Acid Sulfate Soil Management Plan

42 Fullerton Cove Road, Fullerton Cove

NEW20P-0178-AD
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1.0 Introduction

Qualtest were engaged by Canaan PD 2 Pty Ltd c/o Monteath & Powys Pty Ltd (M&P), to prepare an Acid Sulfate Soil (ASS) Management Plan (ASSMP) for site located at 42 Fullerton Cove Road, Fullerton Cove NSW. The site location is shown on Figure 1, Appendix A.

The site is proposed to be developed for a retail development, which would comprise:

- Retail shops and associated car park in an approximately 23,880m^2 area located in the north-west portion of the site. This area is zoned E1 Local Centre;
- Land to remain undeveloped in an approximately 43,260m^2 area in the south and east of the site, which is zoned C2 Environmental Conservation; and
- Cut and fill is currently proposed as part of the development, with cuts up to a maximum of 2m bgs. It is noted that the cut/fill plans may change to avoid site disturbance, and this would reduce the depth of cuts, which would result in a lower risk of encountering ASS.

Qualtest previously carried out an ASS assessment for the site, ref: NEW20P-0178-AB, dated 24 February 2024. The assessment covered approximately 50% of the development footprint, located in the northern portion of the development footprint, as shown on Figure 2, Appendix A. The assessment did not identify ASS to a depth of 2m bgs. Further information on the previous assessment is provided in Section 5.0.

A Development Application (DA 16-2023-685-1) was submitted to Port Stephens Council (Council). As part of the assessment of the DA Council have requested additional information in regards to ASS:

"Council has reviewed the Acid Sulfate Soils Assessment prepared by Qualtest. Soil testing as undertaken as a part of the report which found that ASS was not present. The report concluded that an Acid Sulfate Soil Management Plan was not required. However, the assessment provided identifies that testing was undertaken in proximity to the existing dwelling which is in a lower ASS risk category (Class 4)… As such, further investigation in areas of higher risk where earthworks below the ground surface are proposed is required to be provided to Council."

Further investigation on the site in the areas requested by Council is not practical, due to aboriginal heritage restraints. Information provided by the client states: *"Impacts to part of AHIMS 38-4-0333/Fullerton Cove Road; site 1; and AHIMS 38-4-2140/42 Fullerton Cove Road PAD 3 cannot be avoided. Therefore, it is recommended that an AHIP to allow for harm and salvage be obtained. The AHIP should be for a term of five (5) years and should allow for harm of AHIMS 38-4-0333/Fullerton Cove Road; site 1;, and salvage of AHIMS 38-4-2140/42 Fullerton Cove Road PAD 3 through excavation and community collection prior to harm. The AHIP will need to be obtained from Heritage NSW under Part 6 of the National Parks and Wildlife Act 1974 (NPW Act), prior to impacts occurring." "Therefore, no impacts to the ground including boreholes can occur until after an AHIP is approved, and sub-surface salvage and surface collection of the site has occurred."*

Therefore, this ASSMP has been prepared based on currently available information, and provision if conditions other than those previously encountered (and characteristic of ASS) are encountered. The ASSMP also provides for additional assessment once assessment is permitted to proceed, in areas not previously assessed. Following the additional assessment, this ASSMP would be updated, or superceded by a report stating ASS are not present (whichever is relevant).

The ASS assessment and ASSMP have been completed in accordance with the ASSMAC (1998) Acid Sulfate Soil Manual and the relevant National ASS Guidance (Sullivan et al 2018).

Reference is also made to Dear et al (2024) Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines Version 5.1.

1.1 Objectives

The objectives of the ASSMP are to outline the procedures for the management of ASS that may be encountered during excavations, including treatment and verification, to lower the potential environmental impacts associated with the disturbance of ASS.

2.0 Relevant Legislation, Policy and Guidelines

Management and monitoring of acid sulfate soil materials will be carried out in accordance with the relevant legislation, regulations and guidelines. These include, but are not limited to, the legislation listed in Table 2.1. and guidelines indicated below.

Table 2.1: Relevant NSW Legislation

NSW Legislation/Policy	Relevance to ASSMP
Protection of the Environment Operations Act 1997 (POEO Act)	The purpose of the POEO Act is to control pollution and set up a licensing regime for certain activities. The POEO Act also regulates waste, including excavated soils.
NSW Environmental Planning and Assessment Act 1979 (EP&A Act)	The EP&A Act and Regulation include provisions to ensure that proposals which have the potential to impact the environment are subject to detailed assessment, and provide opportunity for public involvement.
Port Stephens Council ASS Policy	Local Environmental Plan 2013 Part 7 Section 7.1 – *Development consent is required for the carrying out of works described in the Table* (Class 1 to 5) *to this subclause on land shown on the Acid Sulfate Soils Map as being of the class specified for those works.*

Guidelines and standards relevant to ASS management include:

- Ahem CR, Stone Y and Blunden B (1998b) *Acid Sulfate Soils Management Guidelines*, Acid Sulphate Soils Management Advisory Committee, Wollongbar, NSW.
- Dear, S-E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M., (2024). Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.
- National acid sulfate soils identification and laboratory methods manual (Sullivan, L, Ward, N, Toppler, N and Lancaster, G 2018, *National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual,* Department of Agriculture and Water Resources, Canberra, ACT).
- National Environmental Protection Council (1999) National Environmental Protection (Assessment of Site Contamination) Measure 1999, Amended 2013, Schedule B (1) – Guideline on the Investigation Levels for Soil and Groundwater.
- ANZECC (2018) Australian Water Quality Guidelines for Fresh and Marine Waters. Australian and New Zealand Environment & Conservation Council www.waterquality.gov.au .

3.0 Roles and Responsibilities

Table 3.1 summarises the roles and responsibilities during proposed development works.

Table 3.1: Role and Responsibilities

Role	Responsibilities
Principal – Canaan	- To engage suitably qualified personnel/companies to carry out the works. - To ensure the work is undertaken in accordance with this ASSMP.
Contractor – TBA	- Only engaging suitably qualified and competent staff and subcontractors. - Enforcing the implementation of this plan on the site by staff, and subcontractors. - Authorised to stop work as deemed necessary where unsafe activities are being carried out or where management plans are not being followed. - Overseeing the proper use and maintenance of site safety equipment, including staff Personal Protective Equipment (PPE) and first aid equipment. - Training and Induction to make staff and subcontractors aware of their responsibilities and the contents of this ASSMP.
Environmental Consultant –Qualtest	- To provide advice regarding the management of onsite materials. - Carry out tracking, observations, sampling and reporting. - To notify PON as soon as practical of any unexpected finds, or non-compliances. Authorised to stop work as deemed necessary where unsafe activities are being carried out or where this ASSMP is not being followed.
Site Workers	- Taking reasonable care for their own safety and the safety of others. - Following site rules and work instructions. - Taking immediate action to rectify hazards that may arise during the course of the work. - Complying with management plans, relevant OHS legislation and industry standards. - Establish and maintain a positive safety climate on the project.

4.0 Physical Setting and Field Works

4.1 Site Description

The site area is approximately 6.7ha and comprises Lot 14 DP258848. The site has been used for residential purposes, and contains a residence with a swimming pool, and two large sheds in the northern portion of the site. The central and southern portions of the site comprise grass cover and vegetated bushland. The development footprint is located in the central and northern portion of the site and includes the buildings and land that is grassed, with some bushland.

The site is surrounded by Fullerton Cove Road and rural residential land to the north, Nelson Bay Road and undeveloped bushland to the south, Fullerton Cove Road, residential land to the west, and undeveloped bushland to the east. Fullerton Cove is located about 430m west of the site.

4.2 Topography and Drainage

Reference to the NSW Land and Property Information Spatial Information Exchange website (https://six.nsw.gov.au/wps/portal/) indicated the elevation of the site was below 10m AHD.

During the site walkover, carried out by Qualtest in February 2021, the site was observed to generally slope from the north-east down towards the south-west. A low-lying area was present in the northern portion of the site, though it was not clear if this was a man-made feature or a natural gully.

Rain falling on the site would be expected to infiltrate into the site surface. Excess surface water was expected to follow the site topography, and flow to the south west and into municipal stormwater drains, located on Fullerton Cove Road. It was expected that the municipal stormwater drains discharged to Fullerton Cove located approximately 500m west of the site.

4.3 Regional Geology

Reference to the 1:25,000 Nelson Bay Coastal Quaternary Geology map indicates that the site was underlain by Holocene aged backbarrier flats comprising marine sand, silt, clay, gravel and shell.

4.4 Hydrogeology

Groundwater beneath the site is anticipated to be present in an unconfined aquifer in sands. Groundwater was expected to be located within 5m below ground surface (bgs). Groundwater flow direction was anticipated to flow to the south-west, and discharge into Fullerton Cove, located approximately 500m to the west, which drains to North Arm of the Hunter River and then Stockton Bight.

It should be noted that groundwater conditions can vary due to rainfall and other influences including regional groundwater flow, temperature, permeability, recharge areas, surface condition, and subsoil drainage.

4.5 Previous Assessment

Field Works

As part of the previous ASS assessment (Qualtest, 2021), field work was carried out by an Environmental Scientist from Qualtest on 8 February 2021. Three boreholes (BH01 to BH03) were drilled on the northern portion of the development footprint. The borehole locations are shown on Figure 1, attached.

The boreholes were advanced using a hand auger, to depths of about 1.7m and 2.0m bgs. Soil samples were collected at intervals of approximately 0.2m. The samples were placed into zip-lock bags and stored in an ice filled esky during fieldwork and transported to the Qualtest soils laboratory. Disposable nitrile gloves were used during collection of samples.

Following field screening at the Qualtest laboratory, selected samples were kept on ice and transported under chain of custody documentation to Eurofins laboratory for further testing using the chromium reducible sulphur test.

Photographs taken during fieldworks in February 2021 are provided below.

Photo 1 – Showing site looking from north to south

Photo 2 – Showing site looking from south to west

Photo 3 - Showing site looking from west to east

Laboratory Programme

Twelve samples were collected from the boreholes at regular depths and screened at the Qualtest soils laboratory at Newcastle NSW. The samples were screened in accordance with the procedures outlined in Appendix 1 of the ASSMAC (1998) ASS Manual.

Three samples were dispatched to Eurofins under chain of custody conditions and analysed using the chromium reducible sulfur (Scr) method. The results of the field screening and laboratory analysis are presented in Sections 5.4 and 5.5. The laboratory reports are attached in Appendix B.

Subsurface Conditions

Table 4.5 presents a summary of the typical soil profiles observed at the borehole locations during the previous field investigations, divided into representative geotechnical units. The borehole logs are also attached.

Table 4.5 – Summary of Soil Profile

Unit	Soil Description	Depth Range (m)		
		BH01	BH02	BH03
Topsoil	Sand - fine to medium grained, dark brown to grey, rootlets.	0.0 to 0.3	0.0 to 0.15	0.0 to 0.2
Aeolian/Alluvial	Sand – fine to medium grained, orange brown, orange yellow. Sandy Clay – medium to high plasticity, dark grey, fine to medium grained sand. SAND – fine to medium grained, light brown to grey, dark grey.	0.3 to 2.0*	0.15 to 1.7*	0.2 to 1.8*

Note: * depth of investigation.

No odours and/or anthropogenic materials were observed during hand auguring. Groundwater inflows were observed at 1.4m in BH02 and BH03.

5.0 Acid Sulfate Soils

5.1 Acid Sulfate Soil Risk Maps

Reference to the Acid Sulfate Soil Risk Mapping (Edition 3, 2008) for Part of the Lower Hunter River Catchment indicates that:

- The majority of the site is located within an area of "low probability of acid sulfate soils within 1m of the ground surface, in an Aeolian sandplain at an elevation of 1-2m AHD; and,
- The north-eastern corner of the site is located within an area of "low probability of acid sulfate soils within 1m to 3m of the ground surface, in an Aeolian sandplain at an elevation of 2-4m AHD.

The site overlain on the Lower Hunter River Catchment Risk Map is presented as Figure 3, Appendix A.

The ASS Risk Map from eSpade spatial portal (https://www.environment.nsw.gov.au/eSpade2Webapp) indicates that:

- The northern portion of the site lies in an area with a low probability of ASS >3m below ground surface, within Aeolian soils at an elevation of >4m AHD;
- The remainder of the site lies in an area with a high probability of ASS <1m below ground surface, within Aeolian soils at an elevation of 1-2m AHD.

The site overlain on the eSpade Risk Map is presented as Figure 4, Appendix A.

The Port Stephens Local Environmental Plan (LEP) 2013 maps:

- The northern portion of the site as Class 4 ASS, which requires development consent and an ASS Management Plan (ASSMP) for "*Works more than 2m below the natural ground surface. Works by which the watertable is likely to be lowered more than 2m below the natural ground surface.*"
- The remainder of the site as Class 2 ASS, which requires development consent and an ASS Management Plan (ASSMP) for "*Works below the natural ground surface. Works by which the watertable is likely to be lowered.*"

The site overlain on the LEP ASS Map is presented as Figure 5, Appendix A.

5.2 Acid Sulfate Soil Occurrence

Acid sulfate soils can form in a number of geologic and geomorphic landscapes provided there is a source of iron, sulfate and soil bacteria. Coastal Acid Sulfate Soils (CASS) have formed along the east coast of Australia, since the last glacial period (19,000 to 18,000 years ago), when sea levels were around 120m to 130m below today's levels.

Sea levels rose rapidly to about 7,000 years ago, reaching a height about 1.0m above the present day mean sea level (0.0m AHD), at which time they stabilised. Since that time there has been a slow accumulation of coastal sediments within the intertidal zone, including saline wetlands, salt marshes and as bottom sediments in embayments, coastal rivers, estuaries and coastal lakes. This accumulation is still occurring today.

CASS are found along most of the coast of mainland Australia, generally found below about 5m AHD where tidal ranges are large, such as northern Queensland. Along coastal areas with smaller tidal ranges, it is rare to find significant accumulations of CASS above about 2m AHD (Simpson et al 2018).

The formation of sulfidic sediments is a natural part of the sulfur cycle where sulfates from sea water, in combination with iron and sulfate reducing bacteria (SRB), combine to produce reduced inorganic sulphides (RIS). RIS can include iron disulfides (FeS2), pyrite and marcasite, monosulfides (FeS) and elemental sulfur (S8) (Sullivan et al 2018). Provided these sediments remain in an anoxic state (saturated) they are benign (Dear et al 2014, Sullivan et al 2018).

5.3 Results

In order to assess the presence of ASS, the laboratory results (Qualtest, 2021) were compared to Action Criteria from ASSMAC (1998) Acid Sulfate Soil Manual.

The ASSMAC (1998) action levels are based on oxidisable sulfur concentrations for three differing soil textures. There are separate action levels depending on the amount of soil disturbed as a result of the proposed works. For this project it has been assumed that less than 1000 tonnes of ASS will be disturbed and that the soil texture category is coarse. The applicable action levels are indicated below in Table 5.3.

Table 5.3 – ASSMAC (1998) Action Criteria

Texture Category	Approx. Clay Content (%)	Action Criteria	
		Net Acidity (S_{CR}/S_{POS}) (%)	Net Acidity (mot H+/tonne)
Coarse	<5%	0.03	18
Medium	5 to 40%	0.06	36
Fine	>40%	0.1	62

5.4 Field Screening

Field screening of the 12 samples collected was carried out by an experienced Environmental Scientist, at our Warabrook laboratory in February 2021. The field screening results are summarised in Table 5.4 below, and the sheets are attached in Appendix C.

Table 5.4 – Results of Field Screening Tests

Sample ID	pH_F	pH_{FOX}	Reaction
BH01 0.0-0.1	5.92	4.38	None observed
BH01 0.4-0.5	5.73	4.38	None observed
BH01 0.9-1.0	5.77	4.76	None observed
BH01 1.4-1.5	6.02	4.67	None observed
BH01 1.9-2.0	5.87	5.00	None observed
BH02 0.0-0.1	5.66	4.30	None observed
BH02 0.4-0.5	5.40	3.94	Slight
BH02 1.0-1.0	5.76	3.77	None observed
BH02 1.5-1.6	6.15	4.66	None observed
BH02 1.6-1.7	6.19	5.21	None observed
BH03 0.0-0.1	5.76	4.07	Slight
BH03 0.5-0.6	5.71	4.35	None observed
BH03 1.0-1.1	5.62	4.72	None observed
BH03 1.5-1.6	5.48	4.55	None observed
BH03 1.7-1.8	5.41	4.55	None observed

A pH_{FOX} around 3.5 or lower, can sometimes indicate a potential for reduced inorganic sulphides (RIS) to be present within the soils. None of the screened samples recorded a pH_{FOX} below 3.5 and observed reactions were none to slight following the addition of hydrogen peroxide.

5.5 Laboratory Results

Based on the results of the field screening, three samples were selected for laboratory analysis. The samples were dispatched to NATA accredited laboratory Eurofins for Chromium Reducible Sulfur (CRS) testing. The laboratory reports are attached and Table 5.5 provides a summary of the results.

Table 5.5: Laboratory Results

Sample ID	Description	pH_{KCL}	TAA (mol H+/t)	Scr (%S)	Net Acidity (%S)
BH02 0.4-0.5	Clayey SAND – fine to medium grained, dark grey, fines of low plasticity.	5.3	15	<0.005	0.02
BH02 1.0-1.1	SAND – fine to medium grained, orange brown.	5.9	6.5	<0.005	<0.02
BH03 1.0-1.1	Sand – fine to medium grained, grey brown.	5.8	2.5	<0.005	<0.02
Action Criteria*		**-**	**18**	**0.03**	**0.03**

***ASSMAC (1998), Acid Sulfate Soil Manual, Table 4.4 – Action Criteria fine to medium textured soil, >1000 tonne*
Scr – Chromium Reducible Sulfur, TAA – Titratable Actual Acidity, N/A – Not Applicable

The laboratory results showed Titratable Actual Acidity (TAA) below the adopted criteria of 18mol H+/tonne in each sample tested, and Chromium Reducible Sulfur (Scr) and Net Acidity were reported below the adopted criteria of 0.03%S in each sample tested.

5.6 Conclusions

The previous assessment of the northern portion of the development footprint did not identify ASS. Therefore, an ASSMP was not required for the northern portion of the development footprint.

It is noted that as discussed in Section 1.0, the southern portion of the development footprint has not been assessed. The southern portion of the development footprint likely extends into an area with potentially a higher risk of ASS being present. Therefore, an ASSMP has been prepared to provide generic management procedures, see Section 7.0. Further assessment in the southern portion of the development footprint is required once an AHIP has been obtained and sub-surface salvage and surface collection of the site for aboriginal artefacts has occurred. Section 6.0 outlines the recommended additional assessment.

6.0 Additional Assessment

The area of the development footprint that has not been assessed is about 12,000m^2 (1.2ha). The ASSMAC (1998) Acid Sulfate Soil Manual recommends 6 boreholes for sites between 1ha to 2ha where extensive disturbance is proposed. As extensive disturbance of the site soils is not proposed (i.e. filling of the site is proposed), a lower sampling density has been adopted.

The following scope of works is recommended for the additional assessment:

- Drilling of three boreholes to 1m beyond the depth of proposed disturbance, or a minimum of 2m bgs. Based on current knowledge of the development, boreholes are expected to extend to 2m bgs;
- Collection of samples at 0.5m intervals in the boreholes. Samples will be placed into zip-lock bags, taking care to exclude air from the bags, and stored on ice during fieldwork and transport to laboratories;
- Testing of the samples using the ASS field screening procedure outlined in Appendix 1 of the ASSMAC (1998) ASS Manual; and
- Testing of selected samples for the chromium reducible sulfur suite at a NATA accredited laboratory. The number of samples to be tested would be depending on the soil profile observed, and results of field screening. At a minimum one sample per borehole should be tested.

Following receipt of laboratory results, the following would occur:

- If ASS is identified, this ASSMP would be updated; OR
- If no ASS is identified on the site, an Acid Sulfate Soil Assessment Report outlining the results of the Assessment would be provided, and this ASSMP would no longer be required.

7.0 Management Plan and Procedures for ASS

7.1 General

The monitoring and management of ASS will be the responsibility of the Contractor, or their delegated sub-contractor.

The following general management procedures are considered applicable for the proposed works:

i. Appointment of a person to be responsible for managing acid sulfate soil issues during the earthwork activities;
ii. Manage the materials that are assessed to be acid sulfate soils through stockpiling and lime neutralisation.

These procedures are further discussed in the following sections.

7.2 Visual classification

ASS have not been identified in the soils tested to date (the northern portion of the development footprint). There is a potential that ASS may be encountered in the southern portion of the development footprint, which has not yet been assessed.

Information on visual classification of typical soils that can be characteristic of ASS is provided below:

- The preliminary visual checking of potential ASS will be based on material type, colour and consistency;
- Sandy CLAY / Clayey SAND, SAND or CLAY, grey to dark grey will be classified as ASS. If shells are present this can be a strong indicator of ASS.

7.3 Treatment of ASS via Neutralisation

Treatment Pad and Liming Methodology

Excavated ASS will be placed in a specially prepared treatment pad for treatment via application of lime to the soil. The type and amount of lime to be applied should be such that a neutralising value (NV) of 100 can be achieved. The NV should be identified prior to mixing. NV relates to the purity of the lime and an NV of 100 is required to ensure that the lime is effective in neutralising the potential acid.

Fine powdered agricultural lime ($CaCO_3$) generally has an NV of 90% to 100% whilst other manufactured forms of lime can have an NV as low as 80%. Where NV is below 100, the factor of safety, hence the amount of lime will have to be adjusted accordingly.

The design of the treatment pad should be in general accordance with Figure 5, page 48, of Dear et al (2024), re-produced below.

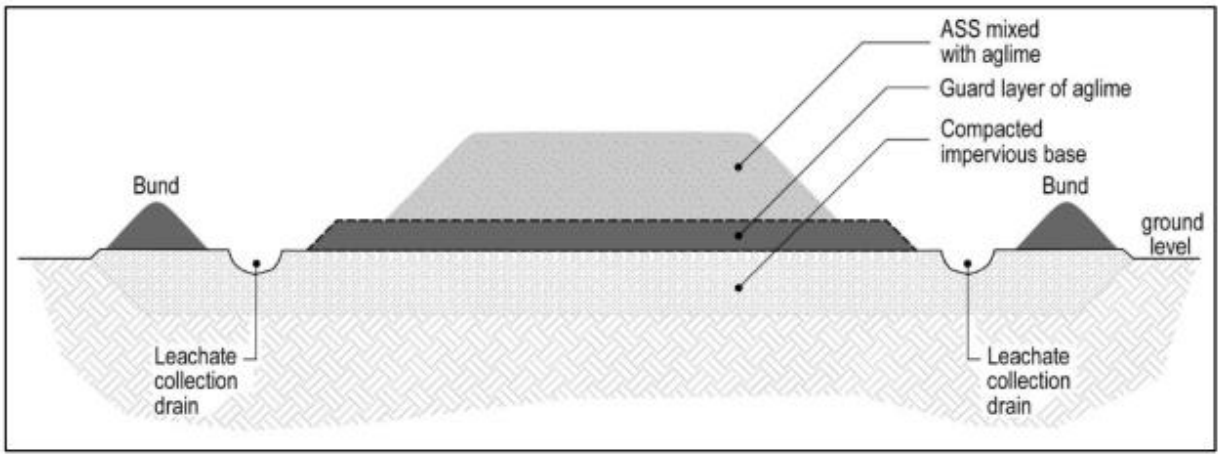


Figure 5: Schematic cross-section of a treatment pad

The following procedures (or other equivalent) should be undertaken for the treatment pad and liming:

- The treatment pad should be located at least 40m from a permanent waterway or creek and, if possible, placed in a topographically high area to avoid inundation following heavy rain. The area should be appropriately bunded and provision made to collect run-off water;
- Spreading of the soil in about 0.3m thick layers within the boundary of the site works. Consideration should be given to providing a suitable foundation for the treatment area that can support the weight of the mixing machinery;
- A guard layer of neutralising agents should be provided at the base of the pad prior to the addition of ASS; and
- Addition of lime by light weight truck followed by mixing, using light weight rotovators or similar tools;
- An amount of lime that allows for liming at a rate of 20kg/tonne should be kept on site by the Contractor for emergencies (i.e. monitoring indicates acidic run-off is occurring).

7.4 Liming Rate

Laboratory results are not currently available for ASS that may be encountered. Therefore, a conservative liming rate of 20 kg $CaCO_3/m^3$ (10 kg $CaCO_3$/tonne) has been adopted.

Once laboratory testing has been completed, the liming rates will be based laboratory data and calculated using the following formula:

per m^3 of soil = $\%S \; x \; 30.59 \; x \; 1.02 \; x \; \frac{100}{ENV\ (\%)} \times D \times FOS$

where %S is highest net acidity recorded per stratigraphic unit (0.10%S)

D is bulk density of soil (1.8 tonnes/m^3)

FOS Factor of safety (1.5)

ENV is Effective Neutralisation value (usually 90 to 95% for agricultural lime)

8.0 Management of ASS via Re-burial

Excavated ASS can be re-used in excavations without treatment and verification, as long as the ASS is managed appropriately.

The steps for re-using ASS without treatment and verification are summarised below:

- A guard layer of 5kg of lime per m^2 (per vertical metre of fill) is placed beneath the temporary stockpiling location and spread over the top of the stockpile to limit the generation of acidity from the surface of the stockpile. The area will also require bunding to collect any leachate, soil or lime washed off during overnight/weekend storms or rain events;
- The different soil profile layers observed in the excavation are excavated and stockpiled separately;
- The material is placed back in the excavation within the following timeframes, based on Section 10.2.2 of Dear et al (2024):
    - Maximum of 18hrs (overnight) for coarse textured soils such as sands;
    - Maximum of 66 hrs (one weekend) for fine textured soils such as silts and clays;
- The stockpiled material is monitored daily for pH. If the pH falls below 6.5 or its likely that stockpiling will be longer than the maximum timeframes in Dear et al (2024) then the material will require treatment and verification testing as per Sections 7.0 and 9.0;
- The material is placed back in the excavation in the order they were removed (i.e. material from the bottom of the excavation is placed back in the bottom of the excavation);
- The material placed back in the excavation is compacted, to prevent infiltration of oxygen into the soils; and
- Records should be maintained of the time of excavation and time of re-use, to demonstrate compliance with the required timeframes.

If the ASS are stockpiled for longer than the timeframes above, then the ASS will require treatment and management as per the procedures in Section 7.0 and 9.0.

9.0 Performance Criteria and Verification Testing

9.1 Treated Acid Sulfate Soils

In order to demonstrate that appropriate quantities of lime have been used, a lime register shall be maintained by the Contractor. The register shall list the amount of lime delivered to the site, verified by delivery dockets, and where/when the lime has been used. The lime usage shall quantify areas limed and soil volumes treated, liming rates and quantities of lime used. The amount of lime to be kept on-site for emergencies will be assessed by the Contractor.

Verification testing should allow for:

- One sample per 250m^3, with a minimum of 3 samples;
- Each test sample to be made from a composite of six individual samples;
- Samples to be tested using the S_{CR} suite with full acid base accounting including retained acidity.

Assuming that greater than 1,000 tonnes will be disturbed, the performance criteria will be:

- No single sample shall exceed a net acidity of 18 mol H+/tonne (0.03% S).
- If any single sample is between 0 and 18mol H^+/tonne (0.03 % S), then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

Where the results indicate that the treatment has not been effective, further liming will be required.

9.2 Re-buried Acid Sulfate Soils

Records should be maintained of the time of excavation and time of re-use (re-burial), to demonstrate compliance with the required timeframes.

10.0 Re-use or Disposal of Soils

10.1 On-site Reuse

If material is neutralised via liming, the material will require verification testing as per Section 9.1. Following verification testing demonstrating that neutralisation was effective, the material would be suitable for reuse on the site.

As per Section 8.0 above ASS can also be re-used within the excavated trench as part of management via re-burial.

10.2 Off-site Disposal

If the material is proposed to be disposed to a licensed waste facility, sampling and analysis of the soil for waste classifications will be required. The soil can then be classified in accordance with the NSW EPA (2014) Waste Classification Guidelines.

The soil will require treatment via lime neutralisation, as per Section 7.0, before disposal to a licensed waste facility. The waste facility must be made aware that the soil comprises treated ASS.

11.0 Contingency Plan

A contingency plan is outlined in Table 11.1, listing potential events relating to ASS that may arise during earthworks and actions that will be undertaken if unexpected conditions occur.

Table 11.1 – Contingency Plan

Unexpected Condition	Action
Accumulated run-off water is observed to be acidified (i.e. pH <4)	Emergency liming of water is to be carried out. Where emergency liming of water is required, and laboratory testing results are not available, liming of acidic water may be carried out at a rate such that residual lime is present and the pH of the water is not less than 6. The emergency liming rate is a temporary measure to lower the immediate risk to the environment and may not be sufficient for complete neutralisation.
Validation samples fail criteria	Carry out additional liming of soil.
Identification of unexpected contaminated materials or archaeological finds during excavations.	Refer to construction environment management plan. An environmental consultant or archaeologist may be required to assess the material and provide management measures.
Other	Other unexpected events which may affect the outcome of the investigation would be notified to the client, and other relevant parties. At that time potential actions to address the unexpected event will be assessed and presented.

12.0 Conclusions

Qualtest previously carried out an ASS assessment for the site, which covered approximately 50% of the development footprint, located in the northern portion of the development footprint. The assessment did not identify ASS to a depth of 2m bgs (Qualtest, 2021).

The southern portion of the development footprint has not been assessed, and likely extends into an area with potentially a higher risk of ASS being present.

Therefore, this ASSMP has been prepared to provide generic management procedures. Further assessment in the southern portion of the development footprint is required once an AHIP has been obtained and sub-surface salvage and surface collection of the site for aboriginal artefacts has occurred. This ASSMP will be updated following completion of the additional investigation.

The management procedures in this ASSMP, will need to be implemented if ASS, or potential ASS, are proposed to be disturbed.

13.0 Limitations

The treatment and management procedures in this report, and used as the basis for recommendations presented herein, are preliminary and are based on limited site investigations and laboratory testing.

Data and opinions contained within the report may not be used in other contexts or for any other purposes without prior review and agreement by Qualtest. If this report is reproduced, it must be in full.

14.0 References

Qualtest (2021) Acid Sulfate Soil Assessment, ref: NEW20P-0178-AB dated 24 February 2021

ASSMAC (1998) Acid Sulfate Soils Manual Acid Sulfate Soils Management Advisory Committee (ASSMAC)

Dear, S.E., Ahern, C. R., O'Brien, L. E., Dobos, S. K., McElnea, A. E., Moore, N. G. & Watling, K. M. (2024) Queensland Acid Sulfate Soil Technical Manual - Soil Management Guidelines Version 5.1

NSW Land and Property Information, Spatial Information eXchange (SIX) Maps - Topographic Map, accessed from https://maps.six.nsw.gov.au/.

DECC (2008) Acid Sulfate Soil Risk Mapping (Edition 3, 2008) for Part of the Lower Hunter River Catchment

eSpade spatial portal (https://www.environment.nsw.gov.au/eSpade2Webapp), ASS Risk Map

Port Stephens Local Environmental Plan (LEP) 2013 (https://legislation.nsw.gov.au/view/html/inforce/current/epi-2013-0755#statusinformation)

Sullivan, L, Ward, N, Toppler, N and Lancaster, G (2018) *National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual,* Department of Agriculture and Water Resources, Canberra, ACT).

APPENDIX A:

Figures

Image obtained from Nearmaps

Qualtest LABORATORY (NSW) PTY LTD

Client:	CANAAN PD 2 PTY LTD C/- MONTEATH & POWYS PTY LTD	Drawing No:	FIGURE 1
Project:	ACID SULFATE SOIL MANAGEMENT PLAN	Project No:	NEW20P-0178-AD
Location:	42 FULLERTON COVE ROAD, FULLERTON COVE NSW	Scale:	N.T.S.
Title:	SITE LOCATION PLAN	Date:	31/05/2024

N

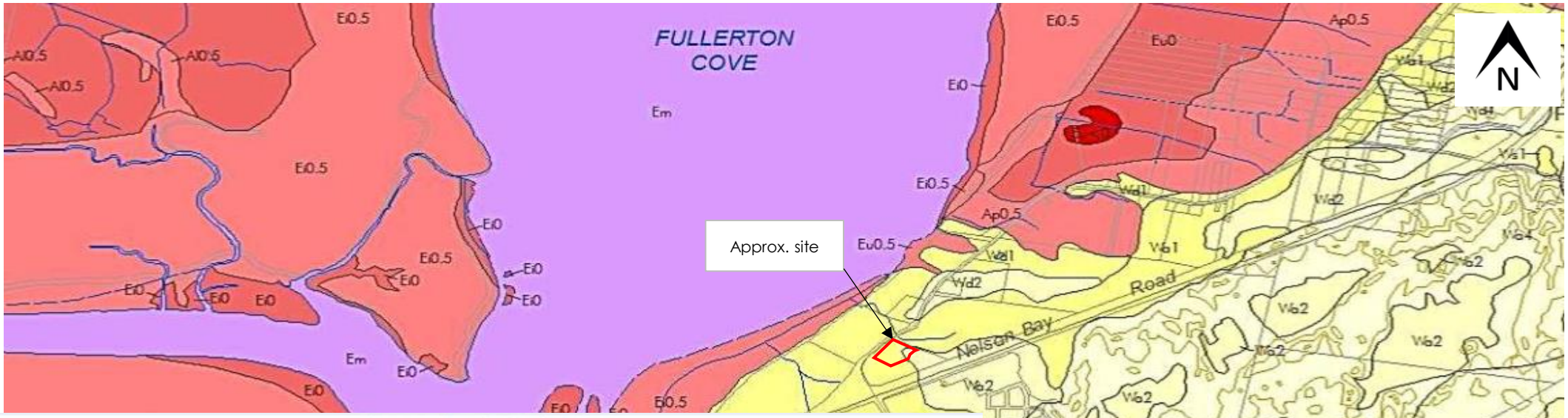
LEGEND:

Approximate borehole location

Image obtained from Nearmaps

Qualtest LABORATORY (NSW) PTY LTD

Client:	CANAAN PD 2 PTY LTD C/- MONTEATH & POWYS PTY LTD	Drawing No:	FIGURE 2
Project:	ACID SULFATE SOIL MANAGEMENT PLAN	Project No:	NEW20P-0178-AD
Location:	42 FULLERTON COVE ROAD, FULLERTON COVE NSW	Scale:	N.T.S.
Title:	PREVIOUSLY ASSESSED AREA AND BOREHOLE LOCATIONS	Date:	31/05/2024



ACID SULFATE SOIL RISK - KEY

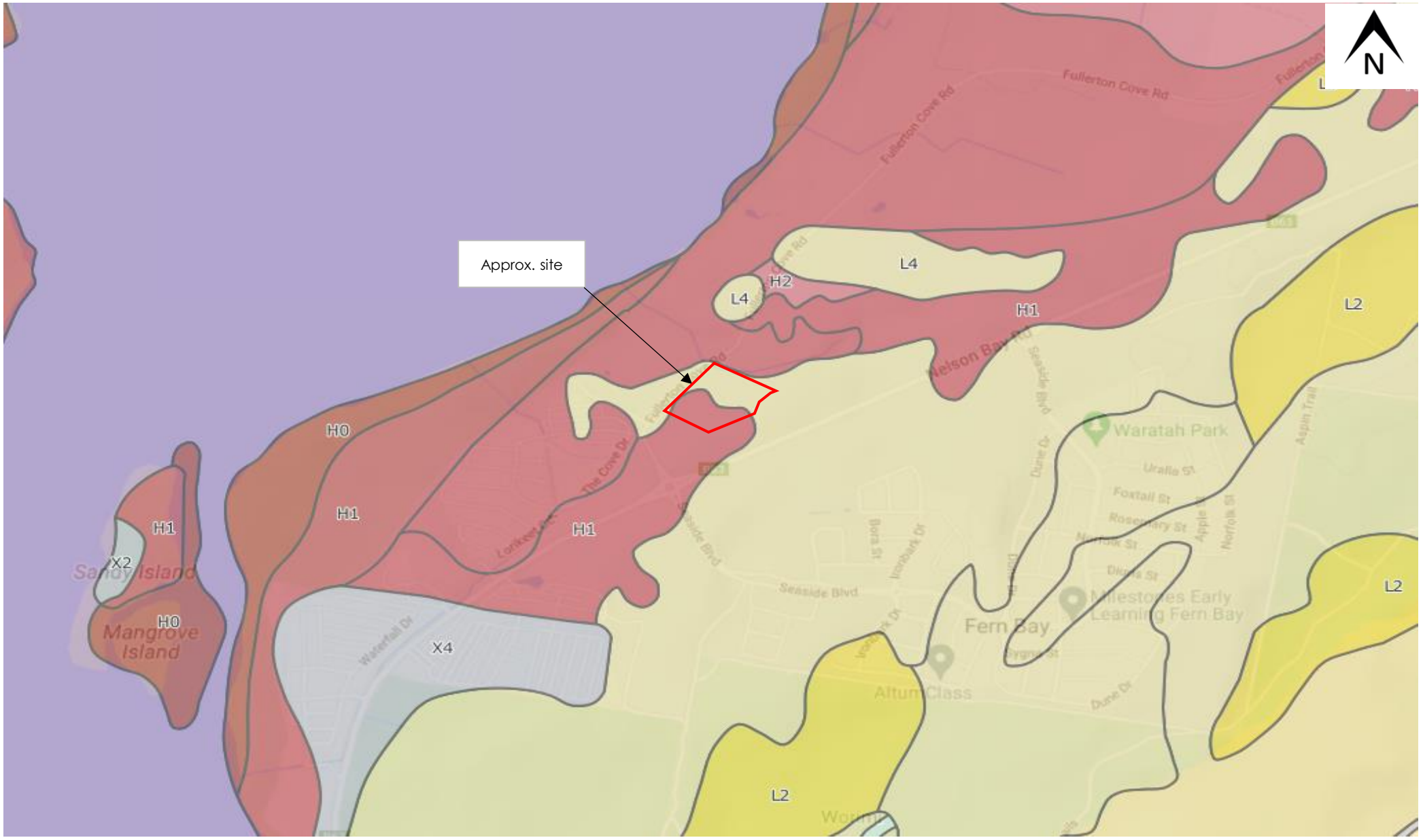
LANDFORM PROCESS CLASS	LANDFORM ELEMENT	PROBABILITY CLASS DESCRIPTION	MAP COLOUR	ELEVATION CODE (with elevation range included in map unit)	ESTIMATED DEPTH TO ACID SOIL MATERIALS DESCRIPTION
A ___ Alluvial E ___ Estuarine W ___ Aeolian B ___ Beach D ___ Disturbed Terrain N ___ No Known Occurence	a ___ Sandplain b ___ Backplain d ___ Dune i ___ Intertidal Flat k ___ Backswamp l ___ Levee m ___ Bottom Sediments n ___ Channel p ___ Plain r ___ Interbarrier Swamp s ___ Swamp t ___ Levee Toe u ___ Supratidel Flat w ___ Swale	HIGH PROBABILITY High probability of occurence of Acid Sulfate materials within the soil profile. The environment of deposition has been suitable for the formation of Acid Sulfate Soil materials. Acid Sulfate Soil materials are widespread or sporadic and may be buried by alluvium or windblown sediments.		Bottom Sediments <0 (<0m AHD) 0 (0-0.5m AHD) 0.5 (0.5-1m AHD) 1 (1-2m AHD) 2 (2-4m AHD) 4 (>4m AHD)	Bottom Sediments At or near ground surface At or near ground surface Within 0.5m of the ground surface Within 1m of the ground surface Between 1 and 3m below the ground surface Greater than 3m below the ground surface
		LOW PROBABILITY Low probability of occurence of Acid Sulfate materials within the soil profile. The environment of deposition has generally not been suitable for the formation of Acid Sulfate Soil materials. Acid Sulfate Soil materials, if present, sporadic and may be buried by alluvium or windblown sediments.		Bottom Sediments <0 (<0m AHD) 0 (0-0.5m AHD) 0.5 (0.5-1m AHD) 1 (1-2m AHD) 2 (2-4m AHD) 4 (>4m AHD)	Bottom Sediments At or near ground surface At or near ground surface Within 0.5m of the ground surface Within 1m of the ground surface Between 1 and 3m below the ground surface Greater than 3m below the ground surface

ADDITIONAL CODES: Disturbed Terrain ..... No Known Occurence .....

ADDITIONAL DESCRIPTIVE CODES: Pleistocene ..... (p) Acidic Scald ..... (s)

Qualtest LABORATORY (NSW) PTY LTD

Client:	CANAAN PD 2 PTY LTD C/- MONTEATH & POWYS PTY LTD	Drawing No:	FIGURE 3
Project:	ACID SULFATE SOIL MANAGEMENT PLAN	Project No:	NEW20P-0178-AD
Location:	42 FULLERTON COVE ROAD, FULLERTON COVE NSW	Scale:	N.T.S.
Title:	DECC (2008) LOWER HUNTER RISK MAPPING	Date:	31/05/2024



Client:	CANAAN PD 2 PTY LTD C/- MONTEATH & POWYS PTY LTD	Drawing No:	FIGURE 4
Project:	ACID SULFATE SOIL MANAGEMENT PLAN	Project No:	NEW20P-0178-AD
Location:	42 FULLERTON COVE ROAD, FULLERTON COVE NSW	Scale:	N.T.S.
Title:	ASS RISK MAPS (eSpade)	Date:	31/05/2024

Qualtest LABORATORY (NSW) PTY LTD

Qualtest
LABORATORY (NSW) PTY LTD

Client:	CANAAN PD 2 PTY LTD C/- MONTEATH & POWYS PTY LTD	Drawing No:	FIGURE 5
Project:	ACID SULFATE SOIL MANAGEMENT PLAN	Project No:	NEW20P-0178-AD
Location:	42 FULLERTON COVE ROAD, FULLERTON COVE NSW	Scale:	N.T.S.
Title:	ASS CLASS MAP - PORT STEPHENS LEP	Date:	31/05/2024

APPENDIX B:

Laboratory Reports

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Qualtest	Project №	NEW20P-0178	Project Manager	Libby Betz
Address	8 Ironbark Close Warabrook NSW 2304	Project Name	ASS testing Fullerton Cove	EDD Format (ESdat, EQuIS etc)	Excel
Contact Name	Libby Betz				
Phone №					
Special Directions					
Purchase Order					
Quote ID №					

Sampler(s)	Steph Cullen				
Handed over by					
Email for Invoice	accounts@qualtest.com.au				
Email for Results	libbybetz@qualtest.com.au emmacoleman@qualtest.com.au stephcullen@qualtest.com.au billynow@qualtest.com				

Analyses
Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing

Containers
Change container type & size if necessary

Required Turnaround Time (TAT)
Default will be 5 days if not ticked.

♦Surcharge will apply
☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☐ 3 days♦
☑ 5 days (Standard)
☒ Other due 15/02/21

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Chromium Reducible Sulfur Suite	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
11	BH01 0.0-0.1	8/02/21	soil									1	
12	BH01 0.4-0.5	8/2/21	soil									1	
13	BH01 1.0-1.1	8/2/21	soil									1	
14	BH01 1.4-1.5	8/2/21	soil									1	
15	BH01 1.9-2.0	8/2/21	soil									1	
16	BH02 0.0-0.1	8/2/21	soil									1	
17	BH02 0.4-0.5	8/2/21	soil	X								1	
18	BH02 1.0-1.1	8/2/21	soil	X								1	
19	BH02 1.5-1.6	8/2/21	soil									1	
20	BH02 1.6-1.7	8/2/21	soil									1	
	Total Counts			2								10	

#773055

Method of Shipment ☐ Courier (#) ☐ Hand Delivered ☐ Postal Name Signature Date Time

Laboratory Use Only											
Received By	Andrew Black	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date	8/2/21	Time	3:20pm	Temperature	10°c
Received By		SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature		Date		Time		Report №	

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☐ Sydney Laboratory
Unit F3 Bld.F 16 Mars Road Lane Cove West NSW 2066
02 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1 21 Smallwood Place Murarrie QLD 4172
07 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
Unit 2 91 Leach Highway Kewdale WA 6105
08 9251 9600 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
03 8564 5000 EnviroSampleVic@eurofins.com

Company	Qualtest	Project №	NEW20P-0178	Project Manager	Libby Betz
Address	8 Ironbark Close Warabrook NSW 2304	Project Name	ASS testing Fullerton Cove	EDD Format (ESdat, EQuIS etc)	excel
Contact Name	Libby Betz				
Phone №					
Special Directions					
Purchase Order					
Quote ID №					

Sampler(s)	Steph Cullen
Handed over by	
Email for Invoice	accounts@qualtest.com.au
Email for Results	libbybetz@qualtest.com.au emmacoleman@qualtest.com.au stephcullen@qualtest.com.au billynow@qualtest.com

Analyses Where metals are requested, please specify "Total" or "Filtered". SUITE code must be used to attract SUITE pricing.

Containers Change container type & size if necessary.

Required Turnaround Time (TAT) Default will be 5 days if not ticked.

♦Surcharge will apply
- ☐ Overnight (reporting by 9am)♦
- ☐ Same day♦ ☐ 1 day♦
- ☐ 2 days♦ ☐ 3 days♦
- ☑ 5 days (Standard)
- ☒ Other (due 15/02/21)

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	Chromium Reducible Sulfur Suite	500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
11	BH03 0.0-0.1	8/02/21	soil									1	
12	BH03 0.4-0.5	8/2/21	soil									1	
13	BH03 1.0-1.1	8/2/21	soil	X								1	
14	BH03 1.5-1.6	8/2/21	soil									1	
15	BH03 1.7-1.8	8/2/21	soil									1	
16													
17													
18													
19													
20													
	Total Counts			1								5	

Method of Shipment ☐ Courier (# ☐ Hand Delivered ☐ Postal Name Signature Date Time

Laboratory Use Only							
Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Temperature		
Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Report №		

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Site # 1254 & 14271

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NATA # 1261 Site # 18217

Brisbane
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NATA # 1261
Site # 23736

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IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Sample Receipt Advice

Company name:	Qualtest
Contact name:	Libby Betz
Project name:	ASS TESTING FULLERTON COVE
Project ID:	Not provided
Turnaround time:	5 Day
Date/Time received	Feb 8, 2021 3:20 PM
Eurofins reference	773055

Sample Information

✓	A detailed list of analytes logged into our LIMS, is included in the attached summary table.
✓	All samples have been received as described on the above COC.
✓	COC has been completed correctly.
✓	Attempt to chill was evident.
✓	Appropriately preserved sample containers have been used.
✓	All samples were received in good condition.
✓	Samples have been provided with adequate time to commence analysis in accordance with the relevant holding times.
✓	Appropriate sample containers have been used.
✓	Sample containers for volatile analysis received with zero headspace.
X	Split sample sent to requested external lab.
X	Some samples have been subcontracted.
N/A	Custody Seals intact (if used).

Notes

MISSING SAMPLES 'BH01 1.0-1.1' AND 'BH01 1.9-2.0'. RECEIVED EXTRA SAMPLES 'TP01 1.9-2.0', 'TP02 0.0-0.1', 'TP02 0.4-0.5', 'TP02 0.6-0.7' AND 'BH01 0.9-1.0'; LOGGED ON HOLD.

Contact

If you have any questions with respect to these samples, please contact your Analytical Services Manager:

Andrew Black on phone : (+61) 2 9900 8490 or by email: AndrewBlack@eurofins.com

Results will be delivered electronically via email to Libby Betz - libbybetz@qualtest.com.au.

Global Leader - Results you can trust

Qualtest
8 Ironbark Close
Warabrook
NSW 2304

NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.

Attention: **Libby Betz**

Report **773055-S**
Project name ASS TESTING FULLERTON COVE
Received Date Feb 08, 2021

Client Sample ID			**BH02 0.4-0.5**	**BH02 1.0-1.1**	**BH03 1.0-1.1**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**B21-Fe20241**	**B21-Fe20242**	**B21-Fe20243**
Date Sampled			**Feb 08, 2021**	**Feb 08, 2021**	**Feb 08, 2021**
Test/Reference	LOR	Unit			
Chromium Suite					
pH-KCL	0.1	pH Units	5.3	5.9	5.8
Acid trail - Titratable Actual Acidity	2	mol H+/t	15	6.5	2.5
sulfidic - TAA equiv. S% pyrite	0.003	% pyrite S	0.024	0.010	0.004
Chromium Reducible Sulfur[S04]	0.005	% S	< 0.005	< 0.005	< 0.005
Chromium Reducible Sulfur -acidity units	3	mol H+/t	< 3	< 3	< 3
Sulfur - KCl Extractable	0.02	% S	n/a	n/a	n/a
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0
HCl Extractable Sulfur	0.02	% S	n/a	n/a	n/a
Net Acid soluble sulfur	0.02	% S	n/a	n/a	n/a
Net Acid soluble sulfur - acidity units	10	mol H+/t	n/a	n/a	n/a
Net Acid soluble sulfur - equivalent S% pyrite[S02]	0.02	% S	n/a	n/a	n/a
Acid Neutralising Capacity (ANCbt)	0.01	% CaCO3	n/a	n/a	n/a
Acid Neutralising Capacity - acidity (a-ANCbt)	2	mol H+/t	n/a	n/a	n/a
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)[S03]	0.02	% S	n/a	n/a	n/a
ANC Fineness Factor		factor	1.5	1.5	1.5
CRS Suite - Net Acidity (Sulfur Units)	0.02	% S	0.02	< 0.02	< 0.02
CRS Suite - Net Acidity (Acidity Units)	10	mol H+/t	15	< 10	< 10
CRS Suite - Liming Rate[S01]	1	kg CaCO3/t	1.1	< 1	< 1
Extraneous Material					
<2mm Fraction	0.005	g	120	84	160
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1
% Moisture	1	%	7.2	23	7.4

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Feb 13, 2021	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Feb 13, 2021	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Feb 15, 2021	14 Days
- Method: LTM-GEN-7080 Moisture			

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NATA # 1261 Site # 20794

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Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

Newcastle
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IANZ # 1327

Christchurch
43 Detroit Drive
Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Qualtest
Address: 8 Ironbark Close
Warabrook
NSW 2304

Project Name: ASS TESTING FULLERTON COVE

Order No.:
Report #: 773055
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: Feb 8, 2021 3:20 PM
Due: Feb 15, 2021
Priority: 5 Day
Contact Name: Libby Betz

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Chromium Reducible Sulfur Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**			
1	BH02 0.4-0.5	Feb 08, 2021		Soil	B21-Fe20241		X	X
2	BH02 1.0-1.1	Feb 08, 2021		Soil	B21-Fe20242		X	X
3	BH03 1.0-1.1	Feb 08, 2021		Soil	B21-Fe20243		X	X
4	BH01 0.0-0.1	Feb 08, 2021		Soil	B21-Fe20244	X		
5	BH01 0.4-0.5	Feb 08, 2021		Soil	B21-Fe20245	X		
6	BH01 1.4-1.5	Feb 08, 2021		Soil	B21-Fe20247	X		
7	BH02 0.0-0.1	Feb 08, 2021		Soil	B21-Fe20249	X		
8	BH02 1.5-1.6	Feb 08, 2021		Soil	B21-Fe20250	X		
9	BH02 1.6-1.7	Feb 08, 2021		Soil	B21-Fe20251	X		
10	BH03 0.0-0.1	Feb 08, 2021		Soil	B21-Fe20252	X		

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Phone : 0800 856 450
IANZ # 1290

Company Name: Qualtest
Address: 8 Ironbark Close
Warabrook
NSW 2304

Project Name: ASS TESTING FULLERTON COVE

Order No.:
Report #: 773055
Phone: 02 4968 4468
Fax: 02 4960 9775

Received: Feb 8, 2021 3:20 PM
Due: Feb 15, 2021
Priority: 5 Day
Contact Name: Libby Betz

Eurofins Analytical Services Manager : Andrew Black

Sample Detail						HOLD	Chromium Reducible Sulfur Suite	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271								
Sydney Laboratory - NATA Site # 18217								
Brisbane Laboratory - NATA Site # 20794						X	X	X
Perth Laboratory - NATA Site # 23736								
Mayfield Laboratory								
External Laboratory								
11	BH03 0.4-0.5	Feb 08, 2021		Soil	B21-Fe20253	X		
12	BH03 1.5-1.6	Feb 08, 2021		Soil	B21-Fe20254	X		
13	BH03 1.7-1.8	Feb 08, 2021		Soil	B21-Fe20255	X		
14	TP01 1.9-2.0	Feb 08, 2021		Soil	B21-Fe21004	X		
15	'TP02 0.0-0.1	Feb 08, 2021		Soil	B21-Fe21005	X		
16	TP02 0.4-0.5	Feb 08, 2021		Soil	B21-Fe21006	X		
17	TP02 0.6-0.7	Feb 08, 2021		Soil	B21-Fe21007	X		
18	BH01 0.9-1.0	Feb 08, 2021		Soil	B21-Fe21008	X		
Test Counts						15	3	3

eurofins | Environment Testing

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram | **mg/L:** milligrams per litre | **ug/L:** micrograms per litre

ppm: Parts per million | **ppb:** Parts per billion | **%:** Percentage

org/100mL: Organisms per 100 millilitres | **NTU:** Nephelometric Turbidity Units | **MPN/100mL:** Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Chromium Suite							
pH-KCL	%	96			80-120	Pass	
Acid trail - Titratable Actual Acidity	%	91			80-120	Pass	
Chromium Reducible Sulfur	%	97			80-120	Pass	
Acid Neutralising Capacity (ANCbt)	%	99			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Chromium Suite				Result 1	Result 2	RPD			
pH-KCL	B21-Fe20241	CP	pH Units	5.3	5.3	<1	30%	Pass	
Acid trail - Titratable Actual Acidity	B21-Fe20241	CP	mol H+/t	15	15	<1	30%	Pass	
sulfidic - TAA equiv. S% pyrite	B21-Fe20241	CP	% pyrite S	0.024	0.024	<1	30%	Pass	
Chromium Reducible Sulfur	B21-Fe20241	CP	% S	< 0.005	< 0.005	<1	30%	Pass	
Chromium Reducible Sulfur -acidity units	B21-Fe20241	CP	mol H+/t	< 3	< 3	<1	30%	Pass	
Sulfur - KCl Extractable	B21-Fe20241	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur	B21-Fe20241	CP	% S	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - acidity units	B21-Fe20241	CP	mol H+/t	n/a	n/a	n/a	30%	Pass	
Net Acid soluble sulfur - equivalent S% pyrite	B21-Fe20241	CP	% S	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity (ANCbt)	B21-Fe20241	CP	% CaCO3	n/a	n/a	n/a	30%	Pass	
Acid Neutralising Capacity - equivalent S% pyrite (s-ANCbt)	B21-Fe20241	CP	% S	n/a	n/a	n/a	30%	Pass	
ANC Fineness Factor	B21-Fe20241	CP	factor	1.5	1.5	<1	30%	Pass	
CRS Suite - Net Acidity (Sulfur Units)	B21-Fe20241	CP	% S	0.02	0.02	n/a	30%	Pass	
CRS Suite - Net Acidity (Acidity Units)	B21-Fe20241	CP	mol H+/t	15	15	n/a	30%	Pass	
CRS Suite - Liming Rate	B21-Fe20241	CP	kg CaCO3/t	1.1	1.1	<1	30%	Pass	
Duplicate									
				Result 1	Result 2	RPD			
% Moisture	B21-Fe20241	CP	%	7.2	7.3	1.0	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) 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/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Andrew Black	Analytical Services Manager
Myles Clark	Senior Analyst-SPOCAS (QLD)

Glenn Jackson
General Manager

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

APPENDIX C:

Borehole Logs

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: BH01

CLIENT: CHRISTINE JORDAN C/O MONTEATH AND POWYS **PAGE:** 1 OF 1

PROJECT: MS CHRISTINE JORDAN PROPOSED REZONING FULLERTON COVE **JOB NO:** NEW20P-0178

LOCATION: 42 FULLERTON COVE ROAD, FULLERTON COVE **LOGGED BY:** SC

DATE: 8/2/21

DRILL TYPE: **SURFACE RL:** **COORDINATE SYSTEM:**

BOREHOLE DIAMETER: **DATUM:** AHD **EASTING:** **NORTHING:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Not Encountered	E 0.10m					TOPOSIL: SAND - fine to medium graine, dark brown to grey, rootlets, trace gravel.					TOPSOIL / FILL
							0.30m SAND - fine to medium grained, light brown to grey.					ALLUVIAL
		0.40m E 0.50m		0.5			Becoming dark grey in colour.					
		1.00m E 1.10m		1.0			Becoming light grey in colour.					
		1.40m E 1.50m		1.5								
		1.90m E 2.00m					2.00m Hole Terminated at 2.00 m Limit Of Required Investigation					

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: BH02

CLIENT: CHRISTINE JORDAN C/O MONTEATH AND POWYS **PAGE:** 1 OF 1

PROJECT: MS CHRISTINE JORDAN PROPOSED REZONING FULLERTON COVE **JOB NO:** NEW20P-0178

LOCATION: 42 FULLERTON COVE ROAD, FULLERTON COVE **LOGGED BY:** SC

DATE: 8/2/21

DRILL TYPE: **SURFACE RL:** **COORDINATE SYSTEM:**

BOREHOLE DIAMETER: **DATUM:** AHD **EASTING:** **NORTHING:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Drilled Over Water	E 0.10m					TOPSOIL / FILL: SAND - fine to medium grained, grey white, some rootlets.					FILL
							0.15m FILL: SAND - fine to medium grained, orange yellow.					
		0.40m					0.40m Clayey SAND - fine to medium grained, dark grey, fines of low plasticity.					ALLUVIAL
		E 0.50m		0.5				D				
							0.60m SAND - fine to medium grained, orange brown.					
							Becoming grey and orange in colour.	M				
							Getting wetter.					
		1.00m		1.0								
		E 1.10m					1.10m Sandy CLAY - medium to high plasticity, dark grey, fine to medium grained sand.					
							1.45m SAND - fine to medium grained, dark grey to brown.	W				
		1.50m		1.5								
		E 1.60m										
		E 1.70m					1.70m Hole Terminated at 1.70 m Sides collapsing as per water content					

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
B	Bulk Sample

Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
HP	Hand Penetrometer test (UCS kPa)

Consistency		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Moisture Condition	
D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit

Density		
V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

ENGINEERING LOG - HAND AUGER

HAND AUGER NO: BH03

CLIENT: CHRISTINE JORDAN C/O MONTEATH AND POWYS **PAGE:** 1 OF 1

PROJECT: MS CHRISTINE JORDAN PROPOSED REZONING FULLERTON COVE **JOB NO:** NEW20P-0178

LOCATION: 42 FULLERTON COVE ROAD, FULLERTON COVE **LOGGED BY:** SC

DATE: 8/2/21

DRILL TYPE: **SURFACE RL:** **COORDINATE SYSTEM:**

BOREHOLE DIAMETER: **DATUM:** AHD **EASTING:** **NORTHING:**

Drilling and Sampling					Material description and profile information					Field Test		
METHOD	WATER	SAMPLES	RL (m)	DEPTH (m)	GRAPHIC LOG	CLASSIFICATION SYMBOL	MATERIAL DESCRIPTION: Soil type, plasticity/particle characteristics,colour,minor components	MOISTURE CONDITION	CONSISTENCY DENSITY	Test Type	Result	Structure and additional observations
HA	Drilled Over Water	E 0.10m					TOPSOIL: SAND - fine to medium grained, white grey, some rootlets.	D				TOPSOIL
							0.20m SAND - fine to medium grained, brown grey.					ALLUVIAL
		0.40m										
		E 0.50m		0.5				M				
		1.00m		1.0								
		E 1.10m					Becoming dark grey.					
		1.50m		1.5				M - W				
		E 1.60m						W				
		1.70m										
		E 1.80m					1.80m Hole Terminated at 1.80 m Sides collapsing as per water content					

LEGEND:

Water

- Water Level (Date and time shown)
- Water Inflow
- Water Outflow

Strata Changes

- Gradational or transitional strata
- Definitive or distict strata change

Notes, Samples and Tests

U_{50}	50mm Diameter tube sample
CBR	Bulk sample for CBR testing
E	Environmental sample (Glass jar, sealed and chilled on site)
ASS	Acid Sulfate Soil Sample (Plastic bag, air expelled, chilled)
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Field Tests

PID	Photoionisation detector reading (ppm)
DCP(x-y)	Dynamic penetrometer test (test depth interval shown)
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Consistency

		UCS (kPa)
VS	Very Soft	<25
S	Soft	25 - 50
F	Firm	50 - 100
St	Stiff	100 - 200
VSt	Very Stiff	200 - 400
H	Hard	>400
Fb	Friable	

Density

V	Very Loose	Density Index <15%
L	Loose	Density Index 15 - 35%
MD	Medium Dense	Density Index 35 - 65%
D	Dense	Density Index 65 - 85%
VD	Very Dense	Density Index 85 - 100%

Moisture Condition

D	Dry
M	Moist
W	Wet
W_p	Plastic Limit
W_L	Liquid Limit