

Rixs Creek
Biophysical Strategic Agricultural Land Verification Assessment

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Rixs Creek Pty Limited

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DOCUMENT CONTROL

Reference	Status	Date	Prepared	Checked	Authorised
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1 INTRODUCTION

1.1 Project Background

Rix's Creek Mine (the Mine) of Rix's Creek Pty Limited, is owned and operated by Bloomfield Collieries Pty Limited (Bloomfield). The Mine is an open cut coal mine approximately 5 km north-west of Singleton in the Hunter Valley Coalfields of NSW. The Mine currently produces approximately 1.5 million tonnes per annum (Mtpa) of product coal from its existing operations.

Bloomfield is seeking approval for the Rix's Creek Continuation of Mining Project (the Project), which relates to the continued operation of the existing open cut coal mine. The Project would allow the Mine to continue to operate as an open cut mine, accessed via its existing infrastructure facilities.

The Project seeks to extend the life of the existing open cut mining operation at Rix's Creek until approximately 2037. The continuation of mining operations will extend in a north-westerly direction and require a modification to Mine Lease 1432 for an out of pit dump. The continuation of operations will utilise the existing mine access, Coal Handling and Preparation Plant, coal stockpiling and rail facilities.

As part of the Director-General's Requirements (DGRs) issued for the Rix's Creek Continuation of Mining Project (SSD 13_6300) on 3 March 2014, a BSAL Verification was required over the 245.4 ha Assessment Area for the out of pit overburden emplacement area. This BSAL verification assessment is required to be submitted to the Office of Environment and Heritage within the NSW Department of Planning and Environment for a BSAL verification certificate. This report is intended to accompany the online BSAL verification certificate application. Clayton Richards (CPSS 2) is author of this report and responsible for laboratory results interpretation, whilst John Lawrie (CPSS 3) undertook the fieldwork and sampling with assistance from SLR staff.

1.2 The Gateway Process

The Strategic Regional Land Use Plans for the Upper Hunter and New England North West (SRLUP) was released by the NSW Government in September 2012, the BSAL mapping for the remainder of the State was released in January 2014. The SRLUP's represent the Government's proposed framework to support growth, protect the environment and respond to competing land uses, whilst preserving key regional values over the next 20 years. An integral component of the plan is the introduction of the new decision making framework, known as the Gateway Process. This process involves the early assessment of potential impacts of mining and coal seam gas development on agricultural land and water resources.

As part of the new Gateway Process, areas of particularly high agricultural values have been identified and mapped in consultation with key industry representatives and industry experts for the whole of NSW. These areas are referred to as Strategic Agricultural Land. Two categories of Strategic Agricultural Land have been identified:

1. biophysical strategic agricultural land (BSAL); and
2. critical industry clusters (CIC).
 - a. Equine Cluster
 - b. Viticulture Cluster

BSAL is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality.

The criteria used to measure BSAL under the original SRLUP was based on three parameters:

1. Soil Fertility – based on the Draft Inherent General Fertility of NSW (OEH),
2. Land and Soil Capability – based on Land and Soil Capability Mapping of NSW, and
3. Access to reliable water supply.

The principal application of the strategic agricultural land mapping is a ‘trigger’ of the new Gateway process for new project development applications.

In April 2013, an Interim protocol for site verification and mapping of biophysical strategic agricultural land (the Interim Protocol) was release by the NSW Government. This Interim protocol outlines the process for seeking verification of whether or not land mapped as BSAL meets the Interim protocol BSAL criteria. This report is based on the criteria outlined in the Interim Protocol. The State Environment Planning Policy (mining, Petroleum Production and Extractive Industries) Amendment 2013 (the 2013 Mining SEPP amendment) requires certain types of developments to verify whether the proposed site is on BSAL. The purpose of the protocol is to assist proponents and landholders to understand what is required to identify the existence of BSAL and outlines the technical requirements for the on-site identification and mapping of BSAL.

1.3 Interim Protocol Checklist

Section 12 of the Interim Protocol provides a checklist of information required to be addressed and included in the site verification assessment. This checklist is provided in **Table 1** along with the relevant references to the sections of this report where the information may be found.

Table 1: Interim Protocol Checklist

Checklist Item	Addressed in Section of Report
Ensure that:	
a qualified soil scientist is overseeing the verification assessment and has signed off on the quality and extent of the work;	Section 1.1
laboratories for soil samples are compliant with AS ISO/IEC17025;	Appendix B
results within 15 per cent of threshold levels are analysed in a laboratory;	Appendix B
all soil profile descriptions and observations are recorded and submitted to SALIS;	Appendix A
laboratory data is supplied to OEH using their standard spreadsheet templates.	Appendix B
The report supporting the BSAL site verification application must include:	
reporting requirements for site verification criteria as described in Appendix 1;	Table 6
three 1:25000 maps showing: base level information; soil types and BSAL;	Figures 1,2 and 3
GIS output files, and metadata statements; and	Electronic versions sent via e-mail
Laboratory report.	Appendix B

2 BSAL VERIFICATION

2.1 Defining BSAL

The Interim Protocol defines BSAL in three different ways:

1. General Commentary: BSAL is land with a rare combination of natural resources highly suitable for agriculture. These lands intrinsically have the best quality landforms, soil and water resources which are naturally capable of sustaining high levels of productivity and require minimal management practices to maintain this high quality. BSAL is able to be used sustainably for intensive purposes such as cultivation. Such land is inherently fertile and generally lacks significant biophysical constraints. (Interim Protocol: Section 3 Paragraph 1 on page 2).
2. On a regional scale, the maps of BSAL meet the three criteria outlined in the SRLUP (Interim Protocol: Section 3 Insert):
 - a. Access to reliable water supply;
 - b. Inherent General Fertility; and
 - c. Land and Soil Capability (LSC) as mapped for NSW by OEH.
3. On a property scale, the verification criteria include specific measurements of the following parameters: slope; rock outcrop; surface rock fragments; gilgai; soil fertility (based on soil type); effective rooting depth to a physical barrier; soil drainage; soil pH; salinity; and effective rooting depth to a chemical barrier. (Interim Protocol: Section 6 on page 5).

This report assesses BSAL according to the requirements of the third definition.

2.2 Methodology

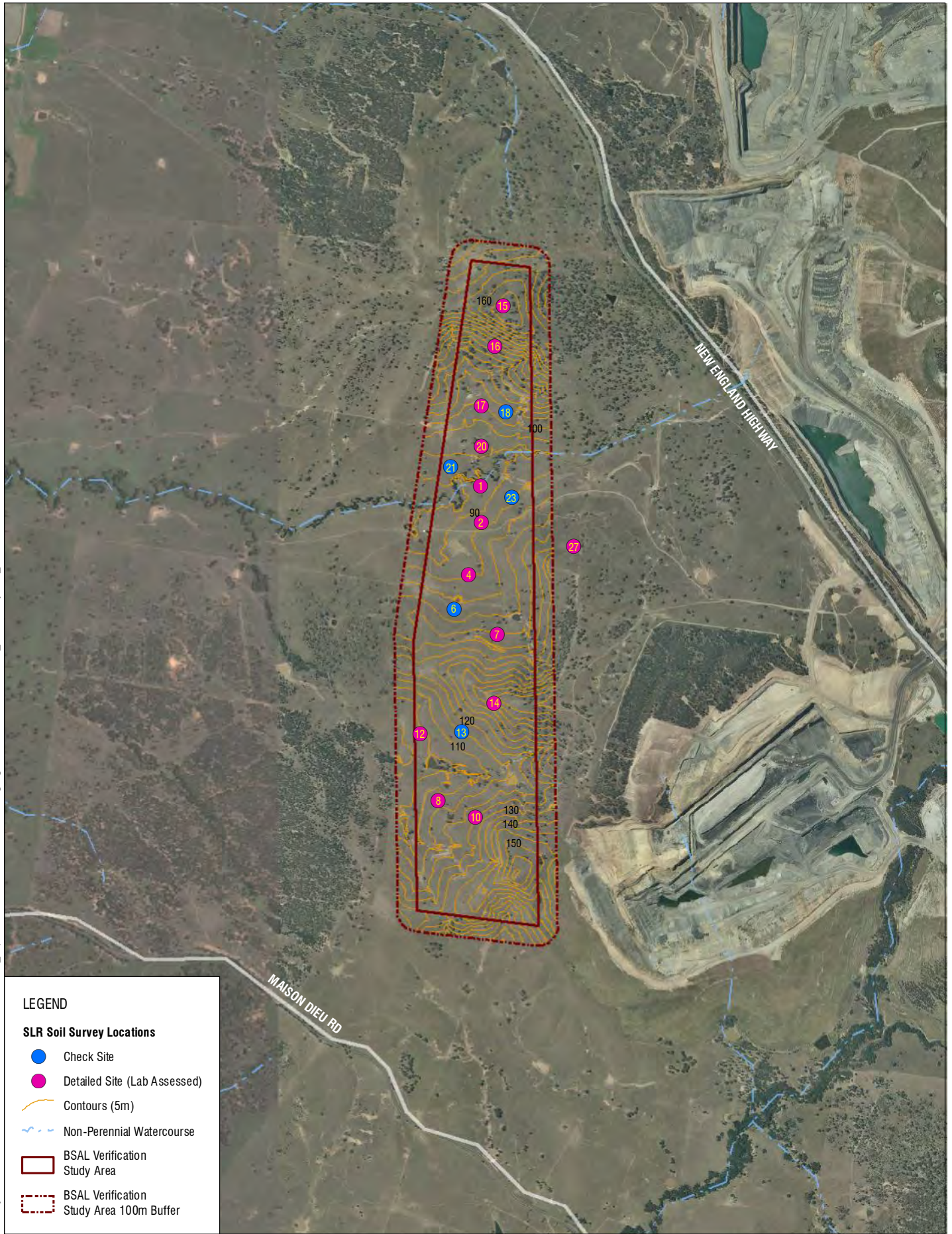
The site verification and methodology reported in the following sections has been undertaken based on the Interim Protocol for Site Verification and Mapping of BSAL.

Step 1: Identify the project area which will be assessed for BSAL

The assessment area should include the entire project area and include at least a 100 m buffer to take into account minor changes in design, surrounding disturbance and minor expansion. If BSAL is part of a larger contiguous mass of BSAL then the boundary of this area must also be identified.

The proposed disturbance area is defined as the Rixs Creek proposed Overburden Emplacement Area (OEA) (170 ha). In addition to this disturbance area, a 100m buffer surrounding the area is included as the Assessment Area, to account for minor changes in design in accordance with the BSAL protocol. The total assessment area is therefore 245.4 ha as shown in **Figure 1**. The Lot and DP's for the area are listed below.

- Lot A DP 404824
- Lot 121 DP 1170863
- Lot 122 DP 1170863
- Lot 55 DP 252692



LEGEND

SLR Soil Survey Locations

- Check Site
- Detailed Site (Lab Assessed)
- Contours (5m)
- Non-Perennial Watercourse
- BSAL Verification Study Area
- BSAL Verification Study Area 100m Buffer



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Rix's Creek PTY LTD

Rix's Creek BSAL Verification Assessment

Study Area

FIGURE 1

Step 2: Confirm access to a reliable water supply

BSAL lands must have access to a “reliable water supply”.

As noted in the SRLUP Upper Hunter, all area covered by this SRLUP map satisfies the requirement for reliable water supply due to adequate rainfall.

Step 3: Choose the appropriate approach to map the soils information

Access to the project area will define the level of investigation that the proponent can undertake. If the proponent has access to the land then the BSAL verification requirements for on-site soils assessment as described in sections 6 and 9 of the Interim Protocol should be met. If the proponent does not have access then the proponent should develop a model of soils distribution guided by sections 6 and 9 based on landscape characteristics using the information listed in Section 5 of the Interim Protocol.

*It is important to note that for either approach, if any criteria indicate that the site is not BSAL, then no further assessment is necessary. The flow chart in **Table 5** is designed to assess the simplest criteria first, to avoid more costly assessments if the site can be easily discounted as BSAL.*

The Proponent has access to the site for the site verification of BSAL. The flowchart from Figure 2 of the Interim Protocol is shown in **Table 5**.

Step 4: Risk assessment

The proponent should undertake a risk assessment as this will influence the density of soil sampling required as explained in Section 9.6.1. The proposed activity on parts or all of the project area may be of low risk to agriculture and so may only require a sampling density of 1:100 000. Alternatively other areas may be at higher risk of impact and so should have a sampling density of 1:25 000.

To identify the potential for the Project to impact on agricultural resources and the appropriate level of soil survey required, an evaluation of risk to agricultural resources and enterprises was undertaken. This risk assessment is taken from the Guideline for Agricultural Impact Statements at the Exploration Stage (DTIRIS, 2012) shown in Tables 2, 3 and 4 below, and is based on the probability of occurrence and the consequence of the impact, as described in the Land Use Conflict Risk Assessment Guide (NSW DPI 2011). Depending on the risk, inspection densities can range from 1 site per 25-400 ha for low risk to 1 site per 5-25 ha for high risk (Gallant *et al.* 2008).

Table 2: Agricultural Impacts Risk Ranking Matrix

Consequence	PROBABILITY				
	A Almost Certain	B Likely	C Possible	D Unlikely	E Rare
1. Severe and/or permanent damage. Irreversible impacts	A1 high	B1 high	C1 high	D1 high	E1 medium
2. Significant and /or long term damage. Long term mgt implications. Impacts difficult or impractical to reverse.	A2 high	B2 high	C2 high	D2 medium	E2 medium
3. Moderate damage and/or medium-term impact to agricultural resources or industries. Some ongoing mgt implications which may be expensive to implement. Minor damage or impacts over the long term.	A3 high	B3 high	C3 medium	D3 medium	E3 medium
4. Minor damage and/or short-term impact to agricultural resources or industries. Can be managed as part of routine operations	A4 medium	B4 medium	C4 low	D4 low	E4 low
5. Very minor damage and minor impact to agricultural resources or industries. Can be effectively managed as part of normal operations	A5 low	B5 low	C5 low	D5 low	E5 low

where:

	= low risk
	= medium risk
	= high risk

Table 3: Agricultural Impact Risk Ranking – Probability Descriptors

Level	Descriptor	Description
A	Almost Certain	Common or repeating occurrence
B	Likely	Known to occur or it has happened
C	Possible	Could occur or I've heard of it happening
D	Unlikely	Could occur in some circumstances but not likely to occur
E	Rare	Practically impossible or I've never heard of it happening

Table 4: Agricultural Impact Risk Ranking – Consequence Descriptors

Level: 1	Severe Consequences	Example of Implications
Description	Severe and/or permanent damage to agricultural resources, or industries Irreversible Severe impact on the community	Long term (eg 20 years) damage to soil or water resources Long term impacts (eg 20 years) on a cluster of agricultural industries or important agricultural lands
Level: 2	Major Consequences	Example of Implications
Description	Significant and/or long-term impact to agricultural resources, or industries Long-term management implications Serious detrimental impact on the community	Water and / or soil impacted, possibly in the long term (eg 20 years) Long term (eg 20 years) displacement / serious impacts on agricultural industries
Level:3	Moderate Consequences	Example of Implications
Description	Moderate and/or medium-term impact to agricultural resources, or industries Some ongoing management implications Minor damage or impacts but over the long term.	Water and/ or soil known to be affected, probably in the short – medium term (eg 1-5 years) Management could include significant change of management needed to agricultural enterprises to continue.
Level: 4	Minor Consequences	Example of Implications
Description	Minor damage and/or short-term impact to agricultural resources, or industries Can be effectively managed as part of normal operations	Theoretically could affect the agricultural resource or industry in short term, but no impacts demonstrated Minor erosion, compaction or water quality impacts that can be mitigated. For example, dust and noise impacts in a 12 month period on extensive grazing enterprises.
Level: 5	Negligible Consequences	Example of Implications
Description	Very minor damage or impact to agricultural resources, or industries Can be effectively managed as part of normal operations	No measurable or identifiable impact on the agricultural resource or industry

The Project consists of the proposed OEA and although the entire site will not be impacted by the proposal, SLR has assumed potential impacts on agriculture:

- a. Consequence: Level 1 – Severe and/or permanent damage to agricultural resources, or industries. Irreversible. Severe impact on the community.
- b. Probability: A – Almost Certain. Common or repeating occurrence.

The risk matrix result is A1 which is considered a high risk to agricultural activities. This area is therefore to have an inspection density of 1:25,000 which requires a minimum observation site every 25 ha. For the purpose of this survey the 100m buffer area is also considered to require an inspection density of 1:25,000. Given the total assessment area is 245.4 ha the required number of inspection sites is within the range of 9 to 10.

Step 5: Soils and landscape verification criteria

Ten site verification criteria are identified by the Interim Protocol, with the easy to measure criteria assessed first. They are:

1. slope;
2. rock outcrop;
3. surface rock fragments;
4. gilgai;
5. soil fertility (based on soil type);
6. effective rooting depth to a physical barrier; soil drainage;
7. soil pH;
8. salinity;
9. effective rooting depth to a chemical barrier; and
10. contiguous area greater than 20ha

For soil to be classified as BSAL at each representative site it must meet all the criteria outlined in the flow chart shown in **Table 4**. If any criteria is not met, the site is not BSAL and there is no need to continue the assessment. The specific requirements for each parameter to be assessed is outlined in the Interim Protocol.

Site assessment of slope gradients was undertaken using a digital elevation model and areas with gradients greater than 10% were considered exclusion sites and are shown in **Figure 2** and **Figure 3**.

Other exclusion parameters were assessed in the field, including rock outcrops, surface rock and the presence of gilgai. These were considered exclusion sites and no further parameters were recorded.

Existing soil landscape information was considered to provide a background understanding of the area however given the relatively small size of the area, the soil landscape information was not relied upon for any part of this BSAL verification assessment.

The BSAL verification fieldwork undertaken in March 2014 mapped 17 observations, of which 12 were detailed test pits. This level of survey is above the required 9 to 10 observations required for a 1:25,000 survey scale. The Results of the verification work are detailed in **Section 2.3**.

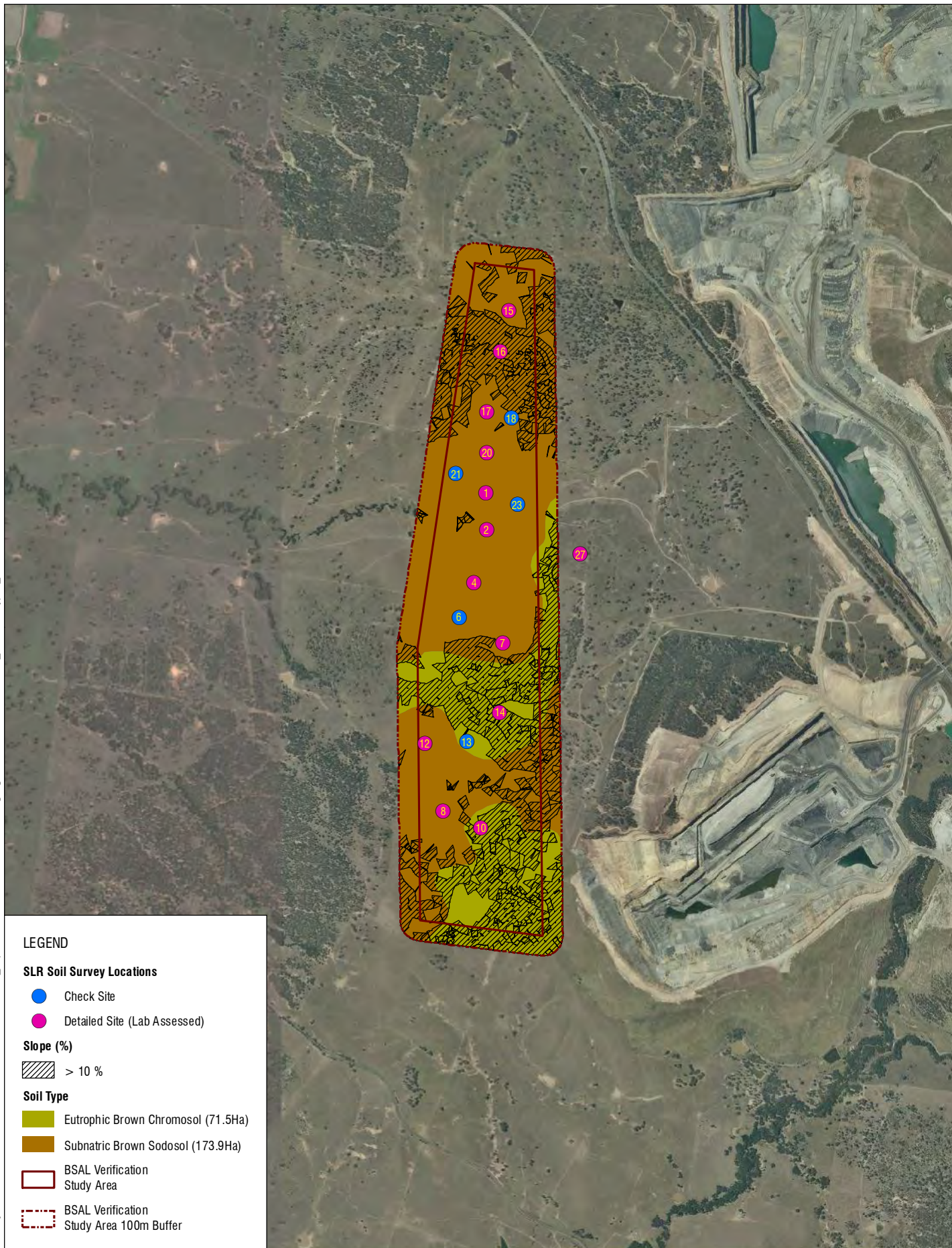
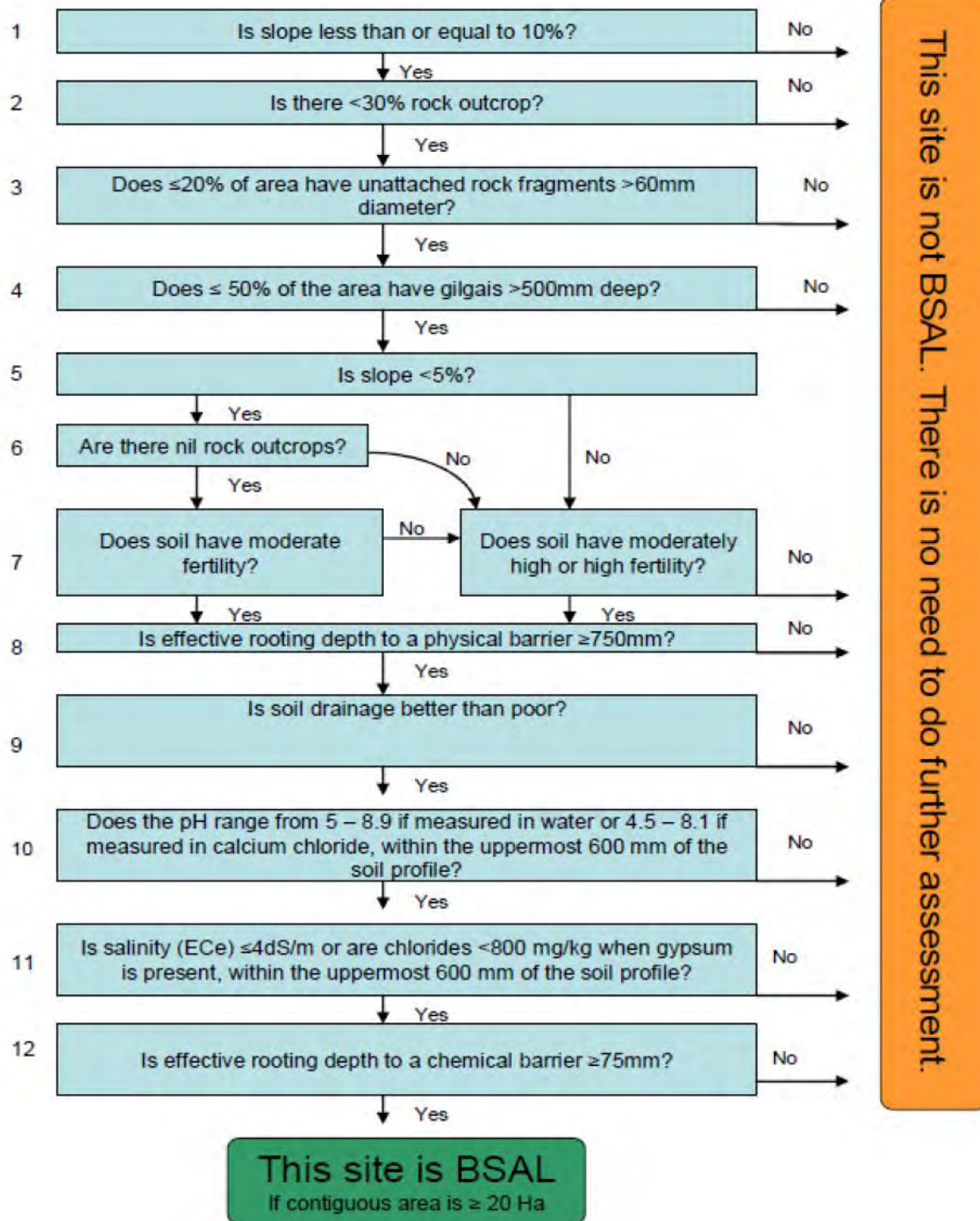


Table 5: Flow Chart for site assessment of BSAL

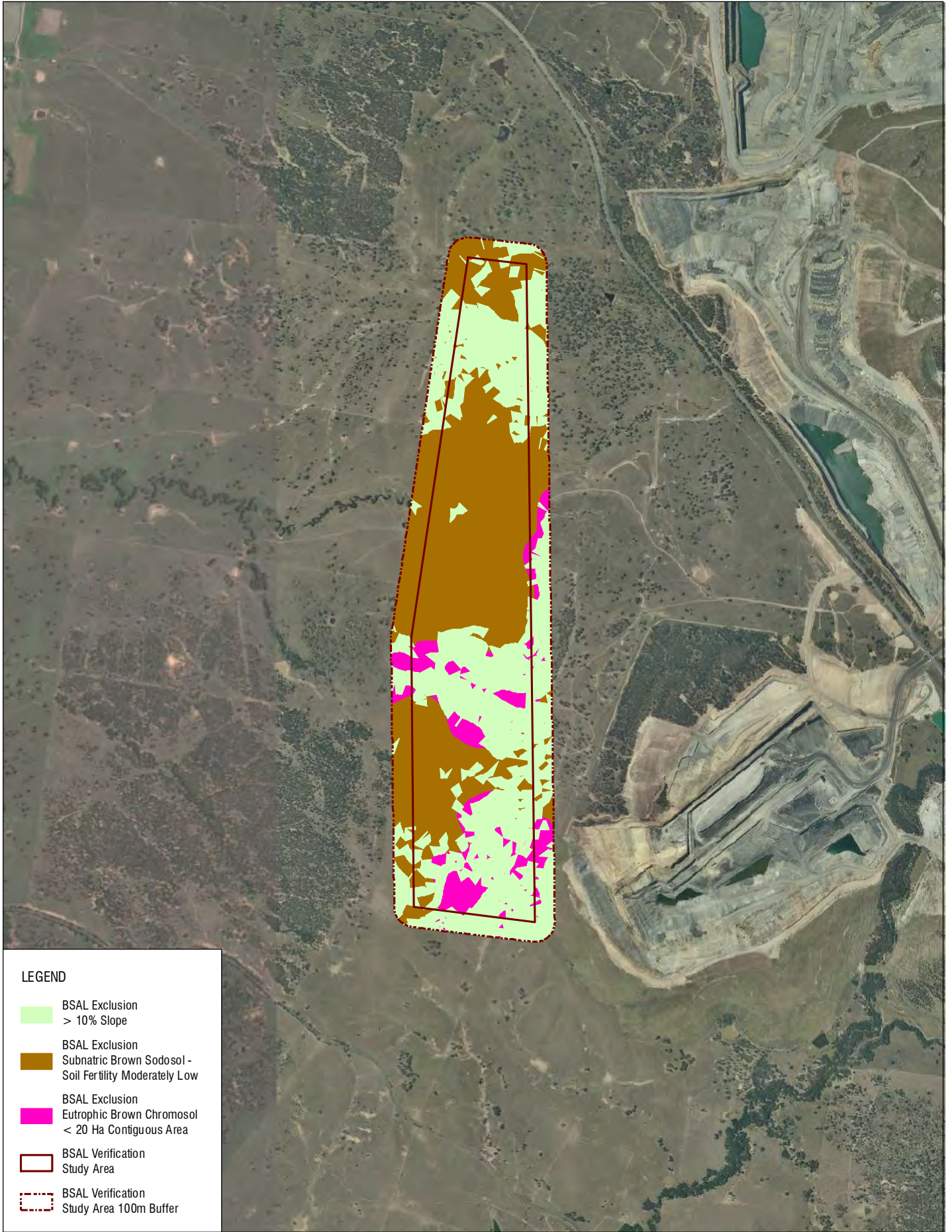


2.3 Results

The BSAL verification assessment resulted in two soil types located within the Assessment Area. **Figure 2** separates the assessment area according to exclusion areas and soil types into the following discrete areas:

1. There was 53.5 ha of land with slope greater than 10%: These areas were located on the sideslopes of the and ridgelines, as shown in **Figure 2**. Slopes greater than 10% are considered non BSAL.
2. Two soil types were found within the Assessment Area:
 - a. Subnatric Brown Sodosol (173.9 ha): This soil type was considered non BSAL due to moderately low soil fertility.
 - b. Eutrophic Brown Chromosols (71.5 ha): This soil type consisted of shallow soils within the >10% slope exclusion area, which is considered non BSAL. The author estimates the soil profiles are deeper on slopes <10%, and therefore the soils qualify for BSAL in those areas. These areas are isolated pockets with slopes between 5% and 10% and do not represent areas greater than 20 ha, and therefore are not BSAL.

These soil types are summarised below and detailed in the BSAL Soil Data Cards attached in **Appendix A**. The accompanying laboratory data can be found in **Appendix B**.



LEGEND

- BSAL Exclusion
> 10% Slope
- BSAL Exclusion
Subnatric Brown Sodosol -
Soil Fertility Moderately Low
- BSAL Exclusion
Eutrophic Brown Chromosol
< 20 Ha Contiguous Area
- BSAL Verification
Study Area
- BSAL Verification
Study Area 100m Buffer

Table 6: Site BSAL Verification Summary

Site #	Inspection Site Type	Australian Soil Classification (to ASC Great Group)	1. Is slope < 10%?	2. Is there < 30% Rock Outcrop?	3. < 20% unattached Rock Fragments > 60mm?	4. Does < 50% have Gilgais > 500mm deep?	5. Is Slope < 5%?	6. Are there nil rock outcrops?	7a. Does Soil Have Moderate Fertility?	7b. Does soil have moderately high or high fertility?	8. Is ERD to a physical barrier > 750mm?	9. Is drainage better than poor?	10. Is pH between 5.0 and 8.9?	11. Is salinity (Ece) < 4 dS/m	12. Is ERD to a chemical barrier > 750mm?	Is the Site BSAL?
Subnatric Brown Sodosol																
1	Detailed (+lab)	Eutrophic Mesonatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
2	Detailed (+lab)	Eutrophic Subnatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
4*	Detailed (+lab)	Eutrophic Subnatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
6	Check	Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
7	Detailed (+lab)	Eutrophic Subnatric Grey Sodosol	Yes	Yes	Yes	Yes	No	Yes	No							No
8	Detailed (+lab)	Eutrophic Haplic Brown Dermosol	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	No					No
12	Detailed (+lab)	Eutrophic Subnatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
15	Detailed (+lab)	Eutrophic Mottled-Mesonatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
16	Detailed (+lab)	Eutrophic Mottled-Subnatric Brown Sodosol	No													No
17	Detailed (+lab)	Eutrophic Subnatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
18	Check	Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
20	Detailed (+lab)	Mesotrophic Hypenatric Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
21	Check	Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
23	Check	Brown Sodosol	Yes	Yes	Yes	Yes	Yes	Yes	No	No						No
Eutrophic Brown Chromosol																
10	Detailed (+lab)	Haplic Eutrophic Brown Chromosol	No													No
13	Check	Brown Chromosol	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	nt	nt	nt	Yes
14	Detailed (+lab)	Sodic Eutrophic Brown Chromosol	No													No
27	Detailed (+lab)	Haplic Eutrophic Brown Chromosol	No													No

Note: Site 27 lies outside the Assessment area, but used for validation of soil type. 4* is noted as site 3 in laboratory data, but site 4 on GPS and Figures nt = not laboratory tested

Subnatric Brown Sodosol

The Subnatric Brown Sodosols dominated the study area and were located on the creeklines, flats, lower slopes, midslopes and on the ridgeline in the north. These soils varied in topsoil depth from 0.1m to 0.3m, with an abrupt to clear boundary to the clay subsoil. Sodicity within the upper section of the subsoil ranged from 7.5 ESP to 16.7 ESP, reaching 25.8 ESP in the lower profile of one site. For the purposes of the BSAL verification assessment these soils failed the fertility criteria given the soil type. **Table 6** and **Table 7** provide a summary and analysis of this soil type.

Table 7: Subnatric Brown Sodosol (Summary)

Site Description	
 Plate 1 – Profile (Site 17)	 Plate 5 – Landscape (Site 17)
ASC Name	Subnatric Brown Sodosol
Representative Sites	1,2,4,6,7,8,12,15,16,17(Pictured),18,20,21,23.
Dominant Slope Association	Mid to Lower slopes and flats (1 to 10% slope)
Land Use	Grazing
Soil Fertility	Moderately Low
BSAL	No

Table 8: Subnatric Brown Sodosol (Analysis)

Horizon	Depth (m)	Description		
A1	0.00 – 0.20	Very dark greyish brown (10YR 3/2) loam with moderate pedality and consistence. Slightly acidic (pH 6.1) and non-sodic (ESP 2.0). Non Saline with moderate cation exchange capacity. No coarse fragments at site 17. Many fine roots and well drained. Clear boundary.		
B21	0.20 – 0.40	Dark brown (10YR 3/3) medium clay with moderate pedality and consistence. Mildly alkaline (pH 7.5) and sodic (ESP 7.8). Non Saline with moderate cation exchange capacity. No coarse fragments at site 17. Few fine roots and moderately drained. Clear boundary.		
B22	0.40 – 0.60	Brown (10YR 4/3) heavy clay with strong pedality and consistence. Moderately alkaline (pH 8.3) and sodic (ESP 7). Non Saline with moderate cation exchange capacity. No coarse fragments at site 17. Few fine roots and moderately drained. Clear boundary.		
B23	0.60 – 0.90	Strong Brown (7.5YR 5/6) light clay with strong pedality and consistence. Strongly alkaline (pH 9.0) and sodic (ESP 7.0). Moderately saline (ECe 6.8) with moderate cation exchange capacity. No coarse fragments at site 17. Few fine roots and imperfectly drained.		
Horizon	ECe		Laboratory pH	
	dS/m	Rating	Value	Rating
A1	0.40	Non Saline	6.0	Moderately Acidic
B21	0.90	Non Saline	7.4	Mildly Alkaline
B22	1.9	Non Saline	8.3	Moderately Alkaline
B23	6.8	Moderately Saline	9.0	Strongly Alkaline
Horizon	CEC		ESP	
	cmol/kg	Rating	%	Rating
A1	13	Moderate	2.0	Non Sodic
B21	24	Moderate	7.5	Sodic
B22	23	Moderate	7.8	Sodic
B23	20	Moderate	7.0	Sodic

Eutrophic Brown Chromosols

The Eutrophic Brown Chromosols were located within the steeper mid to upper slopes and ridgelines. Two detailed sites were used for this assessment as well as 1 detailed site (Site 27) lying approximately 100m outside the assessment area to the east. Despite the two detailed sites lying within the greater than 10% slope exclusion area, this soil type is mapped into the study area with 5-10% slopes. Site 10 and 27 are considered shallow with an ERD physical barrier at 0.55 m, however this soil is not expected to remain as shallow on the more gentle slopes inside the assessment area. Therefore these isolated small pockets of Eutrophic Brown Chromosol, whilst satisfying the 12 BSAL Criteria in **Table 5** above, are less than 20 ha in size and not contiguous, therefore within this assessment area these soils are not considered BSAL. **Table 8** and **Table 9** provide a summary and analysis of this soil type.

Table 9: Eutrophic Brown Chromosols (Summary)

Site Description	
 Plate 1 – Profile (Site 14)	 Plate 5 – Landscape (Site 14)
ASC Name	Eutrophic Brown Chromosol
Representative Sites	10, 13 and 14 (Pictured) (Site 27 outside Assessment Area)
Dominant Slope Association	Moderately steep (5% to 15% slopes)
Land Use	Grazing
Soil Fertility	Moderately High
BSAL	No (Less than 20 ha and not contiguous)

Table 10: Eutrophic Brown Chromosol (Analysis)

Horizon	Depth (m)	Description		
A1	0.00 – 0.20	Very dark greyish brown (10YR 3/2) loam with weak pedality and weak consistence. Slightly acidic (pH 6.3) and non sodic (ESP 0.9). Non saline with moderate cation exchange capacity. Nil Coarse fragments. Many roots and well drained. Clear boundary to B21.		
B21	0.20 – 0.60	Dark yellowish brown (10YR 4/4) heavy clay with strong pedality and moderate consistence. Mildly alkaline (pH 7.6) and non sodic (ESP 4.8). Non saline with moderate cation exchange capacity. Nil Coarse fragments. Many fine roots and moderately drained. Clear boundary to B22.		
B22	0.60 – 1.00	Yellowish Brown (10YR 5/6) heavy clay with strong structure and strong consistence. Moderately alkaline (pH 8.4) and sodic (ESP 10.3). Non saline with high cation exchange capacity. Nil Coarse fragments. Many fine roots and imperfectly drained.		
Horizon	ECe		Laboratory pH	
	dS/m	Rating	Value	Rating
A1	0.5	Non Saline	6.3	Slightly Acidic
B21	0.6	Non Saline	7.6	Mildly Alkaline
B22	1.6	Non Saline	8.4	Moderately Alkaline
Horizon	CEC		ESP	
	cmol/kg	Rating	%	Rating
A11	15	Moderate	0.9	Non Sodic
B21	23	Moderate	5.2	Non Sodic
B22	29	High	10.3	Sodic

3 CONCLUSION

The Rixs Creek BSAL Verification Assessment was undertaken in April 2014 by SLR Consulting. The assessment area was defined as the proposed Overburden Emplacement Area (OEA) totalling approximately 170 ha in area, as well as the required 100m buffer, which resulted in a total 245.4 ha for the Assessment Area. The land and soil was assessed in accordance with the Interim Protocol. Approximately 53.5 ha was greater than 10% slope and two distinct soil types were found: Subnatric Brown Sodosol (173.9 ha), Eutrophic Brown Chromosol (71.5 ha). The Subnatric Brown Sodosol failed the fertility criteria within the BSAL protocol and was therefore considered non BSAL. The two detailed sites within the assessment area for the Eutrophic Brown Chromosol were excluded on greater than 10% slope and ERD depth to physical barrier < 0.75 m, however the areas of this soil type within 0 to 10% slope and were considered to contain a deeper profile and therefore would satisfy the 12 criteria within the Interim protocol. However these areas were isolated pockets of less than 20ha and therefore cannot be considered BSAL.

Therefore it can be concluded that there is no qualifying BSAL within the Assessment Area. The supporting documents including the SALIS BSAL Soil Data Cards and laboratory analysis are attached in **Appendices A** and **B** respectively.

BSAL Soil Data Cards

SURVEY TITLE: R I X S C R E E K B S A L

SITE LOCATION: S O U T H O F C R E E K

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	2
3	3	3	3	3	3	both profile & site	3
4	4	4	4	4	4	Nature of Exposure (2)	4
5	5	5	5	5	5	auger	5
6	6	6	6	6	6	pit	6
7	7	7	7	7	7	batter	7
8	8	8	8	8	8	gully	8
9	9	9	9	9	9	core sample	9
10	10	10	10	10	10	other	10

Potential BSAL? (1)	Site type (1)
yes ☐ no ☒	checked ☐ detailed ☒ exclusion ☐

BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	foredune	pan/playa
O	rainforest	bank	cut face	gully	pediment
A	wet sclerophyll forest	bar	cut-over surface	hillcrest	pit
SO	dry sclerophyll forest	beach	dam	hillslope	plain
B	woodland grass u/storey	beach ridge	drainage depression	lagoon	prior stream
GG	woodland shrub u/storey	bench	dune	lake	rock flat
P	tall shrubland	berm	embankment	landslide	rock platform
SG	low shrubland	blow-out	estuary	levee	scald
A	heath	channel bench	fan	lunette	scarp
H	grassland/herbland	cirque	fill top	maar	scree
B	swamp complex	cliff	flood-out	mound	scroll
E	littoral complex				
N	no vegetation				
O					
W					
C					
G.S.G.					
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					
O					
P					
Q					
R					
S					
T					
U					
V					
W					
X					
Y					
Z					

LITHOLOGY				TOPOGRAPHY	
Substrate (3)				Slope Percent	Site Morphology (1)
not identified	limestone	coarse-basic	10	flat	
unconsolidated	tuff	fine-acidic	1	crest	
gravel	breccia	fine-intermediate	2	hillock	
sand	greywacke	fine-basic	3	ridge	
silt	arkose	serpentine	4	upper slope	
clay	dolomite	gabbro	5	midslope	
organic material	calcrete	dolerite	6	simple slope	
alluvium	aeolianite	diorite	7	lower slope	
colluvium	chert	syenite	8	open depression	
lacustrine	jasper	granodiorite	9	closed depression	
aeolian	metamorphic	adamellite			
marine	gneiss	granite			
calcareous sand	schist/phyllite	aplite			
fill	slate	quartz porphyry			
mud	hornfels	basalt			
till	quartzite	andesite			
sedimentary	greenstone	trachyte			
shale	amphibolite	rhyolite			
siltstone/mudstone	marble	obsidian			
sandstone-quartz	igneous	scoria			
sandstone-lithic	coarse-acidic	ash			
conglomerate	coarse-intermediate	agglomerate			
		other			

HYDROLOGY		SLOPE MEASUREMENT		SLOPE MORPHOLOGY	
Profile Drainage (1)	Permeability (1)	Method (1)			
very poorly drained	very slowly permeable	inclinometer		waxing	
poorly drained	slowly permeable	Abney level		waning	
imperfectly drained	moderately permeable	total station		maximal	
mod. well-drained	highly permeable	RTK GPS		minimal	
well-drained		LIDAR			
rapidly drained					

SITE FIELD NOTES	
Photo file name/s:	

SITE CONDITION		Surface Condition		
Site Disturbance(s) (2)	Ground Cover %	Current (2)	Expected Wet (2) Dry (2)	
natural disturbance		cracked	2	2
no effective disturbance		self-mulched	3	3
limited clearing		loose	4	4
extensive clearing		soft	5	5
cleared, no cultivation		firm	6	6
occasional cultivation		hardset	7	7
rainfed cultivation		surface crust	8	8
irrigated cultivation		trampled	9	9
highly disturbed		poached	10	10
		recently cultivated	11	11
		water repellent	12	12
		gravelly	13	13
		other	14	14



NSW SOIL AND LAND INFORMATION SYSTEM

Please MARK LIKE THIS ONLY:

- Use 2B pencil
- No pen or biro
- Fully erase mistakes
- Make no stray marks
- Numbers in () show max. entries allowed

Please do not mark this space.

4640

cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH	LAYER NOTES				Field pH Test Method (1)								
	Lower	Horizon	Moist Munsell		Dry Munsell	(1 per layer)	1					Raupach test strip pH meter								
2												HCI (1)								
												no effervescence								
												audible/slight efferv.								
												strong effervescence								
3												Boundary Distinctiveness								
												(1 per layer) 1 2 3 4 5								
												not evident								
												sharp (<5 mm)								
												abrupt (5-20 mm)								
												clear (20-50 mm)								
												gradual (50-100 mm)								
												diffuse (>100 mm)								
4												STRUCTURE								
												Grade of Pedality (1) 1 2 3 4 5								
												single-grained								
												massive								
												weak pedality								
												moderate pedality								
												strong pedality								
5												Fabric (1) 1 2 3 4 5								
												sandy								
												earthy								
												rough-faced peds								
												smooth-faced peds								
6												Dominant (1) 1 2 3 4 5								
												Ped Shape								
												Sub-dominant (1) 1 2 3 4 5								
												platy								
												lenticular								
												prismatic								
												columnar								
												angular blocky								
												sub-ang. blocky								
												polyhedral								
												granular								
												crumb								
												round								
7												Dominant (1) 1 2 3 4 5								
												Ped Size								
												Sub-dominant (1) 1 2 3 4 5								
												<2 mm								
												2-5 mm								
												5-10 mm								
												10-20 mm								
												20-50 mm								
												50-100 mm								
												100-200 mm								
												200-500 mm								
												> 500 mm								
8												SEGREGATIONS								
												Soil Water Status (1 each per layer)								
												Type (1 per layer) 1 2 3 4 5								
												dry								
												mod. moist								
												moist								
												wet								
												ferrous								
												ferruginous								
												ferromanganiferous								
												organic								
												not identified								
												other								
												Amount (1 per layer) 1 2 3 4 5								
												none								
												very few (<2%)								
												few (2-10%)								
												common (10-20%)								
												many (20-50%)								
												abundant (>50%)								
												Strength (1 per layer) 1 2 3 4 5								
												weak								
												strong								
												Form (1 per layer) 1 2 3 4 5								
												soft segregations								
												nodules								
												fragments								
												crystals								
												veins								
												concretions								
												root linings								
												tubules								
												Size (1 per layer) 1 2 3 4 5								
												fine (<2 mm)								
												medium (2-6 mm)								
												coarse (6-20 mm)								
												v coarse (20-60 mm)								
												ext coarse (>60 mm)								
9												SUBSTRATE								
												Upper								
												Sample Taken								
												COARSE FRAGMENTS								
												Type (1 per layer) Sur 1 2 3 4 5								
												not evident								
												not identified								
												as substrate								
												as rock outcrop								
												as parent material								
												quartz								
												feldspar								
												ironstone								
												silcrete								
												ironstone								
												bauxite								
												shells								
												charcoal								
												pumice								
												opalised wood								
												other								
												Amount (1 per layer) Sur. 1 2 3 4 5								
												very few (<2%)								
												few (2-10%)								
												common (10-20%)								
												many (20-50%)								
												abundant (50-90%)								
												very abundant (>90%)								
												Size (1 per layer) Sur. 1 2 3 4 5								
												fine gravel (2-6 mm)								
												gravel (6-20 mm)								
												coarse gravel (20-60 mm)								
												cobbles (60-200 mm)								
												stones (200-600 mm)								
												boulders (>600 mm)								
10												MOTTLES								
												Dominant (1) 1 2 3 4 5								
												Abundance 1 2 3 4 5								
												not evident								
												<2%								
												2-10%								
												10-20%								
												20-50%								
												Colour 1 2 3 4 5								
												dark								
												red								
												orange								
												yellow								
												brown								
												pale								
												grey								
												gley								
												Contrast 1 2 3 4 5								
												faint								
												distinct								
												prominent								
11												Estimated Effective Rooting Depth (m)								
12												Base of Observation (1)								
												layer continues								
												soil continues								
												equipment refusal								
												bedrock reached								
13												SUBSTRATE								
												Upper								
												Sample Taken								
												COARSE FRAGMENTS								
												Type (1 per layer) Sur 1 2 3 4 5								
												not evident								
												not identified								
												as substrate								
												as rock outcrop								
												as parent material								
												quartz								
												feldspar								
												ironstone								
												silcrete								
												ironstone								
												bauxite								
												shells								
												charcoal								
												pumice								
												opalised wood								
												other								
												Amount (1 per layer) Sur. 1 2 3 4 5								
												very few (<2%)								
												few (2-10%)								
												common (10-20%)								
												many (20-50%)								
												abundant (50-90%)								
												very abundant (>90%)								
												Size (1 per layer) Sur. 1 2 3 4 5								
												fine gravel (2-6 mm)								
												gravel (6-20 mm)								
												coarse gravel (20-60 mm)								
												cobbles (60-200 mm)								
												stones (200-600 mm)								
												boulders (>600 mm)								
14												MOTTLES								
												Dominant (1) 1 2 3 4 5								
												Abundance 1 2 3 4 5								
												not evident								
												<2%								
												2-10%								
												10-20%								
												20-50%								
												Colour 1 2 3 4 5								
												dark								
												red								
												orange								
												yellow								
												brown								
												pale								
												grey								
												gley								
												Contrast 1 2 3 4 5								
												faint								
												distinct								
												prominent								
15												SUBSTRATE								
												Upper								
												Sample Taken								
												COARSE FRAGMENTS								
												Type (1 per layer) Sur 1 2 3 4 5								
												not evident								
												not identified								
												as substrate								
												as rock outcrop								
												as parent material								
												quartz								
												feldspar								

SURVEY TITLE: RIXS CREEK BSAL
SITE LOCATION: ADJACENT TO TRACK

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	1
3	3	3	3	3	3	both profile & site	1
4	4	4	4	4	4	Nature of Exposure (2)	2
5	5	5	5	5	5	auger	3
6	6	6	6	6	6	pit	4
7	7	7	7	7	7	batter	5
8	8	8	8	8	8	gully	6
9	9	9	9	9	9	core sample	7
10	10	10	10	10	10	other	8

Potential BSAL? (1)	Site type (1)
yes ☐ no ☒	checked ☐ detailed ☒ exclusion ☐

BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	foredune	pan/playa
SO	rainforest	bank	cut face	gully	pediment
A	wet sclerophyll forest	bar	cut-over surface	hilcrest	pit
B	dry sclerophyll forest	beach	dam	hillslope	plain
GG	woodland grass u/storey	beach ridge	drainage depression	lagoon	prior stream
E	woodland shrub u/storey	bench	dune	lake	rock flat
SG	tall shrubland	berm	embankment	landslide	rock platform
S	low shrubland	blow-out	estuary	levee	scald
A	heath	channel bench	fan	lunette	scarp
H	grassland/herbland	cirque	fill top	maar	scree
B	swamp complex	cliff	flood-out	mound	scroll
F	littoral complex				
W	no vegetation				
C					
G.S.G.					
A					
B					
C					
D					
E					
F					
G					
H					
I					
J					
K					
L					
M					
N					
O					
P					
Q					
R					
S					
T					
U					
V					
W					
X					
Y					
Z					

LITHOLOGY				TOPOGRAPHY	
Substrate (3)				Slope Percent	Site Morphology (1)
not identified	limestone	coarse-basic	0	flat	
unconsolidated	tuff	fine-acidic	1	crest	
gravel	breccia	fine-intermediate	2	hillock	
sand	greywacke	fine-basic	3	ridge	
silt	arkose	serpentine	4	upper slope	
clay	dolomite	gabbro	5	midslope	
organic material	calcrete	dolerite	6	simple slope	
alluvium	aeolianite	diorite	7	lower slope	
colluvium	chert	syenite	8	open depression	
lacustrine	jasper	granodiorite	9	closed depression	
aeolian	metamorphic	adamellite			
marine	gneiss	granite			
calcareous sand	schist/phyllite	aplite			
fill	slate	quartz porphyry			
mud	hornfels	basalt			
till	quartzite	andesite			
sedimentary	greenstone	trachyte			
shale	amphibolite	ryholite			
siltstone/mudstone	marble	obsidian			
sandstone-quartz	igneous	scoria			
sandstone-lithic	coarse-acidic	ash			
conglomerate	coarse-intermediate	agglomerate			
		other			

HYDROLOGY	
Profile Drainage (1)	Permeability (1)
very poorly drained	very slowly permeable
poorly drained	slowly permeable
imperfectly drained	moderately permeable
mod. well-drained	highly permeable
well-drained	
rapidly drained	

SITE FIELD NOTES	
Photo file name/s:	

SITE CONDITION	
Site Disturbance(s) (2)	Ground Cover %
natural disturbance	
no effective disturbance	
limited clearing	
extensive clearing	
cleared, no cultivation	
occasional cultivation	
rainfed cultivation	
irrigated cultivation	
highly disturbed	

Surface Condition	
Current (2)	Expected Wet (2) Dry (2)
cracked	
self-mulched	
loose	
soft	
firm	
hardset	
surface crust	
trampled	
poached	
recently cultivated	
water repellent	
gravelly	
other	



NSW SOIL AND LAND INFORMATION SYSTEM

Please MARK LIKE THIS ONLY:
☐ ☒ ☐ ☐
• Use 2B pencil
• No pen or biro
• Fully erase mistakes
• Make no stray marks
• Numbers in () show max. entries allowed

Please do not mark this space.

4641

cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH	LAYER NOTES				Field pH Test Method (1)								
	Lower	Horizon	Moist Munsell		Dry Munsell	(1 per layer)	1					Raupach test strip								
2												pH meter								
3												HCI (1)								
4												no effervescence								
5												audible/slight efferv.								
6												strong effervescence								
7												Boundary Distinctiveness								
8												(1 per layer) 1 2 3 4 5								
9												not evident								
10												sharp (<5 mm)								
11												abrupt (5-20 mm)								
12												clear (20-50 mm)								
13												gradual (50-100 mm)								
14												diffuse (>100 mm)								
15												STRUCTURE								
16												Grade of Pedality (1) 1 2 3 4 5								
17												single-grained								
18												massive								
19												weak pedality								
20												moderate pedality								
21												strong pedality								
22												Fabric (1) 1 2 3 4 5								
23												sandy								
24												earthy								
25												rough-faced peds								
26												smooth-faced peds								
27												Dominant (1) 1 2 3 4 5								
28												Ped Shape								
29												Sub-dominant (1) 1 2 3 4 5								
30												platy								
31												lenticular								
32												prismatic								
33												columnar								
34												angular blocky								
35												sub-ang. blocky								
36												polyhedral								
37												granular								
38												crumb								
39												round								
40												Dominant (1) 1 2 3 4 5								
41												Ped Size								
42												Sub-dominant (1) 1 2 3 4 5								
43												<2 mm								
44												2-5 mm								
45												5-10 mm								
46												10-20 mm								
47												20-50 mm								
48												50-100 mm								
49												100-200 mm								
50												200-500 mm								
51												> 500 mm								
52												SEGREGATIONS								
53												Type (1 per layer) 1 2 3 4 5								
54												not evident								
55												calcareous								
56												gypseous								
57												manganiferous								
58												ferruginous								
59												ferromanganiferous								
60												organic								
61												not identified								
62												other								
63												Amount (1 per layer) 1 2 3 4 5								
64												none								
65												very few (<2%)								
66												few (2-10%)								
67												common (10-20%)								
68												many (20-50%)								
69												abundant (>50%)								
70												Strength (1 per layer) 1 2 3 4 5								
71												weak								
72												strong								
73												Form (1 per layer) 1 2 3 4 5								
74												soft segregations								
75												nodules								
76												fragments								
77												crystals								
78												veins								
79												concretions								
80												root linings								
81												tubules								
82												Size (1 per layer) 1 2 3 4 5								
83												fine (<2 mm)								
84												fine (2-6 mm)								
85												medium (6-20 mm)								
86												coarse (20-60 mm)								
87												v coarse (60-200 mm)								
88												ext coarse (>200 mm)								
89												Soil Water Status (1 each per layer) 1 2 3 4 5								
90												dry								
91												mod. moist								
92												moist								
93												wet								
94												TEXTURE (1 each per layer)								
95												Texture Grade 1 2 3 4 5								
96												sand								
97												loamy sand								
98												clayey sand								
99												sandy loam								
100												loam								
101												silty loam								
102												sandy clay loam								
103												clay loam								
104												clay loam sandy								
105												silty clay loam								
106												sandy clay								
107												clay								
108												fibric peat								
109												hemic peat								
110												sapric peat								
111												Sand Fraction 1 2 3 4 5								
112												coarse								
113												fine								
114												Clay Fraction 1 2 3 4 5								
115												light								
116												medium								
117												medium heavy								
118												heavy								
119												Substrate								
120												Upper								
121												(3 per layer) 1 2 3 4 5								
122												Type (1 per layer) Sur 1 2 3 4 5								
123												not evident								
124												not identified								
125												as substrate								
126												as rock outcrop								
127												as parent material								
128												quartz								
129												feldspar								
130												ironstone								
131												silstone								
132												bauxite								
133												shells								
134												charcoal								
135												pumice								
136												opalised wood								
137												other								
138												Amount (1 per layer) Sur. 1 2 3 4 5								
139												very few (<2%)								
140												few (2-10%)								
141												common (10-20%)								
142												many (20-50%)								
143												abundant (50-90%)								
144												very abundant (>90%)								
145												Size (1 per layer) Sur. 1 2 3 4 5								
146												fine gravel (2-6 mm)								
147												gravel (6-20 mm)								
148												coarse gravel (20-60 mm)								
149												cobble (60-200 mm)								
150												stones (200-600 mm)								
151												boulders (>600 mm)								
152												Contrast 1 2 3 4 5								
153												faint								
154												distinct								
155												prominent								

SURVEY TITLE: R I X S C R E E K B S A L

SITE LOCATION: S O U T H O F D A M

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	1
3	3	3	3	3	3	both profile & site	1
4	4	4	4	4	4	Nature of Exposure (2)	1
5	5	5	5	5	5	auger	1
6	6	6	6	6	6	pit	1
7	7	7	7	7	7	batter	1
8	8	8	8	8	8	gully	1
9	9	9	9	9	9	core sample	1
10	10	10	10	10	10	other	1

Potential BSAL? (1)		Site type (1)		BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD			
yes	1	checked	1				
no	2	detailed	2				
		exclusion	3				

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	foredune	sink hole/doline
O	rainforest	bank	cut face	pan/playa	stream channel
SO	wet sclerophyll forest	bar	cut-over surface	pediment	streambed
B	dry sclerophyll forest	beach	dam	hillcrest	summit surface
GG	woodland grass u'storey	beach ridge	drainage depression	hillslope	swale
S	woodland shrub u'storey	bench	dune	lagoon	swamp
SG	tall shrubland	berm	embankment	lake	talus
A	low shrubland	blow-out	estuary	landslide	tidal creek
H	heath	channel bench	fan	levee	tidal flat
B	grassland/herbland	cirque	fill top	lunette	tor
E	swamp complex	cliff	flood-out	maar	trench
N	littoral complex			mound	valley flat
W	no vegetation			scroll	
C					

LITHOLOGY				TOPOGRAPHY	
Growth Forms (4)		Substrate (3)		Slope Percent	Site Morphology (1)
tree	not identified	limestone	coarse-basic	1-10	flat
tree mallee	unconsolidated	tuff	fine-acidic	11-20	crest
shrub	gravel	breccia	fine-intermediate	21-30	hillock
mallee shrub	sand	greywacke	fine-basic	31-40	ridge
heath shrub	silt	arkose	serpentine	41-50	upper slope
chenopod shrub	clay	dolomite	gabbro	51-60	midslope
hummock grass	organic material	calcrete	dolerite	61-70	simple slope
tussock grass	alluvium	aeolianite	diorite	71-80	lower slope
sod grass	colluvium	chert	syenite	81-90	open depression
sedge	lacustrine	jasper	granodiorite	91-100	closed depression
rush	aeolian	metamorphic	adamellite		
forb	marine	gneiss	granite	Slope Measurement Method (1)	Slope Morphology (1)
fern/cycad	calcareous sand	schist/phyllite	aplite	inclinometer	waxing
moss	fill	slate	quartz porphyry	Abney level	waning
lichen	mud	hornfels	basalt	total station	maximal
liverwort	till	quartzite	andesite	RTK GPS	minimal
vine	sedimentary	greenstone	trachyte	LIDAR	Aspect (1)
	shale	amphibolite	rhyolite	Microrelief Type (1)	
	siltstone/mudstone	marble	obsidian	none	
	sandstone-quartz	igneous	scoria	normal gilgai	
	sandstone-lithic	coarse-acidic	ash	crabhole gilgai	
	conglomerate	coarse-intermediate	agglomerate	linear gilgai	
			other	lattice gilgai	
				melonhole gilgai	
				other	

LAND USE (1)		HYDROLOGY	
national/state parks	affinity with	Profile Drainage (1)	Permeability (1)
timber/scrub/unused	volun./native pasture	very poorly drained	very slowly permeable
logged native forest	improved pasture	poorly drained	slowly permeable
hardwood plantation	cropping	imperfectly drained	moderately permeable
	orchard/vineyard	mod. well-drained	highly permeable
	vegetables/flowers	well-drained	
	urban	rapidly drained	
	industrial		
	quarry/mining		
	other		

SITE CONDITION		Surface Condition		Expected	
Site Disturbance(s) (2)	Ground Cover %	Current (2)	Wet (2)	Dry (2)	
natural disturbance		cracked			
no effective disturbance		self-mulched			
limited clearing		loose			
extensive clearing		soft			
cleared, no cultivation		firm			
occasional cultivation		hardset			
rainfed cultivation		surface crust			
irrigated cultivation		trampled			
highly disturbed		poached			
		recently cultivated			
		water repellent			
		gravelly			
		other			

SITE FIELD NOTES	
Photo file name/s:	



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 • Use 2B pencil
 • No pen or biro
 • Fully erase mistakes
 • Make no stray marks
 • Numbers in () show max. entries allowed

Please do not mark this space.

4626

cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH	LAYER NOTES				Field pH Test Method (1)								
	Lower	Horizon	Moist Munsell		Dry Munsell		(1 per layer)	1				Raupach test strip								
2												pH meter								
3	1											HCl (2)								
4												no effervescence								
5												audible/slight efferv.								
6												strong effervescence								
7												Boundary Distinctiveness								
8												(1 per layer) 1 2 3 4 5								
9												not evident								
10												sharp (<5 mm)								
11												abrupt (5-20 mm)								
12												clear (20-50 mm)								
13												gradual (50-100 mm)								
14												diffuse (>100 mm)								
15	2											STRUCTURE								
16												Grade of Pedality (1) 1 2 3 4 5								
17												single-grained								
18												massive								
19												weak pedality								
20												moderate pedality								
21												strong pedality								
22												Fabric (1) 1 2 3 4 5								
23												sandy								
24												earthy								
25												rough-faced peds								
26												smooth-faced peds								
27												Dominant (1) 1 2 3 4 5								
28												Ped Shape								
29												Sub-dominant (1) 1 2 3 4 5								
30												platy								
31												lenticular								
32												prismatic								
33												columnar								
34												angular blocky								
35												sub-ang. blocky								
36												polyhedral								
37												granular								
38												crumb								
39												round								
40												Dominant (1) 1 2 3 4 5								
41												Ped Size								
42												Sub-dominant (1) 1 2 3 4 5								
43												<2 mm								
44												2-5 mm								
45												5-10 mm								
46												10-20 mm								
47												20-50 mm								
48												50-100 mm								
49												100-200 mm								
50												200-500 mm								
51												> 500 mm								
52												SEGREGATIONS								
53												Soil Water Status (1 each per layer)								
54												Type (1 per layer) 1 2 3 4 5								
55												dry								
56												mod. moist								
57												moist								
58												wet								
59												TEXTURE								
60												(1 each per layer)								
61												Texture Grade 1 2 3 4 5								
62												sand								
63												loamy sand								
64												clayey sand								
65												sandy loam								
66												loam								
67												silty loam								
68												sandy clay loam								
69												clay loam								
70												clay loam sandy								
71												sandy clay								
72												silty clay								
73												clay								
74												Amount (1 per layer) 1 2 3 4 5								
75												none								
76												very few (<2%)								
77												few (2-10%)								
78												common (10-20%)								
79												many (20-50%)								
80												abundant (>50%)								
81												Strength (1 per layer) 1 2 3 4 5								
82												weak								
83												strong								
84												Form (1 per layer) 1 2 3 4 5								
85												soft segregations								
86												nodules								
87												fragments								
88												crystals								
89												veins								
90												concretions								
91												root linings								
92												tubules								
93												Size (1 per layer) 1 2 3 4 5								
94												fine (<2 mm)								
95												medium (2-6 mm)								
96												coarse (6-20 mm)								
97												v coarse (20-60 mm)								
98												ext coarse (>60 mm)								
99												Substrate								
100												Upper								
101												Sample Taken								
102												COARSE FRAGMENTS								
103												Type (1 per layer) Sur 1 2 3 4 5								
104												not evident								
105												not identified								
106												as substrate								
107												as rock outcrop								
108												as parent material								
109												quartz								
110												feldspar								
111												silcrete								
112												ironstone								
113												bauxite								
114												shells								
115												charcoal								
116												pumice								
117												opalised wood								
118												other								
119												Amount (1 per layer) Sur 1 2 3 4 5								
120												very few (<2%)								
121												few (2-10%)								
122												common (10-20%)								
123												many (20-50%)								
124												abundant (50-90%)								
125												very abundant (>90%)								
126												Size (1 per layer) Sur 1 2 3 4 5								
127												fine gravel (2-6 mm)								
128												gravel (6-20 mm)								
129												coarse gravel (20-60 mm)								
130												cobbles (60-200 mm)								
131												stones (200-600 mm)								
132												boulders (>600 mm)								
133												Contrast 1 2 3 4 5								
134												faint								
135												distinct								
136												prominent								

SURVEY TITLE: RIXS CREEK BSAL

SITE LOCATION: OPEN Paddock

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	1
3	3	3	3	3	3	both profile & site	1
4	4	4	4	4	4	Nature of Exposure (2)	1
5	5	5	5	5	5	auger	1
6	6	6	6	6	6	pit	1
7	7	7	7	7	7	batter	1
8	8	8	8	8	8	gully	1
9	9	9	9	9	9	core sample	1
10	10	10	10	10	10	other	1

Potential BSAL? (1)		Site type (1)		BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD	
yes	1	checked	1		
no	2	detailed	2		
		exclusion	3		

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)	
A.S.C.	Vegetation Community (1)	alcove	1
O	unknown	cone	2
	rainforest	crater	3
	wet sclerophyll forest	cut face	4
SO	dry sclerophyll forest	bar	5
	woodland grass u'storey	cut-over surface	6
	woodland shrub u'storey	beach	7
GG	tall shrubland	beach ridge	8
	low shrubland	drainage depression	9
SG	heath	bench	10
	grassland/herbland	berm	11
	swamp complex	embankment	12
	littoral complex	dune	13
	no vegetation	estuary	14
		channel bench	15
		fill fan	16
		cliff	17
		circque	18
		fill top	19
		flood-out	20
		footslope	21
		foredune	22
		gully	23
		hillcrest	24
		hillslope	25
		lagoon	26
		lake	27
		landslide	28
		levee	29
		lunette	30
		maar	31
		mound	32
		ox-bow	33
		pan/playa	34
		pediment	35
		pit	36
		plain	37
		prior stream	38
		rock flat	39
		rock platform	40
		scald	41
		scarp	42
		scree	43
		scroll	44
		sink hole/doline	45
		stream channel	46
		streambed	47
		summit surface	48
		swale	49
		swamp	50
		talus	51
		tidal creek	52
		tidal flat	53
		tor	54
		trench	55
		valley flat	56

LITHOLOGY		TOPOGRAPHY	
Growth Forms (4)	Substrate (3)	Slope Percent	Site Morphology (1)
tree	not identified	1	flat
tree mallee	unconsolidated	2	crest
shrub	gravel	3	hillock
mallee shrub	sand	4	ridge
heath shrub	silt	5	upper slope
chenopod shrub	clay	6	midslope
hummock grass	organic material	7	simple slope
tussock grass	alluvium	8	lower slope
sod grass	colluvium	9	open depression
sedge	lacustrine	10	closed depression
rush	aeolian	11	
forb	marine	12	
fern/cycad	calcareous sand	13	
moss	fill	14	
lichen	mud	15	
liverwort	till	16	
vine	sedimentary	17	
	shale	18	
	siltstone/mudstone	19	
	sandstone-quartz	20	
	sandstone-lithic	21	
	conglomerate	22	
	coarse-intermediate	23	
	limestone	24	
	tuff	25	
	breccia	26	
	greywacke	27	
	arkose	28	
	dolomite	29	
	calcrete	30	
	aeolianite	31	
	chert	32	
	jasper	33	
	metamorphic	34	
	gneiss	35	
	schist/phyllite	36	
	slate	37	
	hornfels	38	
	quartzite	39	
	greenstone	40	
	amphibolite	41	
	marble	42	
	igneous	43	
	coarse-acidic	44	
	coarse-intermediate	45	
	coarse-basic	46	
	fine-acidic	47	
	fine-intermediate	48	
	fine-basic	49	
	serpentine	50	
	gabbro	51	
	dolerite	52	
	diorite	53	
	syenite	54	
	granodiorite	55	
	adamellite	56	
	granite	57	
	aplite	58	
	quartz porphyry	59	
	basalt	60	
	andesite	61	
	trachyte	62	
	ryholite	63	
	obsidian	64	
	scoria	65	
	ash	66	
	agglomerate	67	
	other	68	

HYDROLOGY		SLOPE MEASUREMENT	
Profile Drainage (1)	Permeability (1)	Method (1)	Microrelief Type (1)
very poorly drained	very slowly permeable	inclinometer	none
poorly drained	slowly permeable	Abney level	normal gilgai
imperfectly drained	moderately permeable	total station	crabhole gilgai
mod. well-drained	highly permeable	RTK GPS	linear gilgai
well-drained		LIDAR	lattice gilgai
rapidly drained			melonhole gilgai
			other

SITE FIELD NOTES	
Photo file name/s:	

SITE CONDITION		Surface Condition	
Site Disturbance(s) (2)	Ground Cover %	Current (2)	Expected Wet (2) Dry (2)
natural disturbance	1	cracked	2
no effective disturbance	2	self-mulched	3
limited clearing	3	loose	4
extensive clearing	4	soft	5
cleared, no cultivation	5	firm	6
occasional cultivation	6	hardset	7
rainfed cultivation	7	surface crust	8
irrigated cultivation	8	trampled	9
highly disturbed	9	poached	10
		recently cultivated	11
		water repellent	12
		gravelly	13
		other	14



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cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH	LAYER NOTES				Field pH Test Method (1)								
	Lower	Horizon	Moist Munsell		Dry Munsell		(1 per layer)	1				Raupach test strip								
2												pH meter								
3												HCI (2)								
4												no effervescence								
5												audible/slight efferv.								
6												strong effervescence								
7												Boundary Distinctiveness								
8												(1 per layer) 1 2 3 4 5								
9												not evident								
10												sharp (<5 mm)								
11												abrupt (5-20 mm)								
12												clear (20-50 mm)								
13												gradual (50-100 mm)								
14												diffuse (>100 mm)								
15												STRUCTURE								
16												Grade of Pedality (1) 1 2 3 4 5								
17												single-grained								
18												massive								
19												weak pedality								
20												moderate pedality								
21												strong pedality								
22												Fabric (1) 1 2 3 4 5								
23												sandy								
24												earthy								
25												rough-faced peds								
26												smooth-faced peds								
27												Dominant (1) 1 2 3 4 5								
28												Ped Shape								
29												Sub-dominant (1) 1 2 3 4 5								
30												platy								
31												lenticular								
32												prismatic								
33												columnar								
34												angular blocky								
35												sub-ang. blocky								
36												polyhedral								
37												granular								
38												crumb								
39												round								
40												Dominant (1) 1 2 3 4 5								
41												Ped Size								
42												Sub-dominant (1) 1 2 3 4 5								
43												<2 mm								
44												2-5 mm								
45												5-10 mm								
46												10-20 mm								
47												20-50 mm								
48												50-100 mm								
49												100-200 mm								
50												200-500 mm								
51												> 500 mm								
52												SEGREGATIONS								
53												Soil Water Status (1 each per layer)								
54												Type (1 per layer) 1 2 3 4 5								
55												dry								
56												mod. moist								
57												moist								
58												wet								
59												TEXTURE								
60												(1 each per layer)								
61												Texture Grade 1 2 3 4 5								
62												sand								
63												loamy sand								
64												clayey sand								
65												sandy loam								
66												loam								
67												silty loam								
68												sandy clay loam								
69												clay loam								
70												clay loam sandy								
71												silty clay loam								
72												sandy clay								
73												silty clay								
74												clay								
75												fibric peat								
76												hemic peat								
77												sapric peat								
78												Sand Fraction 1 2 3 4 5								
79												coarse								
80												fine								
81												Clay Fraction 1 2 3 4 5								
82												light								
83												medium								
84												medium heavy								
85												heavy								
86												Size (1 per layer) 1 2 3 4 5								
87												fine (<2 mm)								
88												medium (2-6 mm)								
89												coarse (6-20 mm)								
90												v coarse (20-60 mm)								
91												ext coarse (>60 mm)								
92												COARSE FRAGMENTS								
93												Type (1 per layer) Sur 1 2 3 4 5								
94												not evident								
95												not identified								
96												as substrate								
97												as rock outcrop								
98												as parent material								
99												quartz								
100												feldspar								
101												ironstone								
102												silcrete								
103												ironstone								
104												bauxite								
105												shells								
106												charcoal								
107												pumice								
108												opalised wood								
109												other								
110												Amount (1 per layer) Sur. 1 2 3 4 5								
111												very few (<2%)								
112												few (2-10%)								
113												common (10-20%)								
114												many (20-50%)								
115												abundant (50-90%)								
116												very abundant (>90%)								
117												Size (1 per layer) Sur. 1 2 3 4 5								
118												fine gravel (2-6 mm)								
119												gravel (6-20 mm)								
120												coarse gravel (20-60 mm)								
121												cobbles (60-200 mm)								
122												stones (200-600 mm)								
123												boulders (>600 mm)								
124												Contrast 1 2 3 4 5								
125												faint								
126												distinct								
127												prominent								

SURVEY TITLE: R I X S C R E E K B S A L

SITE LOCATION: O P E N P A D D O C K

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	1
3	3	3	3	3	3	both profile & site	1
4	4	4	4	4	4	Nature of Exposure (2)	2
5	5	5	5	5	5	auger	1
6	6	6	6	6	6	pit	4
7	7	7	7	7	7	batter	5
8	8	8	8	8	8	gully	1
9	9	9	9	9	9	core sample	1
10	10	10	10	10	10	other	1

Potential BSAL? (1)		Site type (1)		BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD			
yes	1	checked	1				
no	2	detailed	2				
		exclusion	3				

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	foredune	pan/playa
SO	rainforest	bank	cut face	gully	pediment
D	wet sclerophyll forest	bar	cut-over surface	hilcrest	pit
GG	dry sclerophyll forest	beach	dam	hillslope	plain
S	woodland grass u/storey	beach ridge	drainage depression	lagoon	prior stream
SG	woodland shrub u/storey	bench	dune	lake	rock flat
A	tall shrubland	berm	embankment	landslide	rock platform
H	low shrubland	blow-out	estuary	levee	scald
B	heath	channel bench	fan	lunette	scarp
E	grassland/herbland	cirque	fill top	maar	scree
N	swamp complex	cliff	flood-out	mound	scroll
O	littoral complex				
W	no vegetation				

LITHOLOGY				TOPOGRAPHY	
Growth Forms (4)		Substrate (3)		Slope Percent	Site Morphology (1)
tree	not identified	limestone	coarse-basic	0	flat
tree mallee	unconsolidated	tuff	fine-acidic	1	crest
shrub	gravel	breccia	fine-intermediate	2	hillock
mallee shrub	sand	greywacke	fine-basic	3	ridge
heath shrub	silt	arkose	serpentine	4	upper slope
chenopod shrub	clay	dolomite	gabbro	5	midslope
hummock grass	organic material	calcrete	dolerite	6	simple slope
tussock grass	alluvium	aeolianite	diorite	7	lower slope
sod grass	colluvium	chert	syenite	8	open depression
sedge	lacustrine	jasper	granodiorite	9	closed depression
rush	aeolian	metamorphic	adamellite		
forb	marine	gneiss	granite		
fern/cycad	calcareous sand	schist/phyllite	aplite		
moss	fill	slate	quartz porphyry		
lichen	mud	hornfels	basalt		
liverwort	till	quartzite	andesite		
vine	sedimentary	greenstone	trachyte		
	shale	amphibolite	rhyolite		
	siltstone/mudstone	marble	obsidian		
	sandstone-quartz	igneous	scoria		
	sandstone-lithic	coarse-acidic	ash		
	conglomerate	coarse-intermediate	agglomerate		
			other		

LAND USE (1)		HYDROLOGY	
national/state parks	Identification Method (1)	Profile Drainage (1)	Permeability (1)
timber/scrub/unused	personal assessment	very poorly drained	very slowly permeable
logged native forest	geology map	poorly drained	slowly permeable
hardwood plantation	both assessment & map	imperfectly drained	moderately permeable
softwood plantation	Rock Outcrop % (1)	mod. well-drained	highly permeable
volun./native pasture	nil	well-drained	
improved pasture	>20-30%	rapidly drained	
cropping	<2%		
orchard/vineyard	2-10%		
vegetables/flowers	>30-50%		
urban	>50%		
industrial			
quarry/mining			
other			

SITE CONDITION		Surface Condition		Slope Morphology (1)	
Site Disturbance(s) (2)	Ground Cover %	Current (2)	Expected Wet (2) Dry (2)	Slope Measurement Method (1)	Aspect (1)
natural disturbance		cracked	2	inclinometer	waxing
no effective disturbance		self-mulched	3	Abney level	waning
limited clearing		loose	4	total station	maximal
extensive clearing		soft	5	RTK GPS	minimal
cleared, no cultivation		firm	6	LIDAR	
occasional cultivation		hardset	7		
rainfed cultivation		surface crust	8		
irrigated cultivation		trampled	9		
highly disturbed		poached	10		
		recently cultivated	11		
		water repellent	12		
		gravely	13		
		other	14		

SITE FIELD NOTES	
Photo file name/s:	



NSW SOIL AND LAND INFORMATION SYSTEM

Please MARK LIKE THIS ONLY:
☐ ☒ ☐ ☐
 • Use 2B pencil
 • No pen or biro
 • Fully erase mistakes
 • Make no stray marks
 • Numbers in () show max. entries allowed

Please do not mark this space.

4645

[illegible]

SITE LOCATION: OPEN Paddock

PROFILE MAP DETAILS										SURVEY DETAILS											
Profile No.	Map Sheet No.	Eastings					Northings					Described By	Profile Date	Photo Taken (1)	No. of Layers						
1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1					
2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2	2					
3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3	3					
4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4					
5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5					
6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6	6					
7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7	7					
8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8	8					
9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9					
Potential BSAL? (1)										Site type (1)		BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD									
yes ☐ no ☐										checked ☐ detailed ☐ exclusion ☐											
SOIL TYPE		VEGETATION		LANDFORM ELEMENT (1)																	
A.S.C.		Vegetation Community (1)		alcove ☐ cone ☐ footslope ☐ ox-bow ☐ sink hole/doline ☐ backplain ☐ crater ☐ foredune ☐ pan/playa ☐ stream channel ☐ bank ☐ cut face ☐ gully ☐ pediment ☐ streambed ☐ bar ☐ cut-over surface ☐ hillcrest ☐ pit ☐ summit surface ☐ beach ☐ dam ☐ hillslope ☐ plain ☐ swale ☐ beach ridge ☐ drainage depression ☐ lagoon ☐ prior stream ☐ swamp ☐ bench ☐ dune ☐ lake ☐ rock flat ☐ talus ☐ berm ☐ embankment ☐ landslide ☐ rock platform ☐ tidal creek ☐ blow-out ☐ estuary ☐ levee ☐ scald ☐ tidal flat ☐ channel bench ☐ fan ☐ lunette ☐ scarp ☐ tor ☐ grassland/herbland ☐ fill top ☐ maar ☐ scree ☐ trench ☐ swamp complex ☐ flood-out ☐ mound ☐ scroll ☐ valley flat ☐ cliff ☐																	
O		D		not identified ☐ limestone ☐ coarse-basic ☐ unconsolidated ☐ tuff ☐ fine-acidic ☐ gravel ☐ breccia ☐ fine-intermediate ☐ sand ☐ greywacke ☐ fine-basic ☐ silt ☐ arkose ☐ serpentine ☐ clay ☐ dolomite ☐ gabbro ☐ organic material ☐ calcareous sand ☐ dolerite ☐ alluvium ☐ aeolianite ☐ diorite ☐ colluvium ☐ chert ☐ syenite ☐ lacustrine ☐ jasper ☐ granodiorite ☐ aeolian ☐ metamorphic ☐ adamellite ☐ marine ☐ gneiss ☐ granite ☐ calcareous sand ☐ schist/phyllite ☐ aplite ☐ fill ☐ slate ☐ quartz porphyry ☐ mud ☐ hornfels ☐ basalt ☐ till ☐ quartzite ☐ andesite ☐ sedimentary ☐ greenstone ☐ trachyte ☐ shale ☐ amphibolite ☐ rhyolite ☐ siltstone/mudstone ☐ marble ☐ obsidian ☐ sandstone-quartz ☐ igneous ☐ scoria ☐ sandstone-lithic ☐ coarse-acidic ☐ ash ☐ conglomerate ☐ coarse-intermediate ☐ agglomerate ☐ other ☐																	
SO		A		Slope Percent ☐ Site Morphology (1) ☐																	
GG		H		Slope Measurement Method (1) ☐ Slope Morphology (1) ☐																	
SG		C		Microrelief Type (1) ☐ Depth (1) & Extent (1) ☐																	
FAMILY		E		Aspect (1) ☐																	
C		V		Identification Method (1) ☐ HYDROLOGY ☐																	
G.S.G.		A		Profile Drainage (1) ☐ Permeability (1) ☐																	
A		B		Rock Outcrop % (1) ☐ SITE FIELD NOTES ☐																	
B		C		Surface Condition ☐																	
C		D		Site Condition ☐																	
D		E		Site Disturbance(s) (2) ☐																	
E		F		Ground Cover % ☐																	
F		G		Site Disturbance(s) (2) ☐																	
G		H		Ground Cover % ☐																	
H		I		Site Disturbance(s) (2) ☐																	
I		J		Ground Cover % ☐																	
J		K		Site Disturbance(s) (2) ☐																	
K		L		Ground Cover % ☐																	
L		M		Site Disturbance(s) (2) ☐																	
M		N		Ground Cover % ☐																	
N		O		Site Disturbance(s) (2) ☐																	
O		P		Ground Cover % ☐																	
P		Q		Site Disturbance(s) (2) ☐																	
Q		R		Ground Cover % ☐																	
R		S		Site Disturbance(s) (2) ☐																	
S		T																			

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Lower		Horizon										Moist Munsell					Dry Munsell					(1 per layer)		1										Raupach test strip										pH meter																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																						
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SURVEY TITLE: RIXS CREEK BSAL

SITE LOCATION: OPEN Paddock

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	1
3	3	3	3	3	3	both profile & site	1
4	4	4	4	4	4	Nature of Exposure (2)	2
5	5	5	5	5	5	auger	1
6	6	6	6	6	6	pit	1
7	7	7	7	7	7	batter	1
8	8	8	8	8	8	gully	1
9	9	9	9	9	9	core sample	1
10	10	10	10	10	10	other	1

Potential BSAL? (1)	Site type (1)	BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD	
yes ☐ no ☒	checked ☐ detailed ☒ exclusion ☐		

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)	
A.S.C.	Vegetation Community (1)	alcove ☐	cone ☐
O	unknown ☐	backplain ☐	crater ☐
H	rainforest ☐	bank ☐	cut face ☐
A	wet sclerophyll forest ☐	bar ☐	cut-over surface ☐
B	dry sclerophyll forest ☐	beach ☐	dam ☐
GG	woodland grass u/storey ☐	beach ridge ☐	drainage depression ☐
A	woodland shrub u/storey ☐	bench ☐	dune ☐
H	tall shrubland ☐	berm ☐	embankment ☐
SG	low shrubland ☐	blow-out ☐	estuary ☐
C	heath ☐	channel bench ☐	fan ☐
D	grassland/herbland ☐	cirque ☐	fill top ☐
B	swamp complex ☐	cliff ☐	flood-out ☐
E	littoral complex ☐		
N	no vegetation ☐		
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1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH	LAYER NOTES				Field pH Test Method (1)								
	Lower	Horizon	Moist Munsell		Dry Munsell	(1 per layer)	1					Rauapach test strip pH meter								
2												HCl (1)								
												no effervescence								
												audible/slight efferv.								
												strong effervescence								
3												Boundary Distinctiveness								
												(1 per layer) 1 2 3 4 5								
												not evident								
												sharp (<5 mm)								
												abrupt (5-20 mm)								
												clear (20-50 mm)								
												gradual (50-100 mm)								
												diffuse (>100 mm)								
4												STRUCTURE								
												Grade of Pedality (1) 1 2 3 4 5								
												single-grained								
												massive								
												weak pedality								
												moderate pedality								
												strong pedality								
5												Fabric (1) 1 2 3 4 5								
												sandy								
												earthy								
												rough-faced peds								
												smooth-faced peds								
6												Dominant (1) 1 2 3 4 5								
												Ped Shape								
												Sub-dominant (1) 1 2 3 4 5								
												platy								
												lenticular								
												prismatic								
												columnar								
												angular blocky								
												sub-ang. blocky								
												polyhedral								
												granular								
												crumb								
												round								
7												Dominant (1) 1 2 3 4 5								
												Ped Size								
												Sub-dominant (1) 1 2 3 4 5								
												<2 mm								
												2-5 mm								
												5-10 mm								
												10-20 mm								
												20-50 mm								
												50-100 mm								
												100-200 mm								
												200-500 mm								
												> 500 mm								
8												SEGREGATIONS								
												Soil Water Status (1 each per layer)								
												Type (1 per layer) 1 2 3 4 5								
												dry								
												mod. moist								
												moist								
												wet								
												manganiferous								
												ferruginous								
												ferromanganiferous								
												organic								
												not identified								
												other								
												Amount (1 per layer) 1 2 3 4 5								
												none								
												very few (<2%)								
												few (2-10%)								
												common (10-20%)								
												many (20-50%)								
												abundant (>50%)								
												Strength (1 per layer) 1 2 3 4 5								
												weak								
												strong								
												Form (1 per layer) 1 2 3 4 5								
												soft segregations								
												nodules								
												fragments								
												crystals								
												veins								
												concretions								
												root linings								
												tubules								
												Size (1 per layer) 1 2 3 4 5								
												fine (<2 mm)								
												medium (2-6 mm)								
												coarse (6-20 mm)								
												v coarse (20-60 mm)								
												ext coarse (>60 mm)								
9												SUBSTRATE								
												Upper								
												Estimated Effective Rooting Depth (m)								
												Sample Taken (3 per layer) 1 2 3 4 5								
												Type (1 per layer) Sur 1 2 3 4 5								
												not evident								
												not identified								
												as substrate								
												as rock outcrop								
												as parent material								
												quartz								
												feldspar								
												ironstone								
												silstone								
												bauxite								
												shells								
												charcoal								
												pumice								
												opalised wood								
												other								
												Amount (1 per layer) Sur. 1 2 3 4 5								
												very few (<2%)								
												few (2-10%)								
												common (10-20%)								
												many (20-50%)								
												abundant (50-90%)								
												very abundant (>90%)								
												Size (1 per layer) Sur. 1 2 3 4 5								
												fine gravel (2-6 mm)								
												gravel (6-20 mm)								
												coarse gravel (20-60 mm)								
												cobbles (60-200 mm)								
												stones (200-600 mm)								
												boulders (>600 mm)								
												COLOUR								
												Dominant (1) 1 2 3 4 5								
												Abundance 1 2 3 4 5								
												not evident								
												<2%								
												2-10%								
												10-20%								
												20-50%								
												COLOUR								
												1 2 3 4 5								
												dark								
												red								
												orange								
												yellow								
												brown								
												pale								
												grey								
												gley								
												Contrast 1 2 3 4 5								
												faint								
												distinct								
												prominent								

SURVEY TITLE: R I X S C R E E K B S A L

SITE LOCATION: O P E N P A D D O C K

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
2	2	2	2	2	2	site	2
3	3	3	3	3	3	both profile & site	3
4	4	4	4	4	4	Nature of Exposure (2)	4
5	5	5	5	5	5	auger	5
6	6	6	6	6	6	pit	6
7	7	7	7	7	7	batter	7
8	8	8	8	8	8	gully	8
9	9	9	9	9	9	core sample	9
10	10	10	10	10	10	other	10

Potential BSAL? (1)		Site type (1)		BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD	
yes	1	checked	1		
no	2	detailed	2		
		exclusion	3		

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	loredune	pan/playa
SO	rainforest	bank	cut face	gully	pediment
A	wet sclerophyll forest	bar	cut-over surface	hillcrest	pit
B	dry sclerophyll forest	beach	dam	hillslope	swale
E	woodland grass u/storey	beach ridge	drainage depression	lagoon	prior stream
GG	woodland shrub u/storey	bench	dune	lake	rock flat
S	tall shrubland	berm	embankment	landslide	rock platform
SG	low shrubland	blow-out	estuary	levee	scald
A	heath	channel bench	fan	lunette	scarp
H	grassland/herbland	cirque	fill top	maar	scree
C	swamp complex	cliff	flood-out	mound	scroll
F	littoral complex				
E	no vegetation				
N					
O					
W					
C					
G.S.G.					
A					
B					
C					
D					
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X					
Y					
Z					

LITHOLOGY				TOPOGRAPHY	
Growth Forms (4)		Substrate (3)		Slope Percent	Site Morphology (1)
tree	not identified	limestone	coarse-basic	1	flat
tree mallee	unconsolidated	tuff	fine-acidic	2	crest
shrub	gravel	breccia	fine-intermediate	3	hillock
mallee shrub	sand	greywacke	fine-basic	4	ridge
heath shrub	silt	arkose	serpentine	5	upper slope
chenopod shrub	clay	dolomite	gabbro	6	midslope
hummock grass	organic material	calcrete	dolerite	7	simple slope
tussock grass	alluvium	aeolianite	diorite	8	lower slope
sod grass	colluvium	chert	syenite	9	open depression
sedge	lacustrine	jasper	granodiorite	10	closed depression
rush	aeolian	metamorphic	adamellite		
forb	marine	gneiss	granite		
fern/cycad	calcareous sand	schist/phyllite	aplite		
moss	fill	slate	quartz porphyry		
lichen	mud	hornfels	basalt		
liverwort	till	quartzite	andesite		
vine	sedimentary	greenstone	trachyte		
	shale	amphibolite	rhyolite		
	siltstone/mudstone	marble	obsidian		
	sandstone-quartz	igneous	scoria		
	sandstone-lithic	coarse-acidic	ash		
	conglomerate	coarse-intermediate	agglomerate		
			other		

LAND USE (1)		HYDROLOGY	
national/state parks	Identification Method (1)	Profile Drainage (1)	Permeability (1)
timber/scrub/unused	personal assessment	very poorly drained	very slowly permeable
logged native forest	geology map	poorly drained	slowly permeable
hardwood plantation	both assessment & map	imperfectly drained	moderately permeable
softwood plantation	Rock Outcrop % (1)	mod. well-drained	highly permeable
volun./native pasture	nil	well-drained	
improved pasture	<2%	rapidly drained	
cropping	>20-30%		
orchard/vineyard	>30-50%		
vegetables/flowers	2-10%		
urban	>10-20%		
industrial			
quarry/mining			
other			

SITE CONDITION		Surface Condition		Slope Measurement Method (1)		Slope Morphology (1)	
Site Disturbance(s) (2)	Ground Cover %	Current (2)	Expected Wet (2) Dry (2)	Method (1)			
natural disturbance		cracked		inclinometer		waxing	
no effective disturbance		self-mulched		Abney level		waning	
limited clearing		loose		total station		maximal	
extensive clearing		soft		RTK GPS		minimal	
cleared, no cultivation		firm		LIDAR			
occasional cultivation		hardset					
rainfed cultivation		surface crust					
irrigated cultivation		trampled					
highly disturbed		poached					
		recently cultivated					
		water repellent					
		gravelly					
		other					

SITE FIELD NOTES	
Photo file name/s:	



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- Fully erase mistakes
- Make no stray marks
- Numbers in () show max. entries allowed

Please do not mark this space.

4632

[illegible]

SITE LOCATION: OPEN Paddock

[illegible]

cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																			
LAYER STATUS		COLOUR (Munsell, 1994)										Field pH	LAYER NOTES										Field pH Test Method (1)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																
Lower		Horizon					Moist Munsell					Dry Munsell					(1 per layer)											Raupach (1) test strip (2) pH meter (2)																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																																											
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SURVEY TITLE: R I X S C R E E K B S A L

SITE LOCATION: T R A C K A L O N G R I D G E

PROFILE MAP DETAILS				SURVEY DETAILS			
Profile No.	Map Sheet No.	Eastings	Northings	Described By	Profile Date	Photo Taken (1)	No. of Layers
1	1	1	1	1	1	profile	1
1	1	1	1	1	1	site	1
2	2	2	2	2	2	both profile & site	1
3	3	3	3	3	3	Nature of Exposure (2)	1
4	4	4	4	4	4	auger	1
5	5	5	5	5	5	pit	1
6	6	6	6	6	6	batter	1
7	7	7	7	7	7	gully	1
8	8	8	8	8	8	core sample	1
9	9	9	9	9	9	other	1

Potential BSAL? (1)	Site type (1)
yes ☐ no ☒	checked ☐ detailed ☒ exclusion ☐

BIOPHYSICAL STRATEGIC AGRICULTURAL LAND SOIL DATA CARD

SOIL TYPE	VEGETATION	LANDFORM ELEMENT (1)			
A.S.C.	Vegetation Community (1)	alcove	cone	footslope	ox-bow
O	unknown	backplain	crater	foredune	pan/playa
H	rainforest	bank	cut face	gully	pediment
A	wet sclerophyll forest	bar	cut-over surface	hillcrest	pit
B	dry sclerophyll forest	beach	dam	hillslope	plain
GG	woodland grass u/storey	beach ridge	drainage depression	lagoon	prior stream
A	woodland shrub u/storey	bench	dune	lake	rock flat
H	tall shrubland	berm	embankment	landslide	rock platform
E	low shrubland	blow-out	estuary	levee	scald
SG	heath	channel bench	fan	lunette	scarp
O	grassland/herbland	cirque	fill top	maar	scree
B	swamp complex	cliff	flood-out	mound	scroll
E	littoral complex				
FAMILY	no vegetation				
L					
O					
W					
C					
G.S.G.					
A					
B					
C					
D					
E					
F					
G					
H					
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R					
S					
T					
U					
V					
W					
X					
Y					
affinity with					

LITHOLOGY		TOPOGRAPHY	
Substrate (3)		Slope Percent	Site Morphology (1)
not identified	limestone	10 20 30	flat
unconsolidated	tuff	1 1 1 1	crest
gravel	breccia	2 2 2 2	hillock
sand	greywacke	3 3 3 3	ridge
silt	arkose	4 4 4 4	upper slope
clay	dolomite	5 5 5 5	midslope
organic material	calcrete	6 6 6 6	simple slope
alluvium	aeolianite	7 7 7 7	lower slope
colluvium	chert	8 8 8 8	open depression
lacustrine	jasper	9 9 9 9	closed depression
aeolian	metamorphic		
marine	gneiss		
calcareous sand	schist/phyllite		
fill	slate		
mud	hornfels		
till	quartzite		
sedimentary	greenstone		
shale	amphibolite		
siltstone/mudstone	marble		
sandstone-quartz	igneous		
sandstone-lithic	coarse-acidic		
conglomerate	coarse-intermediate		

HYDROLOGY	
Profile Drainage (1)	Permeability (1)
very poorly drained	very slowly permeable
poorly drained	slowly permeable
imperfectly drained	moderately permeable
mod. well-drained	highly permeable
well-drained	
rapidly drained	

SITE FIELD NOTES	
Photo file name/s:	

SITE CONDITION	
Site Disturbance(s) (2)	Ground Cover %
natural disturbance	1
no effective disturbance	2
limited clearing	3
extensive clearing	4
cleared, no cultivation	5
occasional cultivation	6
rainfed cultivation	7
irrigated cultivation	8
highly disturbed	9

Surface Condition	
Current (2)	Expected Wet (2) Dry (2)
cracked	1 2
self-mulched	3 4
loose	5 6
soft	7 8
firm	9 10
hardset	11 12
surface crust	13 14
trampled	15 16
poached	17 18
recently cultivated	19 20
water repellent	21 22
gravely	23 24
other	25 26



NSW SOIL AND LAND INFORMATION SYSTEM

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cm	mm	0	10	20	30	40	50	60	70	80	90	100	110	120	130	140	150	160	170	180
1	LAYER STATUS		COLOUR (Munsell, 1994)				Field pH		LAYER NOTES				Field pH Test Method (1)							
	Lower	Horizon	Moist Munsell		Dry Munsell		(1 per layer)		1				Raupach test strip							
2													pH meter							
3													HCl (2)							
4													no effervescence							
5													audible/slight efferv.							
6													strong effervescence							
7													Boundary Distinctiveness							
8													(1 per layer) 1 2 3 4 5							
9													not evident							
10													sharp (<5 mm)							
11													abrupt (5-20 mm)							
12													clear (20-50 mm)							
13													gradual (50-100 mm)							
14													diffuse (>100 mm)							
15													STRUCTURE							
16													Grade of Pedality (1) 1 2 3 4 5							
17													single-grained							
18													massive							
19													weak pedality							
20													moderate pedality							
21													strong pedality							
22													Fabric (1) 1 2 3 4 5							
23													sandy							
24													earthy							
25													rough-faced peds							
26													smooth-faced peds							
27													Dominant (1) 1 2 3 4 5							
28													Ped Shape							
29													Sub-dominant (1) 1 2 3 4 5							
30													platy							
31													lenticular							
32													prismatic							
33													columnar							
34													angular blocky							
35													sub-ang. blocky							
36													polyhedral							
37													granular							
38													crumb							
39													round							
40													Dominant (1) 1 2 3 4 5							
41													Ped Size							
42													Sub-dominant (1) 1 2 3 4 5							
43													<2 mm							
44													2-5 mm							
45													5-10 mm							
46													10-20 mm							
47													20-50 mm							
48													50-100 mm							
49													100-200 mm							
50													200-500 mm							
51													> 500 mm							
52													SEGREGATIONS							
53													Type (1 per layer) 1 2 3 4 5							
54													not evident							
55													calcareous							
56													gypseous							
57													manganiferous							
58													ferruginous							
59													ferromanganiferous							
60													organic							
61													not identified							
62													Amount (1 per layer) 1 2 3 4 5							
63													none							
64													very few (<2%)							
65													few (2-10%)							
66													common (10-20%)							
67													many (20-50%)							
68													abundant (>50%)							
69													Strength (1 per layer) 1 2 3 4 5							
70													weak							
71													strong							
72													Form (1 per layer) 1 2 3 4 5							
73													soft segregations							
74													nodules							
75													fragments							
76													crystals							
77													veins							
78													concretions							
79													root linings							
80													tubules							
81													Size (1 per layer) 1 2 3 4 5							
82													fine (<2 mm)							
83													medium (2-6 mm)							
84													coarse (6-20 mm)							
85													v coarse (20-60 mm)							
86													ext coarse (>80 mm)							
87													Soil Water Status (1 each per layer)							
88													1 2 3 4 5							
89													dry							
90													mod. moist							
91													moist							
92													wet							
93													TEXTURE							
94													(1 each per layer)							
95													Texture Grade 1 2 3 4 5							
96													sand							
97													loamy sand							
98													clayey sand							
99													sandy loam							
100													loam							
101													silty loam							
102													sandy clay loam							
103													clay loam							
104													clay loam sandy							
105													silty clay loam							
106													sandy clay							
107													silty clay							
108													clay							
109													fibric peat							
110													hemic peat							
111													sapric peat							
112													Sand Fraction 1 2 3 4 5							
113													coarse							
114													fine							
115													Clay Fraction 1 2 3 4 5							
116													light							
117													medium							
118													medium heavy							
119													heavy							
120													Contrast 1 2 3 4 5							
121													faint							
122													distinct							
123													prominent							
124													Sample Taken							
125													(3 per layer) 1 2 3 4 5							
126													Type (1 per layer) Sur 1 2 3 4 5							
127													not evident							
128													not identified							
129													as substrate							
130													as rock outcrop							
131													as parent material							
132													quartz							
133													feldspar							
134													silcrete							
135													ironstone							
136													bauxite							
137													shells							
138													charcoal							
139													pumice							
140													opalised wood							
141													other							
142													Amount (1 per layer) Sur 1 2 3 4 5							
143													very few (<2%)							
144													few (2-10%)							
145													common (10-20%)							
146													many (20-50%)							
147													abundant (50-90%)							
148													very abundant (>90%)							
149													Size (1 per layer) Sur 1 2 3 4 5							
150													fine gravel (2-6 mm)							
151													gravel (6-20 mm)							
152													coarse gravel (20-60 mm)							
153													cobble (60-200 mm)							
154													stones (200-600 mm)							
155													boulders (>600 mm)							
156													Base of Observation (1)							
157													layer continues							
158													soil continues							
159													equipment refusal							
160													bedrock reached							
161													Estimated Effective Rooting Depth (m)							
162													1 2 3 4 5							
163													MQTTLES							
164													Sub-dominant (1) 1 2 3 4 5							
165													not evident							
166													<2%							
167													2-10%							
168													10-20%							
169													20-50%							
170													Colour 1 2 3 4 5							
171													dark							
172													red							
173													orange							
174													yellow							
175													brown							
176													pale							
177													grey							
178													gley							
179													Contrast 1 2 3 4 5							
180													faint							
181													distinct							
182													prominent							