ESSEX DEVELOP PTY LTD

Acid Sulfate Soil Assessment and Management Plan

122 Crescent Road, Newport, NSW 2106

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1. Introduction

1.1 Overview

EI Australia (EI) was engaged by Sammy Soliman (‘the client’) on behalf of Essex Develop Pty Ltd to prepare an Acid Sulfate Soil Assessment (ASSA) and Management Plan (ASSMP) for the property located at 122 Crescent Road, Newport, NSW 2106 (‘the site’).

The site is located approximately 25 km north of the Sydney central business district (CBD), within the Local Government Area (LGA) of the Northern Beaches, as shown in **Figure 1**, **Appendix A**. It is further identified as Lots 111 and 112B in Deposited Plan (DP) DP377765, covering an area of approximately 3,000m^2, and Lot 295 in DP820302 with an approximate area of 2,460m^2 as depicted in **Figure 2, Appendix A**. The site is currently occupied by Sirsi Marina, a two story commercial complex used to facilitate the Marina which includes docks, moorings and berths as well as a slip for boat maintenance.

This ASSA was prepared to aid in the management of acid sulfate soils (ASS), should these be encountered during future redevelopment works.

1.2 Proposed Development

Based on the plan of proposed Marina subdivision provided by the client (**Appendix C)**, the proposed development seeks approval for the conversion of the existing commercial forty-three (43) berth marina to a residential nine (9) berth marina, which will provide direct and private access to the future nine residential lots and maintained exclusively by the respective residential lot owner.

The proposed works will be inclusive of:

- Removal of forty-six (46) existing piles & pontoons.
- Construction of new twenty (20) piles and pontoons consisting of a modern concrete, steel and plastic engineered solution.

At this stage, the extent of any development to accommodate commercial and/or residential premises (subject to Council and Crown approval) is unknown. Should this information become available in the future, this report might require updating.

1.3 Project Objectives

The objectives of this assessment are as follows:

- Evaluate and assess the presence of ASS within the site redevelopment area.
- Provide methods and procedures to be implemented for the management of ASS, should the assessment show a potential for these materials to be encountered during the re-development works.

1.4 Scope of Works

In order to achieve the above objectives, the scope of works was as follows:

- Review of relevant topographic, geological and soil landscape maps, including the relevant ASS risk map;
- Site walkover inspection;

- Intrusive site investigation, by way of soil profiling and sampling at test boreholes HA1 and HA2 (shown in **Figure 2, Appendix A**);
- Laboratory analysis of selected soil samples for acid sulfate soil assessment parameters of pH_F, pH_{FOX} and suspension peroxide oxidation combined acidity and sulfate (sPOCAS); and
- Data interpretation and reporting

Should be deemed required, an Acid Sulfate Soils Management Plan (ASSMP) will be prepared, to provide the framework for the on-going management and monitoring of the impacts of ASSs throughout the construction and operation phases of the project in lieu of an Acid Sulfate Soil Assessment.

1.5 ASS Guidance

A general definition of ASS is provided in **Section 3**.

The following guidance documents and mapping databases were relied on and referred to during the preparation of this report:

- Sullivan L, et al (2018) *National Acid Sulfate Soils Guidance: National acid sulfate soils sampling and identification methods manual*. Department of Agriculture and Water Resources, Canberra ACT;
- ASSMAC (1998) *Acid Sulfate Soil Manual*, comprising the ASS Assessment Guidelines and the ASS Planning Guidelines;
- Naylor SD, et al (1998) *Guidelines for the Use of Acid Sulfate Soil Risk Maps* (2nd Edition); and
- Pittwater Local Environmental Plan 2014 Acid Sulfate Soils Map (Sheet ASS_017).

2. Site Description

The site identification details and associated information are presented in **Table 2-1**. Site location and layout plans are shown in **Figure 1** and **2**, **Appendix A**.

Table 2-1 Site Identification, Location and Zoning

Information	Detail
Street Address	122 Crescent Road, Newport, NSW 2106
Lot and Deposited Plan (DP)	Lots 111 and 112 in DP 556902 and Lot 295 in DP820302
Local Government Authority	Northern Beaches Council
Site Description	During the time of the site inspection, the site was in use as a Marina. Site layout included a two story commercial building facilitating the Marina including the docks and berths on the waterway.
Site Surroundings	West: Winji Jimmi Bay, followed by Pittwater (W2 Recreational Waterways) East: Crescent Road, followed by residential dwellings (C4 Environmental Living) North: residential dwellings (C4 Environmental Living) South: Residential properties (C4 Environmental Living and R2 low density residential)
Site Area	Lots 111 and 112 in DP 556902 - Approx. 3,000m^2 Lot 295 in DP820302 - Approx. 2,640m^2 Source: ePlanning Portal NSW Gov (https://www.planningportal.nsw.gov.au/)

3. Desktop Review

3.1 Acid Sulfate Soils

Acid sulfate soils are naturally occurring sediments containing iron sulphides, usually deposited in estuarine environments. As ASS comprise natural geological materials, their occurrence is not related to site boundaries or anthropogenic contamination, but rather extend across areas/regions previously suitable for their deposition.

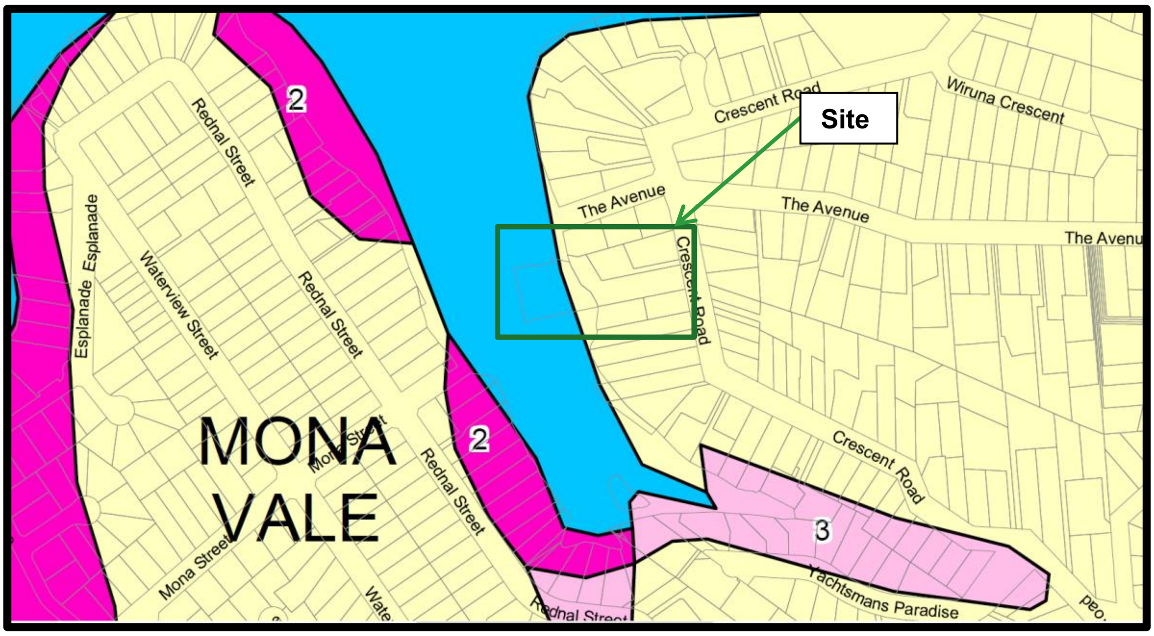
When ASS are exposed to air (e.g. due to bulk excavation or dewatering), oxygen reacts with iron sulphides in the sediment, producing sulphuric acid. This acid can sometimes be produced in large quantities and drain into waterways causing severe short and long term environmental impacts, including damage to man-made structures and natural ecosystems.

ASS can be classified as either actual acid sulphate soils (AASS), or potential acid sulfate soils (PASS). AASS are sulfidic materials that have already reacted with oxygen to produce acid. PASS are materials that contain iron sulphide, but have not been exposed to oxygen (e.g. soils below the water table) and therefore have not produced sulphuric acid (although they have the potential to do so).

3.2 Acid Sulfate Soil Risk and Planning Maps

With reference to the Pittwater Local Environmental Plan 2014 Acid Sulfate Soils Map (Sheet ASS_017), the subject land lies within states that the site is within an area described as “Class 5” with regards to the Acid Sulfate Soil (ASS) risk, consistent with the *eSPADE v2.0* portal information (**Table 3-1**). Refer to **Figure 3-1** for the risk zones of the Pittwater area, derived from *LEP 2014 Sulfate Soils Map – Sheet ASS_017*.

Figure 3-1 ASS Zones for Pittwater, adapted from LEP, 2014



Since a portion of the site (Lot 295 in DP820302) lies in a Class 1 and the remainder of the site (Lots 111 and 112 in DP 556902) lies within a *Class 5* ASS area, ASS presence can be described as “Acid sulfate soils are likely to be found within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 metres AHD and by which the water table is likely to be lowered below 1 mAHD on adjacent Class 1, 2, 3 or 4 land” as noted in the NSW Planning Portal (2022).

Given that these conditions are met for the site, ASS can be considered likely to be found within the property, under certain excavation circumstances.

3.3 Map Information

Site topography, geology and soil landscape information, derived from available maps for the region, are summarised in **Table 3-1**.

Table 3-1 Topographical, Geological, Hydrogeological and Soil Landscape Information

Attribute	Description
Existing site Topography	The site slopes to the west towards Winji Jimmi Bay. The surface elevation varies from approximately 14 mAHD near Crescent Road to 2.5 mAHD towards Winji Jimmi Bay, as detailed on the survey plan in **Appendix C** (Lockley Land Title Solutions, 2008). The existing piles & pontoons are expected to be at 0mAHD as they are installed Winji Jimmi Bay.
Geology	The site is likely to be predominantly underlain by Narrabeen Group with interbedded laminate, shale, and quartz, to lithic-quartz sandstone (Run) Ref. 1:100,000 scale Sydney Geological Series Sheet 9130 (1983).
Soil Landscapes	The Soil Conservation Service of NSW Soil Landscapes of the Sydney 1:100,000 Sheet (Chapman and Murphy, 2002) indicates that the site overlies the *Erina (erg) landscape*. This geology comprises of The Narrabeen Group consisting of lithic and quarts sandstone and siltstone, minor sedimentary breccia, claystone and conglomerate. Soils are identified as moderately deep to deep yellow and red podzolic soils with some deep yellow earths. Limitations include; erosional hazard, localised seasonal waterlogging and localised surface movement potential.
ASS Risk Map	With reference to the *Pittwater Local Environmental Plan 2014 Acid Sulfate Soil Map* (Sheet_017), the subject land lies within a Class 1 (Lot 295 in DP820302) and a Class 5 area with adjacent to Class 1, 2 and 3 areas.
Typical Soil Profile	Based on the site investigations completed onsite, the site soil profile comprises a surface layer of topsoil or Fill, overlaying silty clays, overlaying siltstone (refer to **Table 5-1** for more details).
Depth to Groundwater	Groundwater seepage was not encountered whilst drilling to a depth of 1.2 mBGL. Given the presence of Winji Jimmi Bay directly west of the site, groundwater is expected at shallow depths.
Nearest Surface Water Feature	Winji Jimmi Bay directly west of the site (site forms part of Marina in the Bay)
Groundwater Flow Direction	Inferred to follow westerly towards Winji Jimmi Bay

3.4 Geomorphic and Site Characterisation

Observations from the site inspection and via interpretation of aerial photographs (1943 imagery) archived by *NSW Government Spatial Services* (www.portal.spatial.nsw.gov.au/ www.maps.six.nsw.gov.au) were compared against the geomorphic characteristics given in Ahern *et al.* (1998) that indicate ASS occurrence. - These geomorphic features are reviewed in **Table 3-2**.

Table 3-2 Summary of Geomorphic and Site Indicators of Acid Sulfate Soils

Geomorphic Features	Presence on Site
Holocene Sediments	Not present onsite.
Natural Soils less than 5 mAHD	Present onsite. Current ground elevations slope to 2.5 mAHD. Some areas of the pontoon and boat ramp present ground elevations less than 0.0 mAHD.
Marine / estuarine sediments or tidal lakes	Present onsite. Winji Jimmi Bay, located at west of site
Coastal wetland; backwater swamps; waterlogged or scaled areas; inter-dune swales or coastal sand dunes.	Iron staining evident across site
Dominant vegetation is mangroves, reeds, rushes and other swamp or marine tolerant species	Not identified
Geologies containing sulphide bearing material	Unlikely
Deep older (Pleistocene) estuarine sediments	Unlikely

Given that a portion of the site is within a Class 1 with the reminder of the site within 500m of a Class 1 and Class 2 risk area, a field (intrusive) investigation to confirm the presence, or otherwise, of ASS was necessary prior to the commencement of the development. This requirement was consistent with the current *Pittwater Council Local Environmental Plan 2014*, as well as Schedule 3 of the NSW *Environmental Planning and Assessment Regulation 1994*.

3.5 Previous Investigations

EI is not aware of any previous investigations conducted at this site.

3.6 EI Site walkover observations

- The site is currently situated within a steep slope grading from Crescent road to Winji Jimmi Bay surrounded predominantly by low density residential properties.
- Building footings (brick) and slabs (concrete) were in moderate condition. There was evidence of corrosion, salt scalding and iron oxide (i.e. orange brown) colouration.

Figures 3-2 and 3-3 showing iron oxide discolouration identified onsite

- Paving was in moderate condition, displaying signs of corrosion and iron oxide (i.e. orange brown) colouration or staining.

Figures 3-4 and 3-5 showing iron oxide discolouration identified onsite

- Site plants included small to large trees, shrubs, groundcovers, grass and weeds. The diversity of vegetation indicated that phytotoxicity was not a concern for site soils.
- All parts of the site were found to be free of any odours resulting from ASS (e.g. no hydrogen sulphide (H_2S) odour was detected.
- No surface ponding, derived from seepage water, was observed on the site.

4. Methodology

4.1 Sampling Rationale

Sub-surface investigation involved the examination of a soil profile and representative samples from two boreholes (HA1 and HA2), shown in **Figure 2, Appendix A**.

Boreholes HA1 and HA2 were drilled by hand augering, on 15 March 2022. The extent of drilling was limited to 1.2 mBGL due to refusal on sandstone boulders during the field works.

Soil samples were collected from distinguishable soil horizons within the natural profile, or in 0.5m depth increments, as follows:

- HA1_0.5-0.6 (0.5-0.6 mBGL);
- HA1_1.0-1.1 (1.0-1.1 mBGL);
- HA2_0.4-0.5 (0.4-0.5 mBGL); and
- HA2_1.1-1.2(1.1-1.2 mBGL).

4.2 Soil Logging

Drilled soils were classified in the field with respect to lithological characteristics and evaluated on a qualitative basis for odour and visual signs of ASS. Soil classifications were based on Australian Standard AS1726:2017 *Geotechnical Site Investigations* (Standards Australia, 2017). The recorded borehole logs are presented in **Appendix D**.

4.3 Sample Handling Procedures

A stainless steel, hand trowel was used to transfer soil from the hand auger bucket into laboratory-supplied, zip lock, plastic (high density polyethylene) bags. Each bag was filled to minimise the headspace air volume, then sealed. Upon sealing, the sample was immediately stored in an insulated chest containing ice bricks, where it remained until transported to the designated NATA-accredited laboratory.

All samples were transported under refrigerated conditions to SGS Australia Pty Ltd (SGS), using strict chain-of-custody (COC) procedures. Copies of the completed COC certificate and sample receipt advice (SRA) are presented in **Appendix E**.

4.4 Laboratory Analysis

Representative samples were assigned for analysis of the parameters recommended in Section 2 *ASSs Assessment Guidelines* of Ahern *et al*. (1998) *Acid Sulfate Soil Manual*, Australian Standard AS4969:2009 *Analysis of Acid Sulfate Soil* (Standards Australia, 2009) and Section 6 *Chemical Analysis for Acidity Hazards* of Sullivan *et al*. (2018) *National Acid Sulfate Soils Guidance - National Acid Sulfate Soils Identification and Laboratory Methods Manual*, to confirm the presence/absence of ASSs:

- field pH (pH_F);
- peroxide pH (pH_{FOX}; for PASS); and
- sPOCAS suite.

All laboratory analyses were conducted on discrete (non-composite) samples using NATA-registered methods (**Appendix F**). The results are summarised in **Table B.1, Appendix B**.

4.5 Assessment Criteria

The soil analytical results were interpreted with respect to the indicators of ASS presented in:

- Ahern et al. (1998). Appendix 1 Field pH and the Peroxide Test and Table 4.4 Action criteria based on ASS soil analysis for three broad texture categories, Section 2 ASSs Assessment Guidelines of Acid Sulfate Soil Manual; and
- WA DER (2015a). Table 4 Identification and Investigation of Acid Sulfate Soils and Acidic Landscapes.

In consideration to early stages of potential future development approval processes (**Section 1.2**), it was assumed that more than 1,000 tonnes of coarse textured (sand) soils will be likely disturbed, as a conservative estimate. As such, the corresponding criteria from the sources listed above were adopted. Should development plans be confirmed in the future as not consistent with this assumption, an update to this report may be required. However, EI notes that the outcome with regards to the interpretation of the results is unlikely to be affected.

5. Results

5.1 Field Observations

A summary of the sub-surface profile is provided in **Table 5-1**. The borehole logs for HA1 and HA2 are presented in **Appendix D**.

Table 5-1 Sub-Surface Soil Profile

Material	Depth (mBGL)	Description
Topsoil /Fill	0.0 – 0.5	Sandy CLAY. Interpreted onsite to be of medium plasticity with inclusions of sands and gravels.
Residual Clay	0.2 – 1.2+	Silty CLAY. Generally assessed to be of medium to high plasticity with inclusions of siltstone gravels and cobbles grading into siltstone
Siltstone Bedrock	>1.2	Bedrock is expected at depth, but depth to bedrock was not reached during this investigation due to refusal during augering.

Fill soils were observed at depths of down to 0.5 mBGL, overlaying brown residual clays grading into siltstone. Bedrock was not identified during the drilling ranging down to a depth of 1.2 mBGL. Groundwater seepage was not observed within the natural clays during the works and as such no groundwater sample was collected during the investigation.

Visual indicators of actual acid sulfate soils (AASS) (i.e. soils containing pale yellow deposits / coatings of jarosite) were not observed. Indicators of potential acid sulfate soils (PASS) (i.e. waterlogged sediments and shell fragments) were not observed.

5.2 Laboratory Analytical Results

The laboratory analytical results, including all non-oxidised (pH_F) and oxidised (pH_{FOX}) pH testing, as well as the sPOCAS suites, are summarised in **Appendix B**, **Table B.1**. This table includes the relevant soil criteria. Refer to **Appendix F** for the corresponding laboratory analytical reports.

pH Testing

Non-oxidised (pH_F) and oxidised (pH_{FOX}) pH testing was conducted on four representative samples within the natural soil. All laboratory results for pH_F were above 4.0 (4.50 – 6.5), indicating acidic soils, however not necessarily AAS. All samples collected from 0.4 mBGL onwards reported pH difference between pH_F vs. pH_{FOX} to be <1, suggesting potential ASS.

Results for the peroxide-oxidised samples (pH_{FOX}), which involved their oxidation with 30% hydrogen peroxide prior to measurement, indicated there was low acid generating ability in the natural soil materials. All pH_{FOX} readings were above 4[1] (the ASSMAC (1998) indicative threshold of presence of PASS), suggesting that PASS is not likely to be present.

Note that various natural constituents other than sulfide (e.g. organic matter, iron and manganese minerals) are also able to react with the peroxide, leading to the generation of acid. Indeed, such constituents, especially organic matter and iron minerals, were expected to be present in the examined soils, which may have accounted for the observed pH levels (Sullivan *et al.*, 2018; ASSMAC, 1998; NSW EPA, 1995).

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[1] pH_{FOX} readings ranged from 4.0 up to 6.2.

To confirm the field based results, sPOCAS (acid trail) analysis was conducted on selected samples collected from both HA1 and HA2.

sPOCAS Analysis

The sPOCAS suite was conducted on samples HA1_1.01.1, HA2_0.4-0.5, HA2_1.1-1.2, representing the natural, clay layer.

Results for peroxide oxidisable sulfur (S_{POS}) indicate the low presence of sulphides within the clay layer with the concentration at 0.03% w/w for analysed soils between 0.4 and 0.5 mBGL and exceeding the adopted *Action Criterion* (0.03% w/w) for soils deeper than 1.0 mBGL (0.08 – 0.11% w/w).

With respect to the analysis:

- Actual, potential and sulfidic acidities were above the Action Criterion (18 moles H+/tonne) for soils deeper than 1.0 mBGL (50-67 moles H+/tonne) and below the Action Criterion for soils between 0.4 and 0.5 mBGL (17 moles H+/tonne).
- Titratable Sulfidic Acidity (TSA) results were reported below the limit of detection with the exception of HA2_1.1-1.2 which reported TSA of 7 moles H+/tonne (below the adopted criteria).
- Titratable Actual Acidity (TAA) results were reported between 20 moles H+/tonne and 60 moles H+/tonne, suggesting these sulfur-containing materials were relatively weak acid generators.

6. Conclusion

The main findings of this assessment were as follows:

- According to the corresponding ASS risk and class maps, the subject site lies within a Class 1 (Lot 295 in DP820302 – inclusive of boat ramp and pontoon) and the reminiscence of the site in a Class 5 area, which means acid sulfate soils are likely to be found within 500 metres of adjacent Class 1, 2, 3 or 4 land that is below 5 mAHD and by which the water table is likely to be lowered below 1 mAHD on adjacent Class 1, 2, 3 or 4 land.
- The site is situated on a steep slope (14 mAHD at crescent road grading down towards Winji Jimmi Bay at approximately 0.0 mAHD), likely to be underlain by the Narrabeen Group.
- The typical site soil profile comprises a layer of sandy clay filling (to maximum depth of 0.5 mBGL), overlying a silty clay layer grading into siltstone (down to 1.2 mBGL).
- Groundwater seepage was not observed during the field investigation to depths of 1.2 mBGL, however groundwater is still expected at shallow depths due to the proximity to the Winji Jimmi Bay.
- Indicators of potential ASS were not observed within site soils during the investigation, i.e. grey sediments, marine shell fragments, H_2S odour or waterlogged sediments.
- Signs of corrosion, iron oxide staining and salt scalding were present across paving and at the bases of the buildings onsite;
- Laboratory analysis of representative soil samples confirmed that natural clays collected below 1.0 mBGL recorded TPA as S% concentrations between 0.08 – 0.11% w/w and therefore marginally above the adopted action criterion of 0.03% w/w (ASSMAC, 1998).
- It was concluded that slow acting, unoxidised sulfur compounds (i.e. potential ASSs) were present in the clay sediments. These sulfur-containing materials were relatively weak acid generators, though.

Based on the findings of this assessment and with due consideration to the Statement of Limitations (**Section 8**), it was concluded that, due to the presence of potential ASS within the proposed excavation area, a corresponding ASSMP is warranted. Provisions for ASS management, which are to be adopted throughout the construction and operation phases of the development, are provided in **Section 7**.

7. ASS Management Plan

7.1 Overview

This Management Plan was prepared to assist with the handling of the material to be excavated during the redevelopment stage of works.

Based on the findings of the assessment phase, site soils present a minor risk from unoxidised sulfur compounds (i.e. from potential ASSs), which have the potential to generate acidic sulfate compounds upon oxidation. This management plan has been prepared as a contingency to mitigate these risks.

The extent of any associated adverse impacts will depend on the following factors:

- Volume of excavated soil identified as being ASS;
- Physical characteristics of the ASSs, such as grain size and natural buffering capacity;
- Time that ASSs are exposed to air; and
- Rate of oxidation and transport of the oxidation products.

Soils found within the natural layer below the water table (deeper than 1.2 mBGL) are expected to contain quantities of oxidisable sulfur compounds that may generate acidic leachate. Groundwater extraction as part of future works may require appropriate management to minimise both environmental impacts and effects that are likely to be generated if natural soils are oxidised.

All excavated materials must be either neutralised and disposed off-site to landfill, or disposed of to a waste handling facility and placed below the water table. It is recommended that all ASS be treated (limed) on-site immediately upon disturbance. No soils, ASS or otherwise, should be used for structural or general filling above the groundwater table.

The exposure time of ASS (from the excavated soils) to air is likely to be of short duration (days to weeks). The shortest possible time of air exposure is recommended, to minimise the extent of oxidation and transport of reaction products. Ideally, any stockpiled ASSs will be treated on the same day that they are excavated.

7.2 Disposal of Potential Acid Sulfate Soil

7.2.1 Process for Excavation of PASS

Excavation of ASS shall proceed in stages as follows:

- PASS materials shall be excavated to the required depth and loaded into bins. Each bin load shall be inspected and verification testing for pH shall be carried out to confirm soil pH does not fall below pH 5.0 prior to leaving the site.
- Verification testing is required to demonstrate that materials with existing acidity are not being reburied (either on-site or elsewhere). Should field pH fall below pH 5.0 the materials from that bin shall remain on-site and lime neutralisation techniques shall proceed as discussed in **Section 7.2.2**.

7.2.2 Lime Treatment and Disposal at Landfill

The total soil to be excavated during the development program is unknown at this stage so as a contingency the more conservative action criteria for more than 1000 tonnes of soil disturbed was adopted. As noted in **Section 5.2,** the natural clay below 0.4 mBGL are considered to be PASS and therefore shall be stockpiled separately within bins, and treated (limed) immediately. More specifically, the recommended management procedures are:

- Soils will be chemically assessed and waste classified for off-site disposal in accordance with the NSW EPA (2014) *Waste Classification Guidelines,* prior to excavation.
- Excavated PASS shall be loaded into bins. Lime is to be progressively added to the excavated material as it is loaded into the bins.
- On-site neutralisation of acidic soils (pH <5) will be carried out using powdered, agricultural lime.

If lime treatment on freshly excavated PASS cannot be performed immediately, plastic sheeting shall be placed over the bins to reduce oxidation. For every day a bin of material remains on-site, representative samples will be monitored for pH; where pH falls below pH 5, lime will be applied for neutralisation purposes.

Determination of Lime Requirement

In accordance with Table 4.5 of the ASSMAC (1998) *ASS Manual*, the quantity of lime required to neutralise the theoretical maximum amount of acid that could be generated from complete oxidation of the ASS is approximately 4.7 tonnes $CaCO_3$, assuming about 1,000 tonnes of soils to be excavated, with a S_{CR} concentration of 0.1% w/w.

Method of Neutralisation

In order to facilitate mixing, the soils should be thinly spread (<0.5 m thickness). Lime should be added by hand and/or excavator bucket, followed by mixing using light-weight rotators and/or shovels.

Field pH testing on representative samples should be performed to ensure that sufficient neutralisation has occurred (i.e. pH >5), prior to disposal.

7.2.3 Waste Classification and Transportation

All soils (treated or otherwise) to be removed from the site during the proposed development will require appropriate classification in accordance with the NSW EPA (2014) *Waste Classification Guidelines*. This requirement is to enable their disposal at an appropriately licensed landfill facility. It is recommended that waste classification of soils occurs prior to excavation, so as to avoid an extended holding period.

Transport of PASS material to the receiving landfill facility shall take place immediately after treatment. If this is not possible, PASS shall be covered. Stockpiled PASS materials must leave the site within 24 hours of excavation / treatment, otherwise further lime neutralisation techniques shall proceed as discussed in **Section 7.2.2**.

7.2.4 Disposal Below Water Table

In accordance with the NSW EPA (2014) *Waste Classification Guidelines: Part 4*, potential ASS may be disposed below a permanent water table, provided:

- This occurs before they have had a chance to oxidise (i.e. within 24 hours of excavation);
- They meet the definition of *virgin excavated natural material* (VENM) under the *Protection of the Environment Operations Act 1997*, even though they contain sulfidic ores or soils;
- The landfill is licensed by the NSW EPA to dispose potential ASS below the water table.

Potential ASS must be disposed within 8 hours of their receipt at the landfill and kept wet at all times until their burial at least 2 metres below the lowest historical level of the water table at the disposal site. It is understood that PASS shall be disposed below the water table at the receiving landfill facility, as required.

7.2.5 Documentation

Documentation must be provided to the occupier of the landfill for each truckload of PASS received, indicating that the soil excavation, transport and handling have been in accordance with ASSMAC (1998), thus preventing the generation of acid.

The occupier of the disposal site must also test the pH of each load of soil received immediately prior to its placement under water using the test method(s) in ASSMAC (1998) (Methods 21A and/or 21AF). These details, together with the pH of the soil recorded at the time of its extraction, must be retained by the occupier of the landfill site.

Soil that has dried out, undergone any oxidation of its sulfidic minerals, or which has a pH of less than pH 6.0 must be treated by neutralisation and disposed of at a landfill that can lawfully accept it.

The pH of the water at the landfill into which the potential ASS is placed must not be less than pH 6.0 at any time. Landfill licence conditions require the occupiers of potential ASS disposal sites to regularly monitor the pH of ground and surface waters at their premises.

7.3 Risk Management

This management plan has been based on the assumption that PASS present within the natural clay layer will be disturbed during any future excavation works. As a conservative approach, an estimate of approximately 1000 tonnes of disturbed material was assumed during this assessment. Should the actual amounts of PASS significantly differ from those in this document, management strategies may need to be revised.

During any future excavations, it is recommended that site inspections be conducted by a qualified environmental consultant/engineer, in order to supervise the works and check that the assumptions made in the report are consistent with field evidence. The qualified environmental consultant/engineer should ensure:

- Soils indicative of potential ASS materials are adequately managed; and
- Adequate testing of excavated / exposed PASS is performed, to establish liming requirements (should pH <5).

All contractors must employ best practices in managing any off-site water and soil quality impacts during site redevelopment. All waste materials must be chemically assessed and waste classified under the NSW EPA (2014) *Waste Classification Guidelines*, prior to off-site disposal to appropriate landfill facilities.

7.4 Contingency Measures

A contingency plan is detailed below in **Table 7-1**. The plan provides a list of potential events that may arise during bulk excavation and the actions to be undertaken if unexpected conditions occur.

Table 7-1 Contingency Plan

Unexpected Condition	Action
Potential ASS identified at unexpected depths	Stop excavations. Have material assess by an environmental consultant for the presence of ASS. Follow management procedures adopted in the ASSMP.
Neutralisation of ASS was not effective	Re-assess liming rates and add additional lime to material. Re-test material to check neutralisation.
Neutralisation of ASS indicates that too much lime has been added and soils are alkaline	Remediate soils before use. Remediation comprises mixing additional ASS with the material, i.e. use excess lime to neutralise more ASS. Re-test material to check neutralisation.
Bins are damaged or material falls outside the bin	Repair bin as soon as practicable. Clean-up any PASS that escaped the bin and place it back into the vessel, or truck. Check surrounding area for impact form the PASS or leachate, and undertake remedial action as required.
Groundwater level falls below the top of areas defined as containing PASS	Stop dewatering. Review PASS exposure by checking the ASS and non-ASS interface in the affected area. Determine potential causes by reviewing construction practises, weather, baseline groundwater monitoring data, and performing additional groundwater monitoring as necessary on groundwater monitoring present at the site. Review and confirm mitigation measures to be implemented, including: i. Maintain PASS soil moisture levels through targeted groundwater recharge; ii. adjusting the construction activities or schedule; and iii. Treatment of additional PASS in treatment area.

8. Statement of Limitations

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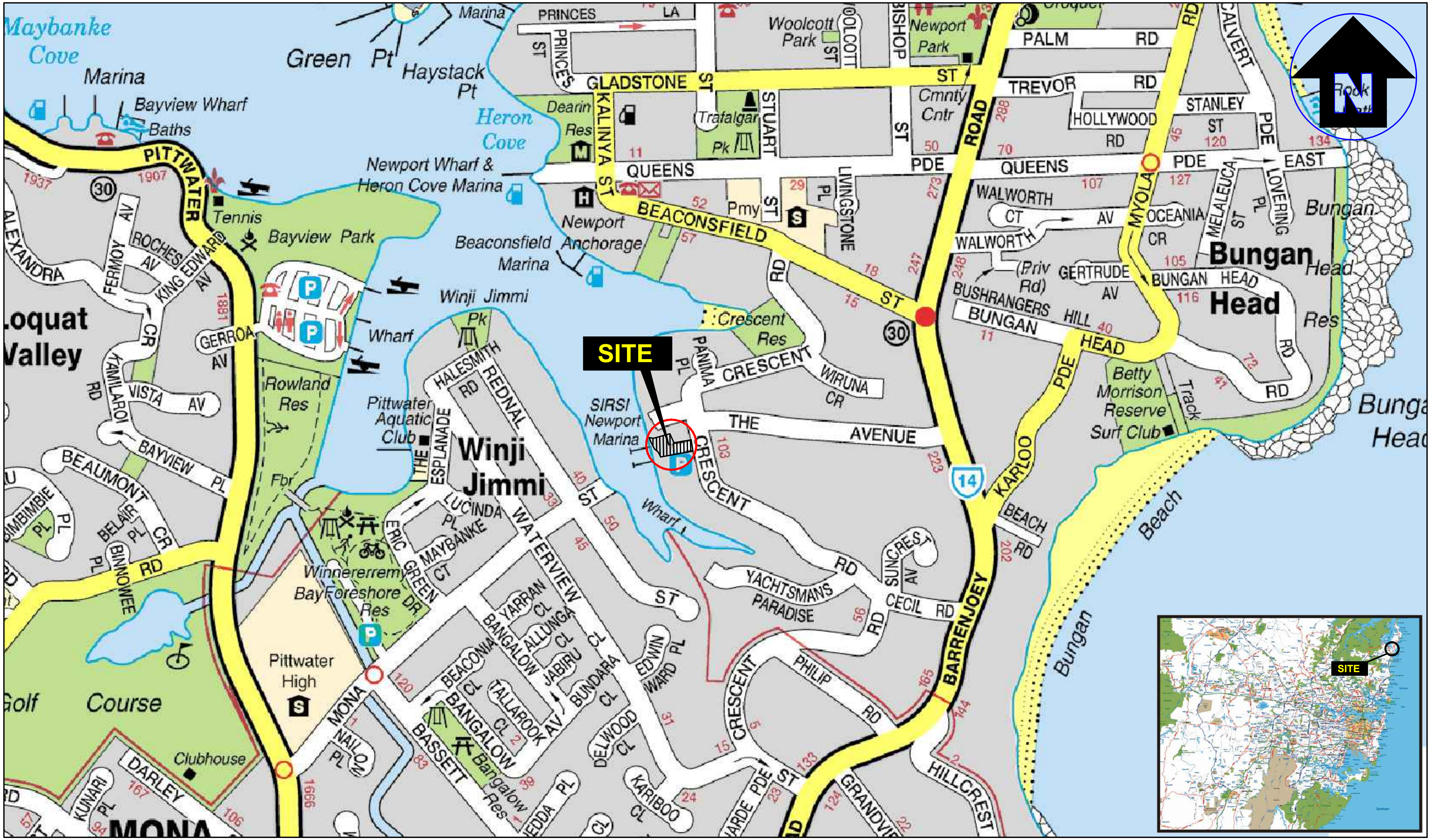
Abbreviations

AASS	Actual Acid Sulfate Soil
ASS	Acid Sulfate Soil
ASSMAC	Acid Sulfate Soil Management Advisory Committee
BEL	Bulk Excavation Level
COC	Chain of Custody
DA	Development Application
DP	Deposited Plan
EC	Electrical Conductivity
km	Kilometres
m	Metres
mAHD	metres Australian Height Datum
mBGL	metres Below Ground Level
NA	Not Analysed
NATA	National Association of Testing Authorities, Australia
NC	No Criterion
NGL	Natural Ground Level
NSW	New South Wales
NSW EPA	Environmental Protection Authority (of New South Wales)
PASS	Potential Acid Sulfate Soil
pH	Potential Hydrogen (a measure of the acidity or basicity of an aqueous solution)
PSH	Phase Separated Hydrocarbons
RL	Relative Level
S_{Cr}	Chromium Reducible Sulfur
SRA	Sample Receipt Advice (document confirming laboratory receipt of samples)
SWL	Standing Water Level
TAA	Titratable Actual Acidity
TSA	Titratable Sulfidic Acidity

Appendix A - Figures

A.1 Figure 1 - Site Location

A.2 Figure 2 - Sampling Location Plan



Verona Co. Pty Ltd
Acid Sulfate Soil Assessment
122 Crescent Road, Newport, NSW

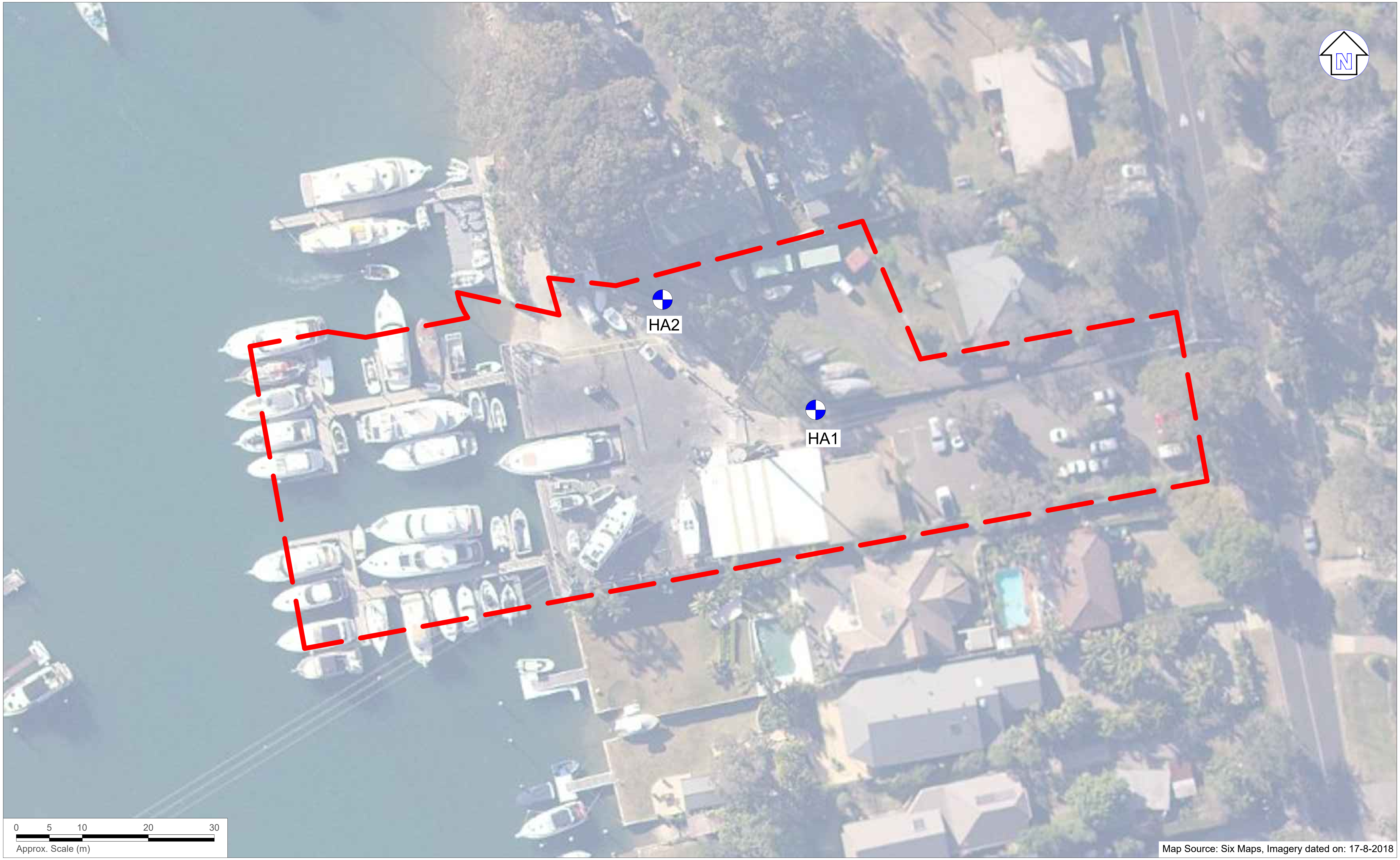
Site Locality Plan

Drawn:	A.N.
Approved:	-
Date:	25-3-22
Scale:	Not To Scale

Figure:
1

Project: E25561.E14_Rev0

eiaustralia
Practical Solutions for Built Environments
Suite 6.01, 55 Miller Street, PYRMONT 2009
Ph (02) 9516 0722 Fax (02) 9518 5088



Map Source: Six Maps, Imagery dated on: 17-8-2018

LEGEND (Note: All locations are approximate)

– – –	Site boundary
◐	Borehole location

eiaustralia
Practical Solutions for Built Environments
Suite 6.01, 55 Miller Street, PYRMONT 2009
Ph (02) 9516 0722 Fax (02) 9518 5088

Drawn:	J.M.
Approved:	-
Date:	27-10-22

Verona Co. Pty Ltd
Acid Sulfate Soil Assessment
122 Crescent Road, Newport, NSW

Sampling Location Plan

Figure:
2

Project: E25561.E14_Rev0

Appendix B – Tables

Sample ID	Sampling Date	Material	ASS (Lab) Assessment				ASS/PASS Laboratory Results						
			pH_F	pH_{FOX}	pH Difference (pH_F - pH_{FOX})	Strength of Reaction	pH KCl	TPA (moles H+/tonne)	TSA (moles H+/tonne)	TAA (moles H+/tonne)	S_{POS} **(as %S)**	Net Acidity (moles H+/tonne)	Liming Rate (kg CaCO$_3$**/t)**
Laboratory Analytical Results													
HA1_0.5-0.6	15/03/2022		6.5	6.2	0.3	1	NA	NA	NA	NA	NA	NA	NA
HA1_1.0-1.1			5.2	4.6	0.6	1	4.3	50	<5	60	0.08	76	5.7
HA2_0.4-0.5			5.1	4.5	0.6	1	4.6	17	<5	20	0.03	25	1.9
HA2_1.1-1.2			4.5	4.0	0.5	1	4.2	67	7	60	0.11	71	5.3
Statistical Analysis													
Minimum			4.50	4.0	0.3	1	4.2	17	<5	20	0.03	25	1.9
Maximum			6.5	6.2	0.6	1	4.6	67	7	60	0.11	76	5.7
SILs													
ASSMAC (1998) Action Criteria	**Action Criteria 1-1,000 tonnes disturbed (Coarse Texture - Sand)**							**≥18**	**≥18**		**≥0.03**		
	Action Criteria >1,000 tonnes disturbed (Coarse Texture - Sand)												
	Action Criteria 1-1,000 tonnes disturbed (Fine Texture - Clay)							**≥62**	**≥62**		**≥0.1**		
	Action Criteria >1,000 tonnes disturbed (Fine Texture - Clay)							**≥18**	**≥18**		**≥0.03**		
	Field pH Indicator of AASS		**≤ 4 actual ASS are present**										
			>4 - <5.5 are acidic, but limited. Not confirmatory of actual ASS										
	Field Indicator of PASS			**pHfox <3 and a strong reaction to peroxide, indicates a high level of certainty.**									
				pHFOX >3 and ≤4, less positive and SPOCAS test required to confirm									
				pHFOX >4 and ≤5, neither positive or negative, SPOCAS test required to confirm									
				pHFOX >5 and little or no drop in pH, sulfur trail in SPOCAS should be used.									
	Field Indicator of PASS				**>1 (May indicate PASS)**								

Notes:

All concentrations are recorded in mg/kg (unless otherwise stated)

🟨	Exceeding ASSMAC 1998 criteria
NT	‘Not Tested’ i.e. the sample was not analysed.
NR	No reference criteria available in current regulatory tools.

Strength of Reaction KEY:

1	Slight Reaction
2	Moderate Reaction
3	Strong / High Reaction
4	Extreme / Vigorous Reaction (gas evolution and heat generation)

PH Field Indicators (ASSMAC 1998)

pHF<=4, indicates that actual acid sulfate soil are present with sulphides being oxidised in the past resulting in acid soil (and soil pore water) conditions.

pHF values >4 and <5.5 are acid and may be the result of some previous or limited oxidation of sulfides but is not confirmatory of actual ASS.

If pHFOX is more than one pH unit below the pHF, it may indicate potential acid sulfate soils.

pHFOX <3 and a strong reaction to peroxide, indicates a high level of certainty of a potential acid sulfate soils.

pHFOX >3 and <=4 is less positive for presence of actual acid sulfate soils and laboratory analyses is need to confirm if sulphides are present.

pHFOX >4 and <=5 is neither positive or negative for presence of actual acid sulfate soils. Laboratory analyses by SPOCAS is need to confirm if oxidisable sulphides are present.

pHFOX >5 and little or no drop in pH from the field value indicates little net acid generating ability. The sulfur trail in the SPOCAS method should be used to check for absence of oxidisable sulfide

SCR – Chromium reducible sulfur

SPOS – Peroxide oxidisable sulfur

pHF – Field pH

pHFOX – Peroxide oxidised pH

pHKCL – Potassium chloride pH

TAA - Titratable actual acidity

TSA - Titratable Sulfidic Acidity

TPA - Titratable Peroxide Acidity

Appendix C – Site Plans

EASEMENTS:

(A) EASEMENT FOR TRANSMISSION LINE (G279303)

(B) RIGHT OF CARRIAGEWAY (N163213)

(C) EASEMENT TO DRAIN WATER 1.83m WIDE (T326401)

NOTES:

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Signature: Dated: 05-May-22

Surveyor Identification No: 115
Surveyor registered under the Surveying and Spatial Information Act 2002

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- DRINKING FOUNTAIN
- FIRE HYDRANT
- HYDRANT
- STOP VALVE
- WATER TAP
- WATER VALVE
- WATER METER
- DP DOWN PIPE
- CONRETE LID
- PIT LID
- METAL LID
- GRATED DRAIN
- SEWER/SEPTIC IP
- SEWER MAN HOLE
- SEWER VENT
- ELECTRICAL CABLE MARKER
- ELECTRICAL PILLAR
- ELECTRICAL PIT
- ELECTRICAL BOX
- LIGHT POLE
- POWER POLE
- OPTICAL FIBRE MARKER
- FIBRE OPTICS BOX
- COMMS PIT
- COMMS PILLAR
- GAS MARKER
- GAS VALVE
- GAS METER
- TREE
- WINDOW
- H HEAD OF WINDOW
- S SILL OF WINDOW
- PALM TREE
- BOUNDARY LINE
- BITUMEN LINE
- TOP OF BANK
- BOTTOM OF BANK
- CONCRETE LINE
- EASEMENT LINE
- FENCE LINE
- GARDEN
- PAVERS LINE
- KERB LINE
- POOL
- ROCK
- ROOF LINE
- CONCRETE
- ▨ WALL

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LOT 1 IN DP 503390
LOT 21 IN DP545339
LOTS 111&112 IN DP 556902
LOT 295 IN DP 820302

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REV	DATE	REVISION DETAILS
A	05.5.2022	CROWN LAND LICENCE AREA ADDED (No.460612)

ORIGIN LEVELS: SSM43648	RL 19.333		
AZIMUTH: MGA20	DATUM: AHD		
SURVEY: LC	DATE: 04.02.2022		
DRAWN: LC	DATE: 05.05.2022		
APPROVED: SL	DATE: 05.05.2022		
SCALE: 1:200	SHEET 1 OF 2		
DRAWING No: 11369-001-A		REV: A	SIZE: A1

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Signature: Dated: 05-May-22

Surveyor Identification No: 115
Surveyor registered under the Surveying and Spatial Information Act 2002

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	FIRE HYDRANT	⊗ ☒	PIT LID
	HYDRANT	⊗ ☒	METAL LID
	STOP VALVE		GRATED DRAIN
	WATER TAP	S	SEWER/SEPTIC IP
W	WATER VALVE		SEWER MAN HOLE
	WATER METER		SEWER VENT
● DP	DOWN PIPE		

☒	ELECTRICAL CABLE MARKER
	ELECTRICAL PILLAR
	ELECTRICAL PIT
	ELECTRICAL BOX
	LIGHT POLE
	POWER POLE
OF	OPTICAL FIBRE MARKER
FO	FIBRE OPTICS BOX
	COMMS PIT
	COMMS PILLAR

☒	GAS MARKER
G	GAS VALVE
	GAS METER
	TREE
	PALM TREE
	WINDOW
H	HEAD OF WINDOW
S	SILL OF WINDOW

BOUNDARY LINE
BITUMEN LINE
TOP OF BANK
BOTTOM OF BANK
CONCRETE LINE
EASEMENT LINE
FENCE LINE
GARDEN
PAVERS LINE
KERB LINE
POOL
ROCK
ROOF LINE

CONCRETE
▨ WALL

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TITLE: PLAN OF SITE DETAIL AND LEVELS WITH AERIAL IMAGERY DATED 10.02.2022

REV	DATE	REVISION DETAILS
A	05.5.2022	CROWN LAND LICENCE AREA ADDED (No.460612)

ORIGIN LEVELS: SSM43648		RL 19.333	
AZIMUTH: MGA20		DATUM: AHD	
SURVEY: LC		DATE: 04.02.2022	
DRAWN: LC		DATE: 05.05.2022	
APPROVED: SL		DATE: 05.05.2022	
SCALE: 1:200		SHEET 2 OF 2	
DRAWING No: 11369-001-A		REV: A	SIZE: A1

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TITLE: PLAN OF PROPOSED MARINA
SUBDIVISION
OPTION 3

REV	DATE	REVISION DETAILS
A	28.06.2022	PROPOSED LAND SUBDIVISION ADDED
B	28.06.2022	ACCESS TO PONTOONS MOVED BELOW SEA WALL

ORIGIN LEVELS: SSM43648 RL 19.333
AZIMUTH: MGA20
DATUM: AHD
SURVEY: LC
DATE: 04.02.2022
DRAWN: SL
DATE: 19.04.2022
APPROVED: SL
DATE: 19.04.2022
SCALE: 1:200
SHEET 1 OF 1
DRAWING No: 11369-003-(B)
REV: B
SIZE: A1

Appendix D – Borehole Logs

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Contamination | Remediation | Geotechnical

BOREHOLE: HA1

Project	Acid Sulfate Soil Assessment			Sheet	1 OF 1
Location	122 Crescent Road, Newport NSW			Date Started	15/3/22
Position	Refer to Figure 2				
Job No.	E25561.E14	Contractor	-	Date Completed	15/3/22
Client	Verona Co. Pty Ltd	Drill Rig	Hand Auger	Logged	AS
		Inclination	-90°	Checked	

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	-	GWNE	0.0				▨	-	FILL: Sandy CLAY; medium plasticity, dark brown, with fine to medium grained sand, with fine to medium grained, subangular shale gravels, with rootlets, no odour.	M	-	FILL
			0.5	*0.50*	HA1_0.5-0.6	■	▤	CI-CH	Silty CLAY: Medium to high plasticity, pale brown, with coarse grained, subrounded to subangular siltstone gravels, with siltstone cobbles, no odour.			NATURAL
				0.90			▤		From 0.90 m, colour change to orange mottled pale brown.			
			1.0	*1.10*	HA1_1.0-1.1	■	▤					
			1.5						Hole Terminated at 1.10 mBGL; Refusal on Siltstone Cobble.			
			2.0									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

BOREHOLE: HA2

Project	Acid Sulfate Soil Assessment	Sheet	1 OF 1
Location	122 Crescent Road, Newport NSW	Date Started	15/3/22
Position	Refer to Figure 2	Date Completed	15/3/22
Job No.	E25561.E14	Contractor	-
Client	Verona Co. Pty Ltd	Drill Rig	Hand Auger
		Inclination	-90°
		Logged	AS
		Checked	

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS SYMBOL	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
HA	-	GWNE	0.0					-	FILL: Sandy CLAY; medium plasticity, dark brown, with fine to medium grained sand, with fine to medium grained, subangular shale gravels, with rootlets, no odour.	M	-	FILL
				0.20				CI-CH	Silty CLAY: Medium to high plasticity, pale brown, with coarse grained, subrounded to subangular siltstone gravels, no odour.			NATURAL
			0.5		HA2_0.4-0.5	■						
				0.60					From 0.60 m, colour change to red mottled pale grey.	D - M		
			1.0									
				1.20	HA2_1.1-1.2	■			Hole Terminated at 1.20 mBGL; Refusal on Siltstone Cobble.			
			1.5									
			2.0									

This borehole log should be read in conjunction with EI Australia's accompanying standard notes.

Appendix E – Chain of Custody and Sample Receipt Forms

Sheet 1 of 1

Site: 122 Crescent Rd, Newport

Project No: E25561

Laboratory:

SGS Australia
Unit 16, 33 Maddox Street,
ALEXANDRIA NSW 2015
P: 02 8594 0400 F: 02 8594 0499

Sample ID	Laboratory ID	Container Type	Sampling Date	Sampling Time	Sample Matrix: SOIL	WATER	0.45 µm field filtered	OTHER	Analysis: HM^A /TRH/BTEX/PAHs OCP/OP/PCB/Asbestos	HM^A /TRH/BTEX/PAHs	HM^A /TRH/BTEX	BTEX	VOCs	Asbestos	Asbestos Quantification	Excavated Natural Material (ENM) Suite	ENM Suite - Stockpile discrete (TRH/BTEX/PAHs)	ENM Suite - Stockpile composite (HM^A /pH / EC / Foreign Materials)	Dewatering Suite	pH / pH peroxide	sPOCAS	Chromium Reducible Sulfur (CrS)	PFAS	pH / CEC (cation exchange)	pH / EC (electrical conductivity)	Sulphate / Chloride	Lead	TCLP HM^B / PAH
HA1_0.5-0.6	1	ZLB	15/3/22	am	X															X								
_1.0-1.1	2	↓	↓	↓	↓															↓								
HA2_0.4-0.5	3																											
_1.1-1.2	4																											

Comments

HM A
Arsenic
Cadmium
Chromium
Copper
Lead
Mercury
Nickel
Zinc

HM B
Arsenic
Cadmium
Chromium
Lead
Mercury
Nickel

Dewatering Suite
pH & EC
TDS / TDU
Hardness
Total Cyanide
Metals (Al, As, Cd, Cr, Cu, Pb, Hg, Ni, Zn)
TRH (F1, F2, F3, F4)
BTEX
PAH
Total Phenol

LABORATORY TURNAROUND

☒ Standard
☐ 24 Hours
☐ 48 Hours
☐ 72 Hours
☐ Other______

Container Type:
J = solvent washed, acid rinsed, Teflon sealed glass jar
S = solvent washed, acid rinsed glass bottle
P = natural HDPE plastic bottle
VC = glass vial, Teflon Septum
ZLB = Zip-Lock Bag BB = Bulk Bag

Investigator: I attest that these samples were collected in accordance with standard EI field sampling procedures.

	Sampler's Name (EI):	Received by (SGS):
Print	Andrew Schmidt	
Signature	A.Schmidt	
Date	15/3/22	15/3 @ 1:30

IMPORTANT:
Please e-mail laboratory results to: lab@eiaustralia.com.au

Report with EI Waste Classification Table ☐

Sampler's Comments:
cc: Sergio.Raposeira

SGS EHS Sydney COC
SE229931

eiaustralia
Contamination | Remediation | Geotechnical

Suite 6.01, 55 Miller Street,
PYRMONT NSW 2009
Ph: 9516 0722
lab@eiaustralia.com.au

COC June 2021 FORM v 5 - SGS

SAMPLE RECEIPT ADVICE

SE229931

CLIENT DETAILS

Contact	Andrew Schmidt
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	andrew.schmidt@eiaustralia.com.au
Project	**E25561 122 Crescent Rd, Newport**
Order Number	**E25561**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Tue 15/3/2022
Report Due	Tue 22/3/2022
SGS Reference	**SE229931**

SUBMISSION DETAILS

This is to confirm that 4 samples were received on Tuesday 15/3/2022. Results are expected to be ready by COB Tuesday 22/3/2022. Please quote SGS reference SE229931 when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	4 Soil
Date documentation received	15/3/2022	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	6°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

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SAMPLE RECEIPT ADVICE

SE229931

CLIENT DETAILS

Client EI AUSTRALIA

Project E25561 122 Crescent Rd, Newport

SUMMARY OF ANALYSIS

No.	Sample ID	Field pH for Acid Sulphate Soil
001	HA1_0.5-0.6	4
002	HA1_1.0-1.1	4
003	HA2_0.4-0.5	4
004	HA2_1.1-1.2	4

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

AU.SampleReceipt.Sydney (Sydney)

From:	Sergio Raposeira - EIAustralia <sergio.raposeira@eiaustralia.com.au>
Sent:	Tuesday, 22 March 2022 9:14 AM
To:	AU.SampleReceipt.Sydney (Sydney); Andrew Schmidt - EIAustralia; Laboratory Results - EIAustralia
Subject:	[EXTERNAL] RE: SGS Sample Receipt Advice (Ref: E25561 122 Crescent Rd, Newport, Lab Ref: SE229931)

*** WARNING: this message is from an EXTERNAL SENDER. Please be cautious, particularly with links and attachments. ***

Good morning SGS,

Is it possible to test the samples below for SPOCAs:

- HA1_1.0-1.1;
- HA2_0.4-0.5; and
- HA2_1.1-1.2

Standard TAT please

Best Regards

Sergio Raposeira
BSc (Env), MSc
Environmental Engineer
T 02 9516 0722 M 04 2032 1984
E sergio.raposeira@eiaustralia.com.au
Suite 6.01, 55 Miller Street
Pyrmont, NSW 2009
www.eiaustralia.com.au

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Please consider the environment before printing this email.

From: AU.Samplereceipt.Sydney@SGS.com [mailto:AU.Samplereceipt.Sydney@SGS.com]
Sent: Tuesday, 15 March 2022 4:46 PM
To: Andrew Schmidt - EIAustralia; Laboratory Results - EIAustralia; Sergio Raposeira - EIAustralia
Subject: SGS Sample Receipt Advice (Ref: E25561 122 Crescent Rd, Newport, Lab Ref: SE229931)

Dear Andrew Schmidt,

Please be advised we have received samples for analysis as detailed in the attached documentation.

Covid-19 update: SGS Australia is open, with our Business Service Continuity Plans being put in place to ensure your project can be delivered as normal, please see the following links further details:

SAMPLE RECEIPT ADVICE

SE229931A

CLIENT DETAILS

Contact	Andrew Schmidt
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	andrew.schmidt@eiaustralia.com.au
Project	**E25561 122 Crescent Rd, Newport**
Order Number	**E25561**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
Samples Received	Tue 22/3/2022
Report Due	Tue 29/3/2022
SGS Reference	**SE229931A**

SUBMISSION DETAILS

This is to confirm that 4 samples were received on Tuesday 22/3/2022. Results are expected to be ready by COB Tuesday 29/3/2022. Please quote SGS reference SE229931A when making enquiries. Refer below for details relating to sample integrity upon receipt.

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	3 Soil
Date documentation received	22/3/2022@9:14am	Type of documentation received	Email
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	6°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

Unless otherwise instructed, water and bulk samples will be held for one month from date of report, and soil samples will be held for two months.

COMMENTS

SPOCAS subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146.

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SAMPLE RECEIPT ADVICE

SE229931A

CLIENT DETAILS

Client EI AUSTRALIA

Project E25561 122 Crescent Rd, Newport

SUMMARY OF ANALYSIS

No.	Sample ID	Moisture Content	SPOCAS Net Acidity Calculations	TAA (Titratable Actual Acidity)	TPA (Titratable Peroxide Acidity)
002	HA1_1.0-1.1	1	6	7	21
003	HA2_0.4-0.5	1	6	7	21
004	HA2_1.1-1.2	1	6	7	21

The above table represents SGS' interpretation of the client-supplied Chain Of Custody document.
The numbers shown in the table indicate the number of results requested in each package.
Please indicate as soon as possible should your request differ from these details .
Testing as per this table shall commence immediately unless the client intervenes with a correction .

Appendix F – Laboratory Analytical Reports

ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Andrew Schmidt
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	andrew.schmidt@eiaustralia.com.au
Project	**E25561 122 Crescent Rd, Newport**
Order Number	**E25561**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE229931 R0**
Date Received	15/3/2022
Date Reported	22/3/2022

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SIGNATORIES

Shane

Shane MCDERMOTT
Inorganic/Metals Chemist

Field pH for Acid Sulphate Soil [AN104] Tested: 21/3/2022

PARAMETER	UOM	LOR	HA1_0.5-0.6 SOIL - 15/3/2022 SE229931.001	HA1_1.0-1.1 SOIL - 15/3/2022 SE229931.002	HA2_0.4-0.5 SOIL - 15/3/2022 SE229931.003	HA2_1.1-1.2 SOIL - 15/3/2022 SE229931.004
pHf	pH Units	-	6.5	5.2	5.1	4.5
pHfox	pH Units	-	6.2	4.6	4.5	4.0
Reaction Rate (pHfox)*	No unit	-	1	1	1	1
pH Difference*	pH Units	-10	0.3	0.6	0.5	0.5

METHOD	METHODOLOGY SUMMARY
AN104	pHF is determined on an extract of approximately 2g of as received sample in approximately 10 mL of deionised water with pH determined after standing 30 minutes.
AN104	pHFox is determined on an extract of approximately 2g of as received sample with a few mLs of 30% hydrogen peroxide (adjusted to pH 4.5 to 5.5) with the extract reaction being rated from slight to extreme, with pH determined after reaction is complete and extract has cooled. Referenced to ASS Laboratory Methods Guidelines, method 23Af-Bf, 2004. 0 No Reaction 1 Slight Reaction 2 Moderate Reaction 3 Strong/High Reaction 4 Extreme/Vigorous Reaction (gas evolution and heat generation)

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
**	Indicative data, theoretical holding time exceeded.	NVL	Not validated.	LOR	Limit of Reporting.
***	Indicates that both * and ** apply.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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STATEMENT OF QA/QC PERFORMANCE

SE229931 R0

CLIENT DETAILS

Contact	Andrew Schmidt
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	andrew.schmidt@eiaustralia.com.au
Project	**E25561 122 Crescent Rd, Newport**
Order Number	**E25561**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE229931 R0**
Date Received	15 Mar 2022
Date Reported	22 Mar 2022

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met (within the SGS Alexandria Environmental laboratory).

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	4 Soil
Date documentation received	15/3/2022	Type of documentation received	COC
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	6°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

HOLDING TIME SUMMARY

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

Field pH for Acid Sulphate Soil

Method: ME-(AU)-[ENV]AN104

Sample Name	Sample No.	QC Ref	Sampled	Received	Extraction Due	Extracted	Analysis Due	Analysed
HA1_0.5-0.6	SE229931.001	LB244942	15 Mar 2022	15 Mar 2022	12 Apr 2022	21 Mar 2022	12 Apr 2022	21 Mar 2022
HA1_1.0-1.1	SE229931.002	LB244942	15 Mar 2022	15 Mar 2022	12 Apr 2022	21 Mar 2022	12 Apr 2022	21 Mar 2022
HA2_0.4-0.5	SE229931.003	LB244942	15 Mar 2022	15 Mar 2022	12 Apr 2022	21 Mar 2022	12 Apr 2022	21 Mar 2022
HA2_1.1-1.2	SE229931.004	LB244942	15 Mar 2022	15 Mar 2022	12 Apr 2022	21 Mar 2022	12 Apr 2022	21 Mar 2022

SURROGATES

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

METHOD BLANKS

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

No method blanks were required for this job.

DUPLICATES

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

Field pH for Acid Sulphate Soil

Method: ME-(AU)-[ENV]AN104

Original	Duplicate	Parameter	Units	LOR	Original	Duplicate	Criteria %	RPD %
SE229931.004	LB244942.006	pHf	pH Units	-	4.5	4.3	30	4
		pHfox	pH Units	-	4.0	4.2	30	3

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

Sample Number	Parameter	Units	LOR

MATRIX SPIKES

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub-sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.

MATRIX SPIKE DUPLICATES

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the

No matrix spike duplicates were required for this job.

FOOTNOTES

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here: https://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
***	Indicates that both * and ** apply.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.
①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

Contact	Andrew Schmidt
Client	EI AUSTRALIA
Address	SUITE 6.01 55 MILLER STREET PYRMONT NSW 2009
Telephone	61 2 95160722
Facsimile	(Not specified)
Email	andrew.schmidt@eiaustralia.com.au
Project	**E25561 122 Crescent Rd, Newport**
Order Number	**E25561**
Samples	4

LABORATORY DETAILS

Manager	Huong Crawford
Laboratory	SGS Alexandria Environmental
Address	Unit 16, 33 Maddox St Alexandria NSW 2015
Telephone	+61 2 8594 0400
Facsimile	+61 2 8594 0499
Email	au.environmental.sydney@sgs.com
SGS Reference	**SE229931A R0**
Date Received	22/3/2022
Date Reported	28/3/2022

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(4354).

SPOCAS subcontracted to SGS Cairns, 2/58 Comport St, Portsmith QLD 4870, NATA Accreditation Number: 2562, Site Number: 3146. Report No. CE158296

SIGNATORIES

Moisture Content [AN002] Tested: 28/3/2022

PARAMETER	UOM	LOR	HA1_1.0-1.1 SOIL - 15/3/2022 SE229931A.002	HA2_0.4-0.5 SOIL - 15/3/2022 SE229931A.003	HA2_1.1-1.2 SOIL - 15/3/2022 SE229931A.004
% Moisture	%w/w	0.5	19	16	12

TAA (Titratable Actual Acidity) [AN219] Tested: 28/3/2022

PARAMETER	UOM	LOR	HA1_1.0-1.1 SOIL - 15/3/2022 SE229931A.002	HA2_0.4-0.5 SOIL - 15/3/2022 SE229931A.003	HA2_1.1-1.2 SOIL - 15/3/2022 SE229931A.004
pH KCl*	pH Units	-	4.3	4.6	4.2
Titratable Actual Acidity	kg H2SO4/T	0.25	2.9	0.98	2.9
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	60	20	60
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	0.10	0.03	0.10
Sulphur (SKCl)	%w/w	0.005	0.019	0.006	0.015
Calcium (CaKCl)	%w/w	0.005	0.10	0.11	0.011
Magnesium (MgKCl)	%w/w	0.005	0.016	0.014	0.012

TPA (Titratable Peroxide Acidity) [AN218] Tested: 28/3/2022

			HA1_1.0-1.1	HA2_0.4-0.5	HA2_1.1-1.2
			SOIL	SOIL	SOIL
			-	-	-
			15/3/2022	15/3/2022	15/3/2022
PARAMETER	**UOM**	**LOR**	**SE229931A.002**	**SE229931A.003**	**SE229931A.004**
Peroxide pH (pH Ox)	pH Units	-	4.3	4.9	4.4
TPA as kg H_2SO_4/tonne	kg H2SO4/T	0.25	2.5	0.86	3.3
TPA as moles H+/tonne	moles H+/T	5	50	17	67
TPA as S % W/W	%w/w S	0.01	0.08	0.03	0.11
Titratable Sulfidic Acidity as moles H+/tonne	moles H+/T	5	<5	<5	7
Titratable Sulfidic Acidity as kg H_2SO_4/tonne	kg H2SO4/T	0.25	<0.25	<0.25	0.37
Titratable Sulfidic Acidity as S % W/W	%w/w S	0.01	<0.01	<0.01	0.01
ANCE as % $CaCO_3$	% CaCO3	0.01	<0.01	<0.01	<0.01
ANCE as moles H+/tonne	moles H+/T	5	<5	<5	<5
ANCE as S % W/W	%w/w S	0.01	<0.01	<0.01	<0.01
Peroxide Oxidisable Sulphur (Spos)*	%w/w	0.005	0.016	0.008	0.017
Peroxide Oxidisable Sulphur as moles H+/tonne*	moles H+/T	5	10	<5	11
Sulphur (Sp)	%w/w	0.005	0.035	0.014	0.032
Calcium (Cap)	%w/w	0.005	0.11	0.12	0.016
Reacted Calcium (CaA)*	%w/w	0.005	0.010	0.008	<0.005
Reacted Calcium (CaA)*	moles H+/T	5	5	<5	<5
Magnesium (Mgp)	%w/w	0.005	0.022	0.020	0.018
Reacted Magnesium (MgA)*	%w/w	0.005	0.006	0.006	0.006
Reacted Magnesium (MgA)*	moles H+/T	5	<5	<5	<5
Net Acid Soluble Sulphur as % w/w*	%w/w	0.005	0.014	-	-
Net Acid Soluble Sulphur as moles H+/tonne*	moles H+/T	5	9	-	-

SPOCAS Net Acidity Calculations [AN220] Tested: 28/3/2022

			HA1_1.0-1.1 SOIL - 15/3/2022	HA2_0.4-0.5 SOIL - 15/3/2022	HA2_1.1-1.2 SOIL - 15/3/2022
PARAMETER	UOM	LOR	SE229931A.002	SE229931A.003	SE229931A.004
s-Net Acidity	%w/w S	0.005	0.12	0.040	0.11
a-Net Acidity	moles H+/T	5	76	25	71
Liming Rate*	kg CaCO3/T	0.1	5.7	1.9	5.3
Verification s-Net Acidity*	%w/w S	-20	0.01	0.00	0.01
a-Net Acidity without ANCE*	moles H+/T	5	76	25	71
Liming Rate without ANCE*	kg CaCO3/T	0.1	5.7	1.9	5.3

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN218	Soil samples are subjected to extreme oxidising conditions using hydrogen peroxide. Continuous application of heat and peroxide ensure all sulfide is converted to sulfuric acid. Excess peroxide is broken down by a copper catalyst prior to titration for acidity. Calcium, magnesium, and sulfur are determined by ICP-OES. Also included is a carbonate modification step which, depending on pH after the initial oxidation, gives a measure of ANC.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.
AN220	SPOCAS Suite: Scheme for the calculation of net acidities and liming rates using a Fineness Factor of 1.5.

FOOTNOTES

*	NATA accreditation does not cover the performance of this service.	-	Not analysed.	UOM	Unit of Measure.
		NVL	Not validated.	LOR	Limit of Reporting.
**	Indicative data, theoretical holding time exceeded.	IS	Insufficient sample for analysis.	↑↓	Raised/lowered Limit of Reporting.
		LNR	Sample listed, but not received.		
***	Indicates that both * and ** apply.				

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calculated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:
a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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STATEMENT OF QA/QC PERFORMANCE

SE229931A R0

CLIENT DETAILS

Contact	Andrew Schmidt	Manager	Huong Crawford
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Project	**E25561 122 Crescent Rd, Newport**	SGS Reference	**SE229931A R0**
Order Number	**E25561**	Date Received	22 Mar 2022
Samples	4	Date Reported	28 Mar 2022

LABORATORY DETAILS

COMMENTS

All the laboratory data for each environmental matrix was compared to SGS' stated Data Quality Objectives (DQO). Comments arising from the comparison were made and are reported below.

The data relating to sampling was taken from the Chain of Custody document.
This QA/QC Statement must be read in conjunction with the referenced Analytical Report.
The Statement and the Analytical Report must not be reproduced except in full.

All Data Quality Objectives were met (within the SGS Alexandria Environmental laboratory).

SAMPLE SUMMARY

Samples clearly labelled	Yes	Complete documentation received	Yes
Sample container provider	Client	Sample cooling method	Ice Bricks
Samples received in correct containers	Yes	Sample counts by matrix	3 Soil
Date documentation received	22/3/2022@9:14am	Type of documentation received	Email
Samples received in good order	Yes	Samples received without headspace	N/A
Sample temperature upon receipt	6°C	Sufficient sample for analysis	Yes
Turnaround time requested	Standard		

HOLDING TIME SUMMARY

SGS holding time criteria are drawn from current regulations and are highly dependent on sample container preservation as specified in the SGS "Field Sampling Guide for Containers and Holding Time" (ref: GU-(AU)-ENV.001). Soil samples guidelines are derived from NEPM "Schedule B(3) Guideline on Laboratory Analysis of Potentially Contaminated Soils". Water sample guidelines are derived from "AS/NZS 5667.1 : 1998 Water Quality - sampling part 1" and APHA "Standard Methods for the Examination of Water and Wastewater" 21st edition 2005.

Extraction and analysis holding time due dates listed are calculated from the date sampled, although holding times may be extended after laboratory extraction for some analytes. The due dates are the suggested dates that samples may be held before extraction or analysis and still be considered valid.

Extraction and analysis dates are shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria. If the

No holding time data is available for this job.

Surrogate results are evaluated against upper and lower limit criteria established in the SGS QA/QC plan (Ref: MP-(AU)-[ENV]QU-022). At least two of three routine level soil sample surrogate spike recoveries for BTEX/VOC are to be within 70-130% where control charts have not been developed and within the established control limits for charted surrogates. Matrix effects may void this as an acceptance criterion. Water sample surrogate spike recoveries are to be within 40-130%. The presence of emulsions, surfactants and particulates may void this as an acceptance criterion.

Result is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No surrogates were required for this job.

METHOD BLANKS

Blank results are evaluated against the limit of reporting (LOR), for the chosen method and its associated instrumentation, typically 2.5 times the statistically determined method detection limit (MDL).

Result is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

No method blanks were required for this job.

DUPLICATES

Duplicates are calculated as Relative Percentage Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

NOTE: The RPD reported is calculated from the unrounded data for the original and replicate result. Manual calculation of the RPD from the rounded data reported may

No duplicates were required for this job.

LABORATORY CONTROL SAMPLES

Laboratory Control Standard (LCS) results are evaluated against an expected result, typically the concentration of analyte spiked into the control during the sample preparation stage, producing a percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA /QC plan (Ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended dagger symbol (†) when outside suggested criteria.

No laboratory control standards were required for this job.

MATRIX SPIKES

Matrix Spike (MS) results are evaluated as the percentage recovery of an expected result, typically the concentration of analyte spiked into a field sub-sample during the sample preparation stage. The original sample's result is subtracted from the sub-sample result before determining the percentage recovery. The criteria applied to the percentage recovery is established in the SGS QA/QC plan (ref: MP-(AU)-[ENV]QU-022). For more information refer to the footnotes in the concluding page of this report.

Recovery is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the end of this report for failure reasons.

No matrix spikes were required for this job.

MATRIX SPIKE DUPLICATES

Matrix spike duplicates are calculated as Relative Percent Difference (RPD) using the formula: RPD = | OriginalResult - ReplicateResult | x 100 / Mean

The original result is the analyte concentration of the matrix spike. The Duplicate result is the analyte concentration of the matrix spike duplicate.

The RPD is evaluated against the Maximum Allowable Difference (MAD) criteria and can be graphically represented by a curve calculated from the Statistical Detection Limit (SDL) and Limiting Repeatability (LR) using the formula: MAD = 100 x SDL / Mean + LR

Where the Maximum Allowable Difference evaluates to a number larger than 200 it is displayed as 200.

RPD is shown in **Green** when within suggested criteria or **Red** with an appended reason identifer when outside suggested criteria. Refer to the footnotes section at the

No matrix spike duplicates were required for this job.

FOOTNOTES

Samples analysed as received.

Solid samples expressed on a dry weight basis.

QC criteria are subject to internal review according to the SGS QA/QC plan and may be provided on request or alternatively can be found here: https://www.sgs.com.au/~/media/Local/Australia/Documents/Technical Documents/MP-AU-ENV-QU-022 QA QC Plan.pdf

*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
***	Indicates that both * and ** apply.
-	Sample not analysed for this analyte.
IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
LOR	Limit of reporting.
QFH	QC result is above the upper tolerance.
QFL	QC result is below the lower tolerance.
①	At least 2 of 3 surrogates are within acceptance criteria.
②	RPD failed acceptance criteria due to sample heterogeneity.
③	Results less than 5 times LOR preclude acceptance criteria for RPD.
④	Recovery failed acceptance criteria due to matrix interference.
⑤	Recovery failed acceptance criteria due to the presence of significant concentration of analyte (i.e. the concentration of analyte exceeds the spike level).
⑥	LOR was raised due to sample matrix interference.
⑦	LOR was raised due to dilution of significantly high concentration of analyte in sample.
⑧	Reanalysis of sample in duplicate confirmed sample heterogeneity and inconsistency of results.
⑨	Recovery failed acceptance criteria due to sample heterogeneity.
⑩	LOR was raised due to high conductivity of the sample (required dilution).
†	Refer to relevant report comments for further information.

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ANALYTICAL REPORT

Accreditation No. 2562

CLIENT DETAILS

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Project	**E25561 122 Crescent Rd, Newport**
Order Number	**SE229931A**
Samples	4

LABORATORY DETAILS

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SGS Reference	**CE158296 R0**
Date Received	23 Mar 2022
Date Reported	28 Mar 2022

COMMENTS

Accredited for compliance with ISO/IEC 17025 - Testing. NATA accredited laboratory 2562(3146/19038)

SIGNATORIES

Anthony NILSSON
Operations Manager

Jon DICKER
Manager Northern QLD

Parameter	Units	LOR	Sample Number Sample Matrix Sample Date Sample Name: CE158296.001 Soil 15 Mar 2022 SE229931A.001	CE158296.002 Soil 15 Mar 2022 SE229931A.002	CE158296.003 Soil 15 Mar 2022 SE229931A.003	CE158296.004 Soil 15 Mar 2022 SE229931A.004

Moisture Content Method: AN002 Tested: 24/3/2022

Parameter	Units	LOR	CE158296.001	CE158296.002	CE158296.003	CE158296.004
% Moisture	%w/w	0.5	-	19	16	12

TAA (Titratable Actual Acidity) Method: AN219 Tested: 25/3/2022

Parameter	Units	LOR	CE158296.001	CE158296.002	CE158296.003	CE158296.004
pH KCl	pH Units	-	-	4.3	4.6	4.2
Titratable Actual Acidity	kg H2SO4/T	0.25	-	2.9	0.98	2.9
Titratable Actual Acidity (TAA) moles H+/tonne	moles H+/T	5	-	60	20	60
Titratable Actual Acidity (TAA) S%w/w	%w/w S	0.01	-	0.10	0.03	0.10
Sulphur (SKCl)	%w/w	0.005	-	0.019	0.006	0.015
Calcium (CaKCl)	%w/w	0.005	-	0.10	0.11	0.011
Magnesium (MgKCl)	%w/w	0.005	-	0.016	0.014	0.012

TPA (Titratable Peroxide Acidity) Method: AN218 Tested: 25/3/2022

Parameter	Units	LOR	CE158296.001	CE158296.002	CE158296.003	CE158296.004
Peroxide pH (pH Ox)	pH Units	-	-	4.3	4.9	4.4
TPA as kg H_2SO_4/tonne	kg H2SO4/T	0.25	-	2.5	0.86	3.3
TPA as moles H+/tonne	moles H+/T	5	-	50	17	67
TPA as S % W/W	%w/w S	0.01	-	0.08	0.03	0.11
Titratable Sulfidic Acidity as moles H+/tonne	moles H+/T	5	-	<5	<5	7
Titratable Sulfidic Acidity as kg H_2SO_4/tonne	kg H2SO4/T	0.25	-	<0.25	<0.25	0.37
Titratable Sulfidic Acidity as S % W/W	%w/w S	0.01	-	<0.01	<0.01	0.01
ANCE as % $CaCO_3$	% CaCO3	0.01	-	<0.01	<0.01	<0.01
ANCE as moles H+/tonne	moles H+/T	5	-	<5	<5	<5
ANCE as S % W/W	%w/w S	0.01	-	<0.01	<0.01	<0.01
Peroxide Oxidisable Sulphur (Spos)	%w/w	0.005	-	0.016	0.008	0.017
Peroxide Oxidisable Sulphur as moles H+/tonne	moles H+/T	5	-	10	<5	11
Sulphur (Sp)	%w/w	0.005	-	0.035	0.014	0.032
Calcium (Cap)	%w/w	0.005	-	0.11	0.12	0.016
Reacted Calcium (CaA)	%w/w	0.005	-	0.010	0.008	<0.005
Reacted Calcium (CaA)	moles H+/T	5	-	5	<5	<5
Magnesium (Mgp)	%w/w	0.005	-	0.022	0.020	0.018
Reacted Magnesium (MgA)	%w/w	0.005	-	0.006	0.006	0.006
Reacted Magnesium (MgA)	moles H+/T	5	-	<5	<5	<5
Net Acid Soluble Sulphur as % w/w	%w/w	0.005	-	0.014	-	-
Net Acid Soluble Sulphur as moles H+/tonne	moles H+/T	5	-	9	-	-

SPOCAS Net Acidity Calculations Method: AN220 Tested: 28/3/2022

Parameter	Units	LOR	CE158296.001	CE158296.002	CE158296.003	CE158296.004
s-Net Acidity	%w/w S	0.005	-	0.12	0.040	0.11
a-Net Acidity	moles H+/T	5	-	76	25	71
Liming Rate	kg CaCO3/T	0.1	-	5.7	1.9	5.3
Verification s-Net Acidity	%w/w S	-20	-	0.01	0.00	0.01
a-Net Acidity without ANCE	moles H+/T	5	-	76	25	71
Liming Rate without ANCE	kg CaCO3/T	0.1	-	5.7	1.9	5.3

HCl Extractable S, Ca and Mg in Soil/Solids ICP OES Method: AN014 Tested: 28/3/2022

Parameter	Units	LOR	CE158296.001	CE158296.002	CE158296.003	CE158296.004
Acid Soluble Sulfur (SHCl)	%w/w	0.005	-	0.034	-	-

MB blank results are compared to the Limit of Reporting
LCS and MS spike recoveries are measured as the percentage of analyte recovered from the sample compared the the amount of analyte spiked into the sample.
DUP and MSD relative percent differences are measured against their original counterpart samples according to the formula : *the absolute difference of the two results divided by the average of the two results as a percentage.* Where the DUP RPD is 'NA' , the results are less than the LOR and thus the RPD is not applicable.

TAA (Titratable Actual Acidity) **Method: ME-(AU)-[ENV]AN219**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
pH KCl	LB100810	pH Units	-	5.9	0 - 2%	98%
Titratable Actual Acidity	LB100810	kg H2SO4/T	0.25	<0.25	0 - 13%	NA
Titratable Actual Acidity (TAA) moles H+/tonne	LB100810	moles H+/T	5	<5	0 - 13%	105%
Titratable Actual Acidity (TAA) S%w/w	LB100810	%w/w S	0.01	<0.01	0 - 13%	106%
Sulphur (SKCl)	LB100810	%w/w	0.005	<0.005	0%	80%
Calcium (CaKCl)	LB100810	%w/w	0.005	<0.005	1 - 16%	87%
Magnesium (MgKCl)	LB100810	%w/w	0.005	<0.005	0 - 14%	84%

TPA (Titratable Peroxide Acidity) **Method: ME-(AU)-[ENV]AN218**

Parameter	QC Reference	Units	LOR	MB	DUP %RPD	LCS %Recovery
Peroxide pH (pH Ox)	LB100811	pH Units	-	6.3	0 - 2%	96%
TPA as kg H_2SO_4/tonne	LB100811	kg H2SO4/T	0.25	<0.25	0%	107%
TPA as moles H+/tonne	LB100811	moles H+/T	5	<5	0%	107%
TPA as S % W/W	LB100811	%w/w S	0.01	<0.01	0%	107%
ANCE as % $CaCO_3$	LB100811	% CaCO3	0.01	<0.01	0%	
ANCE as moles H+/tonne	LB100811	moles H+/T	5	<5	0%	
ANCE as S % W/W	LB100811	%w/w S	0.01	<0.01	0%	
Sulphur (Sp)	LB100811	%w/w	0.005	<0.005	6 - 11%	103%
Calcium (Cap)	LB100811	%w/w	0.005	<0.005	4 - 10%	103%
Magnesium (Mgp)	LB100811	%w/w	0.005	<0.005	0 - 12%	105%

METHOD	METHODOLOGY SUMMARY
AN002	The test is carried out by drying (at either 40°C or 105°C) a known mass of sample in a weighed evaporating basin. After fully dry the sample is re-weighed. Samples such as sludge and sediment having high percentages of moisture will take some time in a drying oven for complete removal of water.
AN014	This method is for the determination of soluble sulfate (SO4-S) by extraction with hydrochloric acid. Sulphides should not react and would normally be expelled. Sulfate as Sulfur is determined by ICP.
AN218	Soil samples are subjected to extreme oxidising conditions using hydrogen peroxide. Continuous application of heat and peroxide ensure all sulfide is converted to sulfuric acid. Excess peroxide is broken down by a copper catalyst prior to titration for acidity. Calcium, magnesium, and sulfur are determined by ICP-OES. Also included is a carbonate modification step which, depending on pH after the initial oxidation, gives a measure of ANC.
AN219	Dried pulped sample is extracted for 4 hours in a 1 M KCl solution. The ratio of sample to solution is 1:40. The extract is titrated for acidity. Calcium, magnesium, and sulfur are determined by ICP-AES.
AN220	SPOCAS Suite: Scheme for the calculation of net acidities and liming rates using a Fineness Factor of 1.5.

FOOTNOTES

IS	Insufficient sample for analysis.
LNR	Sample listed, but not received.
*	NATA accreditation does not cover the performance of this service.
**	Indicative data, theoretical holding time exceeded.
***	Indicates that both * and ** apply.

LOR	Limit of Reporting
↑↓	Raised or Lowered Limit of Reporting
QFH	QC result is above the upper tolerance
QFL	QC result is below the lower tolerance
-	The sample was not analysed for this analyte
NVL	Not Validated

Unless it is reported that sampling has been performed by SGS, the samples have been analysed as received.
Solid samples expressed on a dry weight basis.

Where "Total" analyte groups are reported (for example, Total PAHs, Total OC Pesticides) the total will be calculated as the sum of the individual analytes, with those analytes that are reported as <LOR being assumed to be zero. The summed (Total) limit of reporting is calcuated by summing the individual analyte LORs and dividing by two. For example, where 16 individual analytes are being summed and each has an LOR of 0.1 mg/kg, the "Totals" LOR will be 1.6 / 2 (0.8 mg/kg). Where only 2 analytes are being summed, the " Total" LOR will be the sum of those two LORs.

Some totals may not appear to add up because the total is rounded after adding up the raw values.

If reported, measurement uncertainty follow the ± sign after the analytical result and is expressed as the expanded uncertainty calculated using a coverage factor of 2, providing a level of confidence of approximately 95%, unless stated otherwise in the comments section of this report.

Results reported for samples tested under test methods with codes starting with ARS-SOP, radionuclide or gross radioactivity concentrations are expressed in becquerel (Bq) per unit of mass or volume or per wipe as stated on the report. Becquerel is the SI unit for activity and equals one nuclear transformation per second.
Note that in terms of units of radioactivity:

a. 1 Bq is equivalent to 27 pCi
b. 37 MBq is equivalent to 1 mCi

For results reported for samples tested under test methods with codes starting with ARS-SOP, less than (<) values indicate the detection limit for each radionuclide or parameter for the measurement system used. The respective detection limits have been calculated in accordance with ISO 11929.

The QC and MU criteria are subject to internal review according to the SGS QAQC plan and may be provided on request or alternatively can be found here: www.sgs.com.au/en-gb/environment-health-and-safety.

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