



WHITEHAVEN COAL

1 December 2015

Executive Director
Resource Assessments & Business Systems
Department of Planning & Environment
GPO Box 139
SYDNEY NSW 2001

Attention: Mr David Kitto

Dear David,

RE: APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (Whitehaven) owns the Vickery Coal Mine, an approved open cut coal mine located approximately 25 kilometres north of Gunnedah, within the Gunnedah and Narrabri Local Government Areas (Figure 1). Whitehaven is seeking a Site Verification Certificate (SVC) for potential future mining areas within Exploration Licences (EL) 4699 and 7407 (the SVC Application Area) (Figure 2) in accordance with Division 3 of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007* (Mining SEPP).

The SVC Application Area, comprised of the Northern, Western and Southern Areas (Figure 2), is located within the New England North West Strategic Regional Land Use Plan area. Based on the NSW Government regional mapping, no regionally mapped Biophysical Strategic Agricultural Land (BSAL) is located within the SVC Application Area (Figure 1). No Critical Industry Clusters are located within the New England North West Strategic Regional Land Use Plan area.

SESL Australia (SESL) was commissioned by Whitehaven to conduct a BSAL Assessment of the SVC Application Area. The BSAL Assessment included survey of 56 detailed sites and 9 check sites, all inspected through backhoe excavated test pits (Figure 2).

SESL has assessed the land within the SVC Application Area in accordance with the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government, 2013). The SESL BSAL Assessment Report (Attachment 1) describes the BSAL assessment methodology and results. SESL has verified that no BSAL is located within the SVC Application Area, consistent with the NSW Government regional BSAL mapping.

Table 1 describes how this application addresses the requirements of the *Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land* (NSW Government, 2013).

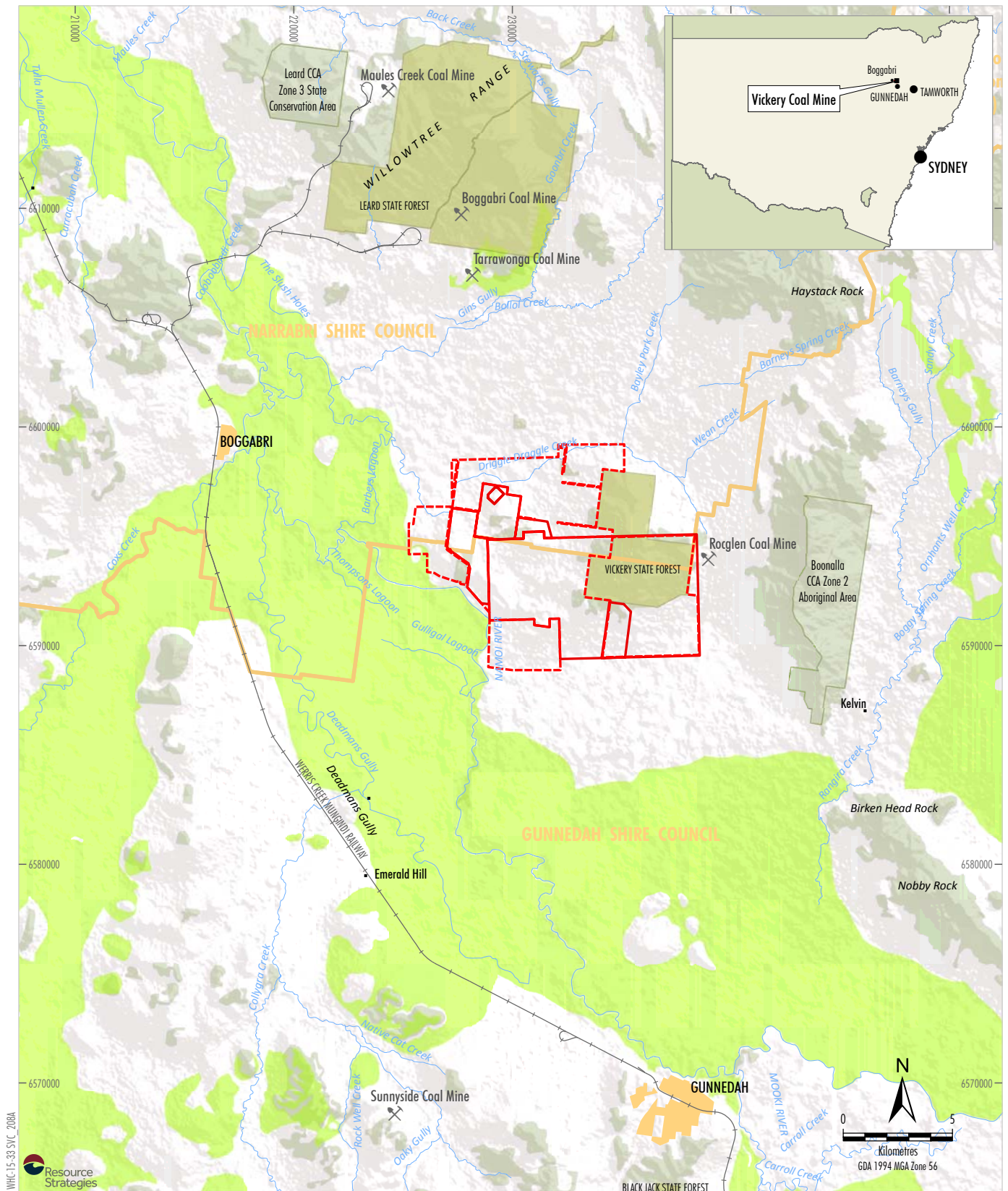
Whitehaven has provided written notice to the owners of the land and infrastructure owners within the SVC Application Area in accordance with Clause 17C(3)(a) of the Mining SEPP. Copies of these notices are provided in Attachment 2.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson

General Manager – Technical Services



WHITEHAVEN COAL
VICKERY EXTENSION PROJECT
Regional Location and
Regionally Mapped BSAL

Figure 1

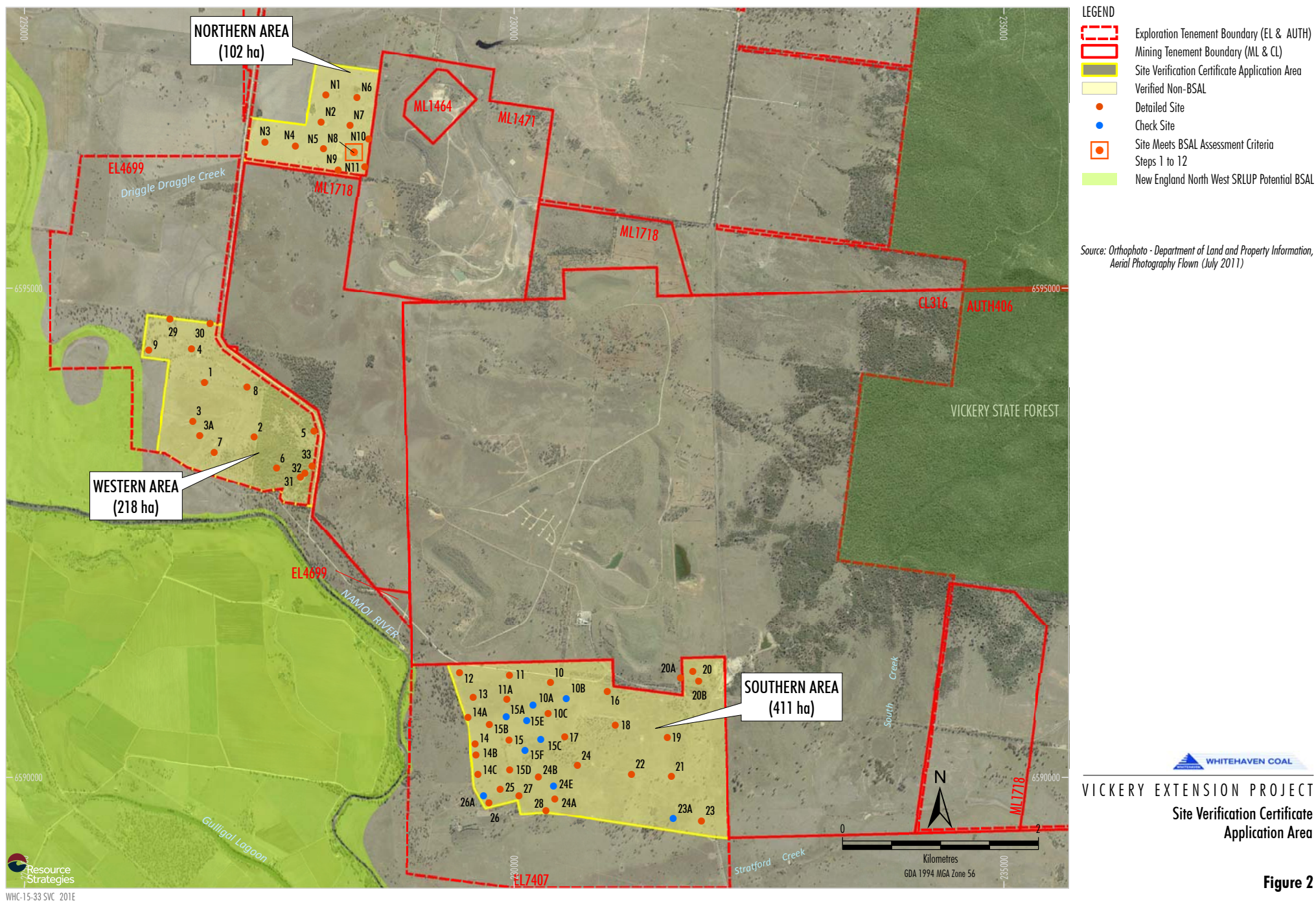


Table 1
Interim Protocol Requirements

Interim Protocol Requirement	Consideration
Personnel	
Evidence provided by the applicant that a qualified soil scientist oversaw the verification assessment and signed off on the quality and extent of the work.	Simon Leake (SESL) and Declan McDonald oversaw the BSAL assessment, including the conduct of the site profile descriptions and laboratory analysis. Simon Leake holds a Bachelor of Science (Ag) (Hons) and is a member of the Australian Society of Soil Science. Declan McDonald holds Certified Professional Soil Scientists (CPSS) accreditation, a Bachelor of Science in Urban Horticulture, and a Masters of Sustainable Agriculture (Soils). The BSAL Assessment Report prepared by SESL is provided as Attachment 1 to this letter.
Maps	
Geographically accurate base map (at 1:25,000) of Application Area supplied. Spatial dataset (boundary of Application Area) supplied in GIS format.	A geographically accurate base map of the Application Area is provided in the SESL BSAL Assessment Report. The maps/figures in the report have been prepared at a scale suitable for presentation on an A4 page. A copy of the base map showing the Application Area at 1:25,000 has been provided separately with this application. A spatial dataset in GIS format of the Application Area boundaries has been provided with this application.
A soil map of the project area (at 1:25,000) supplied including all observation sites. Spatial dataset (soil map, observation sites and data reliability/data source diagram) supplied in GIS format.	A soil map showing all observation sites is provided in the SESL BSAL Assessment Report. The maps/figures in the report have been prepared at a scale suitable for presentation on an A4 page. A copy of the soil map including all observation sites at 1:25,000 has been provided separately with this application. A spatial dataset in GIS format of the soil map and observation sites has been provided with this application.
A map of assessment area showing BSAL (at 1:25,000) and exclusion zones marked according to their BSAL limitation. Spatial dataset (boundary of BSAL areas) supplied in GIS format.	A map of the SVC Application Area showing the exclusion zones and the verified non-BSAL area (the entire Application Area has been verified non-BSAL) is provided in the SESL BSAL Assessment Report. The maps/figures in the report have been prepared at a scale suitable for presentation on an A4 page. A copy of the map showing verified non-BSAL areas at 1:25,000 has been provided separately with this application. A spatial dataset in GIS format of the SVC Application Area showing the verified non-BSAL area and the exclusion zones has been provided with this application.
Maps presented in correct datum with appropriate symbology, north points, unambiguous legends, meaningful colour ramps, scale bars and sampling grid included.	Maps have been prepared in accordance with the Interim Protocol requirements. The maps/figures in the SESL BSAL Assessment Report have been prepared at a scale suitable for presentation on an A4 page.
Metadata for spatial datasets have been provided.	Metadata for spatial datasets prepared in accordance with ISO 19115 has been provided with this application.
Lodgement of Site and Laboratory Data	
All site observations lodged on BSAL Soil Data Cards and all required field attributes completed correctly.	Relevant field observations and laboratory data for all observations sites has been separately submitted via the Office of Environment & Heritage's (OEH's) eDIRT application.
All laboratory data supplied in the SALIS Lab Data Template, appropriate test procedures identified and all relevant test results completed.	Relevant laboratory data is provided as Appendix B of the SESL BSAL Assessment Report. Laboratory data has been separately submitted via the OEH's eDIRT application. Test procedures and results are described in the SESL BSAL Assessment Report.

Table 1 (continued)
Interim Protocol Requirements

Interim Protocol Requirement	Consideration
Model of Soils Distribution	
Where the proponent does not have access to the land, a model of soils distribution is provided.	Not applicable. Access to all of the land within the Application Area was available.
Site Assessment	
The Project area of part thereof contains a contiguous area of at least 20 hectares which meets all BSAL conditions.	No part of the Application Area has more than 20 hectares of land which meets Steps 1 to 12 of the Interim Protocol BSAL criteria.
Sampling density is as specified in the Interim Protocol.	The sampling density in areas with less than 10% slope is approximately 1 detailed pit per 14 hectares in the "Southern Area", 1 pit per 15 hectares in the "Western Area" and 1 pit per 10 hectares in the "Northern Area" which complies with the Interim Protocols required sampling density for more intensive developments e.g. open cut coal mining.
Observation sites (check, detailed and exclusion sites) are relatively evenly distributed across the survey area.	Observation sites were initially evenly distributed across the survey area, targeting a 400 metre spacing (i.e. approximately 1 pit per 17 hectares where slope is <10%). Additional observation sites were inspected to further define boundaries between soil types and improve mapping of soil units. The majority of the observation sites investigated by SESL were detailed sites (56 sites). Consistent with the Interim Protocol, all detailed sites were investigated using backhoe excavated test pits. An additional 9 check sites were also inspected using backhoe excavated test pits. Consistent with the Interim Protocol, no exclusion sites were investigated as the exclusion zones were identified using LIDAR data.
Each soil type identified has at least three detailed sites.	Each soil type identified by the soil survey has at least three detailed sites.
All relevant data has been collected and provided for detailed sites as per the Interim Protocol.	The data for each detailed site is presented in Appendix B of the SESL BSAL Assessment Report and has been separately submitted to OEH via the eDIRT application.
Detailed sites are representative of the soil type being assessed.	All soil types were described using detailed sites.
Description of detailed sites is accompanied by a photograph of the site and of the soil profile being assessed.	Photographs of all soil profiles are provided as Appendix C to the SESL BSAL Assessment Report.
Appropriate information collected for all exclusion sites.	Not applicable. Consistent with the Interim Protocol, no exclusion sites were investigated as the exclusion zones were identified using LIDAR data.
At least two exclusion sites per polygon in excluded areas.	Not applicable. Consistent with the Interim Protocol, no exclusion sites were investigated as the exclusion zones were identified using LIDAR data.
Adequate number of check sites used to (i) allocate a site to a soil type and soil map unit and, (ii) confirm existing mapping.	Detailed sites were investigated across the entire Application Area. Additional check sites were used to define boundaries between soil types.
Cross Reference Assessment with OEH Soils Data	
Soil mapping and attributes appear consistent with OEH soil and landscape data and expected/anticipated soil types in the Project area or locally.	The New England North West Strategic Regional Land Use Plan does not map any BSAL within the Application Area. The results of this BSAL assessment are consistent with the NSW Government's regional BSAL mapping.

ATTACHMENT 1
BSAL ASSESSMENT REPORT (SESL, 2015)

BSAL Assessment Report

FOR

Vickery Coal Mine

Boggabri, NSW

Prepared for Whitehaven Coal
Limited

November 2015

Report: BSAL Assessment
Report_FA

Document Control

Prepared by:	Alisa Bryce, SESL Australia	<i>ABryce</i>	October 2015
Reviewed by:	Simon Leake, SESL Australia	<i>Simon Leake</i>	October 2015
Reviewed by:	Declan McDonald, SESL Australia	<i>Declan McDonald</i>	November 2015
Final submission:	Alisa Bryce, SESL Australia	<i>ABryce</i>	November 2015

DISCLAIMER

This report has been prepared in accordance with the brief provided by Resource Strategies Pty Ltd and Whitehaven Coal Limited. Data has been collated via desktop study and site investigations. Field information was gathered during the specified timeframe (August – October 2015) and reflects site conditions at that time. The report is for the use of Whitehaven Coal. SESL Australia takes no responsibility for its use by other parties.

COPYRIGHT

© 2015, SESL Australia Pty Ltd.

The concepts, information and design ideas contained in this document are the property of SESL Australia Pty Ltd (ABN 70106 810 708). Use or copying of this document in whole or in part without the written permission of SESL Australia constitutes an infringement of copyright.

Table of Contents

1. INTRODUCTION	4
2. SITE DESCRIPTION	4
3. SOIL RESOURCES	7
3.1 Desktop Study and Review of Available Information	7
Desktop study	7
eSPADE Soil Profile Database	7
Geology/Parent Materials for Soil Formation	7
Soil Types (ASC soil orders)	7
Strategic Agricultural Land	8
Agricultural Resource Assessment: “Vickery Coal Project”	8
3.2 Assessment Methodology	8
Field Survey	8
Laboratory testing	12
3.3 Site Soil Types	12
3.5 Site soil characteristics	16
Soil depth, texture and water holding capacity	16
Drainage	16
pH	16
Salinity & Sodicity	16
4. BIOPHYSICAL STRATEGIC AGRICULTURAL LAND (BSAL) ASSESSMENT	17
4.1 Discussion	19
5. REFERENCES	31

Tables

Table 1 Mean climate statistics BoM Station No. 055023 (Gunnedah Pool)	7
Table 2 Study Area Sampling Density	8
Table 3 Number of ASC soil types in the three Study Areas (determined from detailed pits).....	12
Table 4 BSAL Assessment Matrix - Western Area.....	20
Table 5 BSAL Assessment Matrix - Southern Area.....	23
Table 6 Check Site Clarification.....	28
Table 7 BSAL Assessment Matrix - Northern Area	28

Figures

Figure 1 Regional location and regionally mapped BSAL	5
Figure 2 Application Area	6
Figure 3 Regional surface geology	10
Figure 4 Pit locations and slope.....	11
Figure 5 ASC soil types and test pit locations - Southern Area.....	13
Figure 6 ASC soil types and test pit locations - Western Area.....	14
Figure 7 ASC soil types and test pit locations - Northern Area	15
Figure 8 BSAL Assessment flowchart	18

Appendices

Appendix A	Existing soil information
Appendix B	Selected field and laboratory data
Appendix C	Soil pit photos

1. Introduction

The Vickery Coal Mine, owned by Whitehaven Coal Limited (WHC), is located approximately 22km north of the Gunnedah, within the Gunnedah basin of New South Wales (NSW) (Figure 1). The Vickery Coal Mine is located within Mining Leases (ML) 1471 and 1718 and Coal Lease (CL) 316.

WHC is seeking a Site Verification Certificate (SVC) for potential future mining areas within parts of Exploration Licences (EL) 4699 and EL 7407. Three separate Study Areas comprise the SVC Application Area (Figure 2).

This Biophysical Strategic Agricultural Land (BSAL) Assessment Report has been prepared in accordance with the Interim Protocol for Site Verification and Mapping of Biophysical Strategic Agricultural Land (NSW Government, 2013) (Interim Protocol) to accompany WHC's SVC application.

2. Site Description

The Vickery Coal Mine is located within both the Gunnedah and Narrabri Local Government Areas and adjacent to the Vickery State Forest. A number of coal mines are located nearby, including the Canyon (no longer operational), Rocglen, Tarrawonga, Boggabri and Maules Creek Mines.

The Application Area is comprised of three separate Study Areas – the Southern Area, Western Area, and Northern Area (Figure 2).

Elevation in the Southern Area ranges from 250m Australian Height Datum (AHD) along the western boundary to 296m in the north-east corner of the site. The southern area encompasses a flat area rising to 286m in the centre of the Site. Land use is cleared grazing land for cattle.

Elevation in the Western Area ranges from 250m AHD in the north-west of the site up to 294m AHD in the forested area in the east. Land use is cleared grazing land for cattle and remnant and regrowth vegetation.

The Northern Area is relatively flat with an elevation of 249 – 252m AHD. Current land use is cleared grazing land for cattle.

No regionally mapped Biophysical Strategic Agricultural Land (BSAL) (NSW Government 2014) is located within the Application Area (**Figure 1**, Figure 2). Regionally mapped BSAL is associated with lower lying country to the west and south of the Application Area.

The area experiences a temperate climate with an average annual rainfall of approximately 600mm. Data taken from the Bureau of Meteorology (BOM) Gunnedah Pool meteorological station (Station No. 055023) over a 126 year period (1876-2011) shows a mean maximum temperature of 26 °C and mean minimum of 10.9 °C. January is the hottest and wettest month with an average temperature range between 18.4 - 34 °C and mean rainfall of 71.1mm. Table 1 provides major climate statistics for the BOM Gunnedah Pool meteorological station (BOM, 2015).

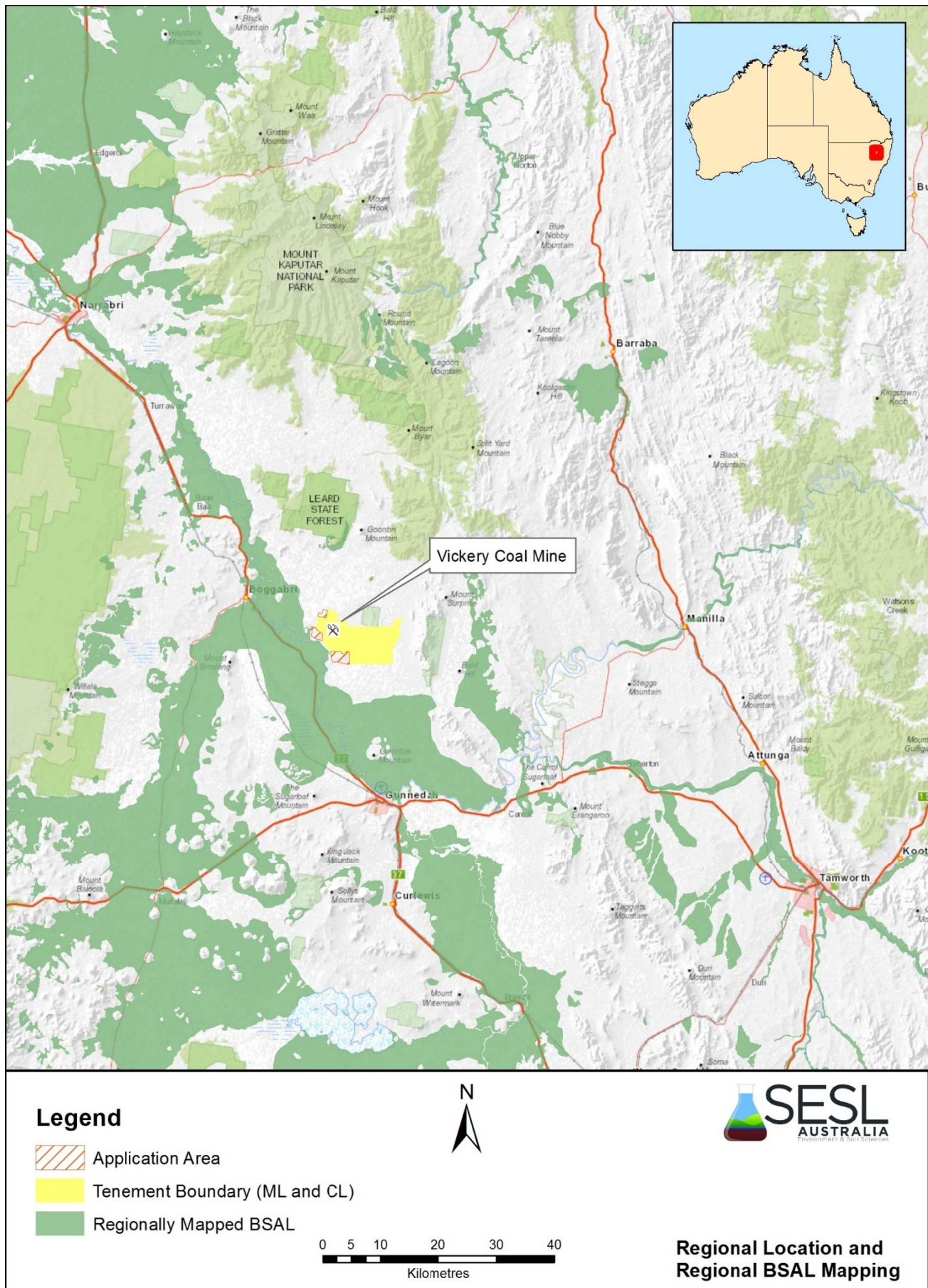


Figure 1 Regional location and regionally mapped BSAL

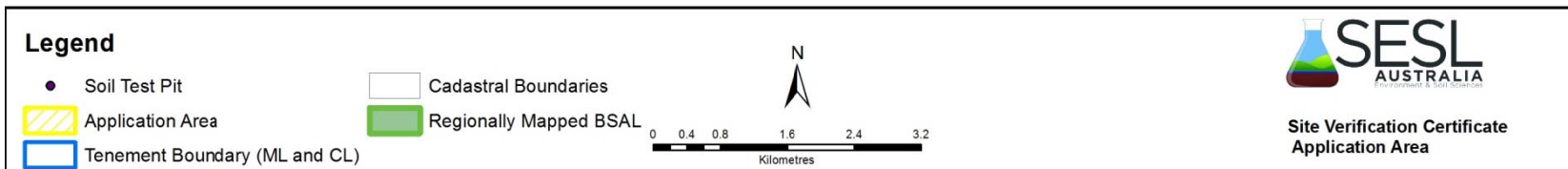
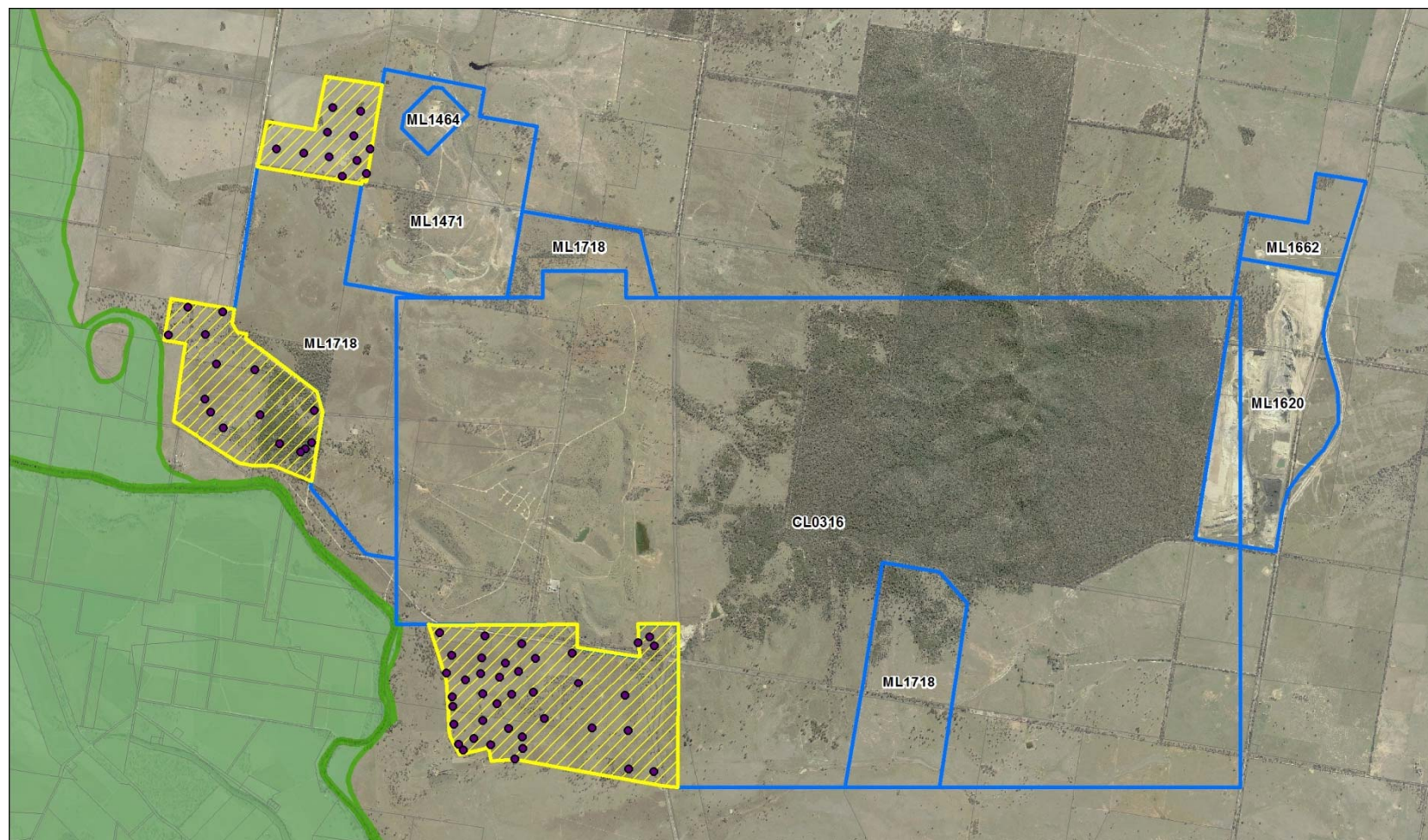


Figure 2 Application Area

Table 1 Mean climate statistics BoM Station No. 055023 (Gunnedah Pool)

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Temperature	Mean maximum temp (°C)	34	32.9	30.7	26.4	21.3	17.6	16.9	18.9	22.8	26.7	30.3	32.9	26
	Mean minimum temp (°C)	18.4	18.1	15.8	11.4	7.1	4.3	3.0	4.2	7.0	10.8	14.2	16.8	10.9
Rainfall	Mean rainfall (mm)	71.1	66.9	48.6	37.5	42.1	44.3	42.3	41.1	39.9	54.6	61.9	70.2	620.3

3. Soil Resources

3.1 Desktop Study and Review of Available Information

Desktop study

Several GIS Data Layers were evaluated using ArcGIS 10.1 to determine possible areas of exclusion based on slope, rocky outcrop and gilgai. Slope was assessed by creating a slope raster layer for the Application Area within ArcGIS 10.1. The slope layer was created using ArcGIS Data Management Tools from highly accurate LIDAR information for the area supplemented with 5m contours and a 20m Digital Elevation Model. The slope analysis mapping is presented in Figure 4. Rocky outcrop and gilgai areas were assessed using satellite imagery.

Small areas with slope >10% were identified in the Southern and Western Areas (Figure 4).

eSPADE Soil Profile Database

There is one Office of Environment and Heritage eSPADE soil profile in the Southern Area (Survey No. 1004239, profile number 48, 'Profile 48'), however the only information available for this profile is topsoil texture (clay loam), structure (moderate pedality, sub-angular blocky, 5 – 10mm) and a pH of 6.

There is one existing eSPADE soil profile in the south-eastern corner of the Western Area (Survey No. 1000935, profile number 225, location 'Gulligal-Broadwater reserve'). The soil profile report classifies the soil as a Brown Sodosol, and is available in Appendix A.

There are no eSPADE soil profiles in the Northern Area.

Geology/Parent Materials for Soil Formation

The main geological units in the Southern and Western Areas are the Maules Creek Formation which consists of carbonaceous claystone, clay sandstone, minor coal and conglomerate. In the Northern Area the geology consists of Sand plains which comprises sand or gravel plains with some residual alluvium, quartz sand sheets, local clay, calcrete, laterite, silcrete, silt and colluvium (Figure 3)(Geoscience Australia, 2009).

Soil Types (ASC soil orders)

Published Australian Soil Classification (ASC) information for the Application Area is only available at 1:2 million scale and therefore considered indicative. Appendix A shows the landscape units mapped with an overlay of the three Study Areas. The Southern area falls within a Sodosol map unit, and the Western and Northern areas within Vertosol map units. This survey has revealed more complexity in soil types, with Sodosols and Dermosols being the most common soil types, followed by Chromosols and Tenosols.

Strategic Agricultural Land

No regionally mapped BSAL is located within the Application Area (NSW Government, 2014). Mapped BSAL areas are located to the west of the Application Area (Figure 2).

Agricultural Resource Assessment: “Vickery Coal Project”

In 2012, McKenzie Soil Management Pty Ltd undertook an agricultural resource assessment in the Vickery Coal Project Area. No pits were examined within the Application Area, however soil pits were placed in adjacent paddocks. ASC soil types are predominantly Dermosols and Sodosols, and reflect similar findings to this BSAL Assessment Report.

3.2 Assessment Methodology

Field Survey

Fieldwork for the Southern and Western Areas was carried out in August and September 2015, and the Northern Area in September and October 2015 (Figure 2).

A total of fifty-six (56) detailed sites were inspected across the Application Area. Thirty (30) were excavated in the Southern Area, fifteen (15) in the Western Area, and eleven (11) in the Northern Area. Sampling density for the three Study Areas is presented in Table 2. The sampling density for each study area is consistent with the Interim Protocol's nominated sampling density of 1 site per 5 to 25 ha for intensive mining developments.

Table 2 Study Area Sampling Density

Study Area	Area (ha)	Number of Detailed Sites	Detailed Site Sampling Density
Southern Area	411 ha	30	1 site per 14 ha
Western Area	218 ha	15	1 site per 15 ha
Northern Area	102 ha	11	1 site per 10 ha

Key data for each detailed pit is presented in Tables 4, 5 and 7. Soil test pits were dug with an excavator to a depth of 1.4m where possible. An additional nine (9) check sites were inspected in the Southern Area (Figure 5 and Table 6). Check sites were also inspected using a backhoe excavated soil test pit. As no areas could be excluded by topography or rocky outcrops, no exclusions sites were necessary.

Pits were located to cover the variety of topographies in each area. In the Northern Area, as elevation only ranges from 249 – 252m, pits were positioned using a grid pattern.

At each detailed pit, the following information was collected:

- thickness of each horizon;
- soil moisture status;
- field pH (using Raupach test kit);
- colour of moistened soil (using Munsell reference colours);
- mottle characteristics;
- pedality of the soil aggregates;
- amount and type of coarse fragments;
- texture (proportions of sand, silt and clay), estimated by hand;
- expected rooting depth;
- presence/absence of carbonates and manganese nodules; and
- other site characteristics as required by eDIRT.

Relevant field observations for each detailed pit are presented in Tables 4, 5 and 7. All field and laboratory data will be made available on eDIRT.

The field description methods were as described in the ‘Australian Soil and Land Survey Field Handbook’ (National Committee on Soil and Terrain, 2009). Soil profiles were classified according to the ASC (Isbell, 2002).

Five soil samples were collected from each detailed pit (0-50mm, 50-150mm, 150-300mm, 300-600mm and 600-1,000mm). One sample was collected from each horizon, however the depth of some horizons meant two samples were collected from within one horizon.

Site data and profile descriptions were compared with the Interim Protocol. A summary of this comparison is provided in Tables 4, 5 and 7.

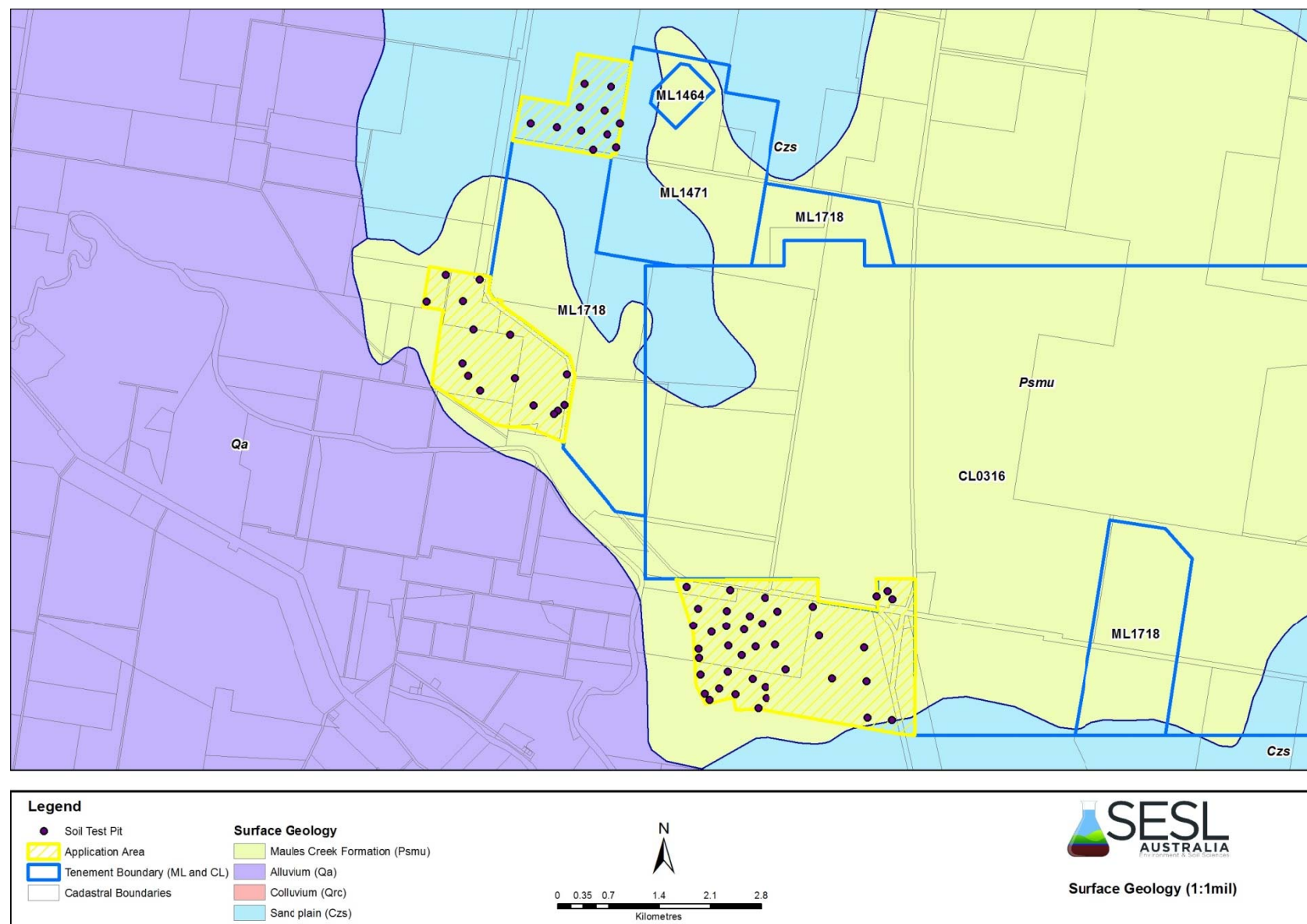


Figure 3 Regional surface geology

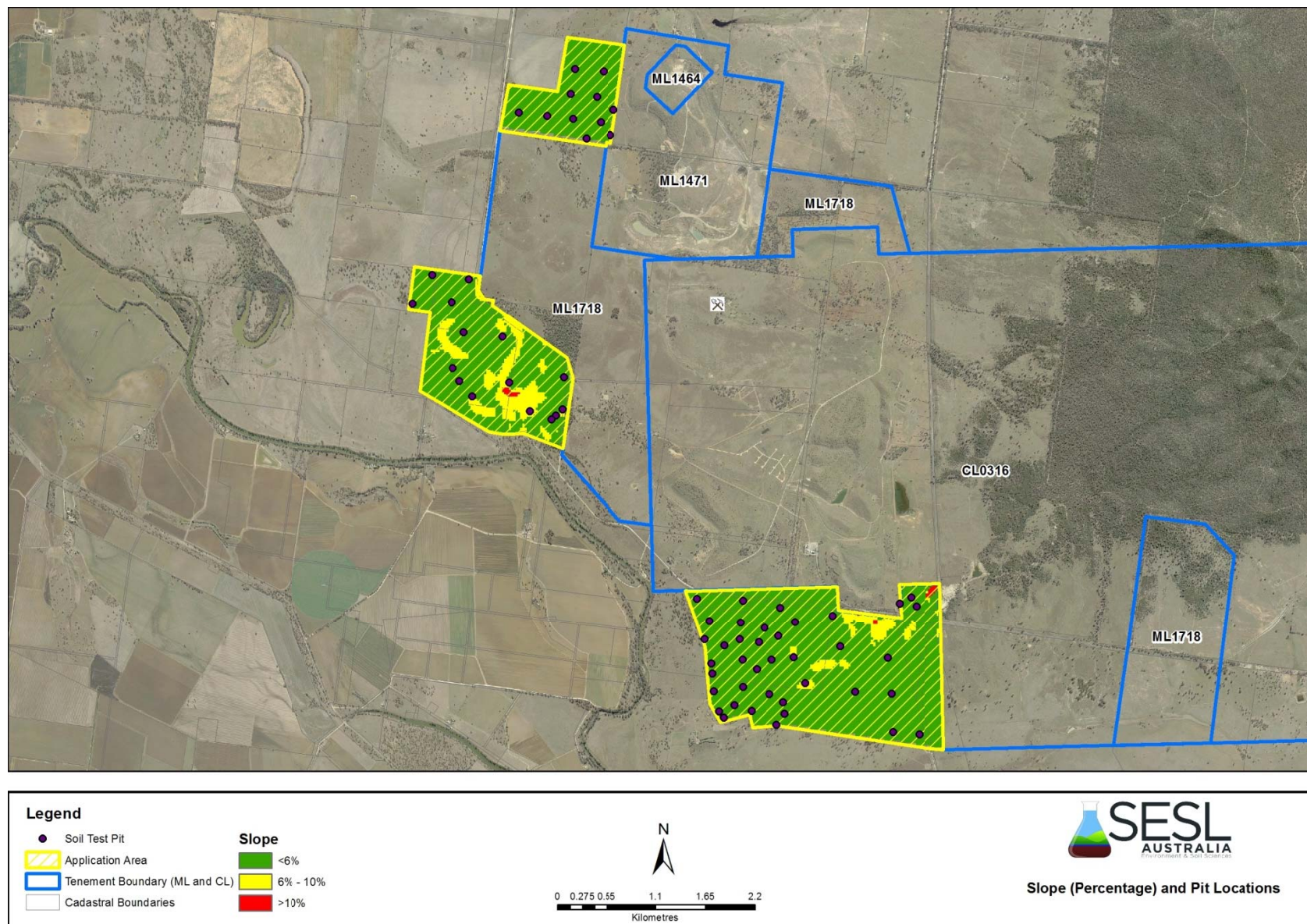


Figure 4 Pit locations and slope

Laboratory testing

Soil samples collected from each detailed pit were sent to the SESL Australia laboratory (Sydney) (NATA Accreditation No 15633) for analysis. Each sample was analysed for pH, salinity (E.C.), chloride, cation exchange capacity, exchangeable cations and exchangeable sodium percentage.

Cations were analysed using an ammonium chloride extraction. Based on the requirements of the Interim Protocol, samples with a field pH of 8 or above had cations analysed with a correction, and samples with a pH below 8 did not have a soluble correction.

The CEC values are the sum of exchangeable sodium, potassium, calcium, magnesium and aluminium. Exchangeable sodium data are presented as exchangeable sodium percentage (ESP).

3.3 Site Soil Types

Soil types were determined using the ASC by Isbell, 2002. The different Soil Orders present within the three Study Areas were determined to be:

Table 3 Number of ASC soil types in the three Study Areas (determined from detailed pits)

	ASC Order	Number of Detailed Sites
Southern Area	Dermosol	15
	Chromosol	6
	Sodosol	6
	Tenosol	3
Western Area	Dermosol	3
	Chromosol	6
	Sodosol	3
	Tenosol	3
Northern Area	Dermosol	5
	Sodosol	6

Photographs of each soil pit are presented in Appendix C.

Under the ASC, the soil types in Table 3 have the following characteristics:

- Chromosols have strong texture contrast between the A and B horizons, and a non-sodic subsoil with pH in water greater than 5.5.
- Sodosols have strong texture contrast between topsoil and subsoil, and the B horizon is sodic (ESP of 6 or greater).
- Dermosols lack a strong texture contrast between the A and B horizons and have moderately to strongly structured B2 horizons.
- Tenosols at this location are shallow with only weak A1 and A2 pedological development, and underlain by rock.

Figures 5, 6 and 7 below illustrate the proposed soil types and boundaries for each study area.

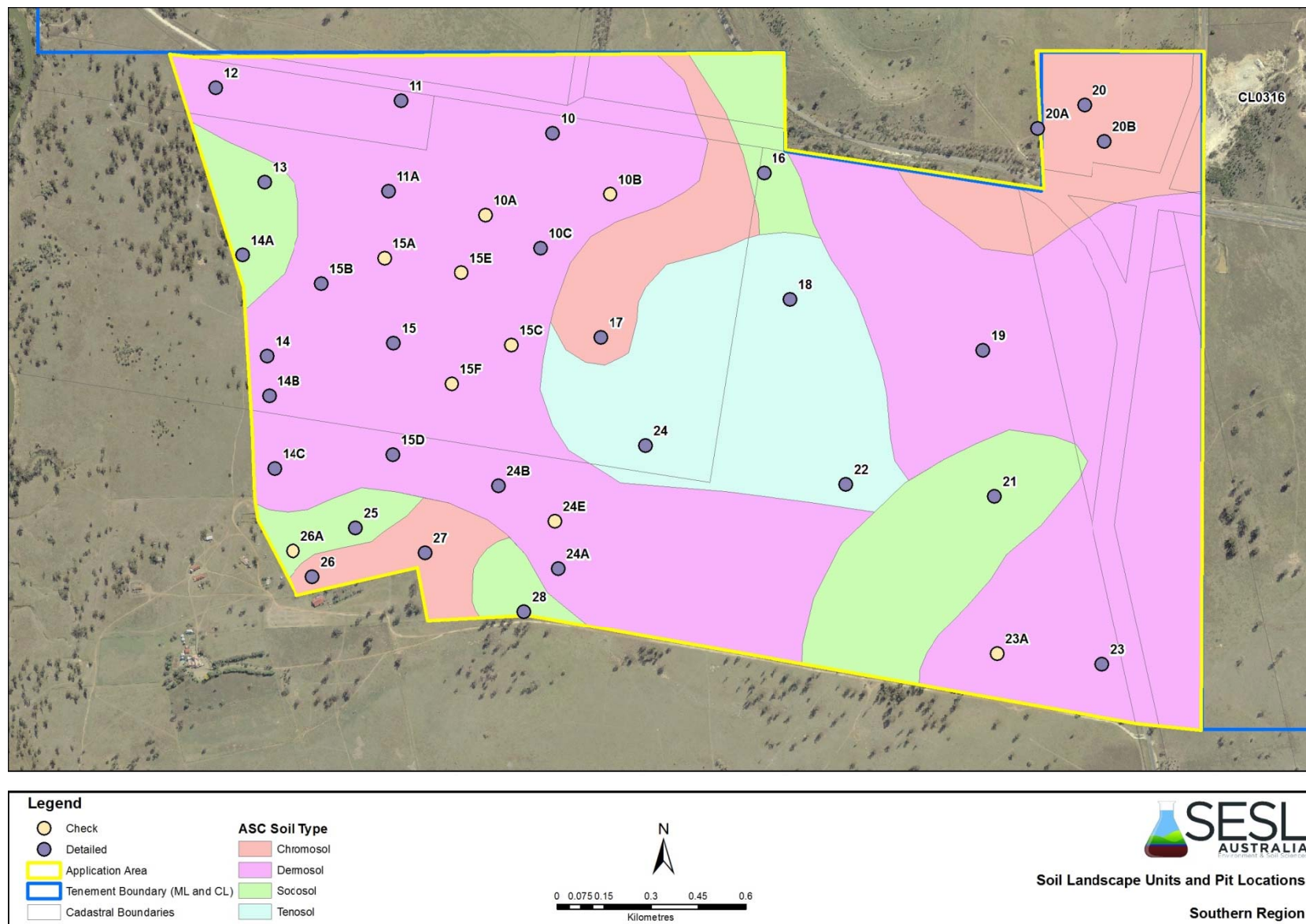


Figure 5 ASC soil types and test pit locations - Southern Area

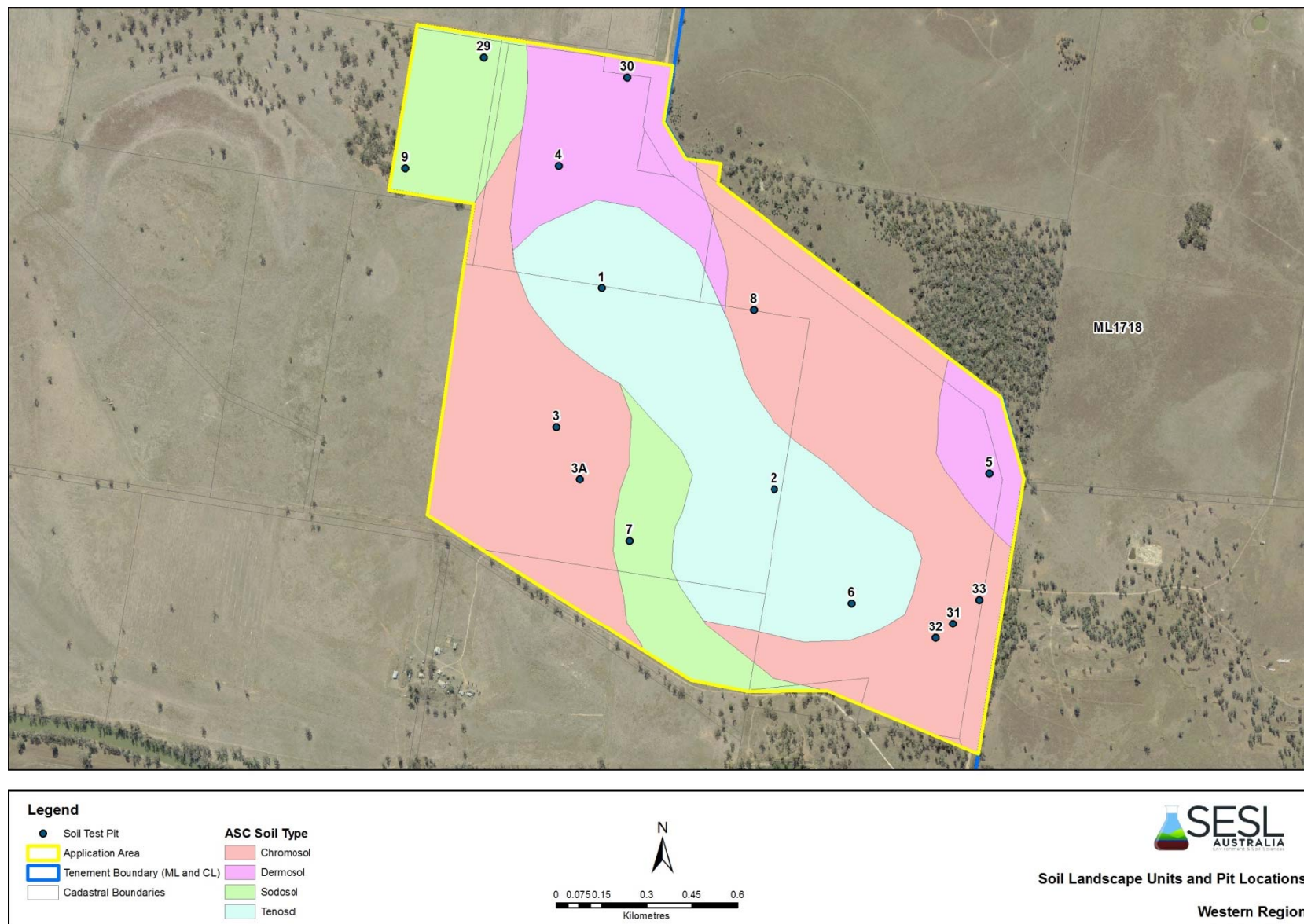


Figure 6 ASC soil types and test pit locations - Western Area

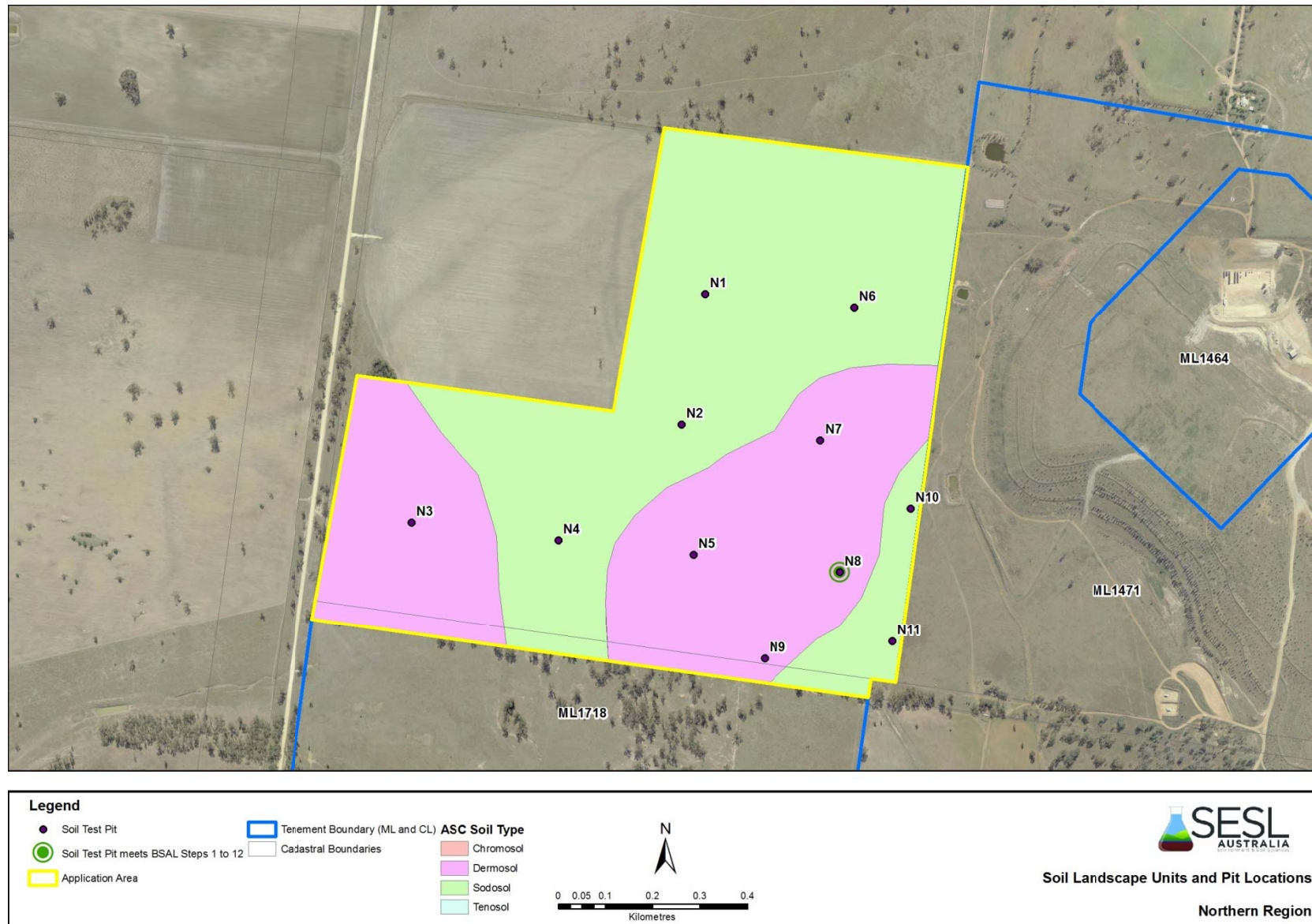


Figure 7 ASC soil types and test pit locations - Northern Area

3.5 Site soil characteristics

Soil depth, texture and water holding capacity

A soil's ability to support healthy plant growth is influenced by soil texture and depth. Sandy, shallow soils have a lower water and nutrient holding capacity than deeper, 'heavier' textured soils such as loams. Note that although clays are the heaviest soil texture, they have a tendency to hold water very tightly and making it unavailable for plant use. Loams are the soil texture that hold the most plant available water.

Across the three Study Areas, soils with the greatest depth were found on the flats and lower slopes. In the more elevated 'ridgeline' topography near the centre of the Western and Southern Areas the soils were shallow and stony, with bedrock encountered as shallow as 400mm depth. These shallow soils often have a sandy loam topsoil and a sandy clay subsoil. The groundcover in these areas was generally more patchy and consisted of shallower rooted species.

At lower elevations across both the Western and Southern Areas, soil profiles are deeper and have higher clay contents. Topsoils tend more towards sandy clay loam and light clay, with light to medium clay B horizons. The B horizons in some of these locations were of such strong, heavy clay that the soil needed to be crushed underfoot before it could be textured. These soils will have a better water holding capacity than shallow, stony soils, however the clay content can still reduce plant available water.

Water holding ability is not considered a major impediment to agriculture in the Application Area – rather chemical issues and poor drainage are greater limitations (see below).

Drainage

Signs of waterlogging include mottling, presence of manganese nodules, and a bleached A2 horizon. Waterlogging is an impediment to plant function through a lack of oxygen in the rootzone. In some cases, anoxic conditions cause root disease.

In the Southern and Western Areas, poor drainage is mostly evident in low-lying areas with strong clay subsoils. These include the north-western and south-western corners of the Southern Area, and the northern and south-western edges of the Western Area. In the Northern Area, waterlogging is an issue in the south-eastern edge, near the two sedimentation dams designed to capture run-off from the rehabilitated Canyon Coal Mine to the east.

pH

All three Study Areas follow a similar pH trend – a neutral pH at the surface grading to an alkaline subsoil. Areas of higher pH are likely a function of high sodium levels.

Salinity & Sodicity

Southern Area

Salinity in the Southern Area is variable. Higher subsoil salinity levels are recorded in the south-west, but only three sites (14C, 15B, 24B) have salinity levels above the Interim Protocol threshold of 4 dS/m. Salinity in the eastern half of the site ranges from 0.2 – 3.2 dS/m throughout the profiles.

Subsoil sodicity is evident in most pits in lower elevations across the site. Pits at higher elevation (18, 20, 20A, 20B, 22, 24) do not exhibit subsoil sodicity.

Western Area

Soil salinity is generally not elevated within this Study Area, with ECe values <2 dS/m across the site and throughout each profile. The subsoil at W5 is saline with an ECe >4 from 500mm depth. Subsoil is generally sodic at lower elevations in the south-western and northern edges of the site. A small pocket around pit 5 in the eastern edge of the site also exhibits subsoil sodicity. Sodicity is not evident in pits at higher elevations (i.e. the ridges in the centre of the site, and the south-eastern edge).

Northern Area

ECe values range from 0.4 to 1.1 dS/m at the surface and 0.5 to 4.2 in the subsoil to 600mm depth. Pits N1 and N10 have elevated salinity, with levels above the BSAL salinity assessment threshold of >4dS/m within the top 600mm of the profile. All pits except N8 are sodic.

4. Biophysical Strategic Agricultural Land (BSAL) Assessment

The Application Area was assessed in accordance with the Interim Protocol (NSW Government, 2013). The 12 Step BSAL assessment criteria are provided in Figure 8 below. Steps 1 to 6 can be assessed using desktop and field observations. No land was found to have:

- slope >10% (Step 1);
- rock outcrop >30% (Step 2);
- unattached rock fragments >60mm diameter over >20% of the area (Step 3);
- gilgai >500mm deep over >50% of the area (Step 4); and
- rock outcrops (Step 6).

Some parts of the Western and Southern Areas were found to have slope between 5 and 10% (Step 5). The fertility status of the soils in these parts was considered in the BSAL assessment (Step 7).

Steps 7 to 12 require laboratory analysis. Steps 7 to 12 of the flowchart were interpreted as follows:

- Step 7: “fertility” – as per Appendix 2 of the Interim Protocol, ASC classes moderate, moderately high and high fertility.
- Step 8: “physical barrier (‘effective rooting depth’)” – a layer >100mm thick with >20% coarse fragments and/or segregations >60mm in diameter (Table 4 of the Interim Protocol), or a layer with >90% coarse fragments within the uppermost 750mm of the profile.
- Step 9: “soil drainage better than poor” – the presence of >10% mottling, and/or a bleached A2 horizon¹, and/or manganiferous nodules or concretions >20% in the top 750mm indicate poor drainage.
- Step 10: “pH” – pH outside 5 – 8.9 if measured in water, within the uppermost 600mm of the profile, is a chemical barrier.
- Step 11: “salinity” - >4 dS/m or chlorides >800 mg/kg in the uppermost 600mm of the profile is a chemical barrier.
- Step 12: “chemical barrier” – an ESP > 6² within the uppermost 750mm of the profile.

¹ Bleached A2 are paler in colour than the A1 above and B horizons below, and are “often an indication of impeded soil drainage” (Murphy and Murphy, 2010 pg 75).

² Although the Interim Protocol adopts >15% sodicity as representing a chemical barrier, according to the ASC a soil with greater than 6% ESP is sodic. ‘Sodosols’, classed as moderately low fertility in Appendix 2 of the Interim Protocol, are initially defined by being texture contrast with a sodic B horizon, where an ESP of 6% is sodic. The key difference between a sodic Dermosol and a Sodosol is texture – Sodosols are texture contrast while Dermosols are not. Therefore if a Sodosol has moderately low fertility, a sodic Dermosol should also have moderately low fertility.

For this reason we adopt the same view as McKenzie (2014) although not for the reason that it imposes a strict chemical barrier, but as it represents a degraded or lower fertility order of Dermosol and it should not have been the intention of the Interim Protocols to include sodic soils as BSAL. Appendix 2 of the Interim Protocol is silent on the issue of sodic Dermosols.

Tables 4, 5 and 7 present a summary of soil data from each detailed site. Parameters that do not meet the BSAL assessment criteria are highlighted in red. Selected field and laboratory data is presented in Appendix B, and all data will be available on eDIRT.

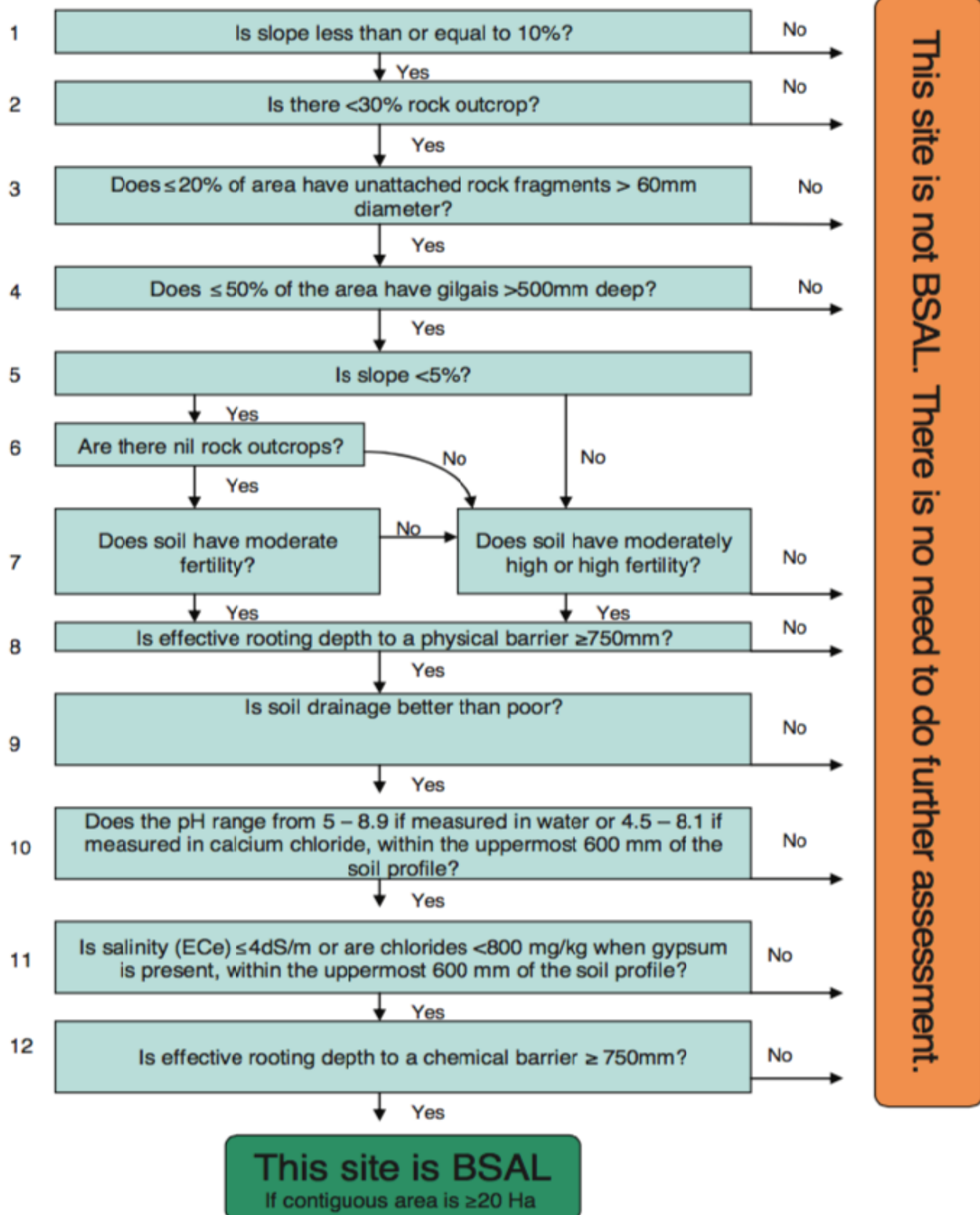


Figure 8 BSAL Assessment flowchart (image: NSW Government, 2013)

4.1 Discussion

The Application Area has been extensively examined using field survey and profile description, laboratory chemical analysis and classification according to the ASC. Field and laboratory results have been used in a BSAL assessment to determine whether any BSAL is located within the Application Area.

No BSAL is located within the Southern or Western Areas.

In the Northern Area, site N8 meets Steps 1 to 12 of the BSAL criteria (Figure 8), however, as the adjacent sites (i.e. sites N5, N7, N9, N10 and N11 [Figure 7]) fail the BSAL criteria, the area of soil that could meet Steps 1 to 12 of the BSAL criteria is less than 20 hectares, and therefore no BSAL is located within in the Northern Area in accordance with the Interim Protocol.

In conclusion, no BSAL is located within the Application Area, consistent with the NSW Government's regional BSAL mapping.

Table 4 BSAL Assessment Matrix - Western Area

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
W1	1	0-100					6	0.3	Leptic Tenosol	Lithic, Basic	No
		100-200					6.3	0.2			
		200-300					6.7	0.3			
		300-400	400	400			6.9	0.7			
		400-700					7.2	0.8			
W2	2	0-100					6.9	0.1	Leptic Tenosol	Lithic, Basic	No
		100-200					6.7	0.2			
		200-300					7	0.2			
		300-400					7.2	0.2			
		400	400				7.2	0.3			
W3	3	0-120					7.2	0.6	Brown Chromosol	Eutrophic, Mottled	No
		120-250					7	0.3			
		250-550		250			7.1	0.5			
		550-750					7.4	0.7			
		750-1000					7.5	0.6			
W3A	301	0-200					6.7	0.5	Brown Chromosol	Eutrophic, Mottled-sodic	No
		200-380					7.7	7.2			
		380-650		380			6.8	16.7			
		650-800	650				6.3	1			
		800-1000					6.7	15.4			
W4	4	0-200					6.7	0.2	Brown Dermosol	Eutrophic, Mottled-sodic	No
		200-400					7.3	1.8			
		400-550		400			7.6	2.6			
		550-800					8.1	7			
		800-1000					8.3	3.9			
W5*	5	0-120					8	2.1	Red Dermosol	Supracalcic, Sodic	No
		120-250					8.3	4.6			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		250-500					8.6	7.2			
		500-750					8.9	13.8			
		750-1000					9	13.3			
W6	6	0-150					7	0.6	Leptic Tenosol	Lithic, Basic	No
		150-300					6.7	0.6			
		300-450					7.2	0.6			
		450-550	450	450			7.4	0.7			
		550-650					7.4	0.6			
W7	7	0-190					7.5	0.8	Brown Sodosol	Mottled-subnatric, Eutrophic	No
		190-320					7.5	1.2			
		320-450					7.9	4.8			
		450-600		450			7.9	13.1			
		600-1000	600				8	7.5			
W8	8	0-220					8.4	0.3	Brown Chromosol	Eutrophic, Melanic	No
		220-400					8.2	0.3			
		400-600		400			8.5	0.5			
		600-800					8.4	0.7			
		800-1000					8.4	0.7			
W9	9	0-80					7	0.4	Brown Sodosol	Subnatric, Eutrophic	No
		80-310					7.2	0.3			
		310-420					7.4	0.8			
		420-750					7.9	5.1			
		750-1000					8.5	8.2			
W29	29	0-50					6.9	0.7	Brown Sodosol	Subnatric, Eutrophic	No
		50-210					7.2	1.4			
		210-340					7.8	6.5			
		340-750					7.9	7.5			
		750-1000					8.4	5.3			
W30	30	0-130					8.5	0.4	Brown Dermosol	Hypocalcic, Sodic	No
		130-300	300				8.3	1			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		300-500					8.6	2.9			
		500-750					8.7	0			
		750-1000					8.7	10			
W31	31	0-50					7.1	0.6	Brown Chromosol	Eutrophic, Mottled	No
		50-160					7.1	0.2			
		160-250					5.6	1.4			
		250-350					5.8	1.4			
		350-500					6.7	3.2			
		500+	500				-	-			
W32	32	0-50					6.6	0.3	Brown Chromosol	Eutrophic, Mottled	No
		50-150					6.9	0.3			
		150-400					7.4	2.2			
		400-550					7.2	5.8			
		500-700	700				7.5	4.2			
W33	33	0-50					7.1	0.2	Brown Chromosol	Eutrophic, Mottled	No
		50-150					7.4	0.3			
		150-300					7.6	0.6			
		300-450					7.4	1.5			
		450-600	600				7.4	1.3			

Red cells indicate parameter exceeds the BSAL assessment criteria.

¹ Indicates whether the site meets the Interim Protocol BSAL assessment criteria Steps 1 to 12.

*W5 has chlorides >800 mg/kg and an ECe >4 dS/m from 500mm depth

Table 5 BSAL Assessment Matrix - Southern Area

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
S10	10	0-50					6.9	0.4	Brown Dermosol	Eutrophic, Sodic	No
		50-150					7.2	0.7			
		150-380					7.5	0.4			
		380-600			500		7.8	5.9			
		600-800		600			8.3	6.8			
S10C	1003	0 - 150					6.2	0.6	Brown Dermosol	Eutrophic, Sodic	No
		150 - 350					7.1	2.3			
		350-550					7.4	3.9			
		550-800					7.9	7.2			
S11	11	0-50				Yes	7	0.8	Brown Dermosol	Eutrophic, Sodic	No
		50-270					7.3	0.9			
		270-330					7.9	4.6			
		330-600					8.7	16.4			
		600-1000					9	22.6			
S11A	1101	0-250				Yes	8	0.3	Grey Dermosol	Eutrophic, Mottled	No
		250-410					7.9	0.2			
		410-500					8	0.7			
		500-750		500			8.1	0.5			
S12	12	0-150				Yes	7.2	0.8	Brown Dermosol	Eutrophic, Manganic	No
		150-330	150				8.1	15.2			
		330-500		330			8.4	20.4			
		500-750					8.9	19.9			
S13	13	0-150					7.6	0.5	Brown Sodosol	Mottled-subnatic, Eutrophic	No
		150-350					7.9	1.9			
		350-500					8.9	18			
		500-750		500			8.9	21.8			
S14	14	0-150					7.8	2.5	Red Dermosol	Hypocalcic, Sodic	No

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		150-400					8.4	3.9			
		400-600					8.6	6.6			
		600-700					8.7	8.4			
		700-1000					8.6	10.3			
S14A	1401	0-150				Yes	7.3	0.7	Brown Sodosol	Mottled-subnatric, Eutrophic	No
		150-300					7.8	4.3			
		300-600		500			8.4	14			
		600-800					8.8	13.3			
S14B	1402	0-50					7.4	0.5	Red Dermosol	Hypocalcic, Sodic	No
		50-150					7.6	0.8			
		150-260					8	2.6			
		260-500					8.1	4.5			
		500-900					8.7	8.1			
S14C^	1403	0-100					6.9	1.7	Brown Dermosol	Eutrophic, Sodic	No
		100-250					8	3.7			
		250-450					8.5	9.1			
		450-750					8.6	9.1			
S15	15	0-100					8.2	0.8	Brown Dermosol	Eutrophic, Sodic	No
		100-250					8.4	5.9			
		250-600					8.5	6.4			
		600-800					8.5	8.9			
S15B^	1502	1-100					7.5	4	Brown Dermosol	Eutrophic, Sodic	No
		100-250					8.5	13.1			
		250-400					8.8	19.1			
		400-700					8	6.3			
		700-1100					8.4	12.2			
S15D	1504	0-150					6.1	0	Red Dermosol	Eutrophic, Mottled	No
		150-300					6.8	0.1			
		300-600		500			7.1	0.4			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		600-800	700				7.3	0.3			
S16	16	0-50				Yes	8.1	0.4	Brown Sodosol	Subnatric,Eutrophic	No
		50-180					8	0.3			
		180-450					8.1	1.1			
		450-580					8.2	17.3			
		580-850					8.5	11.8			
S17	17	0-120					7.6	0.4	Brown Chromosol	Eutrophic,Bleached-mottled	No
		120-450					7.9	1.3			
		450-600		450			8.7	3.4			
		600-800					9	6			
S18	18	0-50					7.5	0.3	Leptic Tenosol	Lithic,Basic	No
		50-120					7.8	0.4			
		120-450					8.4	0.3			
		450-700	650				8.8	5.4			
		700-1000					8.8	5.1			
S19	19	0-50					7.8	1.3	Brown Dermosol	Supracalcic,Sodic	No
		50-170					7.9	3.7			
		170-400					8.9	11.8			
		400-600					9.1	12.2			
		600-1000					9.2	15.8			
S20A	2001	0-50					7.4	0.4	Brown Chromosol	Eutrophic,Haplic	No
		50-150					7.5	0.7			
		150-350					7.6	0.4			
		350-550					7.7	0.1			
		550-700	700				8.2	0.4			
S20	20	0-50					7.1	0.9	Brown Chromosol	Eutrophic,Haplic	No
		50-220					7.6	2.2			
		220-300					8.2	2.8			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		300-400	400				8.6	3.2			
S20B	2002	0-50					7.2	0.1	Brown Chromosol	Eutrophic,Haplic	No
		50-150					7.3	0.2			
		150-350					7.6	0.4			
		350-450	450				7.7	1			
S21	21	0-170					7.1	1.5	Brown Sodosol	Subnatric,Hypocalcic	No
		170-400					8.7	12.4			
		400-600					8.8	14.8			
		600-800					8.9	13.4			
S22	22	0-300					8.6	0.5	Leptic Tenosol	Lithic,Calcareous	No
		300-500	500	500			8.7	1.5			
		500-700					8.9	1.5			
		700-900					9	1.2			
S23	23	0-50					8.9	3	Brown Dermosol	Hypocalcic,Sodic	No
		50-100					8.6	1.6			
		100-280					9	12			
		280-520					9.3	16.1			
		520-900+					9.5	16.8			
S24	24	0-200					7.5	0.6	Leptic Tenosol	Lithic,Basic	No
		200-400					7.5	0.8			
		400-600	400				7.7	1.7			
		600-800		600			7.9	1.7			
S24A	2401	0-200					8.1	1.3	Red Dermosol	Hypocalcic,Sodic	No
		200-400					8.4	12.4			
		400-600					8.6	13			
		600-800					9	9.4			
S24B^	2402	0-150					7	0.6	Brown Dermosol	Eutrophic,Sodic	No
		150-300					7.6	2.8			
		300-500					8.5	6.8			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		500-750					8.7	13.5			
S25	25	0-150					8	0.7	Brown Sodosol	Mottled-subnatic,Eutrophic	No
		150-200					8.2	4.9			
		200-300					8	8.4			
		300-600					8.6	12.5			
		600-900		600			8.6	6.7			
S26	26	0-50					7.7	0.3	Red Chromosol	Eutrophic,Mottled	No
		50-150					7.9	0.4			
		150-300					7.8	0			
		300-600		300			8.2	0.1			
		650+	650				8.5	0.3			
S27	27	0-200					8.7	0.1	Brown Chromosol	Eutrophic,Bleached-mottled	No
		200-400		400			8.5	1.3			
		400-600					8.3	1.9			
		600-800					9.3	0.7			
S28	28	0-250					8.2	2.9	Brown Sodosol	Subnatic,Eutrophic	No
		250-350					8.8	16.8			
		350-500					9	15.1			
		500-650					9.2	29.7			
		650-1000					9.3	35.6			

Red cells indicate parameter exceeds the BSAL assessment criteria.

¹ Indicates whether the site meets the Interim Protocol BSAL assessment criteria Steps 1 to 12.

^ Pits 14C, 15B and 24B have an E_{ce} > 4 dS/m in the top 600mm of the profile.

Table 6 Check Site Clarification

Check site	Reason not BSAL
10a	Bleached A2 horizon (poor drainage)
10b	Bleached A2 horizon (poor drainage)
15a	Bleached A2 horizon (poor drainage)
15c	Bedrock from 600mm
15e	pH >9 at 300mm, ESP >15% from 500mm
15f	>50% mottles from 600mm (poor drainage)
23a	>90% coarse fragments from 600mm
24e	Bleached A2 horizon (poor drainage)
26a	Sodosol

Table 7 BSAL Assessment Matrix - Northern Area

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
N1*	34	0-100					6.1	5.5	Brown Sodosol	Subnatric,Eutrophic	No
		100-300					8.4	15.4			
		300-500					8.5	19.4			
		500-900					7.4	3.7			
N2	35	0-100					6.1	7.4	Brown Sodosol	Subnatric,Hypocalcic	No
		100-300					8.2	14.8			
		300-500					8.2	17.1			
		500-750					8.9	25.8			
N3	36	0-100					6.8	7.3	Brown Dermosol	Eutrophic,Sodic	No
		100-200					7.8	10			
		200-400					7.9	11.3			
		400-600					8.7	13.5			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		600-1000					8.7	18.6			
N4	37	0-150					6.4	1.6	Brown Sodosol	Subnatric, Eutrophic	No
		150-300					7.2	3.6			
		300-500					8	5.6			
		500-800					8.6	9.1			
N5	38	0-150					6.2	5.5	Brown Dermosol	Eutrophic, Sodic	No
		150-300					7.7	24.1			
		300-500	500				7.8	36.1			
		500-800					8	40.3			
N6	39	0-150					5.9	8.1	Brown Sodosol	Subnatric, Hypocalcic	No
		150-350					7.6	16			
		350-550					8.7	20.8			
		550-700					8.5	23.1			
		700-1000					8.9	19.2			
N7	40	0-150					6.4	10.8	Brown Dermosol	Hypocalcic, Sodic	No
		150-350					8.9	28.8			
		350-550					9.1	30.7			
		550-850					8.9	38.7			
N8	41	0-100					6	1.9	Brown Dermosol	Supracalcic, Haplic	Yes
		100-150					6.6	2.3			
		150-400					7.8	4.0			
		400-750					8.6	5.8			
N9	42	0-50					6.2	4.5	Dermosol	Eutrophic, Sodic	No
		50-150					6.3	7			
		150-300					7.7	14.7			
		300-700					8.8	21			
		700-1100					8.8	23.1			
N10*	43	0-50					6.7	7.1	Sodosol	Subnatric, Eutrophic	No
		50-150					6.7	4.9			

Pit	eDIRT profile number	Depth (mm)	Physical barrier	Waterlogging			Chemical Barrier		ASC		BSAL Status ¹
			Depth to Rock (mm)	Depth to mottles >10% (mm)	Depth to Mn >20% (mm)	Bleached A2 horizon	pHw	ESP	Order suborder	Great group, subgroup	
		150-350					8.9	12.7			
		350-500					9.1	14.2			
		500-1100					9.2	15.6			
N11	44	0-50				Yes	6.3	1.7	Sodosol	Subnatric, Eutrophic	No
		50-300					7.3	0.9			
		300-400					8.1	6.2			
		400-800					8.3	9.8			

Red cells indicate parameter exceeds the BSAL assessment criteria.

¹ Indicates whether the site meets the Interim Protocol BSAL assessment criteria Steps 1 to 12.

* N1 and N10 have an ECe > 4dS/m in the top 600mm of the soil profile

5. References

Bureau of Meteorology (BOM) (2015) Climate statistics for Australian locations: summary statistics Gunnedah Pool. Available from: http://www.bom.gov.au/climate/averages/tables/cw_055023.shtml

Geoscience Australia (2009) *Surface geology of Australia 1:1 million scale*

Isbell, R (2002) *The Australian Soil Classification*, Revised Edition (CSIRO: Melbourne)

McKenzie DC (2014) *Site Verification Report: Wilpinjong Coal Mine*. A report prepared for Peabody Energy by McKenzie Soil Management Pty Ltd, Orange NSW, August 2014.

McKenzie DC (2012) *Agricultural Resource Assessment: Vickery Coal Project*. McKenzie Soil Management Pty Ltd, Orange NSW, 2012.

Murphy, B and Murphy, C (2010) 'The Soil Profile', Chapter 5 in Charman, P and Murphy, B (Eds.) *Soils: their properties and management*. Victoria; Oxford University Press

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

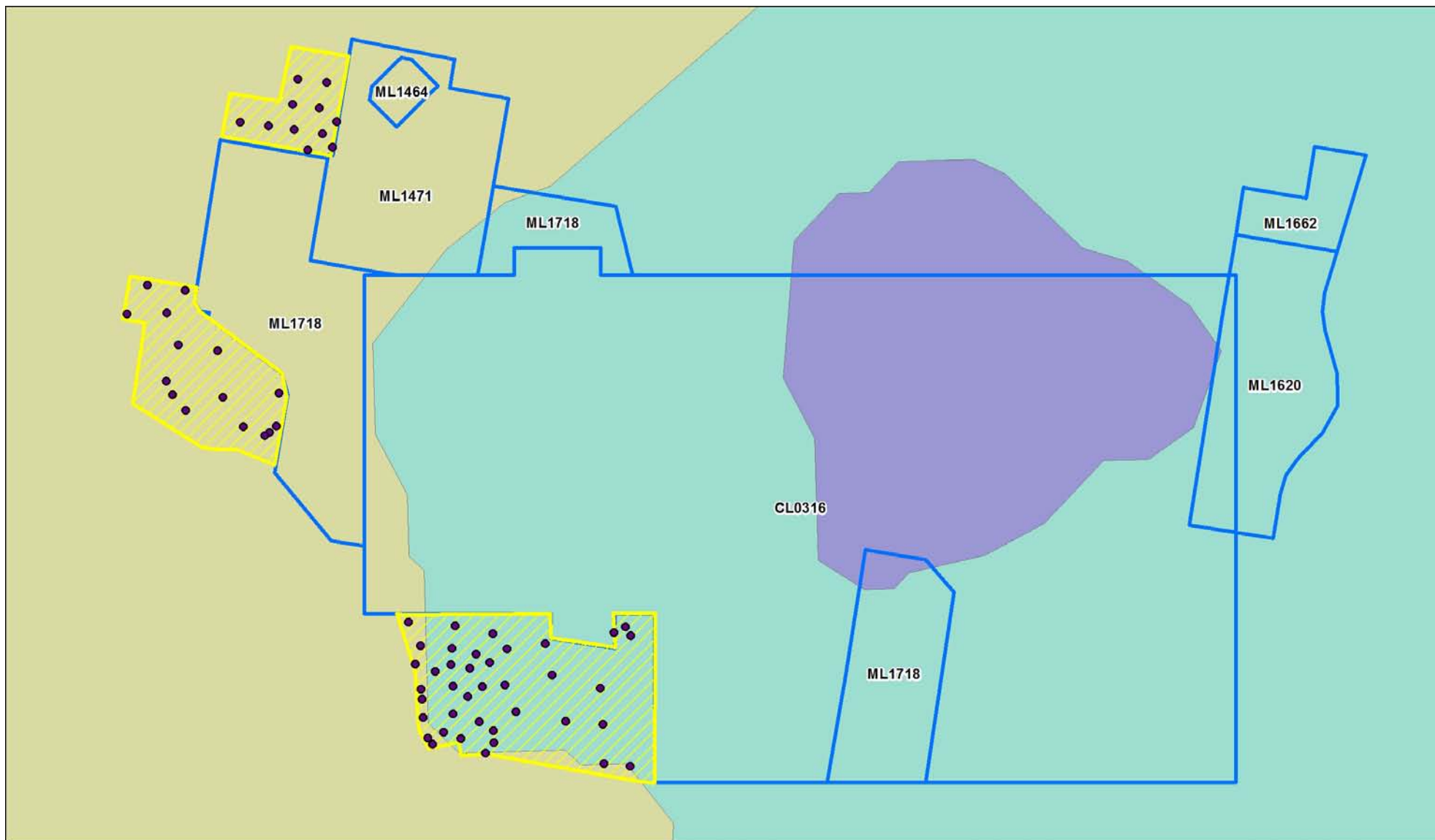
NSW Government (2013) Interim Protocol for site verification and mapping of biophysical strategic agricultural land.

NSW Government (2014) Strategic Agricultural Land Map – Sheet STA_008.

NSW Government (1992) Manilla-Narrabri Metallogenic Map, 1:250, 000. Metallogenic Series Sheet SH/56-9, SH/55-12.

Appendix A

Existing Soil Information



Legend

● Soil Test Pit

Application Area

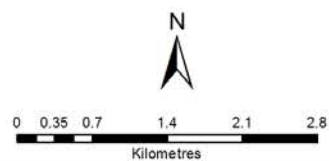
Tenement Boundary (ML and CL)

ASC Soil Type

Sodosol

Tenosol

Vertosol



Regional Australian Soil Classification (1:2mil)

NSW SOIL AND LAND INFORMATION SYSTEM

Soil essentials report

SITE DETAILS:

Site Location:	Gulligal - Broadwater Reserve
Map Reference:	MGA Grid Reference: Zone 56, Easting 227293, Northing 6592777 BOGGABRI (8936) 1:100,000 sheet
Profile Details:	Soil Landscapes of the Boggabri 1:100 000 Sheet Survey (1000935), Profile 225, collected by Robert Banks on July 02, 2002
Physiography:	footslope in low hills under woodland grass u'storey on sandstone-lithic, conglomerate, colluvium lithology and used for volun./native pasture. Slope 4% (measured), elevation 245 m, aspect south. profile is imperfectly drained, erosion hazard is moderate, and no salting evident
Soil Type:	Brown Sodosol (ASC), Solodic Soil(GSG)
Profile Field Notes:	

SOIL DESCRIPTION:

Layer 0 00.00 - 00.00 m	Coarse fragments are few (2-10%), as parent material, gravel (6-20 mm)
Layer 1 00.00 - 00.10 m A1 Horizon	dark greyish brown (greyish yellow brown) (10YR 4/2) sandy clay loam with massive structure (earthy), abundant (>100/10x10cm) roots (<1mm), field pH is 6.5. Coarse fragments are very few (< 2%), as parent material, gravel (6-20 mm), segregations are not evident; clear (20-50 mm) boundary to ...
Layer 2 00.10 - 00.25 m A2 conspicuously bleached Horizon	brown (dull yellowish brown) (10YR 4/3) light clay with massive structure (earthy), many (25-100/10x10cm) roots (<1mm), field pH is 7. Coarse fragments are very few (< 2%), as parent material, gravel (6-20 mm), segregations are not evident; abrupt (5-20 mm) boundary to ...
Layer 3 00.25 - 00.68 m B2 Horizon	strong brown (brown) (7.5YR 4/6) light medium clay with strong pedality (prismatic, 20 - 50 mm, smooth-faced peds), few (1-10/10x10cm) roots (<1mm), field pH is 8.5. Coarse fragments are very few (< 2%), as parent material, gravel (6-20 mm), segregations are not evident; diffuse (>100 mm) boundary to ...
Layer 4 00.68 - 02.00 m 2B2 Horizon	dark brown (7.5YR 3/3) medium clay with strong pedality (prismatic, 20 - 50 mm, smooth-faced peds), few (1-10/10x10cm) roots (<1mm), field pH is 8.5. Coarse fragments are many (20-50%), as parent material, gravel (6-20 mm), segregations are few (2% - 10%), coarse (6-20 mm), calcareous; diffuse (>100 mm) boundary to ...
Layer 99	sandstone-lithic, conglomerate, colluvium soil continues

LABORATORY TESTS:

Sample No	Upper Bound	Lower Bound	% Clay (N517.99_CL)	USCS (N550.02)	pH (N4A1)	EC (N3A1)	OC (N6A1)	Bray Phos. (N9E1)	Phos. Sorb. (N9I1)	Exch. Al (N15F1_AL)	Exch. Ca (N15F1_CA)	Exch. K (N15F1_K)	Exch. M (N15F1_M)
209	00.00	00.10	10		6.0	0.04		38	156	0	4.2	1.3	1.5
210	00.10	00.25	24		6.9	0.11		14	194	0	9.3	1.4	4.8
211	00.25	00.68	30		8.5	0.14		26	202	0	9.2	0.7	4.9
212	00.68	02.00	38		9.3	1.10		25	238	0	5.0	0.5	6.6

For information on laboratory test data and units of measure, please see [Soil survey standard test methods](#)

Soil essentials report

To contact us email: soils@environment.nsw.gov.au

Generated: Sat Aug 15 08:22 2015

© Office of Environment and Heritage (OEH)

Appendix B

Field & Laboratory Results

Western Area – selected chemical data

Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
							Ca	Mg	Na	K	Al			
W1	0-100	Sandy Loam	6	0.02	0.3	19	3.2	0.5	0.0	0.6	0.04	6.5	4	0.3
W1	100-200	Sandy Clay Loam	6.3	0.02	0.2	23	5.6	0.7	0.0	0.5	<0.03	8.6	7	0.2
W1	200-300	Sandy Clay Loam	6.7	0.02	0.2	28	6.5	0.9	0.0	0.4	<0.03	7.1	8	0.3
W1	300-400	Sand	6.9	0.02	0.3	26	3.8	1.2	0.0	0.4	<0.03	3.2	5	0.7
W1	400-700	Sand	7.2	0.02	0.3	24	3.3	1.4	0.0	0.3	<0.03	2.4	5	0.8
W2	0-100	Sandy Loam	6.9	0.04	0.6	21	5.9	0.7	0.0	1.0	<0.03	8.9	8	0.1
W2	100-200	Sandy Clay Loam	6.7	0.03	0.3	19	5.2	0.6	0.0	0.8	<0.03	8.7	7	0.2
W2	200-300	Sandy Clay Loam	7	0.02	0.2	27	4.7	0.6	0.0	0.6	<0.03	8.2	6	0.2
W2	300-400	Sandy Clay Loam	7.2	0.02	0.2	24	4.7	0.6	0.0	0.5	<0.03	8.2	6	0.2
W3	0-120	Sandy Clay Loam	7.2	0.03	0.3	19	4.7	0.8	0.0	1.1	0.05	6.1	7	0.6
W3	120-250	Sandy Clay Loam	7	0.04	0.4	30	8.5	1.3	0.0	1.3	<0.03	6.5	11	0.3
W3	250-550	Clay	7.1	0.03	0.3	78	10.0	2.1	0.1	1.0	<0.03	4.8	13	0.5
W3	550-750	Clay	7.4	-	-	39	10.8	3.1	0.1	1.0	<0.03	3.5	15	0.7
W3A	0-200	Sandy Clay Loam	6.7	0.03	0.3	19	2.8	0.6	0.0	0.8	0.07	4.7	4	0.5
W3A	200-380	Sandy Loam	7.7	0.02	0.3	38	1.3	1.0	0.2	0.3	0.04	1.4	3	7.2
W3A	380-650	Clay	6.8	0.11	0.9	374	2.7	5.6	1.8	0.7	0.03	0.5	11	16.7
W3A	650-800	Clay	6.3	0.02	0.2	29	2.4	0.6	0.0	0.6	<0.03	4.1	4	1
W4	0-200	Sandy Clay Loam	6.7	0.03	0.3	24	8.0	1.2	0.0	1.5	<0.03	6.7	11	0.2
W4	200-400	Sandy Clay Loam	7.3	0.04	0.4	104	15.2	5.2	0.4	1.2	<0.03	2.9	22	1.8
W4	400-550	Clay	7.6	0.05	0.4	159	15.1	5.4	0.6	1.1	<0.03	2.8	22	2.6
W4	550-800	Sandy Clay	8.1	-	-	109	17.0	8.5	2.0	1.0	<0.03	2.0	29	7
W5	0-120	Sandy Clay Loam	8	0.08	0.8	36	9.6	2.9	0.3	1.8	<0.03	3.3	15	2.1
W5	120-250	Sandy Clay Loam	8.3	0.11	1.0	482	10.2	7.2	0.9	0.8	<0.03	1.4	19	4.6
W5	250-500	Sandy Clay Loam	8.6	0.42	4.0	293	11.3	9.7	1.7	0.8	<0.03	1.2	23	7.2
W5	500-750	Sandy Clay Loam	8.9	0.71	6.7	1034	11.2	9.8	3.5	0.9	<0.03	1.1	25	13.8

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

E info@sesl.com.au

PO Box 357

16 Chilvers Rd

F 1300 64 46 89

W sesl.com.au

Pennant Hills NSW 1715

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
W6	0-150	Sandy Loam	7	0.03	0.4	36	3.8	1.2	0.0	0.4	0.0	3.2	6	0.6
W6	150-300	Sandy Loam	6.7	0.02	0.3	17	3.5	0.9	0.0	0.4	<0.03	4.0	5	0.6
W6	300-450	Sandy Loam	7.2	0.02	0.3	12	2.2	0.8	0.0	0.2	0.0	2.7	3	0.6
W6	450-550	Sand	7.4	0.02	0.3	10	2.3	0.9	0.0	0.2	0.0	2.4	3	0.7
W6	550-650	Sand	7.4	0.02	0.3	15	2.3	1.4	0.0	0.2	0.0	1.6	4	0.6
W7	0-190	Sandy Loam	7.5	0.04	0.6	23	6.2	1.4	0.1	1.0	<0.03	4.4	9	0.8
W7	190-320	Sandy Loam	7.5	0.02	0.3	42	4.9	1.6	0.1	0.7	<0.03	3.1	7	1.2
W7	320-450	Clay	7.9	0.04	0.3	256	7.3	4.0	0.6	0.5	<0.03	1.8	12	4.8
W7	450-600	Clay	7.9	0.2	1.7	286	6.2	4.7	1.7	0.3	<0.03	1.3	13	13.1
W7	600-1000	Sandy Clay	8	-	-	280	6.4	3.9	0.9	0.4	<0.03	1.6	12	7.5
W8	0-220	Sandy Loam	8.4	0.03	0.4	52	6.3	0.8	0.0	0.7	<0.03	8.0	8	0.3
W8	220-400	Sandy Loam	8.2	0.04	0.6	23	5.8	0.4	0.0	0.4	<0.03	13.5	7	0.3
W8	400-600	Clay	8.5	0.03	0.3	224	8.6	1.9	0.1	0.6	<0.03	4.5	11	0.5
W8	600-800	Clay	8.4	0.05	0.4	45	10.1	2.7	0.1	0.7	<0.03	3.7	14	0.7
W9	0-80	Sandy Loam	7	0.04	0.6	20	4.0	0.8	0.0	1.2	<0.03	5.3	6	0.4
W9	80-310	Sandy Loam	7.2	0.02	0.3	29	2.8	0.6	0.0	0.5	<0.03	4.4	4	0.3
W9	310-420	Sandy Loam	7.4	-	-	20	1.9	0.5	0.0	0.3	<0.03	3.8	3	0.8
W9	420-750	Clay	7.9	-	-	545	7.2	2.5	0.5	0.0	<0.03	2.9	10	5.1
W29	0-50	Sandy Loam	6.9	0.02	0.3	18	1.4	0.7	0.0	0.5	0.18	2.0	3	0.7
W29	50-210	Sandy Loam	7.2	0.02	0.3	32	1.6	1.0	0.0	0.3	<0.03	1.7	3	1.4
W29	210-340	Sandy Loam	7.8	-	-	53	1.7	1.3	0.2	0.0	<0.03	1.3	3	6.5
W29	340-750	Clay	7.9	-	-	197	6.0	4.9	0.9	0.0	<0.03	1.2	12	7.5
W30	0-130	Clay Loam	8.5	0.04	0.3	26	11.5	1.9	0.1	1.7	0.08	6.1	15	0.4
W30	130-300	Clay Loam	8.3	0.05	0.4	525	11.7	2.4	0.2	1.3	<0.03	4.9	16	1
W30	300-500	Clay	8.6	-	-	36	21.3	7.9	0.9	0.9	<0.03	2.7	31	2.9
W30	500-750	Clay	8.7	-	-	44	24.1	8.2	0.0	1.4	0.08	2.9	34	0
W31	0-50	Sandy Loam	7.1	0.03	0.4	12	5.1	1.4	0.0	0.4	0.04	3.6	7	0.6

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

E info@sesl.com.au

PO Box 357

16 Chilvers Rd

F 1300 64 46 89

W sesl.com.au

Pennant Hills NSW 1715

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
W31	50-160	Sandy Loam	7.1	0.06	0.8	29	9.2	1.7	0.0	0.6	<0.03	5.4	11	0.2
W31	160-250	Sandy Clay Loam	5.6	0.03	0.3	31	0.6	1.0	0.0	0.4	1.4	0.6	3	1.4
W31	250-350	Sandy Clay Loam	5.8	0.02	0.2	40	0.5	1.5	0.0	0.4	1.1	0.3	4	1.4
W31	350-500	Clay	6.7	0.03	0.3	109	6.0	4.0	0.4	0.6	<0.03	1.5	11	3.2
W32	0-50	Sandy Loam	6.6	0.04	0.6	21	9.0	1.8	0.0	0.5	<0.03	5.0	11	0.3
W32	50-150	Sandy Loam	6.9	0.05	0.7	18	7.6	1.7	0.0	0.6	<0.03	4.5	10	0.3
W32	150-400	Sandy Clay Loam	7.4	0.02	0.2	180	2.7	1.1	0.1	0.2	<0.03	2.5	4	2.2
W32	400-550	Clay	7.2	0.09	0.8	280	4.4	7.0	0.7	0.6	<0.03	0.6	13	5.8
W32	500-700	Clay	7.5	0.09	0.8	149	5.9	7.1	0.6	0.6	<0.03	0.8	14	4.2
W33	0-50	Sandy Loam	7.1	0.07	1.0	13	5.5	1.3	0.0	0.6	<0.03	4.2	7	0.2
W33	50-150	Sandy Loam	7.4	0.02	0.3	25	4.4	1.1	0.0	0.4	<0.03	4.0	6	0.3
W33	150-300	Sandy Clay Loam	7.6	0.02	0.2	20	2.8	1.1	0.0	0.3	<0.03	2.5	4	0.6
W33	300-450	Sandy Clay	7.4	0.03	0.3	525	6.1	4.4	0.2	0.5	<0.03	1.4	11	1.5
W33	450-600	Sandy Clay	7.4	0.05	0.4	136	6.0	4.1	0.1	0.4	<0.03	1.5	11	1.3

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Southern area – selected chemical data

Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
							Ca	Mg	Na	K	Al			
S10	0-50	Sandy Clay Loam	6.9	0.03	0.3	20	4.1	0.8	0.0	1.0	<0.03	5.5	6	0.4
S10	50-150	Sandy Clay Loam	7.2	0.03	0.3	22	4.4	0.7	0.0	1.0	0.06	6.5	6	0.7
S10	150-380	Sandy Clay Loam	7.5	0.02	0.2	36	3.8	0.5	0.0	0.5	<0.03	7.0	5	0.4
S10	380-600	Clay	7.8	0.05	0.4	160	4.1	2.4	0.5	0.7	<0.03	1.7	8	5.9
S10	600-800	Clay	8.3	-	-	221	5.4	4.2	0.8	1.0	<0.03	1.3	11	6.8
S10C	0 - 150	Sandy Loam	6.2	0.05	0.7	27	5.5	2.4	0.1	1.2	<0.03	11.2	9	0.6
S10C	150 - 350	Sandy Clay	7.1	0.04	0.3	62	8.8	6.8	0.4	1.2	<0.03	9.2	17	2.3
S10C	350-550	Sandy Clay	7.4	0.06	0.5	77	9.6	8.9	0.8	1.2	<0.03	8.6	21	3.9
S10C	550-800	Sandy Clay	7.9	0.19	1.6	115	10.1	10.8	1.7	1.1	<0.03	10.6	24	7.2
S11	0-50	Sandy Clay Loam	7	0.05	0.5	23	4.6	0.8	0.1	1.2	<0.03	5.6	7	0.8
S11	50-270	Sandy Clay Loam	7.3	0.02	0.2	24	3.7	0.7	0.0	0.7	<0.03	5.2	5	0.9
S11	270-330	Sandy Clay Loam	7.9	-	-	225	4.4	0.0	0.2	0.0	<0.03	4.4	5	4.6
S11	330-600	Clay	8.7	-	-	399	7.7	3.0	2.1	0.0	<0.03	2.6	13	16.4
S11	600-1000	Clay	9	-	-	311	4.9	3.2	2.4	0.1	<0.03	1.5	11	22.6
S11A	0-250	Sandy Clay Loam	8	0.03	0.3	22	4.5	0.6	0.0	1.1	<0.03	7.8	6	0.3
S11A	250-410	Sandy Clay Loam	7.9	0.02	0.2	25	4.5	0.6	0.0	0.7	<0.03	7.9	6	0.2
S11A	410-500	Sandy Clay	8	0.02	0.2	35	4.7	0.8	0.0	0.5	<0.03	6.2	6	0.7
S11A	500-750	Sandy Clay	8.1	-	-	91	10.2	0.9	0.1	0.0	<0.03	11.1	11	0.5
S12	0-150	Sandy Clay Loam	7.2	0.05	0.5	25	5.1	1.3	0.1	1.3	<0.03	3.9	8	0.8
S12	150-330	Sandy Clay Loam	8.1	0.05	0.5	187	2.1	1.3	0.7	0.2	<0.03	1.6	4	15.2
S12	330-500	Sandy Clay	8.4	-	-	1111	3.9	0.0	1.0	0.0	<0.03	0.0	5	20.4
S12	500-750	Sandy Clay	8.9	-	-	494	9.6	6.1	3.9	0.0	<0.03	1.6	20	19.9
S13	0-150	Sandy Loam	7.6	0.25	3.5	18	3.4	0.6	0.0	0.8	<0.03	5.5	5	0.5
S13	150-350	Sandy Loam	7.9	0.02	0.3	16	2.0	0.4	0.1	0.2	<0.03	5.4	3	1.9

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80 E info@sesl.com.au

F 1300 64 46 89 W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
S13	350-500	Clay	8.9	-	-	120	7.4	4.9	2.7	0.0	<0.03	1.5	15	18
S13	500-750	Clay	8.9	-	-	235	5.6	4.7	2.9	0.1	<0.03	1.2	13	21.8
S14A	0-150	Sandy Loam	7.3	0.04	0.6	23	4.7	0.9	0.0	1.2	<0.03	5.2	7	0.7
S14A	150-300	Sandy Loam	7.8	0.02	0.3	18	2.5	0.6	0.2	0.3	<0.03	4.4	3	4.3
S14A	300-600	Clay	8.4	-	-	118	11.6	6.4	3.0	0.4	<0.03	1.8	21	14
S14A	600-800	Sandy Clay Loam	8.8	-	-	237	13.2	7.0	3.2	0.6	<0.03	1.9	24	13.3
S14	0-150	Silty Clay Loam	7.8	0.07	0.0	44	12.5	4.2	0.5	1.8	<0.03	3.0	19	2.5
S14	150-400	Silty Clay	8.4	0.16	0.0	34	27.4	8.5	1.5	0.6	<0.03	3.2	38	3.9
S14	400-600	Clay	8.6	0.39	3.4	167	20.3	10.6	2.2	0.5	<0.03	1.9	34	6.6
S14	600-700	Clay	8.7	-	-	271	20.1	11.2	2.9	0.5	<0.03	1.8	35	8.4
S14	700-1000	Clay	8.6	-	-	422	19.8	12.0	3.7	0.6	<0.03	1.7	36	10.3
14B	0-50	Sandy Clay Loam	7.4	0.05	0.5	27	8.1	1.9	0.1	1.9	<0.03	4.3	12	0.5
14B	50-150	Sandy Clay Loam	7.6	0.04	0.4	32	11.0	2.3	0.1	1.7	<0.03	4.8	15	0.8
14B	150-260	Silty Clay	8	0.03	0.0	78	8.3	2.8	0.3	0.7	<0.03	3.0	12	2.6
14B	260-500	Clay	8.1	0.04	0.3	128	13.8	6.7	1.0	0.7	<0.03	2.1	22	4.5
14B	500-900	Clay	8.7	0.26	2.2	110	15.1	9.3	2.2	0.6	<0.03	1.6	27	8.1
S14C	0-100	Sandy Clay Loam	6.9	0.09	0.9	26	10.0	7.3	0.3	1.4	<0.03	1.4	19	1.7
S14C	100-250	Clay	8	0.19	1.6	21	20.4	14.8	1.4	1.2	<0.03	1.4	38	3.7
S14C	250-450	Clay	8.5	0.36	3.1	103	15.5	17.0	3.3	0.6	<0.03	0.9	37	9.1
S14C	450-750	Clay	8.6	0.63	5.4	272	13.2	20.4	3.4	0.5	<0.03	0.6	38	9.1
S15	0-100	Clay Loam	8.2	0.04	0.3	32	14.8	3.5	0.2	1.6	0.08	4.2	20	0.8
S15	100-250	Clay	8.4	0.08	0.7	48	25.3	7.7	2.1	0.6	<0.03	3.3	36	5.9
S15	250-600	Clay	8.5	0.31	2.7	145	27.5	9.8	2.6	0.5	<0.03	2.8	40	6.4
S15	600-800	Clay	8.5	-	-	432	23.7	9.6	3.3	0.4	<0.03	2.5	37	8.9
S15B	1-100	Sandy Clay Loam	7.5	0.09	0.9	28	7.3	3.9	0.5	0.9	<0.03	1.9	13	4
S15B	100-250	Clay	8.5	0.17	1.5	78	14.0	13.8	4.3	0.6	<0.03	1.0	33	13.1
S15B	250-400	Clay	8.8	0.58	5.0	248	14.0	15.6	7.1	0.5	<0.03	0.9	37	19.1

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
S15B	400-700	Clay	8	2.91	25.0	699	23.2	12.2	2.4	0.5	<0.03	1.9	38	6.3
S15B	700-1100	Clay	8.4	-	-	678	17.0	16.4	4.7	0.6	<0.03	1.0	39	12.2
S15D	0-150	Sandy Clay Loam	6.1	0.05	0.5	38	9.4	2.7	0.0	1.3	<0.03	3.5	14	0
S15D	150-300	Clay Loam	6.8	0.02	0.2	60	13.8	2.8	0.0	0.5	<0.03	4.9	17	0.1
S15D	300-600	Clay	7.1	0.03	0.3	62	16.7	3.4	0.1	0.3	<0.03	4.9	21	0.4
S15D	600-800	Clay	7.3	-	-	41	16.3	3.9	0.1	0.3	<0.03	4.2	21	0.3
S16	0-50	Sandy Loam	8.1	0.02	0.3	19	4.6	0.8	0.0	0.6	<0.03	6.0	6	0.4
S16	50-180	Sandy Loam	8	0.02	0.3	20	3.8	0.8	0.0	0.6	<0.03	5.1	5	0.3
S16	180-450	Sandy Loam	8.1	0.02	0.3	14	2.2	0.8	0.0	0.4	<0.03	2.9	3	1.1
S16	450-580	Clay	8.2	0.34	2.9	396	2.5	6.9	2.1	0.6	0.05	0.4	12	17.3
S16	580-850	Sandy Clay Loam	8.5	-	-	381	1.9	4.2	0.8	0.0	<0.03	0.5	7	11.8
S17	0-120	Sandy Loam	7.6	0.03	0.4	19	3.2	1.0	0.0	0.8	<0.03	3.2	5	0.4
S17	120-450	Sandy Loam	7.9	0.02	0.3	28	2.0	1.1	0.0	0.5	<0.03	1.8	4	1.3
S17	450-600	Sandy Clay	8.7	-	-	90	5.1	3.9	0.3	0.1	<0.03	1.3	9	3.4
S17	600-800	Sandy Clay	9	-	-	128	4.6	5.0	0.6	0.3	<0.03	0.9	11	6
S18	0-50	Sandy Loam	7.5	0.23	3.2	33	8.2	2.3	0.0	1.7	<0.03	3.6	12	0.3
S18	50-120	Sandy Loam	7.8	0.08	1.1	38	4.0	1.1	0.0	1.1	<0.03	3.6	6	0.4
S18	120-450	Sandy Clay Loam	8.4	-	-	66	5.4	2.0	0.0	0.2	<0.03	2.7	8	0.3
S18	450-700	Sandy Clay	8.8	-	-	222	5.8	6.7	0.8	0.5	<0.03	0.9	14	5.4
S18	700-1000	Sandy Clay	8.8	-	-	267	5.9	6.5	0.7	0.3	<0.03	0.9	13	5.1
S19	0-50	Sandy Clay Loam	7.8	0.04	0.4	22	3.2	1.5	0.1	0.7	<0.03	2.1	5	1.3
S19	50-170	Sandy Clay Loam	7.9	0.03	0.3	30	3.4	2.0	0.2	0.5	<0.03	1.7	6	3.7
S19	170-400	Sandy Clay Loam	8.9	-	-	260	6.2	5.0	1.5	0.0	<0.03	1.2	13	11.8
S19	400-600	Clay	9.1	-	-	397	6.5	7.6	2.0	0.3	<0.03	0.9	16	12.2
S19	600-1000	Sandy Clay Loam	9.2	-	-	519	6.2	9.8	3.1	0.5	<0.03	0.6	20	15.8
S20A	0-50	Sandy Loam	7.4	0.04	0.6	21	3.7	1.6	0.0	0.9	<0.03	2.3	6	0.4
S20A	50-150	Sandy Loam	7.5	0.03	0.4	29	2.7	1.0	0.0	0.6	<0.03	2.8	4	0.7

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
S20A	150-350	Sandy Clay Loam	7.6	0.03	0.3	34	2.7	0.9	0.0	0.7	<0.03	2.9	4	0.4
S20A	350-550	Clay	7.7	-	-	123	7.1	4.1	0.0	0.1	<0.03	1.7	11	0.1
S20A	550-700	Clay	8.2	-	-	50	8.5	5.6	0.1	0.7	<0.03	1.5	15	0.4
S20	0-50	Sandy Loam	7.1	-	-	61	5.2	4.1	0.1	1.2	<0.03	2.1	11	0.9
S20	50-220	Sandy Clay Loam	7.6	-	-	95	6.4	5.8	0.3	1.0	<0.03	1.8	13	2.2
S20	220-300	Clay	8.2	-	-	136	6.7	5.3	0.3	0.0	<0.03	1.7	12	2.8
S20	300-400	Clay	8.6	-	-	114	8.0	7.7	0.5	0.4	<0.03	1.7	17	3.2
S20	400-1000	Clay	8.8	-	-	384	6.5	8.6	1.0	0.3	<0.03	1.2	16	6.1
S20B	0-50	Sandy Loam	7.2	0.04	0.6	20	3.0	1.2	0.0	0.6	<0.03	2.5	5	0.1
S20B	50-150	Sandy Loam	7.3	0.04	0.6	18	2.6	1.2	0.0	1.0	<0.03	2.2	5	0.2
S20B	150-350	Sandy Clay Loam	7.6	0.02	0.2	20	2.6	1.1	0.0	0.5	<0.03	2.4	4	0.4
S20B	350-450	Clay	7.7	0.04	0.3	96	5.7	5.1	0.1	0.5	<0.03	1.1	11	1
S20B	450-1000	Clay	8.8	0.12	1.0	35	4.4	5.2	0.3	0.5	<0.03	0.8	10	2.9
S21	0-170	Sandy Loam	7.1	0.04	0.6	25	3.5	1.7	0.1	1.0	0.05	2.1	6	1.5
S21	170-400	Clay	8.7	-	-	434	6.8	9.6	2.4	0.6	<0.03	0.7	19	12.4
S21	400-600	Clay	8.8	-	-	743	6.3	9.8	2.9	0.6	<0.03	0.6	20	14.8
S21	600-800	Clay	8.9	-	-	673	7.7	10.4	2.9	0.7	<0.03	0.7	22	13.4
S22	0-300	Sandy Loam	8.6	0.04	0.6	17	3.8	0.9	0.0	0.7	<0.03	4.1	5	0.5
S22	300-500	Silty Clay Loam	8.7	-	-	47	4.0	2.9	0.1	0.4	<0.03	1.4	7	1.5
S22	500-700	Silty Clay Loam	8.9	-	-	37	3.4	2.7	0.1	0.4	<0.03	1.3	7	1.5
S22	700-900	Silty Clay Loam	9	-	-	43	3.5	2.6	0.1	0.3	<0.03	1.3	6	1.2
S23	0-50	Sandy Clay Loam	8.9	0.06	0.6	32	4.8	2.6	0.3	0.6	<0.03	1.8	8	3
S23	50-100	Sandy Clay Loam	8.6	0.04	0.4	24	6.1	2.7	0.2	0.7	<0.03	2.3	10	1.6
S23	100-280	Clay	9	0.11	0.9	139	7.0	10.2	2.4	0.4	<0.03	0.7	20	12
S23	280-520	Clay	9.3	-	-	383	5.8	11.2	3.3	0.2	<0.03	0.5	21	16.1
S23	520-900	Clay	9.5	-	-	381	5.8	10.8	3.4	0.2	<0.03	0.5	20	16.8
S24	0-200	Sandy Loam	7.5	0.03	0.4	16	2.5	0.9	0.0	0.5	0.04	2.8	4	0.6

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

E info@sesl.com.au

PO Box 357

16 Chilvers Rd

F 1300 64 46 89

W sesl.com.au

Pennant Hills NSW 1715

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
S24	200-400	Sandy Loam	7.5	0.02	0.3	14	1.8	0.7	0.0	0.4	<0.03	2.8	3	0.8
S24	400-600	Clay	7.7	0.04	0.3	145	4.8	3.2	0.2	0.6	<0.03	1.5	9	1.7
S24	600-800	Sand	7.9	0.04	0.6	18	1.9	1.6	0.1	0.3	<0.03	1.2	4	1.7
S24A	0-200	Clay Loam	8.1	0.03	0.3	24	5.4	2.1	0.1	0.8	<0.03	2.6	8	1.3
S24A	200-400	Clay Loam	8.4	0.03	0.3	708	8.9	9.8	2.7	0.3	<0.03	0.9	22	12.4
S24A	400-600	Clay	8.6	0.02	0.2	754	7.9	9.2	2.6	0.3	<0.03	0.9	20	13
S24A	600-800	Clay	9	0.04	0.3	239	10.3	7.0	1.8	0.0	<0.03	1.5	19	9.4
S24B	0-150	Sandy clay	7	0.04	0.3	31	13.3	3.9	0.1	1.8	<0.03	3.4	19	0.6
S24B	150-300	Clay	7.6	0.06	0.5	42	16.4	6.5	0.7	1.1	<0.02	2.5	25	2.8
S24B	300-500	Clay	8.5	0.26	2.2	72	22.0	11.4	2.5	0.8	<0.01	1.9	37	6.8
S24B	500-750	Clay	8.7	0.56	4.8	270	18.3	13.0	5.0	0.6	<0.00	1.4	37	13.5
S25	0-150	Sandy Clay Loam	8	0.06	0.6	27	3.8	1.9	0.0	1.1	<0.03	2.0	7	0.7
S25	150-200	Loam	8.2	0.04	0.0	38	1.9	1.7	0.2	0.5	<0.03	1.1	4	4.9
S25	200-300	Loam	8	-	-	309	4.6	7.2	1.1	0.2	<0.03	0.6	13	8.4
S25	300-600	Clay	8.6	-	-	663	6.3	11.3	2.6	0.6	<0.03	0.6	21	12.5
S25	600-900	Clay	8.6	-	-	505	6.6	9.6	1.2	0.6	<0.03	0.7	18	6.7
S26	0-50	Sandy Clay Loam	7.7	0.06	0.6	27	4.6	1.4	0.0	1.3	<0.03	3.3	7	0.3
S26	50-150	Sandy Clay Loam	7.9	-	-	34	7.0	1.3	0.0	1.1	<0.03	5.4	9	0.4
S26	150-300	Sandy Loam	7.8	-	-	62	5.5	0.3	0.0	0.4	<0.03	19.0	6	0
S26	300-600	Clay Loam	8.2	-	-	49	11.6	1.6	0.0	0.6	<0.03	7.3	14	0.1
S26	650+	Sandy Loam	8.5	-	-	46	8.9	4.1	0.0	0.4	<0.03	2.2	13	0.3
S27	0-200	Sandy Loam	8.7	0.02	0.3	13	2.7	0.9	0.0	0.6	<0.03	3.0	4	0.1
S27	200-400	Sandy Clay	8.5	0.03	0.3	54	3.8	2.2	0.1	0.3	<0.03	1.7	6	1.3
S27	400-600	Sandy Clay	8.3	0.04	0.3	84	4.4	2.9	0.2	0.3	<0.03	1.5	8	1.9
S27	600-800	Sand	9.3	-	-	9	3.7	1.8	0.0	0.1	<0.03	2.1	6	0.7
S28	0-250	Clay Loam	8.2	0.05	0.4	34	3.6	1.8	0.2	0.7	<0.03	2.0	6	2.9
S28	250-350	Sandy Clay Loam	8.8	0.03	0.3	144	1.8	1.6	0.7	0.2	<0.03	1.1	4	16.8

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
S28	350-500	Clay	9	-	-	191	6.5	4.2	1.9	0.0	<0.03	1.5	13	15.1
S28	500-650	Clay	9.2	-	-	379	3.5	2.9	2.7	0.0	<0.03	1.2	9	29.7
S28	650-1000	Clay	9.3	-	-	495	4.4	0.3	2.6	0.0	<0.03	14.2	7	35.6

Northern area – selected chemical data

Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
							Ca	Mg	Na	K	Al			
N1	0-100	Sandy Clay Loam	6.1	0.11	1.0	34	9.0	5.5	0.9	0.8	<0.03	1.6	16	5.5
N1	100-300	Medium clay	8.4	0.23	2.0	93	16.2	9.3	4.7	0.4	<0.03	1.7	31	15.4
N1	300-500	Medium clay	8.5	-	-	237	17.3	11.3	7.0	0.4	<0.03	1.5	36	19.4
N1	500-900	Sandy Clay	7.4			205	40.0	6.4	1.8	0.4	<0.03	6.3	49	3.7
N2	0-100	Sandy Clay Loam	6.1	0.09	0.9	36	4.7	3.3	0.7	1.2	<0.03	1.4	10	7.4
N2	100-300	Medium Clay	8.2	0.12	1.0	52	13.8	7.8	3.8	0.3	<0.03	1.8	26	14.8
N2	300-500	Medium Clay	8.2	0.21	1.8	73	11.9	7.2	4.0	0.3	<0.03	1.7	23	17.1
N2	500-750	Sandy Clay	8.9	-	-	145	9.5	6.1	5.5	0.2	<0.03	1.6	21	25.8
N3	0-100	Medium Clay	6.8	0.11	0.9	41	10.3	5.5	1.3	0.8	<0.03	1.9	18	7.3
N3	100-200	Medium Clay	7.8	0.12	1.0	43	16.5	7.4	2.7	0.5	<0.03	2.2	27	10
N3	200-400	Medium Clay	7.9	0.09	0.8	46	14.1	6.0	2.6	0.3	<0.03	2.4	23	11.3
N3	400-600	Clay	8.7	-	-	47	13.2	5.8	3.0	0.2	<0.03	2.3	22	13.5
N3	600-1000	Clay	8.7	-	-	66	11.2	6.6	4.1	0.2	<0.03	1.7	22	18.6
N4	0-150	Clay Loam	6.4	0.07	0.6	28	11.0	6.4	0.3	1.7	<0.03	1.7	19	1.6
N4	150-300	Medium Clay	7.2	0.05	0.4	45	16.0	7.7	0.9	0.5	<0.03	2.1	25	3.6
N4	300-500	Medium Clay	8	0.07	0.6	46	20.5	9.5	1.8	0.5	<0.03	2.2	32	5.6
N4	500-800	Medium Clay	8.6	-	-	50	15.4	6.6	2.2	0.1	<0.03	2.3	24	9.1
N5	0-150	Light clay	6.2	0.05	0.4	26	5.7	3.8	0.6	1.1	<0.03	1.5	11	5.5
N5	150-300	Light clay	7.7	0.06	0.5	45	5.3	3.7	2.9	0.1	<0.03	1.4	12	24.1
N5	300-500	Light clay	7.8	0.35	3.0	203	7.3	8.2	8.9	0.2	<0.03	0.9	25	36.1
N5	500-800	Light clay	8	0.42	3.6	241	5.6	6.9	8.6	0.2	<0.03	0.8	21	40.3
N6	0-150	Sandy Clay Loam	5.9	0.05	0.5	29	4.8	3.5	0.8	0.7	<0.03	1.4	10	8.1
N6	150-350	Medium clay	7.6	0.09	0.8	47	10.1	8.0	3.5	0.3	<0.03	1.3	22	16

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Pit	Depth (mm)	Texture	pHw	EC (dS/m)	ECe (dS/m)	Cl (mg/kg)	Cations (meq/100g)					Ca:Mg	ECEC 1:5 meq	ESP (%)
N6	350-550	Sandy Clay Loam	8.7	-	-	131	11.7	10.9	6.0	0.3	<0.03	1.1	29	20.8
N6	550-700	Sandy Clay Loam	8.5	-	-	223	9.2	10.2	5.9	0.3	<0.03	0.9	26	23.1
N6	700-1000	Sandy Clay	8.9	-	-	439	13.5	12.9	6.4	0.5	<0.03	1.0	33	19.2
N7	0-150	Clay Loam	6.4	0.13	1.1	50	5.5	3.5	1.2	0.9	<0.03	1.6	11	10.8
N7	150-350	Light clay	8.9	-	-	53	11.7	7.9	8.0	0.2	<0.03	1.5	28	28.8
N7	350-550	Light clay	9.1	-	-	91	9.9	6.0	7.1	0.2	<0.03	1.7	23	30.7
N7	550-850	Light clay	8.9	-	-	324	7.8	7.8	10.1	0.4	<0.03	1.0	26	38.7
N8	0-100	Sandy Loam	6	0.04	0.6	19	6.0	3.0	0.2	1.1	<0.03	2.0	10	1.9
N8	100-150	Sandy clay	6.6	0.03	0.3	23	10.9	4.9	0.4	0.4	<0.03	2.2	17	2.3
N8	150-400	Sandy Clay Loam	7.8	0.05	0.5	19	26.7	14.0	1.7	0.5	<0.03	1.9	43	4
N8	400-750	Sandy Clay Loam	8.6	0.18	1.7	19	23.9	14.8	2.4	0.5	<0.03	1.6	42	5.8
N9	0-50	Clay Loam	6.2	0.07	0.6	21	4.7	2.5	0.4	1.1	<0.03	1.9	8.7	4.5
N9	50-150	Clay Loam	6.3	0.06	0.5	23	4.3	2.2	0.5	0.5	<0.03	2.0	7.5	7
N9	150-300	Clay Loam	7.7	0.06	0.5	110	6.8	4.1	1.9	0.1	<0.03	1.7	12.9	14.7
N9	300-700	Medium clay	8.8	0.14	1.2	89	8.6	5.9	3.9	0.2	<0.03	1.5	18.6	21
N9	700-1100	Sandy Clay	8.8	0.25	2.2	147	7.6	4.7	3.7	0.0	<0.03	1.6	16.0	23.1
N10	0-50	Silty Clay Loam	6.7	0.09	0.0	38	5.2	4.3	0.8	0.6	<0.03	1.2	10.8	7.1
N10	50-150	Silty Clay Loam	6.7	0.11	0.0	23	5.6	3.6	0.5	0.7	<0.03	1.6	10.4	4.9
N10	150-350	Medium Clay	8.9	0.37	3.2	140	12.5	8.7	3.1	0.1	<0.03	1.4	24.4	12.7
N10	350-500	Sandy Clay	9.1	0.49	4.2	209	13.6	9.3	3.8	0.1	<0.03	1.5	26.8	14.2
N10	500-1100	Sandy Clay	9.2	0.68	5.8	271	11.9	9.6	4.0	0.2	<0.03	1.2	25.7	15.6
N11	0-50	Sandy Clay Loam	6.3	0.07	0.7	26	3.9	2.0	0.1	1.4	<0.03	2.0	7.4	1.7
N11	50-300	Sandy Clay Loam	7.3	0.03	0.3	21	4.5	1.9	0.1	0.9	<0.03	2.4	7.4	0.9
N11	300-400	Sandy Clay Loam	8.1	0.02	0.2	26	2.9	1.6	0.3	0.4	<0.03	1.8	5.2	6.2
N11	400-800	Medium clay	8.3	0.04	0.3	71	7.1	5.8	1.4	0.0	<0.03	1.2	14.3	9.8

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80

F 1300 64 46 89

E info@sesl.com.au

W sesl.com.au

PO Box 357

Pennant Hills NSW 1715

16 Chilvers Rd

Thornleigh NSW 2120



Western area – selected physical data

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
					Amount	Size
W1	0-100	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
W1	100-200	A2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	20-60mm
W1	200-300	A2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	20-60mm
W1	300-400	C	Sand / Rock	Single Grained	Very Abundant (>90%)	20-60mm
W1	400-700	C	Sand / Rock	Single Grained	Very Abundant (>90%)	20-60mm
W2	0-100	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
W2	100-200	A2	Sandy Clay Loam	Weak Pedality	Abundant (50-90%)	60-200mm
W2	200-300	A2	Sandy Clay Loam	Weak Pedality	Abundant (50-90%)	60-200mm
W2	300-400	A2	Sandy Clay Loam	Weak Pedality	Abundant (50-90%)	60-200mm
W2	400	C	Rock	-	-	-
W3	0-120	A1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	6-20mm
W3	120-250	A2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	6-20mm
W3	250-550	B1	Clay	Strong Pedality	Common (10-20%)	20-60mm
W3	550-750	B2	Clay	Strong Pedality	Common (10-20%)	20-60mm
W3	750-1000	B2	Clay	Strong Pedality	Common (10-20%)	20-60mm
W3A	0-200	A1	Sandy Clay Loam	Weak Pedality	Many (20-50%)	6-20mm
W3A	200-380	A2	Sandy Loam	Weak Pedality	Few (2-10%)	6-20mm
W3A	380-650	B1	Clay	Moderate Pedality	Many (20-50%)	6-20mm
W3A	650-800	B2	Clay	Strong Pedality	Abundant (50-90%)	60-200mm
W3A	800-1000	B2	Clay	Strong Pedality	Abundant (50-90%)	60-200mm
W4	0-200	A1	Sandy Clay Loam	Weak Pedality	Very Few (<2%)	2-6mm
W4	200-400	A1	Sandy Clay Loam	Weak Pedality	Very Few (<2%)	6-20mm
W4	400-550	A2	Clay	Moderate Pedality	Many (20-50%)	6-20mm
W4	550-800	B1	Sandy Clay	Moderate Pedality	Many (20-50%)	6-20mm
W4	800-1000	B1	Sandy Clay	Moderate Pedality	Many (20-50%)	6-20mm
W5	0-120	A1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	6-20mm
W5	120-250	B1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	6-20mm
W5	250-500	B1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	6-20mm
W5	500-750	B2	Sandy Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
W5	750-1000	B2	Sandy Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
W6	0-150	A1	Sandy Loam	Weak Pedality	Common (10-20%)	6-20mm
W6	150-300	A2	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
W6	300-450	A2	Sandy Loam	Weak Pedality	Many (20-50%)	>600mm
W6	450-550	C1	Sand	Strong Pedality	Very Abundant (>90%)	>600mm
W6	550-650	C1	Sand	Strong Pedality	Very Abundant (>90%)	>600mm
W7	0-190	A1	Sandy Loam	Weak Pedality	Few (2-10%)	2-6mm
W7	190-320	A2	Sandy Loam	Weak Pedality	Very Few (<2%)	2-6mm
W7	320-450	B1	Clay	Moderate Pedality	Very Few (<2%)	6-20mm
W7	450-600	B1	Clay	Moderate Pedality	Very Few (<2%)	20-60mm
W7	600-1000	B2	Sandy Clay	Weak Pedality	Very Abundant (>90%)	20 - 60mm
W8	0-220	A1	Sandy Loam	Weak Pedality	Common (10-20%)	6-20mm
W8	220-400	A2	Sandy Loam	Weak Pedality	Common (10-20%)	6-20mm

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
W8	400-600	B1	Clay	Strong Pedality	Common (10-20%)	6-20mm
W8	600-800	B1	Clay	Strong Pedality	Common (10-20%)	6-20mm
W8	800-1000	B2	Clay	Strong Pedality	Common (10-20%)	6-20mm
W9	0-80	A11	Sandy Loam	Weak Pedality	Few (2-10%)	2-6mm
W9	80-310	A12	Sandy Loam	Weak Pedality	Many (20-50%)	2-6mm
W9	310-420	A2	Sandy Loam	Massive	Many (20-50%)	6-20mm
W9	420-750	B1	Clay	Strong Pedality	Few (2-10%)	2-6mm
W9	750-1000	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm
W29	0-50	A11	Sandy Loam	Weak Pedality	Few (2-10%)	2-6mm
W29	50-210	A12	Sandy Loam	Moderate Pedality	Common (10-20%)	2-6mm
W29	210-340	A2	Sandy Loam	Weak Pedality	Few (2-10%)	2-6mm
W29	340-750	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm
W29	750-1000	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm
W30	0-130	A1	Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
W30	130-300	A (gravel layer)	Clay Loam	Moderate Pedality	Very Abundant (>90%)	20-60mm
W30	300-500	B1	Clay	Strong Pedality	Few (2-10%)	6-20mm
W30	500-750	B1	Clay	Strong Pedality	Few (2-10%)	2-6mm
W30	750-1000	B2	Clay	Strong Pedality	Very Few (<2%)	2-6mm
W31	0-50	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
W31	50-160	A1	Sandy Loam	Weak Pedality	Many (20-50%)	20-60mm
W31	160-250	A2	Sandy Clay Loam	Massive	Abundant (50-90%)	20-60mm
W31	250-350	B1	Sandy Clay Loam	Massive	Abundant (50-90%)	6-20,,
W31	350-500	B2	Clay	Strong Pedality	Many (20-50%)	6-20mm
W31	500-1000	B2	Clay	Strong Pedality	Many (20-50%)	6-20mm
W32	0-50	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	20-60mm
W32	50-150	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	20-60mm
W32	150-400	A2	Sandy Clay Loam	Massive	Abundant (50-90%)	6-20mm
W32	400-550	B1	Clay	Strong Pedality	Many (20-50%)	6-20mm
W32	500-700	B2	Clay	Strong Pedality	Many (20-50%)	6-20mm
W33	0-50	A1	Sandy Loam	Weak Pedality	Common (10-20%)	20-60mm
W33	50-150	A1	Sandy Loam	Weak Pedality	Common (10-20%)	20-60mm
W33	150-300	A2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	20-60mm
W33	300-450	B2	Sandy Clay	Strong Pedality	Common (10-20%)	60-200mm
W33	450-600	B2	Sandy Clay	Strong Pedality	Common (10-20%)	60-200mm
W33	600+	C	Rock			

Southern area – selected physical data

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
					Amount	Size
S10	0-50	A1	Sandy Clay Loam	Weak Pedality	-	-
S10	50-150	A1	Sandy Clay Loam	Weak Pedality	-	-
S10	150-380	B1	Sandy Clay Loam	Weak Pedality	Few (2-10%)	6-20mm
S10	380-600	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm
S10	600-800	B22	Clay	Strong Pedality	Few (2-10%)	2-6mm
S10	800-1000	B3	Clay	Polyhedral	Common (10-20%)	2-6mm
S10C	0 - 150	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
S10C	150 - 350	B1	Sandy Clay	Strong Pedality	Many (20-50%)	6-20mm
S10C	350-550	B2	Sandy Clay	Strong Pedality	Many (20-50%)	6-20mm
S10C	550-800	B2	Sandy Clay	Strong Pedality	Many (20-50%)	6-20mm
S10C	800-1100	B2	Sandy Clay	Strong Pedality	Many (20-50%)	6-20mm
S11	0-50	A1	Sandy Clay Loam	Weak Pedality	Very Few (<2%)	6-20mm
S11	50-270	A1	Sandy Clay Loam	Weak Pedality	Very Few (<2%)	6-20mm
S11	270-330	A2	Sandy Clay Loam	Massive	Many (20-50%)	2-6mm
S11	330-600	B1	Clay	Strong Pedality	Few (2-10%)	6-20mm
S11	600-1000	B2	Clay	Strong Pedality	-	-
S11A	0-250	A1	Sandy Clay Loam	Moderate Pedality	-	-
S11A	250-410	A2	Sandy Clay Loam	Moderate Pedality	Few (2-10%)	2-6mm
S11A	410-500	A22	Sandy Clay	Strong Pedality	Few (2-10%)	6-20mm
S11A	500-750	B1	Sandy Clay	Strong Pedality	-	-
S11A	750-1000	B2	Sandy Clay	Strong Pedality	-	-
S12	0-150	A1	Sandy Clay Loam	Weak Pedality	Many (20-50%)	2-6mm
S12	150-330	A2	Sandy Clay Loam	Weak Pedality	Abundant (50-90%)	200-600mm
S12	330-500	B1	Sandy Clay	Moderate Pedality	Few (2-10%)	6-20mm
S12	500-750	B1	Sandy Clay	Moderate Pedality	Few (2-10%)	2-6mm
S12	750-1000	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S13	0-150	A1	Sandy Loam	Weak Pedality	Few (2-10%)	2-6mm
S13	150-350	A2	Sandy Loam	Weak Pedality	Few (2-10%)	6-20mm
S13	350-500	B1	Clay	Strong Pedality	-	-
S13	500-750	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S13	750-1000	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S14A	0-150	A1	Sandy Loam	Weak Pedality	-	-
S14A	150-300	A2	Sandy Loam	Massive	-	-
S14A	300-600	B1	Clay	Strong Pedality	-	-
S14A	600-800	B2	Sandy Clay Loam	Strong Pedality	-	-
S14A	800-1000	B3	Sandy Clay Loam	Polyhedral	Very Few (<2%)	2-6mm
S14	0-150	A	Silty Clay Loam	Strong Pedality	Very Few (<2%)	2-6mm
S14	150-400	B1	Silty Clay	Strong Pedality	-	-
S14	400-600	B2	Clay	Strong Pedality	-	-
S14	600-700	B2	Clay	Strong Pedality	-	-
S14	700-1000	B3	Clay	Strong Pedality	-	-
14B	0-50	A1	Sandy Clay Loam	Strong Pedality	-	-

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
14B	50-150	A1	Sandy Clay Loam	Strong Pedality	-	-
14B	150-260	B1	Silty Clay	Moderate Pedality	-	-
14B	260-500	B2	Clay	Strong Pedality	-	-
14B	500-900	B22	Clay	Strong Pedality	-	-
S14C	0-100	A1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	2-6mm
S14C	100-250	B1	Clay	Weak Pedality	Common (10-20%)	2-6mm
S14C	250-450	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S14C	450-750	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S14C	750-1000	B2	Clay	Strong Pedality	Common (10-20%)	2-6mm
S15	0-100	A1	Clay Loam	Moderate Pedality	-	-
S15	100-250	A2	Clay	Strong Pedality	Few (2-10%)	20-60mm
S15	250-600	B1	Clay	Moderate Pedality	Many (20-50%)	6-20mm
S15	600-800	B2	Clay	Strong Pedality	Very Few (<2%)	6-20mm
S15B	1-100	A1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	2-6mm
S15B	100-250	B1	Clay	Strong Pedality	Many (20-50%)	2-6mm
S15B	250-400	B2	Clay	Strong Pedality	Many (20-50%)	2-6mm
S15B	400-700	B2	Clay	Strong Pedality	Many (20-50%)	2-6mm
S15B	700-1100	B2	Clay	Strong Pedality	Many (20-50%)	2-6mm
S15D	0-150	A1	Sandy Clay Loam	Weak Pedality	Many (20-50%)	6-20mm
S15D	150-300	B1	Clay Loam	Strong Pedality	Common (10-20%)	2-6mm
S15D	300-600	B2	Clay	Strong Pedality	Abundant (50-90%)	20-60mm
S15D	600-800	B2	Clay	Strong Pedality	Abundant (50-90%)	20-60mm
S16	0-50	A1	Sandy Loam	Weak Pedality	-	-
S16	50-180	A1	Sandy Loam	Weak Pedality	-	-
S16	180-450	A2	Sandy Loam	Massive	-	-
S16	450-580	B1	Clay	Strong Pedality	-	-
S16	580-850	B2	Sandy Clay Loam	Strong Pedality	-	-
S16	850-1000	B3	Sandy Clay Loam	Polyhedral	Very Few (<2%)	2-6mm
S17	0-120	A1	Sandy Loam	Weak Pedality	Common (10-20%)	6-20mm
S17	120-450	A2	Sandy Loam	Weak Pedality	Abundant (50-90%)	6-20mm
S17	450-600	B1	Sandy Clay	Strong Pedality	Common (10-20%)	20-60mm
S17	600-800	B2	Sandy Clay	Strong Pedality	Common (10-20%)	20-60mm
S18	0-50	A11	Sandy Loam	Weak Pedality	Common (10-20%)	20-60mm
S18	50-120	A12	Sandy Loam	Moderate Pedality	Abundant (50-90%)	6-20mm
S18	120-450	B1	Sandy Clay Loam	Massive	Many (20-50%)	6-20mm
S18	450-700	B2	Sandy Clay	Massive	Very Abundant (>90%)	60-200mm
S18	700-1000	B2	Sandy Clay	Massive	Very Abundant (>90%)	60-200mm
S19	0-50	A1	Sandy Clay Loam	Moderate Pedality	Common (10-20%)	20-60mm
S19	50-170	A1	Sandy Clay Loam	Moderate Pedality	Common (10-20%)	20-60mm
S19	170-400	B1	Sandy Clay Loam	Moderate Pedality	Common (10-20%)	2-6mm
S19	400-600	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm
S19	600-1000	B3	Sandy Clay Loam	Strong Pedality	Abundant (50-90%)	6-20mm
S20A	0-50	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
S20A	50-150	A1	Sandy Loam	Weak Pedality	Many (20-50%)	20-60mm
S20A	150-350	B1	Sandy Clay Loam	Massive	Abundant (50-90%)	6-20mm

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
S20A	350-550	B2	Clay	Strong Pedality	Common (10-20%)	200-600mm
S20A	550-700	B2	Clay	Strong Pedality	Common (10-20%)	200-600mm
S20A	700+	C	Rock	Massive	Very Abundant (>90%)	-
S20	0-50	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	2-6mm
S20	50-220	B1	Sandy Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
S20	220-300	B2	Clay	Strong Pedality	Many (20-50%)	6-20mm
S20	300-400	B2	Clay	Strong Pedality	Many (20-50%)	6-20mm
S20	400+	C	Rock			
S20B	0-50	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
S20B	50-150	A1	Sandy Loam	Weak Pedality	Many (20-50%)	6-20mm
S20B	150-350	B1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	20-60mm
S20B	350-450	B2	Clay	Moderate Pedality	Abundant (50-90%)	60-200mm
S20B	450-1000	B2	Clay	Moderate Pedality	Abundant (50-90%)	60-200mm
S21	0-170	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	20-60mm
S21	170-400	B1	Clay	Moderate Pedality	-	-
S21	400-600	B1	Clay	Moderate Pedality	-	-
S21	600-800	B2	Clay	Moderate Pedality	-	-
S21	800-1000	B2	Clay	Moderate Pedality	-	-
S22	0-300	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	6-20mm
S22	300-500	C	Silty Clay Loam	Weak Pedality	Very Abundant (>90%)	60-200mm
S22	500-700	C	Rock		-	-
S22	700-900				-	-
S23	0-50	A11	Sandy Clay Loam	Weak Pedality	Few (2-10%)	6-20mm
S23	50-100	A11	Sandy Clay Loam	Weak Pedality	Few (2-10%)	6-20mm
S23	100-280	A12	Clay	Strong Pedality	Common (10-20%)	2-6mm
S23	280-520	B1	Clay	Strong Pedality	Few (2-10%)	
S23	520-900+	B2	Clay	Moderate Pedality		
S24	0-200	A1	Sandy Loam	Weak Pedality	Abundant (50-90%)	20-60mm
S24	200-400	A2	Sandy Loam	Weak Pedality	Abundant (50-90%)	20-60mm
S24	400-600	C	Clay	Moderate Pedality	Very Abundant (>90%)	2-6mm
S24	600-800	C	Sand	Massive	Very Abundant (>90%)	20-60mm
S24A	0-200	A1	Clay Loam	Weak Pedality	Very Few (<2%)	20-60mm
S24A	200-400	B1	Clay Loam	Weak Pedality	-	-
S24A	400-600	B2	Clay	Strong Pedality	-	-
S24A	600-800	B2	Clay	Strong Pedality	-	-
S24B	0-150	A1	Sandy clay	Weak Pedality	Common (10-20%)	2-6mm
S24B	150-300	B1	Clay	Strong Pedality	Common (10-20%)	6-20mm
S24B	300-500	B2	Clay	Strong Pedality	Common (10-20%)	6-20mm
S24B	500-750	B2	Clay	Strong Pedality	Common (10-20%)	6-20mm
S24B	750-1000	B2	Clay	Strong Pedality	Common (10-20%)	6-20mm
S25	0-150	A1	Sandy Clay Loam	Strong Pedality	Many (20-50%)	6-20mm
S25	150-200	A2	Loam	Single Grained	Many (20-50%)	6-20mm
S25	200-300	A2	Loam	Single Grained	Many (20-50%)	6-20mm
S25	300-600	B1	Clay	Strong Pedality	Very Few (<2%)	6-20mm
S25	600-900	B2	Clay	Strong Pedality	Few (2-10%)	6-20mm

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
S26	0-50	A1	Sandy Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
S26	50-150	A1	Sandy Clay Loam	Moderate Pedality	Many (20-50%)	6-20mm
S26	150-300	A2	Sandy Loam	Weak Pedality	Many (20-50%)	20-60mm
S26	300-600	B2	Clay Loam	Moderate Pedality	Common (10-20%)	20-60mm
S26	650+	C1	Sandy Loam	Massive	Very Abundant (>90%)	60-200mm
S27	0-200	A1	Sandy Loam	Weak Pedality	Few (2-10%)	6-20mm
S27	200-400	B1	Sandy Clay	Strong Pedality	-	-
S27	400-600	B2	Sandy Clay	Strong Pedality	-	-
S27	600-800	C1	Sand	Strong Pedality	-	-
S28	0-250	A1	Clay Loam	Weak Pedality	-	-
S28	250-350	A2	Sandy Clay Loam	Weak Pedality	-	-
S28	350-500	B1	Clay	Moderate Pedality	-	-
S28	500-650	B1	Clay	Moderate Pedality	-	-
S28	650-1000	B2	Clay	Strong Pedality	Few (2-10%)	2-6mm

Northern area – selected physical data

■ WATER ■ MINING ■ SPORTS & RECREATION ■ HORTICULTURE & AGRICULTURE ■ ENVIRONMENTAL ■ ENGINEERING & GEOTECH ■ URBAN HORTICULTURE & LANDSCAPING

ABN 70 106 810 708

T 1300 30 40 80 E info@sesl.com.au
 F 1300 64 46 89 W sesl.com.au

PO Box 357
 Pennant Hills NSW 1715

16 Chilvers Rd
 Thornleigh NSW 2120



Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
					Amount	Size
N1	0-100	A1	Sandy Clay Loam	Weak Pedality	Few (2-10%)	6-20mm
N1	100-300	B1	Medium clay	Strong Pedality	Few (2-10%)	2-6mm
N1	300-500	B1	Medium clay	Strong Pedality	Few (2-10%)	2-6mm
N1	500-900	B2	Sandy Clay	Moderate Pedality	Very Few (<2%)	2-6mm
N1	900-1100	B3	Sandy Clay	Moderate Pedality	Common (10-20%)	6-20mm
N2	0-100	A1	Sandy Clay Loam	Weak Pedality	Few (2-10%)	2-6mm
N2	100-300	B1	Medium Clay	Strong Pedality	Many (20-50%)	6-20mm
N2	300-500	B1	Medium Clay	Strong Pedality	Many (20-50%)	6-20mm
N2	500-750	B2	Sandy Clay	Moderate Pedality	Few (2-10%)	2-6mm
N2	750-1100	B3	Sandy Clay	Moderate Pedality	Many (20-50%)	2-6mm
N3	0-100	A1	Medium Clay	Strong Pedality	Few (2-10%)	2-6mm
N3	100-200	A1	Medium Clay	Strong Pedality	Few (2-10%)	2-6mm
N3	200-400	B1	Medium Clay	Strong Pedality	Very Few (<2%)	2-6mm
N3	400-600	B2	Clay	Strong Pedality	Few (2-10%)	6-20mm
N3	600-1000	B3	Clay	Strong Pedality	-	-
N4	0-150	A1	Clay Loam	Moderate Pedality	Few (2-10%)	2-6mm
N4	150-300	B1	Medium Clay	Strong Pedality	Very Few (<2%)	2-6mm
N4	300-500	B1	Medium Clay	Strong Pedality	Very Few (<2%)	2-6mm
N4	500-800	B2	Medium Clay	Strong Pedality	Few (2-10%)	6-20mm
N4	800-1000	B3	Light clay	Strong Pedality	Few (2-10%)	2-6mm
N5	0-150	A1	Light clay	Strong Pedality	Common (10-20%)	2-6mm
N5	150-300	A1	Light clay	Strong Pedality	Common (10-20%)	2-6mm
N5	300-500	B1	Light clay	Strong Pedality	Very Abundant (>90%)	6-20mm
N5	500-800	B2	Light clay	Strong Pedality	Very Abundant (>90%)	Rock
N6	0-150	A1	Sandy Clay Loam	Weak Pedality	Common (10-20%)	6-20mm
N6	150-350	B1	Medium clay	Strong Pedality	Very Few (<2%)	2-6mm
N6	350-550	B2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	6-20mm
N6	550-700	B2	Sandy Clay Loam	Weak Pedality	Many (20-50%)	6-20mm
N6	700-1000	B3	Sandy Clay	Moderate Pedality	-	-
N7	0-150	A1	Clay Loam	Moderate Pedality	Common (10-20%)	6-20mm
N7	150-350	B1	Light clay	Weak Pedality	Many (20-50%)	6-20mm
N7	350-550	B1	Light clay	Weak Pedality	Many (20-50%)	6-20mm
N7	550-850	B2	Light clay	Moderate Pedality	Few (2-10%)	6-20mm
N7	850-1100	B3	Sandy Clay	Weak Pedality	-	-
N8	0-100	A1	Sandy Loam	Weak Pedality	-	-
N8	100-150	A2	Sandy clay	Moderate Pedality	Few (2-10%)	2-6mm
N8	150-400	B1	Sandy Clay Loam	Moderate Pedality	-	-
N8	400-750	B1	Sandy Clay Loam	Moderate Pedality	-	-
N8	750-1000	B2	Sandy Clay Loam	Moderate Pedality	-	-
N9	0-50	A1	Clay Loam	Weak Pedality	Few (2-10%)	2-6mm
N9	50-150	A1	Clay Loam	Weak Pedality	Few (2-10%)	2-6mm
N9	150-300	A2	Clay Loam	Weak Pedality	-	-
N9	300-700	B1	Medium clay	Moderate Pedality	-	-
N9	700-1100	B2	Sandy Clay	Moderate Pedality	Many (20-50%)	2-6mm

Pit	Depth	Horizon	Texture	Structure	Coarse Fragments	
N10	0-50	A1	Silty Clay Loam	Weak Pedality	Very Few (<2%)	6-20mm
N10	50-150	A1	Silty Clay Loam	Weak Pedality	Very Few (<2%)	6-20mm
N10	150-350	B1	Medium Clay	Strong Pedality	Common (10-20%)	6-20mm
N10	350-500	B2	Sandy Clay	Strong Pedality	Few (2-10%)	6-20mm
N10	500-1100	B2	Sandy Clay	Strong Pedality	Few (2-10%)	6-20mm
N11	0-50	A1	Sandy Clay Loam	Weak Pedality	Few (2-10%)	2-6mm
N11	50-300	A2	Sandy Clay Loam	Moderate Pedality	Few (2-10%)	2-6mm
N11	300-400	A3	Sandy Clay Loam	Weak Pedality	Few (2-10%)	6-20mm
N11	400-800	B1	Medium clay	Strong Pedality	Few (2-10%)	2-6mm

Appendix C

Soil Pit Photos

Representative photos of each soil type

Southern Area



S10 – Dermosol



S14a - Sodosol



S22 – Tenosol



S17 - Chromosol

Western Area



W6 – Tenosol



W3a – Chromosol



W4 – Dermosol



W29 - Sodosol

Northern Area



N8- Dermosol



N10 - Sodosol

Southern Area



S10 – Brown Dermosol



S10c – Brown Dermosol



S11 – Brown Dermosol



S12 – Brown Dermosol



S15 – Brown Dermosol



S23 – Brown Dermosol



S19 – Brown Dermosol



S24b – Brown Dermosol



S11a – Grey Dermosol



S14 – Red Dermosol



S24A – Red Dermosol



S14b – Red Dermosol



S13 – Brown Sodosol



S14a – Brown Sodosol



S16 – Brown Sodosol



S21 – Brown Sodosol



S25 – Brown Sodosol



S28 – Brown Sodosol



S18 – Leptic Tensol



S22 – Leptic Tensol



S24 – Leptic Tensol



S17 – Brown Chromosol



S20 – Brown Chromosol



S20a – Brown Chromosol



S20b – Brown Chromosol



S27 – Brown Chromosol



S26 – Red Chromosol



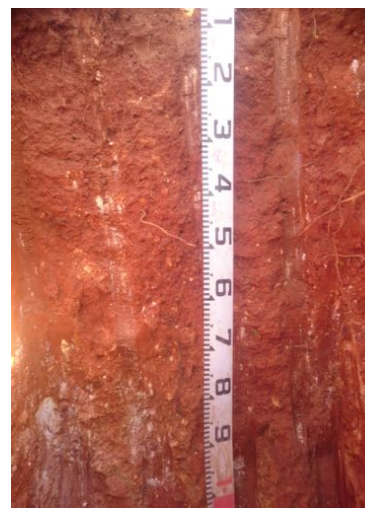
S14c – Brown Dermosol



S15b – Brown Dermosol



S24b – Brown Dermosol



S15d – Red Dermosol

Western Area



W1 – Leptic Tensol



W2 – Leptic Tensol



W6 – Leptic Tensol



W3 – Brown Chromosol



W3a – Brown Chromosol



W8 – Brown Chromosol



W31 – Brown Chromosol



W32 – Brown Chromosol



W33 – Brown Chromosol



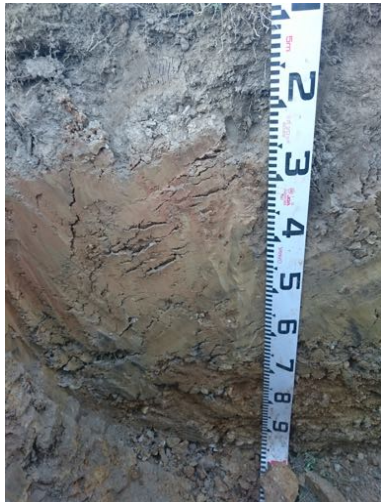
W4 – Brown Dermosol



W5 – Red Dermosol



W30 – Brown Dermosol



W7 – Brown Sodosol



W9 – Brown Sodosol



W29 – Brown Sodosol

Northern Area



N1 – Brown Sodosol



N2 – Brown Sodosol



N4 – Brown Sodosol



N6 – Brown Sodosol



N3 – Brown Dermosol



N5 – Brown Dermosol



N7 – Brown Dermosol



N8 – Brown Dermosol



N9 – Brown Dermosol



N10 – Brown Sodosol



N11 – Brown Sodosol

ATTACHMENT 2
WRITTEN NOTICES TO LANDHOLDERS



WHITEHAVEN COAL

17 November 2015

Keith Blanch
Bungalow
Braymont Road
Boggabri NSW 2382

Dear Keith,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

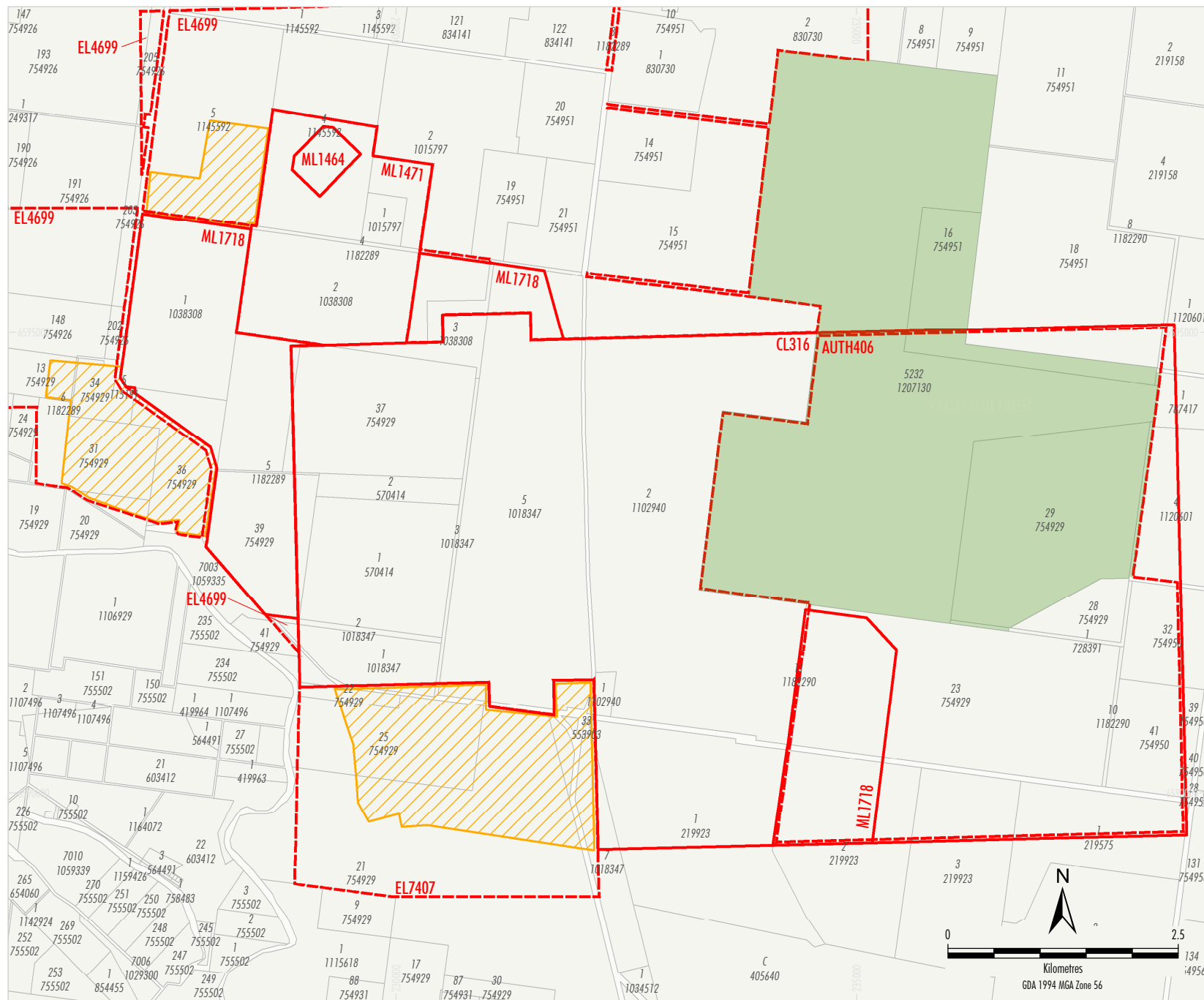
A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)


VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1



WHITEHAVEN COAL

27 November 2015

Jack and Merrienne Corey
13058 Kamilaroi Highway
BOGGABRI NSW 2382

Dear Jack and Merrienne,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

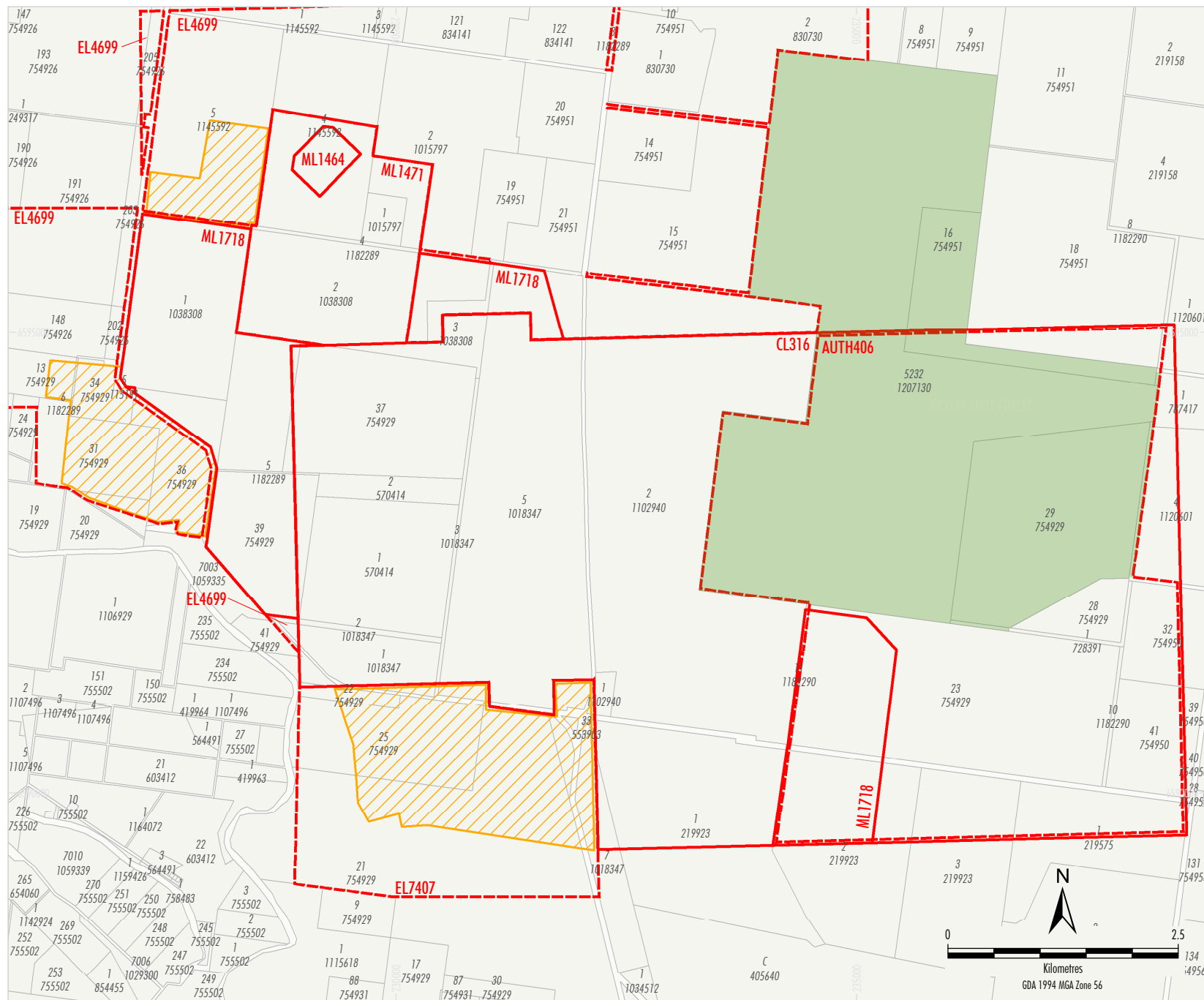
A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1

27 November 2015

Stewart Todd
General Manager
Narrabri Shire Council
PO Box 261
NARRABRI NSW 2390

Dear Stewart,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

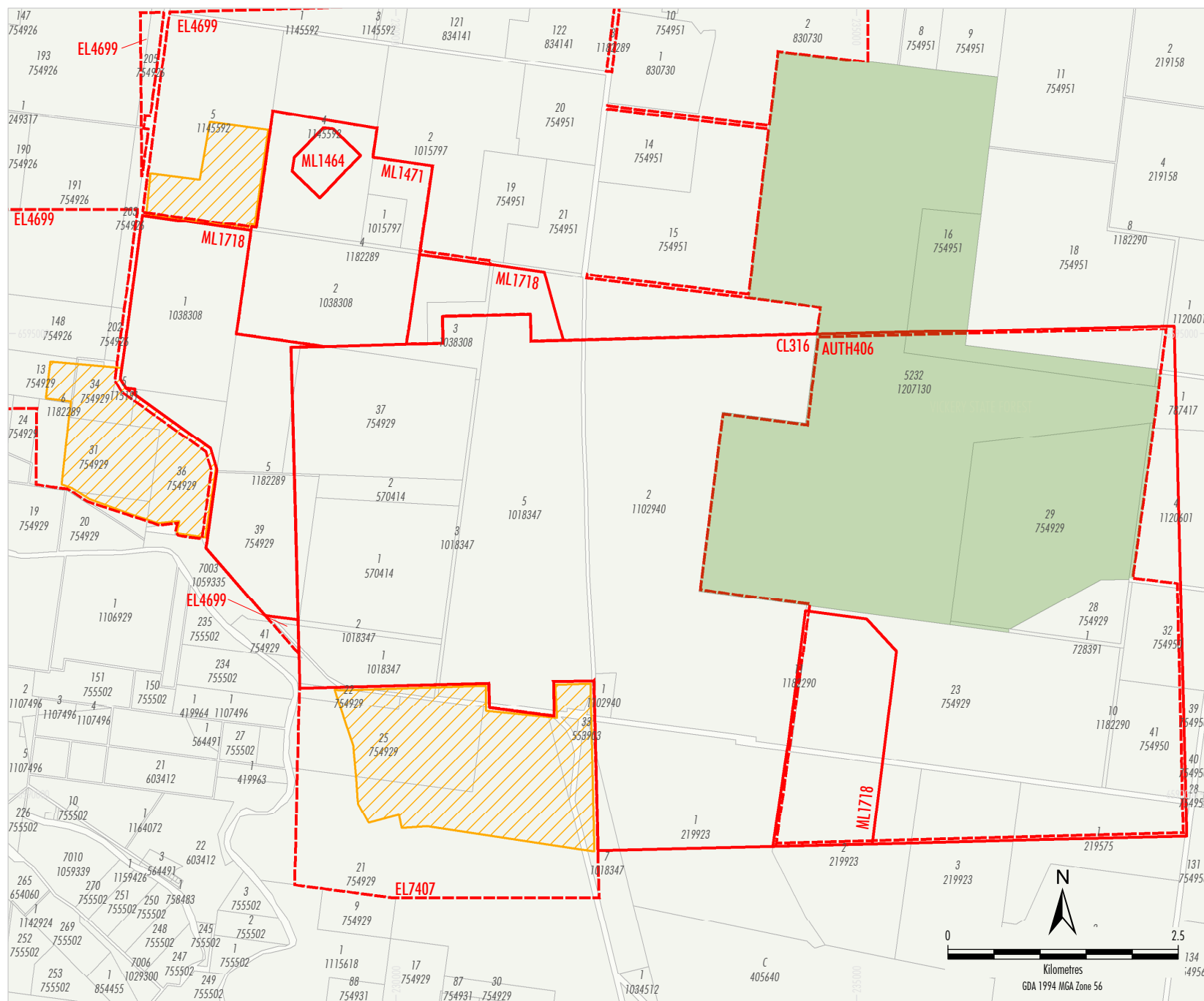
For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED



Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1



WHITEHAVEN COAL

17 November 2015

Eric Groth
General Manager
Gunnedah Shire Council
PO Box 63
GUNNEDAH NSW 2380

Dear Eric,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

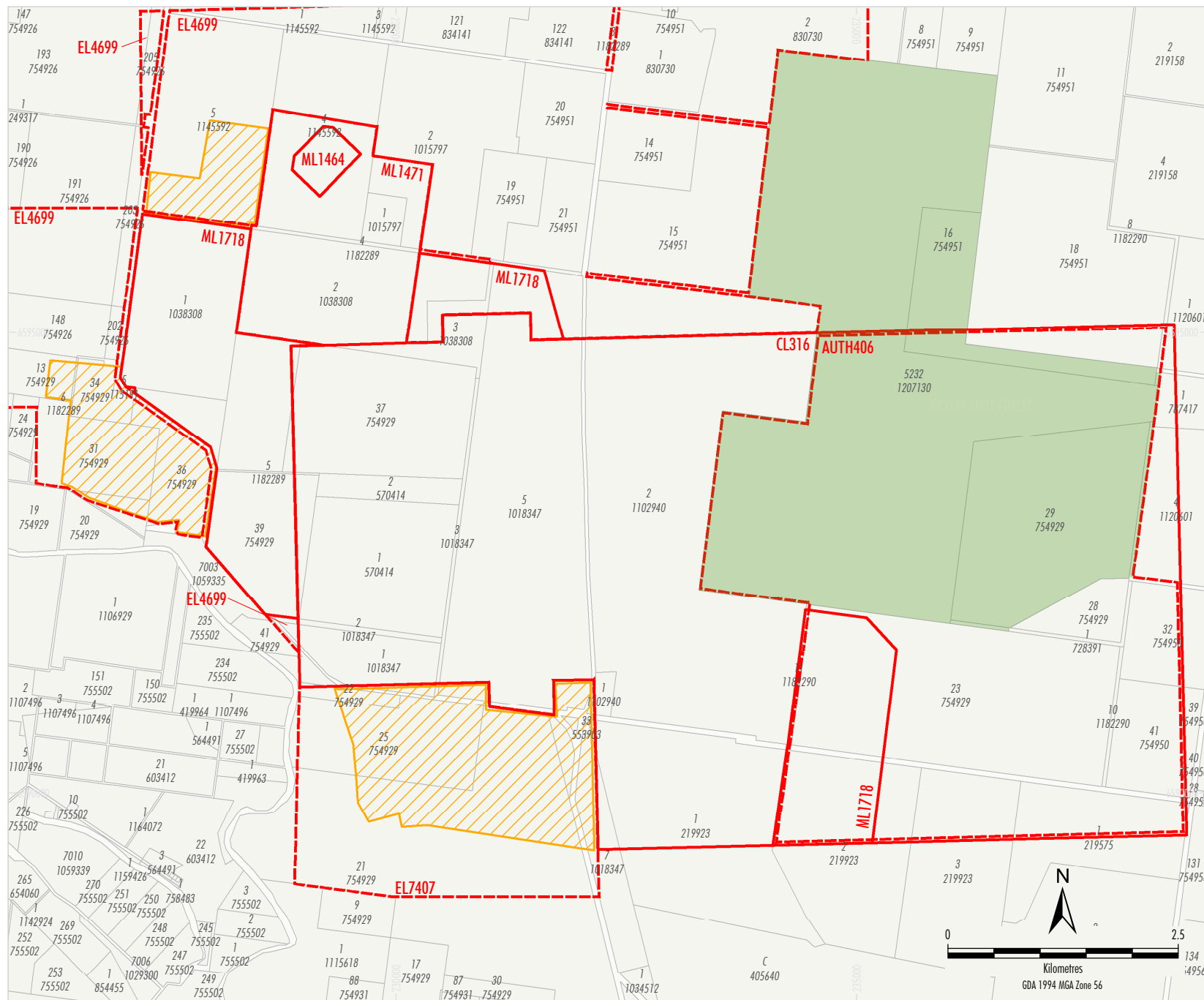
A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1

27 November 2015

Danny Young
Area Manager North West
Crown Lands Division of NSW Trade & Investment
Tamworth Office
PO Box 2185
Dangar NSW 2340

Dear Danny,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

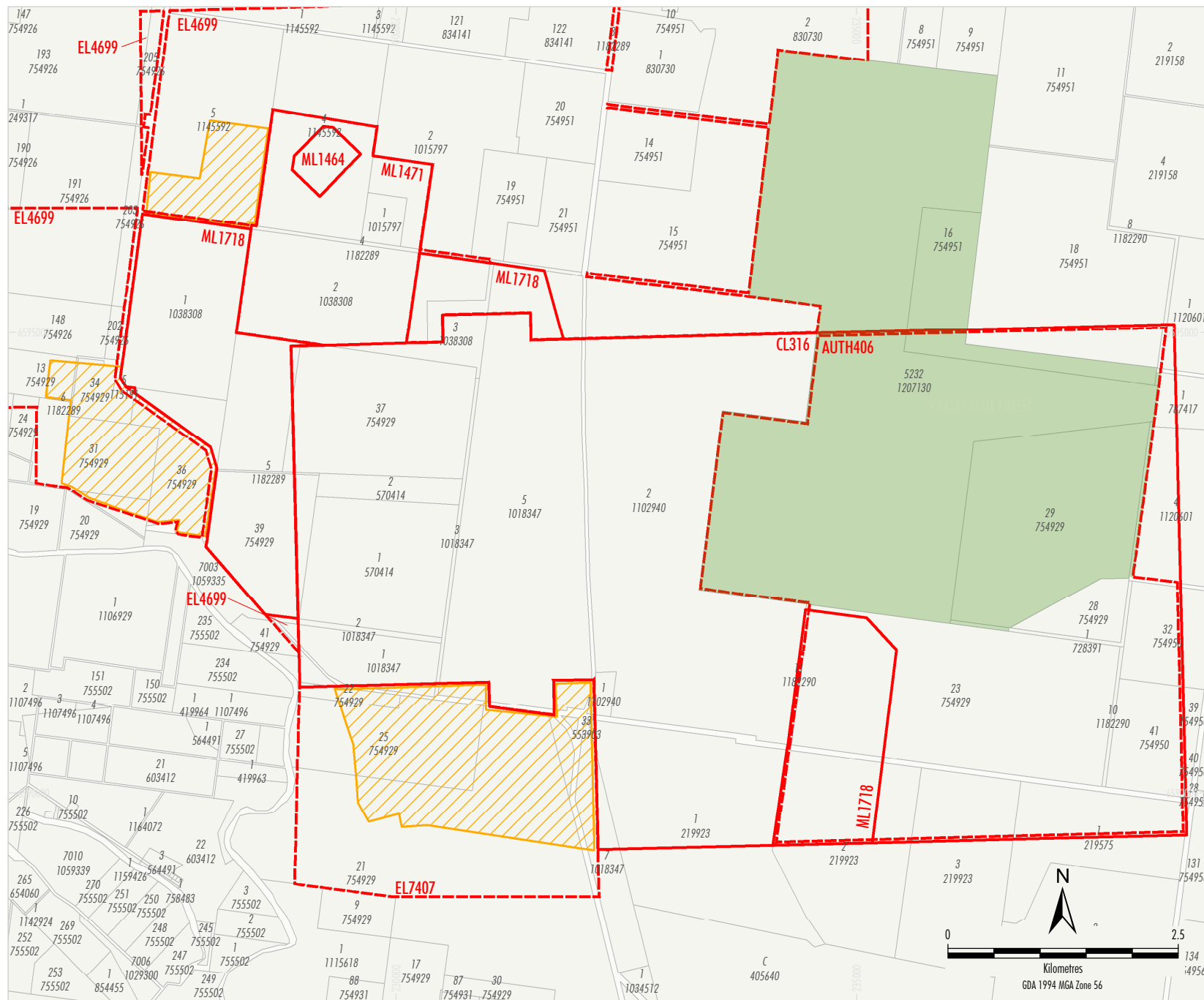
For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED



Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1



WHITEHAVEN COAL

27 November 2015

Darrell Groth
Essential Energy
PO Box 718
QUEANBEYAN NSW 2620

Dear Darrell,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*. Essential Energy infrastructure is located within the Site Verification Certificate Application area.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

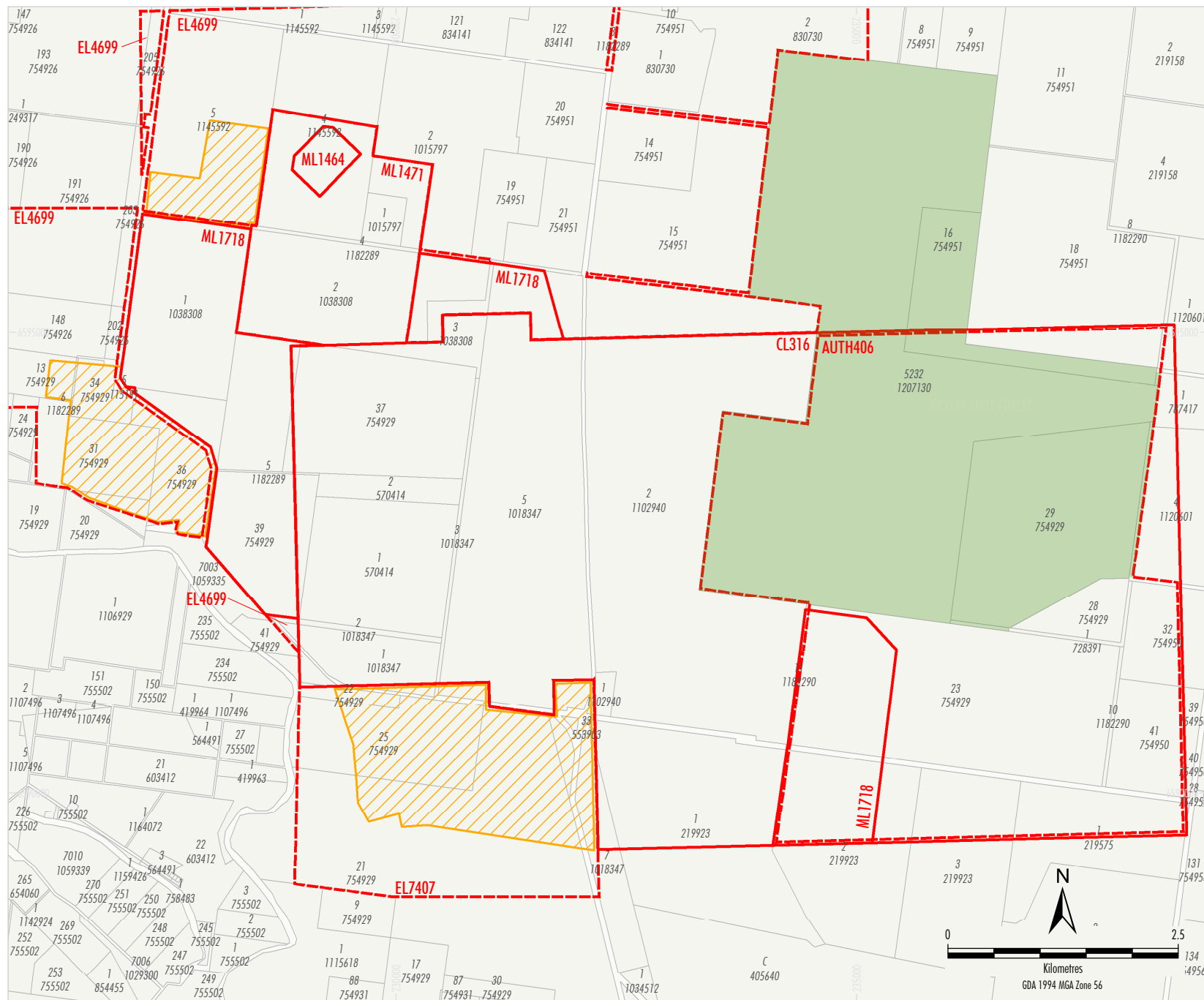
A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1



WHITEHAVEN COAL

27 November 2015

Michael Marom
Area General Manager – North West NSW
Telstra
1/91-95 Dangar Street
ARMIDALE NSW 2350

Dear Michael,

RE: NOTICE OF APPLICATION FOR A SITE VERIFICATION CERTIFICATE

Whitehaven Coal Limited (WHC) (ABN 68 124 425 396) is planning to make an application to the Secretary of the Department of Planning & Environment for a Site Verification Certificate that potential future mining areas within parts of Exploration Licences 4699 and 7407 do not constitute Biophysical Strategic Agricultural Land (BSAL).

WHC gives notice of the proposed application for a Site Verification Certificate in accordance with Clause 17C(3)(a) of the New South Wales *State Environmental Planning Policy (Mining, Petroleum Production and Extractive Industries) 2007*. Telstra infrastructure is located within the Site Verification Certificate Application area.

Application Details

Proponent: Whitehaven Coal Limited
Locked Bag 1002
Narrabri NSW 2390

Site Description: The Application area is contained within Exploration Licences 4699 and 7407 within the local government areas of Gunnedah Shire and Narrabri Shire.
A cadastral plan of the Application area is enclosed with this letter.

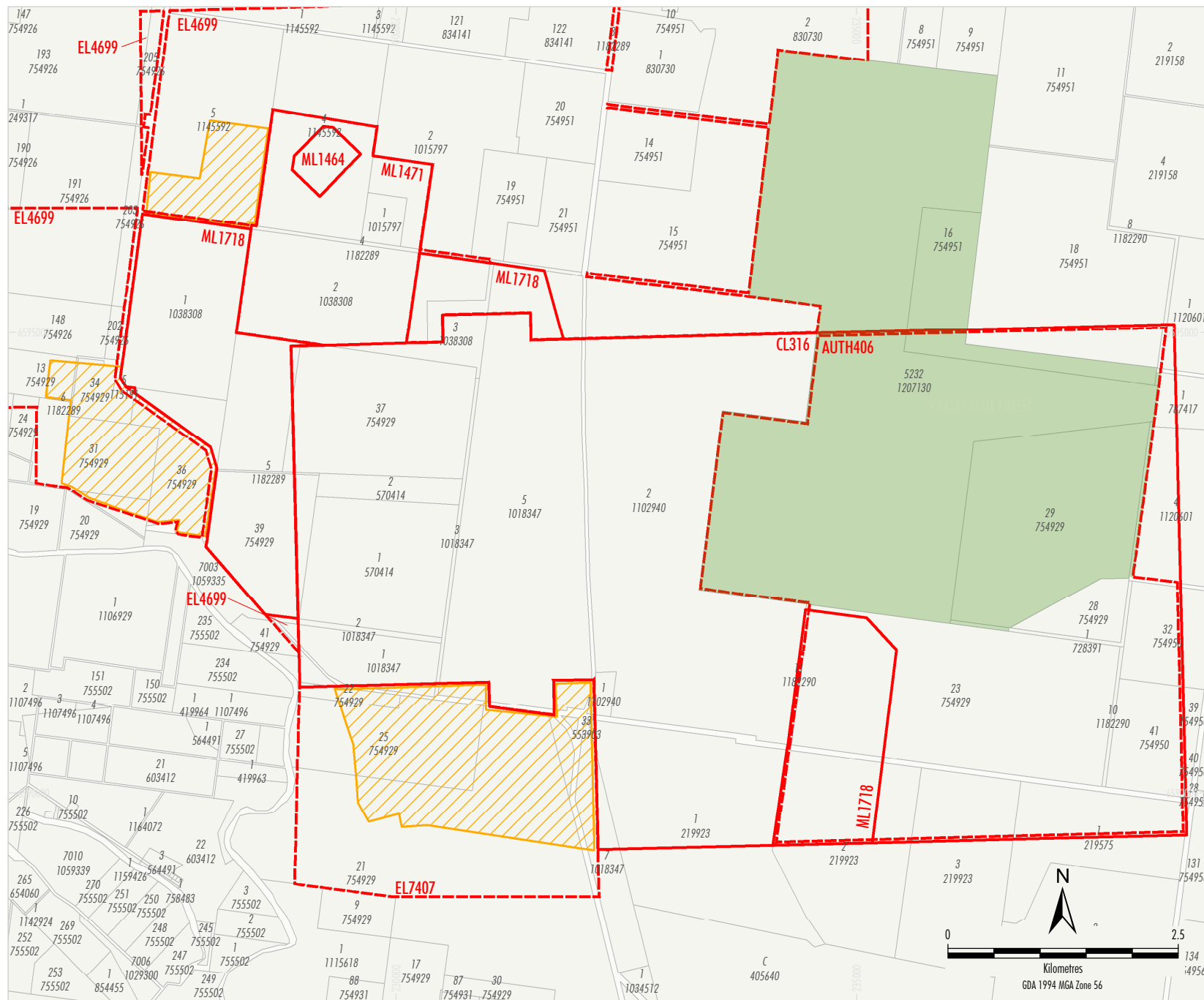
A copy of the application and any Site Verification Certificate issued will be placed on the Department of Planning & Environment website.

For further information, please don't hesitate to contact the undersigned.

Yours sincerely

WHITEHAVEN COAL LIMITED

Mark Edmondson
General Manager – Technical Services
Whitehaven Coal



LEGEND

- Exploration Tenement Boundary (EL & AUTH)
- Mining Tenement Boundary (ML & CL)
- Site Verification Certificate Application Area

Source: Department of Land and Property Information (2015)



VICKERY EXTENSION PROJECT
 Site Verification Certificate
 Application Area

Figure 1