0	0.69	0.60
		(kg/ha)		870	1,167	878	608	525
		(mg/kg)		389	521	392	271	234
	Exchangeable Sodium	**(cmol$_+$/kg)**		7.2	0.24	0.83	1.6	0.39
		(kg/ha)		3,730	124	426	825	201
		(mg/kg)		1,665	55	190	368	90
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	0.09	<0.01	<0.01	0.12
		(kg/ha)		<1	2.0	<1	<1	2.6
		(mg/kg)		<1	<1	<1	<1	1.2
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	50	18	31	46	17
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	41	58	50	59	49
	Magnesium (%)			43	33	44	36	44
	Potassium (%)			2.0	7.4	3.2	1.5	3.6
	Sodium - ESP (%)			14	1.3	2.6	3.5	2.3
	Aluminium (%)			0.01	0.02	0.01	0.01	0.02
	Hydrogen (%)			0.00	0.50	0.00	0.00	0.70
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.95	1.7	1.1	1.6	1.1
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.4	5.3	6.0	7.9	5.4
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/3 Brown	10 YR 3/2 Very Dark Greyish Brown	10 YR 3/2 Very Dark Greyish Brown	7.5 YR 3/2 Dark Brown	7.5 YR 3/2 Dark Brown
	Mottles Munsell Colour			..	..	..	..	..
				..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

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	Parameter		Method reference	Sample 31 W10 20-30 27/7/2020 Soil Wambo	Sample 32 W10 40-50 27/7/2020 Soil Wambo	Sample 33 W10 65-75 27/7/2020 Soil Wambo	Sample 34 W11 0-10 27/7/2020 Soil Wambo	Sample 35 W11 20-30 27/7/2020 Soil Wambo
	Sample ID:							
	Crop:							
	Client:							
	Parameter		**Method reference**	**J6517/31**	**J6517/32**	**J6517/33**	**J6517/34**	**J6517/35**
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.97	8.85	9.09	6.17	8.55
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.081	0.681	0.889	0.142	0.147
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	8.9	22	20	9.4	14
		(kg/ha)		3,982	9,934	9,114	4,218	6,171
		(mg/kg)		1,778	4,435	4,069	1,883	2,755
	Exchangeable Magnesium	**(cmol$_+$/kg)**		14	26	31	6.2	23
		(kg/ha)		3,687	6,973	8,362	1,681	6,261
		(mg/kg)		1,646	3,113	3,733	750	2,795
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.59	0.77	0.70	3.2	2.1
		(kg/ha)		516	673	615	2,820	1,878
		(mg/kg)		230	300	275	1,259	838
	Exchangeable Sodium	**(cmol$_+$/kg)**		1.5	5.6	8.0	0.47	2.2
		(kg/ha)		765	2,904	4,111	244	1,129
		(mg/kg)		342	1,296	1,835	109	504
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	0.15	<0.01
		(kg/ha)		<1	<1	<1	3.3	<1
		(mg/kg)		<1	<1	<1	1.5	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	24	54	60	19	41
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	36	41	34	48	33
	Magnesium (%)			55	47	51	32	56
	Potassium (%)			2.4	1.4	1.2	17	5.2
	Sodium - ESP (%)			6.1	10	13	2.4	5.3
	Aluminium (%)			0.01	0.01	0.00	0.01	0.01
	Hydrogen (%)			0.00	0.00	0.00	0.76	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.66	0.86	0.66	1.5	0.60
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.8	8.2	8.5	5.7	7.6
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 3/2 Dark Brown	10 YR 4/3 Brown	10 YR 5/4 Yellowish Brown	7.5 YR 2.5/2 Yellowish Brown	7.5 YR 3/2 Dark Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

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E: eal@scu.edu.au
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	Parameter		Method reference	Sample 36 W11 40-50 27/7/2020 Soil Wambo J6517/36	Sample 37 W11 65-75 27/7/2020 Soil Wambo J6517/37	Sample 38 W12 0-10 27/7/2020 Soil Wambo J6517/38	Sample 39 W12 20-30 27/7/2020 Soil Wambo J6517/39	Sample 40 W13 0-10 27/7/2020 Soil Wambo J6517/40
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	9.28	9.29	6.11	7.25	6.47
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.458	0.878	0.066	0.060	0.075
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	21	18	7.4	7.8	8.6
		(kg/ha)		9,311	8,032	3,319	3,490	3,846
		(mg/kg)		4,157	3,586	1,482	1,558	1,717
	Exchangeable Magnesium	(cmol$_+$/kg)		21	16	2.7	8.5	7.5
		(kg/ha)		5,658	4,395	739	2,316	2,054
		(mg/kg)		2,526	1,962	330	1,034	917
	Exchangeable Potassium	(cmol$_+$/kg)		0.64	0.45	1.1	0.78	0.88
		(kg/ha)		557	397	962	685	775
		(mg/kg)		249	177	429	306	346
	Exchangeable Sodium	(cmol$_+$/kg)		4.0	5.6	0.12	0.20	0.48
		(kg/ha)		2,081	2,861	61	104	249
		(mg/kg)		929	1,277	27	46	111
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	<1	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	0.19	<0.01	0.16
		(kg/ha)		<1	<1	4.2	<1	3.6
		(mg/kg)		<1	<1	1.9	<1	1.6
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	46	40	12	17	18
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	45	45	64	45	49
	Magnesium (%)			45	40	24	49	43
	Potassium (%)			1.4	1.1	9.5	4.5	5.0
	Sodium - ESP (%)			8.7	14	1.0	1.2	2.7
	Aluminium (%)			0.01	0.01	0.04	0.01	0.03
	Hydrogen (%)			0.00	0.00	1.6	0.00	0.90
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.00	1.1	2.7	0.91	1.1
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.4	8.6	5.4	6.4	5.6
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 4/3 Brown	10 YR 5/3 Brown	7.5 YR 3/2 Dark Brown	7.5 YR 5/6 Strong Brown	7.5 YR 3/2 Dark Brown
	Mottles Munsell Colour			..	..	..	..	..
				..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 41 W13 20-30 27/7/2020 Soil Wambo J6517/41	Sample 42 W13 40-50 27/7/2020 Soil Wambo J6517/42	Sample 43 W13 65-75 27/7/2020 Soil Wambo J6517/43	Sample 44 W14 0-10 27/7/2020 Soil Wambo J6517/44	Sample 45 W14 10-20 27/7/2020 Soil Wambo J6517/45
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	7.99	8.94	8.95	6.23	6.20
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.131	0.566	0.790	0.099	0.045
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	11	16	13	6.9	3.6
		(kg/ha)		4,968	7,051	5,918	3,091	1,638
		(mg/kg)		2,218	3,148	2,642	1,380	731
	Exchangeable Magnesium	**(cmol$_+$/kg)**		14	13	11	2.7	2.0
		(kg/ha)		3,707	3,593	3,069	733	545
		(mg/kg)		1,655	1,604	1,370	327	243
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.72	0.61	0.56	2.0	0.80
		(kg/ha)		634	531	494	1,749	699
		(mg/kg)		283	237	221	781	312
	Exchangeable Sodium	**(cmol$_+$/kg)**		2.0	4.1	4.6	0.23	0.10
		(kg/ha)		1,044	2,089	2,388	116	50
		(mg/kg)		466	933	1,066	52	22
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	1.2	1.0
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	0.21	0.06
		(kg/ha)		<1	<1	<1	4.8	1.3
		(mg/kg)		<1	<1	<1	2.1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	27	34	30	12	6.6
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	40	47	44	57	55
	Magnesium (%)			50	39	38	22	30
	Potassium (%)			2.6	1.8	1.9	17	12
	Sodium - ESP (%)			7.4	12	16	1.9	1.5
	Aluminium (%)			0.01	0.01	0.01	0.05	0.08
	Hydrogen (%)			0.00	0.00	0.00	1.8	0.89
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.81	1.2	1.2	2.6	1.8
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.9	8.4	8.4	5.4	5.2
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 3/1 Very Dark Grey	7.5 YR 3/2 Dark Brown	7.5 YR 4/3 Brown	10 YR 2/2 Very Dark Brown	7.5 YR 3/2 Dark Brown
	Mottles Munsell Colour			..	..	..	..	..
				..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 46 W14 40-50 27/7/2020 Soil Wambo J6517/46	Sample 47 W14 65-75 27/7/2020 Soil Wambo J6517/47	Sample 48 W15 0-10 27/7/2020 Soil Wambo J6517/48	Sample 49 W15 10-20 27/7/2020 Soil Wambo J6517/49	Sample 50 W15 30-40 27/7/2020 Soil Wambo J6517/50
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.11	8.28	6.77	6.37	7.36
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.432	0.862	0.072	0.065	0.170
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	5.2	4.0	10	4.8	13
		(kg/ha)		2,338	1,795	4,605	2,164	5,772
		(mg/kg)		1,044	802	2,056	966	2,577
	Exchangeable Magnesium	(cmol$_+$/kg)		10.0	9.2	5.4	2.3	7.0
		(kg/ha)		2,719	2,504	1,479	625	1,910
		(mg/kg)		1,214	1,118	660	279	853
	Exchangeable Potassium	(cmol$_+$/kg)		1.1	0.72	0.70	0.26	0.58
		(kg/ha)		921	630	614	231	512
		(mg/kg)		411	281	274	103	228
	Exchangeable Sodium	(cmol$_+$/kg)		2.4	4.5	0.35	0.27	0.70
		(kg/ha)		1,227	2,305	178	141	359
		(mg/kg)		548	1,029	79	63	160
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01
		(kg/ha)		<1	<1	<1	1.7	<1
		(mg/kg)		<1	<1	<1	<1	<1
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	0.14	<0.01
		(kg/ha)		<1	<1	<1	3.2	<1
		(mg/kg)		<1	<1	<1	1.4	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	19	18	17	7.8	21
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	28	22	61	62	61
	Magnesium (%)			54	50	32	29	33
	Potassium (%)			5.6	3.9	4.2	3.4	2.8
	Sodium - ESP (%)			13	24	2.1	3.5	3.3
	Aluminium (%)			0.01	0.00	0.01	0.11	0.01
	Hydrogen (%)			0.00	0.00	0.00	1.8	0.00
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.52	0.43	1.9	2.1	1.8
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.4	7.8	6.2	5.8	6.7
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	7.5 YR 4/2 Brown	7.5 YR 3/3 Dark Brown	7.5 YR 4/2 Brown	7.5 YR 4/3 Brown	7.5 YR 5/6 Strong Brown
	Mottles Munsell Colour			..	..	..	..	..
	Degree of Mottling (%)			..	..	..	..	..

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

51 samples supplied by SLR Consulting Australia Pty Ltd on 29/07/2020. Lab Job No.J6517
Analysis requested by Murray Fraser. Your Job: PO: SLR 630.30047; Wambo Mod 18
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 51 W15 50-60 27/7/2020 Soil Wambo	*Heavy Soil* Clay	*Medium Soil* Clay Loam	*Light Soil* Loam	*Sandy Soil* Loamy Sand
		Sample ID:		J6517/51	Indicative guidelines - refer to Notes 6 and 8			
		Crop:						
		Client:						
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.76	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.176	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	25	*15.6*	*10.8*	*5.0*	*1.9*
		(kg/ha)		11,094	*7000*	*4816*	*2240*	*840*
		(mg/kg)		4,953	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium	(cmol$_+$/kg)		7.3	*2.4*	*1.7*	*1.2*	*0.60*
		(kg/ha)		1,986	*650*	*448*	*325*	*168*
		(mg/kg)		887	*290*	*200*	*145*	*75*
	Exchangeable Potassium	(cmol$_+$/kg)		0.41	*0.60*	*0.50*	*0.40*	*0.30*
		(kg/ha)		363	*526*	*426*	*336*	*224*
		(mg/kg)		162	*235*	*190*	*150*	*100*
	Exchangeable Sodium	(cmol$_+$/kg)		0.56	*0.3*	*0.26*	*0.22*	*0.11*
		(kg/ha)		288	*155*	*134*	*113*	*57*
		(mg/kg)		128	*69*	*60*	*51*	*25*
	Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	*121*	*101*	*73*	*30*
		(mg/kg)		<1	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	*13*	*11*	*8*	*3*
		(mg/kg)		<1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	33	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	75	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)			22	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)			1.3	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)			1.7	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)			0.01	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)			0.00				
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.4	*6.5*	*6.4*	*4.2*	*3.2*
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	8.1	..			
	Moist Munsell Colour		**Inhouse Munsell Soil Colour Classification	10 YR 5/4	..			
				Yellowish Brown	..			
	Mottles Munsell Colour			..	..			
				..	..			
	Degree of Mottling (%)			..	..			

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

51 soil samples supplied by SLR Consulting Australia Pty Ltd on 29 July, 2020 - Lab Job No. J6517
Analysis requested by Murray Fraser
10 Kings Road LAMBTON NSW 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in air-dry sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
W1 0-10 27/07/2020	J6517/1	13.7%	2.8%	0.0%	2.8%	7.2%	32.2%	32.3%	25.4%	100.0%
W1 20-30 27/07/2020	J6517/2	13.8%	0.3%	0.0%	0.3%	2.8%	20.6%	19.7%	56.6%	100.0%
W1 40-50 27/07/2020	J6517/3	15.9%	7.9%	0.0%	7.9%	3.0%	13.7%	12.1%	63.3%	100.0%
W2 0-10 27/07/2020	J6517/4	14.3%	6.1%	0.0%	6.1%	17.4%	34.2%	15.2%	27.1%	100.0%
W2 10-20 27/07/2020	J6517/5	13.0%	1.1%	0.0%	1.1%	14.6%	32.1%	22.1%	30.2%	100.0%
W2 40-50 27/07/2020	J6517/6	10.9%	1.1%	0.0%	1.1%	19.3%	26.9%	14.3%	38.4%	100.0%
W2 65-75 27/07/2020	J6517/7	8.9%	19.0%	12.9%	6.0%	24.7%	18.4%	12.9%	25.0%	100.0%
W3 0-10 27/07/2020	J6517/8	20.4%	5.8%	0.0%	5.8%	30.4%	20.7%	21.0%	22.1%	100.0%
W3 10-20 27/07/2020	J6517/9	10.2%	8.5%	0.0%	8.5%	28.6%	29.0%	13.6%	20.2%	100.0%
W3 30-40 27/07/2020	J6517/10	12.9%	2.4%	0.0%	2.4%	32.8%	18.0%	9.4%	37.4%	100.0%
W3 65-75 27/07/2020	J6517/11	13.0%	24.5%	13.2%	11.3%	28.8%	8.5%	6.9%	31.4%	100.0%
W4 0-10 27/07/2020	J6517/12	23.3%	1.8%	0.0%	1.8%	7.9%	20.9%	17.0%	52.4%	100.0%
W4 20-30 27/07/2020	J6517/13	16.3%	0.4%	0.0%	0.4%	5.2%	21.1%	27.2%	46.2%	100.0%
W5 0-10 27/07/2020	J6517/14	6.6%	9.0%	0.0%	9.0%	2.8%	31.1%	21.6%	35.5%	100.0%
W5 30-40 27/07/2020	J6517/15	11.4%	0.0%	0.0%	0.0%	2.5%	21.9%	16.6%	59.0%	100.0%
W5 60-70 27/07/2020	J6517/16	10.7%	0.0%	0.0%	0.0%	2.1%	32.5%	14.4%	51.0%	100.0%
W6 0-10 27/07/2020	J6517/17	11.4%	11.4%	0.0%	11.4%	5.0%	29.8%	22.5%	31.3%	100.0%
W6 20-30 27/07/2020	J6517/18	12.3%	0.0%	0.0%	0.0%	0.9%	10.5%	22.4%	66.2%	100.0%
W6 50-60 27/07/2020	J6517/19	30.0%	0.0%	0.0%	0.0%	1.1%	9.6%	28.4%	61.0%	100.0%
W7 0-10 27/07/2020	J6517/20	18.8%	2.8%	0.0%	2.8%	16.2%	28.3%	22.9%	29.8%	100.0%
W7 20-30 27/07/2020	J6517/21	17.9%	0.4%	0.0%	0.4%	12.6%	16.0%	16.5%	54.5%	100.0%
W7 40-50 27/07/2020	J6517/22	18.7%	0.7%	0.0%	0.7%	10.8%	11.9%	15.4%	61.2%	100.0%
W8 0-10 27/07/2020	J6517/23	17.8%	1.0%	0.0%	1.0%	9.0%	23.6%	19.9%	46.5%	100.0%
W8 20-30 27/07/2020	J6517/24	19.3%	4.4%	0.0%	4.4%	7.2%	14.0%	20.6%	53.9%	100.0%
W8 40-50 27/07/2020	J6517/25	17.0%	2.1%	0.0%	2.1%	8.9%	20.8%	13.7%	54.6%	100.0%
W8 65-75 27/07/2020	J6517/26	12.0%	0.4%	0.0%	0.4%	10.5%	26.1%	7.6%	55.4%	100.0%
W9 0-10 27/07/2020	J6517/27	17.6%	1.2%	0.0%	1.2%	8.7%	19.8%	30.1%	40.2%	100.0%
W9 20-30 27/07/2020	J6517/28	17.8%	0.3%	0.0%	0.3%	5.1%	21.5%	12.8%	60.3%	100.0%
W9 40-50 27/07/2020	J6517/29	16.3%	0.9%	0.0%	0.9%	6.5%	7.5%	25.5%	59.6%	100.0%
W10 0-10 27/07/2020	J6517/30	16.3%	1.0%	0.0%	1.0%	9.6%	33.3%	18.5%	37.5%	100.0%
W10 20-30 27/07/2020	J6517/31	21.1%	0.5%	0.0%	0.5%	4.7%	15.4%	17.2%	62.1%	100.0%
W10 40-50 27/07/2020	J6517/32	23.0%	0.1%	0.0%	0.1%	4.3%	1.9%	19.7%	74.0%	100.0%
W10 65-75 27/07/2020	J6517/33	17.6%	1.3%	0.0%	1.3%	3.4%	19.7%	24.2%	51.4%	100.0%
W11 0-10 27/07/2020	J6517/34	18.6%	6.8%	0.0%	6.8%	10.1%	30.0%	21.7%	31.4%	100.0%
W11 20-30 27/07/2020	J6517/35	22.2%	0.6%	0.0%	0.6%	3.0%	7.4%	23.9%	65.0%	100.0%
W11 40-50 27/07/2020	J6517/36	20.1%	0.7%	0.0%	0.7%	3.8%	0.2%	26.3%	69.0%	100.0%
W11 65-75 27/07/2020	J6517/37	14.9%	2.4%	0.0%	2.4%	3.1%	11.1%	25.2%	58.2%	100.0%
W12 0-10 27/07/2020	J6517/38	12.7%	2.4%	0.0%	2.4%	32.9%	22.0%	11.1%	31.5%	100.0%
W12 20-30 27/07/2020	J6517/39	14.7%	1.8%	0.0%	1.8%	18.2%	9.1%	8.9%	62.0%	100.0%
W13 0-10 27/07/2020	J6517/40	14.8%	9.5%	0.0%	9.5%	15.4%	16.0%	19.4%	39.7%	100.0%
W13 20-30 27/07/2020	J6517/41	17.7%	0.8%	0.0%	0.8%	11.0%	8.4%	21.2%	58.6%	100.0%
W13 40-50 27/07/2020	J6517/42	17.2%	3.5%	0.0%	3.5%	16.9%	9.8%	16.0%	53.8%	100.0%
W13 65-75 27/07/2020	J6517/43	15.1%	6.5%	0.0%	6.5%	19.0%	9.4%	21.8%	43.3%	100.0%
W14 0-10 27/07/2020	J6517/44	8.0%	8.6%	0.0%	8.6%	37.5%	13.7%	14.1%	26.1%	100.0%
W14 10-20 27/07/2020	J6517/45	6.0%	46.7%	0.0%	46.7%	18.7%	8.8%	7.5%	18.3%	100.0%
W14 40-50 27/07/2020	J6517/46	12.7%	3.5%	0.0%	3.5%	18.5%	8.0%	16.2%	53.8%	100.0%
W14 65-75 27/07/2020	J6517/47	12.2%	18.7%	0.0%	18.7%	25.5%	7.7%	14.8%	33.3%	100.0%
W15 0-10 27/07/2020	J6517/48	8.8%	1.7%	0.0%	1.7%	11.6%	31.6%	20.3%	34.8%	100.0%
W15 10-20 27/07/2020	J6517/49	5.5%	6.1%	0.0%	6.1%	29.1%	24.5%	19.0%	21.3%	100.0%
W15 30-40 27/07/2020	J6517/50	12.5%	0.0%	0.0%	0.0%	13.3%	13.2%	18.3%	55.2%	100.0%
W15 50-60 27/07/2020	J6517/51	10.1%	0.3%	0.0%	0.3%	7.3%	21.9%	25.6%	44.9%	100.0%

Note:

1. The Hydrometer Analysis method was used to determine the percentage sand, silt and clay,
modified from SOP meth004 (California Dept of Pesticide Regulation), using method of Gee & Bauder (1986)," &
in Methods of Soil Analysis. Part 1 Agron. Monogr. 9 (2nd Ed). Klute, A., American Soc. of Agronomy Inc., Soil Sci. Soc. America Inc., Madison WI: 383-411.
2. The texture classification was based on the hydrometer results and the appropriate texture triangle.
3. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (see EAL website: scu.edu.au/eal).
4. This report is not to be reproduced except in full.
5. This report was issued on 07/08/2020

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

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

14 samples supplied by SLR Consulting Australia Pty Ltd on 9/05/2022 . Lab Job No.M8431
Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL
10 Kings Road NEW LAMBTON NSW 2305

Parameter		Method reference	Sample 1	Sample 2	Sample 3	Sample 4	Sample 5	Sample 6
Sample ID:			W17 0-20	W17 20-30	W17 40-50	W17 65-75	W18 0-10	W18 20-30
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			WCPL	WCPL	WCPL	WCPL	WCPL	WCPL
			M8431/1	M8431/2	M8431/3	M8431/4	M8431/5	M8431/6
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.30	6.61	6.89	7.23	7.03	7.69
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.056	0.023	0.023	0.024	0.047	0.049
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	6.7	7.6	9.0	11	18	17
	(kg/ha)		3,030	3,390	4,020	4,786	7,864	7,805
	(mg/kg)		1,353	1,514	1,795	2,137	3,511	3,485
Exchangeable Magnesium	(cmol$_+$/kg)		1.7	2.5	3.5	4.4	21	22
	(kg/ha)		471	679	951	1,204	5,591	6,030
	(mg/kg)		210	303	424	538	2,496	2,692
Exchangeable Potassium	(cmol$_+$/kg)		0.92	0.52	0.60	0.55	0.65	0.64
	(kg/ha)		803	455	523	486	567	560
	(mg/kg)		359	203	233	217	253	250
Exchangeable Sodium	(cmol$_+$/kg)		0.18	0.13	0.17	0.24	0.56	0.92
	(kg/ha)		94	66	88	121	290	475
	(mg/kg)		42	30	39	54	130	212
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		3	<1	<1	<1	<1	<1
	(mg/kg)		1	<1	<1	<1	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	10	11	13	16	39	41
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	70	71	68	67	45	42
Magnesium (%)			18	23	26	28	52	54
Potassium (%)			9.6	4.9	4.5	3.5	1.6	1.6
Sodium - ESP (%)			1.9	1.2	1.3	1.5	1.4	2.2
Aluminium (%)			0.16	0.00	0.00	0.00	0.00	0.00
Hydrogen (%)			0.08	0.00	0.00	0.00	0.00	0.00
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	3.9	3.0	2.6	2.4	0.85	0.78
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.42	5.57	5.85	6.17	6.17	6.73

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal
ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

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Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL
10 Kings Road NEW LAMBTON NSW 2305

Parameter		Method reference	Sample 7	Sample 8	Sample 9	Sample 10	Sample 11	Sample 12
Sample ID:			W18 40-50	W18 65-75	W19 0-10	W19 20-30	W19 40-50	W19 65-75
Crop:			Soil	Soil	Soil	Soil	Soil	Soil
Client:			WCPL	WCPL	WCPL	WCPL	WCPL	WCPL
			M8431/7	M8431/8	M8431/9	M8431/10	M8431/11	M8431/12
pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.67	9.17	6.75	7.01	7.99	8.78
Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.183	0.196	0.074	0.048	0.076	0.167
Exchangeable Calcium	(cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	23	18	11	13	11	7.6
	(kg/ha)		10,256	7,877	5,059	5,821	5,117	3,426
	(mg/kg)		4,579	3,517	2,259	2,599	2,285	1,530
Exchangeable Magnesium	(cmol$_+$/kg)		24	23	6.1	12	14	12
	(kg/ha)		6,462	6,196	1,649	3,346	3,788	3,136
	(mg/kg)		2,885	2,766	736	1,494	1,691	1,400
Exchangeable Potassium	(cmol$_+$/kg)		0.46	0.25	1.5	1.3	1.1	0.71
	(kg/ha)		400	217	1,273	1,153	997	622
	(mg/kg)		179	97	568	515	445	278
Exchangeable Sodium	(cmol$_+$/kg)		1.8	2.9	0.18	0.79	1.9	2.5
	(kg/ha)		912	1,501	95	405	957	1,270
	(mg/kg)		407	670	43	181	427	567
Exchangeable Aluminium	(cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1
Exchangeable Hydrogen	(cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
	(kg/ha)		<1	<1	<1	<1	<1	<1
	(mg/kg)		<1	<1	<1	<1	<1	<1
Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	49	43	19	27	28	22
Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	47	40	59	47	40	34
Magnesium (%)			49	52	32	45	49	52
Potassium (%)			0.94	0.57	7.7	4.8	4.0	3.2
Sodium - ESP (%)			3.6	6.7	0.98	2.9	6.6	11
Aluminium (%)			0.00	0.00	0.00	0.00	0.00	0.00
Hydrogen (%)			0.00	0.00	0.00	0.00	0.00	0.00
Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	0.96	0.77	1.9	1.1	0.82	0.66
pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.84	8.05	5.91	5.99	6.91	7.88

Environmental Analysis Laboratory

Southern Cross University
PO Box 157 Lismore NSW 2480
P: +61 2 6620 3678
E: eal@scu.edu.au
www.scu.edu.au/eal

ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

14 samples supplied by SLR Consulting Australia Pty Ltd on 9/05/2022 . Lab Job No.M8431
Analysis requested by Murray Fraser. Your Job: PO SLR 630.30258 Wambo Mod BSAL
10 Kings Road NEW LAMBTON NSW 2305

	Parameter		Method reference	Sample 13	Sample 14	*Heavy Soil*	*Medium Soil*	*Light Soil*	*Sandy Soil*
	Sample ID:			**W16 0-10**	**W16 20-30**				
	Crop:			**Soil**	**Soil**				
	Client:			**WCPL**	**WCPL**	*Clay*	*Clay Loam*	*Loam*	*Loamy Sand*
				M8431/13	**M8431/14**	**Indicative guidelines - refer to Notes 6 and 8**			
	pH		Rayment & Lyons 2011 - 4A1 (1:5 Water)	8.33	8.69	*6.5*	*6.5*	*6.3*	*6.3*
	Electrical Conductivity (dS/m)		Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.261	0.148	*0.200*	*0.150*	*0.120*	*0.100*
	Exchangeable Calcium	**(cmol$_+$/kg)**	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	27	28	*15.6*	*10.8*	*5.0*	*1.9*
		(kg/ha)		12,084	12,451	*7000*	*4816*	*2240*	*840*
		(mg/kg)		5,395	5,559	*3125*	*2150*	*1000*	*375*
	Exchangeable Magnesium	**(cmol$_+$/kg)**		3.7	4.1	*2.4*	*1.7*	*1.2*	*0.60*
		(kg/ha)		1,020	1,127	*650*	*448*	*325*	*168*
		(mg/kg)		455	503	*290*	*200*	*145*	*75*
	Exchangeable Potassium	**(cmol$_+$/kg)**		0.78	0.57	*0.60*	*0.50*	*0.40*	*0.30*
		(kg/ha)		683	499	*526*	*426*	*336*	*224*
		(mg/kg)		305	223	*235*	*190*	*150*	*100*
	Exchangeable Sodium	**(cmol$_+$/kg)**		0.21	0.31	*0.3*	*0.26*	*0.22*	*0.11*
		(kg/ha)		106	161	*155*	*134*	*113*	*57*
		(mg/kg)		47	72	*69*	*60*	*51*	*25*
	Exchangeable Aluminium	**(cmol$_+$/kg)**	**Inhouse S37 (KCl)	<0.01	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	<1	*121*	*101*	*73*	*30*
		(mg/kg)		<1	<1	*54*	*45*	*32*	*14*
	Exchangeable Hydrogen	**(cmol$_+$/kg)**	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	<0.01	<0.01	*0.6*	*0.5*	*0.4*	*0.2*
		(kg/ha)		<1	<1	*13*	*11*	*8*	*3*
		(mg/kg)		<1	<1	*6*	*5*	*4*	*2*
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)		**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	32	33	*20.1*	*14.3*	*7.8*	*3.3*
	Calcium (%)		**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	85	85	*77.6*	*75.7*	*65.6*	*57.4*
	Magnesium (%)			12	13	*11.9*	*11.9*	*15.7*	*18.1*
	Potassium (%)			2.5	1.7	*3.0*	*3.5*	*5.2*	*9.1*
	Sodium - ESP (%)			0.65	0.96	*1.5*	*1.8*	*2.9*	*3.3*
	Aluminium (%)			0.00	0.00	*6.0*	*7.1*	*10.5*	*12.1*
	Hydrogen (%)			0.00	0.00				
	Calcium/Magnesium Ratio		**Calculation: Calcium / Magnesium (cmol$_+$/kg)	7.2	6.7	*6.5*	*6.4*	*4.2*	*3.2*
	pH		**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	7.71	7.85	..			

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

14 soil samples supplied by SLR Consulting Australia Pty Ltd on 09th May, 2022 - Lab Job No. M8431.
Analysis requested by Murray Fraser. You Job: PO SLR 630.30258 Wambo Mod BSAL.
10 Kings Road, New Lambton, NSW, 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm ISSS (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)
W17 0-20	M8431/1	23.4%	2.6%	0.0%	2.6%	30.2%	37.4%	18.0%	11.9%
W17 20-30	M8431/2	16.6%	3.0%	0.0%	3.0%	29.4%	26.0%	20.7%	20.8%
W17 40-50	M8431/3	17.6%	25.7%	22.5%	3.2%	20.4%	22.1%	12.7%	19.1%
W17 65-75	M8431/4	18.2%	4.1%	2.4%	1.7%	17.9%	31.2%	18.8%	28.1%
W18 0-10	M8431/5	26.8%	0.5%	0.0%	0.5%	9.4%	32.5%	11.7%	45.9%
W18 20-30	M8431/6	26.1%	0.2%	0.0%	0.2%	8.4%	23.1%	11.9%	56.5%
W18 40-50	M8431/7	23.1%	0.4%	0.0%	0.4%	10.8%	22.0%	18.6%	48.3%
W18 65-75	M8431/8	16.6%	16.1%	14.2%	1.9%	34.7%	29.6%	6.7%	12.8%
W19 0-10	M8431/9	18.9%	1.1%	0.0%	1.1%	17.0%	39.6%	17.0%	25.3%
W19 20-30	M8431/10	22.7%	0.3%	0.0%	0.3%	7.3%	19.9%	21.9%	50.6%
W19 40-50	M8431/11	21.8%	0.2%	0.0%	0.2%	5.1%	33.7%	20.0%	41.0%
W19 65-75	M8431/12	17.1%	0.0%	0.0%	0.0%	1.0%	22.1%	36.6%	40.4%
W16 0-10	M8431/13	10.5%	1.9%	0.0%	1.9%	15.6%	19.6%	22.4%	40.5%
W16 20-30	M8431/14	11.8%	0.1%	0.0%	0.1%	2.6%	16.5%	35.0%	45.8%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

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

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6. This report was issued on 27/05/2022.

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Graham Lancaster (Nata signatory)
Laboratory Manager

MUNSELL COLOUR ANALYSIS

14 soil samples supplied by SLR Consulting Australia Pty Ltd on 09th May, 2022 - Lab Job No. M8431.
Analysis requested by Murray Fraser. You Job: PO SLR 630.30258 Wambo Mod BSAL.
10 Kings Road, New Lambton, NSW, 2305

SAMPLE ID	Lab Code	MOIST MUNSELL COLOUR		MOTTLE MUNSELL COLOUR		DEGREE OF MOTTLING (%)
		Code	Description	Code	Description	
W17 0-20	M8431/1	10 YR 2/2	Very Dark Brown	..	..	..
W17 20-30	M8431/2	7.5 YR 2.5/2	Very Dark Brown	..	..	..
W17 40-50	M8431/3	10 YR 3/2	Very Dark Grayish Brown	..	..	..
W17 65-75	M8431/4	10 YR 2/1	Black	..	..	..
W18 0-10	M8431/5	7.5 YR 2.5/2	Very Dark Brown	..	..	..
W18 20-30	M8431/6	7.5 YR 2.5/2	Very Dark Brown	..	..	..
W18 40-50	M8431/7	7.5 YR 2.5/2	Very Dark Brown	..	..	..
W18 65-75	M8431/8	7.5 YR 3/4	Dark Brown	..	..	..
W19 0-10	M8431/9	10 YR 2/1	Black	..	..	..
W19 20-30	M8431/10	10 YR 3/2	Very Dark Grayish Brown	..	..	..
W19 40-50	M8431/11	10 YR 4/3	Brown	..	..	..
W19 65-75	M8431/12	2.5 Y 6/3	Light Yellowish Brown	..	..	..
W16 0-10	M8431/13	7.5 YR 5/2	Brown	..	..	..
W16 20-30	M8431/14	10 YR 6/1	Gray	..	..	..

Note:

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

Agricultural Productivity Gross Margin Data

Department of Primary Industries

BEEF CATTLE GROSS MARGIN BUDGET

Farm enterprise Budget Series: April 2019

Enterprise: **Inland store weaners**

Enterprise Unit: **100 cows**

Pasture: **Native pasture**

INCOME:			**Standard Budget**	**Your Budget**
42	steer weaners @	$725 /hd	$30,467	
21	heifer weaners @	$463 /hd	$9,727	
1	CFA Bull @	$1,554 /hd	$1,554	
6	CFA cows @	$963 /hd	$5,779	
0	Dry cows @	$963 /hd	$0	
13	Other culls @	$963 /hd	$12,522	
83				
	A. Total Income:		**$60,049**	

VARIABLE COSTS:						
Replacements	1	Bull @	$3,500	/hd	$3,500	
Livestock and vet costs: see section titled beef health costs for details.					$1,244	
Hay & Grain or silage. Low level supplementary feeding for 3 months					$2,250	
Drought feeding costs.					$0	
Pasture maintenence (372 Ha of native pasture)					$0	
Livestock selling cost (see assumptions on next page)					$4,776	
		B. Total Variable Costs:			**$11,770**	

GROSS MARGIN (A-B)	**$48,279**
GROSS MARGIN/COW	**$482.79**
GROSS MARGIN/DSE*	**$32.45**
GROSS MARGIN/HA	**$129.78**

Change in gross margin ($/cow) for change in price &/or the weight of sale stock

(Note: Table assumes that the price and weight of other stock changes in the same proportion as steers. As an example if steer sale price falls to 269c/kg and steer weight to 240 kg, gross margin would fall to $419 per cow. This assumes that price and weight of all other sale stock falls by the same percentage.

Liveweight (kg's) of Stock sold		**Steer sale price cents/kg live**				
		259	**269**	**279**	**289**	**299**
Steer wt.						
-40 kgs	**220**	358	375	393	411	429
-20 kgs	**240**	399	419	438	457	477
0	**260**	441	462	483	504	525
+20 kgs	**280**	483	505	528	550	572
+40 kgs	**300**	524	548	572	596	620

GM $ per Cow

An increase of 5% in weaning percentage increases gross margin per cow by $27.08

Assumptions **Inland store weaners**

Enterprise unit is 100 cows weighing on average 480 kg
Weaning rate: 84% - conception rate 90%

Sales

Steers sold at 9 months	260 kg	@279c/kg	live weight
Heifers sold at 9 months	230 kg	@201c/kg	live weight
21 heifers retained for replacement.			
Cull cows cast for age at 10 years	240 kg	@401c/kg	dressed weight
100% of preg tested empty cows culled	"	"	"
4% cows culled for other reasons	"	"	"
Bulls run at 3% & sold after 4 years use	420 kg	@370c/kg	dressed weight

Selling costs include: Commission 4%; yard dues $8.00/hd; MLA levy $5/hd; average freight cost to saleyards $12/hd; NLIS tags $3.60

Cows: age at first calf : 24 months

Mortality rate of adult stock: 2%

The average feed requirement of a cow + followers is rated at 2.21 LSU or 15.25 dse's. This is an average figure and will vary during the year.
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Age structure

Age	Number
2	21
3	18
4	15
5	13
6	11
7	9
8	7
9	6
Total Joined	**100**
10	6

6 sold cfa

Marketing Information:

Mainly sold to grass back-grounders for growing out.
Steers likely to end up in feedlots after further weight gain on grass.
Following sale, heifers either grown out to become breeders or fattened for the local trade market.

Production Information:

Mixed sex weaners sold from March to June from lighter country or at heavier stocking rates than for vealers. Common on unimproved areas with some supplementary feed in normal years.
This enterprise is the most drought susceptible.

ASIA PACIFIC OFFICES

BRISBANE
Level 2, 15 Astor Terrace
Spring Hill QLD 4000
Australia
T: +61 7 3858 4800
F: +61 7 3858 4801

CANBERRA
GPO 410
Canberra ACT 2600
Australia
T: +61 2 6287 0800
F: +61 2 9427 8200

DARWIN
Unit 5, 21 Parap Road
Parap NT 0820
Australia
T: +61 8 8998 0100
F: +61 8 9370 0101

GOLD COAST
Level 2, 194 Varsity Parade
Varsity Lakes QLD 4227
Australia
M: +61 438 763 516

MACKAY
21 River Street
Mackay QLD 4740
Australia
T: +61 7 3181 3300

MELBOURNE
Level 11, 176 Wellington Parade
East Melbourne VIC 3002
Australia
T: +61 3 9249 9400
F: +61 3 9249 9499

NEWCASTLE
10 Kings Road
New Lambton NSW 2305
Australia
T: +61 2 4037 3200
F: +61 2 4037 3201

PERTH
Ground Floor, 503 Murray Street
Perth WA 6000
Australia
T: +61 8 9422 5900
F: +61 8 9422 5901

SYDNEY
Tenancy 202 Submarine School
Sub Base Platypus
120 High Street
North Sydney NSW 2060
Australia
T: +61 2 9427 8100
F: +61 2 9427 8200

TOWNSVILLE
12 Cannan Street
South Townsville QLD 4810
Australia
T: +61 7 4722 8000
F: +61 7 4722 8001

WOLLONGONG
Level 1, The Central Building
UoW Innovation Campus
North Wollongong NSW 2500
Australia
T: +61 2 4249 1000

AUCKLAND
68 Beach Road
Auckland 1010
New Zealand
T: 0800 757 695

NELSON
6/A Cambridge Street
Richmond, Nelson 7020
New Zealand
T: +64 274 898 628