Land and Soil Capability Assessment

Panorama BESS

Panorama BESS SubCo

Prepared by:

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Australia

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Revision Record

Revision	Date	Prepared By	Checked By	Authorised By
01	7 June 2023	Murray Fraser	Rod Masters	
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v1.1	20 March 2024	Rod Masters	Rod Masters	

Basis of Report

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

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1.0 Introduction

SLR has been commissioned by Panorama BESS SubCo to complete a Land & Soil Capability (LSC) Assessment for the Panorama Battery Energy Storage System (BESS) Project (the Project). The purpose of this LSC Assessment is to form part of the site due diligence and ultimately inform any Environmental Impact Statement (EIS) for the Project in support of a development application, to be submitted under Part 4 of the NSW *Environmental Planning and Assessment Act 1979* (EP&A Act) (NSW Department of Planning, Housing and Infrastructure (DPHI), 1979).

This report has been prepared to meet the DPHI Secretary's Environmental Assessment Requirements (SEARs) for the Project.

1.1 Background

Panorama BESS SubCo is proposing to develop a BESS with a delivery capacity of 100 Megawatt (MW) and useable energy storage of 200 Megawatt hours (MWh) on land adjacent to the existing 132 kV substation operated by TransGrid. The Project is proposed to be constructed and operated on a portion of Lot 2 DP 864272 at 800 Mid-Western Highway, and Lot 521 DP 603541 at 749 Mid-Western Highway, Evans Plans, NSW. The development site is located approximately 2.5 kilometres to the west of the suburb of Robin Hill and approximately 5.8 kilometres south-west of the township of Bathurst (**Figure 1**).

The broader lot (Lot 2 DP 864272) is irregular in shape and currently zoned RU1 – Primary Production under the *Bathurst Regional Local Environmental Plan 2014* (LEP). The lot currently contains one residential dwelling within the central western portion of the lot that is not permanently inhabited. Current land use is cattle grazing improved grass pasture.

1.2 Project Description

The Project will involve the development, construction, operation, and eventual decommissioning of a BESS with a capacity of 100MW, 200 MWH adjacent to the existing 132 kV substation operated by TransGrid. The BESS will consist of SolBank BESS containers (or enclosures) in 'back-to-back' formation in two north-south aligned rows. Each SolBank container has dimensions of 6,058 millimetres by 2,438 millimetres by 2,896 millimetres with an approximate weight of 30,000 kilograms. The BESS will be supported by inverters which will convert the electricity from the BESS and connect to the existing TransGrid substation via approximately 100 metres of 132kV underground cable.

The general layout of the Project can be seen in the Site Plan.

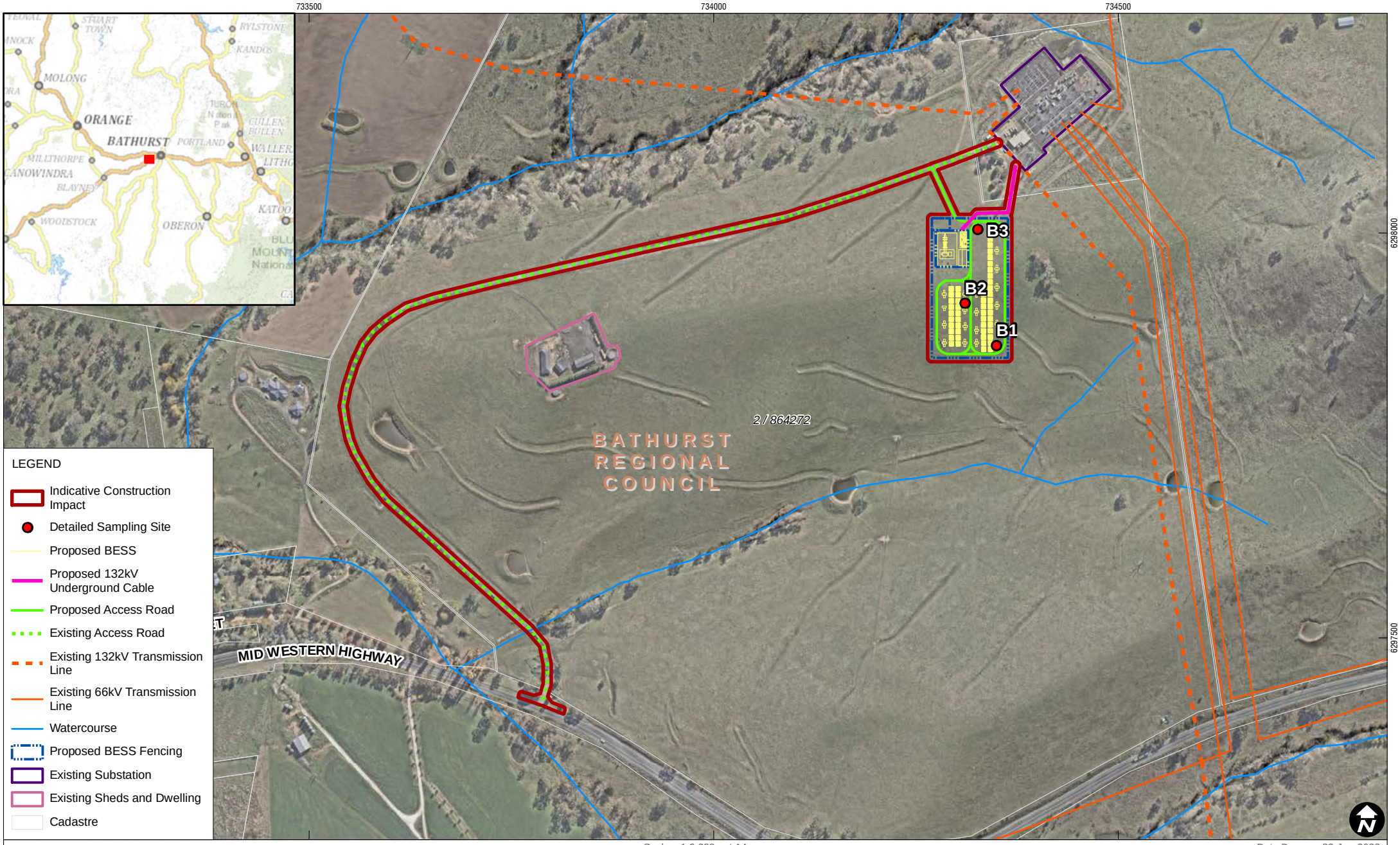
The key elements of the Project include the following:

- Installation and operation of a SolBank BESS including battery enclosures, inverters, and transformers;
- Associated ancillary infrastructure including:
  - A 132kV underground cable connecting a 33kV switch building to the existing substation;
  - Formalisation of existing access from Mid Western Highway and existing access road within Lot 2 DP 864272 to accommodate heavy vehicles;
  - Proposed access road from the BESS to connect to the existing access road within Lot 2 DP 864272;
  - Operations and maintenance (O&M) building;
  - Stormwater management infrastructure, lighting, and security fencing; and

  - Construction laydown areas.
- Decommissioning of the SolBank BESS at the end of life (EOL) include disassembly and removal of associated infrastructure from the site, to be returned as close as possible to its existing condition.

Construction of the Project is anticipated to take approximately 14 to 15 months and it is expected that the operational life of the Project would be approximately 20 years, after which the BESS would be decommissioned and the infrastructure removed, returning the site to its original use.

The capital investment value (CIV) of the Project will be greater than $30 million and therefore the development is classified as State Significant Development (SSD) in accordance with Schedule 1, Clause 20 ‘Electricity generating works and heat or co-generation’ of *State Environmental Planning Policy (Planning Systems) 2021* (Planning Systems SEPP), previously the *State Environmental Planning Policy (State and Regional Development) 2011.*



Scale: 1:6,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

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Data Source: Basedata NSW SS, December 2021
Inset base supplied by © Department of Customer Service 2020
Aerial imagery supplied by Nearmap (May, 2023)
Elevation data supplied by DCS Spatial Services (July, 2019)

SLR

STUDY AREA

FIGURE 1

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1.3 Objective

The objective was to conduct an LSC Assessment for an area of land proposed for the Project to support any EIS/Development Application for the project.

1.4 Scope of Work

The LSC Assessment includes:

- Completion of field work to obtain required level of field samples in accordance with any relevant guidelines.
- Determination of Australian Soil Classification (ASC) (Isbell, 2002) soil types across the Study Area.
- Detailed assessment of the site and soil characteristics as per the requirements of *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012).
- Determination of preliminary Biophysical Strategic Agricultural Land (BSAL) status according to the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (OEH, 2013).
- Determination of erosive potential for soil types within development footprint.

There is no regionally mapped BSAL within or adject to the Study Area (**Figure 2**). The site is also not mapped on the State Significant Agricultural Land (SSAL) map.

1.5 Study Area

Panorama BESS SubCo requires an LSC Assessment for the Area of Interest (the Study Area) to support an EIS for the Project. **Table 1** shows the areas requiring soil survey for the LSC Study Area. It is noted that the LSC Study Area includes an existing access track from the Mid-Western Highway through to the TransGrid substation.

Table 1: Study Area

Assessment Component	Hectares
BESS Development Footprint / Project Area	2.0
Existing Access Track	1.5
Total LSC Study Area	**3.5**

1.6 Legislation and Standards

The Large-Scale Solar Energy Guideline (LSSEG) for SSD was issued August 2022 by the NSW Government. The guideline provides the community, industry, applicants and regulators with general guidance on the planning framework for the assessment and determination of State Significant large-scale energy projects under the Environmental Planning and Assessment Act 1979.

The appropriate guideline for assessment of Land and Soil Capability is *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012).

1.6.1 Secretary's Environmental Assessment Requirements

Panorama BESS Subco received the Planning Secretary's Environmental Assessment Requirements (SEARs) (**Table 2**) on the 12th December, 2022 which noted relating to land and soils:

The EIS must address the following specific matters:

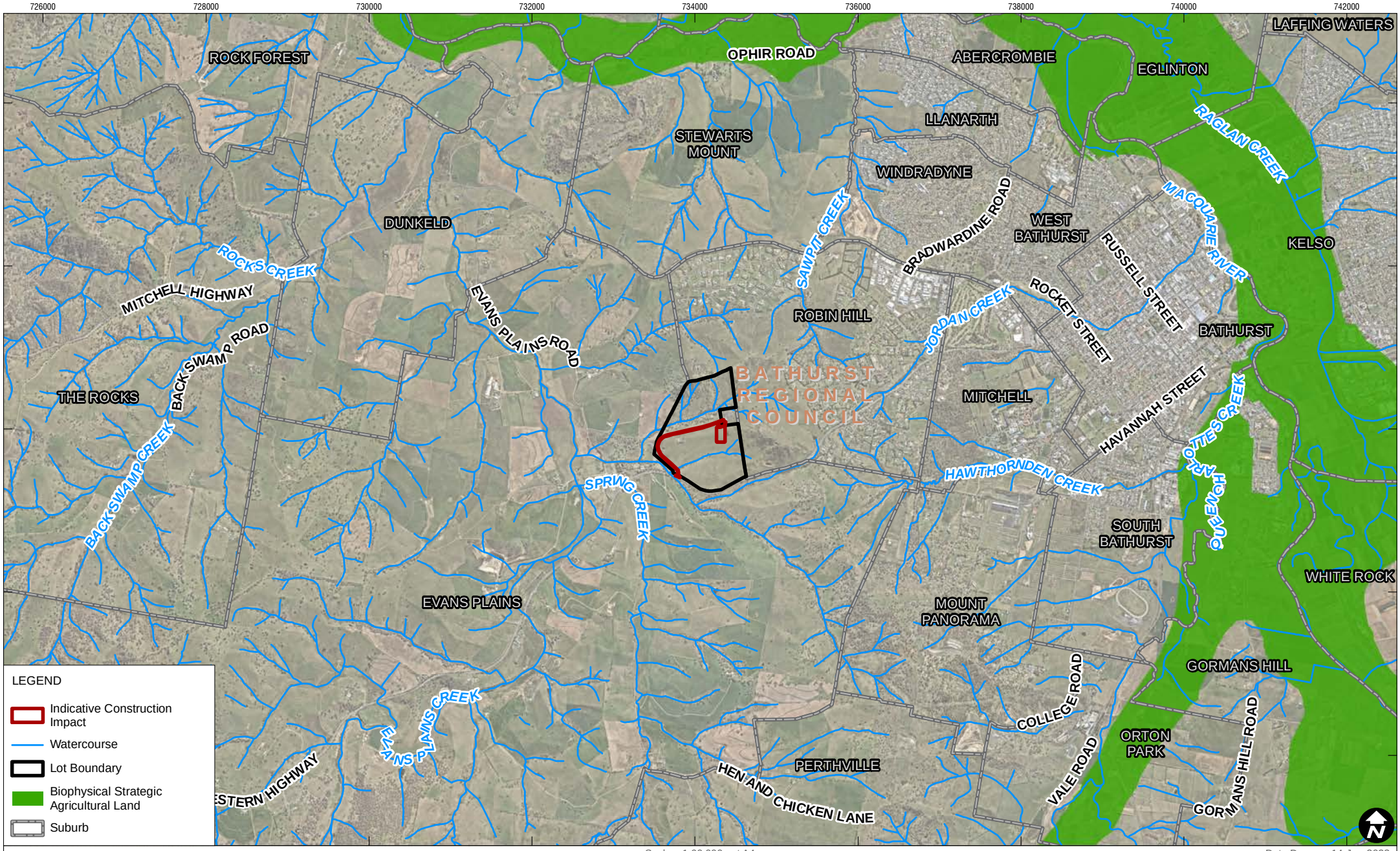
Land – including:

- *a detailed justification of the suitability of the site and that the site can accommodate the proposed development having regard to its potential environmental impacts, permissibility, strategic context and existing site constraints;*
- *an assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including:*
  - *flood prone land, acid sulphate soils, Crown lands, mining, quarries, mineral or petroleum rights;*
  - *a soil survey to determine the soil characteristics and consider the potential for erosion to occur; and*
  - *a cumulative impact assessment of nearby developments;*
- *an assessment of the compatibility of the development with existing land uses, during construction, operation and after decommissioning, including:*
  - *consideration of the zoning provisions applying to the land, including subdivision (if required);*
  - *completion of a Land Use Conflict Risk Assessment in accordance with the Department of Industry's Land Use Conflict Risk Assessment Guide; and*
  - *assessment of the impact on agricultural resources and agricultural production on the site and region*.

Matters relating to land required by the SEARs which are not addressed in this report are assessed in the main EIS and the *Surface Water Impact Assessment* (SLR, 2023).

Table 2: SEARs Register

DPE General Comments	SLR Response	Section
•An assessment of the potential impacts of the development on existing land uses on the site and adjacent land, including acid sulfate soils	None of the soil types mapped within the Study Area have acid sulfate soil potential.	3.2.1
A soil survey to determine the soil characteristics and consider the potential for erosion to occur.	ASC soil type Eutrophic Brown Chromosol of LSC Class 4 with minimal potential for erosion to occur	3 & 4
Assessment of the impact on agricultural resources and agricultural production on the site and region.	Agricultural impact on the site and region is negligible	7



Scale: 1:60,000 at A4
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Aerial imagery supplied by Nearmap (May, 2023)
Elevation data supplied by DCS Spatial Services (July, 2019)
Biophysical Strategic Agricultural Land (State Government of NSW and Department of Planning and Environment)

SLR

SITE LAYOUT

FIGURE 2

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2.0 LSC Assessment Methodology

The LSC classification applied to the Study Area was in accordance with the OEH guideline The Land and Soil Capability Assessment Scheme; Second Approximation (OEH, 2012). This scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC Classes are described in **Table 3** and their definition has been based on two considerations:

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

Table 3: Land and Soil Capability Assessment Classification

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

2.1.1 Calculating LSC Classes

The biophysical features of the land that are associated with various hazards are broadly soil, climate and landform and more specifically: slope, landform position, acidity, salinity, drainage, rockiness; and climate.

The eight hazards associated with these biophysical features that are assessed by the scheme are:

1 Water erosion
2 Wind erosion
3 Soil structure decline
4 Soil acidification
5 Salinity
6 Water logging
7 Shallow soils and rockiness
8 Mass movement

Each hazard is assessed against set criteria tables, as described in the LSC Guideline; each hazard for the land is ranked from 1 through to 8 with the overall ranking of the land determined by its most significant limitation.

Hazard 1: Water Erosion

The Study Area lies within the Eastern NSW Division, and the appropriate criteria for this division were used in the assessment. Assessment of water erosion hazard is almost solely dependent on the slope percentage of the land, based on each Soil Landscape Unit. The only exception is land which falls within the slope range of 10 to 20%, which may be designated LSC Class 4 or LSC Class 5 depending on the presence of gully erosion and/or sodic/dispersible soils. A slope analysis for the Study Area is shown on **Figure 3** while the slope analysis methodology is shown in **Appendix A**.

Hazard 2: Wind Erosion

There are four factors used to assess wind erosion hazard for each soil type. Three criteria were assessed to be consistent for each soil type:

- Average rainfall determines the capacity of the land to maintain vegetative cover and keep soil wet. The average rainfall for the Bathurst region is 640 millimetres (BOM, 2023), and therefore the Study Area lies within the “greater than 500 millimetres rainfall” category for the purpose of assessing wind erosion hazard;
- Wind erosive power for the Study Area has been mapped as “Moderate” (NSW Department of Trade and Investment); and
- Exposure of the land to wind was also determined to be “High” throughout the Study Area.

The determining factor with regard to wind erosion hazard was therefore the erodibility of each soil type as determined by soil texture according the LSC Guideline.

Hazard 3: Soil Structure Decline

Soil structure decline is assessed on soil characteristics, including surface soil texture, sodicity (laboratory tested) and degree of self-mulching (field tested). These parameters assess the soil structure, stability and resilience of the soil.

Hazard 4: Soil Acidification

The soil acidification hazard is assessed using three criteria, being soil buffering capacity, pH and mean annual rainfall. In this assessment, soil buffering capacity was based on soil Great Soil Group; surface soil pH and a regional mean annual rainfall range of 550 to 700 millimetres.

Hazard 5: Salinity

The salinity hazard is determined through a range of data and criteria. The recharge potential for the site was determined based on an average annual rainfall of 640 millimetres, with annual evaporation of 1,400 to 1,600 millimetres (BOM, 2023). This would suggest a low recharge potential.

Based on the annual rainfall data (640 millimetres) and an average annual evapotranspiration of 600 to 700 millimetres, a low discharge potential exists for the site due to a likely balanced rate of water flow. The Study Area according to the Salt Store Map of NSW, is located in an area of low salt store. However, due to the current available scale of this mapping, laboratory tested ECe values were used to determine salt store, all soil profiles tested were non-saline.

Hazard 6: Water Logging

Water logging was determined by the soils drainage characteristics, specifically field sample evidence of mottling, soil texture attributes as well as slope and climate.

Drainage was observed to be generally good across the site, given there was 24.6 millimetres of rain recorded at Bathurst Agricultural Station (Bureau of Meteorology site 63005) during the week prior to the field survey (19th October – 25th October), and no surface ponding was observed at the time of inspection.

Hazard 7: Shallow Soils and Rockiness

The shallow soils and rockiness hazard is determined by an estimated exposure of rocky outcrops and average soil depth. There were no rock outcrops observed and soil depth exceeded profile excavation depth of 800 millimetres.

Hazard 8: Mass Movement

The mass movement hazard is assessed through a combination of three criteria; mean annual rainfall, presence of mass movement and slope class.

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Aerial imagery supplied by Nearmap (May, 2023)
Elevation data supplied by NSW Government Spatial Services - DFSI (BATHURST, 2kmx2km
1 metre Resolution Digital Elevation Model)

SLR

SLOPE ANALYSIS

FIGURE 3

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2.1.2 Risk Assessment

The soil survey was designed to meet the requirements for LSC classification and the Interim Protocol (OEH, 2013). A risk assessment was undertaken to determine the required survey density. The Interim Protocol states "*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 a project to impact on agricultural resources and the appropriate level of soil survey required, an evaluation of risk to agricultural resources and enterprises has been undertaken. The risk assessment is based on the probability of occurrence and the consequence of the impact as described in the *Interim Protocol*. The potential impacts were assessed as:

- Consequence Level 4 – Minor damage and/or short-term impact to agricultural resources or industries, with probability A, almost certain. The risk matrix result was A4 which is considered a medium risk. The Study Area requires an inspection density of 1:25,000.

Based on the Project only being temporary and having no permanent impact on the intrinsic properties of the soil, a minimum inspection density of 1:25,000 was proposed for the Study Area.

2.2 Field Soil Survey

The field survey for the LSC Assessment was undertaken on the 26th October 2022 by SLR's Principal Agronomist Murray Fraser and overseen by SLR's Technical Director Rod Masters (CPSS-3).

To satisfy the Interim Protocol soil mapping requirements a minimum of 3 sites were required. A breakdown of the required soil survey density, as per LSC requirements, is provided in **Table 4** which exceeds the requirements for a 1:25,000 LSC Assessment.

Table 4 Assessment of Soil Survey Density

Category	LSC Study Area
Total Study Area Hectares	3.5
1:25,000 Survey Density Target	Minimum 1
Detailed Sites	3
Check Sites	Nil
Actual Total Number Sites	**3**
Laboratory Analysed Sites	**3**

2.3 Soil Survey Observation Types

Soil profiles were assessed at two sites in accordance with the *Australian Soil and Land Survey Field Handbook* (NCST, 2009). Each soil-profile exposure was sampled with a hydraulic soil corer, either a depth of 1.2 metres, to equipment refusal, or to bedrock. Detailed soil profile morphological descriptions were prepared at all sites to record the information specified in *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012) Information was recorded for the major parameters specified in **Table 5.**

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

Table 5: Field Assessment Parameters

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

A total of three detailed sites were evaluated, with soil collected from each major soil horizon (soil layer).

Soil samples from three detailed sites were utilised in the LSC and BSAL Assessment laboratory testing program. Samples were analysed in order to classify Australian Soil Classification (ASC) (Isbell, 2002) soil taxonomic class and enable LSC classification.

Soil collected from each major soil horizon (soil layer) was sent to a National Association of Testing Authorities Australia (NATA) accredited laboratory (EAL Laboratories) for analysis. The selected physical and chemical laboratory analysis properties and their relevant application are listed in **Table 6**.

Table 6: Laboratory Analysis Parameters

Property	Application
Coarse Fragments (>2mm)	Soil workability; root development
Particle-Size Distribution (<2mm)	Determine fraction of clay, silt, fine sand and coarse sand; nutrient retention; exchange properties; erodibility; workability; permeability; sealing; drainage; interpretation of most other physical and chemical properties and soil qualities
Soil Reaction (pH)	Nutrient availability; nutrient fixation; toxicities (especially aluminium and manganese); liming; Sodicity; correlation with other soil properties

Property	Application
Electrical Conductivity (EC)	Appraisal of salinity hazard in soil substrates or groundwater; total soluble salts
Cation Exchange Capacity (CEC) & Exchangeable Cations	Nutrient status; calculation of exchangeable cations including sodium, calcium, magnesium, potassium and exchangeable sodium percentage (ESP); assessment of other physical and chemical properties, especially dispersivity, shrink – swell, water movement, aeration
Munsell Colour Chart (Munsell)	Drainage, oxidation, fertility, correlation with other physical, chemical and biological properties

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

3.0 Soil Assessment

Two soil map units (SMUs) were identified within the Study Area, dominated by a Eutrophic Brown Dermosol (2 hectares) and an Anthroposol (1.5 hectares) and were mapped according to the dominant ASC soil type (**Figure 4**) using a combination of the soil survey and laboratory analysis results. These soil units and the observation sites associated with each are shown below in **Table 7** and **Table 8**.

The Anthroposol (SMU 2) was mapped along the existing gravel access track from the Mid-Western Highway to the TransGrid substation.

A description of each detailed site from SMU 1 follows Figure 4 with laboratory certificates of analysis shown in **Appendix B.**

Table 7: Soil Map Unit Summary

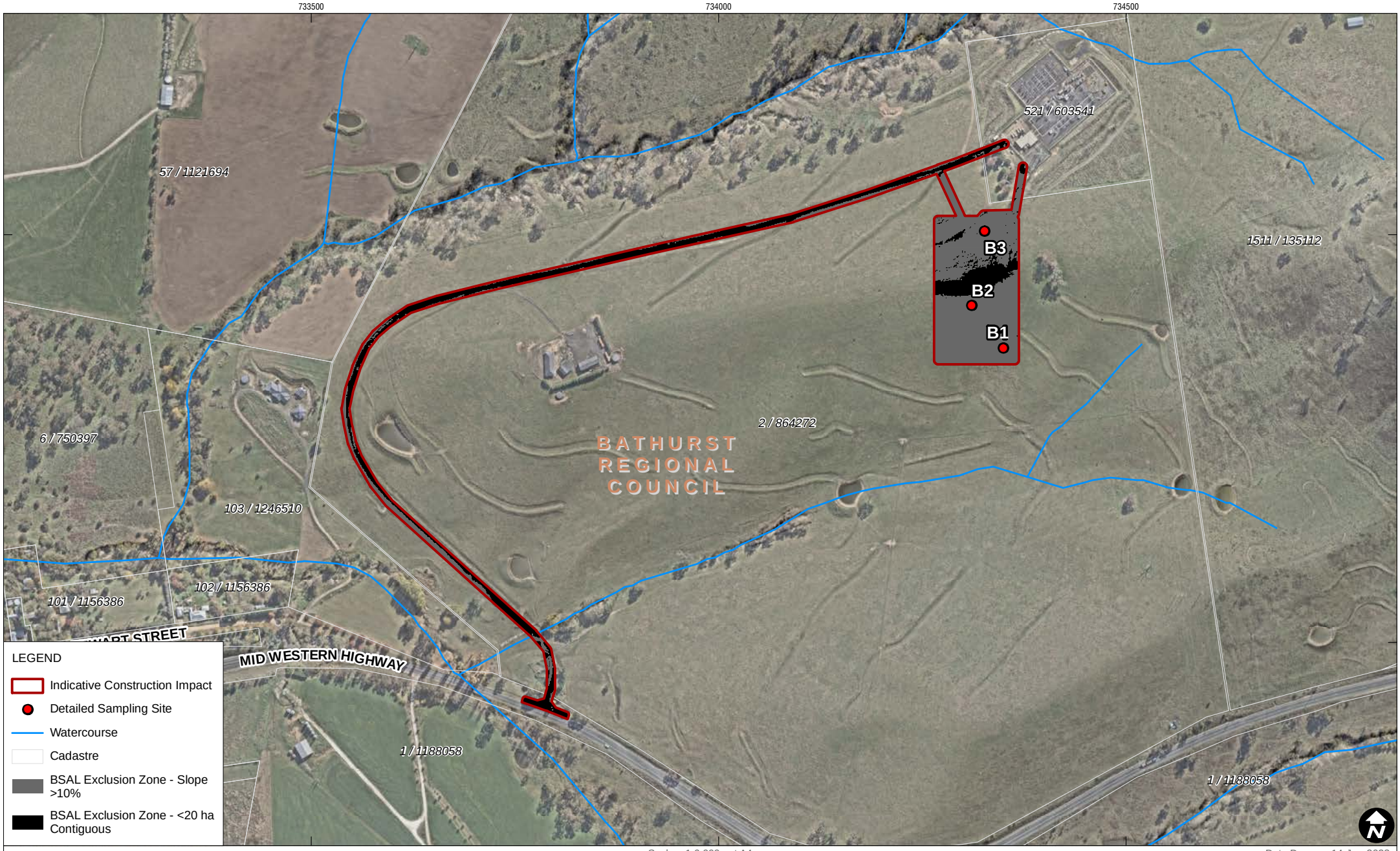
SMU	ASC Soil Type	Detailed Site	Check Site	Hectares
1	Eutrophic Brown Dermosol	B1, B2, B3	Nil	2
2	Anthroposol	Nil	Nil	1.5

Table 8: ASC Soil Types within Study Area

SMU	ASC Soil Type	Soil Type Group	Detailed Site	Check Site	Hectares
1	Eutrophic Brown Dermosol	Dominant	B1, B2	Nil	2
	Eutrophic Brown Chromosol	Sub-Dominant	B3	Nil	
2	Anthroposol	Nil	Nil	Nil	1.5

3.1.1 Acid Sulfate Soils

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



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EXCLUSION AREAS

FIGURE 4

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3.2 Soil Map Unit 1: Eutrophic Brown Dermosol

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

Table 9: Summary Eutrophic Brown Dermosol (Site B1)

Overview	
Landscape Site B1 	
ASC Name	Eutrophic Brown Dermosol
Representative Site	B1
Other Mapped Sites	B2, B3
Survey Type	Detailed Lab
Dominant Topography	Upper Midslope
Dominant Land Use	Cattle Grazing
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately High
Slope (%)	15
Surrounding Slope (%)	>10
Aspect	South-West
LSC Class	4
Verified BSAL	Non-BSAL – Slope

Table 10: Profile: Eutrophic Brown Dermosol (Site B1)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.10	Dark brown (7.5YR 3/2) sandy loam, moderate structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 20% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.10 – 0.35	Very dusky red (2.5YR 2.5/2) sandy loam, moderate structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 25% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B21 0.35 – 0.60	Dark yellowish-brown (10YR 4/4) sandy loam, moderate structure of 10-25 mm blocky peds with a sandy fabric and weak consistence. Nil mottling; 30% gravel content 5-10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.60	Brown (7.5YR 5/4) sandy loam, moderate structure of 10-30 mm blocky peds with a sandy fabric and moderate consistence. Nil mottling; 30% gravel content 5-10 mm; nil segregations; well drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 11: Chemical Parameters: Eutrophic Brown Dermosol (Site B1)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.2	Slightly Acidic	5.3	Non-Sodic	0.5	Non-Saline	3.2	Ca Low
A2	6.0	Moderately Acidic	0.9	Non-Sodic	0.3	Non-Saline	5.5	Balanced
B21	6.8	Neutral	1.3	Non-Sodic	0.3	Non-Saline	4.2	Balanced
B22	7.2	Neutral	1.6	Non-Sodic	0.2	Non-Saline	4.6	Balanced

Soil Type: Eutrophic Brown Dermosol

Table 12 Summary: Eutrophic Brown Dermosol (Site B2)

Overview	
Landscape SiteB2 	
ASC Name	Eutrophic Brown Dermosol
Representative Site	B2
Other Mapped Sites	B1, B3
Survey Type	Detailed Lab
Dominant Topography	Upper Slope Crest
Dominant Land Use	Cattle Grazing
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately High
Slope (%)	16
Surrounding Slope (%)	>10
Aspect	South-West
LSC Class	4
Verified BSAL	Non-BSAL – Slope

Table 13: Profile: Eutrophic Brown Dermosol (Site B2)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.15	Dark brown (7.5YR 3/2) sandy loam, moderate structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 20% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.0 – 0.10.
	A2 0.15 – 0.30	Dark-yellowish brown (10YR 4/4) sandy loam, moderate structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 30% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B21 0.30 – 0.50	Brown (7.5YR 4/4) sandy clay loam, moderate structure of 10-20 mm blocky peds with a sandy fabric and moderate consistence. Nil mottling; 25% gravel content 5-10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B22 +0.50	Brown (7.5YR 5/4) sandy loam, moderate structure of 10-30 mm blocky peds with a sandy fabric and weak consistence. Nil mottling; 35% gravel content 5-10 mm; nil segregations; well drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 14: Chemical Parameters: Eutrophic Brown Dermosol (Site B2)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	6.5	Slightly Acidic	2.5	Non-Sodic	0.9	Non-Saline	1.5	Ca Low
A2	6.4	Slightly Acidic	1.1	Non-Sodic	0.4	Non-Saline	3.9	Ca Low
B21	7.0	Neutral	2.3	Non-Sodic	0.3	Non-Saline	3.0	Ca Low
B22	7.3	Mildly Alkaline	1.7	Non-Sodic	0.3	Non-Saline	1.6	Ca Low

Sub-Dominant Soil Type: Eutrophic Brown Chromosol

Table 15: Summary: Eutrophic Brown Chromosol (Site B3)

Overview	
Landscape Site B3 	
ASC Name	Eutrophic Brown Chromosol
Representative Site	B3
Other Mapped Sites	B1, B2
Survey Type	Detailed Lab
Dominant Topography	Upper Slope
Dominant Land Use	Cattle Grazing
Vegetation	Grass Pasture
Inherent Soil Fertility	Moderately High
Slope (%)	11
Surrounding Slope (%)	>10
Aspect	North-West
LSC Class	4
Verified BSAL	Non-BSAL – Slope & Poor Drainage

Table 16: Profile: Eutrophic Brown Chromosol (Site B3)

Profile	Horizon / Depth (m)	Description
	A1 0.0 – 0.20	Dark reddish-brown (5YR 3/3) sandy loam, weak structure of 5-15 mm crumb peds with a sandy fabric and weak consistence. Nil mottling; 15% gravel content <10 mm; nil segregations; well drained with a clear and even boundary. Sampled 0.0 – 0.10.
	B21 0.20 – 0.40	Brown (7.5YR 4/4) medium clay, strong structure of 10-25 mm blocky peds with a rough fabric and strong consistence. Nil mottling; 5% gravel content <10 mm; nil segregations; well drained with a gradual and even boundary. Sampled 0.20 – 0.30.
	B22 0.40 – 0.60	Brown (7.5YR 4/4) heavy clay, strong structure of 10-25 mm blocky peds with a rough fabric and strong consistence. 10% distinct yellow mottling; 10% gravel content <10 mm; nil segregations; moderately well drained with a gradual and even boundary. Sampled 0.40 – 0.50.
	B23 +0.60	Dark reddish-brown (5YR 3/2) sandy clay, strong structure of 20-40 mm blocky peds with a rough fabric and strong consistence. 20% distinct yellow mottling; 10% gravel content 5-10 mm; nil segregations; poorly drained. Sampled 0.65 – 0.75. Layer continues beyond sampling depth.

Table 17: Chemical Parameters: Eutrophic Brown Chromosol (Site B3)

Layer	pH (1:5 water)		ESP		ECe		Ca:Mg	
	Unit	Rating	%	Rating	dS/m	Rating	Ratio	Rating
A1	5.8	Moderately Acidic	0.7	Non-Sodic	0.4	Non-Saline	2.9	Ca Low
B21	6.5	Neutral	0.7	Non-Sodic	0.3	Non-Saline	3.5	Ca Low
B22	7.2	Neutral	0.7	Non-Sodic	0.2	Non-Saline	1.5	Ca Low
B23	8.0	Moderately Alkaline	0.7	Non-Sodic	0.3	Non-Saline	3.5	Ca Low

3.3 Soil Map Unit 2: Anthroposol

Dominant Soil Type: Anthroposol

Anthroposols are Soils Resulting from Human Activities

Table 18: Anthroposols

Overview	
Landscape 	
ASC Name	Anthroposol
Representative Site	Access Track
Other Mapped Sites	Nil
Survey Type	Observation
Dominant Topography	Midslope
Dominant Land Use	Transport
Vegetation	Grass Pasture
Inherent Soil Fertility	Low
Slope (%)	Various
Surrounding Slope (%)	>10
Aspect	West to South-West
LSC Class	8
Verified BSAL	Non-BSAL – Slope, Fertility & Rockiness

4.0 Land and Soil Capability Assessment

The majority of the Study Area was classified as LSC Class 4. This was due to LSC *Hazard Criteria 1 Slope Class and LSC Hazard Criteria 2 Wind Erosion Hazard.*

The two LSC Classes identified, comprising 2 hectares of LSC Class 4 with the remaining 1.5 hectares (the formed access track) being LSC Class 8 and are summarised in **Table 19** and shown on **Figure 5**. The major assessment points are listed below.

Table 19: Land and Soil Capability Assessment

Soil Type		LSC Hazard Criteria								
Site	**ASC Great Group**	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**LSC**
B1	Eutrophic Brown Dermosol	4	4	3	3	1	2	1	1	**4**
B2	Eutrophic Brown Dermosol	4	4	3	3	1	2	1	1	**4**
B3	Mottled Eutrophic Brown Chromosol	4	4	3	3	1	4	1	1	**4**

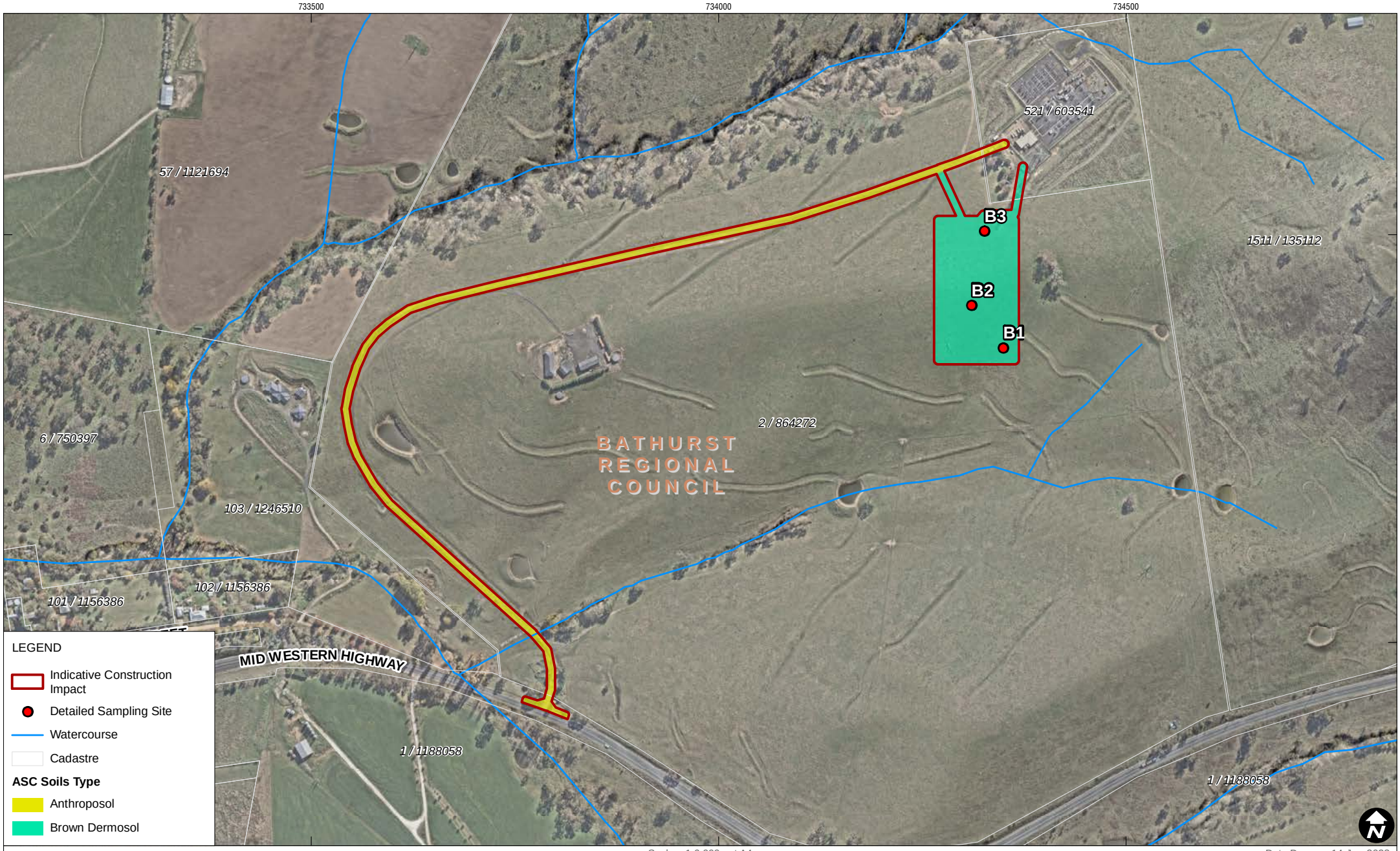
LSC Class 4 is considered to have moderate agricultural capability with moderate to high limitations for high-impact land uses which restrict land management options for regular high-impact land uses such as cropping, high-intensity grazing and horticulture. LSC Class 4 is associated with the Dermosols and Chromosols comprises 57% of the Study Area.

LSC Class 8 is considered to have extremely low agricultural capability with limitations are so severe that the land is incapable of sustaining any land use apart from nature conservation. There should be no disturbance of native vegetation. LSC Class 8 is associated with the Anthroposol comprises 43% of the Study Area.

The entire Study Area is considered to have moderate to extremely low agricultural capability (**Table 20**) according to definitions given in *The Land and Soil Capability Assessment Scheme: Second Approximation* (OEH, 2012).

Table 20: Land and Soil Capability

LSC	Site	Dominant ASC	Limitation	Agricultural Capability Rating	Hectares
4	B1, B2, B3	Dermosol	Slope & Wind Erosion Hazard	Moderate	2
8	Access Track	Anthroposol	Rockiness	Extremely Low	1.5
Total					**3.5**



Scale: 1:6,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 14-Jun-2023
Project Number: 660.30234.00000

Data Source: Basedata NSW SS, December 2021
Aerial imagery supplied by Nearmap (October, 2022)

SLR

ASC SOIL TYPE

FIGURE 5

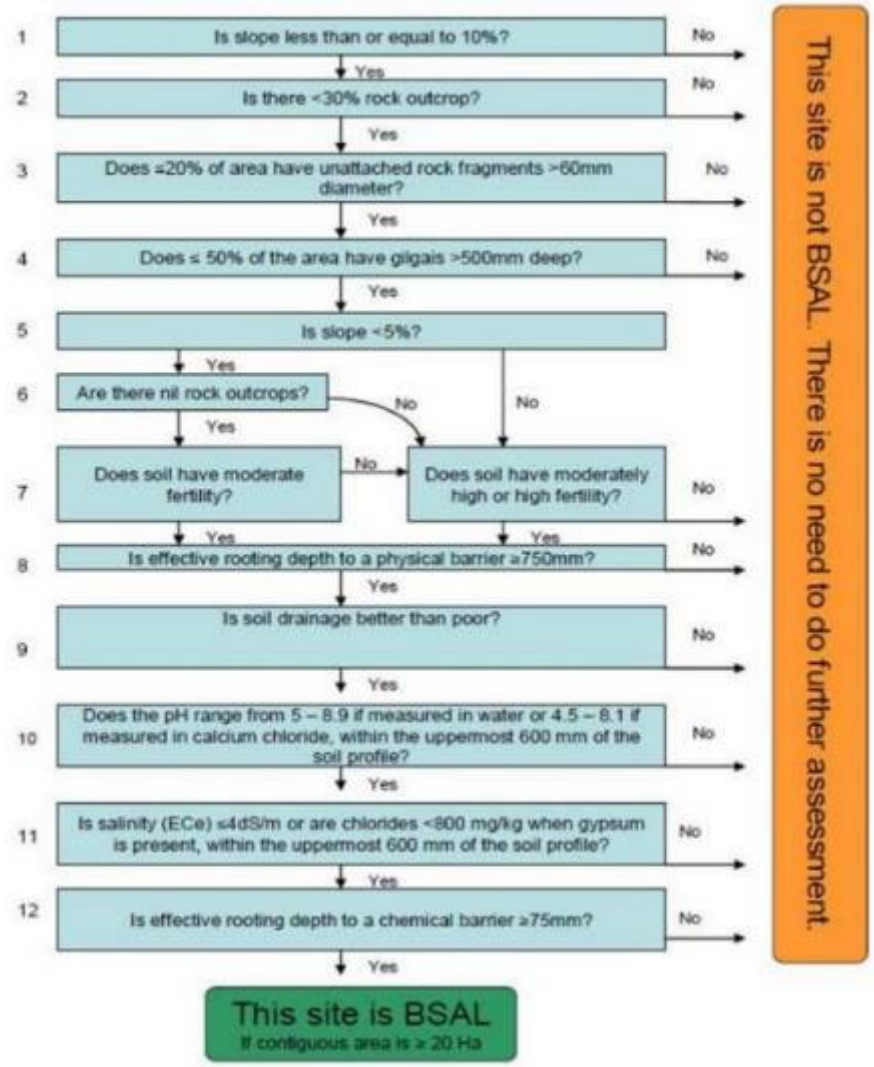
H:\Projects-SLR\660-SrvWOL\660-WOL\660.30234.00000 Bathurst BESS SSD Approvals\06 SLR Data\01 CADGIS\GIS\SLR66030234_BSAL_F5_ASC Soil Type_003.mxd

5.0 Preliminary BSAL Verification

According to the *Interim protocol for site verification and mapping of biophysical strategic agricultural land* (the Interim Protocol) (NSW Government, 2013), the Study Area cannot be considered biophysical strategic agricultural land (BSAL) due to failing Step 1 (is slope less than or equal to 10%) on the Interim Protocol BSAL Criteria Flow Diagram shown on **Diagram 1** and in **Table 21**. Additionally, the portion of the area that is less than 10% slope is less than 20 hectares contiguous area, again failing the BSAL criteria (**Figure 6).**

There is no verified BSAL within or adjacent to the Study (**Figure 7).**

Diagram 1: Interim Protocol BSAL Criteria Flow Diagram

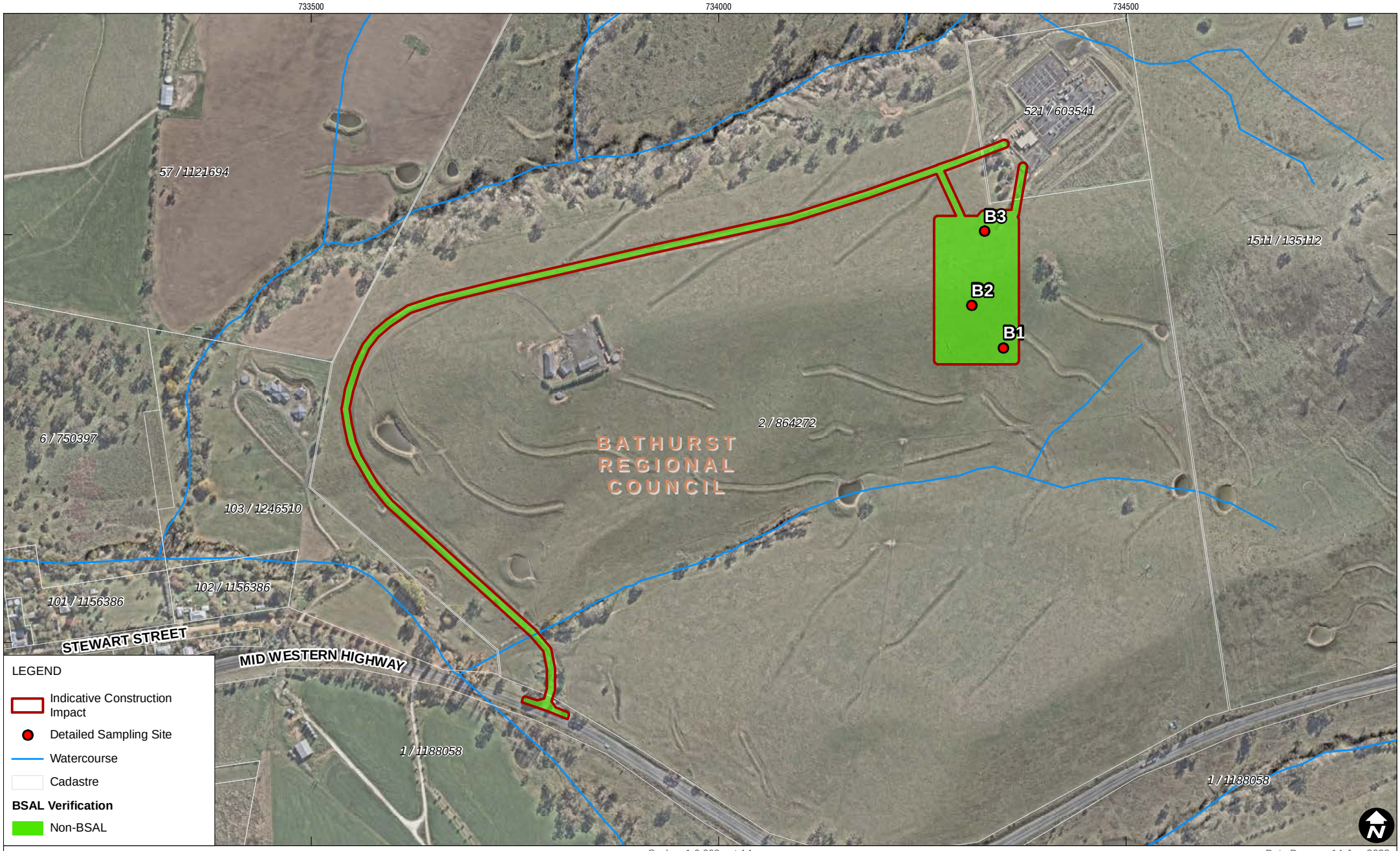


Note: In applying step 12 it was assumed that the effective rooting depth to a chemical barrier of ≥75 mm was incorrect as stated in Diagram 1, and instead a value of ≥750 mm was adopted as stated in Section 6.10 of the Interim Protocol. Where soil profiles fail BSAL criteria they are shown in red font in the detailed description.

Table 21: BSAL Verification Assessment

SMU	Site Number	Inspection Type	ASC Soil Type (Described to ASC Great Group for detailed sites)	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 (water) and 4.5 and 8.1 (CaCl2)?	11. Is salinity (ECe) < 4 dS/m	12. Is ERD to a chemical barrier >750mm?	Is the Site BSAL?	Is the Soil Map Unit BSAL?
1	B1	Detailed Lab	Eutrophic Brown Dermosol	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	No	No
	B2	Detailed Lab	Eutrophic Brown Dermosol	✗	✓	✓	✓	✗	✓	✓	✓	✓	✓	✓	✓	✓	No	
	B3	Detailed Lab	Mottled Eutrophic Brown Chromosol	✗	✓	✓	✓	✗	✓	✓	✓	✓	✗	✓	✓	✓	No	
2	N/A	Observation	Anthroposol	✗	✓	✗	✓	✗	✓	✗	✗	✗	✓	NLT	NLT	NLT	No	No

✓ = passes the BSAL criteria ✗ = fails the criteria but not excluded as BSAL ✗ = fails the BSAL criteria NLT = Not Lab Tested



Scale: 1:6,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 14-Jun-2023
Project Number: 660.30234.00000

Data Source: Basedata NSW SS, December 2021
Aerial imagery supplied by Nearmap (May, 2023)

SLR

BSAL VERIFICATION

FIGURE 6

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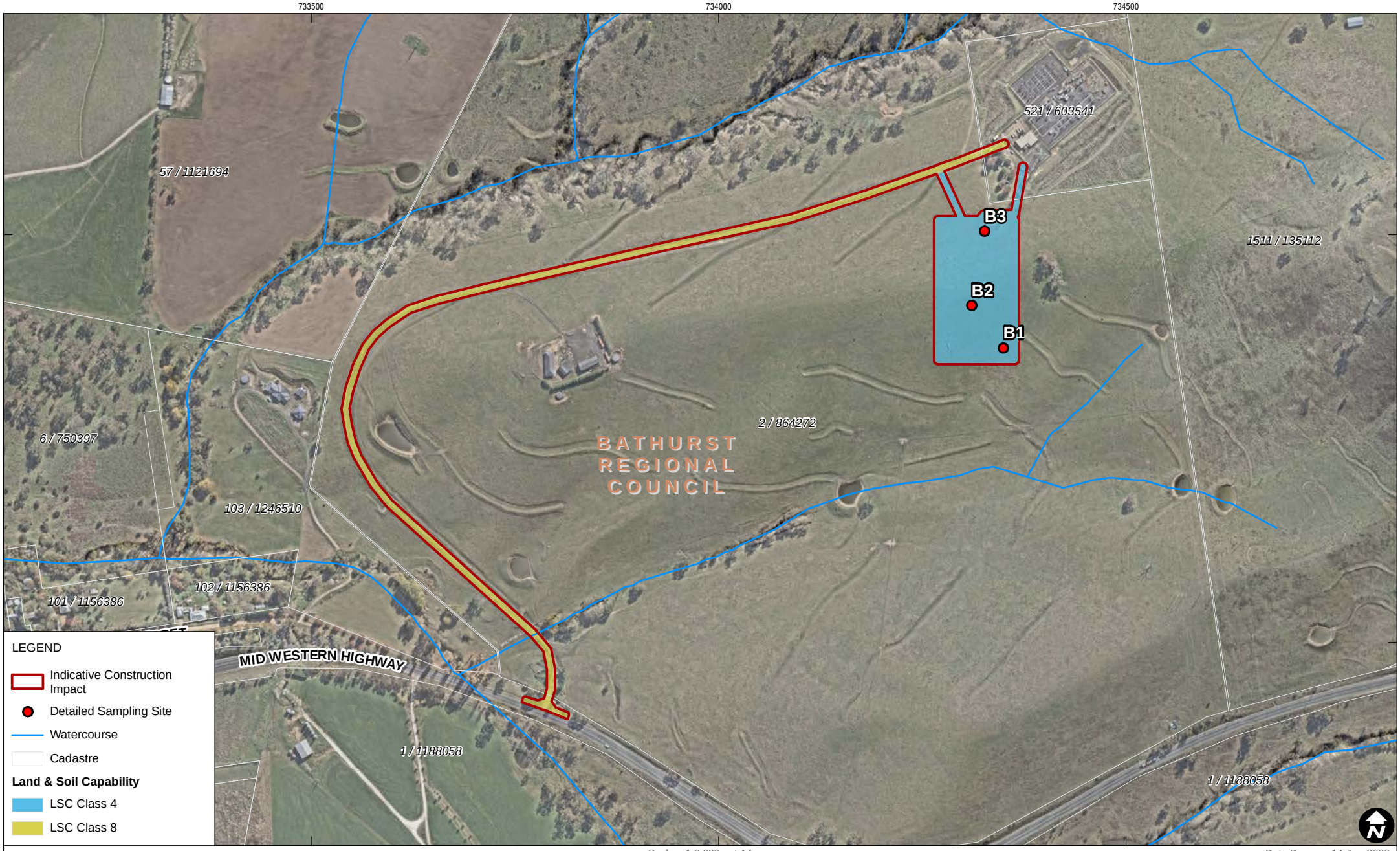


Scale: 1:6,000 at A4
Coordinate System: GDA 1994 MGA Zone 55

Date Drawn: 14-Jun-2023
Project Number: 660.30234.00000

Data Source: Basedata NSW SS, December 2021
Aerial imagery supplied by Nearmap (May, 2023)
Elevation data supplied by NSW Government Spatial Services - DFSI (BATHURST, 2kmx2km
1 metre Resolution Digital Elevation Model)

SLR

LAND SOIL CAPABILITY MAP

FIGURE 7

H:\Projects-SLR\660-SrvWOL\660-WOL\660.30234.00000 Bathurst BESS SSD Approvals\06 SLR Data\01 CADGIS\GIS\SLR66030234_BSAL_F7_Land Soil Capability Map_003.mxd

6.0 Soil Erosive Potential

The dispersion class and erosive potential of soil within the Study Area were determined using the Emmerson Aggregate Test (EAT), shown in **Table 22**. All soil horizons within the Study Area are classed as non-dispersive or slightly dispersive and do not require amelioration with gypsum. Soils within the Study Area pose minimal risk for erosion during construction, operation and decommissioning. This statement is supported from field inspection where no erosion was observed, even though slopes were in the range of 10-30%.

Table 22: EAT Results

Site	Horizon	Sample Depth (cm)	EAT Score	EAT Rating	Gypsum Application
B1	A1	0-10	3	Slight Dispersion	Nil
	A2	20-30	3	Slight Dispersion	
	B21	40-50	3	Slight Dispersion	
	B22	65-75	3	Slight Dispersion	
B2	A1	0-10	4	Non-Dispersive	Nil
	A2	20-30	3	Slight Dispersion	
	B21	40-50	3	Slight Dispersion	
	B22	65-75	3	Slight Dispersion	
B3	A1	0-10	4	Non-Dispersive	Nil
	B21	20-30	3	Slight Dispersion	
	B22	40-50	4	Non-Dispersive	
	B23	65-75	4	Non-Dispersive	

7.0 Agricultural Impact

Agricultural production values for the Bathurst LGA totals $45 million, detailed in **Table 23** The main agricultural production by value is from lamb and sheep production (livestock slaughtering and livestock products), accounting for almost 90% of the value of agricultural commodities produced (ABS, 2016*).

Table 23: Regional Agricultural Production

Agricultural Production Gross Value	Value	%
Crops	$5M	11
Livestock slaughtering	$27M	60
Livestock products	$13M	29
Total gross agricultural production	**$45M**	**100**

Source: ABS (2016*)*2016 is the latest agricultural data available from ABS

Total area available for cattle grazing within the Study Area is 2 hectares, which does not include the already formed access track (1.5 hectares).

Potential agricultural productivity was determined using the NSW Department of Primary Industry agricultural productivity data for agricultural enterprises suitable for each of the LSC Classes that will be impacted. This information can be used to generate potential farm incomes. *Growing out steers 240kg - 460kg in 12 months Farm Enterprise Budget Series* (DPI, 2019) gross margin has been applied to this assessment. The Agricultural Productivity Gross Margin Sensitivity Analysis information is contained in **Appendix C.**

Table 24 summarises the potential gross margin for each LSC Class. Carrying capacity was determined using the NSW DPI Beef Stocking Rates & Farm Size (DPI, 2006) which gives potential stocking rates using Dry Sheep Equivalents (DSE). The Bathurst LGA is in the 600 millimetre per annum rainfall zone and DSE for each LSC Class were calculated accordingly. The major points are listed below.

- LSC Class 4 land has the potential to generate a gross margin of $412 per hectare from beef cattle production, with variable costs of $858 per hectare.
- LSC Class 8 land does not have the potential to generate a gross margin from beef cattle production.

Table 24: Gross Margin per LSC Class

LSC	Stocking Rate	Revenue	Variable Costs	Gross Margin
Class	DSE	Per Hectare	Per Hectare	Per Hectare
4	16	$1,270	$858	$412
8	0	$0	$0	$0

Based on the nominated gross margins, the Project Area has the capacity to generate an estimated gross margin of $824 per annum (**Table 24**), with associated variable costs of $1,716. For the gross margin and variable costs calculations it is assumed the entire area of LSC Class 4 land within Study Area is available for improved pasture production with the remaining 1.5 hectares of LSC Class 8 (the already formed access track) is not suitable for improved pasture production. Using a conservative gross margin assessment it is also assumed the entire 3.5 hectares which is unavailable for agricultural production during the life of the Project.

Table 25: Potential Annual Gross Margins (Pre-Development)

LSC	Gross Margin	Actual Arable Area	
Class	Per Hectare	Hectares	Gross Margin
4	$412	2	$824
8	$0	1.5	$0
Total		**3.5**	**$824**

Potential income generated by agriculture within the Study Area represents 0.002% regional agricultural production within the Bathurst LGA.

8.0 Conclusion

SLR Consulting has completed an LSC Assessment according to *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH, 2012) encompassing the proposed Panorama BESS, comprising 3.5 hectares (which excludes the section of the site located on the existing Ausgrid substation hardstand area). The LSC Assessment found the entire Study Area to be LSC Class 4 (moderate capability land) and LSC Class 8 (extremely low capability land).

A preliminary BSAL assessment found the entire Study Area is non-BSAL, and was verified as non-BSAL due to slopes greater than 10% and being less than 20 hectares contiguous area.

The Study Area is not considered highly productive agricultural land as defined in *The Land and Soil Capability Assessment Scheme; Second Approximation* (OEH 2012).

The Eutrophic Brown Dermosol is classed non-dispersive to slightly dispersive and poses a minimal risk for erosion during construction, operation and decommissioning.

Agricultural enterprises the Study Area are suited to livestock grazing pastures with very occasional cultivation for pasture renovation. It is not considered highly productive agricultural land as defined in T*he Land and Soil Capability Assessment Scheme; Second Approximation* (OEH 2012). The Study Area has the potential to generate $824 per annum from cattle grazing improved pastures, representing 0.002% of the Bathurst LGA agricultural production.

Appendix A Slope Analysis Methodology

Land and Soil Capability Assessment

Panorama BESS

Panorama BESS SubCo

SLR Project No.: 660.30234.00003

20 March 2024

4th March 2023

Panorama BESS
Land & Soil Capability Assessment SLR Slope Analysis Methodology

1. Acquire appropriate elevation information.

2. Load Contours into ArcMap 10.3

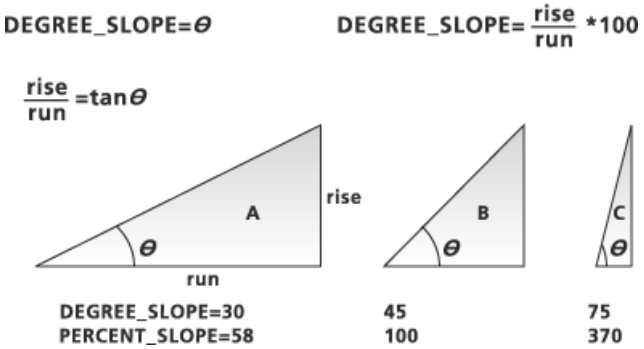
3. Using 3D Analyst Extension - Create a TIN Surface based on the contours (http://resources.arcgis.com/en/help/main/10.1/index.html#/Create_TIN/00q900000001v000000/)

4. Using 3D Analyst Extension – Run the Surface Slope Tool (http://resources.arcgis.com/en/help/main/10.1/index.html#//00q900000076000000) using a custom Break File (attached).

5. Using a Spatial Join, correlate the Surface Slope at the Soil Survey coordinates.

The Surface Slope Tool

Surface Slope creates an output polygon feature class containing polygons that classify an input TIN or terrain dataset by slope. The slope is the angle of inclination between the surface and a horizontal plane, which may be analysed in degrees or percent. Slope in degrees is given by calculating the arctangent of the ratio of the change in height (dZ) to the change in horizontal distance (dS), or slope
= Arctan (dZ/dS). Percent slope is equal to the change in height divided by the change in horizontal distance multiplied by 100, or (dZ/dX) * 100.



The {**slope_field**} is the name of attribute field used to record the polygon aspect codes. Its default value is SlopeCode.

Each triangle is classified into a slope class. Contiguous triangles belonging to the same class are merged during the formation of output polygons. The {units} parameter can be set to use PERCENT or DEGREES. The default is PERCENT. The default percent slope class breaks are 1.00, 2.15, 4.64, 10.00, 21.50, 46.40, 100.00, 1000.00. Optionally, DEGREES may be used to classify slope. The default degree slope class breaks are 0.57, 1.43, 2.66, 5.71, 12.13, 24.89, 45.0, 90.0.

The {**class_breaks_table**} is used to define custom slope classes. The table can be either a TXT or DBF file for a Windows environment, and a DBF file in a UNIX environment. Each record in the table needs to contain two values that are used to represent the slope range of the class and its corresponding class code.

Table example:

break,

code

10.0,

11

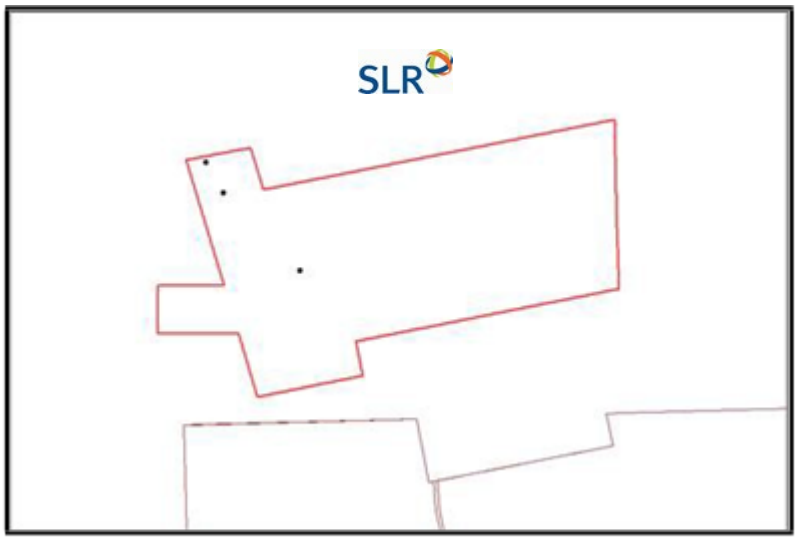
25.0, 22

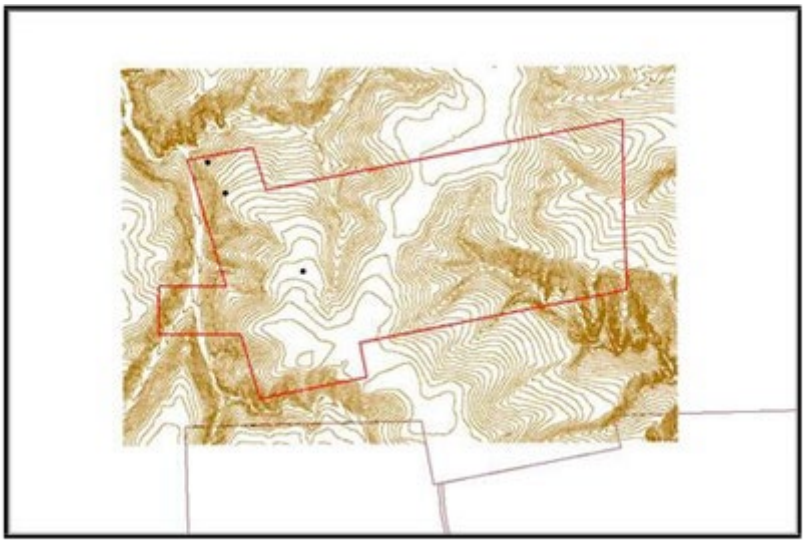
40.0, 33

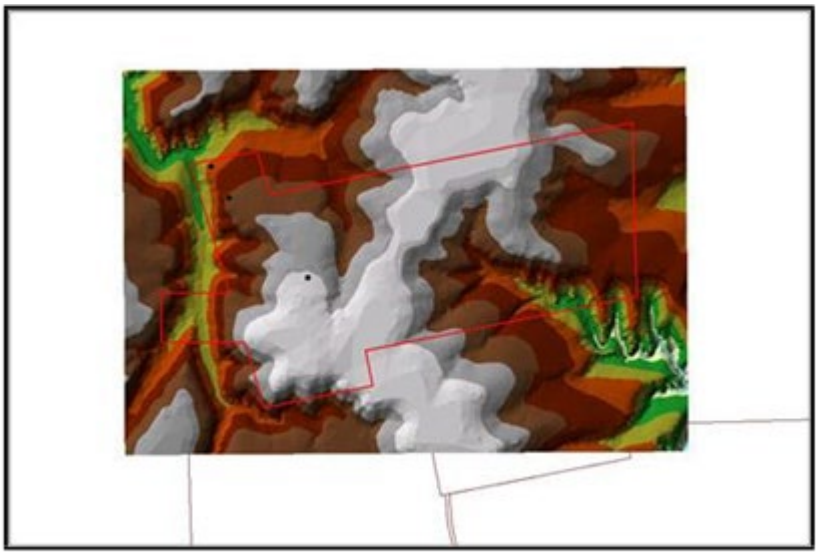
70.0, 44

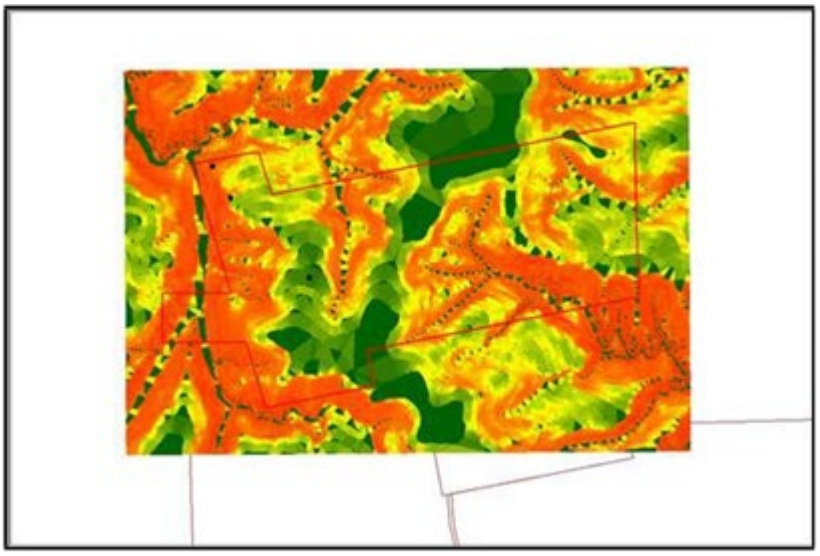
Note the comma delineation and use of decimals in the first field. Field names are needed but are ignored. The first field represents the breaks and values need to be decimal, the second field represents codes and values need to be integer. The units of the slope range are defined by the {units}. When this argument is not specified, the default classification is used.

And here is how we do it pictographically (example study shown):









Appendix B Laboratory Certificate of Analysis

Land and Soil Capability Assessment

Panorama BESS

Panorama BESS SubCo

SLR Project No.: 660.30234.00003

20 March 2024

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ABN: 41 995 651 524

AGRICULTURAL SOIL ANALYSIS REPORT

12 samples supplied by SLR Consulting Australia Pty Ltd on 31/10/2022. Lab Job No.N4112

Analysis requested by Murray Fraser. Your Job: 660.30234.003 Bathurst BESS BSAL

10 Kings Road NEW LAMBTON NSW 2305

			Sample 1	Sample 2	Sample 3	Sample 4
		Sample ID:	B1 0-10cm	B1 20-30cm	B1 40-50cm	B1 65-75cm
		Crop:	n/g	n/g	n/g	n/g
		Client:	Canadian Solar	Canadian Solar	Canadian Solar	Canadian Solar
	Parameter	Method reference	N4112/1	N4112/2	N4112/3	N4112/4
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.15	6.00	6.76	7.16
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.039	0.021	0.019	0.018
	Exchangeable Calcium (cmol+/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	14	29	18	25
	Exchangeable Calcium (kg/ha)		6,488	13,087	7,885	11,187
	Exchangeable Calcium (mg/kg)		2,896	5,842	3,520	4,994
	Exchangeable Magnesium (cmol+/kg)		4.5	5.3	4.2	5.4
	Exchangeable Magnesium (kg/ha)		1,218	1,434	1,133	1,474
	Exchangeable Magnesium (mg/kg)		544	640	506	658
	Exchangeable Potassium (cmol+/kg)		1.8	1.7	0.26	0.37
	Exchangeable Potassium (kg/ha)		1,550	1,531	229	328
	Exchangeable Potassium (mg/kg)		692	683	102	146
	Exchangeable Sodium (cmol+/kg)		1.2	0.33	0.29	0.50
	Exchangeable Sodium (kg/ha)		594	168	148	258
	Exchangeable Sodium (mg/kg)		265	75	66	115
	Exchangeable Aluminium (cmol+/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		3.5	1.7	<1	<1
	Exchangeable Aluminium (mg/kg)		1.6	<1	<1	<1
	Exchangeable Hydrogen (cmol+/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.08	0.07	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		1.7	1.6	<1	<1
	Exchangeable Hydrogen (mg/kg)		<1	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol+/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol+/kg)	22	37	22	31
	Calcium (%)	**Base Saturation Calculations - Cation cmol+/kg / ECEC x 100	66	80	79	80
	Magnesium (%)		20	14	19	17
	Potassium (%)		8.1	4.8	1.2	1.2
	Sodium - ESP (%)		5.3	0.89	1.3	1.6
	Aluminium (%)		0.08	0.02	0.01	0.01
	Hydrogen (%)		0.35	0.20	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol+/kg)	3.2	5.5	4.2	4.6
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.75	5.34	6.16	6.28
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 3/2 Dark Brown	2.5 YR 2.5/2 Very Dusky Red	10 YR 4/4 Dark Yellowish Brown	7.5 YR 5/4 Brown
	Mottles Munsell Colour		..	..	..	..
	Degree of Mottling (%)		..	..	..	..

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwood.
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
7. Total Acid Extractable Nutrients indicate a store of nutrients.
8. National Environmental Protection (Assessment of Site Contamination) Measure 2013, Schedule B(1) - Guideline on Investigation Levels for Soil and Groundwater. Table 5-A Background Ranges.
9. Information relating to testing colour codes is available on sheet 2 - 'Understanding your agricultural soil results'.
10. Conversions for 1 cmol+/kg = 230 mg/kg Sodium, 390 mg/kg Potassium, 122 mg/kg Magnesium, 200 mg/kg Calcium
11. Conversions to kg/ha = mg/kg x 2.24
12. The chloride calculation of Cl mg/L = EC x 640 is considered an estimate, and most likely an over-estimate
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AGRICULTURAL SOIL ANALYSIS REPORT

12 samples supplied by SLR Consulting Australia Pty Ltd on 31/10/2022. Lab Job No.N4112

Analysis requested by Murray Fraser. Your Job: 660.30234.003 Bathurst BESS BSAL

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10 Kings Road NEW LAMBTON NSW 2305

			Sample 5	Sample 6	Sample 7	Sample 8
		Sample ID:	B2 0-10cm	B2 20-30cm	B2 40-50cm	B2 65-75cm
		Crop:	n/g	n/g	n/g	n/g
		Client:	Canadian Solar	Canadian Solar	Canadian Solar	Canadian Solar
	Parameter	Method reference	N4112/5	N4112/6	N4112/7	N4112/8
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	6.48	6.38	6.95	7.31
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.068	0.027	0.037	0.024
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	34	20	14	6.9
	Exchangeable Calcium (kg/ha)		15,196	8,777	6,145	3,110
	Exchangeable Calcium (mg/kg)		6,784	3,918	2,744	1,388
	Exchangeable Magnesium (cmol$_+$/kg)		23	5.0	4.5	4.2
	Exchangeable Magnesium (kg/ha)		6,311	1,374	1,222	1,150
	Exchangeable Magnesium (mg/kg)		2,817	613	546	513
	Exchangeable Potassium (cmol$_+$/kg)		0.85	0.40	0.22	0.39
	Exchangeable Potassium (kg/ha)		746	349	194	344
	Exchangeable Potassium (mg/kg)		333	156	87	153
	Exchangeable Sodium (cmol$_+$/kg)		1.5	0.27	0.43	0.20
	Exchangeable Sodium (kg/ha)		767	141	223	102
	Exchangeable Sodium (mg/kg)		342	63	100	46
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	<0.01	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		1.7	<1	<1	<1
	Exchangeable Aluminium (mg/kg)		<1	<1	<1	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.12	0.07	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.7	1.6	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.2	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	60	25	19	12
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	57	77	73	59
	Magnesium (%)		39	20	24	36
	Potassium (%)		1.4	1.6	1.2	3.3
	Sodium - ESP (%)		2.5	1.1	2.3	1.7
	Aluminium (%)		0.01	0.02	0.02	0.02
	Hydrogen (%)		0.21	0.28	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	1.5	3.9	3.0	1.6
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	6.15	5.79	6.21	6.52
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	7.5 YR 3/2 Dark Brown	10 YR 4/4 Dark Yellowish Brown	7.5 YR 4/4 Brown	7.5 YR 5/4 Brown
	Mottles Munsell Colour		..	7.5 YR 6/8 Reddish Yellow	10 YR 7/4 Very Pale Brown	5 YR 7/4 Pink
	Degree of Mottling (%)		..	1	10	5

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
4. 'Morgan 1 Extract' adapted from 'Science in Agriculture', 'Non-Toxic Farming' and LaMotte Soil Handbook.
5. Guidelines for phosphorus have been reduced for Australian soils.
6. Indicative guidelines are based on 'Albrecht' and 'Reams' concepts.
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10 Kings Road NEW LAMBTON NSW 2305

			Sample 9	Sample 10	Sample 11	Sample 12
		Sample ID:	B3 0-10cm	B3 20-30cm	B3 40-50cm	B3 65-75cm
		Crop:	n/g	n/g	n/g	n/g
		Client:	Canadian Solar	Canadian Solar	Canadian Solar	Canadian Solar
	Parameter	Method reference	N4112/9	N4112/10	N4112/11	N4112/12
	pH	Rayment & Lyons 2011 - 4A1 (1:5 Water)	5.75	6.54	7.19	7.95
	Electrical Conductivity (dS/m)	Rayment & Lyons 2011 - 3A1 (1:5 Water)	0.031	0.034	0.034	0.035
	Exchangeable Calcium (cmol$_+$/kg)	Rayment & Lyons 2011 - 15D3 (Ammonium Acetate)	8.1	9.6	2.4	3.0
	Exchangeable Calcium (kg/ha)		3,617	4,325	1,095	1,354
	Exchangeable Calcium (mg/kg)		1,615	1,931	489	605
	Exchangeable Magnesium (cmol$_+$/kg)		2.8	2.7	1.7	0.87
	Exchangeable Magnesium (kg/ha)		761	739	451	237
	Exchangeable Magnesium (mg/kg)		340	330	201	106
	Exchangeable Potassium (cmol$_+$/kg)		0.59	1.1	0.16	0.22
	Exchangeable Potassium (kg/ha)		518	985	137	194
	Exchangeable Potassium (mg/kg)		231	440	61	87
	Exchangeable Sodium (cmol$_+$/kg)		0.08	0.10	<0.065	<0.065
	Exchangeable Sodium (kg/ha)		39	50	<33	<33
	Exchangeable Sodium (mg/kg)		17	22	<15	<15
	Exchangeable Aluminium (cmol$_+$/kg)	**Inhouse S37 (KCl)	0.02	<0.01	<0.01	<0.01
	Exchangeable Aluminium (kg/ha)		4.6	1.2	<1	<1
	Exchangeable Aluminium (mg/kg)		2.0	<1	<1	<1
	Exchangeable Hydrogen (cmol$_+$/kg)	**Rayment & Lyons 2011 - 15G1 (Acidity Titration)	0.13	<0.01	<0.01	<0.01
	Exchangeable Hydrogen (kg/ha)		2.9	<1	<1	<1
	Exchangeable Hydrogen (mg/kg)		1.3	<1	<1	<1
	Effective Cation Exchange Capacity (ECEC) (cmol$_+$/kg)	**Calculation: Sum of Ca,Mg,K,Na,Al,H (cmol$_+$/kg)	12	14	4.3	4.1
	Calcium (%)	**Base Saturation Calculations - Cation cmol$_+$/kg / ECEC x 100	69	71	57	73
	Magnesium (%)		24	20	38	21
	Potassium (%)		5.1	8.3	3.6	5.4
	Sodium - ESP (%)		0.65	0.71	1.2	0.27
	Aluminium (%)		0.19	0.05	0.08	0.03
	Hydrogen (%)		1.1	0.00	0.00	0.00
	Calcium/Magnesium Ratio	**Calculation: Calcium / Magnesium (cmol$_+$/kg)	2.9	3.5	1.5	3.5
	pH	**Rayment & Lyons 2011 - 4B4 ($CaCl_2$)	5.20	5.69	6.30	6.99
	Moist Munsell Colour	**Inhouse Munsell Soil Colour Classification	5 YR 3/3 Dark Reddish Brown	7.5 YR 4/4 Brown	7.5 YR 4/4 Brown	5 YR 3/2 Dark Reddish Brown
	Mottles Munsell Colour		..	..	10 YR 6/4 Light Yellowish Brown	10 YR 7/6 Yellow
	Degree of Mottling (%)		..	..	2	3

Notes:

1. All results presented as a 40°C oven dried weight. Soil sieved and lightly crushed to < 2 mm.
2. Methods from Rayment and Lyons, 2011. *Soil Chemical Methods - Australasia.* CSIRO Publishing: Collingwo
3. Soluble Salts included in Exchangeable Cations - NO PRE-WASH (unless requested).
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AGRICULTURAL SOIL ANALYSIS REPORT

12 samples supplied by SLR Consulting Australia Pty Ltd on 31/10/2022. Lab Job No.N4112

Analysis requested by Murray Fraser. Your Job: 660.30234.003 Bathurst BESS BSAL

RESULTS OF SOIL ANALYSIS

12 soil samples supplied by SLR Consulting Australia on 31st October, 2022 - Lab Job No. N4112

Analysis requested by Murray Fraser. Job Ref 660.30234.003 Bathurst BESS BSAL

10 Kings Road NEW LAMBTON NSW 2305

	Method	Sample 1 B1 0-10cm	Sample 2 B1 20-30cm	Sample 3 B1 40-50cm	Sample 4 B1 65-75cm	Sample 5 B2 0-10cm	Sample 6 B2 20-30cm	Sample 7 B2 40-50cm	Sample 8 B2 65-75cm	Sample 9 B3 0-10cm	Sample 10 B3 20-30cm	Sample 11 B3 40-50cm	Sample 12 B3 65-75cm
	Job No.	*N4112/1*	*N4112/2*	*N4112/3*	*N4112/4*	*N4112/5*	*N4112/6*	*N4112/7*	*N4112/8*	*N4112/9*	*N4112/10*	*N4112/11*	*N4112/12*
Emerson Dispersion Class	*** Emerson Aggregate Test (EAT)*	3	3	3	3	4	3	3	3	4	3	4	4

Notes:

1. All results as dry weight DW - samples were dried at 40 oC for 24-48 h prior to crushing and analysis.
2. Australian Standard 1289.3.8.1-1997 (see summary attached as EAT Flow Chart); AS/NZS 1547:2000
3. Analysis conducted between sample arrival date and reporting date.
4. ** NATA accreditation does not cover the performance of this service.
5. .. Denotes not requested.
6. This report is not to be reproduced except in full.
7. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer scu.edu.au/eal or on request).
8. Results relate only to the samples tested.
9. This report was issued on 15/11/2022

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

GRAIN SIZE ANALYSIS (hydrometer and sieving techniques)

12 soil samples supplied by SLR Consulting Australia on 31st October, 2022 - Lab Job No. N4112

Analysis requested by Murray Fraser. Job Ref 660.30234.003 Bathurst BESS BSAL

10 Kings Road NEW LAMBTON NSW 2305

SAMPLE ID	Lab Code	MOISTURE CONTENT (% of water in sample)	TOTAL GRAVEL > 2 mm (% of total oven-dry equivalent)	GRAVEL > 4.75 mm (% of total oven-dry equivalent)	GRAVEL 2.00-4.75 mm (% of total oven-dry equivalent)	COARSE SAND 200-2000 µm (0.2-2.0 mm) (% of total oven-dry equivalent)	FINE SAND 20-200 µm (0.02-0.2 mm) (% of total oven-dry equivalent)	SILT 2-20 µm (% of total oven-dry equivalent)	CLAY < 2 µm (% of total oven-dry equivalent)	Total soil fractions (incl. Gravel)
B1 0-10cm	N4112/1	23.0%	16.5%	2.1%	14.5%	46.3%	19.0%	8.6%	9.6%	100.0%
B1 20-30cm	N4112/2	13.0%	25.7%	6.8%	18.9%	37.6%	26.5%	3.2%	7.1%	100.0%
B1 40-50cm	N4112/3	9.5%	33.3%	14.0%	19.3%	30.2%	23.8%	5.5%	7.1%	100.0%
B1 65-75cm	N4112/4	11.1%	28.2%	3.8%	24.4%	35.8%	16.4%	5.8%	13.7%	100.0%
B2 0-10cm	N4112/5	19.7%	20.6%	4.7%	15.8%	40.4%	21.8%	7.3%	9.9%	100.0%
B2 20-30cm	N4112/6	8.9%	30.8%	5.2%	25.6%	38.5%	19.3%	3.0%	8.4%	100.0%
B2 40-50cm	N4112/7	10.2%	25.6%	3.5%	22.2%	39.8%	14.3%	5.3%	15.1%	100.0%
B2 65-75cm	N4112/8	6.4%	36.4%	5.1%	31.3%	34.6%	17.7%	4.4%	6.9%	100.0%
B3 0-10cm	N4112/9	18.7%	15.2%	5.5%	9.7%	41.1%	26.0%	3.8%	14.0%	100.0%
B3 20-30cm	N4112/10	18.6%	6.9%	0.0%	6.9%	28.1%	18.4%	1.8%	44.7%	100.0%
B3 40-50cm	N4112/11	21.4%	8.7%	3.7%	5.0%	19.8%	15.4%	5.9%	50.2%	100.0%
B3 65-75cm	N4112/12	17.8%	9.5%	0.0%	9.5%	32.7%	21.6%	2.6%	33.6%	100.0%

Note:

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

2: Australian Standard 1289.3.8.1-1997 (see attached)

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

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

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

6. This report was issued on 15/11/2022.

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

Appendix C Agricultural Productivity Gross Margin Sensitivity Analysis

Land and Soil Capability Assessment

Panorama BESS

Panorama BESS SubCo

SLR Project No.: 660.30234.00003

20 March 2024

NSW GOVERNMENT | Department of Primary Industries

BEEF CATTLE GROSS MARGIN BUDGET

Farm enterprise Budget Series: April 2019

Enterprise: **Growing out steers 240kg - 460kg in 12 months**

Enterprise Unit: **100 steers**

Pasture: **Improved Pasture**

INCOME:			**Standard Budget**	**Your Budget**
88	Steers @	$1,403 /hd	$123,464	
10	Steers @	$1,373 /hd	$13,725	
	A. Total Income:		**$137,189**	

VARIABLE COSTS:

Steer Purchase	100 steers purchased at		$670 /hd		$66,960
Cartage to Property	100 steers at	$15.00	/head		$1,500
Livestock and vet costs: see section titled beef health costs for details.					$1,224
Fodder crops (12 ha)					$4,200
Hay & Grain or silage					$0
Drought feeding costs.					$0
Pasture maintenence (for 108 ha of improved country)					$10,800
Livestock selling cost (see assumptions on next page)					$8,004
		B. Total Variable Costs:			$92,688

	GM including pasture cost	GM excluding pasture cost
GROSS MARGIN (A-B)	**$44,501**	**$55,301**
GROSS MARGIN/STEER	**$445.01**	**$553.01**
GROSS MARGIN/DSE*	**$51.57**	**$64.08**
GROSS MARGIN/HA	**$412.04**	**$512.04**

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

Liveweight (kg's) of Stock sold		**Steer sale price cents/kg live**				
		285	**295**	**305**	**315**	**325**
Steer wt.						
-20 kgs	**440**	305	346	388	429	471
0	**460**	359	402	**445**	488	531
+20 kgs	**480**	413	457	502	547	592

Change in gross margin ($/steer) for change in purchase price & sale price.

Steer sale price cents/kg live

Steer Purchase Price C/Kg	**285**	**295**	**305**	**315**	**325**
239	455	498	541	584	627
259	407	450	493	536	579
279	359	402	**445**	488	531
299	311	354	397	440	483
319	263	306	349	392	435

Assumptions **Growing out steers 240kg - 460kg in 12 months**

Enterprise unit is 100 steers purchased at 9 months of age at 240kg liveweight, held for 12 months and sold direct to feedlots at 460kg liveweight.

Sales			
90% steers sold at 21 months	460 kg	@305c/kg	live weight
10% steers sold at 21 months	450 kg	@305c/kg	live weight
Purchases			
Steers purchased at 9 months	240 kg	@279c/kg	live weight

Steers kept for 12 months

Selling costs include: Commission 4%, yard dues $0 (sold direct to feedlot.)
MLA levy $5/hd, average freight cost to feedlot 20.00/hd,
no NLIS tags costed in this budget.

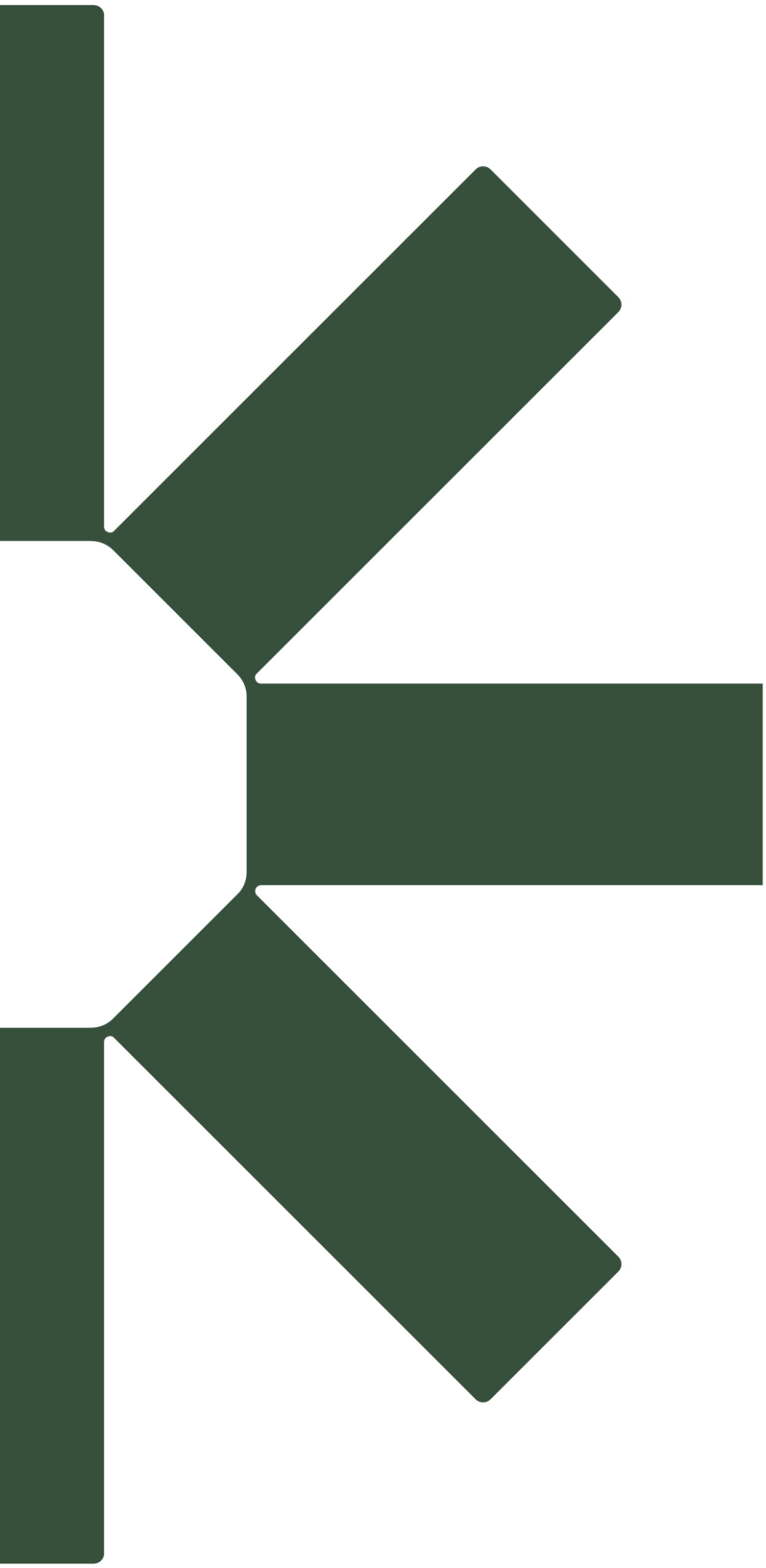
Mortality rate of adult stock: 2%

The average feed requirement for this enterprise is rated at 1.29 LSU
8.90 dse's*. This is an average figure and will vary during the year.

Note that as with breeding enterprises there has been no interest charged on livestock.
If an interest charge of 10% pa is charged a further $6696 of costs should be allowed in the budget.

Marketing Information:
Finished animals are best marketed in deck loads of straight lines, so care needs to be taken when purchasing stores to ensure an even line of weaners for weight and frame.
Later maturing types prefered for the Japanese feedlot 120-170 day grain fed market.
Freight costs will vary depending on proximity to major feedlots.

Production Information:
It may be necessary to wean the steers after purchase which requires adequate facilities on farm.
Growing out enterprises can be risky because of the price variation in both purchases and sales. Producers should consult the table on the previous page that shows gross margin changes due to variation in purchase and sale prices. Producers should determine the maximum purchase price they are prepared to pay before the sale.
Liveweight and description buying are recommended methods.



Making Sustainability Happen