TETRA TECH COFFEY

Unit 4, 60 Griffiths Road
Lambton
NSW 2299 Australia

t: +61 2 4028 9700

tetratechcoffey.com

18 October 2022

Our ref: 754-NTLGE293239-AD

Hunter Street JV Co Pty Ltd.
3/ 8 Windmill Street
Millers Point
NSW 2000

Attention: Luke McNamara – Development Manager

Dear Luke,

Acid Sulfate Soil Management Plan - 711 Hunter Street, Newcastle West NSW, 2302

1. INTRODUCTION

1.1 OVERVIEW

This Acid Sulfate Soil Management Plan (ASSMP) has been prepared by Tetra Tech Coffey Pty Ltd. (Tetra Tech) on behalf of Hunter Street JV Co Pty Ltd. (the applicant). It accompanies a Statement of Environmental Effects (SEE) in support of a Development Application (DA) at 711 Hunter Street, Newcastle West (the Site).

Based on the findings from the Geotechnical Investigation (currently being completed), Acid Sulfate Soils (ASS) have been assessed at depth and will need to be managed during construction. The ASSMP provides the applicant and their contractors with ASS management protocols for use during the earthworks proposed for the redevelopment at the Site. This ASSMP presents the approach and methodology for ASS management at the site to be followed by Council and its subcontractors. This report provides a basis for specifications for ASS management. However, it is important to note that this document is not a specification.

The objective of the ASSMP is to lower the potential environmental impacts associated with the disturbance of ASS during the proposed excavations. The ASSMP was developed generally in accordance with the Acid Sulfate Soils Management Advisory Committee (1998) Acid Sulfate Soil Manual (ASSMAC 1998) and the National Acid Sulfate Soils Sampling and Identification Methods Manual (Sullivan et al 2018).

The development has undergone an Architectural Design Competition where three competitors put forward their designs in accordance with the brief. The Plus Architecture scheme was recommended by the Jury as the winning scheme in the competitive design process. The overall outcome of the proposal aims to develop a mixed-use precinct with high quality tower forms providing a positive relationship to the immediate surrounds and acknowledging the surrounding heritage context. The proposal intends to act as a landmark for Newcastle West with a curated mix of eclectic and creative retail, F&B and commercial opportunities activating the ground levels.

The key features are summarised below:

- Demolition of the existing commercial premises and ancillary structures on site.

- Construction of a mixed-use precinct, forming active ground and podium levels reaching 5 storeys of retail and commercial tenancies; with two tower forms for residential apartments reaching 26 storeys comprising 258 apartments
- Podium level car park for 300 cars incorporated within the podium levels.
- Communal open space for residents located on level 5 and 17.
- Vehicle access to the site via Little King Street.
- Associated landscaping with the public domain improvements.
- An urban plaza fronting National Park Street providing opportunities for activation and public art.
- Construction of ancillary infrastructure and utilities as required.

It is noted the overall development will form two separate Das. Stage 1 will form the northern tower and podium elements and Stage 2 will form the southern tower and podium elements. These separate DA components are explored further below.

1.1.1 Stage 1

The northern tower will include commercial and retail tenancies at ground level which will be accessible via National Park Street, Little King Street and Hunter Street. The podium levels will be situated above ground and contain car parking for both visitors and residents, accessed via Little King Street. Level 5 to Level 25 will contain a mixture of residential apartments ranging from 1 bedroom to 3 bedrooms.

A numerical breakdown of Stage 1 is shown below:

- 136 apartments including 35 one bedroom, 74 two bedroom, 26 three bedroom and 1 four bedroom.
- Total gross floor area (GFA) 13,581m^2
- Floor space ratio: 5.41:1
- Total car parking spaces 165 spaces over four podium levels

1.1.2 Stage 2

The southern tower will include commercial and retail tenancies at ground level which will be accessible via National Park Street, Little King Street and Hunter Street. The podium levels will be situated above ground and contain car parking for both visitors and residents, accessed via Little King Street. Level 5 to Level 25 will contain a mixture of residential apartments ranging from 1 bedroom to 3 bedrooms.

A numerical breakdown of Stage 1 is shown below:

- 122 apartments including 35 one bedroom, 72 two bedroom and 15 three bedroom.
- Total gross floor area (GFA) 12,027m^2.
- Floor space ratio: 5.43:1
- Total car parking spaces 135 spaces over four podium levels.

Both stages will include surrounding landscaping, public domain works and green spaces, The strata and stratum approach are detailed further in the SEE.

This report must be read in conjunction with the attached sheet entitled "*Important Information about your Tetra Tech Coffey Environmental Report*", which can be found at the end of this report.

2. SITE AND REGIONAL INFORMATION

A summary of Site and regional information is summarised below in Table 2.1.

Table 2.1: Site and Regional Information

Site Address	711 Hunter Street, Newcastle West, NSW, 2302
Title Identification Details	as Lot 1 DP867617
Site Area	4,724m^2
Boundaries	The site has frontages of 48m to Hunter Street to the north, 113m to National Park Street to the east and 43m to King Street to the south
Heritage Significance	Not identified as a heritage item but is adjoining an identified local heritage item to the south-west, namely the Army Drill Hall (I508) located at 498 King Street and is diagonally adjacent to the Bank Corner which is a locally listed heritage item located at 744 Hunter Street. The site is also located within the Newcastle City Centre Heritage Conservation Area
Site Topography and Drainage	Reference to the online NSW eSpade v2.2 database describes the topography of the area within the Soil Landscapes as "Level to undulating, broad (to 5 km), well-drained sand plain. Slope gradients are commonly <2%. Elevation is up to 12 m above sea level. Occasional low dunes occur, for example, at Cooks Hill. Hunter Street was constructed on reclaimed land with fill over natural sand plain sediments. During the site walkover, the general slope along National Park Street was observed to be generally flat with minimal elevation change. It is anticipated that surface water over Site would drain to the municipal stormwater system. Stormwater likely discharges into the Hunter River, located to the north of the Site and Newcastle Harbour located about 1.5km to the NE.
Regional Geology	A review of the 1:100,000 Newcastle Coalfields Geological Map indicates that the site is underlain by Quaternary Alluvium comprising sands, silts, clays and gravels which overlies the Newcastle Coal Measures.
Acid Sulfate Soils	Reference to the online NSW eSpade v2.2 database identified the Site to be located in an area with an ASS probability classification of L4: Low probability, >3 m below ground surface. The Newcastle Local Environmental Plan 2012 identified the land as Acid Sulfate Soils Class 4 requiring development consent for *"Works more than 2 metres below the natural ground surface."* and *"Works by which the watertable is likely to be lowered more than 2 metres below the natural ground surface"*.
Hydrogeology	Groundwater beneath the site is anticipated be present in alluvial soils at a depth of about 1.5m to 2.0m below ground surface (bgs). Given that the site is located close to Newcastle Harbour and the Hunter River, it is anticipated that groundwater would flow off-site towards the south-southwest and discharge to Newcastle Harbour. A search of the online WaterNSW All Groundwater Map identified 19 registered groundwater bores located within a 500m radius of the Site. The search results summary show that standing water levels within the area ranges from 1.19 to 4mbgs.

3. ACID SULFATE SOIL ASSESSMENT

The ASS assessment was undertaken in conjunction with the Geotechnical Investigation, which is reported within Tetra Tech (2022) Preliminary Geotechnical Report, Proposed Mixed-Use Tower Development - 711 Hunter Street, Newcastle West NSW (Reference No. 754-NTLGE293239-AC, Report Pending). A summary of the fieldworks relevant to the ASS assessment is provided below in Table 3.1.

Table 3.1: ASS Assessment

Fieldworks	A summary of the fieldworks undertaken relevant to the ASS assessment component is as follows: • Samples collected for ASS assessment were taken at borehole BH22-03, (identified as BH03) which is located within the south-eastern portion of the Site. • Borehole BH03 was drilled between 24/08/2022 to 1/09/2022. • Sampling was undertaken in conjunction with the geotechnical investigation and samples were taken in 1m to 1.5m depth intervals along with Standard Penetration Testing (SPT) samples. • Logging of soils encountered in each bore was completed in accordance with the Unified Soil Classification System (USCS). • Borehole locations were surveyed with a handheld GPS unit. • Samples were collected directly into zip-lock plastic bags, which were completely filled, and any residual oxygen forced out. Samples were placed directly into an ice filled cooler while in the field and transported to Tetra Tech's Lambton office where they were stored within a freezer to preserve the samples prior to being forwarded to the laboratory.
Field Geological Observations	Site specific geology, recorded within borehole BH03 included: • **Wearing Course** (0.0 to 0.13m) - Concrete. • **Fill** - (0.13 to 1.0m) - clayey sand, fine grained with gravels, coarse sub-angular with silt, black to dark grey colour, with some rounded cobbles. • **Estuarine (**1.0 to12.5m) - Silty SAND: fine, medium grained sand with trace peat, dark grey to brown colour, wet, very loose consistency • **Alluvial/ Estuarine** (12.5 to 31.5m) - Silty Clay, sandy CLAY, medium to high plasticity, dark grey, grey, pale brown to orange, orange to red colour with trace decomposed wood, iron oxide, weathered claystone, shell inclusions (19.3 to 20.5m) • **Residual** (31.5 to 39.3m) - Sandy CLAY, medium to high plasticity, pale blue to purple, black to dark grey colour with iron oxide staining with fine to coarse angular to sub-angular gravels with claystone. Borehole log sheet for BH03, is presented within the Attachments (LOG SHEETS PENDING).
Laboratory Analysis	Nineteen soil samples were collected as part of the ASS assessment were forwarded to ALS Environmental a National Association of Testing Authority (NATA) accredited laboratory. Samples were analysed for the following: • pH Screening (pH_F and pH_{FOX}). • Chromium reduced Sulfur suite. Note: Samples were stored within Tetra Tech's freezer for a period of 15 to 24 days prior to being forward to the laboratory for analysis. As the samples were frozen during this period and were then transported to the laboratory within 48 hours, minimal oxidisation would be expected and samples would still be considered usable for the assessment of ASS potential.

4. ASSESSMENT CRITERIA

Depending on the amount of soils disturbed during the project, future results will need to be compared to the appropriate criteria listed below. If there is doubt about the amount of soil to be disturbed, the more conservative criteria should be adopted. The action criteria provided in the ASSMAC 1998 Acid Soil Manual are summarised in Table 4.1.

Table 4.1: Acid Sulfate Soil Action Criteria

Soil Texture	Approximate Clay Content (%)	Action Criteria (<1000 tonnes)1		Action Criteria (>1000 tonnes)2	
		Sulfur Trail Net Acidity (S_{POS} or S_{CR}) (%)	Acid Trail Net Acidity TAA, TPA or TSA (mol H^+/tonne)	Sulfur Trail Net Acidity (S_{POS} or S_{CR}) (%)	Acid Trail Net Acidity TAA, TPA or TSA (mol H^+/tonne)
Coarse	<5%	0.03	18	0.03	18
Medium	5% to 40%	0.06	36	0.03	18
Fine	>40%	0.1	62	0.03	18

***Notes**:*
1 - Action criteria where less than 1000 tonnes of ASS is to be disturbed
2 - Action criteria where greater than 1000 tonnes of ASS is to be disturbed
Net Acidity calculated using acid base accounting
S_{POS} = Peroxide oxidisable sulphur, S_{CR} = Chromium reducible sulphur, TAA = Total Actual Acidity, TPA = Total Potential Acidity, TSA = Total Sulfidic Acidity

To assess the potential for acid sulfate soils at the site, field pH screening was completed in accordance with Appendix 1 of the NSW ASSMAC (1998) *Acid Sulfate Soil Manual* (ASSMAC). Results of the pH screening were compared against Section 2.2 of the ASSMAC (1998). The ASSMAC (1998) assessment guidelines in Appendix 1 state the following:

- A pH less than or equal to 4 is likely to indicate the presence of Actual Acid Sulfate Soils (AASS) when soil is added to a mixture with a ratio of 1:5 with distilled water; and
- A final pH_{FOX} of less than 3, strong sulphuric odour and colour change can be indicative of Potential Acid Sulfate Soils (PASS) when soil is added to a mixture with a ratio of 1:5 with hydrogen peroxide. Based on experience, a final pH_{FOX} of 3.5 has been adopted for screening purposes.

5. RESULTS

5.1 ACID SULFATE SOIL SCREENING

A summary of the analytical results is presented in Table LR1 of the Attachments. The laboratory reports are also included within the Attachments.

The results of the laboratory analysis of the ASS samples collected during the most recent site assessment indicated the following:

- Samples in a 1:5 mixture with distilled water were recorded at a pH of between 5.8 and 9.0 pH Units. A pH less than or equal to 4 is likely to indicate the presence of Actual Acid Sulfate Soils (AASS).
- Samples in a 1:5 mixture with water and hydrogen peroxide (30%) recorded a final pH ranging between 1.6 and 8.1 pH units. Moderate to extreme reactions after oxidation in hydrogen peroxide were recorded for the samples. A final pH of less than 3.5 can be indicative of Potential Acid Sulfate Soils (PASS).

- The total pH drop was in the range of 0.5 to 6.8 pH units. A pH drop of more than 1 unit, plus temperature, effervescence, colour and odour factors can be indicative of PASS.

The field screening results indicated that there was a high probability of ASS being encountered in the estuarine soils from approximately 2m to about 20.5m depth. In order to confirm the screening results, five samples were further analysed using the chromium reducible sulphur suite (SCR).

5.2 LABORATORY RESULTS

A summary of ASS laboratory results are summarised in Table LR1 of the Attachments. The laboratory reports are also included within the Attachments.

The results of the laboratory analysed samples were compared to the action criteria provided in the ASSMAC (1998) Acid Sulfate Soils Manual, based on less than 1,000 tonnes of coarse texture soils to be disturbed. The results have been summarised below in Table 5.1. NATA endorsed laboratory reports are included within the Attachments.

Table 5.1: Summary of ASS Laboratory Results

Depth (mbgs)	pH KCL	TAA (moles/ tonne)	%SCR	Net Acidity (moles/ tonne)
2	4.8	**58**	**0.157**	**156**
5.5	5.3	8	**0.222**	**146**
8.5	6.4	<2	**0.128**	**80**
11.5	5.8	2	**0.396**	**250**
19	7.8	<2	**1.74**	**827**
Action Criteria	**-**	**18**	**0.03**	**18**

Notes
KCl: potassium chloride solution; TAA: titratable actual acidity; SCR: chromium reducible sulfur.
Bold values exceed the action criteria.

Based on the above results it is assessed that soils are hypersulfidic acid sulfate soils (or potential ASS)).

The samples were collected from 24 August to 1 September, analysed for pH_F and pH_{FOX} on 21 September 2022 and then analysed for Chromium Reduced Sulfur (S_{CR}) on 4 October 2022. Whilst the samples were kept frozen for the majority of this time, there is a risk that some samples could have begun oxidising. A factor of safety of ≥1.5 will be used in liming calculations, to account for the potential for under estimation of the net acidity.

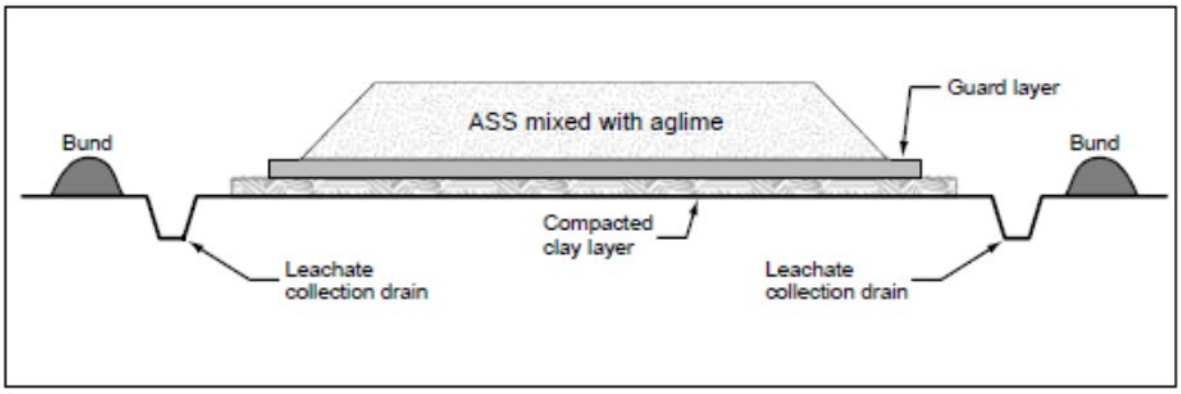
6. ASS MANAGEMENT PLAN

The management principles and procedures which should be implemented during construction works and handling of soils that are ASS are summarised below in Table 6.1..

Table 6.1: ASS Management Principals and Procedures

General Principals	The following is an outline of the general principles for mitigating impacts associated with identified ASS as per ASSMAC (1998): i. Avoid land where ASS occur. ii. Avoid disturbing ASS soils if present on the property and avoid lowering the water table. iii. Prevent the oxidation of sulfides.

	iv. Neutralising acid as it is produced. v. Separate out and treat the sulfidic component (i.e. pyrite) by sluicing if this material is very sandy. vi. Immediate burial of excavated ASS below the permanent water table. It is envisaged that the ASS material will be neutralised following excavation and either re-used on site or disposed offsite to landfill following waste classification.
Training and Responsibilities	The earthworks contractor should appoint an appropriately trained person who is responsible for managing the ASS issues during the earthwork activities. This person should be familiar with: • Council and other relevant statutory requirements. • Recognition of ASS materials. • Acid sulfate soil testing and treatment procedures. • Onsite management of ASS materials, including implementing management procedures. The classification of ASS materials during construction should be carried out by personnel trained in the identification of ASS and be based on visual classification and the field screening test. If required, a suitably qualified Environmental Consultant could be engaged to assist, guide and/ or train the Contractor in the identification of ASS.
Visual Classification	The preliminary visual checking of the soils will be based on material type, colour, odour and consistency. ASS material is generally characterised by grey, dark grey, and black clayey sands and sandy clays which can be accompanied by a sulfuric odour. Marine sediments when encountered will often contain seashells. It is important that when these characteristics are encountered that the procedures documented in the ASSMP are implemented. Where doubt exists an experienced ASS consultant should be contacted so the material can be assessed, separated and managed correctly to allow the works to progress.
Management of Excavated ASS	Excavated natural soils below about 0.5m in depth should be either placed in temporary stockpiles or transported directly to a specially prepared treatment area for liming. At this stage, the volume of ASS that may be excavated is not known, though is considered to be more than 1,000 tonnes.
Establishment of Treatment Pads	A bunded, impervious treatment area(s) should be constructed for the purpose of treatment/ neutralisation of ASS, or to store ASS material that would remain onsite for longer than 2 to 3 days before treatment. Treatment areas should be constructed using impervious clay or plastic sheeting as a base. The treatment area should be suitably bunded to prevent stormwater from entering or leaving the area. The treatment area should include installation of a leachate collection settlement pond to collect runoff. The treatment area should be graded towards the leachate pond for efficient drainage. The settlement leachate pond should be designed to capture and store runoff from a 1 in 10-year, 1 hour storm duration event. Leachate runoff collected in the settlement pond should be assessed prior to disposal. Any sediment removed from the leachate pond should also be assessed for the presence of ASS. The treatment pad should be constructed as per the cross-section below.



Cross-Section: Treatment Pad Design, based on QASSIT (2014) Queensland Acid Sulfate Soil Technical Manual – Soil Management Guidelines

Temporary Stockpiling	Where temporary stockpiling exceeds a few days, the excavated soils should be bunded and covered with plastic to help slow the oxidation process. Where extended periods of stockpiling occur (i.e. greater than one week) the soils should be removed to a treatment area and lime applied. Appropriate stormwater and sediment controls should be in place. Extended periods of stockpiling may require leachate collection and monitoring. Where monitoring of the leachate indicates low pH, the addition of a neutralising agent (e.g. lime) and additional assessment will be required prior to discharge to stormwater. Where temporary stockpiles are created, stockpiles should be placed on relatively level ground, and away (e.g. at least 40m) from nearby waterways. Stockpile heights should be kept to a maximum of 2m, and stockpile areas should be bunded with appropriate sediment controls such as silt fences and/ or hay bales.
ASS Treatment	
Preliminary Liming Rate	The following preliminary liming rate is based on the existing laboratory data and the following formula: kg $CaC0_3$ per m^3 of soil = $\frac{\%S\ x623.7}{19.98}\ x\ \frac{100}{ENV\ (\%)} \times D \times FOS$ Where: • %S is average net acidity (0.63%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) The preliminary liming rate is 56kg $CaCO_3/m^3$ (31kg $CaCO_3$/tonne). The average net acidity has been used to provide the liming rate as it is envisaged that stockpiled and/ or piled spoil once on the surface will be a mixture of ASS and non-ASS. The liming rate will need to be confirmed prior to treatment.
Liming Methodology	A suitable supply of lime should be available on site during the construction works when ASS is identified in order to enable efficient neutralisation of ASS. A lime register should be maintained by the contractor to record the amount of lime delivered and used on site. The type and amount of lime to be applied will be such that a neutralising value (NV) of 95 can be achieved. 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. Liming should be undertaken inside a treatment pad constructed as outlined above. The following liming procedures (or other equivalent) should be undertaken: • If practical, spreading of the soil in thin (<200mm) layers within the boundary of the site works; and • Addition of lime followed by mixing, using an Allu bucket or pugmill. The equipment used should be based on the type of material and ease of mixing.
Offsite Disposal or Reuse of Acid Sulfate Soils	
Offsite Disposal	Once treated with lime the soils may be disposed of to an appropriately licensed landfill following waste classification in accordance with NSW EPA (2014) Waste Classification Guidelines: Part 1 Classifying Waste. The waste classification and disposal should be undertaken in accordance with relevant standards and requirements, including the NSW EPA (2014) Waste Classification Guide-lines – Part 4.
Reuse of Treated Soils Onsite	The following monitoring programme (or other approved equivalent) is recommended for lime treated material where the material is to be reused on site for structural or general filling above the water table, prior to its placement: • Monitoring of soil pH daily for two weeks with pH > 5.5. The monitoring frequency may be revised based on the results of the monitoring. • Collection of soil samples 1 per 100m^3 for the first 1,000m^3 then 1 per 250m^3 thereafter. Each sample should be screened using the hydrogen peroxide test and have a pH_{FOX} of >5.0. In order to demonstrate that appropriate quantities of lime have been used, a lime register should be maintained by the Contractor. The register should list all lime delivered to the site, verified by delivery dockets, and where the lime has been used. The lime usage shall quantify areas limed and soil volumes treated, liming rates and quantities of lime used. The lime register shall be a verifiable performance indicator and extracts may be used in a final environmental report. The following verification testing of the soil will be required: • Chromium suite should be carried out to verify that the lime applied is sufficient to neutralise acidity. The net acidity should be < 0. The frequency of testing should be assessed based on the volumes but not exceed 1 per 250m^3. The verification testing should be carried out by a suitably trained environmental consultant. Material may be reused on site once the above and site-specific land use criteria are met.
Off-Site Re-Use	Provided the neutralised material meets a Virgin Excavated Natural Material (VENM), Excavated Natural Material (ENM) classification or other NSW EPA Resource Recovery Exemption/ Order, excavated spoil generated as part of the project may be re-used at an alternative location under a Site-Specific Resource Recovery Exemption/ Order once approved by the NSW EPA.
Management of Dewatering Activities	Based on the proposed works, groundwater may be encountered. Some dewatering may be required from the excavations Where groundwater is encountered, pH levels should be monitored prior to any dewatering.

	If there is a potential for the groundwater table to be lowered for considerable period of time (several weeks or months) a Dewatering Management Plan, appropriate liaison and approvals from National Resources Access Regulator (NRAR) will be required. The Contractor should install and/or employ an appropriate groundwater control system to minimise the ingress of groundwater into the excavation such that the surrounding groundwater table will be maintained. The surrounding groundwater level should be monitored regularly by the sub-contractor, and this would involve monitoring from nearby existing wells or installation of monitoring wells. Should groundwater require pH adjustment prior to disposal offsite or to stormwater, the following general procedures should be followed: • Water should be placed in an acid-resistant holding tank or pond, and samples collected to assess the pH, electrical conductivity, chloride sulfate ions, and heavy metals. • Should pH adjustment be required, a neutralising agent should be added to the water at a rate assessed from the results of the testing and Table 7.1 of Management Guidelines in the ASSMAC (1998) *Acid Sulfate Soils Manual*. • Following treatment, the water should be re-sampled and tested again for pH, electrical conductivity and metals to assess the disposal options; and Depending on the laboratory results, the treated water could either be applied to land, discharged to stormwater or be removed and disposed by a licensed liquid waste contractor. Permission from the relevant regulatory authority (i.e. NSW Office of Water and/or Hunter Water) must be obtained before disposal to stormwater networks.
Monitoring and Reporting	Complete records of all testing, treatment and monitoring should be kept by Council and/ or the sub-contractor including: • Results of additional ASS testing and or field screening. • Groundwater monitoring results and details of the dewatering methodology. • Records of off-site disposal and monitoring results. • The lime register. • Results of verification testing. • Results of Waste Classification if disposed off site. • Validation Reports (if material is re-used on site).

7. CLOSING

This Acid Sulfate Soil Management Plan (ASSMP) provides an assessment of material to be excavated from 711 Hunter Street, Newcastle West NSW by Hunter Street JV Co Pty Ltd. The ground investigation was limited to the assessment of soils from within borehole BH03 from a depth of 2mbgs down to 38.5mbgs to assess the potential for acid sulfate soils and to develop a management plan for soils. It is envisaged that excavated and stockpiled soils will be sampled and tested in order to confirm the liming rate and management procedures.

We trust this assessment meets your requirements at this time. We draw your attention to the attached sheets titled “Important Information about your Tetra Tech Coffey Environmental Report” which should be read in conjunction with this letter. Please do not hesitate to contact the undersigned if you have any questions about this assessment.

For and on behalf of Tetra Tech Coffey Pty Ltd.

Regards,

Craig Schrader
Associate Environmental Scientist

Attachments

Important Information about your Tetra Tech Coffey Environmental Report
Figures
Borehole Log Sheet for BH03
Analytical Results Table
NATA Endorsed Laboratory Reports

IMPORTANT INFORMATION ABOUT YOUR TETRA TECH COFFEY ENVIRONMENTAL REPORT

Introduction

This report has been prepared by Tetra Tech Coffey for you, as Tetra Tech Coffey's client, in accordance with our agreed purpose, scope, schedule and budget.

The report has been prepared using accepted procedures and practices of the consulting profession at the time it was prepared, and the opinions, recommendations and conclusions set out in the report are made in accordance with generally accepted principles and practices of that profession.

The report is based on information gained from environmental conditions (including assessment of some or all of soil, groundwater, vapour and surface water) and supplemented by reported data of the local area and professional experience. Assessment has been scoped with consideration to industry standards, regulations, guidelines and your specific requirements, including budget and timing. The characterisation of site conditions is an interpretation of information collected during assessment, in accordance with industry practice.

This interpretation is not a complete description of all material on or in the vicinity of the site, due to the inherent variation in spatial and temporal patterns of contaminant presence and impact in the natural environment. Tetra Tech Coffey may have also relied on data and other information provided by you and other qualified individuals in preparing this report. Tetra Tech Coffey has not verified the accuracy or completeness of such data or information except as otherwise stated in the report. For these reasons the report must be regarded as interpretative, in accordance with industry standards and practice, rather than being a definitive record.

Your report has been written for a specific purpose

Your report has been developed for a specific purpose as agreed by us and applies only to the site or area investigated. Unless otherwise stated in the report, this report cannot be applied to an adjacent site or area, nor can it be used when the nature of the specific purpose changes from that which we agreed.

For each purpose, a tailored approach to the assessment of potential soil and groundwater contamination is required. In most cases, a key objective is to identify, and if possible quantify, risks that both recognised and potential contamination pose in the context of the agreed purpose. Such risks may be financial (for example, clean up costs or constraints on site use) and/or physical (for example, potential health risks to users of the site or the general public).

Limitations of the Report

The work was conducted, and the report has been prepared, in response to an agreed purpose and scope, within time and budgetary constraints, and in reliance on certain data and information made available to Tetra Tech Coffey.

The analyses, evaluations, opinions and conclusions presented in this report are based on that purpose and scope, requirements, data or information, and they could change if such requirements or data are inaccurate or incomplete.

This report is valid as of the date of preparation. The condition of the site (including subsurface conditions) and extent or nature of contamination or other environmental hazards can change over time, as a result of either natural processes or human influence. Tetra Tech Coffey should be kept appraised of any such events and should be consulted for further investigations if any changes are noted, particularly during construction activities where excavations often reveal subsurface conditions.

In addition, advancements in professional practice regarding contaminated land and changes in applicable statues and/or guidelines may affect the validity of this report. Consequently, the currency of conclusions and recommendations in this report should be verified if you propose to use this report more than 6 months after its date of issue.

The report does not include the evaluation or assessment of potential geotechnical engineering constraints of the site.

Interpretation of factual data

Environmental site assessments identify actual conditions only at those points where samples are taken and on the date collected. Data derived from indirect field measurements, and sometimes other reports on the site, are interpreted by geologists, engineers or scientists to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions.

Variations in soil and groundwater conditions may occur between test or sample locations and actual conditions may differ from those inferred to exist. No environmental assessment program, no matter how comprehensive, can reveal all subsurface details and anomalies. Similarly, no professional, no matter how well qualified, can reveal what is hidden by earth, rock or changed through time.

The actual interface between different materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

For this reason, parties involved with land acquisition, management and/or redevelopment should retain the services of a suitably qualified and experienced environmental consultant through the development and use of the site to identify variances, conduct additional tests if required, and recommend solutions to unexpected conditions or other unrecognised features encountered on site. Tetra Tech Coffey would be pleased to assist with any investigation or advice in such circumstances.

Recommendations in this report

This report assumes, in accordance with industry practice, that the site conditions recognised through discrete sampling are representative of actual conditions throughout the investigation area. Recommendations are based on the resulting interpretation.

Should further data be obtained that differs from the data on which the report recommendations are based (such as through excavation or other additional assessment), then the recommendations would need to be reviewed and may need to be revised.

Report for benefit of client

Unless otherwise agreed between us, the report has been prepared for your benefit and no other party. Other parties should not rely upon the report or the accuracy or completeness of any recommendation and should make their own enquiries and obtain independent advice in relation to such matters.

Tetra Tech Coffey assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusions expressed in the report, or for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusions expressed in the report.

To avoid misuse of the information presented in your report, we recommend that Tetra Tech Coffey be consulted before the report is provided to another party who may not be familiar with the background and the purpose of the report. In particular, an environmental disclosure report for a property vendor may not be suitable for satisfying the needs of that property's purchaser. This report should not be applied for any purpose other than that stated in the report.

Interpretation by other professionals

Costly problems can occur when other professionals develop their plans based on misinterpretations of a report. To help avoid misinterpretations, a suitably qualified and experienced environmental consultant should be retained to explain the implications of the report to other professionals referring to the report and then review plans and specifications produced to see how other professionals have incorporated the report findings.

Given Tetra Tech Coffey prepared the report and has familiarity with the site, Tetra Tech Coffey is well placed to provide such assistance. If another party is engaged to interpret the recommendations of the report, there is a risk that the contents of the report may be misinterpreted and Tetra Tech Coffey disowns any responsibility for such misinterpretation.

Data should not be separated from the report

The report as a whole presents the findings of the site assessment and the report should not be copied in part or altered in any way. Logs, figures, laboratory data, drawings, etc. are customarily included in our reports and are developed by scientists or engineers based on their interpretation of field logs, field testing and laboratory evaluation of samples. This information should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

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Responsibility

Environmental reporting relies on interpretation of factual information using professional judgement and opinion and has a level of uncertainty attached to it, which is much less exact than other design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded. As noted earlier, the recommendations and findings set out in this report should only be regarded as interpretive and should not be taken as accurate and complete information about all environmental media at all depths and locations across the site.

WICKHAM
HAMILTON EAST
NEWCASTLE WEST
HUNTER RIVER
Throsby Creek
Park
Greenway St
Foundry St
Church St
Railway St
Holland St
Throsby St
Lindus St
Union St
Dickson St
Grey St
Railway Ln
Bishopsgate St
Hannell St
A43
Wickham St
Charles St
Dangar St
Station St
Railway St
Tighe St
Hunter St
Beresford St
Cooper St
Honeysuckle Dr
Wickham Station
Smart St
Denison St
Denison St
Wood St
Ada St
Skelton St
Parry St
A15
STEWART AVENUE
Beresford Ln
Hunter St
SITE LOCATION
HUNTER STREET
Birdwood Park
National Park St
KING STREET
Hebburn St
PACIFIC HIGHWAY
Coles-Marketown Shopping Centre
King St
Marketown Shopping Centre
Parry St
Warrah St
Corona St
Hebburn St
Steel St
Car Park
Ravenshaw St
Devonshire St
Dick St
Hall St
Arnott St
Union St
Bull St
Dumaresq St
Parkway Ave
National Park
Kemp St
National Park St
Jenner Pde
Corlette St
Bruce St

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	-	-	4-10-2022

LEGEND

SITE BOUNDARY

MAP PROJECTION: GDA2020 MGA ZONE 56

50 0 50 100 150 200 250

Scale (metres) 1:5000

IMAGERY SOURCE: WORLD STREET MAP
SOURCES: ESRI, HERE, GARMIN, USGS, INTERMAP, INCREMENT P, NRCAN, ESRI JAPAN, METI, ESRI CHINA (HONG KONG), ESRI KOREA, ESRI (THAILAND), NGCC, © OPENSTREETMAP CONTRIBUTORS, AND THE GIS USER COMMUNITY

drawn	HK / AW
approved	-
date	4-10-2022
scale	AS SHOWN
original size	A3

TETRA TECH COFFEY

client: HUNTER STREET JV CO PTY LTD

project: ACID SULFATE SOILS MANAGEMENT PLAN
711 HUNTER STREET NEWCASTLE WEST, NSW

title: SITE LOCATION PLAN

project no: 754-NTLGE293239-AD | figure no: FIGURE 1 | rev: A

PLOT DATE: 23/9/2022 2:44:54 PM DWG FILE: \\ETSS782NF11.TT.LOCAL\AUVOLUME1\LEGACY\TTS79\FS1\PROTECTED\DATA\GEOTECH\NCS\1. JOB FILES\NEWCASTLE PROJECTS\NTLGE293239-AD.DWG

revision	no.	description	drawn	approved	date
	A	ORIGINAL ISSUE	-	-	4-10-2022

LEGEND

- SITE BOUNDARY
- BOREHOLE LOCATION

MAP PROJECTION: GDA2020 MGA ZONE 56

5 0 5 15 25

Scale (metres) 1:500

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drawn	HK / AW
approved	-
date	4-10-2022
scale	AS SHOWN
original size	A3

TETRA TECH COFFEY

client: HUNTER STREET JV CO PTY LTD

project: ACID SULFATE SOILS MANAGEMENT PLAN
711 HUNTER STREET NEWCASTLE WEST, NSW

title: SAMPLE LOCATION PLAN

project no: 754-NTLGE293239-AD | figure no: FIGURE 2 | rev: A

PLOT DATE: 23/9/2022 11:41:44 AM DWG FILE: \\ETTS57820NF11.TT.LOCAL\AU\VOLUME1\LEGACY\TTS798FS1\PROTECTED\DATA\GEOTECHNICS\1. JOB FILES\NEWCASTLE PROJECTS\NTLGE290000\754-NTLGE293239 - 711 HUNTER STREET, NEWCASTLE WEST\DRAWINGS\754-NTLGE293239-AD.DWG

TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	6 of 11
project no.	**754-NTLGE293239**
client:	**HUNTER STREET JV CO PTY LIMITED**
date started:	**24 Aug 2022**
principal:	
date completed:	**01 Sep 2022**
project:	**Proposed Mixed Use Development**
logged by:	**OB**
location:	**711 Hunter Street, Newcastle West**
checked by:	**SJB**

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

drilling information				material substance						rock mass defects		
method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular	general
		-30	33.0									
		-31	34.0									
		-32	35.0									
		-33	36.0									
		-34	37.0									
		-35	38.0									
		-36	39.0									
		-37			started coring at 39.50m							
HQ					**CLAYSTONE**: orange to brown, returned as gravel.	HW MW SW		a=0.27 d=0.07	95%		Hammer bouncing PT, 3°, PL, SO, Clay VN, 5 mm	

method
DT diatube
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS sheared surface
SZ sheared zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

CDF_0_10_00.3_LIBRARY.GLB rev:CDF_0_10_00.3 2020-08-25 Log COF BOREHOLE: CORED 754-NTLGE293239.GPJ <<DrawingFile>> 10/10/2022 16:04

TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	7 of 11
project no.	**754-NTLGE293239**
client:	**HUNTER STREET JV CO PTY LIMITED**
date started:	**24 Aug 2022**
principal:	
date completed:	**01 Sep 2022**
project:	**Proposed Mixed Use Development**
logged by:	**OB**
location:	**711 Hunter Street, Newcastle West**
checked by:	**SJB**

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular	general
HQ		-38			39.89 m: Several coal laminations **SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins. *(continued)* 40.20 m: 200mm siltstone/ mudstone bed with carbonacous laminations at start	SW HW FR		a=1.88 d=1.25 a=1.71 d=1.33 a=1.12 d=1.63			PT, 2°, PL, SO, Clay VN, 3 mm CS, 2°, IR, VR, Clay, 50 mm	
			41.0		40.44 m: 100mm of fine to coarse sandstone			a=1.79 d=1.20	95%			
		-39			41.60 m: 100mm siltstone bed	MW FR		a=1.15 d=0.32 d=0.21 a=2.38 d=2.00			PT, 2°, ST, RO, CN, 2 mm Drilling Break Drilling Break	
			42.0		42.00 m: trace of carbonacous laminations			a=2.07 d=1.35 a=0.42 d=0.22				
		-40			42.55 m: 150mm of fine to coarse sandstone grey to dark grey						PT, 10°, PL, RO, CN, 3 mm PT, 10°, UN, RO, VN, 3 mm, White calcite? PT, 0°, CU, RO, CN, <1 mm Drilling Break	
			43.0					a=2.22 d=0.93	97%		PT, 3°, ST, RO, CN, <5 mm Drilling Break	
		-41						a=2.20 d=1.77 a=2.81 d=1.74			Drilling Break	
			44.0		44.16 m: 40mm of siltstone laminations			a=2.23 d=1.66 a=3.16 d=1.84				
		-42			44.39 m: 30mm of pebbly sandstone, mixed origin clasts			a=1.21 a=1.55 d=1.20			Drilling Break	
			45.0					a=2.16 d=2.47 a=2.59 d=2.21				
		-43										
			46.0		45.84 m: 200mm of fine to coarse sandstone with some coal veins 46.10 m: 200mm of laminations with			a=2.74 d=0.95				
		-44			46.28 m: 30mm siltstone bed			a=2.00 d=2.07 a=2.00 d=2.13	91%		PT, 3°, UN, VR, CN, <1 mm	
			47.0					d=1.94				
		-45									PT, 3°, ST, VR, CN, <1 mm JT, 90°, PL, RO, VN, White? Drilling Break Drilling Break	
									100%			Defects are: PT, 1 - 5°, PL, RO, CN, <1 mm, unless otherwise described

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method
DT diatube
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS sheared surface
SZ sheared zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	8 of 11
project no.	**754-NTLGE293239**
client:	**HUNTER STREET JV CO PTY LIMITED**
date started:	**24 Aug 2022**
principal:	
date completed:	**01 Sep 2022**
project:	**Proposed Mixed Use Development**
logged by:	**OB**
location:	**711 Hunter Street, Newcastle West**
checked by:	**SJB**

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
HQ		-46			**SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins. *(continued)* 48.17 m: 130mm of increased carbonacous laminations 48.62 m: 50mm of siltstone laminations	FR		d=2.04 a=2.69 d=2.27 a=2.54 d=0.74			PT, 2°, UN, RO, CN, 3 mm
			49.0					a=2.39 d=2.47 a=2.46 d=1.69 a=2.91 d=2.12 a=2.78 d=2.30 a=1.71 d=2.57 d=1.71 a=1.50 d=1.74 a=1.66 d=1.63	100%		
		-47									
			50.0								
		-48			50.30 to 50.50 m: 200mm interlaminated siltstone and sandstone						
			51.0					a=3.33 d=3.17			
		-49									
			52.0		51.75 m: 30mm siltstone at 3°			a=2.38 d=2.04			PT, 1°, CU, RO, CN, <1 mm
		-50							100%		
			53.0								PT, 1 - 12°, CU, RO, CN, <1 mm
		-51			53.19 to 53.40 m: some thick carbonacous laminations			a=1.61 d=2.18			PT, 1°, ST, RO, Coal VN, 1 mm PT, 25°, ST, RO, Coal VN
			54.0					a=2.46 d=2.20			
		-52									
			55.0					a=1.83 d=2.71	100%		PT, 5°, ST, RO, CN, 5 mm
		-53									JT, 80°, PL, RO, VN, 2 mm, White?

Defects are: PT, 1 - 5°, PL, RO, CN, <1 mm, unless otherwise described

method
DT diatube
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS sheared surface
SZ sheared zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

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TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	9 of 11
project no.	**754-NTLGE293239**
client:	**HUNTER STREET JV CO PTY LIMITED**
date started:	**24 Aug 2022**
principal:	
date completed:	**01 Sep 2022**
project:	**Proposed Mixed Use Development**
logged by:	**OB**
location:	**711 Hunter Street, Newcastle West**
checked by:	**SJB**

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
HQ		-54			**SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins. *(continued)*	FR		a=2.33 d=2.89	100%		
			57.0					a=3.23 d=2.22			
		-55									
			58.0		**INTERLAMINATED SILTSTONE AND SANDSTONE**: dark grey and black, SANDSTONE fine grained, dark grey, SILTSTONE dark grey with carbonacous laminations.			a=1.69 d=0.84	100%		
		-56			57.80 m: Starts with a 300mm siltstone bed **SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins. 58.40 m: Becoming more sandstone with carbonacous laminations						PT, 2°, ST, SO, SN, White?
			59.0					a=2.97 d=2.08			
		-57			**INTERLAMINATED SILTSTONE AND SANDSTONE**: dark grey and black, SANDSTONE fine grained, dark grey, SILTSTONE dark grey with carbonacous laminations. 59.55 m: Increasing siltstone content						JT, 60°, PL, RO, CN
			60.0					a=2.39 d=0.89			
		-58			**SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins.						
			61.0					a=2.12 d=3.10	100%		
		-59			**INTERLAMINATED SILTSTONE AND SANDSTONE**: dark grey and black, SANDSTONE fine grained, dark grey, SILTSTONE dark grey with carbonacous laminations.						
			62.0					a=1.96 d=0.92			
		-60			**SANDSTONE**: fine grained, grey, thinly bedded, with some carbonacous laminations parallel and cross bedded, some carbonaceous veins.						Drilling Break
			63.0					a=2.24 d=0.22			
		-61							100%		

Defects are: PT, 1 - 5°, PL, RO, CN, <1 mm, unless otherwise described

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method
DT diatube
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
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PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
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XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS sheared surface
SZ sheared zone
CO contact
CS crushed seam
SM seam

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

coating
CN clean
SN stained
VN veneer
CO coating

TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	10 of 11
project no.	**754-NTLGE293239**
client:	***HUNTER STREET JV CO PTY LIMITED***
date started:	***24 Aug 2022***
principal:	
date completed:	***01 Sep 2022***
project:	***Proposed Mixed Use Development***
logged by:	***OB***
location:	***711 Hunter Street, Newcastle West***
checked by:	***SJB***

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

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method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
HQ		-62	65.0		**INTERLAMINATED SILTSTONE AND SANDSTONE**: dark grey and black, SANDSTONE fine grained, dark grey, SILTSTONE dark grey with carbonacous laminations.	FR		a=2.01 d=0.90	100%		JT, 45°, PL, RO, CN, <2 mm
		-63						a=2.33 d=1.03			
			66.0					a=3.31 d=0.70			
		-64							71%		PT, 2°, PL, SO, CN, <1 mm
			67.0		**NO CORE:** 0.31 m Possibly interlaminated siltstone and sandstone.						
		-65			**INTERLAMINATED SILTSTONE AND SANDSTONE**: dark grey and black, SANDSTONE fine grained, dark grey, SILTSTONE dark grey with carbonacous laminations.	SW					
			68.0		**NO CORE:** 3.00 m Open void.				0%		
		-66									
			69.0								
		-67									
			70.0		**ROOF COLLAPSE**: Fragments comprise of SILTSTONE, grey to dark brown.						
		-68			**NO CORE:** 0.50 m Probable roof collapse.				0%		
			71.0		**ROOF COLLAPSE**: Fragments comprise of SILTSTONE, grey to dark brown.						
		-69			**NO CORE:** 0.80 m Probable roof collapse.				0%		

method
DT diatube
NMLC NMLC core (51.9 mm)
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PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

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10/10/12, water level on date shown
water inflow
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roughness
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SO smooth
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CN clean
SN stained
VN veneer
CO coating

CDF_0_10_00.3_LIBRARY.GLB rev:CDF_0_10_00.3 2020-08-25 Log COF BOREHOLE: CORED 754-NTLGE293239.GPJ <<DrawingFile>> 10/10/2022 16:04

TETRA TECH COFFEY

Engineering Log - Cored Borehole

Borehole ID.	**BH22-03**
sheet:	11 of 11
project no.	**754-NTLGE293239**
client:	**HUNTER STREET JV CO PTY LIMITED**
date started:	**24 Aug 2022**
principal:	
date completed:	**01 Sep 2022**
project:	**Proposed Mixed Use Development**
logged by:	**OB**
location:	**711 Hunter Street, Newcastle West**
checked by:	**SJB**

position: E: 384,156.7; N: 6,356,144.2 (MGA94) | surface elevation: 2.50 m (AHD) | angle from horizontal: 90°

drill model: Hanjin DB8 | drilling fluid: | casing diameter : HW/PW

drilling information | **material substance** | **rock mass defects**

method & support	water	RL (m)	depth (m)	graphic log	material description **ROCK TYPE**: grain characterisics, colour, structure, minor components	weathering & alteration	estimated strength & Is50 (X = axial; O = diametral) VL L M H VH EH	samples, field tests & Is(50) (MPa) a = axial; d = diametral	core run & RQD	defect spacing (mm) 30 100 300 1000 3000	additional observations and defect descriptions (type, inclination, planarity, roughness, coating, thickness, other) particular / general
HQ		-70	73.0		**ROOF COLLAPSE**: Fragments comprise of SILTSTONE, grey to dark brown. **NO CORE:** 0.58 m Probable roof collapse.				0%		
		-71	74.0		**ROOF COLLAPSE**: Fragments comprise of SILTSTONE, grey to dark brown. **FILL/ COAL WASTE**: Fragments comprise of coal, black dull and shiny, medium to coarse grained sized gravel. **NO CORE:** 1.30 m Probable coal waste.				0%		
		-72	75.0		**FILL/ COAL WASTE**: Fragments comprise of coal, black dull and shiny, medium to coarse grained sized gravel.				0%		
		-73	76.0		**INTERLAMINATED SILTSTONE, SANDSTONE AND COAL**: SANDSTONE fine grained, dark grey, SILTSTONE dark grey, COAL black and dull. **SANDSTONE**: fine to coarse grained, grey, some coal veins.	SW FR		a=1.29 d=0.05 a=1.97 d=2.78	100%		Many partings possibly drilling induced PT, 3°, PL, VR, CN, <3 mm PT, 15°, PL, VR, CN, <3 mm PT, 5°, PL, VR, CN, <3 mm PT, 10°, PL, VR, CN, <3 mm
		-74									
		-75	77.0					a=3.22 d=3.20			
		-76	78.0		Borehole BH22-03 terminated at 77.60 m						
		-77	79.0								

CDF_0_10_00.3_LIBRARY.GLB rev:CDF_0_10_00.3 2020-08-25 Log COF BOREHOLE: CORED 754-NTLGE293239.GPJ <<DrawingFile>> 10/10/2022 16:04

method
DT diatube
NMLC NMLC core (51.9 mm)
NQ wireline core (47.6mm)
HQ wireline core (63.5mm)
PQ wireline core (85.0mm)
RR rock roller

support
C casing M mud N none

water
10/10/12, water level on date shown
water inflow
complete drilling fluid loss
partial drilling fluid loss
25uL water pressure test result (lugeons) for depth interval shown

graphic log / core recovery
core recovered (graphic symbols indicate material)
no core recovered

core run & RQD
barrel withdrawn
RQD = Rock Quality Designation (%)

weathering & alteration*
RS residual soil
XW extremely weathered
HW highly weathered
MW moderately weathered
SW slightly weathered
FR fresh
*W replaced with A for alteration

strength
VL very low
L low
M medium
H high
VH very high
EH extremely high

defect type
PT parting
JT joint
SS sheared surface
SZ sheared zone
CO contact
CS crushed seam
SM seam

planarity
PL planar
CU curved
UN undulating
ST stepped
IR Irregular

roughness
VR very rough
RO rough
SO smooth
POL polished
SL slickensided

coating
CN clean
SN stained
VN veneer
CO coating

TETRA TECH COFFEY

Table LR1
Analytical Results - Acid Sulfate Soils

						Sample ID	BH22-03_2	BH22-03_4	BH22-03_5.5	BH22-03_7	BH22-03_8.5	BH22-03_11.5	BH22-03_10	BH22-03_13.45	BH22-03_14.5	BH22-03_16	BH22-03_17.5	BH22-03_19	BH22-03_20.5	BH22-03_23.5	BH22-03_26.5
						Date	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022	28/08/2022
						Soil Type	Esturine Sand	Estuarine Sand	Estuarine Sand (Peat)	Estuarine Sand (Peat)	Estuarine Silty SAND	Estuarine Silty SAND	Estuarine Silty SAND	Alluvial Silty CLAY	Alluvial Silty CLAY	Alluvial Silty CLAY	Alluvial Silty CLAY	Estuarine Silty CLAY	Estuarine Silty CLAY	CLAY with Iron oxide	CLAY with Iron oxide
		Unit	EQL	ASSMAC Field pH Screening	ASSMAC Action Criteria if more than 1,000 tonnes disturbed - Sulfur Trail %S (Coarse Texture)	ASSMAC Action Criteria if more than 1,000 tonnes disturbed - Acid Trail %S (Coarse Texture)															
Field Screening	Reaction Rate	-	1				Strong	Moderate	Extreme	Extreme	Extreme	Extreme	Strong	Extreme	Extreme	Extreme	Extreme	Extreme	Extreme	Extreme	Extreme
	Moisture Content	%	1				-	-	4.4	-	-	21.8	-	-	-	-	-	-	-	-	-
	pH_F			<4			6.3	7.8	5.8	6.2	7.3	7.8	8.4	8.5	8.6	9	8.7	8.8	9	9	8.5
	pH_{FOX}	pH Unit		<3.5			1.8	2.8	2.1	2.1	2.7	1.9	1.6	6.4	8	7.5	5.3	2	2.5	8.1	8
			pH Change				4.5	5	3.7	4.1	4.6	5.9	6.8	2.1	0.6	1.5	3.4	6.8	6.5	0.9	0.5
Actual Acidity	pH (KCl)	-	0.1				4.8	-	5.3	-	6.4	5.8	-	-	-	-	-	7.8	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02				0.09	-	<0.02	-	<0.02	<0.02	-	-	-	-	-	<0.02	-	-	-
	Titratable Actual Acidity	mole H+/t	2			18	58	-	8	-	<2	2	-	-	-	-	-	<2	-	-	-
Potential Acidity	Chromium Reducible Sulfur	%S	0.005		0.03		0.157	-	0.222	-	0.128	0.396	-	-	-	-	-	1.74	-	-	-
	Chromium Reducible Sulphur	mole H+/t	10				98	-	138	-	80	247	-	-	-	-	-	1080	-	-	-
Acid Neutralising Capacity	Acid Neutralising Capacity Acid Neutralising Capacity (19A2)	0.01	% CaCO3				-	-	-	-	-	-	-	-	-	-	-	1.94	-	-	-
	acidity - Acid Neutralising Capacity (a-19A2)	10	mole H+ / t				-	-	-	-	-	-	-	-	-	-	-	387	-	-	-
	sulfidic - Acid Neutralising Capacity (s-19A2)	0.01	% pyrite S				-	-	-	-	-	-	-	-	-	-	-	0.62	-	-	-
Acid Base Counting	EA033-E: Acid Base Accounting ANC Fineness Factor	0.5	-				1.5	-	1.5	-	1.5	1.5	-	-	-	-	-	1.5	-	-	-
	Net Acidity (sulfur units)	0.02	% S				0.25	-	0.23	-	0.13	0.4	-	-	-	-	-	1.33	-	-	-
	Net Acidity (acidity units)	10	mole H+ / t			18	156	-	146	-	80	250	-	-	-	-	-	827	-	-	-
	Liming Rate	1	kg CaCO3/t				12	-	11	-	6	19	-	-	-	-	-	62	-	-	-
	Net Acidity excluding ANC (sulfur units)	0.02	% S				0.25	-	0.23	-	0.13	0.4	-	-	-	-	-	1.74	-	-	-
	Net Acidity excluding ANC (acidity units)	10	mole H+ / t				156	-	146	-	80	250	-	-	-	-	-	1080	-	-	-
	Liming Rate excluding ANC	1	kg CaCO3/t				12	-	11	-	6	19	-	-	-	-	-	81	-	-	-
						Exceeds Action Criteria	**Yes**	**-**	**Yes**	**-**	**Yes**	**Yes**	**-**	**-**	**-**	**-**	**-**	**Yes**	**-**	**-**	**-**

Result	exceeds ASSMAC 1998 Field Screening Criteria
Result	exceeds ASSMAC 1998 Acid Sulfate SoilsAssessment Guidelines
Result	exceeds ASSMAC 1998 Acid Sulfate SoilsAssessment Guidelines
-	Not tested

TETRA TECH COFFEY

Table LR1
Analytical Results - Acid Sulfate Soils

						Sample ID	BH22-03_29.5	BH22-03_32.5	BH22-02_35.5	BH22-03_38.5
						Date	28/08/2022	28/08/2022	28/08/2022	28/08/2022
						Soil Type	CLAY with Iron oxide	Sandy CLAY	CLAY	Gravel
		Unit	EQL	ASSMAC Field pH Screening	ASSMAC Action Criteria if more than 1,000 tonnes disturbed - Sulfur Trail %S (Coarse Texture)	ASSMAC Action Criteria if more than 1,000 tonnes disturbed - Acid Trail %S (Coarse Texture)				
Field Screening	Reaction Rate	-	1				Strong	Extreme	Extreme	Extreme
	Moisture Content	%	1				-	-	-	-
	pH_F			<4			8.4	8	7.5	8.3
	pH_{FOX}	pH Unit		<3.5			7.9	7.4	5.3	3.8
			pH Change				0.5	0.6	2.2	4.5
Actual Acidity	pH (KCl)	-	0.1				-	-	-	-
	sulfidic - Titratable Actual Acidity	%S	0.02				-	-	-	-
	Titratable Actual Acidity	mole H+/t	2			18	-	-	-	-
Potential Acidity	Chromium Reducible Sulfur	%S	0.005		0.03		-	-	-	-
	Chromium Reducible Sulphur	mole H+/t	10				-	-	-	-
Acid Neutralising Capacity	Acid Neutralising Capacity Acid Neutralising Capacity (19A2)	0.01	% CaCO3				-	-	-	-
	acidity - Acid Neutralising Capacity (a-19A2)	10	mole H+ / t				-	-	-	-
	sulfidic - Acid Neutralising Capacity (s-19A2)	0.01	% pyrite S				-	-	-	-
Acid Base Counting	EA033-E: Acid Base Accounting ANC Fineness Factor	0.5	-				-	-	-	-
	Net Acidity (sulfur units)	0.02	% S				-	-	-	-
	Net Acidity (acidity units)	10	mole H+ / t			18	-	-	-	-
	Liming Rate	1	kg CaCO3/t				-	-	-	-
	Net Acidity excluding ANC (sulfur units)	0.02	% S				-	-	-	-
	Net Acidity excluding ANC (acidity units)	10	mole H+ / t				-	-	-	-
	Liming Rate excluding ANC	1	kg CaCO3/t				-	-	-	-
						Exceeds Action Criteria	-	-	-	-

Result	exceeds ASSMAC 1998 Field Screening Criteria
Result	exceeds ASSMAC 1998 Acid Sulfate SoilsAssessment Guidelines
Result	exceeds ASSMAC 1998 Acid Sulfate SoilsAssessment Guidelines
-	Not tested

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2227369**	Page	: 1 of 6
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Contact	: Khaleda Ataei
Address	: 4/60 Griffiths Rd Lambton 2299	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 20-Sep-2022 08:05
Order number	: WARA22-5754	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: ----	Issue Date	: 28-Sep-2022 16:03
Sampler	: Osman Baig		
Site	:		
Quote number	: NE/021/22 BQ		
No. of samples received	: 19		
No. of samples analysed	: 19		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- ALS is not NATA accredited for the analysis of Exchangeable Aluminium and Exchange Acidity in soils when performed under ALS Method ED005.
- ALS is not NATA accredited for the analysis of Exchangeable Cations on Alkaline Soils when performed under ALS Method ED006.
- ED006 (Exchangeable Cations on Alkaline Soils): Unable to calculate Magnesium/Potassium Ratio result for some samples as required Exchangeable Magnesium and/or Potassium results are less than the limit of reporting.
- ED007 (Exchangeable Cations by ICP-AES): Unable to calculate Magnesium/Potassium Ratio for some samples as required Exchangeable Magnesium and/or Potassium results are less than the limit of reporting.
- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme
- ED007 and ED008: When Exchangeable Al is reported from these methods, it should be noted that Rayment & Lyons (2011) suggests Exchange Acidity by 1M KCl - Method 15G1 (ED005) is a more suitable method for the determination of exchange acidity (H+ + Al3+).

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH22-0.3_2	BH22-03_4	BH22-03_5.5	BH22-03_7	BH22-03_8.5
			Sampling date / time	25-Aug-2022 00:00	25-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	EB2227369-001	EB2227369-002	EB2227369-003	EB2227369-004	EB2227369-005
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	----	----	5.9	----	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	6.3	7.8	5.8	6.2	7.3
pH (Fox)	----	0.1	pH Unit	1.8	2.8	2.1	2.1	2.7
Reaction Rate	----	1	Reaction Unit	3	2	4	4	4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	----	----	37	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	----	----	4.4	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	----	----	7	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	----	----	2.58	----	----
ED005: Exchange Acidity								
ø Exchange Acidity	----	0.1	meq/100g	----	----	0.2	----	----
ø Exchangeable Aluminium	----	0.1	meq/100g	----	----	<0.1	----	----
ED007: Exchangeable Cations								
Exchangeable Calcium	----	0.1	meq/100g	----	----	0.6	----	----
Exchangeable Magnesium	----	0.1	meq/100g	----	----	0.2	----	----
Exchangeable Potassium	----	0.1	meq/100g	----	----	<0.1	----	----
Exchangeable Sodium	----	0.1	meq/100g	----	----	<0.1	----	----
Cation Exchange Capacity	----	0.1	meq/100g	----	----	1.1	----	----
Exchangeable Sodium Percent	----	0.1	%	----	----	11.1	----	----
Calcium/Magnesium Ratio	----	0.1	-	----	----	3.0	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Iron	7439-89-6	50	mg/kg	----	----	1800	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH22-03_11.5	BH22-03_10	BH22-03_13.45	BH22-03_14.5	BH22-03_16
			Sampling date / time	26-Aug-2022 00:00	27-Aug-2022 00:00	26-Aug-2022 00:00	27-Aug-2022 00:00	26-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	EB2227369-006	EB2227369-007	EB2227369-008	EB2227369-009	EB2227369-010
				Result	Result	Result	Result	Result
EA002: pH 1:5 (Soils)								
pH Value	----	0.1	pH Unit	7.6	----	----	----	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	7.8	8.4	8.5	8.6	9.0
pH (Fox)	----	0.1	pH Unit	1.9	1.6	6.4	8.0	7.5
Reaction Rate	----	1	Reaction Unit	4	3	4	4	4
EA010: Conductivity (1:5)								
Electrical Conductivity @ 25°C	----	1	µS/cm	74	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	21.8	----	----	----	----
EA150: Soil Classification based on Particle Size								
Clay (<2 µm)	----	1	%	12	----	----	----	----
EA152: Soil Particle Density								
Soil Particle Density (Clay/Silt/Sand)	----	0.01	g/cm3	2.58	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils								
ø Exchangeable Calcium	----	0.2	meq/100g	1.2	----	----	----	----
ø Exchangeable Magnesium	----	0.2	meq/100g	0.4	----	----	----	----
ø Exchangeable Potassium	----	0.2	meq/100g	<0.2	----	----	----	----
ø Exchangeable Sodium	----	0.2	meq/100g	<0.2	----	----	----	----
ø Cation Exchange Capacity	----	0.2	meq/100g	1.7	----	----	----	----
ø Exchangeable Sodium Percent	----	0.2	%	<0.2	----	----	----	----
ø Calcium/Magnesium Ratio	----	0.2	-	2.7	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Iron	7439-89-6	50	mg/kg	4310	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH22-03_17.5	BH22-03_19	BH22-03_20.5	BH22-03_23.5	BH22-03_26.5
			Sampling date / time	26-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00	29-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	EB2227369-011	EB2227369-012	EB2227369-013	EB2227369-014	EB2227369-015
				Result	Result	Result	Result	Result
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.7**	**8.8**	**9.0**	**9.0**	**8.5**
pH (Fox)	----	0.1	pH Unit	**5.3**	**2.0**	**2.5**	**8.1**	**8.0**
Reaction Rate	----	1	Reaction Unit	**4**	**4**	**4**	**4**	**4**

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH22-03_29.5	BH22-03_32.5	BH22-03_35.5	BH22-03_38.5	----
			Sampling date / time	29-Aug-2022 00:00	29-Aug-2022 00:00	29-Aug-2022 00:00	29-Aug-2022 00:00	----
Compound	CAS Number	LOR	Unit	EB2227369-016	EB2227369-017	EB2227369-018	EB2227369-019	--------
				Result	Result	Result	Result	----
EA003 :pH (field/fox)								
pH (F)	----	0.1	pH Unit	**8.4**	**8.0**	**7.5**	**8.3**	**----**
pH (Fox)	----	0.1	pH Unit	**7.9**	**7.4**	**5.3**	**3.8**	**----**
Reaction Rate	----	1	Reaction Unit	**3**	**4**	**4**	**4**	**----**

PO. No :- WARA22-5754

TETRA TECH COFFEY

Consigning Office:	Lambton				
Report Results to:	Simon Baker/Osman Baig	Mobile:	406793245	Email:	Simon.baker@tetratech.com Osman.baig@tetratech.com
Invoices to:	**Newcastle Accounts**	**Phone:**	**02 4028 9700**	**Email:**	**newcastle@coffey.com**

Project No:	754-NTLGE293239	Task No:	Lab
Project Name:	711 Huter St	Laboratory:	ALS
Sampler's Name:	Osman Baig	Project Manager:	Paul Wright/ Simon Baker
Special Instructions:			

NE/021/22

Analysis Request Section

Lab No.	Sample ID	Sample Date	Time	Matrix (Soil...etc)	Container Type & Preservative*	T-A-T (specify)	Chromium Suite for Acid Sulphate Soils	Acid Sulfate Soils Screen	pH, Cation Exchange Capacity (CEC), Iron and Clay Content	NOTES
1	BH22-03_2	25/08/2022		Soil	Z	STD		X		
2	BH22-03_4	25/08/2022		Soil	Z	STD		X		
3	BH22-03_5.5	26/08/2022		Soil	Z	STD		X	X	
4	BH22-03_7	26/08/2022		Soil	Z	STD		X		
5	BH22-03_8.5	26/08/2022		Soil	Z	STD		X		
6	BH22-03_11.5	26/08/2022		Soil	Z	STD		X	X	
7	BH22-03_10	27/08/2022		Soil	Z	STD		X		
8	BH22-03_13.45	26/08/2022		Soil	Z	STD		X		
9	BH22-03_14.5	27/08/2022		Soil	Z	STD		X		
10	BH22-03_16	26/08/2022		Soil	Z	STD		X		
11	BH22-03_17.5	26/08/2022		Soil	Z	STD		X		
12	BH22-03_19	26/08/2022		Soil	Z	STD		X		
13	BH22-03_20.5	26/08/2022		Soil	Z	STD		X		
14	BH22-03_23.5	26/08/2022		Soil	Z	STD		X		
15	BH22-03_26.5	29/08/2022		Soil	Z	STD		X		
16	BH22-03_29.5	29/08/2022		Soil	Z	STD		X		
17	BH22-03_32.5	29/08/2022		Soil	Z	STD		X		
18	BH22-03_35.5	29/08/2022		Soil	Z	STD		X		
19	BH22-03_38.5	29/08/2022		Soil	Z	STD		X		
20	BH22-03_39.5	29/08/2022		Soil	Z	STD		X		

Please Hold all samples for additional analysis

Sample BH22-03_39.5 may not be present, Continue analysis

Environmental Division
Brisbane
Work Order Reference
EB2227369

Telephone : + 61-7-3243 7222

RELINQUISHED BY		RECEIVED BY		Sample Receipt Advice: (Lab Use Only)	
Name: Osman Baig	Date: 16.09.2022	Name: [illegible]	Date: 20/9/22	All Samples Recieved in Good Condition	☐
Coffey Geotechnics	Time:	Company:	Time: 0805	All Documentation is in Proper Order	☐
Name:	Date: →	Name:	Date:	Samples Received Properly Chilled	☐
Company:	Time:	Company:	Time:	Lab. Ref/Batch No.	

***Container Type & Preservation Codes:** **P** - Plastic, **G**- Glass Bottle, **J** - Glass Jar, **V**- Vial, **Z** - Ziplock bag, **N** - Nitric Acid Preserved, **C** - Hydrochloric Acid Preserved, **S** - Sulphuric Acid Preserved, **I** - Ice, **ST** - Sodium Thiosulfate, **NP** - No Preservative

TOLL: MYTN 525 488

QUALITY CONTROL REPORT

Work Order	: **EB2227369**	Page	: 1 of 4
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Contact	: Khaleda Ataei
Address	: 4/60 Griffiths Rd Lambton 2299	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 20-Sep-2022
Order number	: WARA22-5754	Date Analysis Commenced	: 21-Sep-2022
C-O-C number	: ----	Issue Date	: 28-Sep-2022
Sampler	: Osman Baig		
Site	:		
Quote number	: NE/021/22 BQ		
No. of samples received	: 19		
No. of samples analysed	: 19		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Inorganics, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD
Kim McCabe	Senior Inorganic Chemist	Brisbane Inorganics, Stafford, QLD

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 4592839)									
EB2227369-003	BH22-03_5.5	EG005T: Iron	7439-89-6	50	mg/kg	1800	1940	7.3	0% - 20%
EB2227575-092	Anonymous	EG005T: Iron	7439-89-6	50	mg/kg	77300	78500	1.5	0% - 20%
EA002: pH 1:5 (Soils) (QC Lot: 4596211)									
EB2227816-001	Anonymous	EA002: pH Value	----	0.1	pH Unit	10.4	10.5	0.0	0% - 20%
EA003 :pH (field/fox) (QC Lot: 4597066)									
EB2227369-001	BH22-0.3_2	EA003: pH (F)	----	0.1	pH Unit	6.3	6.3	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	1.8	1.8	0.0	0% - 50%
EB2227369-011	BH22-03_17.5	EA003: pH (F)	----	0.1	pH Unit	8.7	8.6	0.0	0% - 20%
		EA003: pH (Fox)	----	0.1	pH Unit	5.3	5.2	0.0	0% - 20%
EA010: Conductivity (1:5) (QC Lot: 4596210)									
EB2227816-001	Anonymous	EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	319	319	0.0	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 4592849)									
EB2227455-001	Anonymous	EA055: Moisture Content	----	0.1	%	4.4	4.8	9.3	0% - 20%
ED005: Exchange Acidity (QC Lot: 4601019)									
EB2227369-003	BH22-03_5.5	ED005: Exchange Acidity	----	0.1	meq/100g	0.2	0.2	0.0	No Limit
		ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
ED006: Exchangeable Cations on Alkaline Soils (QC Lot: 4601032)									
EB2227369-006	BH22-03_11.5	ED006: Exchangeable Calcium	----	0.2	meq/100g	1.2	1.3	0.0	No Limit
		ED006: Exchangeable Magnesium	----	0.2	meq/100g	0.4	0.5	0.0	No Limit
		ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	<0.2	0.0	No Limit
		ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	<0.2	0.0	No Limit
		ED006: Cation Exchange Capacity	----	0.2	meq/100g	1.7	1.9	14.7	No Limit
ED007: Exchangeable Cations (QC Lot: 4601018)									

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
ED007: Exchangeable Cations (QC Lot: 4601018) - continued									
EB2227369-003	BH22-03_5.5	ED007: Exchangeable Calcium	----	0.1	meq/100g	0.6	0.5	0.0	No Limit
		ED007: Exchangeable Magnesium	----	0.1	meq/100g	0.2	0.1	0.0	No Limit
		ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit
		ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	<0.1	0.0	No Limit

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 4592839)								
EG005T: Iron	7439-89-6	50	mg/kg	<50	31000 mg/kg	98.7	70.0	120
EA002: pH 1:5 (Soils) (QCLot: 4596211)								
EA002: pH Value	----	----	pH Unit	----	4 pH Unit	100	98.0	102
				----	7 pH Unit	100	98.0	102
EA010: Conductivity (1:5) (QCLot: 4596210)								
EA010: Electrical Conductivity @ 25°C	----	1	µS/cm	<1	1412 µS/cm	100	97.0	103
EA152: Soil Particle Density (QCLot: 4592933)								
EA152: Soil Particle Density (Clay/Silt/Sand)	----	----	g/cm3	----	2.68 g/cm3	97.8	80.0	120
ED005: Exchange Acidity (QCLot: 4601019)								
ED005: Exchange Acidity	----	0.1	meq/100g	<0.1	----	----	----	----
ED005: Exchangeable Aluminium	----	0.1	meq/100g	<0.1	----	----	----	----
ED006: Exchangeable Cations on Alkaline Soils (QCLot: 4601032)								
ED006: Exchangeable Calcium	----	0.2	meq/100g	<0.2	8.0039 meq/100g	86.2	70.0	130
ED006: Exchangeable Magnesium	----	0.2	meq/100g	<0.2	5.5128 meq/100g	84.5	70.0	130
ED006: Exchangeable Potassium	----	0.2	meq/100g	<0.2	1.2397 meq/100g	99.9	70.0	130
ED006: Exchangeable Sodium	----	0.2	meq/100g	<0.2	2.0342 meq/100g	86.8	70.0	130
ED006: Cation Exchange Capacity	----	0.2	meq/100g	<0.2	16.7906 meq/100g	86.7	70.0	130
ED007: Exchangeable Cations (QCLot: 4601018)								
ED007: Exchangeable Calcium	----	0.1	meq/100g	<0.1	8.9 meq/100g	100	79.0	113
ED007: Exchangeable Magnesium	----	0.1	meq/100g	<0.1	9.52 meq/100g	97.3	85.0	115
ED007: Exchangeable Potassium	----	0.1	meq/100g	<0.1	1.49 meq/100g	104	70.0	122
ED007: Exchangeable Sodium	----	0.1	meq/100g	<0.1	1.3726 meq/100g	112	76.0	112
ED007: Cation Exchange Capacity	----	0.1	meq/100g	<0.1	21.283 meq/100g	100.0	82.0	112

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2227369**	Page	: 1 of 7
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 20-Sep-2022
Site	:	Issue Date	: 28-Sep-2022
Sampler	: Osman Baig	No. of samples received	: 19
Order number	: WARA22-5754	No. of samples analysed	: 19

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

- **Analysis Holding Time Outliers exist - please see following pages for full details.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Outliers : Analysis Holding Time Compliance

Matrix: **SOIL**

Method / Container / Client Sample ID(s)	Extraction / Preparation			Analysis		
	Date extracted	Due for extraction	Days overdue	Date analysed	Due for analysis	Days overdue
EA002: pH 1:5 (Soils)						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5, BH22-03_11.5	26-Sep-2022	02-Sep-2022	**24**	----	----	----
EA010: Conductivity (1:5)						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5, BH22-03_11.5	26-Sep-2022	02-Sep-2022	**24**	----	----	----
ED005: Exchange Acidity						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5	26-Sep-2022	23-Sep-2022	**3**	27-Sep-2022	23-Sep-2022	**4**
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_11.5	27-Sep-2022	23-Sep-2022	**4**	27-Sep-2022	23-Sep-2022	**4**
ED006: Exchangeable Cations on Alkaline Soils						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_11.5	26-Sep-2022	23-Sep-2022	**3**	27-Sep-2022	23-Sep-2022	**4**
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5	27-Sep-2022	23-Sep-2022	**4**	27-Sep-2022	23-Sep-2022	**4**
ED007: Exchangeable Cations						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5	26-Sep-2022	23-Sep-2022	**3**	27-Sep-2022	23-Sep-2022	**4**
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_11.5	27-Sep-2022	23-Sep-2022	**4**	27-Sep-2022	23-Sep-2022	**4**
ED008: Exchangeable Cations						
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_5.5	26-Sep-2022	23-Sep-2022	**3**	28-Sep-2022	23-Sep-2022	**5**
Snap Lock Bag - frozen on receipt at ALS						
BH22-03_11.5	27-Sep-2022	23-Sep-2022	**4**	27-Sep-2022	23-Sep-2022	**4**

Outliers : Frequency of Quality Control Samples

Matrix: **SOIL**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
Soil Particle Density	0	2	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
Total Metals by ICP-AES	0	4	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA002: pH 1:5 (Soils)							
Snap Lock Bag - frozen on receipt at ALS (EA002)							
BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**26-Sep-2022**	02-Sep-2022	×	**26-Sep-2022**	26-Sep-2022	✓
EA003 :pH (field/fox)							
Snap Lock Bag - frozen on receipt at ALS (EA003)							
BH22-0.3_2, BH22-03_4	**25-Aug-2022**	**23-Sep-2022**	20-May-2025	✓	**23-Sep-2022**	22-Dec-2022	✓
Snap Lock Bag - frozen on receipt at ALS (EA003)							
BH22-03_5.5, BH22-03_7, BH22-03_8.5, BH22-03_11.5, BH22-03_13.45, BH22-03_16, BH22-03_17.5, BH22-03_19, BH22-03_20.5, BH22-03_23.5	**26-Aug-2022**	**23-Sep-2022**	21-May-2025	✓	**23-Sep-2022**	22-Dec-2022	✓
Snap Lock Bag - frozen on receipt at ALS (EA003)							
BH22-03_10, BH22-03_14.5	**27-Aug-2022**	**23-Sep-2022**	22-May-2025	✓	**23-Sep-2022**	22-Dec-2022	✓
Snap Lock Bag - frozen on receipt at ALS (EA003)							
BH22-03_26.5, BH22-03_29.5, BH22-03_32.5, BH22-03_35.5, BH22-03_38.5	**29-Aug-2022**	**23-Sep-2022**	24-May-2025	✓	**23-Sep-2022**	22-Dec-2022	✓
EA010: Conductivity (1:5)							
Snap Lock Bag - frozen on receipt at ALS (EA010)							
BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**26-Sep-2022**	02-Sep-2022	×	**26-Sep-2022**	24-Oct-2022	✓
EA055: Moisture Content (Dried @ 105-110°C)							
Snap Lock Bag - frozen on receipt at ALS (EA055)							
BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**----**	----	----	**21-Sep-2022**	22-Feb-2023	✓
EA150: Soil Classification based on Particle Size							
Snap Lock Bag - frozen on receipt at ALS (EA150H)							
BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**----**	----	----	**28-Sep-2022**	22-Feb-2023	✓
EA152: Soil Particle Density							
Snap Lock Bag - frozen on receipt at ALS (EA152)							
BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**----**	----	----	**28-Sep-2022**	22-Feb-2023	✓

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
ED005: Exchange Acidity							
Snap Lock Bag - frozen on receipt at ALS (ED005) BH22-03_5.5	**26-Aug-2022**	**26-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
Snap Lock Bag - frozen on receipt at ALS (ED005) BH22-03_11.5	**26-Aug-2022**	**27-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
ED006: Exchangeable Cations on Alkaline Soils							
Snap Lock Bag - frozen on receipt at ALS (ED006) BH22-03_11.5	**26-Aug-2022**	**26-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
Snap Lock Bag - frozen on receipt at ALS (ED006) BH22-03_5.5	**26-Aug-2022**	**27-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
ED007: Exchangeable Cations							
Snap Lock Bag - frozen on receipt at ALS (ED007) BH22-03_5.5	**26-Aug-2022**	**26-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
Snap Lock Bag - frozen on receipt at ALS (ED007) BH22-03_11.5	**26-Aug-2022**	**27-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
ED008: Exchangeable Cations							
Snap Lock Bag - frozen on receipt at ALS (ED008) BH22-03_5.5	**26-Aug-2022**	**26-Sep-2022**	23-Sep-2022	×	**28-Sep-2022**	23-Sep-2022	×
Snap Lock Bag - frozen on receipt at ALS (ED008) BH22-03_11.5	**26-Aug-2022**	**27-Sep-2022**	23-Sep-2022	×	**27-Sep-2022**	23-Sep-2022	×
EG005(ED093)T: Total Metals by ICP-AES							
Snap Lock Bag - frozen on receipt at ALS (EG005T) BH22-03_5.5, BH22-03_11.5	**26-Aug-2022**	**23-Sep-2022**	22-Feb-2023	✓	**26-Sep-2022**	22-Feb-2023	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	3	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Moisture Content	EA055	1	10	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	1	6	**16.67**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH field/fox	EA003	2	19	**10.53**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soil Particle Density	EA152	0	2	**0.00**	**10.00**	×	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	4	**50.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
pH (1:5)	EA002	2	6	**33.33**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Soil Particle Density	EA152	1	2	**50.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Electrical Conductivity (1:5)	EA010	1	6	**16.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchange Acidity by 1M Potassium Chloride	ED005	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations	ED007	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Exchangeable Cations on Alkaline Soils	ED006	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	4	**25.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Total Metals by ICP-AES	EG005T	0	4	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
pH (1:5)	EA002	SOIL	In house: Referenced to Rayment and Lyons 4A1 and APHA 4500H+. pH is determined on soil samples after a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
pH field/fox	EA003	SOIL	In house: Referenced to Ahern et al 1998 - determined on a 1:5 soil/water extract designed to simulate field measured pH and pH after the extract has been oxidised with peroxide.
Electrical Conductivity (1:5)	EA010	SOIL	In house: Referenced to Rayment and Lyons 3A1 and APHA 2510. Conductivity is determined on soil samples using a 1:5 soil/water leach. This method is compliant with NEPM Schedule B(3).
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM Schedule B(3).
Particle Size Analysis by Hydrometer	EA150H	SOIL	Particle Size Analysis by Hydrometer according to AS1289.3.6.3
Soil Particle Density	EA152	SOIL	Soil Particle Density by AS 1289.3.5.1: Methods of testing soils for engineering purposes - Soil classification tests - Determination of the soil particle density of a soil - Standard method
Exchange Acidity by 1M Potassium Chloride	* ED005	SOIL	In house: referenced to Rayment and Lyons, method 15G1. This method is unsuitable for near neutral and alkaline soils. NATA accreditation does not cover performance of this service.
Exchangeable Cations on Alkaline Soils	* ED006	SOIL	In house: Referenced to Soil Survey Test Method C5. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with alcoholic ammonium chloride at pH 8.5. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil.
Exchangeable Cations	ED007	SOIL	In house: Referenced to Rayment & Lyons Method 15A1. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Exchangeable Cations with pre-treatment	ED008	SOIL	In house: Referenced to Rayment & Lyons Method 15A2. Soluble salts are removed from the sample prior to analysis. Cations are exchanged from the sample by contact with Ammonium Chloride. They are then quantitated in the final solution by ICPAES and reported as meq/100g of original soil. This method is compliant with NEPM Schedule B(3).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
Exchangeable Cations Preparation Method (Alkaline Soils)	ED006PR	SOIL	In house: Referenced to Rayment and Lyons method 15C1.
Exchangeable Cations Preparation Method	ED007PR	SOIL	In house: Referenced to Rayment & Lyons method 15A1. A 1M NH4Cl extraction by end over end tumbling at a ratio of 1:20. There is no pretreatment for soluble salts. Extracts can be run by ICP for cations.
Drying only	EN020D	SOIL	In house
1:5 solid / water leach for soluble analytes	EN34	SOIL	10 g of soil is mixed with 50 mL of reagent grade water and tumbled end over end for 1 hour. Water soluble salts are leached from the soil by the continuous suspension. Samples are settled and the water filtered off for analysis.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM Schedule B(3).

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EB2228546**	Page	: 1 of 3
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Contact	: Khaleda Ataei
Address	: 4/60 Griffiths Rd Lambton 2299	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 28-Sep-2022 17:03
Order number	: WARA22-5754	Date Analysis Commenced	: 04-Oct-2022
C-O-C number	: ----	Issue Date	: 04-Oct-2022 16:27
Sampler	: Osman Baig		
Site	: ----		
Quote number	: NE/021/22 BQ		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

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

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

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

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

- ASS: EA033 (CRS Suite):Retained Acidity not required because pH KCl greater than or equal to 4.5
- ASS: EA033 (CRS Suite): Laboratory determinations of ANC needs to be corroborated by effectiveness of the measured ANC in relation to incubation ANC. Unless corroborated, the results of ANC testing should be discounted when determining Net Acidity for comparison with action criteria, or for the determination of the acidity hazard and required liming amounts.
- ASS: EA033 (CRS Suite): 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'.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Sample ID	BH22-03_2	BH22-03_5.5	BH22-03_8.5	BH22-03_11.5	BH22-03_19
			Sampling date / time	25-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00	26-Aug-2022 00:00
Compound	CAS Number	LOR	Unit	EB2228546-001	EB2228546-002	EB2228546-003	EB2228546-004	EB2228546-005
				Result	Result	Result	Result	Result
EA033-A: Actual Acidity								
pH KCl (23A)	----	0.1	pH Unit	**4.8**	**5.3**	**6.4**	**5.8**	**7.8**
Titratable Actual Acidity (23F)	----	2	mole H+ / t	**58**	**8**	<2	**2**	<2
sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	**0.09**	<0.02	<0.02	<0.02	<0.02
EA033-B: Potential Acidity								
Chromium Reducible Sulfur (22B)	----	0.005	% S	**0.157**	**0.222**	**0.128**	**0.396**	**1.74**
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	**98**	**138**	**80**	**247**	**1080**
EA033-C: Acid Neutralising Capacity								
Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	**----**	**----**	**----**	**----**	**1.94**
acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	**----**	**----**	**----**	**----**	**387**
sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	**----**	**----**	**----**	**----**	**0.62**
EA033-E: Acid Base Accounting								
ANC Fineness Factor	----	0.5	-	**1.5**	**1.5**	**1.5**	**1.5**	**1.5**
Net Acidity (sulfur units)	----	0.02	% S	**0.25**	**0.23**	**0.13**	**0.40**	**1.33**
Net Acidity (acidity units)	----	10	mole H+ / t	**156**	**146**	**80**	**250**	**827**
Liming Rate	----	1	kg CaCO3/t	**12**	**11**	**6**	**19**	**62**
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	**0.25**	**0.23**	**0.13**	**0.40**	**1.74**
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	**156**	**146**	**80**	**250**	**1080**
Liming Rate excluding ANC	----	1	kg CaCO3/t	**12**	**11**	**6**	**19**	**81**

From: Wright, Paul <Paul.Wright@tetratech.com>
Sent: Wednesday, 28 September 2022 5:03 PM
To: Khaleda Ataei <khaleda.ataei@ALSGlobal.com>
Cc: Baker, Simon <Simon.Baker@tetratech.com>; Baig, Osman <OSMAN.BAIG@tetratech.com>
Subject: [EXTERNAL] - FW: RESULTS & EDD for ALS Workorder : EB2227369 | Your Reference: 711 Huter St - 754-NTLGE293239

CAUTION: This email originated from outside of ALS. Do not click links or open attachments unless you recognize the sender and are sure content is relevant to you.

Hi Khaleda,
Could I request the following samples for EA033 chromium suite analysis please? Fastest TAT possible would be appreciated.

BH22-03_2
BH22-03_5.5
BH22-03_8.5
BH22-03_11.5
BH22-03_19

Environmental Division
Brisbane
Work Order Reference
EB2228546

Telephone : +61-7-3243 7222

Cheers

Dr. Paul Wright | Newcastle Geoservices Leader
Direct **+61 2 4028 9700**| Mobile **+61 417 667 296** | paul.wright@tetratech.com

Tetra Tech Coffey | *Leading with Science®*
Unit 4/60 Griffiths Road | Lambton NSW 2299 | tetratech.com | tetratechcoffey.com

We have moved – we are now located at Unit 4/60 Griffiths Road, Lambton NSW 2299

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EB2228546**	Page	: 1 of 4
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Contact	: Khaleda Ataei
Address	: 4/60 Griffiths Rd Lambton 2299	Address	: 2 Byth Street Stafford QLD Australia 4053
Telephone	: ----	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 28-Sep-2022
Order number	: WARA22-5754	Date Analysis Commenced	: 04-Oct-2022
C-O-C number	: ----	Issue Date	: 04-Oct-2022
Sampler	: Osman Baig		
Site	: ----		
Quote number	: NE/021/22 BQ		
No. of samples received	: 5		
No. of samples analysed	: 5		

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Accredited for compliance with
ISO/IEC 17025 - Testing

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

This Quality Control Report contains the following information:

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Ben Felgendrejeris	Senior Acid Sulfate Soil Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

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

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Acceptable RPD (%)
EA033-A: Actual Acidity (QC Lot: 4611554)									
EB2228224-001	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.0	9.1	0.0	0% - 20%
EB2228224-011	Anonymous	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	9.7	9.7	0.0	0% - 20%
EA033-A: Actual Acidity (QC Lot: 4611557)									
EB2228546-005	BH22-03_19	EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.0	No Limit
		EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	0.0	No Limit
		EA033: pH KCl (23A)	----	0.1	pH Unit	7.8	7.9	1.3	0% - 20%
EA033-B: Potential Acidity (QC Lot: 4611554)									
EB2228224-001	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.027	0.025	6.2	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	16	16	6.2	No Limit
EB2228224-011	Anonymous	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	0.012	0.012	0.0	No Limit
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	0.0	No Limit
EA033-B: Potential Acidity (QC Lot: 4611557)									
EB2228546-005	BH22-03_19	EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	1.74	1.64	5.9	0% - 20%
		EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	1080	1020	5.9	0% - 20%
EA033-C: Acid Neutralising Capacity (QC Lot: 4611554)									
EB2228224-001	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	0.67	0.60	11.0	0% - 20%

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Acceptable RPD (%)*
EA033-C: Acid Neutralising Capacity (QC Lot: 4611554) - continued									
EB2228224-001	Anonymous	EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.22	0.19	11.0	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	134	120	11.0	0% - 50%
EB2228224-011	Anonymous	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	2.88	2.82	1.8	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.92	0.90	1.8	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	575	564	1.8	0% - 20%
EA033-C: Acid Neutralising Capacity (QC Lot: 4611557)									
EB2228546-005	BH22-03_19	EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	1.94	1.64	16.8	0% - 20%
		EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	0.62	0.52	16.8	0% - 20%
		EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	387	327	16.8	0% - 20%

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

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

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Acceptable Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EA033-A: Actual Acidity (QCLot: 4611554)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	100	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	16 mole H+ / t	113	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-A: Actual Acidity (QCLot: 4611557)								
EA033: pH KCl (23A)	----	----	pH Unit	----	4.4 pH Unit	100	91.0	107
EA033: Titratable Actual Acidity (23F)	----	2	mole H+ / t	<2	16 mole H+ / t	107	70.0	124
EA033: sulfidic - Titratable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4611554)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	109	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-B: Potential Acidity (QCLot: 4611557)								
EA033: Chromium Reducible Sulfur (22B)	----	0.005	% S	<0.005	0.246 % S	102	77.0	121
EA033: acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 4611554)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	99.6	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----
EA033-C: Acid Neutralising Capacity (QCLot: 4611557)								
EA033: Acid Neutralising Capacity (19A2)	----	0.01	% CaCO3	<0.01	10 % CaCO3	97.4	91.0	112
EA033: acidity - Acid Neutralising Capacity (a-19A2)	----	10	mole H+ / t	<10	----	----	----	----
EA033: sulfidic - Acid Neutralising Capacity (s-19A2)	----	0.01	% pyrite S	<0.01	----	----	----	----

Matrix Spike (MS) Report

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

- **No Matrix Spike (MS) or Matrix Spike Duplicate (MSD) Results are required to be reported.**

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EB2228546**	Page	: 1 of 4
Client	: **TETRA TECH COFFEY PTY LTD**	Laboratory	: Environmental Division Brisbane
Contact	: PAUL WRIGHT	Telephone	: + 61 2 8784 8555
Project	: 711 Huter St - 754-NTLGE293239	Date Samples Received	: 28-Sep-2022
Site	: ----	Issue Date	: 04-Oct-2022
Sampler	: Osman Baig	No. of samples received	: 5
Order number	: WARA22-5754	No. of samples analysed	: 5

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

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

Summary of Outliers

Outliers : Quality Control Samples

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

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

Outliers : Analysis Holding Time Compliance

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

Outliers : Frequency of Quality Control Samples

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

Analysis Holding Time Compliance

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

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

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

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

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA033-A: Actual Acidity							
80* dried soil (EA033) BH22-03_5.5	**26-Aug-2022**	**04-Oct-2022**	26-Aug-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
80* dried soil (EA033) BH22-03_2, BH22-03_8.5, BH22-03_11.5, BH22-03_19	**29-Sep-2022**	**04-Oct-2022**	29-Sep-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
EA033-B: Potential Acidity							
80* dried soil (EA033) BH22-03_5.5	**26-Aug-2022**	**04-Oct-2022**	26-Aug-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
80* dried soil (EA033) BH22-03_2, BH22-03_8.5, BH22-03_11.5, BH22-03_19	**29-Sep-2022**	**04-Oct-2022**	29-Sep-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
EA033-C: Acid Neutralising Capacity							
80* dried soil (EA033) BH22-03_5.5	**26-Aug-2022**	**04-Oct-2022**	26-Aug-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
80* dried soil (EA033) BH22-03_2, BH22-03_8.5, BH22-03_11.5, BH22-03_19	**29-Sep-2022**	**04-Oct-2022**	29-Sep-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
EA033-D: Retained Acidity							
80* dried soil (EA033) BH22-03_5.5	**26-Aug-2022**	**04-Oct-2022**	26-Aug-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
80* dried soil (EA033) BH22-03_2, BH22-03_8.5, BH22-03_11.5, BH22-03_19	**29-Sep-2022**	**04-Oct-2022**	29-Sep-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
EA033-E: Acid Base Accounting							
80* dried soil (EA033) BH22-03_5.5	**26-Aug-2022**	**04-Oct-2022**	26-Aug-2023	✓	**04-Oct-2022**	02-Jan-2023	✓
80* dried soil (EA033) BH22-03_2, BH22-03_8.5, BH22-03_11.5, BH22-03_19	**29-Sep-2022**	**04-Oct-2022**	29-Sep-2023	✓	**04-Oct-2022**	02-Jan-2023	✓

Quality Control Parameter Frequency Compliance

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

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Chromium Suite for Acid Sulphate Soils	EA033	3	30	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Chromium Suite for Acid Sulphate Soils	EA033	2	30	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Chromium Suite for Acid Sulphate Soils	EA033	2	30	**6.67**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Brief Method Summaries

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

Analytical Methods	Method	Matrix	Method Descriptions
Chromium Suite for Acid Sulphate Soils	EA033	SOIL	In house: Referenced to Ahern et al 2004. This method covers the determination of Chromium Reducible Sulfur (SCR); pHKCl; titratable actual acidity (TAA); acid neutralising capacity by back titration (ANC); and net acid soluble sulfur (SNAS) which incorporates peroxide sulfur. It applies to soils and sediments (including sands) derived from coastal regions. Liming Rate is based on results for samples as submitted and incorporates a minimum safety factor of 1.5.

Preparation Methods	Method	Matrix	Method Descriptions
Drying at 85 degrees, bagging and labelling (ASS)	EN020PR	SOIL	In house