



# Acid Sulfate Soil Management Plan

Gullivers Lane, East Maitland, New South Wales

Prepared for: East Maitland Land 62 Pty Ltd  
EP3799.001 v2 14 August 2024



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Gullivers Lane, East Maitland, New South Wales

East Maitland Land 62 Pty Ltd  
1 Hartley Drive,  
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14 August 2024

Our Ref: EP3799.001 v2

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## QUALITY CONTROL

Version	Author	Date	Reviewer	Date	Quality Review	Date
v1	H. Erskine	13.08.2024	P. Simpson	13.08.2024	T. Rodgers	13.08.2024
v2	H. Erskine	14.08.2024	P. Simpson	14.08.2024	T. Rodgers	14.08.2024

## DOCUMENT CONTROL

Version	Date	Reference	Submitted to
v1	13.08.2024	EP3799.001_ East Maitland Land 62 _ ASSMP v1	East Maitland Land 62 Pty Ltd
v2	14.08.2024	EP3799.001_ East Maitland Land 62 _ ASSMP v2	East Maitland Land 62 Pty Ltd



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# 1 Introduction

East Maitland Land 62 Pty Ltd (East Maitland Land) engaged EP Risk Management Pty Ltd (EP Risk) to prepare an Acid Sulfate Soil Management Plan (ASSMP) for the construction of a proposed stormwater basin (Proposed Works) at Gullivers Lane, East Maitland, New South Wales (NSW) (the Site), as part of an extension of the previous five-stage subdivision development proposal for 62 Mount Vincent Road and 6 Wilton Drive, East Maitland, NSW.

The proposed stormwater basin is located on part of Lot 142 Deposited Plan (DP) 1225076 is approximately 2,800 m<sup>2</sup> in area and has a maximum depth of around 2 m below ground level (BGL). A figure showing the location of the Site and Proposed Works footprint is presented as **Figure 1**.

## 1.1 Objective and Scope

The objective of the ASSMP is to assess the nature and extent of actual acid sulfate soil (AASS) and potential acid sulfate soil (PASS) within the Proposed Works footprint and to ensure that water quality, soil run-off, site wastewater, potential water contamination associated with actual acid sulfate soil (AASS) and potential acid sulfate soil (PASS) are considered and effectively managed during the Proposed Works.

The scope of work to satisfy the objective comprise:

- Site inspection to observe on and off-site conditions.
- Advance four sampling locations within the Proposed Works area.
- Sampling and analytical testing of selected soil samples by a National Association of Testing Authorities (NATA) accredited laboratory for pH<sub>F</sub>, pH<sub>FOX</sub> and the chromium reducible sulfur suite (Scr).
- Address the requirements of the relevant environmental legislation and statutory requirements as it applies to the Proposed Development.
- Summarise potential impacts on the environment from the Proposed Works.
- Document environmental procedures that must be followed to control potential environmental impacts.
- Confirmation of the effectiveness of the adopted control measures by validation testing and documentation.



## 2 Site Identification

Pertinent Site identification details are presented in **Table 1**.

<b>Table 1 – Site Identification</b>	
<b>Item</b>	<b>Description</b>
Site Address	Gullivers Lane, East Maitland, New South Wales ( <b>Figure 1</b> )
Legal Description	Part Lot 142 DP 1225076
Approximate Site Area	Approximately 2,800 m <sup>2</sup> (the Stormwater Basin)
Site Owner	East Maitland Land 62 Pty Ltd
Municipality	Maitland City Council (Council)
Site Zoning	The Maitland Local Environmental Plan (LEP) 2011 identifies the Site as RU2 Rural Landscape

### 3 Legal and Other Requirements

The following statutory provisions and guidelines are applicable to the Proposed Works, with regards to the ASSMP:

- Maitland LEP 2011 (amended 12 April 2024, accessed 5 August 2024), Part 7.1 Acid Sulfate Soils.
- *Contaminated Land Management Act 1997* (CLM Act).
- *Protection of the Environment Operations Act 1997* (POEO Act).
- Stone, Y, Ahern C R, and Blunden N (1998). Acid Sulfate Soil Manual 1998. Acid Sulfate Soil Management Advisory Committee, Wollongbar, NSW, Australia (NSW acid sulfate soil (ASS) Manual 1998) (ASSMAC 1998).
- National Acid Sulfate Soils Guidance, National Acid Sulfate Soils Sampling and Identification Methods Manual, 2018 (National ASS Guidance 2018).

## 4 Site Condition and Surrounding Environment

The Proposed Stormwater Basin (Gullivers Lane) is an extension south of the current five stage residential subdivision proposal at 62 Mount Vincent Road and 6 Wilton Drive, East Maitland, NSW. The Proposed Works are located on cleared farmland, approximately 50 m north of an existing watercourse. The surrounding area is mostly cleared farmland with residential development to the north.

Topographically the Proposed Works footprint is located at an elevation from 5 metres above Australian Height Datum (m AHD) at the southern extent of the Stormwater Basin to 8 m AHD at the northern extent of the Stormwater Basin.

Based on the Newcastle Coalfield Regional Geological series sheet 9231 (1:100,00), the Proposed Works footprint is underlain by Palaeozoic Aged Tomago Coal Measures comprising of siltstone, sandstone, coal, tuff, claystone, conglomerate, minor clay. A search of the WaterNSW groundwater map indicated there were no registered groundwater bores located at the Site or within a 500 m radius of the Site.

The Maitland LEP (2011) has mapped the location of the Proposed Works footprint as Class 2 and Class 5 ASS zone, which will require development consent for work within 500 m of adjacent Class 1, 2, 3 or 4 that is below 5 m AHD and by which the water table is likely to be lowered below 1 m AHD. Review of the CSIRO ASS Risk map indicates the Site has a low probability of ASS occurrence.

Potential receptors sensitive to ASS identified in the vicinity of the Site are considered to be:

- Terrestrial ecosystems surrounding the Site.
- Ecosystems dependent upon watercourses to the South of the Proposed Works.



## 5 Proposed Disturbance Activity

The Proposed Works consists of the construction of a stormwater detention basin with an area of approximately 2,800 m<sup>2</sup>.

It is understood the proposed basin construction is likely to include but not be limited to, the following:

- Bulk earthworks, including topsoil stripping, excavation to a depth of around 2.0 m BGL.
- Bulk earthworks, including construction of the basin walls and base.
- Temporary stockpiling of surplus soil material and subsequent reuse on-site or classification and off-site disposal / re-use at a Site legally able to accept the material.

This ASSMP relates to the earthworks for the proposed stormwater detention basin construction and at the time of writing this ASSMP the cut to fill earthworks plan is not available and the estimated soil volume to be disturbed is unknown. However, based on the footprint of the basin it is assumed that greater than 1,000 tonnes will be disturbed, and the corresponding action levels have been adopted.

A copy of the preliminary concept plans for the stormwater detention basin is provided as **Appendix A**.

## 6 Sampling and Analysis Methodology

### 6.1 Soil Sampling Methodology

A total of four sampling locations within the extent of the Proposed Stormwater Basin were chosen, in accordance with the minimum recommended sampling density in the ASSMAC (1998), which requires a minimum density of 4 sampling locations up to 1 hectare (ha). The sample locations are provided in **Figure 1**.

Soil sampling was conducted as follows:

- Soil samples were collected from four borehole locations across the Proposed Works footprint (BH01-BH04) advanced to a maximum depth of 2.1 m BGL, or prior refusal.
- Soil samples were collected at the nominal depths of 0.1, 1.0, 2.0 m BGL from the natural soil horizons.
- Soil was logged in accordance with AS1726 as presented in the bore logs attached as **Appendix B**.
- Soil samples were collected using dedicated, disposable nitrile gloves and assessed for visual and olfactory signs of ASS (incl. grey staining, iron oxide and hydrogen sulphide odour).
- Samples were collected into sealable bags ( $S_{cr}$  suite), double bagged with the sample details and an individual identification added to the label. The samples were then frozen at the laboratory in accordance with lab protocol.
- The sample containers were preserved on ice immediately after sampling and during shipment to a NATA accredited laboratory under appropriate chain-of-custody documentation.

### 6.2 Analytical Testing

EP Risk used ALS Global as the project laboratory, which is NATA accredited for the required analysis. The laboratory analysis was undertaken in accordance with **Table 2**.

Sample Location	Analytical Testing
BH01 depths of 0.1m, 1.0 m and 2.0 m BH02, depths of 1.0 m and 2.0 m BH03, depths of 1.0 m and 2.0 m BH04, depths of 0.1m, 1.0 m and 2.0 m	<ul style="list-style-type: none"> <li>• <math>pH_F/pH_{FOX} - 10</math></li> <li>• <math>S_{cr}</math> Suite – 10</li> </ul>

## 7 Acid Sulfate Soil Indicators and Assessment Criteria

The following ASS indicators and assessment criteria are based on the National ASS Guidance 2018.

### 7.1 Field Screening

Acid sulfate soils generally consist of clays and sands containing pyritic material and are usually found in estuarine areas. The field indicators of AASS include:

- pH readings measured in the field of less than 4;
- Iron staining on any drain surfaces;
- Unusually clear or milky green water discharge;
- Iron mottling of soil in the subsurface; and
- Corrosion of concrete or steel structures.

Undisturbed soil which contain iron sulfides or sulfidic material, which have not been exposed to air and oxidised, generally waterlogged, and have a pH of 4 or more and may be neutral or slightly alkaline are known as PASS. The following may also be indicators of PASS:

- Presence of any sulfurous odours;
- pH following oxidation with 30% hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) is less than 3;
- Strength of the oxidation reaction; and
- Lowering of the pH by at least 1 unit.

### 7.2 Soil Analytical Testing

The above field screening observations are used to guide selection of samples for laboratory analysis. Soil samples submitted for laboratory analysis are tested using the chromium reducible sulfur method and the results assessed against the criteria shown in **Table 3** for the disturbance of >1,000 tonnes or 1 - <1,000 tonnes (National ASS Guidance 2018 and ASSMAC Guidelines 1998).

Texture Range	Approximate Clay Content (%)	1-1,000 tonne Material Disturbed		>1,000 tonne Material Disturbed	
		Net Acidity	Sulfur Trail	Acid Trail	Acid Trail
		% S oxidisable <sup>1</sup> (oven-dry basis)	mol H <sup>+</sup> /tonne <sup>2</sup> (oven-dry basis)	% S oxidisable <sup>1</sup> (oven-dry basis)	mol H <sup>+</sup> /tonne <sup>2</sup> (oven-dry basis)
<b>Coarse and Peats</b> Sands to loamy sands	< 5	≥ 0.03	≥ 18	≥ 0.03 <sup>3</sup>	≥ 18 <sup>4</sup>
<b>Medium</b> Clayey sand to light clays	5-40	≥ 0.06	≥ 36		
<b>Fine</b> Light medium to heavy clays	> 40	≥ 0.1	≥ 62		

<sup>1</sup> % S – measure of reduced inorganic sulfur (using the S<sub>Cr</sub> or peroxide oxidisable sulfur (S<sub>POS</sub>) methods) expressed as a percentage of the weight of dry soil analysed. Can also be used as an 'equivalent sulfur unit' when comparing the results of tests expressed in other units e.g. peroxide oxidisable sulfur (S<sub>POS</sub>) or total oxidisable sulfur (S<sub>TOS</sub>).

<sup>2</sup> mol H<sup>+</sup>/tonne – measure of acidity, expressed as the number of moles of hydrogen cations per tonne of oven-dry soil material. A mole is 6.022x10<sup>23</sup> atoms of a given substance.

<sup>3</sup> Net Acidity excluding ANC (sulfur units) (National ASS 2028) and Chromium Reducible Sulfur (ASSMAC 1998).

<sup>4</sup> Net Acidity excluding ANC (acidity units) (National ASS 2028) and Sulfidic - Titratable Actual Acidity (ASSMAC 1998).

### 7.3 Leachate Criteria

The treatment and management of surface water flows from areas containing PASS or AASS to prevent leaching of acidic waters and metal contaminants into the environment should maintain the present surface water quality. The discharge of surface water should be done so in accordance with NSW EPA, WaterNSW and Council requirements. In the absence of site-specific criteria, the minimum requirements are presented in **Table 4**.

<b>Table 4 – Adopted Leachate Criteria</b>		
<b>Indicator</b>	<b>Fresh Water</b>	<b>Marine Water</b>
pH	6.5-8.0	8.0-8.4 and <0.2 unit change
Suspended Solids	Not Defined	
Turbidity (NTU)	1-20	0.5-10
Dissolved Oxygen (field measured, %)	110	
Oil and Grease	None visible or detected	
Iron Floc and Scum	None visible or detected in discharge water	

## 8 Results

To assess site conditions and whether ASS exist on the Site, soil analytical results were compared to published investigation and screening criteria. The adopted framework against which the soil analytical results are compared, is detailed in **Table 3**.

### 8.1 Field Observations

Sulfurous odours were not observed in the boreholes, there was no observed staining, odour, pooled liquid, stressed vegetation or any other evidence of PASS at the Site or surrounding area. A **photolog** is included as **Appendix C**.

### 8.2 Soil Lithology

The soil lithology in the majority of the Site generally comprised:

- 1A - TOPSOIL: Silty Sandy CLAY / Sandy CLAY: Dark Brown, moist, fine to medium sand, medium plasticity, with organic material.
- 2A – Alluvial: Silty CLAY / Sandy CLAY: Yellow to Light Brown to Dark Brown, dry, fine to coarse sand, fine to coarse sub angular gravel.
- 3A – Residual: Silty CLAY / Sandy CLAY: with sand, fine to medium-grained, high plasticity, Brown to Light brown and Yellow to Orange, mottling, well graded, slightly moist.
- 4A – Residual: Extremely Weathered Sandstone; fine to medium-grained, Light brown to Light Grey.

### 8.3 Soil Analytical Results

The soil investigation has been conducted to assess the presence of ASS at the Site. Soil results are summarised below and in the attached **Analytical Tables**. The NATA certified laboratory reports are included as **Appendix D**.

#### *Field ASS Indicators – pH<sub>F</sub>/pH<sub>FOX</sub>*

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All samples from boreholes BH01-BH04 were screened for the ASS indicator parameters pH<sub>F</sub> and pH<sub>FOX</sub>.

One of the 10 natural soil samples reported pH<sub>FOX</sub> values of <3.0, which indicates the potential for the presence of PASS. It is noted the pH<sub>F</sub> values of the natural soil samples were all <4 and the change in pH<sub>F</sub> and pH<sub>FOX</sub> was greater than 1 pH unit for all natural soil samples tested.

#### *Chromium reducible sulfur suite*

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Of the 10 natural soil samples analysed for the chromium reducible suite, five samples (BH01\_0.1, BH01\_1.0, BH02\_1.0, BH04\_0.1 and BH04\_1.0) reported Net Acidity above the National ASS Guidance 2018 action criteria and Titratable Actual Acidity (TAA) above the ASSMAC 1998 Guideline, indicating AASS is present at the Site.

Based on the results of this assessment, the Site requires the preparation and implementation of an ASSMP, outlining suitable methods for liming application and construction methods for future development in soil containing ASS within the natural silty sand soil.

## 9 Acid Sulfate Soil Management Plan

### 9.1 Assigning Roles and Responsibilities

The key stakeholders responsible for the implementation of the control measures outlined in the ASSMP are presented in **Table 5**.

<b>Table 5 – Roles and Responsibilities</b>		
<b>Role</b>	<b>Party</b>	<b>Responsibilities</b>
Principal	East Maitland Land 62 Pty Ltd	To engage the consultants and contractors and undertake all stakeholder management.
Contractor	TBA	To carry out the civil works associated with the Proposed Works and ensure compliance with the ASSMP and any work health and safety controls outlined in the construction environment management plan (CEMP). The Contractor must maintain written records of activities undertaken each day and manage any unexpected finds.
Sub-contractors	TBA	Toolbox meetings will be conducted with all subcontractors which will include an ASS component outlining the adopted management measures to address ASS.
Environmental Consultant	EP Risk	To validate all stockpiles and managed soils by sampling and analytical testing and to prepare a validation report.

### 9.2 Environmental Impacts

The potential impacts of ASS from the Proposed construction of the stormwater detention basin include:

- Exposing ASS to air during bulk earthworks and temporary stockpiling of soils causing oxidation and a release of acid into the environment.
- Leaching of acid into the environment at treatment sites.

It is not considered there will be any activities that have potential to lower the water table and potentially enhance the oxidation of sediments.

Elements of the Proposed Development will be designed to minimise stockpiling where practicable, however, excavations will be required and do have potential to intercept ASS.

### 9.3 Minimisation of Disturbance

Where disturbance of ASS cannot be avoided, there are a number of strategies that can be implemented to minimise disturbance to ASS. These strategies include:

- Designing earthworks to consider areas containing low or negligible levels of existing and potential acidity.
- Keeping earthworks shallow (viable when ASS is located within deeper soil profiles).
- Minimising groundwater fluctuations by avoiding the following:
  - deep drains/canals/artificial water bodies that may change the water table;
  - installation of groundwater extraction bores or continuing the use of existing groundwater bores;



- dewatering for installation of infrastructure such as road, water and sewerage mains and underground cabling;
- changing vegetation from pasture to deep rooted large trees; and
- Filling (under the supervision of a geotechnical consultant) to compress and dewater saturated ASS material before construction but keeping the soil in anoxic conditions.
- When practicable, excavation works in ASS areas and soil treatment should be conducted during dry periods to minimise risk of overflow from heavy or sudden rain events.

## 9.4 Neutralisation and Treatment

Neutralisation involves the application and mixing of a sufficient amount of alkaline materials into the soil to neutralise all existing acidity that may be present, and all potential acidity that could be generated from complete oxidation. Usually neutralisation involves the excavation of ASS which must be stored and treated in a contained area. There can be significant risks to the environment if neutralisation is poorly managed.

There are a several different methods for carrying out neutralisation of ASS, including:

- Batch processing where the excavated ASS is spread out in a thin layer and the neutralising material is spread on top. The two materials are then mechanically mixed together.
- Continuous processing where a mixing machine (such as a pug mill) is used, and the soil and neutralising agent is fed into the machine.

The preferred neutralising agent is fine agricultural lime (aglime) with not less than 95% fine grained calcium carbonate. Other common neutralising agents include hydrated lime, quick lime and sodium bicarbonate. Sandy soil can be mixed with neutralising agents with ease, but high plasticity clay soil requires significant areas to allow adequate mixing and reaction.

### 9.4.1 Construction of the Soil Treatment Area

Prior to commencing the neutralisation works, a soil treatment area will be constructed in the vicinity of the earthworks. The soil treatment area should be:

- Constructed as far as practicable from any drainage channels.
- Designed and sized to accommodate the anticipated volumes of spoil produced from the excavation works.
- Barricaded and appropriate signage erected.
- Bunded to a height of approximately 0.3 m and appropriate sediment controls installed to prevent runoff and sediment migration.
- Designed such that overland flow is diverted.
- Constructed with a guard layer comprising of a neutralising agent as described in the ASSMAC 1998 and National ASS Guidelines 2018.

The minimum guard layer rate will be 5 kg aglime/m<sup>2</sup> per vertical meter of fill material. If the highest detected sum of existing and potential acidity is greater than 1% S-equivalent, the guard layer rate will be a minimum of 10 kg aglime/m<sup>2</sup> per vertical metre of fill.

### 9.4.2 Stockpiling Soils

It is recommended on-site monitoring is carried out during any deeper excavation earthworks carried out on Site so that disturbance of ASS can be identified, and ASS can be segregated, stockpiled and treated. The management of stockpiled soils within the soil treatment area will be required as follows:

- All excavated soils containing ASS should be segregated from the spoil and stockpiled separately.
- The residence time for short term stockpiling of soils within the soil treatment area should not exceed recommended periods detailed in the ASSMAC 1998 and National ASS Guidelines 2018 as presented in **Table 6**.
- If ASS is required to be stockpiled for longer time frames then those presented in **Table 6**, then it must be fully treated.

Texture	Approximate Clay Content (%)	Duration of Stockpiling (hours)
Coarse and Peats Sands to loamy sands	<5	18
Medium Clayey sand to light clays	5-40	42
Fine Light medium to heavy clays	>40	66

Additional measures to minimise short term effects of oxidation of stockpiles during the Proposed Development works include:

- Spreading aglime over the surface of the stockpile to limit the generation of acidity from the surface of the stockpile where it is considered likely the stockpile will contain ASS. The results of previous validation testing can be used as a guide to the likely presence of existing or potential ASS within the stockpile.
- Soils within the soil treatment area should be kept moist, but not saturated to minimise oxidation prior to treatment.
- All soils should be covered with tarpaulins or geomembrane to mitigate generation of leachate within the soil treatment area.

### 9.4.3 Monitoring

If disturbance of ASS is suspected to have occurred, parameters may need to be monitored daily. More frequent monitoring may also be required to assess the impact of events such as heavy rainfall. The monitoring program should be developed by the Environmental Consultant in conjunction with the Project Contractor. Measurement and testing equipment should be operated by personnel experienced in water and soil sampling using appropriately maintained and calibrated test equipment. The action criteria for treatment is summarised below in **Table 7**.

Table 7 – Monitoring Program Action Criteria		
Media	Indicator	Action
Water	6.5 < pH < 8.5 or +/-0.2 units of adjacent surface water bodies	pH outside this range is not suitable for discharge to the surrounding environment and requires treatment prior to discharge.
Soil	pH<4	Indicates the excavated material is oxidising and would require treatment with lime to neutralise the acidity.

#### 9.4.4 Soil Treatment

The treatment option for soil is neutralisation as follows:

- Stockpile the excavated spoil on the central portion of the guard layer.
- Mechanically break up any clods, add aglime and mix. The aglime should be thoroughly mixed with the soil using an appropriate mechanical device such as an excavator (or other alternatives as appropriate).
- Dosing rates of aglime to be in accordance with the results of net acidity testing. Based on the laboratory calculations, dosing rates ranged from 1 kg CaCO<sub>3</sub>/t<sup>5</sup> to 3 kg CaCO<sub>3</sub>/t for samples collected at the surface and 1.0 mBGL. As a conservative measure, the recommended dosing rate of 3 kg CaCO<sub>3</sub>/t has been adopted<sup>6</sup>.
- It is recommended progressive neutralisation of stockpiled soil is undertaken to minimise the size of the soil treatment area.
- Additional liming may be required should the results indicate the neutralisation has not been achieved.

#### 9.4.5 Water Treatment

Surface water (i.e. water pooled within bunded/treatment areas) with the potential to become acidic as a result of interaction with the treatment area or excavations will be treated and monitored as follows:

- Surface water accumulated in excavations or treatment area will be tested for pH. If the pH is outside the range of 6.5 – 8.5 then the water will be neutralised with the addition of agricultural lime or hydrated lime.
- Records of water discharged from Site shall be maintained.
- Backfilling excavations, completion of footings as soon as possible to minimise the oxidation of in-situ soils exposed within the excavations.
- Minimise the drainage of soils by limiting any groundwater drawdown within excavations to the absolute minimum required to complete the excavation safely. Seepage entering the excavation should be minimised through the use of physical barriers. Treatment of water from dewatering activities may be required subject to further testing.
- Where material is to be transported to the treatment area via public roads, wheel cleaning facilities will be established at site exits to prevent offsite contamination during transport.

<sup>5</sup> The maximum liming rate was adopted as a conservative measure, despite the calculated rate likely to be representative of naturally occurring acidity of the soils. This calculation assumes that an aglime with a neutralising value ('NV') of 98% will be used and a safety factor of 1.5 has been applied. Should an aglime with an alternative NV be adopted then the dosing rate will need to be recalculated.

<sup>6</sup> Samples from 2 m depth did not exceed the ASS action criteria for Net Acidity, however did record a pH change of >2 and pH<sub>Fox</sub> of <4 and soils should be managed as ASS where excavation is <2 m BGL.

- Material will be transported within trucks with secure tailgates.
- Records of transport including individual truck details and quantity transport will be retained at the Project Office.
- At the end of each transport shift an inspection of the transport route will be undertaken by the Supervisor to determine if material has been spilt. Where material has been spilt on public roads it will be removed immediately.

When run-off accumulates, water quality will be monitored regularly during the construction period, particularly following substantial rainfall events. Retained water will be sampled, tested and treated to the parameters in **Table 4** prior to discharge.

## 9.5 Sampling and Testing

It is recommended the following inspections and testing should be undertaken:

- Inspections and testing of stockpile spoil within the treatment area at least every 1-2 days (depending upon the soil type) and with reference to **Table 6** to determine whether the addition of aglime is required.
- If it is determined aglime application is required, it is to be done so as per the dosing rates determined from proposed testing. Mixing the treated soil is to be undertaken in accordance with the timelines provided in **Table 6**.
- Inspections of stockpiles for visual signs of seepage impacted by ASS including milky waters, iron staining and sulfur odour should be undertaken daily.
- Collection of verification soil samples per the following sampling density in accordance with the National ASS Guidance 2018:
  - volume of stockpile < 250 m<sup>3</sup> – 2 samples;
  - volume of stockpile 251 - 500 m<sup>3</sup> – 3 samples;
  - volume of stockpile 1,000 m<sup>3</sup> – 4 samples; and
  - volume of stockpile > 1,000 m<sup>3</sup> – 4 samples plus one per additional 500 m<sup>3</sup>.
- Verification testing for the success of the soil neutralisation is to be carried out in accordance with the National ASS Guidance 2018, including testing of each sample for the chromium reducible sulfur suite by a NATA accredited laboratory.

## 9.6 Performance Criteria

The performance criteria outlined in **Table 3** from (National ASS guidelines 2028) was adopted for assessment of the neutralisation of treated soil. Post treatment net acidity verification is determined as:

$$\text{Net Acidity} =$$

$$\text{Potential sulfidic acidity} + \text{Actual acidity} + \text{Retained acidity}$$

$$- (\text{Post treatment Acid Neutralising Capacity} - \text{Initial acid neutralising capacity}).$$

Soil that has been treated by neutralisation techniques and has not met these criteria must be re-treated and re-tested until the above performance criteria are met. These performance criteria equate to there being no positive calculated net acidity (using acid base accounting) in the soil above the adopted criteria following treatment.

The neutralisation management strategy is most effective when soil and neutralising agents are completely homogenised, which may not be fully achievable for large volumes of soil, especially when moist and/or clayey.

## 9.7 Reporting

The following details should be recorded during the soil treatment process and reported in a final Validation Report:

- Total final volumes and dimensions of disturbed ASS.
- Where dewatering was involved, final location, extent and duration of dewatering and details of testing and groundwater management strategies applied.
- Details of soil management strategies undertaken at the Site (including evidence of specific management measures such as waste tracking, photographic evidence of neutralisation and of banded treatment pads).
- Details of surface water management strategies undertaken at the Site.
- Location of any offsite disposal of ASS and evidence of treatment onsite prior to disposal.
- Summary of verification testing results for material treated.
- Location and maps of areas used for strategic burial of treated ASS, with depth below finished surface and details of safety margin below the permanent water table.
- Summary of monitoring results for surface water and groundwater (with an emphasis on trends in water quality).
- In appendices, full results of monitoring and verification testing regimes.
- A discussion of the effectiveness of management strategies employed at the Site.
- Details of any incidence of nonconformity with the ASSMP and corrective actions taken.
- A discussion of any potential risks to the environment or human health.
- Proposed future monitoring and/or reporting programs.
- Proposed remediation measures if needed.

A record of these observations, calculations and soil monitoring results should be provided to the client for each day an inspection is undertaken. At the completion of works a final closure report will be prepared detailing the above information.

## 10 Contingency Plan

A number of contingency measures for the soil treatment works have been provided in **Table 8**.

<b>Table 8 – Contingency Plan</b>		
<b>Scenario</b>	<b>Consequence</b>	<b>Contingency Measures</b>
Under liming of ASS	Potential for acid generation and impact to sensitive receptors	Addition of more aglime with additional chromium reducible sulfur testing to determine additional liming rate (if required).
Over liming of ASS	High pH may cause environmental impact	Mix over limed soil with ASS to reduce pH levels to within adopted criteria.
Volume of ASS exceeds treatment area	Delays to earthwork	Increase size of soil treatment area.
Observations of ASS leachate production in soil treatment area	Loss of containment of leachate	Conduct aglime treatment and apply leachate back to stockpile.
Heavy rain causing ponding of water within treatment area	Damage to bunding and sediment controls	Testing of water for adopted action criteria and treatment if exceedance of relevant criteria. Irrigation of validated water to adjacent areas.
pH values increase in surrounding water bodies	Potential for acid generation and impact to sensitive receptors	Increase monitoring frequency and submit samples to laboratory for analysis. If continues, notify relevant statutory authority.



## 11 Conclusion

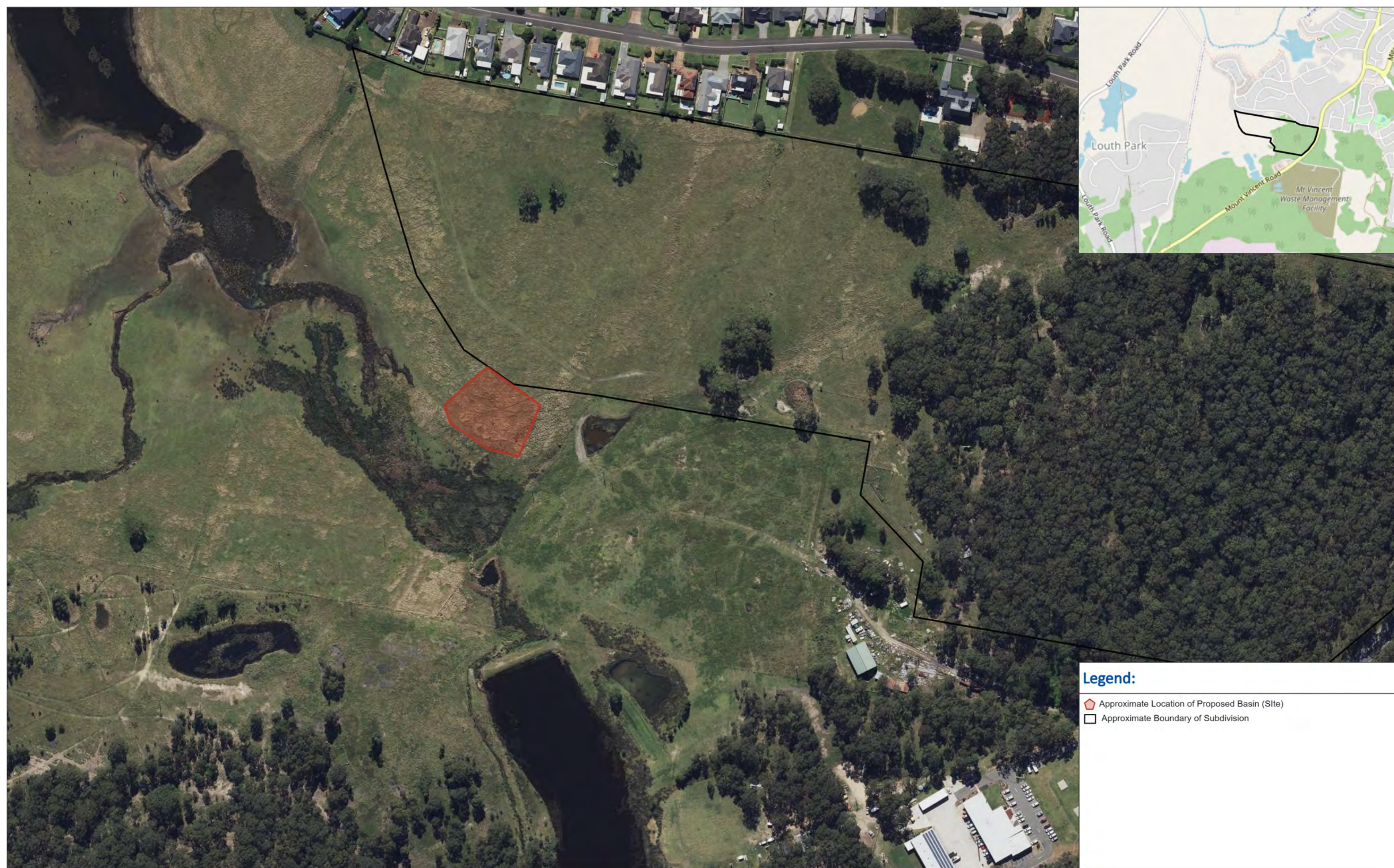
Based on the results of this assessment, ASS was identified at the Site to a depths of <2 m which trigger the implementation of this ASSMP for bulk earthworks. The ASSMP outlines suitable methods for treatment and construction management controls for disturbance of natural silty and sand clay ASS during construction of the Proposed Development.



The laboratory recommended liming rates ranging between 1 kg CaCO<sub>3</sub>/t to 3 kg CaCO<sub>3</sub>/t. A liming rate of 3 kg CaCO<sub>3</sub>/t was adopted for neutralisation of ASS. Monitoring and verification should be conducted as per the ASSMP and liming adjusted as required based on screening and testing results.

Provided this ASSMP is implemented, it is considered that ASS can be readily managed and would not preclude the Proposed Development.

# Figures





- Legend:**
-  Approximate Location of Proposed Basin (Site)
  -  Approximate Boundary of Subdivision

**Acid Sulfate Soil Management Plan**  
**Wilton Drive, East Maitland NSW, Australia**

**Job No: EP3799**  
**Date: 02-08-2024**  
**Version: v1**

**Figure 1 - Site Location and Layout**

**Coordinate System: WGS84**  
**Drawn By: HE      Checked: TR**  
**Scale of regional map not shown**






0 25 m 50 m  
 Approximate Scale Only





**Legend:**

-  Approximate Investigation Locations
-  Approximate Location of Proposed Basin (Site)
-  Approximate Sub-Division Area Boundary

**Acid Sulfate Soil Management Plan**  
**Wilton Drive, East Maitland NSW, Australia**

Job No: EP3799  
 Date: 13-08-2024  
 Version: v1



0 25 m 50 m  
 Approximate Scale Only

**Figure 2 - Site Layout and Sampling Locations**

Coordinate System: WGS 84  
 Drawn By: HE Checked By: TR  
 Scale of regional map not shown  
 Source: © Department of Finance, Services & Innovation 2018





# Tables

	pH (F)	pH (Fox)	pHf - pH(fox)	Reaction Rate	pH KCl (25A)	ANC Fineness Factor	Net Acidity (sulfur units)	Net Acidity (acidity units)	Liming Rate	Net Acidity excluding ANC (sulfur units)	Net Acidity excluding ANC (acidity units)	Titrateable Actual Acidity (23F)	Liming Rate excluding ANC	sulfide - Titrateable Actual Acidity (s-23F)	Chromium Reducible Sulfur (22B)	acidity - Chromium Reducible Sulfur (s-22B)
	pH	pH	pH	reaction unit	ph	-	%s	mole h+/t	kg caco3/t	%s	mole h+/t	mole h+/t	kg caco3/t	% pyrite s	%s	mole h+/t
EQL	0.1	0.1	0.1	1	0.1	0.5	0.02	10	1	0.02	10	2	1	0.02	0.005	10
NSW ASSMAC (1998) Potential Acid Sulfate Soil (PASS) Screen Indicators		>3	>1								-	-	-	-	-	-
NSW ASSMAC (1998) Action Criteria (>1000 tonnes disturbed)											-	18	-	-	0.03	-
National ASS (2018) Acid Sulfate Soil (ASS) Screen Indicators	<4										-	-	-	-	-	-
National ASS (2018) Action Criteria (>1000 tonnes disturbed)										0.03	18	-	-	-	-	-

Field ID	Sample ID	Depth	Sampled Date																
BH01	BH01_0.1	0.1m	30-07-2024	6	2.7	3.3	3	5.4	1.5	0.04	24	2	0.04	24	24	2	0.04	< 0.005	< 10
BH01	BH01_1.0	1m	30-07-2024	5.4	3.4	2	2	4.6	1.5	0.05	29	2	0.05	29	24	2	0.04	0.008	< 10
BH01	BH01_2.0	2m	30-07-2024	7	4.7	2.3	2	5.8	1.5	< 0.02	12	< 1	< 0.02	12	8	< 1	< 0.02	0.006	< 10
BH02	BH02_1.0	1m	30-07-2024	5.9	3.8	2.1	3	5.1	1.5	0.03	19	1	0.03	19	19	1	0.03	< 0.005	< 10
BH02	BH02_2.0	2m	30-07-2024	8.3	5.7	2.6	2	6.2	1.5	< 0.02	< 10	< 1	< 0.02	< 10	2	< 1	< 0.02	< 0.005	< 10
BH03	BH03_1.0	1m	30-07-2024	7.2	5.1	2.1	2	6.2	1.5	< 0.02	< 10	< 1	< 0.02	< 10	7	< 1	< 0.02	< 0.005	< 10
BH03	BH03_2.0	2m	30-07-2024	8.7	5.9	2.8	2	6.3	1.5	< 0.02	< 10	< 1	< 0.02	< 10	< 2	< 1	< 0.02	0.006	< 10
BH04	BH04_0.1	0.1m	30-07-2024	6.1	3.2	2.9	3	5.4	1.5	0.04	26	2	0.04	26	21	2	0.03	0.009	< 10
BH04	BH04_1.0	1m	30-07-2024	5.1	3.5	1.6	2	4.6	1.5	0.06	37	3	0.06	37	32	3	0.05	0.007	< 10
BH04	BH04_2.0	2m	30-07-2024	5.8	3.8	2	2	5.6	1.5	< 0.02	11	< 1	< 0.02	11	8	< 1	< 0.02	0.006	< 10

Criteria adopted from the following guidelines:

<sup>4</sup>NSW ASSMAC (1998) Action Criteria (1 - 1000 tonnes disturbed) - Sandy loams to light clays - Approx. clay content (%<0.002 mm) - (5 - 40)

<sup>5</sup>NSW ASSMAC (1998) Action Criteria (1 - 1000 tonnes disturbed) - Medium to heavy clays and silty clays - Approx. clay content (%<0.002 mm) > 40

National ASS Guidance 2018

Notes:

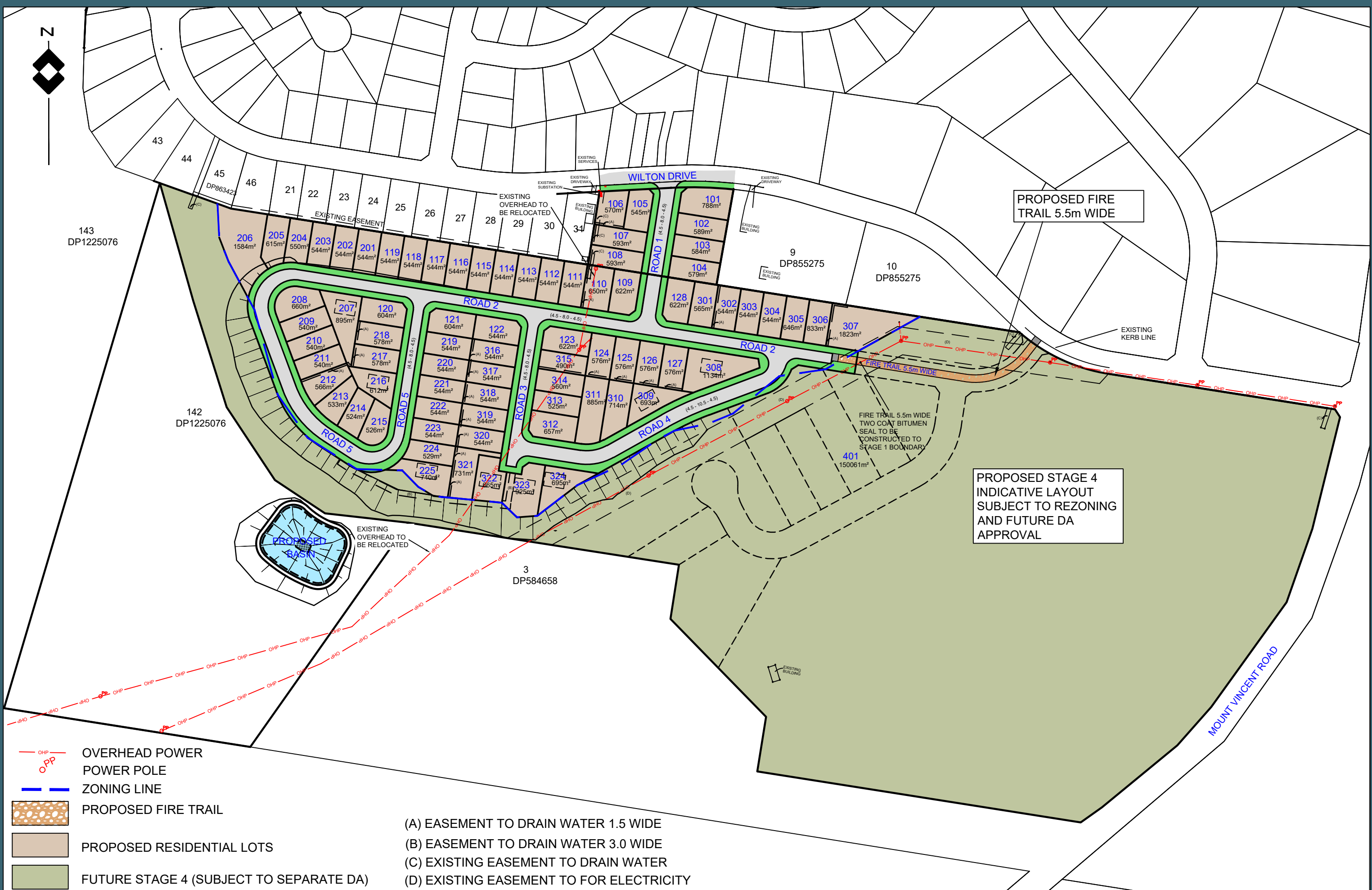
This table does not represent the full analytical results, please refer to the laboratory results for full details.











# Appendix A

PROPOSED DEVELOPMENT DRAWING



PROPOSED FIRE TRAIL 5.5m WIDE

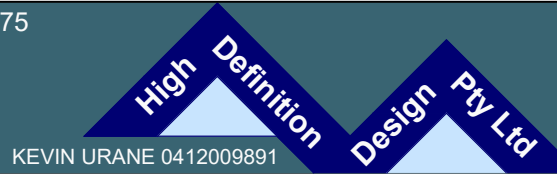
PROPOSED STAGE 4 INDICATIVE LAYOUT SUBJECT TO REZONING AND FUTURE DA APPROVAL

-  OVERHEAD POWER
-  POWER POLE
-  ZONING LINE
-  PROPOSED FIRE TRAIL
-  PROPOSED RESIDENTIAL LOTS
-  FUTURE STAGE 4 (SUBJECT TO SEPARATE DA)

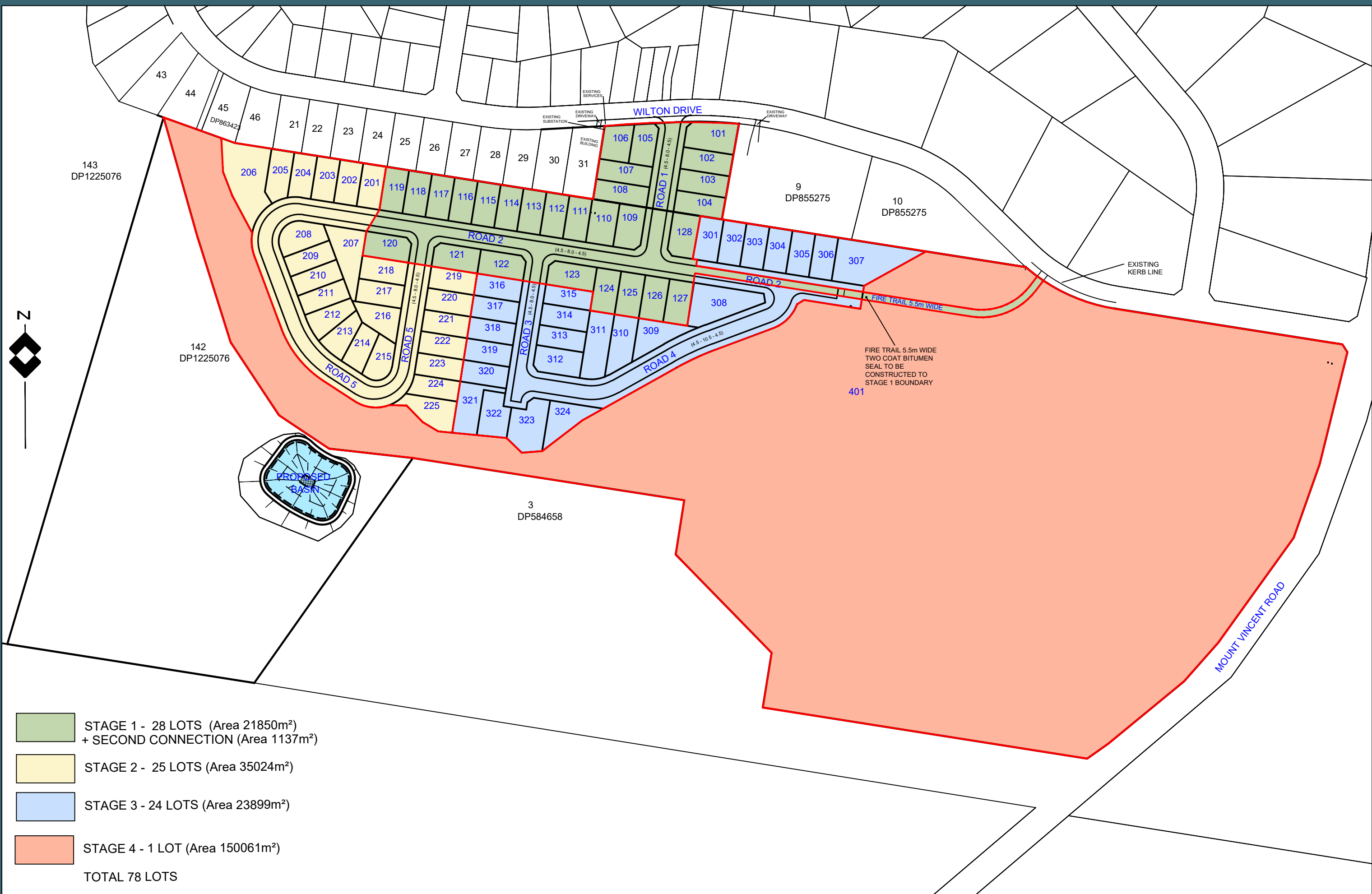
- (A) EASEMENT TO DRAIN WATER 1.5 WIDE
- (B) EASEMENT TO DRAIN WATER 3.0 WIDE
- (C) EXISTING EASEMENT TO DRAIN WATER
- (D) EXISTING EASEMENT TO FOR ELECTRICITY

TITLE: PROPOSED SUBDIVISION OF LOT 141 & 142 DP1225076 & LOT 8 DP855275  
WILTON DRIVE EAST MAITLAND

OVERALL PLAN

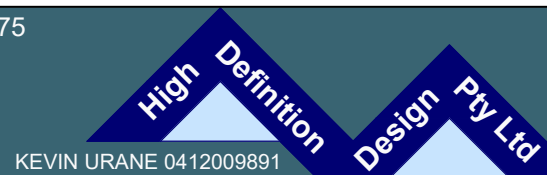


Date:	28.08.23	Scale:	1:2500 A3	Designed:	KU	Project No:	HD374
Cad Ref:	HD374 r9					Drawing No:	HD02
						Revision:	9
No	Amendment	Drawn	Date				

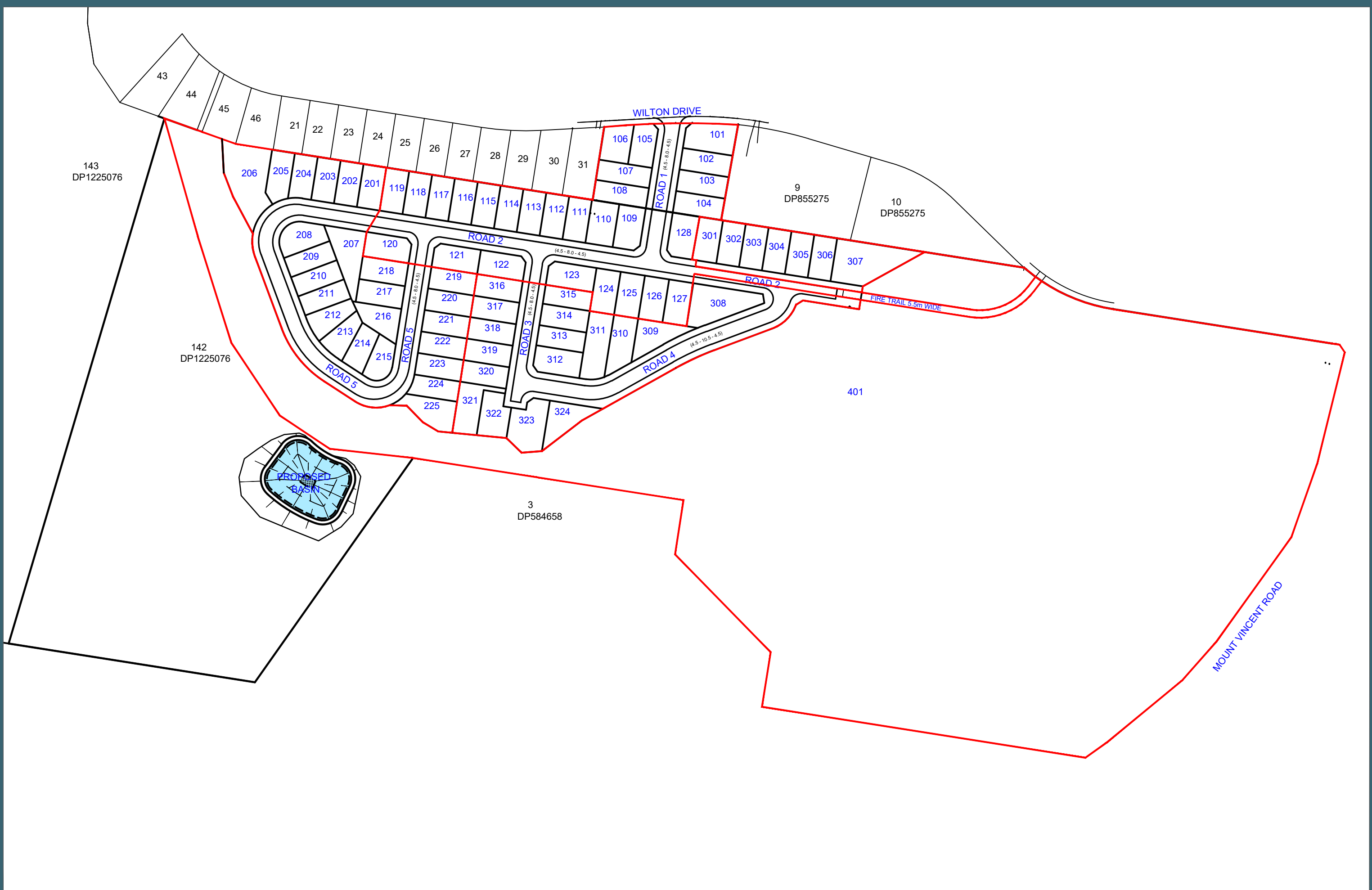


TITLE: PROPOSED SUBDIVISION LOT 141 & 142 DP1225076 AND LOT 8 DP855275  
 WILTON DRIVE EAST MAITLAND

STAGING PLAN

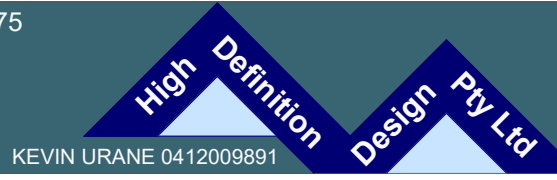


Date:	28.08.23	Scale:	1:2500 A3	Designed:	KU	Project No	HD374	
Cad Ref:	HD374 r9					Drawing No	Revision	
9	DA ISSUE			KU	16.07.24	HD03	9	
8	AMEND STAGING			KU	03.07.24			
7	AMEND LAYOUT			KU	30.04.24			
No	Amendment			Drawn	Date			



TITLE: PROPOSED SUBDIVISION LOT 141 & 142 DP1225076 AND LOT 8 DP855275  
 WILTON DRIVE EAST MAITLAND

STAGING PLAN



Date:	Scale:	1:2500 A3	Designed:	KU	Project No	HD374	
Cad Ref:		HD374 boundary					
		DA ISSUE	KU	16.07.24	Drawing No	Revision	
		AMEND STAGING	KU	03.07.24	HD13	9	
		AMEND LAYOUT	KU	30.04.24			
No	Amendment	Drawn	Date				

# Appendix B

BORE LOGS



# ENVIRONMENTAL LOG: BH01

**PROJECT NO.:** EP3799  
**PROJECT NAME:** East Maitland ASSMP  
**CLIENT:** Hunter Land  
**ADDRESS:** Wilton Drive, East Maitland NSW, Australia

**DRILLING DATE:** 07-30-2024  
**DRILLING CO.:** Coffey Testing  
**DRILL METHOD:** Dingo Drill Rig  
**DRILLER:**  
**LOGGED BY:** HE

**TOTAL DEPTH:** 2  
**COORDINATES:** -32.77016, 151.5682  
**COORD. SYSTEM:**  
**GROUND ELEV.:**  
**CHECKED BY:** TR

## NOTES:

Depth	Sample Number	PID READING (ppm)	Graphic	Soil Classification	Material Description	Additional Observations
Ground Surface at (m)						
0	BH01_0.1			TOPSOIL Silty Sandy CLAY TOPSOIL Silty Sandy CLAY, medium plasticity, Dark brown, moist		
				Silty CLAY Silty CLAY, high plasticity, Grey, light brown, moist		
1	BH01_1.0					
				Silty SAND Silty SAND, fine to medium-grained, Grey, well graded, dry		
2	BH01_2.0				End of Test Hole at 2 (m)	
3						

RSLog / EP Risk Environmental Soil Logging Template without well - NM Edit / ep-risk-management-ply-ld / admin / August 01, 2024 09:45 pm

**Disclaimer:** This log is intended for environmental not geotechnical purposes.





# ENVIRONMENTAL LOG: BH02

**PROJECT NO.:** EP3799  
**PROJECT NAME:** East Maitland ASSMP  
**CLIENT:** Hunter Land  
**ADDRESS:** Wilton Drive, East Maitland NSW, Australia

**DRILLING DATE:** 07-30-2024  
**DRILLING CO.:** Coffey Testing  
**DRILL METHOD:** Dingo Drill rig  
**DRILLER:**  
**LOGGED BY:** HE

**TOTAL DEPTH:** 2.1  
**COORDINATES:** -32.77037, 151.56824  
**COORD. SYSTEM:**  
**GROUND ELEV.:**  
**CHECKED BY:** TR

## NOTES:

Depth	Sample Number	PID READING (ppm)	Graphic	Soil Classification	Material Description	Additional Observations
Ground Surface at (m)						
0				TOPSOIL Sandy CLAY	TOPSOIL Sandy silty CLAY, low plasticity, Dark brown, fine to medium-grained, moist	
				Silty CLAY	Silty CLAY, high plasticity, Yellow, light brown, moist	
1	BH02_1.0					
				Silty SAND	Silty SAND, low plasticity, Light grey, yellow, dry	
2	BH02_2.0					
					Refusal of Test Hole at 2.1 (m)	
3						

RSJLog / EP Risk Environmental Soil Logging Template without well - NM Edit / ep-risk-management-ply-ld / admin / August 01, 2024 09:45 pm



# ENVIRONMENTAL LOG: BH03

**PROJECT NO.:** EP3799  
**PROJECT NAME:** East Maitland ASSMP  
**CLIENT:** Hunter Land  
**ADDRESS:** Wilton Drive, East Maitland NSW, Australia

**DRILLING DATE:** 07-30-2024  
**DRILLING CO.:** Coffey Testing  
**DRILL METHOD:** Dingo Drill Rig  
**DRILLER:**  
**LOGGED BY:** HE

**TOTAL DEPTH:** 2  
**COORDINATES:** -32.77039, 151.56802  
**COORD. SYSTEM:**  
**GROUND ELEV.:**  
**CHECKED BY:** TR

## NOTES:

Depth	Sample Number	PID READING (ppm)	Graphic	Soil Classification	Material Description	Additional Observations
Ground Surface at (m)						
0	BH03_0.1			TOPSOIL Sandy CLAY	TOPSOIL Sandy silty CLAY, low plasticity, Dark brown, fine to medium grained, moist.	
				Silty CLAY	Silty CLAY, medium plasticity, Dark brown, moist	
1	BH03_1.0					
				Sandy CLAY	Sandy silty CLAY with gravels, high plasticity, Yellow, light brown, slightly moist	
2	BH03_2.0				Refusal of Test Hole at 2 (m)	
3						

RSLog / EP Risk Environmental Soil Logging Template without well - NM Edit / ep-risk-management-ply-ld / admin / August 01, 2024 09:45 pm

**Disclaimer:** This log is intended for environmental not geotechnical purposes.



# ENVIRONMENTAL LOG: BH04

**PROJECT NO.:** EP3799  
**PROJECT NAME:** East Maitland ASSMP  
**CLIENT:** Hunter Land  
**ADDRESS:** Wilton Drive, East Maitland NSW, Australia

**DRILLING DATE:** 07-30-2024  
**DRILLING CO.:** Coffey Testing  
**DRILL METHOD:** Dingo Drill Rig  
**DRILLER:**  
**LOGGED BY:** HE

**TOTAL DEPTH:** 2  
**COORDINATES:** -32.77052, 151.56842  
**COORD. SYSTEM:**  
**GROUND ELEV.:**  
**CHECKED BY:** TR

## NOTES:

Depth	Sample Number	PID READING (ppm)	Graphic	Soil Classification	Material Description	Additional Observations
Ground Surface at (m)						
0	BH04_0.1				TOPSOIL Silty Sandy CLAY TOPSOIL Silty Sandy CLAY, low plasticity, Dark brown, moist	
					Silty CLAY Silty CLAY, medium plasticity, Dark brown, very moist	
1	BH04_1.0					
					Silty CLAY Silty CLAY with sand, fine to medium-grained, high plasticity, Brown, light brown, orange mottling, well graded, slightly moist	
2	BH04_2.0					
					End of Test Hole at 2 (m)	
3						


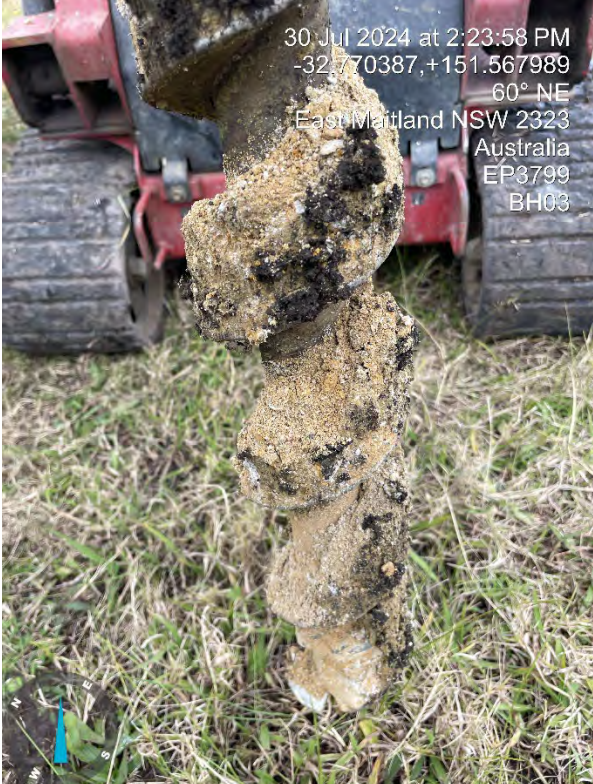
RSLog / EP Risk Environmental Soil Logging Template without well - NM Edit / ep-risk-management-ply-ld / admin / August 01, 2024 09:45 pm

**Disclaimer:** This log is intended for environmental not geotechnical purposes.




# Appendix C

## PHOTOLOG

 <p>30 Jul 2024 at 1:51:15 PM -32.770375, +151.568317 346° N East Maitland NSW 2323 Australia EP3799 BH02</p>	<p><b>Plate 1</b></p> <p><b>Description:</b></p> <p>BH02 at 1 m BGL</p> <p><b>Date:</b></p> <p>30.07.2024</p>
 <p>30 Jul 2024 at 2:23:58 PM -32.770387, +151.567989 60° NE East Maitland NSW 2323 Australia EP3799 BH03</p>	<p><b>Plate 2</b></p> <p><b>Description:</b></p> <p>BH03 at 2.0 m BGL</p> <p><b>Date:</b></p> <p>30.07.2024</p>



 <p>30 Jul 2024 at 2:40:03 PM -32.770604,+151.868887 46° NE East Maitland NSW 2323 Australia EP3799 BH04</p>	<p><b>Plate 3</b></p> <p><b>Description:</b></p> <p>BH04 at 1- 2.0 m BGL</p> <p><b>Date:</b></p> <p>30.07.2024</p>
 <p>30 Jul 2024 at 2:22:18 PM -32.770435,+151.568093 116° SE East Maitland NSW 2323 Australia EP3799 BH03</p> <p>CLIENT / REF: EP3799 A SAMPLED BY: HE SAMPLE ID: BH03-2.0 DATE / TIME: 30.7.24 ACID SULFATE SOILS This bag contains no preservatives It is a field sample Samples should be frozen for confirmation after analysis.</p>	<p><b>Plate 4</b></p> <p><b>Description:</b></p> <p>BH03 at 2.0 m BGL</p> <p><b>Date:</b></p> <p>30.07.2024</p>

	<p><b>Plate 6</b></p> <p><b>Description:</b></p> <p>BH03 – Surface topsoil material</p> <p><b>Date:</b></p> <p>30.07.2024</p>
---	---



# Appendix D

NATA ACCREDITED LABORATORY CERTIFICATES





## CERTIFICATE OF ANALYSIS

**Work Order** : **ES2424867**  
**Client** : **EP RISK MANAGEMENT**  
**Contact** : MR TERRY RODGERS  
**Address** : 3/19 BOLTON STREET  
NEWCASTLE NSW 2300  
**Telephone** : ----  
**Project** : EP3799  
**Order number** : ----  
**C-O-C number** : ----  
**Sampler** : Hayley Erskine  
**Site** : East Maitland ASS  
**Quote number** : ES23EPRISK0002 - ES PRIMARY WORK ONLY  
**No. of samples received** : 11  
**No. of samples analysed** : 11

**Page** : 1 of 7  
**Laboratory** : Environmental Division Sydney  
**Contact** : Jason Dighton  
**Address** : 277-289 Woodpark Road Smithfield NSW Australia 2164  
**Telephone** : +61-2-8784 8555  
**Date Samples Received** : 30-Jul-2024 16:36  
**Date Analysis Commenced** : 31-Jul-2024  
**Issue Date** : 06-Aug-2024 17:41



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

**Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.**

### *Signatories*

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contract for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
LOR = Limit of reporting  
^ = This result is computed from individual analyte detections at or above the level of reporting  
ø = ALS is not NATA accredited for these tests.  
~ = Indicates an estimated value.

- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite): Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- Unless otherwise stated, analytical work for this work order will be conducted at ALS Sydney, NATA accreditation no. 825, site no. 10911.
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO<sub>3</sub>) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m<sup>3</sup> in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m<sup>3</sup>'.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- EP231: Stable isotope enriched internal standards are added to samples prior to extraction. Target compounds have a direct analogous internal standard with the exception of PFPeS, PFHpA, PFDS, PFTrDA and 10:2 FTS. These compounds use an internal standard that is chemically related and has a retention time close to that of the target compound. The DQO for internal standard response is 50-150% of that established at initial calibration or as per USEPA 1633 limits where LISTED. PFOS is quantified using a certified, traceable standard consisting of linear and branched PFOS isomers. These practices are in line with recommendations in the National Environmental Management Plan for PFAS and also conform to QSM 5.4 (US DoD) requirements.



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH01_0.1	BH01_1.0	BH01_2.0	BH02_1.0	BH02_2.0
Sampling date / time				30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	
Compound	CAS Number	LOR	Unit	ES2424867-001	ES2424867-002	ES2424867-003	ES2424867-004	ES2424867-005	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	6.0	5.4	7.0	5.9	8.3	
pH (Fox)	----	0.1	pH Unit	2.7	3.4	4.7	3.8	5.7	
Reaction Rate	----	1	Reaction Unit	3	2	2	3	2	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	5.4	4.6	5.8	5.1	6.2	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	24	24	8	19	2	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.04	0.04	<0.02	0.03	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.008	0.006	<0.005	<0.005	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	0.04	0.05	<0.02	0.03	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	24	29	12	19	<10	
Liming Rate	----	1	kg CaCO3/t	2	2	<1	1	<1	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.04	0.05	<0.02	0.03	<0.02	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	24	29	12	19	<10	
Liming Rate excluding ANC	----	1	kg CaCO3/t	2	2	<1	1	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH03_0.1	BH03_1.0	BH03_2.0	BH04_0.1	BH04_1.0
Sampling date / time				30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	
Compound	CAS Number	LOR	Unit	ES2424867-006	ES2424867-007	ES2424867-008	ES2424867-009	ES2424867-010	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	----	7.2	8.7	6.1	5.1	
pH (Fox)	----	0.1	pH Unit	----	5.1	5.9	3.2	3.5	
Reaction Rate	----	1	Reaction Unit	----	2	2	3	2	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	----	6.2	6.3	5.4	4.6	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	----	7	<2	21	32	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	----	<0.02	<0.02	0.03	0.05	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	----	<0.005	0.006	0.009	0.007	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	----	<10	<10	<10	<10	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	----	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	----	<0.02	<0.02	0.04	0.06	
Net Acidity (acidity units)	----	10	mole H+ / t	----	<10	<10	26	37	
Liming Rate	----	1	kg CaCO3/t	----	<1	<1	2	3	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	----	<0.02	<0.02	0.04	0.06	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	----	<10	<10	26	37	
Liming Rate excluding ANC	----	1	kg CaCO3/t	----	<1	<1	2	3	
<b>EA055: Moisture Content (Dried @ 105-110°C)</b>									
Moisture Content	----	0.1	%	35.1	19.5	----	22.8	17.6	
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>									
Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	0.0007	<0.0002	----	0.0003	<0.0002	
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>									



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH03_0.1	BH03_1.0	BH03_2.0	BH04_0.1	BH04_1.0
Sampling date / time				30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	30-Jul-2024 00:00	
Compound	CAS Number	LOR	Unit	ES2424867-006	ES2424867-007	ES2424867-008	ES2424867-009	ES2424867-010	
				Result	Result	Result	Result	Result	
<b>EP231B: Perfluoroalkyl Carboxylic Acids - Continued</b>									
Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	----	<0.001	<0.001	
Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	----	<0.0002	<0.0002	
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>									
4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	----	<0.0005	<0.0005	
6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	----	<0.0005	<0.0005	
8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	----	<0.0005	<0.0005	
10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	----	<0.0005	<0.0005	
<b>EP231P: PFAS Sums</b>									
Sum of PFHxS and PFOS	355-46-4/1763-23-1	0.0002	mg/kg	<b>0.0007</b>	<0.0002	----	<b>0.0003</b>	<0.0002	
Sum of PFAS (WA DER List)	----	0.0002	mg/kg	<b>0.0007</b>	<0.0002	----	<b>0.0003</b>	<0.0002	
<b>EP231S: PFAS Surrogate</b>									
13C4-PFOS	----	0.0002	%	<b>103</b>	<b>90.4</b>	----	<b>94.2</b>	<b>90.4</b>	
13C8-PFOA	----	0.0002	%	<b>94.4</b>	<b>95.1</b>	----	<b>91.6</b>	<b>97.2</b>	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID		BH04_2.0	----	----	----	----
		Sampling date / time		30-Jul-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2424867-011	-----	-----	-----	-----
				Result	---	---	---	---
<b>EA003 :pH (field/fox)</b>								
pH (F)	----	0.1	pH Unit	<b>5.8</b>	----	----	----	----
pH (Fox)	----	0.1	pH Unit	<b>3.8</b>	----	----	----	----
Reaction Rate	----	1	Reaction Unit	<b>2</b>	---	---	---	---
<b>EA033-A: Actual Acidity</b>								
pH KCl (23A)	----	0.1	pH Unit	<b>5.6</b>	----	----	----	----
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<b>8</b>	----	----	----	----
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
<b>EA033-B: Potential Acidity</b>								
Chromium Reducible Sulfur (22B)	----	0.005	% S	<b>0.006</b>	----	----	----	----
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
<b>EA033-E: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	<b>1.5</b>	----	----	----	----
Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
Net Acidity (acidity units)	----	10	mole H+ / t	<b>11</b>	----	----	----	----
Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<b>11</b>	----	----	----	----
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----



### Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
<b>EP231S: PFAS Surrogate</b>			
<b>13C4-PFOS</b>	----	60	120
<b>13C8-PFOA</b>	----	60	120

### Inter-Laboratory Testing

Analysis conducted by ALS Brisbane, NATA accreditation no. 825, site no. 818 (Chemistry / Biology).

(SOIL) EA033-E: Acid Base Accounting

(SOIL) EA003 :pH (field/fox)

(SOIL) EA033-B: Potential Acidity

(SOIL) EA033-C: Acid Neutralising Capacity

(SOIL) EA033-D: Retained Acidity

(SOIL) EA033-A: Actual Acidity



## QUALITY CONTROL REPORT

Work Order	: <b>ES2424867</b>	Page	: 1 of 5
Client	: <b>EP RISK MANAGEMENT</b>	Laboratory	: Environmental Division Sydney
Contact	: MR TERRY RODGERS	Contact	: Jason Dighton
Address	: 3/19 BOLTON STREET NEWCASTLE NSW 2300	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: EP3799	Date Samples Received	: 30-Jul-2024
Order number	: ----	Date Analysis Commenced	: 31-Jul-2024
C-O-C number	: ----	Issue Date	: 06-Aug-2024
Sampler	: Hayley Erskine		
Site	: East Maitland ASS		
Quote number	: ES23EPRISK0002 - ES PRIMARY WORK ONLY		
No. of samples received	: 11		
No. of samples analysed	: 11		



This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted, unless the sampling was conducted by ALS. This document shall not be reproduced, except in full.

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

### Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Alex Rossi	Organic Chemist	Sydney Inorganics, Smithfield, NSW
Alex Rossi	Organic Chemist	Sydney Organics, Smithfield, NSW
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD





## General Comments

The analytical procedures used by ALS have been developed from established internationally recognised procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are fully validated and are often at the client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis. Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

Key :  
 Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot  
 CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.  
 LOR = Limit of reporting  
 RPD = Relative Percentage Difference  
 # = Indicates failed QC  
 \* = The final LOR has been raised due to dilution or other sample specific cause; adjusted LOR is shown in brackets. The duplicate ranges for Acceptable RPD% are applied to the final LOR where applicable.

## Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EA003 :pH (field/fox) (QC Lot: 5968387)</b>									
ES2424379-001	Anonymous	EA003: pH (F)	----	0.1	pH Unit	7.5	7.4	1.7	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	5.1	5.0	0.0	0% - 20%
ES2424678-004	Anonymous	EA003: pH (F)	----	0.1	pH Unit	5.8	5.8	1.7	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.3	3.4	0.0	0% - 20%
<b>EA003 :pH (field/fox) (QC Lot: 5968388)</b>									
ES2424867-002	BH01_1.0	EA003: pH (F)	----	0.1	pH Unit	5.4	5.2	2.5	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	3.4	3.4	0.0	0% - 20%
<b>EA033-A: Actual Acidity (QC Lot: 5966346)</b>									
EP2410037-017	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.8	9.8	0.0	0% - 20%
ES2424867-007	BH03_1.0	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	7	6	22.4	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	6.2	6.2	0.0	0% - 20%
<b>EA033-B: Potential Acidity (QC Lot: 5966346)</b>									
EP2410037-017	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.039	0.037	3.2	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	24	23	0.0	No Limit
ES2424867-007	BH03_1.0	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	<0.005	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit



Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
<b>EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 5964214)</b>									
ES2424846-015	Anonymous	EA055: Moisture Content	----	0.1 (1.0)*	%	7.8	10.5	28.6	0% - 50%
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QC Lot: 5959627)</b>									
ES2424471-013	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QC Lot: 5959627)</b>									
ES2424471-013	Anonymous	EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	<0.0002	0.0	No Limit
		EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	<0.001	0.0	No Limit
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QC Lot: 5959627)</b>									
ES2424471-013	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	<0.0005	0.0	No Limit



## Method Blank (MB) and Laboratory Control Sample (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Sample (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: SOIL

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
				Result	Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit			LCS	Low	High
<b>EA033-A: Actual Acidity (QCLot: 5966346)</b>								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.7 pH Unit	104	80.0	120
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	23.5 mole H+ / t	112	80.0	120
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
<b>EA033-B: Potential Acidity (QCLot: 5966346)</b>								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.283 % S	99.2	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 5959627)</b>								
EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.3	72.0	128
EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	85.6	67.0	130
EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	83.6	68.0	136
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 5959627)</b>								
EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.001	mg/kg	<0.001	0.00625 mg/kg	78.9	71.0	135
EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.0002	mg/kg	<0.0002	0.00125 mg/kg	78.0	69.0	132
EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.0002	mg/kg	<0.0002	0.00125 mg/kg	110	70.0	132
EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.0002	mg/kg	<0.0002	0.00125 mg/kg	87.2	71.0	131
EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.0002	mg/kg	<0.0002	0.00125 mg/kg	77.9	69.0	133
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 5959627)</b>								
EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	74.4	62.0	145
EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.0005	mg/kg	<0.0005	0.00125 mg/kg	106	64.0	140
EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.0005	mg/kg	<0.0005	0.00125 mg/kg	93.7	65.0	137
EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.0005	mg/kg	<0.0005	0.00125 mg/kg	98.0	69.2	143

## Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery (%)	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number		MS	Low	High
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 5959627)</b>							
ES2424471-013	Anonymous	EP231X: Perfluorobutane sulfonic acid (PFBS)	375-73-5	0.00125 mg/kg	85.6	72.0	128



Sub-Matrix: SOIL

				Matrix Spike (MS) Report			
				Spike Concentration	Spike Recovery(%) MS	Acceptable Limits (%)	
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
<b>EP231A: Perfluoroalkyl Sulfonic Acids (QCLot: 5959627) - continued</b>							
ES2424471-013	Anonymous	EP231X: Perfluorohexane sulfonic acid (PFHxS)	355-46-4	0.00125 mg/kg	81.5	67.0	130
		EP231X: Perfluorooctane sulfonic acid (PFOS)	1763-23-1	0.00125 mg/kg	78.5	68.0	136
<b>EP231B: Perfluoroalkyl Carboxylic Acids (QCLot: 5959627)</b>							
ES2424471-013	Anonymous	EP231X: Perfluorobutanoic acid (PFBA)	375-22-4	0.00625 mg/kg	86.6	71.0	135
		EP231X: Perfluoropentanoic acid (PFPeA)	2706-90-3	0.00125 mg/kg	83.0	69.0	132
		EP231X: Perfluorohexanoic acid (PFHxA)	307-24-4	0.00125 mg/kg	78.4	70.0	132
		EP231X: Perfluoroheptanoic acid (PFHpA)	375-85-9	0.00125 mg/kg	86.8	71.0	131
		EP231X: Perfluorooctanoic acid (PFOA)	335-67-1	0.00125 mg/kg	76.5	69.0	133
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids (QCLot: 5959627)</b>							
ES2424471-013	Anonymous	EP231X: 4:2 Fluorotelomer sulfonic acid (4:2 FTS)	757124-72-4	0.00125 mg/kg	80.4	62.0	145
		EP231X: 6:2 Fluorotelomer sulfonic acid (6:2 FTS)	27619-97-2	0.00125 mg/kg	88.6	64.0	140
		EP231X: 8:2 Fluorotelomer sulfonic acid (8:2 FTS)	39108-34-4	0.00125 mg/kg	97.2	65.0	137
		EP231X: 10:2 Fluorotelomer sulfonic acid (10:2 FTS)	120226-60-0	0.00125 mg/kg	77.0	69.2	143



## QA/QC Compliance Assessment to assist with Quality Review

Work Order	: ES2424867	Page	: 1 of 5
Client	: EP RISK MANAGEMENT	Laboratory	: Environmental Division Sydney
Contact	: MR TERRY RODGERS	Telephone	: +61-2-8784 8555
Project	: EP3799	Date Samples Received	: 30-Jul-2024
Site	: East Maitland ASS	Issue Date	: 06-Aug-2024
Sampler	: Hayley Erskine	No. of samples received	: 11
Order number	: ----	No. of samples analysed	: 11

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

### Summary of Outliers

#### Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO** Method Blank value outliers occur.
- **NO** Duplicate outliers occur.
- **NO** Laboratory Control outliers occur.
- **NO** Matrix Spike outliers occur.
- For all regular sample matrices, where applicable to the methodology, **NO** surrogate recovery outliers occur.

#### Outliers : Analysis Holding Time Compliance

- **NO** Analysis Holding Time Outliers exist.

#### Outliers : Frequency of Quality Control Samples

- **NO** Quality Control Sample Frequency Outliers exist.





## Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for VOC in soils vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA003 :pH (field/fox)</b>							
<b>Snap Lock Bag - frozen (EA003)</b>							
BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	06-Aug-2024	25-Apr-2027	✓	06-Aug-2024	04-Nov-2024	✓
<b>EA033-A: Actual Acidity</b>							
<b>Snap Lock Bag - frozen (EA033)</b>							
BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	05-Aug-2024	30-Jul-2025	✓	05-Aug-2024	03-Nov-2024	✓
<b>EA033-B: Potential Acidity</b>							
<b>Snap Lock Bag - frozen (EA033)</b>							
BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	05-Aug-2024	30-Jul-2025	✓	05-Aug-2024	03-Nov-2024	✓
<b>EA033-C: Acid Neutralising Capacity</b>							
<b>Snap Lock Bag - frozen (EA033)</b>							
BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	05-Aug-2024	30-Jul-2025	✓	05-Aug-2024	03-Nov-2024	✓



Matrix: SOIL

Evaluation: \* = Holding time breach ; ✓ = Within holding time.

Method Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
<b>EA033-D: Retained Acidity</b>							
Snap Lock Bag - frozen (EA033) BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	05-Aug-2024	30-Jul-2025	✓	05-Aug-2024	03-Nov-2024	✓
<b>EA033-E: Acid Base Accounting</b>							
Snap Lock Bag - frozen (EA033) BH01_0.1, BH01_2.0, BH02_2.0, BH03_2.0, BH04_1.0, BH01_1.0, BH02_1.0, BH03_1.0, BH04_0.1, BH04_2.0	30-Jul-2024	05-Aug-2024	30-Jul-2025	✓	05-Aug-2024	03-Nov-2024	✓
<b>EA055: Moisture Content (Dried @ 105-110°C)</b>							
HDPE Soil Jar (EA055) BH03_0.1, BH04_0.1, BH03_1.0, BH04_1.0	30-Jul-2024	----	----	----	02-Aug-2024	13-Aug-2024	✓
<b>EP231A: Perfluoroalkyl Sulfonic Acids</b>							
HDPE Soil Jar (EP231X) BH03_0.1, BH04_0.1, BH03_1.0, BH04_1.0	30-Jul-2024	31-Jul-2024	26-Jan-2025	✓	01-Aug-2024	09-Sep-2024	✓
<b>EP231B: Perfluoroalkyl Carboxylic Acids</b>							
HDPE Soil Jar (EP231X) BH03_0.1, BH04_0.1, BH03_1.0, BH04_1.0	30-Jul-2024	31-Jul-2024	26-Jan-2025	✓	01-Aug-2024	09-Sep-2024	✓
<b>EP231D: (n:2) Fluorotelomer Sulfonic Acids</b>							
HDPE Soil Jar (EP231X) BH03_0.1, BH04_0.1, BH03_1.0, BH04_1.0	30-Jul-2024	31-Jul-2024	26-Jan-2025	✓	01-Aug-2024	09-Sep-2024	✓
<b>EP231P: PFAS Sums</b>							
HDPE Soil Jar (EP231X) BH03_0.1, BH04_0.1, BH03_1.0, BH04_1.0	30-Jul-2024	31-Jul-2024	26-Jan-2025	✓	01-Aug-2024	09-Sep-2024	✓



## Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: ✖ = Quality Control frequency not within specification ; ✔ = Quality Control frequency within specification.

Quality Control Sample Type	Method	Count		Rate (%)			Quality Control Specification
		QC	Regular	Actual	Expected	Evaluation	
<b>Analytical Methods</b>							
<b>Laboratory Duplicates (DUP)</b>							
Chromium Suite for Acid Sulphate Soils	EA033	2	15	13.33	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	10	10.00	10.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	6	16.67	10.00	✔	NEPM 2013 B3 & ALS QC Standard
pH field/fox	EA003	3	29	10.34	10.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Laboratory Control Samples (LCS)</b>							
Chromium Suite for Acid Sulphate Soils	EA033	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	6	16.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Method Blanks (MB)</b>							
Chromium Suite for Acid Sulphate Soils	EA033	1	15	6.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	6	16.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard
<b>Matrix Spikes (MS)</b>							
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	1	6	16.67	5.00	✔	NEPM 2013 B3 & ALS QC Standard



## Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Per- and Polyfluoroalkyl Substances (PFAS) by LCMSMS	EP231X	SOIL	In-house: Analysis of soils by solvent extraction followed by LC-Electrospray-MS-MS, Negative Mode using MRM using internal standard quantitation. Isotopically labelled analogues of target analytes used as internal standards and surrogates are added to a portion of soil which is then extracted with MTBE and an ion pairing reagent. A portion of extract is exchanged into the analytical solvent mixture, combined with an equal volume reagent water and filtered for analysis. Method procedures and data quality objectives conform to US DoD QSM 5.4, table B-15 requirements.

Preparation Methods	Method	Matrix	Method Descriptions
Drying only	EN020D	SOIL	In house
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house
QuEChERS Extraction of Solids	ORG71	SOIL	In house: Sequential extractions with Acetonitrile/Methanol by shaking. Extraction efficiency aided by the addition of salts under acidic conditions. Where relevant, interferences from co-extracted organics are removed with dispersive clean-up media (dSPE). The extract is either diluted or concentrated and exchanged into the analytical solvent.

**Mandatory Fields**

**CHAIN OF CUSTODY**

CLIENT CODE: \*PROJECT MANAGER: Terry Rodgers

\*CLIENT: EP Risk Newcastle MOBILE: 04 48087817

OFFICE: Newcastle ALS QUOTE # ES 28 EP RISK 0602 PURCHASE ORDER NO.:

PROJECT NO./PROJECT: EP379a ACCOUNTS @ ep.risk.com.au

INVOICE TO: accounts @ ep.risk.com.au

REPORTS TO: Terry Rodgers @ ep.risk.com.au

EMAIL: hayley.erskine @ ep.risk.com.au

\*STORAGE REQUIREMENTS: Standard Storage  Extended Storage

\*TURNAROUND: 5+ days (no surcharge)  3 day (+15%)  2 day (+30%)  1 day (+50%)

Comments: None

MATRIX: Soil/Solid(S) Water(W) Sediments (SD) Dust (D) Product (P) Biota (B) Biosolid (BS)

ALS Use Only Lab ID	Sample ID	Depth	Date/Time	No. Bottles	PH/PH Tox	CRS Suite EA033	PFAS Short Suite EP231	LAB OF ORIGIN: NEWCASTLE	LAB QC (Additional bottles req) Dup MS	Additional Information (Comment on hazards - e.g. asbestos, known high contamination)
	EP00 BH01-0.1	0.1	30.7.24	1	X	X	X			Please freeze
	BH01-1.0	1.0		1	X	X	X			freeze
	BH01-2.0	2.0		1	X	X	X			ASS
	BH02-1.0	1.0		1	X	X	X			boGS
	BH02-2.0	2.0		1	X	X	X			
	BH03-0.1	0.1		1	X	X	X			
	BH03-1.0	1.0		2	X	X	X			
	BH03-2.0	2.0		1	X	X	X			
	BH04-0.1	0.1		2	X	X	X			
	BH04-1.0	1.0		2	X	X	X			

Requisitioned by: Emma Signature: Date/Time: 30.07.24 17:00

Received by: Emma Signature: Date/Time: 30.07.24 16:33

Signature: Emma Date/Time: 30.07.24 16:33

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**Mandatory Fields**

**CHAIN OF CUSTODY**

CLIENT CODE: \_\_\_\_\_ PROJECT MANAGER: \_\_\_\_\_ SAMPLER: \_\_\_\_\_

\*CLIENT: \_\_\_\_\_ \*PM MOBILE: \_\_\_\_\_ PURCHASE ORDER NO.: \_\_\_\_\_

OFFICE: \_\_\_\_\_ ALS QUOTE # \_\_\_\_\_ SITE: \_\_\_\_\_

\*INVOICE TO: \_\_\_\_\_ CC Invoice to PM

\*EVAL REPORTS TO: \_\_\_\_\_ (default to PM if blank)  
When Matrix is required, specify Total (undiluted bottle required) or Discolored (diluted bottle required).  
Make an X in the boxes below analysis to indicate the parameter listed above to be tested on that sample.  
\*ANALYSIS REQUIRED


- \*STORAGE REQUIREMENTS: Please check box.
  - Standard Storage:  Standard Storage
  - Extended Storage:  Extended Storage
  - Specialty Disposal Date:  Specialty Disposal Date: \_\_\_\_\_ (Note: Extended storage incurs a fee and requires a signed agreement.)
- \*TURNAROUND: Please check box.
  - 5+ days (no surcharge):  5+ days (no surcharge)
  - 3 day (+15%):  3 day (+15%)
  - 2 day (+30%):  2 day (+30%)
  - 1 day (+50%):  1 day (+50%)

Comments: \_\_\_\_\_  
MATRIX: Soil/Solid(S) Water(W) Sediments (SD), Dust (D), Product (P), Biota (B), Biosolid (BS)

ALS Use Only Lab ID	Sample ID	Depth	Date/Time	No. Bottles	MATRIX	PH/PHa	CRS	Suite	EA	OC	Additional Information
	B404-2.0	2.0	86.7.24	1		X	X				

Relinquished by: \_\_\_\_\_ Signature: \_\_\_\_\_ Date/Time: \_\_\_\_\_  
Received by: \_\_\_\_\_ Signature: \_\_\_\_\_ Date/Time: \_\_\_\_\_

Page 2 of 2  
 Country of Origin: \_\_\_\_\_ (if not Australia)  
 BIOSECURITY



WO Sticker to go here.  
(ALS use only)

