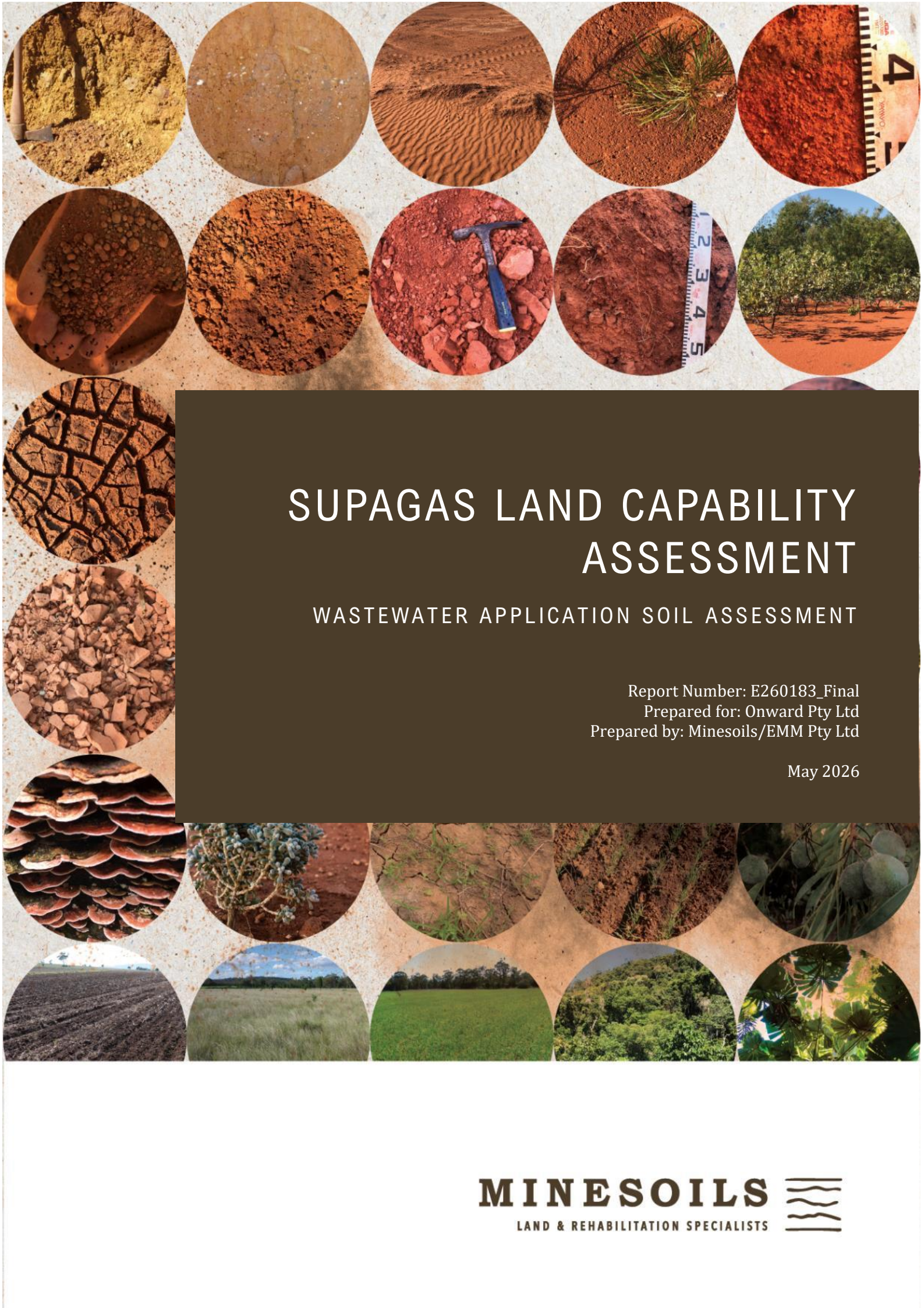


Appendix N

Land Capability Assessment

A circular collage of 20 images showing various soil types, textures, and landscapes. The images include close-ups of different soil colors (yellow, brown, red), soil profiles, soil with rocks, soil with a hammer, soil with a ruler, and various vegetation types (grass, shrubs, trees) growing in different soil environments.

SUPAGAS LAND CAPABILITY ASSESSMENT

WASTEWATER APPLICATION SOIL ASSESSMENT

Report Number: E260183_Final
Prepared for: Onward Pty Ltd
Prepared by: Minesoils/EMM Pty Ltd

May 2026

MINESOILS
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DISCLAIMER

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DOCUMENT CONTROL

Reference	Date	Prepared by	Approved
E260183_V1 Draft	6 th May 2026	Matt Hemingway, Clayton Richards	Clayton Richards
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Figure 1: Study Area and Locality

APPENDICES

Appendix A: Laboratory Certificates of Analysis



1. INTRODUCTION

1.1 OVERVIEW

Onward Pty Ltd engaged Minesoils Pty Ltd to undertake soils assessment to determine the suitability of soils for wastewater application. Supagas (the Proponent) is seeking to construct and operate a carbon dioxide (CO₂) plant, which would connect to the adjacent Wilga Park Power Station (WPPS). The CO₂ plant would capture and process exhaust gases from the WPPS gas generators and output a high purity CO₂ product for export and use in food, beverage, and other markets (the Project). The Project would be located in the Narrabri Local Government Area (LGA), approximately 12 km south-west of Narrabri, NSW. The WPPS is located on Lot 12 of DP 1171292 and is owned and operated by Santos NSW (Eastern) Pty Ltd (Santos). In addition, an Essential Energy substation is located on the eastern boundary of the WPPS site.

The irrigation method involves a pump to automatically start and operate via a timer for 5 hours at a rate of 2 m³/hr. The treated water will be distributed through a piping system connected to sprinklers network to cover the required irrigation area. Please note that, at this stage, this represents our preliminary concept for the irrigation system. The detailed design will be developed later in consultation with an irrigation specialist.

The total storage of treated water is 30KL and the irrigation frequency will be Once every two days (5 hrs total), with an approximate volume of 10 KL per irrigation cycle, with an application rate of 2m³/hr.

1.2 ASSESSMENT APPROACH

Minesoils objective is to assess the Project Area for land and soil parameters ability of the soils to absorb wastewater without compounding risks to the environment. In order to address these items, Minesoils conducted a soil survey and land capability assessment for the Project. The following guidelines were used:

- *Environmental Guidelines, Use of Effluent by Irrigation* (NSW DEC, 2004); and

The purpose of this report is to provide findings of the site investigation to determine the suitability of landform, land area and soil characteristics for wastewater application. This will include the following components:

- Landform characterisation – detailed description of landform within the Study Area and assessment of suitability for wastewater application;
- Soil characterisation – detailed physical and chemical characteristics of the soils within the Study Area and assessment of suitability for wastewater application;
- Project suitability review – justification of the suitability of the Study Area for wastewater application with monitoring and mitigation recommendations.

1.3 STUDY AREA

The Study Area subject to this assessment includes the direct application areas and immediate surrounds of the proposed wastewater activities, covering an area of 4.3 ha (refer **Figure 1**). The Study Area is largely native Casuarina forest with some minor cleared areas in the south. The topography is flat with minor low profile drainage lines running east to Bohena Creek via an unnamed tributary (refer Plates 1 and 2).



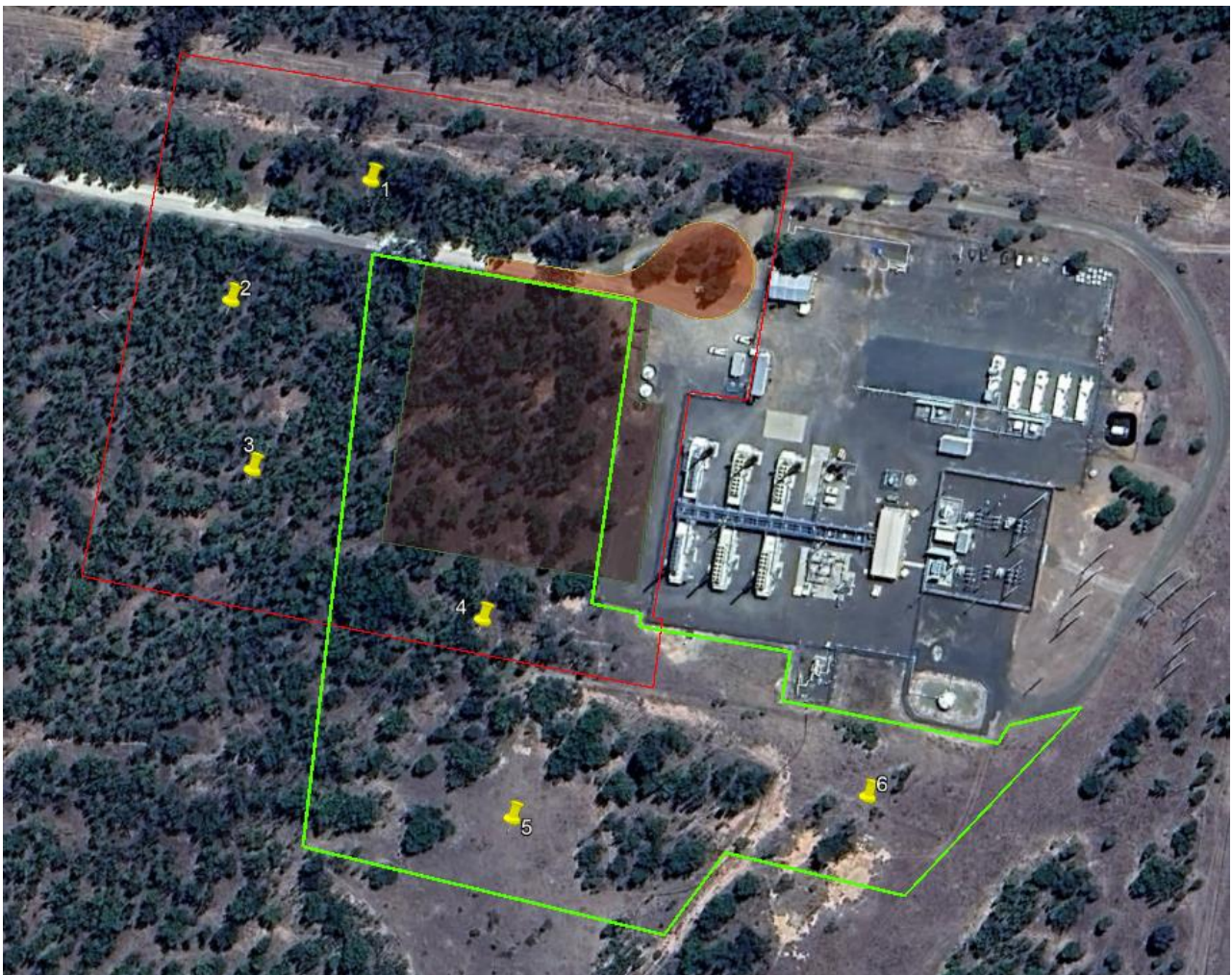


Plate 1: Study Area flat landform native forest



Plate 2: Study Area flat landform cleared area

Figure 1: Study Area



2 LANDFORM REQUIREMENTS

This section addresses the landform requirements for waste water application derived from effluent application standards and determines the suitability of the Study Area landform by reviewing slope, flooding, landform pattern and rock outcrop. The findings reported herein are based on site inspections undertaken by Minesoils in March 2026, along with a review of desktop data and on-site evidence.

The *Environmental Guideline: Use of Effluent by Irrigation* (NSW DEC, 2004) outlines the landform requirements for wastewater irrigation systems as outlined in Table 1 below.

Table 1: Landform requirements for effluent irrigation systems

Property 1	Limitation			Restrictive Feature
	Nil or Slight	Moderate	Severe ²	
Slope (%) (for following irrigation methods)				
– flood/surface/underground	< 1	1–3	> 3	excess runoff and erosion risk
– sprinkler	< 6	6–12 ³	> 12 ³	
– trickle/microspray	< 10	10–20 ³	> 20 ³	
Flooding	none or rare	Occasional	frequent	limited irrigation opportunities
Landform	crests, convex slopes and plains	concave slopes and foot-slopes	drainage lines and incised channels	erosion and seasonal water- logging risk
Surface rock outcrop (%)	Nil	0–5	> 5	interferes with irrigation and/or cultivation equipment; risk of runoff
Source: Based on Hardie and Hird (1998), NSW Agriculture, Organic Waste Recycling Unit Notes: 1. Careful consideration should also be given to potential impacts on groundwater (see 2.6 Groundwater). 2. Sites with these properties are generally not suitable for irrigation. 3. Slopes over 12% may be acceptable provided runoff and erosion risks are identified in the site selection process.				

(NSW DEC, 2004)

2.1 SLOPE AND LANDFORM

The landform pattern within the Study Area consists of an open plain and drainage flats. Slopes are flat (0 - 1%). Local relief in the Study Area is approximately <2m at approximately 220 m AHD. Note: in context of slope, the proposed Project will consist of wastewater being applied by sprinkler.

2.2 SURFACE WATER AND FLOODING

The Project Area drains to Bohena Creek via an unnamed tributary which runs generally northeast through the Project Area (refer **Figure 1**). Bohena Creek is a highly ephemeral stream only flowing <15% of the time, that drains to the Namoi River approximately 10km to the north of the Project Area.



A review of flood modelling undertaken for the Narrabri Gas Project (GHD, 2016) indicates that the Project Area is not subject to flood inundation under both the 10% and 1% Annual Exceedance Probability (AEP) storm events and the Probable Maximum Flood (PMF). The maximum flood depth maps utilised from the Narrabri Gas Project in relation to the Project area show that the Project Area is outside of the flood extents for all events; 10% AEP, 1% AEP and PMF.

2.3 ROCK OUTCROP

There is no evidence of rock outcrop that would inhibit irrigation or increase run-off within the Study Area proposed for wastewater irrigation.

2.4 LANDFORM SUITABILITY

Table 2 provides a summary of the landform characteristics of the Study Area against requirements for wastewater irrigations systems as outlined above in Table 1.

Table 2: Study Area limitations ranking against landform requirements for wastewater irrigation systems

Landform Characteristic	Limitation Class	Limitation Ranking
1. Slope	'<1%'	Nil or Slight
2. Flooding	'None or rare'	Nil or Slight
3. Landform Element	'Crests, convex slopes and plains' (Plain)	Nil or Slight
4. Surface Rock Outcrop	'Nil'	Nil or Slight

The landform characteristics of the Study Area represent a nil to slight limitation for the area proposed for wastewater irrigation and indicates a suitability for the proposed activities of the Project.

2.5 GROUNDWATER

The mechanism for impacts to groundwater from the Project include percolation of wastewater through soils under the proposed irrigation areas. The soils occurring in the Project Area are dominated by Sodosols with poor drainage, indicating saturated soils tend to remain saturated for long periods of time following flooding or irrigation until the water slowly infiltrates the clay subsoil or moves through the landscape, or is taken up by vegetation, typically taking several months.



3 SOIL SURVEY AND CHARACTERISATION

3.1 REGIONAL MAPPING

Based on landscape unit correlations with the *Soil and Land Resources of the Moree Plains* (NSW DCCEEW 2016), the regional soil landscapes of the Study Area have been determined.

Each soil landscape unit is an inventory of soil and landscape information with relatively uniform land management requirements, allowing major soil and landscape qualities and constraints to be identified. Many representative type profiles are supported by laboratory analysis and soils are described using the Australian Soil Classification and the Great Soil Groups systems. The two soil landscape units that characterise the Study Area are as follows;

Piliga Forest Way (pfx) Soil landscape

Landscapes are characterised by broad stagnant alluvial plains and fan deposits derived from old outwash of the Pilliga Sandstone in the far southern Moree Plains. Slopes <2%, local relief <10m, elevation 180-300m. Partially cleared open woodland.

Soils are Dominated by giant (>500 cm), well-drained to imperfectly drained, Grey, Yellow and Brown Sodosols (Solodic Soils), with minor moderately deep to deep (100 - >150 cm), well-drained Red Tenosol/Red Kandosols intergrades (Earthy Sands/Red Earths). Giant (>500 cm), poorly-drained, scalded Sodosols (Solodic Soils) at northern terminal extent.

Limitations to this unit include localised complex soils, widespread poor moisture availability, widespread non-cohesive soils, localised woody weeds, localised dieback, widespread recharge zone, localised discharge zone, localised salinity hazard, localised wind erosion hazard, localised gully erosion hazard, widespread sheet erosion hazard, localised streambank erosion hazard, widespread high run-on, widespread poor drainage, localised seasonal waterlogging, localised flood hazard.



Plate 3: Characteristic Piliga Forest Way Landscape (NSW DCCEEW 2016)

Moglewit (mwn) Soil Landscape

Landscapes are characterised by flat to very gently inclined plains of old coalescing fans, prone to scalding, in the northern Pilliga Outwash in the southern Moree Plains. Slopes 0 - 3%, local relief < 3m, elevation 180-230m, partially to extensively cleared open woodland.

Soils are Deep (>150 cm), imperfectly to poorly-drained Sodosols (Solodic Soils and Solonized Solonetz).

Limitations include localised non-cohesive soils, localised foundation hazard, localised recharge zone, localised discharge zone, localised wind erosion hazard, widespread sheet erosion hazard, widespread high run-on, widespread poor drainage, widespread seasonal waterlogging, localised flood hazard



Plate 4: Characteristic Moglewit Soil Landscape (NSW DCCEEW 2016)

Further to regional soil landscape mapping, NSW has state-wide Australian Soil Classification (ASC) mapping. This mapping indicates the dominant soil type within the Study Area are Sodosols.

3.2 SOIL SURVEY METHODOLOGY

Minesoils undertook a soil and land resource survey to inform the wastewater irrigation suitability assessment. This includes:

- Soil assessment, identifying soil units, soil qualities (including depth and salinity) and risks to wastewater irrigation;
- Identify any soil limitations that will require special management practice; and
- Collect baseline data for any future soil monitoring programs.

The objective of the Minesoils fieldwork program is to satisfy the field assessment, sampling and testing requirements related to soil and land resources. The fieldwork plan outlined below was designed to satisfy the following requirements:

- Soil survey and mapping: This was recommended to be undertaken at 1:10,000 survey intensity (1 site every 5 ha), and requires collection of landform pattern and element information, soil profile data, and taxonomic parameters to distinguish Soil Units according to the Australian Soil Classification criteria, within the Project site.
- Soil depth qualities: Additional information was recorded in the field on soil depth, bedrock presence, transitional layers to parent material and evidence of water table presence.

The field program was designed as an integrated free survey. An integrated survey assumes that many land characteristics are interdependent and tend to occur in correlated sets (NSCT, 2008). Survey points are irregularly located according to the survey teams' judgement to enable the delineation of soil boundaries. Soil boundaries can be abrupt or gradual, and catena and toposequences are used to aid the description of gradual variation. Soil test cores were excavated by a soil corer from 0.8 to 1.0m deep. Site clearances and dial before you dig (DBYD) plans were undertaken as part of the excavation planning requirements.

A total of six sites were assessed, concentrating sites on the proposed areas for wastewater irrigation, resulting in a survey intensity for the overall property of 1 site per 0.72 ha. Soil profiles within the Project Area were assessed in accordance with the Australian Soil and Land Survey Field Handbook soil classification procedures (NCST, 2009). Detailed soil profile descriptions were recorded covering the major parameters specified in **Table 3** below. Soil profile logging was undertaken in the field using Minesoils soil data sheets, including GPS recordings and photographs of the landforms and soil profiles. Soils were keyed out in accordance with the Australian Soil Classification (ASC) Revised Edition (2021).

Soil samples were collected at each of the assessment site's soil horizons to a depth of up to 1m, with a total of 20 samples collected. 12 of these were considered representative and subject to laboratory testing. The laboratory testing suite for these sites is detailed in the **Table 4** below.

Table 3: Detailed soil profile description parameters

Detailed Field Assessment Parameters	
Horizon depth including distinctiveness and shape	Pan presence and form
Field texture grade	Permeability and drainage
Field colour (Munsell colour chart)	Field pH
Pedality structure, grade and consistence	Field moisture
Soil fabric and stickiness	Surface condition
Stones (abundance and size)	Landform pattern / element
Mottles (amount, size and distinctiveness)	Current land use and previous disturbance



Table 4: Soil Sample

Lab Analysis	
Analyte	Methodology
pH (1:5 water & CaCl)	Rayment & Lyons 2011-4A1
Electrical Conductivity (EC) and Chloride	Rayment & Lyons 2011-3A1
Cation Exchange Capacity (CEC) & ESP and Ca:Mg Ratio	Rayment & Lyons 2011-15J1
Particle Size Analysis (PSA)	ISSS Hydrometer plus 0.2 and 2.0 mm Sieving (CSIRO 'Yellow Book')
Heavy metals (mg/kg)	Rayment & Lyons 2011 - 17C1 Aqua Regia

3.3 SOIL SURVEY RESULTS

The soil survey undertaken by Minesoils found the Project area to contain one dominant soil mapping unit: 1. Brown Sodosol, and one subdominant mapping unit 2. Brown Dermosol. **Table 5** summarises the soil profiles and associated mapping units. Full ASC has been applied where laboratory analysis was undertaken for representative sites. The distribution of the soil assessment sites and the soil mapping units is displayed on **Figure 3**.

Table 5: Soil Mapping Units and Soil Profiles

Site #	Soil Profile - Australian Soil Classification (ASC)	Soil Mapping Units	
		#	Name
1	Brown Sodosol	1	Brown Sodosol
2	Eutrophic Hypernatric Brown Sodosol	1	Brown Sodosol
3	Unclassified (Suspected Sodosol)	1	Brown Sodosol
4	Sodic Eutrophic Brown Dermosol	2	Brown Dermosol
5	Eutrophic Hypernatric Brown Sodosol	1	Brown Sodosol
6	Brown Sodosol	1	Brown Sodosol

All soil profile descriptions are provided below with laboratory results and Certificates included as **Appendix A**.



Site Description – Site 1				
Site Reference	1	ASC Name	Brown Sodosol	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'45.08'S
Surface Condition	Loose/Hardset	Permeability	Moderate	149°40'32.69"E

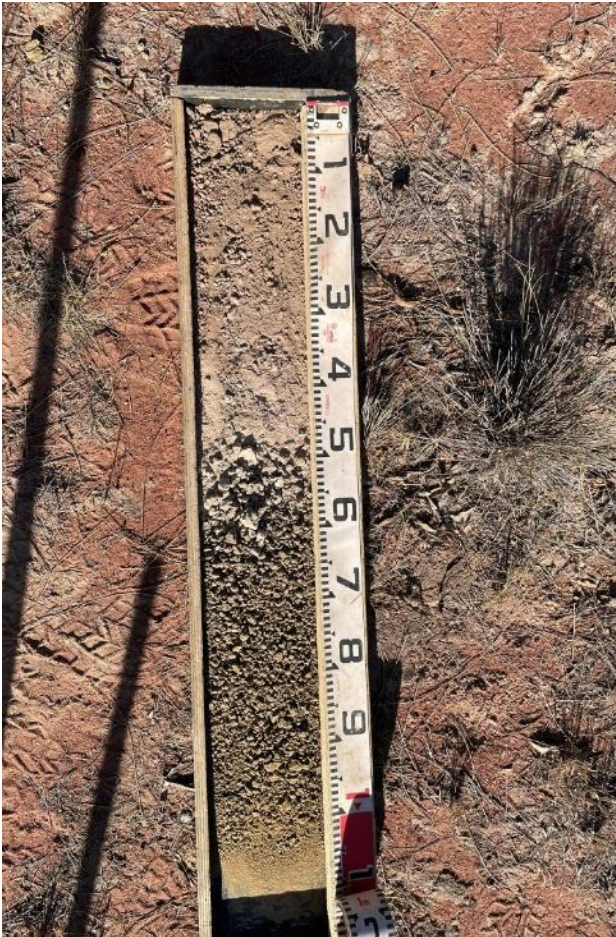


Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description
A1	0.00 – 0.25	Brown (Munsell 7.5YR/4/3) Sandy Loam with weak pedality, earthy fabric and moderate consistence. Slightly acidic pH, non-saline and non-sodic. No coarse fragments. No mottling. Common roots. Imperfectly drained. Gradual boundary.
A2	0.25 – 0.55	Bleached Light Grey (Munsell 7.5YR 7/3) apedal Sandy Loam. Strongly alkaline pH, slightly saline and sodic. No coarse fragments. No mottling. Very few roots. Poorly drained. Clear boundary. (Cemented pan at base on layer.)
B2	0.55 +	Light Brown (Munsell 7.5YR/6/3 to 7.5YR 6/3) Sandy Clay Loam with strong pedality, rough fabric and strong consistence. Strongly alkaline pH, moderately saline and sodic. No coarse fragments. No mottling. No roots. Poorly drained.



Site Description – Site 2				
Site Reference	2	ASC Name	Eutrophic Hypernatric Brown Sodosol	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'45.78"S
Surface Condition	Loose/Hardset	Permeability	Moderate	149°40'30.96"E



Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description				
A1	0.00 – 0.20	Brown (Munsell 7.5YR/4/3) Sandy Loam with weak pedality, earthy fabric and moderate consistence. Moderately acidic pH, non-saline and sodic. No coarse fragments. No mottling. Common roots. Imperfectly drained. Gradual boundary.				
A2	0.20 – 0.60	Bleached Pinkish Grey (Munsell 7.5YR 7/2) apedal Sandy Loam. Slightly acidic pH, non-saline and sodic. No coarse fragments. No mottling. Very few roots. Poorly drained. Clear boundary.				
B2	0.60 +	Light Brown (Munsell 7.5YR 6/3) Sandy Clay Loam with strong pedality, rough fabric and strong consistence. Very strongly alkaline pH, slightly saline and sodic. No coarse fragments. No mottling. No roots. Poorly drained.				
Sample Depth	ECe		pH _(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.4	Non-saline	5.8	Moderately Acidic	10.3	Sodic
0.30 – 0.40	0.6	Non-saline	6.1	Slightly Acidic	27.5	Strongly Sodic
0.60 – 0.70	1.4	Non-saline	9.7	Very Strongly Alkaline	60.1	Strongly Sodic
0.90 – 1.00	2.2	Slightly saline	9.7	Very Strongly Alkaline	58.8	Strongly Sodic

Site Description – Site 3				
Site Reference	3	ASC Name	Unclassified (suspected Sodosol)	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'47.94"S
Surface Condition	Loose	Permeability	Moderate	149°40'31.32"E



Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description
A1	0.00 – 0.40	Very pale brown (Munsell 10YR 7/6) Loamy Sand with weak pedality, earthy fabric and moderate consistence. No coarse fragments. No mottling. Common roots. Imperfectly drained. Gradual boundary.
A2	0.30– 0.70	Bleached White (Munsell 10YR 5/1) apedal Sand. No coarse fragments. No mottling. Very few roots. Poorly drained. Clear boundary.(Cemented pan at base on layer.)
B2	0.70 +	Corer refusal on cemented layer. Suspected clay B horizon beneath,



Site Description – Site 4				
Site Reference	4	ASC Name	Sodic Eutrophic Brown Dermosol	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'49.42"S
Surface Condition	Loose/Hardset	Permeability	Moderate	149°40'33.97"E



Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description				
A1	0.00 – 0.35	Grey to Light Grey (Munsell 7.5YR/6/1 to 7.5YR/7/1) Sandy Clay Loam with weak pedality, earthy fabric and moderate consistence. Neutral to moderately alkaline pH, slightly saline and sodic. No coarse fragments. No mottling. Common roots. Imperfectly drained. Gradual boundary.				
B2	0.35 – 0.90	Brown to Light Brown (Munsell 7.5YR/5/2 to 7.5YR/6/4) Sandy Loam with moderate pedality, rough fabric and strong consistence. Very strongly alkaline pH, highly saline and sodic. No coarse fragments. No mottling. Very few roots. Poorly drained.				
Sample Depth	ECe		pH _(1-5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.8	Non-saline	7.2	Neutral	22.3	Strongly Sodic
0.20 – 0.30	3.4	Slightly saline	8.0	Moderately Alkaline	59	Strongly Sodic
0.40 – 0.50	15.0	Highly saline	9.1	Very Strongly Alkaline	64.9	Strongly Sodic
0.70 – 0.80	10.4	Highly saline	9.6	Very Strongly Alkaline	56.1	Strongly Sodic



Site Description – Site 5				
Site Reference	5	ASC Name	Eutrophic Hypernatric Brown Sodosol	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'51.39"S
Surface Condition	Loose/Hardset	Permeability	Moderate	149°40'34.31"E



Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description				
A1	0.00 – 0.15	Brown (Munsell 7.5YR/5/2) Sandy Loam with weak pedality, earthy fabric and moderate consistence. Neutral pH, non-saline and sodic. No coarse fragments. No mottling. Common roots. Imperfectly drained. Clear boundary.				
B2	0.15+	Brown trending to Light Brown (Munsell 7.5YR/4/2 to 7.5YR/6/3) Sandy Clay Loam to Sandy Clay with strong pedality, rough fabric and strong consistence. Strongly to very strongly alkaline pH, moderately to highly saline and sodic. No coarse fragments. No mottling. Very few roots. Poorly drained.				
Sample Depth	ECe		pH _(1:5water)		ESP	
	dS/m	Rating	Value	Rating	Value	Rating
0.00 – 0.10	0.6	Non-saline	6.6	Neutral	10.5	Sodic
0.20 – 0.30	4.8	Moderately saline	8.9	Strongly Alkaline	43.1	Strongly Sodic
0.50 – 0.60	2.8	Slightly saline	9.6	Very Strongly Alkaline	46.9	Strongly Sodic
0.90 – 1.00	9.8	Highly saline	9.6	Very Strongly Alkaline	39.0	Strongly Sodic

Site Description – Site 6				
Site Reference	6	ASC Name	Brown Sodosol	
Average Slope	0.0 – 0.5%	Land Use	Bushland/ Vacant Use	Coordinates
Landform Pattern	Plain	Soil Fertility	Moderately Low	Lat/Long
Landform Element	Flat Plain	Drainage	Poor	30°21'51.18"S
Surface Condition	Loose/Hardset	Permeability	Moderate	149°40'38.39"E



Plate 1 – Soil Profile



Plate 2 – Landscape



Plate 3 – Surface

Horizon	Depth (m)	Description
A1	0.00 – 0.30	Brown (Munsell 7.5YR/4/3) Sandy Loam with weak pedality, earthy fabric and moderate consistence. No coarse fragments. No mottling. Common roots. Imperfectly drained. Gradual boundary.
A2	0.30 – 0.50	Bleached Light Grey (Munsell 10YR 7/2) apedal Sandy Loam. No coarse fragments. No mottling. Very few roots. Poorly drained. Clear boundary.
B2	0.50 – 0.90	Yellowish brown (Munsell 5/4) Sandy Clay Loam with strong pedality, rough fabric and strong consistence. No coarse fragments. No mottling. No roots. Poorly drained.



3.4 SOIL REQUIREMENTS

The Environmental Guideline: Use of Effluent by Irrigation (NSW DEC, 2004) outlines the soil limitations for effluent/wastewater irrigation systems as outlined in Table 6. The representative soil profiles for Sodosols within the study were assessed against the listed properties. The soil profiles limitations for effluent irrigation based on each soil unit is presented in Tables 7 – 8, and is summarised as follows:

- Key limitations to Soil Unit 1 Sodosols include ESP, ECEC & Salinity. These limitations are determined to be severe.
- Key limitations to Soil Unit 2 Dermosol include ESP & Salinity. These limitations are determined to be severe.

Restrictive features of the key limitations of the Soil Units are as follows, in order of severity:

Severe

Structural Degradation and waterlogging – ESP>10 (All sites)

The high exchangeable sodium results from all soils tested indicate poor soil drainage which may lead to waterlogging if irrigated continuously without adequate drainage time.

Salinity – Measured as ECE >8 dS/m (Site 4 only)

Excess salinity may restrict plant growth and potential seasonal groundwater rise. Not high levels of salinity may assist in stabilising sodic soils, however if the salinity is leached out via irrigation of non-saline water, this can significantly increase the erodible nature of the sodic soils.

ECEC (Equivalent Cation Exchange Capacity) (Site 2 Only)

Low ECEC indicates soil inability to store nutrients, metals etc and prevent from passing through to groundwater in shallow soils.

Salinity – Measured as ECE >8 dS/m (Sites 4 throughout and Site 5 at depth only)

Excess salinity may restrict plant growth and potential seasonal groundwater rise. Not high levels of salinity may assist in stabilising sodic soils, however if the salinity is leached out via irrigation of non-saline water, this can significantly increase the erodible nature of the sodic soils.

Moderate

AWC (Available Water Capacity) –

Low AWC indicates soil inability to store water and prevent wastewater from passing through to groundwater in shallow soils.

EAT (Emerson Aggregate Test) (All Sites)

Poor structure and high dispersion can reduce optimum plant growth, restrict permeability and increase surface run-off.



Table 6: Soil limitations for effluent/wastewater irrigation systems

Property	Limitation			Restrictive Feature
	Nil or Slight	Moderate	Severe ¹	
Exchangeable sodium percentage (0–40 cm)	0–5	5–10 ²	> 10	structural degradation and waterlogging
Exchangeable sodium percentage (40–100 cm)	< 10	>10	–	structural degradation and waterlogging
Salinity measured as electrical conductivity (EC _e) (dS/m at 0–70 cm)	< 2	2–4	> 4 ³	excess salt may restrict plant growth
Salinity measured as electrical conductivity (EC _e) (dS/m at 70–100 cm)	< 4	4–8	> 8 ³	excess salt may restrict plant growth, potential seasonal groundwater rise
Depth to top of seasonal high water table (metres)	> 3 ⁴	0.5–3 ⁴	< 0.5	poor aeration, restricts plant growth, risk to groundwater ⁵
Depth to bedrock or hardpan (metres)	> 1	0.5–1	< 0.5	restricts plant growth, excess runoff, waterlogging
Saturated hydraulic conductivity (K _s , mm/h, 0–100 cm)	20–80	5–20 ⁶ or >80 ⁶	<5	excess runoff, waterlogging, poor infiltration
Available water capacity (AWC, mm/m)	> 100	< 100 ⁶	–	little plant-available water in reserve, risk to groundwater
Soil pH _{CaCl2} (surface layer)	> 6–7.5	3.5 ⁷ –6.0 > 7.5	< 3.5	reduces optimum plant growth
Effective cation exchange capacity (ECEC, cmol (+)/kg, average 0–40 cm)	> 15	3–15 ⁸	< 3	unable to hold plant nutrients
Emerson aggregate test (0–100cm)	4, 5, 6, 7, 8	2, 3	1	Poor structure
Phosphorus (P) sorption (kg/ha at total 0–100 cm)	high ⁹	moderate ⁹	Low	unable to immobilise any excess phosphorus

Source: Based on Hardie and Hird (1998), See also NSW Department of Primary Industries (2004)

Notes:

1. Sites with these properties are unlikely to be suitable for irrigation of some or all effluent products.
2. Application of gypsum or lime may be required to maintain long-term site sustainability.
3. Some high EC soils containing calcium 'salts' are not necessarily considered 'severe'.
4. Where unable to excavate to 3m, local knowledge and absence of indications of water table to the depth of sampling (1m) should be used.
5. Criteria are set primarily for assessing site suitability for plant growth. Presence of a shallow soil water table may indicate soil conditions that favour movement of nutrients and contaminants into groundwater. In such cases, careful consideration should be given to quality and potential impacts on groundwater (see 2.6 Groundwater).
6. Careful irrigation scheduling and good irrigation practices will be required to maintain site sustainability.
7. Soil pH may need to be increased to improve plant growth. Where effluent is alkaline or lime is available, opportunities exist to raise pH. If acid sulfate soil is present, site-specific specialist advice should be obtained.
8. Soil may become more sodic with effluent irrigation. In some cases, however, this soil property may be ameliorated with addition of a calcium source.
9. Soils with medium to high phosphorus sorption capacity can adsorb excess phosphorus not taken up by plants. The effectiveness of this depends not only on the sorption capacity but also, the depth and permeability of the soil. A nutrient budget must be undertaken (see Section 4.3).

(Source: NSW DEC, 2004)



Table 7: Soil Unit 1 and 2 - Soil Characteristics Limitations

	Soil Unit 1: Brown Sodosols				Soil Unit 2: Brown Dermosol	
Soil Characteristic	Site 2: Eutrophic Hypernatric Brown Sodosol		Site 5: Eutrophic Hypernatric Brown Sodosol		Site 4: Sodic Eutrophic Brown Dermosol	
	Class	Ranking	Class	Ranking	Class	Ranking
ESP (0 – 40 cm)	>10	Severe	>10	Severe	>10	Severe
ESP (40 – 100 cm)	>10	Moderate	>10	Moderate	>10	Moderate
ECe (dS/m at 0 – 70 cm)	<2	Nil or Slight	2-4	Moderate	>4	Severe
ECe (dS/m at 70 – 100 cm)	<4	Nil or Slight	>8	Severe	>8	Severe
Depth to top of seasonal high water table (meters)	0.5-3m	Moderate	0.5-3m	Moderate	0.5-3m	Moderate
Depth to bedrock or hardpan (meters)	>1	Nil or Slight	>1	Nil or Slight	>1	Nil or Slight
Saturated hydraulic conductivity (Ks, mm/h, 0 – 100cm)	-	-	-	-	-	-
AWC (mm/m)	<100	Moderate	<100	Moderate	<100	Moderate
Soil pH _{CaCl2} (surface layer)	3.5-6.0	Moderate	3.5-6.0	Moderate	>6-7.5	Nil or Slight
ECEC (cmol (+)/kg average 0 – 40 cm)	<3	Severe	3-15	Moderate	3-15	Moderate
Emerson aggregate test (0 – 100 cm)	2, 3	Moderate	2, 3	Moderate	2, 3	Moderate
P sorption (kg/ha at a total 0 – 100 cm)	-	-	-	-	-	-
Maximum Limitation Class	Severe		Severe		Severe	



4 SUITABILITY ASSESSMENT

The soil types located on site have severe limitations in the traditional model of wastewater or effluent irrigation due to soil profile characteristics. It should be noted that the aim of the wastewater irrigation program is not to hold nutrients in the soil to be then taken up by harvestable crops or pastures. The aim is to irrigate with wastewater over an adequate area so not to cause contamination or impacts on soil or vegetation. The quality of the wastewater is important to consider given the soil types with poor drainage are unlikely to hold mobile elements in situ, but rather transfer these with water through the environment and rely on a dilution effect.

It must also be noted that the existing vegetation on site may not be considered high water usage species and therefore the site may remain saturated for long periods following irrigation, which may in turn impact the health of the existing vegetation.

4.1 SOIL ASSESSMENT

Suitable soils possess a structure that permits air movement and water penetration (which assists seedling emergence and root penetration), and have sufficient depth to permit optimum root development by the vegetation species, especially grasses. Adequate drainage, sufficient water-holding capacity to sustain plant growth between successive irrigations and ease of cultivation are also desirable for typical irrigation areas. Very sandy soils, poorly structured clay soils and soils with low permeability or high salt content may be unsuitable for effluent application, however may tolerate small volumes of irrigated wastewater.

As outlined in Section 3, Soil Units 1 and 2 of the Project Area contain severe and moderate limitations for typical irrigation applications. The land has a suitable topography for traditional agriculture however the soil types are limiting therefore agriculture is not typically undertaken with Land and Soil Capability 6 across the project area.

4.2 LAND CAPABILITY ASSESSMENT

Land capability, as detailed in LSC Scheme, is the inherent physical capacity of the land to sustain a range of land uses and management practices in the long term without degradation to soil, land, air and water resources. Failure to manage land in accordance with its capability risks degradation of resources both on- and off-site, leading to a decline in natural ecosystem values, agricultural productivity, and infrastructure functionality.

The scheme uses the biophysical features of the land and soil to derive detailed rating tables for a range of land and soil hazards. The scheme consists of eight classes, which classify the land based on the severity of long-term limitations. The LSC classes defined based on two considerations:

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

The biophysical features of the land that are associated with various hazards are broadly soil, climate and landform, specifically noted as slope, landform position, acidity, salinity, drainage, rockiness; and climate. The eight hazards associated with these biophysical features that are assessed by the LSC scheme are:

- Water erosion
- Wind erosion
- Soil structure decline
- Soil acidification
- Salinity



- Water logging
- Shallow soils and rockiness
- Mass movement

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

Table 8: LSC Parameters and Overall Class

		Hazard Criteria								
		1	2	3	4	5	6	7	8	Overall
		Water erosion	Wind erosion	Structure	Acidity	Salinity	Water logging	Soil depth	Movement	Class
1	Brown Sodosol	1	3	3	5	2	6	1	1	6
2	Eutrophic Hypernatric Brown Sodosol	1	4	3	5	2	6	1	1	6
3	Unclassified (suspected Sodosol)	1	6	1	5	6	6	1	1	6
4	Sodic Eutrophic Brown Dermosol	1	3	6	4	6	6	1	1	6
5	Eutrophic Hypernatric Brown Sodosol	1	4	3	5	6	6	1	1	6
6	Brown Sodosol	1	4	3	5	6	6	1	1	6

The results of the land capability assessment indicate the LSC throughout the Project Area is Class 6 as defined below:

Land capable for a limited set of land uses (grazing, forestry and nature conservation, some horticulture)

Low capability land: Land has very high limitations for high-impact land uses. Land use restricted to low-impact land uses such as grazing, forestry and nature conservation. Careful management of limitations is required to prevent severe land and environmental degradation.

4.3 MINIMUM IRRIGATION AREA ASSESSMENT

The expected outflow of irrigated wastewater is 10,000L over two days, every two days. The minimum irrigation area assessment is calculated using the following assumptions:

- Wastewater is irrigated by piping water through to sprinkler network.
- The rate is 10,000L per cycle (5hrs/2days at 2m³ per hr = 10m³ per cycle)
- The soil profile capacity is assumed to be 0.4m deep covering the average of the A1 and A2 layers only due to the slow infiltration into the clay B2 layer. Whilst infiltration into this layer will occur over time, it is unlikely to be adequate within 2 days.
- The soil layers used for this calculation are considered poorly structured loams with 30% water holding capacity by volume, with an in situ moisture content of 10% prior to irrigation, therefore leaving a 20% capacity to saturation.
- The moisture content at time of irrigation is assumed to be very low to dry.



The calculation is based on soil starting with a Dry A1 & A2 layer to being saturated.

Required irrigation Area (per cycle)(m²) = Volume required (10m³) / Depth of soil (A1 & A2)(m) x 20%

Required irrigation Area (per cycle)(m²) = 10m³ / (0.40m x 0.2)

Required irrigation Area (per cycle) = 125m²

Therefore, the minimum required area for irrigation of one cycle (10m³) of wastewater irrigation, using the above assumptions is 125m². Using this area as an ideal base case with dry soil profile, scenarios can then be built upon monitoring of moisture content of soil. Furthermore, assumptions are made based on monitoring, around the drying time for the soil profile following saturation. For example, if it is assumed that on average years it takes 30 days in summer for a soil to dry out from saturation back to baseline moisture, then in theory the same irrigation area will be ready for a second cycle of irrigation in 30 days. Note the duration of drying time will need to be based on monitoring of rainfall and soil moisture. It should also be noted that the vegetation community in the Project Area is accustomed to long dry periods, therefore if the irrigation program is managed appropriately to allow for dry periods, there should be no impact on the health of the current vegetation community.

The detailed irrigation plan to be developed should also ensure the sprinkler system is designed to minimise surface runoff, due to the erodible nature of the topsoils within the Project Area



5 GENERAL RECOMMENDATIONS

5.1 APPLICATION MANAGEMENT

When applying wastewater, it needs to be spread over sufficient area to avoid concentration of water in one location, leading to long term saturation. Allowing for rest periods between applications reduced anaerobic conditions and allows aeration of the soil. This prevents a decline in the soil infiltration rates. To avoid surface ponding in the irrigation area, it is good practice to apply wastewater in several low-volume applications rather than a large volume at once.

The timing of wastewater irrigation will often be driven by the need to empty wastewater storage units so that they are ready to receive future inputs. Wastewater applications should never raise the soil moisture content above field capacity and the application rate must be controlled to ensure runoff does not occur, which could lead to topsoil removal and severe erosion. Wastewater should not be irrigated under heavy cloud if rain is forecast.

Ponding and runoff on the irrigation area are indications the rate of wastewater application is too high for the irrigation area to effectively absorb the volumes.

General wastewater irrigation recommendations (NSW DEC, 2004). include the following:

- The weather forecast and the moisture content of the soil are checked. Wastewater is irrigated only when the soil is sufficiently dry to absorb the applied liquid and should not occur within 48 hours of heavy rain. Do not irrigate if significant rainfall is expected.
- The soil is monitored during irrigation to ensure there is no surface pooling or runoff.
- The irrigation system is set up to apply wastewater at the target rate.
- Details of the following are recorded: – date of irrigation – weather forecast summary, including rainfall – assessment of likelihood of amenity impacts – utilisation area – target and actual rate of application (mm)
- An annual environmental report is prepared that includes
 - soil analysis results for samples taken from any irrigated area where wastewater has been spread in the reporting year
 - analysis results for wastewater for irrigation
 - details of any complaints received, communications with the complainant, investigations into the cause of the complaint, any corrective actions taken and any changes to procedures
 - details of any environmental incidents and any associated corrective actions and reporting.

5.2 OTHER FACTORS TO CONSIDER

5.2.1 SALT

Proper management is necessary to ensure that wastewater irrigation does not lead to soil degradation by increasing soil salinity (NSW DEC 2004). All irrigation waters contain some salt. Salt may concentrate in the root zone if there is insufficient drainage to take away any salt not utilised by the growing plant. With each wastewater application, the salt concentration in the root zone may progressively increase unless leaching and drainage remove it. Without the downward water flow of leaching and drainage, salts within the root zone can be drawn towards the soil surface by water evaporation. Therefore, the prime requirement for salinity control in irrigation systems is to provide adequate leaching to prevent salt accumulation. This requires periodic monitoring of the levels and distributions of soil salinity, particularly within the root zone areas (NSW DEC 2004).

Modelling the movement of salt through the soil is particularly difficult as the interactions between irrigation and natural rainfall, plant uptake and recycling of specific salts and the dynamics of soil salt and sodicity levels on soil hydraulic conductivity are not precisely understood. Estimates of salt movement are possible with commercially



available modelling software that calculate salt balances from inputs of parameters such as salt load, irrigation volumes, climatic data, vegetation regimes and associated water use and physical soil properties (NSW DEC 2004). Salt balances should be determined for the Project to ensure that salinity is appropriately managed.

Standard soil monitoring would include samples of irrigation water and soil from irrigated areas. The monitoring would provide ongoing data for management to determine the trend in soil salinity and potential procedures such as dilution of irrigation water that may need to occur.

5.3 MONITORING AND MITIGATION MEASURES

5.3.1 WATER

Runoff from the irrigation area needs to be captured and prevented from entering the surface water system. Generally, stormwater runoff capture will not be required if the receiving environment is less sensitive, and the potential for contamination is very small. To minimise the risk of runoff from the wastewater irrigation area, it is necessary to ensure that any irrigation systems in close proximity to surface waters are well-designed and managed, the contaminant loading is appropriate for the soil and plants being irrigated so that contaminants are not mobilised, and an adequate buffer zone is provided between the irrigation area and any surface water body.

Also implement the following measures:

- Establish soil moisture monitoring program to facilitate information fed into the irrigation program, to ensure soils are capable of absorbing irrigation water at each event.
- maintain a minimum groundwater depth to promote aerobic conditions in the soil and prevent surface waterlogging;
- protect groundwater from contamination by irrigated wastewater (of particular concern is the potential contamination by nitrogen compounds, salts and toxic contaminants);
- develop a program to monitor soil water content, and combine this with strategies to suspend irrigation when soil moisture content is high; and
- measure rainfall and pan evaporation and conduct occasional checks against soil moisture.

Good irrigation management will ensure wastewater application operations are sustainable. Any wastewater irrigation operation should employ best management measures to ensure its long-term sustainability.

Adopting the following measures will help sustainably manage wastewater:

- do not allow irrigated wastewater to escape to any watercourse;
- do not apply wastewater to land if soil moisture conditions mean surface run-off or ponding is likely to occur;
- regularly inspect and maintain diversion banks, drains and any holding ponds or depressed areas;
- do not carry out irrigation of wastewater to land within 50 m of any major watercourse; and
- maintain the irrigation area in a proper and efficient condition to provide adequate assimilation, percolation, evaporation and transpiration of the irrigated wastewater.

Manage runoff on site to ensure the ground and surface waters do not become contaminated by any flow from irrigation areas. To effectively manage runoff, adopt the following measures:

- use diversion banks to prevent all uncontaminated stormwater from entering the irrigation area;
- maintain all bunds, supply channels and drains in good condition, especially at the end of wet periods; and
- inspect all bunds, supply channels and drains at least once a month.



5.3.2 SOILS

Soils in the irrigation area need to be monitored regularly to ensure vegetation is assimilating the wastewater being applied and no nutrient/compound/metals build-up is occurring. Generally, annual sampling should be carried out at a time that fits in with irrigation requirements, or as specified by the licence requirements. Samples need to be taken at about the same time each year. Topsoil samples are usually taken to 10–20 cm depth and deep-soil cores are taken to 1 m or the bottom of the root zone. Deep-soil samples can help monitor the potential for salt leaching. Monitoring each irrigation area (if treated differently) therefore providing more accurate data, as wastewater irrigation application can vary in volume, quality and frequency across areas. Samples should be collected from all the soil types in the irrigation area, and from areas of forest versus cleared vegetation.



6 SUMMARY

Minesoils objective was to assess the land and soil within the project area for its capability to accommodate wastewater by an irrigation program. Minesoils conducted a soil and land capability assessment to provide inputs for water specialists to plan a program of irrigation.

The landform and soil characteristics of the Study Area were measured against limitation class and ranking as per the environmental guideline for wastewater effluent irrigation (NSW DEC, 2004). There were severe limitations to wastewater irrigation present across the soils within the project area.

The soil assessment undertaken found the dominant soil mapping units present in the Study Area was a Brown Sodosol with one site keying out as a sub-dominant Brown Dermosol. The results indicated there are limitations to the volume of water to be irrigated due to the soil profile and drainage characteristics. Whilst the soils appear to have adequate depth, the drainage and physio-chemical parameters will require regular monitoring to ensure accumulation of salts and metals are not impacting the long term health of the soil or vegetation.



7 REFERENCES

- ANZECC (Australian and New Zealand Environment and Conservation Council) and ARMCANZ (Agriculture and Resource Management Council of Australia and New Zealand) (2000), *Australian and New Zealand guidelines for fresh and marine water quality, National Water Quality Management Strategy – Paper No. 4, vol. 1.*
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- National Committee on Soil and Terrain (NCST) (2009) *Australian Soil and Land Survey Field Handbook*, 3rd edition (CSIRO, Australia).
- NSW Department of Environment and Conservation (2003) *Environmental Guideline: Use of Effluent by Irrigation*
- NSW Office of Environment and Heritage (2013) *The land and soil capability assessment scheme – Second Approximation.*
- NSW DEC (2004). Environmental Guidelines, Use of effluent by Irrigation. Department of Environment and Conservation (NSW), Sydney, Australia.



Appendix A

Laboratory Certificates of Analysis



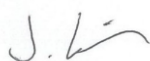
ANALYSIS REPORT SOIL

PROJECT NO:	EW260703	Date of Issue:	25/03/2026
Customer:	EMM Consulting	Report No:	1
Address:	Suite 01 20 Chandos Street ST LEONARDS NSW 2065	Date Received:	13/03/2026
Attention:	Clayton Richards	Matrix:	Soil
Phone:	0408 474 248	Location:	Supagas
Fax:		Sampler ID:	Client
Email:	clayton@minesoils.com.au	Date of Sampling:	5/03/2026
		Sample Condition:	Acceptable

Comments:

3b = moderate to slight dispersion of the remould.

Results apply to the samples as submitted. All pages of this report have been checked and approved for release.



Signed: Jason Lowien



GSG Laboratories is certified by the Australasian Soil & Plant Analysis Council to perform various soil and plant tissue analysis. The tests reported herein have been performed in accordance with our terms of accreditation.

This report must not be reproduced except in full and GSG takes no responsibility of the end use of the results within this report.

This analysis relates to the sample submitted and it is the client's responsibility to make certain the sample is representative of the matrix to be tested.

Samples will be discarded one month after the date of this report. Please advise if you wish to have your sample/s returned.

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID DEPTH					Site 2	Site 2	Site 2	Site 2
					0-10	30-40	60-70	90-100
Test Parameter	Method Description	Method Reference	Units	LOR	260703-1	260703-2	260703-3	260703-4
pH (1:5 in H2O)	Electrode	R&L 4A1	pH units	na	5.79	6.05	9.67	9.67
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.03	0.04	0.15	0.23
Exchangeable Potassium	NH4CI/ICP	R&L 15A1	mg/kg	10	65.8	82.9	1467	1878
Exchangeable Calcium	NH4CI/ICP	R&L 15A1	mg/kg	20	240	111	85.3	125
Exchangeable Magnesium	NH4CI/ICP	R&L 15A1	mg/kg	10	72.2	74.6	130	158
Exchangeable Sodium	NH4CI/ICP	R&L 15A1	mg/kg	10	52.2	121	1830	2222
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.17	0.21	3.76	4.82
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.20	0.56	0.43	0.63
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	0.60	0.62	1.08	1.32
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.23	0.53	7.96	9.66
ECEC	Calculation	PMS-15A1	cmol/kg	na	2.20	1.92	13.2	16.4
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.99	0.89	0.39	0.47
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.28	0.34	3.47	3.66
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	7.68	11.1	28.4	29.3
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	54.6	29.0	3.22	3.81
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	27.4	32.5	8.19	8.02
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	10.3	27.5	60.1	58.8
Soil Colour	Munsell	Munsell	Class	na	7.5YR/4/3	7.5YR/6/2	7.5YR/6/3	7.5YR/6/3
Soil Colour (Description)	Munsell	Munsell	Class	na	Brown	Pinkish Gray	Light Brown	Light Brown
Total Arsenic	ICP-OES	AS4479.2	mg/kg	0.5	1.6	4.0	0.5	1.8
Total Cadmium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Chromium	ICP-OES	AS4479.2	mg/kg	0.5	6.0	4.9	19.2	21.1
Total Cobalt #	ICP-OES	AS4479.2	mg/kg	0.5	1.3	1.8	10.7	10.3
Total Copper #	ICP-OES	AS4479.2	mg/kg	0.5	2.1	5.1	5.5	15.6
Total Iron #	ICP-OES	AS4479.2	mg/kg	0.5	7590	10400	19900	23900
Total Lead	ICP-OES	AS4479.2	mg/kg	0.5	3.1	4.0	6.4	7.5
Total Manganese #	ICP-OES	AS4479.2	mg/kg	0.5	72.0	38.0	132	170

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID					Site 2	Site 2	Site 2	Site 2
					0-10	30-40	60-70	90-100
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	260703-1	260703-2	260703-3	260703-4
Total Molybdenum	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Nickel	ICP-OES	AS4479.2	mg/kg	0.5	3.1	3.1	14.1	15.5
Total Selenium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Zinc #	ICP-OES	AS4479.2	mg/kg	0.5	2.7	1.9	16.1	19.3
Emerson Aggregate Test	Class	PMS-21	Number	na	7	3b	2	3b
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	1.2	11.1	1.6	1.3
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	57.9	54.7	42.5	47.7
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	23.0	21.7	22.5	18.4
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	6.0	3.6	4.5	7.0
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	11.8	8.9	28.9	25.5

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID					Site 4	Site 4	Site 4	Site 4
					0-10	20-30	40-50	70-80
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	260703-5	260703-6	260703-7	260703-8
pH (1:5 in H2O)	Electrode	R&L 4A1	pH units	na	7.19	7.97	9.08	9.64
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.08	0.24	0.65	0.74
Exchangeable Potassium	NH4CI/ICP	R&L 15A1	mg/kg	10	106	240	1027	841
Exchangeable Calcium	NH4CI/ICP	R&L 15A1	mg/kg	20	317	186	252	796
Exchangeable Magnesium	NH4CI/ICP	R&L 15A1	mg/kg	10	160	236	651	573
Exchangeable Sodium	NH4CI/ICP	R&L 15A1	mg/kg	10	211	1162	3962	3209
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.27	0.62	2.63	2.16
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	1.59	0.93	1.26	3.98
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.33	1.97	5.43	4.78
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.92	5.05	17.2	14.0
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.11	8.56	26.5	24.9
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.19	0.47	0.23	0.83
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.20	0.31	0.49	0.45
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	6.62	7.19	9.92	8.67
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	38.6	10.9	4.75	16.0
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	32.5	23.0	20.4	19.2
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	22.3	59.0	64.9	56.1
Soil Colour	Munsell	Munsell	Class	na	7.5YR/6/1	7.5YR/7/1	7.5YR/5/2	7.5YR/6/4
Soil Colour (Description)	Munsell	Munsell	Class	na	Gray	Light Gray	Brown	Light Brown
Total Arsenic	ICP-OES	AS4479.2	mg/kg	0.5	1.6	<0.5	2.8	3.8
Total Cadmium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Chromium	ICP-OES	AS4479.2	mg/kg	0.5	1.7	6.1	24.2	13.1
Total Cobalt #	ICP-OES	AS4479.2	mg/kg	0.5	2.2	3.8	10.3	6.3
Total Copper #	ICP-OES	AS4479.2	mg/kg	0.5	2.1	1.7	6.5	5.9
Total Iron #	ICP-OES	AS4479.2	mg/kg	0.5	6910	10400	25700	17400
Total Lead	ICP-OES	AS4479.2	mg/kg	0.5	3.1	4.1	8.1	5.7
Total Manganese #	ICP-OES	AS4479.2	mg/kg	0.5	90.0	47.5	97.4	126

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID					Site 4	Site 4	Site 4	Site 4
					0-10	20-30	40-50	70-80
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	260703-5	260703-6	260703-7	260703-8
Total Molybdenum	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Nickel	ICP-OES	AS4479.2	mg/kg	0.5	4.1	5.6	15.5	13.7
Total Selenium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Zinc #	ICP-OES	AS4479.2	mg/kg	0.5	4.2	5.6	19.3	11.1
Emerson Aggregate Test	Class	PMS-21	Number	na	3b	3b	3b	3b
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	0.6	1.1	<0.1	1.1
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	59.6	57.2	61.5	51.1
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	20.1	23.8	25.8	25.6
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	2.0	4.0	5.1	4.5
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	17.8	13.9	7.6	17.7

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID					Site 5	Site 5	Site 5	Site 5
					0-10	20-30	50-60	90-100
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	260703-9	260703-10	260703-11	260703-12
pH (1:5 in H2O)	Electrode	R&L 4A1	pH units	na	6.61	8.88	9.56	9.59
Electrical Conductivity	Electrode	R&L 3A1	dS/m	0.01	0.04	0.51	0.32	1.14
Exchangeable Potassium	NH4CI/ICP	R&L 15A1	mg/kg	10	213	110	245	366
Exchangeable Calcium	NH4CI/ICP	R&L 15A1	mg/kg	20	473	869	890	1929
Exchangeable Magnesium	NH4CI/ICP	R&L 15A1	mg/kg	10	164	734	934	940
Exchangeable Sodium	NH4CI/ICP	R&L 15A1	mg/kg	10	115	1868	2608	2711
Exchangeable Potassium	R&L 15A1	R&L 15A1	cmol/kg	na	0.55	0.28	0.63	0.94
Exchangeable Calcium	R&L 15A1	R&L 15A1	cmol/kg	na	2.37	4.35	4.45	9.65
Exchangeable Magnesium	R&L 15A1	R&L 15A1	cmol/kg	na	1.37	6.12	7.78	7.83
Exchangeable Sodium	R&L 15A1	R&L 15A1	cmol/kg	na	0.50	8.12	11.3	11.8
ECEC	Calculation	PMS-15A1	cmol/kg	na	4.78	18.9	24.2	30.2
Ca/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	1.73	0.71	0.57	1.23
K/Mg Ratio	Calculation	PMS-15A1	cmol/kg	na	0.40	0.05	0.08	0.12
Exchangeable Potassium %	Calculation	PMS-15A1	%	na	11.4	1.50	2.60	3.11
Exchangeable Calcium %	Calculation	PMS-15A1	%	na	49.5	23.0	18.4	31.9
Exchangeable Magnesium %	Calculation	PMS-15A1	%	na	28.6	32.4	32.2	25.9
Exchangeable Sodium %	Calculation	PMS-15A1	%	na	10.5	43.1	46.9	39.0
Soil Colour	Munsell	Munsell	Class	na	7.5YR/5/2	7.5YR/4/2	7.5YR/4/3	7.5YR/6/3
Soil Colour (Description)	Munsell	Munsell	Class	na	Brown	Brown	Brown	Light Brown
Total Arsenic	ICP-OES	AS4479.2	mg/kg	0.5	0.8	2.3	1.9	3.8
Total Cadmium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Chromium	ICP-OES	AS4479.2	mg/kg	0.5	1.8	13.1	17.4	15.9
Total Cobalt #	ICP-OES	AS4479.2	mg/kg	0.5	1.9	5.2	10.9	8.4
Total Copper #	ICP-OES	AS4479.2	mg/kg	0.5	2.5	3.4	6.9	7.6
Total Iron #	ICP-OES	AS4479.2	mg/kg	0.5	7520	16600	19700	18600
Total Lead	ICP-OES	AS4479.2	mg/kg	0.5	3.7	5.6	6.9	5.8
Total Manganese #	ICP-OES	AS4479.2	mg/kg	0.5	115	59.4	146	214

ANALYSIS REPORT

PROJECT NO: EW260703

Location: Supagas

CLIENT SAMPLE ID					Site 5	Site 5	Site 5	Site 5
					0-10	20-30	50-60	90-100
DEPTH								
Test Parameter	Method Description	Method Reference	Units	LOR	260703-9	260703-10	260703-11	260703-12
Total Molybdenum	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Nickel	ICP-OES	AS4479.2	mg/kg	0.5	3.9	9.7	17.7	15.2
Total Selenium	ICP-OES	AS4479.2	mg/kg	0.5	<0.5	<0.5	<0.5	<0.5
Total Zinc #	ICP-OES	AS4479.2	mg/kg	0.5	3.2	10.1	14.1	16.1
Emerson Aggregate Test	Class	PMS-21	Number	na	7	2	3b	3b
Gravel >2.0mm #	Sieve	ASTMD422-63	%	na	0.4	0.8	0.3	0.3
Coarse Sand 0.2-2.0mm #	Sieve	ASTMD422-63	%	na	33.8	51.7	39.5	42.0
Fine Sand 0.02-0.2mm #	Sieve	ASTMD422-63	%	na	44.4	23.1	16.6	23.3
Silt 0.002-0.02mm #	Hydrometer	ASTMD422-63	%	na	5.8	2.0	8.8	4.3
Clay <0.002mm #	Hydrometer	ASTMD422-63	%	na	15.5	22.4	34.9	30.1

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Soils are air dried at 40°C and ground <2mm.

NB: LOR is the Lowest Obtainable Reading.

DOCUMENT END