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ACID SULFATE SOIL MANAGEMENT PLAN

Sandhills Stormwater Management System – Cowper Street, Byron Bay, NSW

(Lot 383, DP728202)

For:

Byron Shire Council

Date:

14 December 2023

ENV Services Pty Ltd
ABN 58 600 788 814
PO Box 248, Ballina NSW 2478
T: +61 428 910 445
E: admin@envsolutions.com.au
www.envsolutions.com.au

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Scope of Engagement and Limitations:

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List of Acronyms:

Below is a list of commonly used acronyms in this report:

AASS – Actual Acid Sulfate Soils

ASS – Acid Sulfate Soils

ASSMAC – Acid Sulfate Soils Management Advisory Committee (NSW)

BSC – Byron Shire Council

COC – Chain of Custody

CRS – Chromium Reducible Sulfur

ENV – ENV Solutions PTY LTD

ha – Hectare

mBGL – Metres Below Ground Level

NASSIMM – National Acid Sulfate Soils Sampling and Identification Methods Manual

NEPC – National Environment Protection Council

NEPM – National Environment Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013)

NSW EPA – New South Wales Environment Protection Authority

PASS – Potential Acid Sulfate Soils

QA/QC – Quality Assurance and Quality Control

TAA – Titratable Actual Acidity

N/D – No Data

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Executive Summary

ENV Services Pty Ltd (ENV) was engaged by Byron Shire Council (Council) to complete an Acid Sulfate Soils Assessment and Management Plan (ASSMP) for the proposed development of Sandhills Stormwater Management System; Cowper Street, Byron Bay NSW; Lot 383, DP728202 (herein referred to as 'the site').

Proposal Description

ENV understand that Council proposes to develop to develop a stormwater management system on the site including constructed wetlands featuring three cells (W1, W2 and W3) with trafficable spillways and paths collectively referred to in this plan as the *Sandhills Wetlands*.

Acid sulfate soil (ASS) risk mapping presented in GeoLINK (2007) *Sandhills Wetland Estate Strategic Planning Study* shows the site as having Class 3 ASS risk in the southern portion of the site and Class 5 ASS Risk in the northern portion of the site.

Works with potential to impact ASS comprise the excavation of proposed wetland cells, which will be excavated to a maximum depth of 3.0 mBGL.

Preliminary design plans indicate that an approximate 15,642 m^3 soil material is to be excavated from an area of approximately 20,750 m^2 during the construction program, comprising the following wetland cells:

- W1 – 1,903 m^3;
- W2 – 3,235 m^3;
- W3 – 9,700 m^3; and
- Paths – 25 m^3.

An additional 3,636m^3 of topsoil (0-300mm) is anticipated to be cut and reused onsite.

Action Criteria

Action criteria for ASS was adopted in accordance with the Acid Sulfate Soils Assessment Guidelines (ASSMAC) (Stone *et al*., 1998) and with reference to the anticipated disturbance of > 1000 tonnes of soil. The site-specific action criteria for this ASS investigation consisted of:

- Net Acidity (Non-Treated Soil): ≤ 18 mol H+/tonne or ≤ 0.03 % S_{cr}

Investigation Results

ENV completed field programs on 29-30 June 2021, 25 November 2021 and 31 August 2023. The additional investigation rounds were undertaken in consideration of revised cell locations. Each of the 70 collected samples were subject to field peroxide screening. Of these, 35 samples were selected for analysis for ASS and net acidity using the chromium reducible sulfur (CRS) suite test.

Samples were collected at 0.5m intervals (or where a discrete soil layer was encountered) in accordance with the ASSMAC Guidelines and scheduled ASS analysis (using pH peroxide screening and select samples for chromium reducible Sulfur suite).

Laboratory analysis results indicated the presence of Actual Acid Sulfate Soil (AASS) and Potential Acid Sulfate Soil (PASS) material on-site, with the Net Acidity exceeding the adopted action criteria in samples collected from the natural ground surface to a depth of 5.0 mBGL. Surface soils typically comprised AASS sands with clay and silt inclusions overlaying a PASS clay stratum. Discrete bands of material exceeding the PASS threshold of 0.03 %Scr were also noted to occur in materials sampled as; BH1_0.65 (0.041 %Scr), BH5_0.0 (0.033 %Scr), EA-1_1.0 (0.038 %Scr) & EX3_1.3 (0.036 %Scr).

Due to the reported net acidity exceeding the adopted action criteria, an acid sulfate soils management plan (ASSMP) is required to mitigate any human-health and environmental impacts from ASS during the proposed redevelopment works.

Neutralisation Rates

Comparison of reported analytical results (i.e. chromium reducible sulfur suite – CRS) presented in Table 3, with the geologic profile recorded during the sampling program (refer to borehole logs, Appendix C), indicate that the material can be managed as three (3) treatment units:

- **Unit 1** - Associated with samples BH1_0.65, BH5_0.0, EX3_1.3 (noting that this material occurred as a discrete soil stratum. Material at these sample locations comprised silts. The maximum Net Acidity recorded was at BH5_0.0 (344 mol H+/t) with an applicable liming rate of 26 kg $CaCO_3$/t DW. To facilitate practical application and mixing of lime, all soils from the surface to the maximum depth of the silt layer (0.7 mBGL at BH1, 0.4 mBGL at BH5 & 1.5m BGL at EX3) shall be treated as Unit 1.
- **Unit 2** – Associated with all samples up to a depth of 4.0 mBGL (excluding Unit 1). Soils associated with this management unit primarily comprise sand-clay mixtures and sand. The maximum Net Acidity recorded was at BH1_3.0 (184 mol H+/t) with an applicable liming rate of 14 kg $CaCO_3$/t DW.
- **Unit 3** – Associated with material at a depth of 4.0 -5 mBGL and below comprising clay. The maximum Net Acidity recorded was at BH1_4.5 (724 mol H+/t) with an applicable liming rate of 54 kg $CaCO_3$/t DW.

For the management of each treatment unit, the maximum applicable liming rate has been adopted.

Summary of Liming Rates

Treatment Unit	Depth Interval* (mBGL)	Liming Rate ($CaCO_3$/t DW)	Typical soils
Unit 1	BH1 – 0.0 to 1.0, BH5 – 0.0 to 0.5 EX3 – 1.3 to 1.5	26	Silt
Unit 2	0.0 to 4.0 (excluding Unit 1)	14	Sand/Sandy Clays
Unit 3	4.0 to 5.0	54	Clay

Options for treatment of excavated ASS soil comprise the following:

Option 1 - In-situ mixing during excavation

During the excavation program, aglime is to be progressively added to in-situ soils (0.3 m layers). The aglime is to be mixed into the upper portion of the soil by a tractor pulled rotary hoe or excavator (with mixing attachment) prior to excavation. After mixing, the soil is to be stockpiled within the self-bunded excavation pending validation results. Any potential acidic leachate is to be managed through pH correction during construction water management. Adequate sediment and erosion measures are required to be in place to prevent surface water flow entering the self-bunded area (i.e. clean water diversions).

Option 2 - On-pad treatment

Untreated soil will be excavated directly onto a suitably designed treatment pad where aglime will be added and validation will occur.

In-situ Soils

Dusting of exposed surfaces of excavations should be carried out at a rate of not less than 1 kg of fine aglime per m^2 of exposed soil surface.

Validation

Once neutralised, the treated soils must be validated by a duly qualified environmental consultant.

Validation sampling and analysis will be undertaken at a frequency that will demonstrate that satisfactory neutralisation has taken place. The frequency of soil validation sampling and analysis will be:

- **Treatment Units 1-2**: 1 sample per 1000 m^3 of remediated soil (low risk material); and
- **Treatment Unit 3**: 1 sample per 500 m^3 of remediated soil (medium risk material).

Management of Treated Soils

It is understood that the excavated and treated soil will be reused off site where possible (i.e. a specific exemption will be sought from NSW Environment Protection Authority (NSW EPA) for the beneficial re-use of neutralised material). A receiving site has not been nominated at this stage. Receiving sites will require Development Approval to receive fill. If an exemption from the NSW EPA is not sought, the material is considered a waste product and is to be disposed in a suitably licenced facility.

1. Introduction

1.1 Introduction

ENV Services Pty Ltd (ENV) was engaged by Byron Shire Council (Council) to complete an Acid Sulfate Soils Assessment and Management Plan (ASSMP) for the proposed development of Sandhills Stormwater Management System; Cowper Street, Byron Bay NSW; Lot 383, DP728202 (herein referred to as 'the site'). The regional site location is presented on Figure 1, Appendix A.

The site is currently undeveloped with exception of an underground sewer line and a gravel pedestrian and vehicle access road.

ENV understands that Council intends to develop a stormwater management system on the site including constructed wetlands, comprising three (3) cells (W1, W2 and W3) with trafficable spillways connecting each cell, collectively referred to as Sandhills Wetlands.

Preliminary design plans provided to ENV by the client indicate that excavations will be required up to an approximate depth of 3.0 metres below ground level (mBGL) and an approximate 15,642 m^3 of soil (in-situ volume) will be excavated as part of the development. A copy of the preliminary design drawings is provided as Appendix B.

Acid sulfate soil (ASS) risk mapping presented in GeoLINK (2007) *Sandhills Wetland Estate Strategic Planning Study* shows the site as having Class 3 ASS risk in the southern portion of the site and Class 5 ASS Risk in the northern portion of the site. An ASS Management Plan (ASSMP) is required to satisfy the Secretary's Environmental Assessment Requirements dated 1 September 2023.

The assessment completed by ENV determined that ASS exist at the site. Actual Acid Sulfate Soil (AASS) material was encountered from surface level and Potential Acid Sulfate Soil (PASS) occurs from 3.0 mBGL. In addition, small discrete bands of PASS material at select sample points were identified. These soils will require management throughout the construction and dewatering process.

This ASSMP presents the treatment works and management procedures to be adopted during the proposed earthworks associated with the development. The management measures for dewatering should be incorporated into a dewatering management plan (DMP).

1.2 Relevant Objectives

The objectives that are relevant to ASS management include:

- To minimise the potential for inappropriate material handling through accurate identification of ASS;
- To manage ASS material so that the potential for environmental harm is minimised;
- To minimise lowering of the groundwater, due to dewatering, in areas containing PASS;
- To minimise the potential for adverse environmental impact due to handling, storage and application of hazardous materials related to the treatment of ASS;
- To ensure awareness of all personnel involved in the works in the proposed development, of the requirements of this ASSMP and its objectives and management, particularly those aspects relevant to the individual worker.

1.3 Targets & Performance Indicators

The targets that are relevant to management of ASS include:

- ASS material has been identified;
- Excavation and/or filling to occur only in those areas where disturbance is necessary;
- No residual sulfidic acidity is present in treated excavated material, this to be confirmed by collection and analysis of verification samples;
- Confirmation that any containment measures (i.e. bunds) are intact and impermeable and that records be kept of effectiveness and augmentation of these facilities;
- Groundwater level is maintained above PASS during and after works, where practically possible;
- Confirmation that any collected groundwater or surface water meets relevant approved release criteria and/or existing characteristics prior to discharge to a receiving environment;
- Confirmation that handling and storage of hazardous materials is undertaken in accordance with relevant legislation and that records are kept of said handling and storage;
- All personnel involved in the works have undertaken appropriate training for their role in the project with regards to management of ASS.

1.4 Acid Sulfate Soils (ASS)

Acid Sulfate Soil (ASS) is the common name given to soils containing iron sulfides. When exposed to oxygen through lowering of surrounding groundwater or excavation, air drawn into the soils can cause oxidation of the iron sulfides, producing sulfuric acid.

ASS typically occurs in low-lying coastal areas with historically high organic matter. Runoff from exposed ASS areas may find its way to stormwater, groundwater and eventually into natural aquatic environments. The acidic runoff may lower the pH of receiving waters, increase the concentration of metals and reduce the natural buffering capacity of the receiving waters.

There are two basic types of ASS: Actual Acid Sulfate Soils (AASS) and Potential Acid Sulfate Soils (PASS). AASS are soils in which some sulfides have already been oxidised. PASS are soils in which the sulfides have not yet been oxidised (i.e. they contain oxidisable sulfur). AASS and PASS can coexist. Hence, AASS environments may already be acidic and an ongoing source acid generation.

In anaerobic conditions (such as below the water table), PASS do not pose an environmental threat, however if conditions change (such as during dewatering or excavation), the sulfides can oxidise and form sulfuric acid (and release metals such as aluminium at toxic concentrations) which can then enter groundwater and/or surface water. Developments involving excavation or dewatering must establish the presence and extent of ASS down the soil profile, as works may intercept ASS horizons and pose risks to both human and ecological health.

Exposure of PASS to oxygen, even for a short period of time, can result in the continued oxidisation of pyrite (FeS_2) through the exchange of electrons between Fe^{2+} and Fe^{3+}. This reaction, which can produce sulfuric acid (H_2SO_4), can continue in the absence of oxygen (re-saturated sediments) resulting in the same environmental impact as could be expected should excavated materials be exposed to the atmosphere.

1.5 Proposed Development

1.5.1 Summary

The proposed redevelopment works include removal of vegetation across the construction envelope and construction of three wetland cells (W1, W2 and W3) with trafficable spillways. Walking tracks through the greater site will allow for public recreational use of the site.

1.5.2 Excavation

Works with potential to impact ASS comprise the excavation of proposed wetland cells, to be excavated to a maximum depth of 3.0 mBGL.

Preliminary design plans indicate that an approximate 15,642 m^3 of soil material is to be excavated from an area of 20,750 m^2 during the construction program, comprising the following wetland cells:

- W1 – 1,903 m^3;
- W2 – 3,235 m^3;
- W3 – 9,700 m^3; and
- Paths – 25m^3.

An additional 3,636m^3 of topsoil to a depth of 300mm is to be removed and be reused over the construction area. Development plans provided by the client are available as Appendix B.

1.5.3 Dewatering

The site is low-lying, and the ASS investigation encountered the water table between 1.0 and 2.5 mBGL. Consequently, groundwater will be intercepted during the proposed excavations. A Construction Water Management Plan (CWMP) (ENV, 2023) has been developed outlining the dewatering process, water treatment, mitigation measures, discharge criteria, action criteria and contingency and emergency responses.

2 Existing Site Conditions

2.1 Topography

The site is relatively flat and low lying, with an elevation ranging between 7 and 11 m Australian Height Datum (AHD) (Google Earth Imagery). Land surrounding the site generally grades down to the south-west. Land to the east of the site (Massinger Street and the proceeding area) is elevated. Surface runoff may flow into the site from Massinger Street.

2.2 Geology and Soils

The site is situated within the Tyagarah soil landscape. The Tyagarah soil landscape is generally summarised as follows:

Soils - deep (>150 cm), moderately well-drained minimal Prairie Soils near basaltic areas. Deep (>150 cm), well-drained Podzols and Acid Peats near barrier systems.

Geology - Quaternary estuarine alluvium overlain by and/or mixed with Quaternary (Pleistocene) sands. The sands are generally aeolian, originating from the adjacent beach ridge systems (NSW Department of Planning, Industry and Environment, 2020).

The Strategic Planning Study (GeoLINK, 2007) identifies that the Department of Land & Water Conservation have mapped site as having acid sulfate soils (ASS) risk, Class 5 risk in the northern portion and Class 3 risk for the remainder of the site. An excerpt of the ASS risk mapping is provided as Figure 7, Appendix A.

2.3 Surface Water Drainage and Flooding

Information relating to surface water, drainage and stormwater has been summarised from the Strategic Planning Study (GeoLINK, 2007). An excerpt of the GeoLINK stormwater and flooding map is presented as Figure 5, Appendix A.

The areas along the southern boundary of the site are prone to flooding and are mapped as having a 1 in 100-year flood event risk.

The site contains stormwater drainage lines, consisting of an open creek line in the east and piped stormwater lines in the central and south-western areas. A stormwater inlet pit is situated within the Cowper Street road reserve, where it enters the site. Water flowing into this inlet pit travels north along a stormwater pipe that outlets onto Clarkes Beach. During larger rainfall events, a second pipe flows to the west, to the 'Railway outfall' catchment. Stormwater exceeding the pipe capacity overflows into the site (GeoLINK, 2007).

2.4 Groundwater Resources

A search of regional groundwater bores was undertaken on 2 July 2021 using the WaterNSW Realtime Database. Six (6) licensed groundwater bores within 4,500 m of the site were listed on the database. Details of these bores are summarised in Table 1.

Table 1: Licensed Groundwater bores

Bore ID	Distance (approximate) & Direction	Purpose	Installation Depth (m)	Standing Water Level (m)	Completion Date
GW306318	100 m South	Monitoring Bore	4.6	-	2007
GW300932	150 m South	Domestic, Recreation	10.0	-	1997
GW306401	170 m South	Monitoring Bore	1.5	0.6	2007
GW301091	250 m South	Domestic	7.0	-	1995
GW303447	200 m West	Dewatering	13.0	-	-
GW303689	220 m West	Domestic	3.1	1.8	1981

Three of the licensed bores identified on the WaterNSW database have a listed purpose of 'Domestic'.

The township of Byron Bay is serviced by reticulated water supply. On this basis, it is reasonably assumed that any (potential) water abstraction is used for irrigation or other non-consumption purposes.

The site and surrounding areas' topography and surface drainage indicate that regional groundwater likely flows to the south-west.

A plan showing licensed groundwater bores within the site region is presented as Figure 6, Appendix A.

2.5 Surrounding Land Use

The site is located within the township of Byron Bay, landuse immediately surrounding the site can be generally summarised as:

- North: Residential properties proceeded by the Pacific Ocean;
- South: Residential properties and sports fields;
- East: Residential properties;
- West: Undeveloped land, proceeded by Byron Bay central business district.

3 Acid Sulfate Soil Investigation

3.1 Methodology

The investigation program comprised six (6) boreholes (BH1 to BH6) to a maximum depth of 5.0 mBGL.

The total number of sampling locations meet the minimum density required by the *Acid Sulfate Soil Management Advisory Committee (ASSMAC)* for a site area of up to 2 ha (Stone *et al*., 1998). Additional acid Sulfate soils sampling programs were undertaken on 25 November 2021 (EA-1) and 31 August 2023 (EX1-EX4) due to revised cell locations. Sampling locations are illustrated in Figure 3, Appendix A and sampling location GPS Coordinates are presented in Appendix F.

Two boreholes (BH1 and BH2) were undertaken using ENV's trailer mounted drill rig at the perimeter of the proposed wetland areas. Boreholes BH1 and BH2 were completed to a target depth of 5.0 m.

Borehole locations BH3 to BH6 & EA-1 could not be accessed by vehicle due to extensive vegetation and waterlogged soils. As such, boreholes at each of these locations were undertaken by hand augur. Hand augured boreholes could not be advanced beyond 2.0 – 2.5 mBGL as saturated sands encountered below the water table resulted in repeated borehole collapse. Samples EX-1 to EX-4 were collected by the use of an excavator with solid flight auger attachment and/or excavator bucket depending on ground stability at the sampling point.

Samples were collected from the surface (0.0 – 0.1 mBGL) and every 0.5 m thereon, to the maximum investigation depth of 5.0 m. A total of 70 samples were obtained, including three (3) additional sample collected from BH1 at a depth of 0.65 mBGL & EX3 at a depth of 0.8mBGL & 1.3mBGL where a discrete soil horizon occurred (silt layer) between 0.6 and 0.7 mBGL (refer to borehole logs provided as Appendix C). Each sample was collected by hand from directly against the auger stem to minimise the risk of mixing (drill rig boreholes) or for hand augured boreholes, directly from the augur barrel. Samples EX1-EX4 were collected off the excavator auger or directly from the bucket of the excavator. Disposable nitrile gloves were used for all discrete sampling events. The geological profile was logged in general accordance with the unified soil classification system (USCS) and photographs taken of the soil and the site.

Each of the samples were sealed in new jars, supplied by the analytical laboratory, and filled such that it contained no headspace. Organic matter (e.g. leaves and twigs) were removed from the sample as much as practically possible prior to collection. Collected samples were placed immediately into an insulated container chilled with ice and transported to Environmental Analysis Laboratory (EAL) in Lismore or Eurofins (Brisbane) with accompanying chain of custody (COC) documentation.

Each of the 70 collected samples were subject to field peroxide screening. Of these, 35 samples were selected for analysis for ASS and net acidity using the chromium reducible sulfur (CRS) suite test.

Selection criteria for samples analysed for CRS was based on a combination of the results of field observations and peroxide screening results.

3.1.1 Action Criteria

Action criteria for ASS was adopted in accordance with the Acid Sulfate Soils Assessment Guidelines (ASSMAC) (Stone et al., 1998) and with reference to the anticipated disturbance of > 1000 tonnes of soil. The site-specific action criteria for this ASS investigation consisted of:

- Net Acidity (Non-Treated Soil): ≤ 18 mol H+/tonne or ≤ 0.03 % S_{cr}

3.2 Results

3.2.1 Field Observations

The natural soils at the site, based on observations made during the drilling and soil sampling activities, can generally be described as silty/sandy clays overlaying sands. At BH1, a clay layer was encountered from 4.2 to 5.0 mBGL.

All soils encountered appeared to be natural soils with exception of BH2, where the upper 0.55 m of soils appeared to comprise fill material.

Groundwater was encountered between a depth of 1.0 and 2.5 mBGL. The variation in water table is attributable to the undulating ground surface level and proximity to surface water drains. It is noted that the site investigation as undertaken during a period of wet weather.

Sulfidic odours were noted in subsurface soils at the locations of BH1, BH2, BH3, EX1 & EX3. A discrete layer of silt with strong sulfur odours was encountered at EX3 between 1.3-1.5m BGL.

Detailed borehole logs are provided as Appendix C.

An area of scalded grass was noted in the south-eastern portion of the site during the investigation program. BH6 was undertaken in the centre of the scalded area. No sulfuric odours were observed at this location.

Vegetation at the site comprised low-lying coastal swamp communities intersected by natural and constructed ephemeral and perennial drainage lines. Paperbark and sedges typical of coastal swamp vegetation were common across the site.

3.2.2 Laboratory Analysis Results

The laboratory results (chromium suite testing) for the ASS investigation are presented in Table 2. The laboratory certificate, which also includes the field peroxide screening results, are provided in Appendix D**.**

The field peroxide screening results reported by the laboratory are summarised as follows:

- pH_F ranged between 4.14 and 7.14;
- pH_{FOX} results ranged between 1.65 and 5.48;
- The peroxide reaction strengths, classified by the laboratory, varied between low and volcanic for the samples collected; and

Soil texture was classified as either fine or coarse.

All samples analysed for the CRS suite (with exception of BH1_0.1 & EX3_0.5) were reported to support a Net Acidity in exceedance of the adopted action criteria (≤ 18 mol H+/tonne). Net acidity results ranged from 5 mol H+/tonne (BH1_0.1) to 724 mol H+/tonne (BH1_4.5).

The analytical results indicate that the majority of the material sampled comprise AASS, with PASS occurring at discrete sample points (i.e. BH1_0.65, BH1_3.0, BH1_4.5, BH5_0.0, EA-1_1.0, EX3_1.3) (refer to Table 2).

It is noted that the maximum sampling depth through the centre of the construction envelope was 2.5 mBGL as saturated sands could not be recovered from the hand augured boreholes. As such, the potential exists for ASS to occur in soils between 2.0 and 5.0 mBGL.

The CRS results are presented as Table 2. The full laboratory reports including peroxide screening results are provided as Appendix D.

Table 2: Laboratory results (CRS Suite)

Sample Location	Depth (m)	Texture	pH_{KCl}	Net Acidity (Non-Treated Soil) (mole H^+/tonne)	Net Acidity (Non-Treated Soil) Action Criterion* (mole H^+/tonne)	Potential Sulfidic Acidity (CRS) ($\%S_{cr}$)*	Potential Sulfidic Acidity (C_{RS}) Action Criterion ($\%S_{cr}$)*	Liming Rate (kg $CaCO_3$/tonne DW)
BH1	0.1	Coarse	6.16	5	≤ 18	<0.005	≤ 0.03	0
	0.65	Fine	4.44	180		0.041		14
	1.5	Coarse	5.15	34		0.012		3
	3	Coarse	4.83	184		0.233		14
	4.5	Fine	4.58	724		1.008		54
BH2	1	Coarse	4.41	45		<0.005		3
	2.5	Fine	5.09	36		0.015		3
	3.5	Coarse	5.34	41		0.029		3
	5	Fine	4.98	35		0.011		3
BH3	0.5	Coarse	4.72	46		0.009		3
	2.5	Coarse	5.48	22		0.019		2
BH4	0	Fine	4.62	68		0.017		5
	1	Coarse	5.04	42		0.01		3
	2	Coarse	5.36	25		0.008		2
BH5	0	Fine	4.17	344		0.033		26
	0.5	Fine	4.33	111		0.006		8
	1.5	Coarse	4.34	51		<0.005		4
	2.5	Coarse	5.02	36		0.009		3
BH6	0.5	Fine	4.52	76		0.017		6
	1.5	Fine	4.76	55		0.012		4

Sample Location	Depth (m)	Texture	pH_{KCl}	Net Acidity (Non-Treated Soil)	Net Acidity	Potential Sulfidic Acidity (CRS)	Potential Sulfidic Acidity (C_{RS}) Action Criterion ($\%S_{cr}$)*	Liming Rate (kg $CaCO_3$/tonne DW)
EA-1	0.5	Fine	4.94	78		0.018		6
	1	Fine	4.46	163		0.038		12
	2	Fine	4.94	73		0.029		6
EX1	0.5	Coarse	4.7	44		0.07		3.3
EX2	+0.5 AG*	Coarse	4.7	62		0.009		4.7
	0.5	Coarse	5.5	20		0.018		1.5
	2	Coarse	5.0	31	**≤ 18**	0.014	**≤ 0.03**	2.4
EX3	0.5	Fine	5.2	10		0.007		<1
	0.8	Fine	4.8	150		0.012		11
	1.3	Fine	4.5	220		0.036		16
	1.5	Fine	5.0	31		0.012		2.3
EX4	0.1	Fine	4.4	140		0.015		11
	0.5	Fine	4.3	66		0.007		4.9
	1.5	Fine	4.8	43		0.008		3.2

Note: * AG = Above Ground for mounded spoil

3.3 Conclusion

Laboratory analysis results indicated the presence of AASS and PASS material on-site, with the Net Acidity exceeding the adopted action criteria in samples collected from the natural ground surface to a depth of 5.0 mBGL. Surface soils typically comprised AASS sands with clay and silt inclusions overlaying a PASS clay stratum. Discrete bands of material exceeding the PASS threshold of 0.03%Scr were also noted to occur in materials sampled as; BH1_0.65 (0.041 %Scr), BH5_0.0 (0.033 % Scr), EA-1_1.0 (0.038%Scr) and EX3_1.3 (0.036 %Scr).

The results indicate that all material to be excavated must be managed as ASS.

Due to the reported Net Acidity exceeding the adopted action criteria, an Acid Sulfate Soils Management Plan (ASSMP) is required to mitigate any human-health and environmental impacts from ASS during the proposed redevelopment works.

It is noted that only boreholes BH1 and BH2 were accessible by drill rig. As such, boreholes BH3-BH6 & EA-1 were drilled utilising hand auger and EX1-EX4 were collected using an excavator. The depths of EX1-EX4 were targeted to the proposed cell depth based upon the proposed plans. Hand augured boreholes encountered practical refusal between depth of 2.0 to 2.5 mBGL. Thus, the results of BH1 and BH2 have been drawn on to infer the required neutralisation rates for material occurring deeper than 2.5 mBGL though the central portion of the excavation area.

4 Environmental Responsibilities and Roles

4.1 Overview

Council is responsible for ensuring that the Principal Contractor (PC) for the development implements the management requirements of this ASSMP. The PC will have responsibility for ensuring that all employees, subcontractors and persons involved with the proposed works are familiar with the requirements of the ASSMP.

Determining and implementing management for other environmental aspects associated with the works at the proposed development site; including but not limited to erosion and sediment control, and stormwater management; is the responsibility of Council and is likely to have been addressed in a project-specific Construction Environmental Management Plan (CEMP). This ASSMP does not address environmental impact and mitigation measures associated with other environmental aspects of the project.

A copy of this ASSMP and the CEMP must be kept by Council and a copy must always also be kept by the PC onsite and accessible to all site personnel.

Successful implementation of this ASSMP relies upon support from and compliance by all involved parties. Such responsibilities are detailed below.

4.2 Appointed Project Manager

- Review and monitor environmental performance at regular worksite meetings.
- Required to be notified of any major environmental incidents and review the management procedures in place to deal with such occurrences.
- Monitor non-compliance and review management procedures if problem persists.
- Ensure that appropriate and adequate resources are allocated to allow for effective implementation and maintenance of the ASSMP, in particular the excavation, treatment and validation of excavated ASS.

4.3 Principal Contractor's Site Supervisor/Foreman

- Facilitate the reporting of incidents that may impact on the surrounding environment.
- Manage neutralisation actions to correct incidents of environmental non-compliance.
- Ensure that all staff are aware of and understand their responsibilities under the ASSMP.
- Identify any environmental training requirements.

4.4 Principal Contractor's Environment Officer

- Provide guidance and advice to staff regarding ASS management requirements.
- Monitor statutory requirements and ensure compliance.
- Where necessary, coordinate and/or assist in the response to environmental incidents.
- Maintain records of treatment, including verification testing of treated soils.
- Report all incidents with the potential to cause serious environmental harm to the Project Manager and where necessary, to the NSW EPA.

4.5 Protection of Ecological and Biodiversity Values

By undertaking in-situ treatment, the risk of any potential runoff of leaching of sulfuric acid (generated during oxidisation of PASS), or alkaline solution (i.e. from dissolved liming agent) is mitigated by containment within the excavation and extraction of groundwater (leaching) during dewatering (extract and treat prior to discharge), which will be operational during the excavation program. Alkaline materials (Ag lime for treatment of ASS) must be bunded and tarped during any onsite storage and brought to site as needed.

5 Dewatering

5.1 Dewatering

The site is low-lying, and the ASS investigation encountered the water table between 1.0 and 2.5 mBGL. Consequently, groundwater will be intercepted during the proposed excavations. A Construction Water Management Plan (CWMP) (ENV, 2023) has been developed outlining the dewatering process, water treatment, mitigation measures, discharge criteria, action criteria and contingency and emergency responses.

The proposed construction methodology works to minimise captured water extraction volumes to the greatest possible & practicable extent (i.e., work in dry periods, progressive staging of construction) to minimise the risk to oxidisation of AASS and PASS adjacent to the wetland excavations. Monitoring and action/analysis measures outlined in Section 7 and 8 of the CWMP to ensure that any impacts to water quality are noted and mitigated prior to being discharged to land or the receiving environment.

Extracted groundwater will be pH treated, metals precipitated, and turbidity treated to meet Water Quality Objectives (WQO's) specified in the CWMP before discharge.

6 Neutralisation Treatment of Excavated Soil

6.1 Application Rates for Neutralising Agent

The laboratory analysis has determined a liming application rate (with a safety factor of 1.5) based on the results of the chromium reducible sulfur (CRS) analysis.

Comparison of CRS results presented in Table 3, with the geologic profile recorded during the sampling program (refer to borehole logs, Appendix C), indicate that the material can be managed as four (4) treatment units, those being:

- **Unit 1** - Associated with samples BH1_0.65, BH5_0.0, EX3_1.3 (noting that this material occurred as a discrete soil stratum. Material at these sample locations comprised silts. The maximum Net Acidity recorded was at BH5_0.0 (344 mol H+/t) with an applicable liming rate of 26 kg $CaCO_3$/t DW. To facilitate practical application and mixing of lime, all soils from the surface to the maximum depth of the silt layer (0.7 mBGL at BH1, 0.4 mBGL at BH5 & 1.5m BGL at EX3) shall be treated as Unit 1.
- **Unit 2** – Associated with all samples up to a depth of 4.0 mBGL (excluding Unit 1). Soils associated with this management unit primarily comprise sand-clay mixtures and sand. The maximum Net Acidity recorded was at BH1_3.0 (184 mol H+/t) with an applicable liming rate of 14 kg $CaCO_3$/t DW..
- **Unit 3** – Associated with material at a depth of 4.0 -5 mBGL and below comprising clay. The maximum Net Acidity recorded was at BH1_4.5 (724 mol H+/t) with an applicable liming rate of 54 kg $CaCO_3$/t DW.

For the management of each treatment unit, the maximum applicable liming rate has been adopted.

ENV understand the wetland area will comprise an excavation with a lateral area dimension of 20,750 m^2, and a maximum depth of 3.0 mBGL.

Preliminary design plans indicate that an approximately 15,642 m^3 of soil material is to be excavated during the construction program, comprising the following wetland cells:

- W1 – 1,903 m^3;
- W2 – 3,235 m^3;
- W3 – 9,700 m^3; and
- Paths – 25 m^3.

Soil material excavated during the construction of the three wetland cells and paths must be neutralised with lime at the rated set out in Table 4. Approximate quantification of material types were calculated with consideration to the acid sulfate soil results, onsite field assessment and cut volumes. ENV notes the cut and fill volumes on the AWC Cut and Fill Plan (Rev F) include an assumed 300mm of topsoil. The onsite field assessment encountered limited topsoil as the natural soils are silt and sandy clay, typical of a wetland. The volume estimate below includes all material (including the 300mm of assumed topsoil segregated in the cut and fill plans). All material, including the 300mm of topsoil requires treatment as AASS and PASS are present at surface level. Table 3 summarises the approximate volumes of unit types. It is noted that these quantities are preliminary estimates and actual soils encountered may vary during excavation.

Table 3: Anticipated Volumes

Cell	Cut Total (m^3)	Area (m^2) Approximate	Unit 1 Estimate (m^3)	Unit 2 Estimate (m^3)	Unit 3 Estimate (m^3)
1	1,903	2,320	1,200 (0-1.5m BGL)	703 (0-2m BGL)	N/A
2	3,235	4,990	N/D	3,235 (0-2.5m BGL)	N/A
3	9,700	9,145	1,150 (0-1m BGL)	8,550 (0-3m BGL)	N/A
Paths	25	2,823	N/A	25 (0-1m BGL)	N/A
Topsoil Layer (0-0.3m BGL)	3,636	20,750	795 (0-0.3m BGL) at EX3, BH-1 & BH-5	2,841	N/A
Total			**3,145**	**15,354**	**Nil**

The treatment units are summarised in Table 3.

Table 4: Treatment Units

Treatment Unit	Depth Interval* (mBGL)	Liming Rate ($CaCO_3$/t DW)	Typical soils
Unit 1	BH1 – 0.0 to 1.0, BH5 – 0.0 to 0.5 EX3 – 1.3 to 1.5	26	Silt
Unit 2	0.0 to 4.0 (excluding Unit 1)	14	Sand/Sandy Clays
Unit 3	4.0 to 5.0	54	Clay

Note: *To facilitate practical excavation, all depth intervals have been rounded up to the nearest half meter.

Where treatment Units 1 and 2 occur at the corresponding depths, the inferred unit bounds are illustrated as Figure 8, Appendix A.

All material excavated from these depths (i.e. treatment units 1-3) should be treated using the specified liming rate. If a variation from the liming rate is proposed, further field investigations will be required. If sub-surface conditions vary significantly from those observed during this investigation (refer s.3.2.1), excavation should cease and qualified personnel engaged to assess the site conditions, including laboratory testing to confirm the concentrations of any contaminants observed.

Agricultural lime (Ag lime) has been selected as the preferred neutralising agent for management of disturbed material. Ag lime is a calcium Carbonate (CaCO3) product. Ag lime is an alkaline product with a pH of approximately 8.5 to 9.0 and has relatively low solubility compared to other alternative (e.g. hydrated lime) and it is often broadly applied to agricultural land as a soil amendment.

Aglime is to comprise >98% calcium carbonate by weight with a particle size <0.5 mm. This material typically has a neutralising value (NV) of 98%. If there is any variation in the NV of the aglime used, the application rate may need to be recalculated.

The lateral and vertical extent of each treatment unit have been developed based on the investigation data presented in this report. If differing soil units are encountered during the excavation program, a duly qualified environmental consultant should be engaged to determine the required liming neutralisation rate.

6.2 Treatment Methodology Option 1 – *In-situ* Mixing of Excavated Soil

The proposed treatment methodology is for in situ mixing of excavated soil. By treating the soils in situ, the excavation itself will act as a bunded treatment area with any potential leachate being captured by the dewatering process (i.e. potential leaching will infiltrate down through the excavation, eventually being intercepted by waters being drawn down during dewatering).

During the excavation program, aglime is to be progressively added to in-situ soils (0.3 m layers). The aglime is to be mixed into the upper portion of the soil to be removed (via a tractor pulled rotary hoe or by an excavator with mixing attachment) and validated prior to excavation. Validation of treatment material is to occur in accordance with Section 7.

6.2.1 Treatment process (Surface to Deepest Excavation at Approximately 3.0 mBGL)

The process for the treatment of ASS is as follows.

1. Establish all necessary controls in accordance with the CEMP (temporary fencing, erosions and sediment controls, dewatering system operational etc.).
2. A trench should be excavated along the inner perimeter of the initial excavation area to at least 0.5 m, to ensure that any treated material at the initial excavation (i.e. at surface level), is isolated from the surrounding environment (allowing the excavation to self-bund). This trenched material is to be treated and stockpiled inside the self-bunded area. Acidic leachate is to be treated through pH correction during dewatering.
3. Ideally, soils should be allowed to partially dry prior to attempting to mix the neutralising agent. If the soils are too moist, the neutralising agent will not be evenly distributed

throughout the soils and pockets of aglime, and untreated PASS will form. The dewatering process will result in this drying.

4. Aglime is to be progressively added to in-situ soils (0.3 m layers). The aglime is to be mixed into the upper portion of the soil by a tractor pulled rotary hoe prior to excavation.
5. Minimum tonnage of lime to be applied evenly across entire excavation area should be applied as per the unit of material encountered and appropriate liming rate in Table 3.
6. The limes layer of material is to be mixed (until homogenous), and then validation samples shall be collected. Three passes are recommended to ensure adequate mixing, however, additional passes may be required if soils are not yet considered homogenous. The excavator plant must be equipped with mixing attachment or use a tractor pulled plow). Treatment of soils below the water table may be too soft to drive a tractor through and may be better suited to mixing with an excavator bucket.
7. Validation sampling and testing should be undertaken in accordance with Section 7 to verify the neutralisation treatment.
8. A 0.3 m layer of treated material can now be stockpiled pending validation results. Note, the excavation must not extend into untreated soils.
9. Results of validation sample lab analysis will be compared to the criteria provided within Section 7 of this ASSMP to determine if the neutralisation process has been successful. Where all results are reported at concentrations below the adopted criteria, the material will be considered treated satisfactorily and can be transferred out of the excavation area and into trucks for delivery to the receiving site with ASS Neutralisation Certification Report ('ASSNCR') (further discussed in Section 7.2).

To assist in the practical application of lime, the liming rate per cubic meter has been calculated with a dry weight bulking factor of 1.6. The approximate kg of lime per m^2 to treat 0.3m intervals has been calculated by the following;
Area of excavation m^2 x 0.3 x Liming Rate listed in Table 5 = Kgs of lime (CaCO3). Table 5 summarises the required kg of lime per m^2 for a 0.3m layer for each unit.

Table 5: Summary of Liming Rates

Unit	Liming Rate (kg CaCO3/m3)	Approx. weight (kg) of lime required (t) to treat 0.3 m layers per m2
1	41.6	12.5
2	22.4	6.7
3	86.4	25.9

i.e. a 100m^2 area of unit 3 will require 672 Kgs of lime every 0.3m intervals.

Based upon the estimated quantities derived in Section 6.1, the approximate quantity of lime for the project is summarised in Table 6. Actual quantities may differ and lime is to be brought to site as required.

Table 6: Approximate Lime Required

Unit	Material (m^3)	Bulking Factor	Material (t)	Liming Rate (CaCO3/t DW)	Approximate Total Lime Required (t)
1	3,145	1.6	5,032	26	131
2	15,354	1.6	24,803	14	344
3	N/A	N/A	N/A	54	N/A
Total					**474 Tonnes**

All excavation works will be completed under the supervision of a spotter (as per industry best-practice). The treatment and excavation extents shall be actively guided by GPS depth guided bucket to ensure no untreated material is excavated. If for any reason, over excavation extends into the untreated layer, this material must be placed back into its excavation location and re-processed. If validation sample results do not meet the validation criteria the material must be managed in its stockpiling area for re-processing and validation. If treated material fails validation twice, the material must be managed as a waste product.

6.3 Treatment Option 2 – *Ex-situ* Treatment

If excavated soil is to be treated on a treatment pad, the treatment pad should be constructed prior to commencement of excavation.

Material should be moved to the nominated treatment area(s) within 24 hours of exposure.

Prior to commencement of excavation, the treatment area must be appropriately constructed to intercept any material that may cause environmental harm to the surrounding environments (e.g. acid leachate collection systems and sediment traps around the treatment pad). Multiple treatment areas may be required for different portions of the excavation to allow for effective onsite treatment and validation before removal.

6.3.1 Leachate Capture

The entire liming pad (treatment area) is to be constructed with a perimeter bund wall, no less than 400 mm high and no less than 500 mm wide. The bund wall should be constructed using fine-grained and non-dispersive material (clay) and should be compacted to be as impermeable as possible. The leachate collection point should be constructed as a sump that is of sufficient size to store a Q_{10} storm event (1:10 year ARI). Additional construction details are provided in Section 6.4.3.

It may be more efficient and effective to have a sump of limited size that is fitted with a pump with a float trigger. Water would then be pumped from the smaller (concrete pit style) sump to a portable plastic water tank. This tank could then be emptied by a wastewater contractor or the water treated and released in accordance with the site CEMP.

6.3.2 Leachate Treatment

Water and leachate collected in the sump should be monitored using a calibrated pH meter prior to the commencement of work, and following the completion of work, each day for 14-21 days after the completion of works. All pH measurements should be recorded.

Should water in the sump have a pH falling outside the ANZECC & ARMCANZ (2000) trigger value appropriate for the receiving watercourse, the water should be buffered using an accepted chemical neutralisation agent, (commonly superfine agricultural aglime). Additional treatment

may be required where other parameters such as turbidity (high iron "floc") exceed the trigger values.

Standard application rates for the treatment of water and leachate are presented in Table 7. The table indicates the amount of neutralising agent required to raise the pH of the water to neutral (7.0 pH units). For example, if the leachate has low salinity and a pH of 3.5, 16 kg of aglime would be required to neutralise 1ML of water.

Table 7 has been provided as a guide only. Depending on the chemistry of the water, additional neutralising agent may be required to obtain a pH of 7.0. Regular pH testing of the water should also be undertaken to monitor changes in pH during any dosing operations.

Table 7: Neutralisation Rates for Leachate

Water pH	H+ (mol/L)	H+ (mol/ML)	Aglime to Neutralise 1 ML	Hydrated Aglime to Neutralise 1 ML	Sodium Bicarbonate to Neutralise 1 ML
			Kilograms Required		
0.5	0.316	316228	15824	11716	26574
1.0	0.1	100000	5004	3705	8403
1.5	0.032	31623	1582	1172	2657
2.0	0.01	10000	500	371	840
2.5	0.0032	3162	158	117	266
3.0	0.001	1000	50	37	84
3.5	0.00032	316	16	12	27
4.0	0.0001	100	5	4	8.4
4.5	0.000032	32	1.6	1.17	2.66
5.0	0.00001	10	0.5	0.37	0.84
5.5	0.0000032	3.2	0.16	0.12	0.27
6.0	0.000001	1.0	0.05	0.037	0.08
6.5	0.00000032	0.3	0.016	0.012	0.027

Source: State Planning Policy 2/02 Guideline: Acid Sulfate Soils, Department of Natural Resources and Mines, Brisbane, 2004.

6.3.3 Liming Pad Design

If excavated soil is to be treated on a treatment pad, the treatment pad should be constructed prior to commencement of excavation.

The liming pad (treatment area) should be constructed in an area that is not to be disturbed during the excavation and filling processes. If this is not possible, the treatment area may need to be relocated as excavation works progress. A graphical representation of a treatment pad is provided as Figure 1.

6.3.3.1 Basic Design

The liming pad should be constructed so the base of the pad is composed of compacted fine-grained material, so as to produce as impermeable foundation as possible. Ideally a clay liner, no less than 300 mm thick, should be placed on the base of the pad. The base of the pad should slope gently (2 – 5%) so as to allow water/leachate to drain to a designated collection point. A leachate collection system, as described above, should be constructed.

6.3.3.2 Guard Layer

The base of the liming pad should be dusted with aglime at a rate determined using the following equation:

Guard layer (kg/m^2) = 0.2 x thickness of layer to be treated (m) x average liming rate (kg/tonne).

The aglime for the guard layer should be spread using an aglime/fertilizer spreader (tractor-towed) to ensure the base of the pad is evenly covered, prior to the placement of the material requiring treatment.

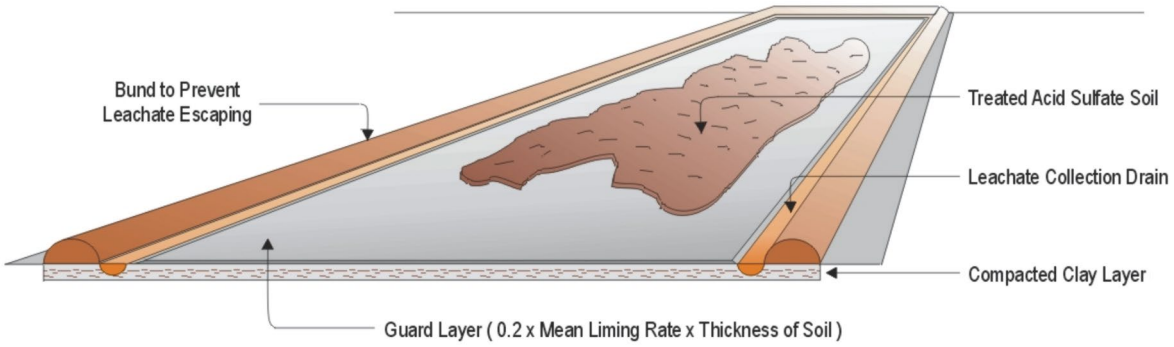


Figure 1: Treatment Pad Design

6.3.4 Mixing of Neutralising Agent on Treatment Pad

The following section describes the techniques that can be implemented if mixing of aglime is to occur on a treatment pad.

The material excavated should be placed on the liming pad in a layer no greater than 300 mm in thickness.

Ideally, the soils/sediments should be allowed to partially dry prior to attempting to mix the neutralising agent. If the soils are too moist, the neutralising agent will not be evenly distributed throughout the soils and pockets of aglime and untreated PASS will form within the stockpile.

There are several ways to mix the neutralising agent into the materials to be treated, all of which have positive and negative aspects. Common mixing methods are described in Table 8.

No less than three (3) passes will be required to mix the neutralising agent through the soil. The effectiveness of the mixing process is contingent on the methodology of mixing.

Table 8: Common Mixing Methods (Liming Agent)

Method	Positive Factors	Negative Factors
Tractor-towed disc plough / rotary hoe	▪ Allows thorough mixing of aglime and constant turning of soil to ensure aglime distribution is even. ▪ Works well on dry soils.	▪ Requires a tractor, which may have no other use on site. ▪ Can require relatively large areas to enable treatment, as tractor will require turning space.
Rubber tyred vehicles	▪ Able to utilise any idle machinery to drive over the aglime/soil mixture to mix materials together.	▪ Often results in pockets of aglime forming in the soils.
Excavator	▪ Can utilise idle excavators to mix aglime with soils. ▪ Works well on moist/wet soils.	▪ Requires specialised (longer) teeth to allow soils to be ripped deeply, allowing aglime to be mixed more thoroughly. ▪ Can result in the formation of aglime pockets in the soils.
Grader	▪ Can utilise idle machinery on site. ▪ Allows some churning of soil/aglime mix by inclining blade and using tines.	▪ Can result in pockets of aglime developing. ▪ Can result in damage to low permeability liner beneath the liming pad.
Pug Mill	▪ Allows high aglime dosage rates. ▪ Guaranteed thorough mixing of neutralising material and soil.	▪ Additional plant required at high mobilisation cost.

6.4 Dusting of Exposed Excavation Surfaces

If left untreated after excavation, the exposed ASS in excavation faces may oxidise over time, causing an acidic environment. In addition, any acid produced during exposure may corrode concrete and other structures constructed within the excavations. It is therefore critically important to neutralise the exposed surfaces (base and walls) of excavations into ASS, to minimise drying out and reduce the potential for ASS and/or PASS to produce acid leachate.

Dusting of exposed surfaces of excavations should be carried out at a rate of not less than 1 kg of fine aglime per m^2 of exposed soil surface.

6.4.1 Stockpile Management

Additional stockpile management measures are required as follows:

- All stockpiles to be situated on builders plastic sheet or similar marker layer, atop an already limed layer of soil to prevent cross contamination with un-treated material.
- All stockpiles must be sufficiently segregated and labelled (marked with Signage) to allow clear traceability of materials (e.g. SP-1 - treated).

- Where material fails validation, this stockpile area is to be cordoned off (e.g. flagging tape or similar) and managed for re-processing separate to other site activities.
- During disturbance of any stockpile, the spotter must be present to prevent over-excavation into underlying soils.

At each pre-start meeting, the status of each stockpile should be discussed to confirm at site personal are familiar with the management requirements.
The traceability of each stockpile should be presented in the closure report.

6.5 Short Term Stockpiling and Exposure

Table 9 presents information regarding the short-term stockpiling of soils within the treatment area without liming for neutralisation.

Table 9: Indicative Maximum Periods for Short-Term Stockpiling of Untreated ASS

Type of Material		Duration of stockpiling		
Texture range	**Approx clay content (%)**	**Days**		**Hours**
Coarse texture: Sands to loamy sands	≤ 5	Overnight	or	18 hours
Medium texture: Sandy loams to light clays	5-40	2½ days	or	70 hours
Fine texture: Medium to heavy clays and silty clays	≥ 40	2½ days	or	70 hours

Source: Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines, Department of Natural Resources and Mines, Brisbane, 2014.

Additional measures to minimise any impacts of stockpiled untreated material include the following:

- Covering the stockpiled material with impervious material such as black plastic to prevent ingress by rainfall and subsequent acidic leaching and runoff;
- Ensure surface water run-off does not enter the treatment area (the excavation).

Where results indicate the material does not meet the validation criteria, an environmental consultant should assess the treatment procedure to determine the likely cause of treatment failure and adjust the methodology accordingly. Material that does not meet the validation criteria must not leave the site until further treatment is completed and further validation is undertaken which indicated the material meets the validation criteria;

Additional lime will be required if sampling results indicate that appropriate neutralisation has not been achieved.

If the validation criteria cannot be achieved, material must be disposed as waste to a facility lawfully licensed to accept the waste.

6.6 Storage of Neutralising agent

Ag lime must be stored in accordance with the Material Safety Data Sheet (MSDS) as provided by the supplier.

6.6.1 General Storage and Handling Procedures for Ag Lime:

- Wear protective eye and breathing equipment in events where Ag lime may become airborne.
- Wear long sleeves and trousers to minimise potential for direct contact with skin.
- Store away from fluorine, magnesium, aluminium, silicon, hydrogen, mercury, aluminium sulfate, ammonium salts and acids (ENV is not aware of any of these products being stored at the site).
- During days of excessive wind restrict use/spreading of lime to minimize risk of nuisance dust impacting neighbouring properties.

6.6.2 Additional Measures for Protection of Nearby Sensitive Receivers:

- Minimise onsite storage of Ag lime where possible (i.e. staged deliveries over the project)
- The storage area must be bunded.
- Material must be tarped overnight and during rainfall events to avoid potential alkaline leaching.

6.7 Waste Tracking

Waste tracking must be undertaken by the contractor and provided in a final report to the Project Manager, as per the requirements outlined in Section 7.

6.7.1 Treatment (Re-Processing) of material that fails validation

Where material fails to meet validation criteria (i.e. under-limed or over-limed material), the failed material shall be retained in its stockpile location and neutralised with additional lime or by addition of un-treated soil from the base of the excavation.
The incorporation of ither material is to be completed by use of mixing attachment to ensure thorough blending.
Selection of neutralisation option to be selected as follows:

- For under-limed material, the reported validation sample results shall be inclusive of the required liming rate with 1.5 safety factor.
- For over-limed material, the acid base accounting (refer Section 7) will equal an excess acid neutralising capacity (ANC). The ANC can then be used for mass balance calculation to work out the required volume of raw soil to neutralise the over-limed material.

Neutralising Balance Equation: M1 x V1 = M2 x V2

Once re-processed, the stockpile shall then be re-sampled for validation in accordance with Section 7.
If a stockpile of material supports both under-limes and over-limed material, the results should be considered as a single material. Where a stockpile is deemed to be self-neutralising (i.e. the over-limed and under-limed materials will balance out) or the inconsistency between samples is too great to determine the best approach, the stockpile may be re-blended the collect validation samples undertaken.
It is noted that an existing stockpile of material that has failed validation criteria will first be re-mixed, and then validation samples collected prior to any further dilution or addition of lime.
To avoid disruption to the in-situ treatment methodology, raw soils should be accessed by removal of the upper treated guard layer (where present), excavation of raw soil and then

reinstatement of the guard layers of limes soils prior to re-commencing the 0.3 m in-situ treatment process.
Any stockpiled materials must be sufficiently segregated, and records maintained, to ensure that there is no cross-contamination between ex-situ and in-situ treated materials.

7 Validation of Treated Soils

7.1 Environmental Testing of Treated Soils

The principal contractor will be responsible for ensuring that any validation sampling and analysis of aglime treated soil undertaken is conducted by a suitably qualified person, and in a manner that will demonstrate, with acceptable confidence, that sufficient aglime has been mixed into the ASS, to provide an adequate buffer, such that the material meets the criteria set out in Table 10.

Validation sampling locations will be selected, as approved by the Site Supervisor/Foreman, such that a representative distribution for sample locations is achieved for the treated soil.

Validation sampling and analysis will be undertaken at a frequency that will demonstrate that satisfactory neutralisation has taken place. The frequency of soil validation sampling and analysis will be:

- Treatment Units 1-2: 1 Sample per 1000m^3 of remediated soil (low risk material); and
- Treatment Unit 3: 1 sample per 500m^3 of remediated soil (medium risk material).

7.1.1 Sampling Technique

A suitably qualified Engineer/Scientist shall collect ten representative sub-samples to produce one (1) representative (composite) sample from each batch 1000m^3/500m^3 of remediated soil, in accordance with the following requirements:

- approximately 250 g of soil must be collected from 10 representative locations, evenly distributed through the treated spoil; and
- where the soil is cohesive, the sample must be homogenised in a large stainless bowl or similar, and a representative sample taken from the homogenised material.

7.1.2 Laboratory Analysis

Acid sulfate soil net acidity for treatment verification must be undertaken by a third-party laboratory accredited by the National Association of Testing Authorities (NATA) for the required testing on all material that has been treated. Southern Cross University's Environmental Analysis Laboratory (EAL) can perform the required testing.

7.2 Validation Reporting

The principal contractor is responsible for ensuring that a suitably qualified Engineer/Scientist prepares two (2) copies of an ASS Neutralisation Certification Report ('ASSNCR') suitable for submission to Byron Shire Council. The report will demonstrate that the excavated and treated soil has been sufficiently neutralised and meets the criteria presented in Table 10.

The ASSNCR will include, but not be limited to, the following information:

- Summary table of analytical results for each soil stockpile and the results of validation analysis;
- Plan of earthworks stockpile locations, showing:
  - Sample identification numbers
  - Location of validation sampling

An ASSNCR is required for every batch of treated material prior to being moved offsite or reused onsite. The material must be compliant with the site specific NSW EPA resource recovery Order & Exemption where material is beneficially reused offsite.

By submitting the ASSNCR to the Superintendent for review, the contractor is deemed to be stating to the Superintendent that all information presented in the ASSNCR is true and accurate and that the remediation and validation of the ASS soils is of sufficient quality that the contractor is certifying that remediation, as defined under the contract, has been satisfactorily completed.

If the Superintendent considers that the ASSNCR does not provide sufficient evidence to demonstrate that satisfactory remediation has been achieved, or is of unsatisfactory quality, the Superintendent shall notify the contractor in writing, outlining the deficiencies in the ASSNCR and any corrective actions to be undertaken before approval by the Superintendent will be further considered. The contractor must immediately undertake such corrective action to the ASSNCR. The cost of such corrective action will be borne by the contractor.

7.3 Neutralisation Criteria

The criteria presented in Table 10 will be used to ensure that the excavated material has been sufficiently neutralised. The criteria have been drawn from the ASSMAC (1998) Guidelines and further detail provided from Dear *et al* (2014).

Verification testing is deemed to have been successful, for medium to fine material when the following is achieved:

- No single sample shall exceed a net acidity of 18 mol H^+/tonne (0.03% S).
- If any single sample is between 0 and 18 mol H^+/tonne (0.00 to 0.03% S), then the average of any four spatially adjacent samples (including the exceeding sample) shall have an average net acidity of zero or less.

Table 10: Action Limits for Treatment

ASS Soil Texture	Clay Content %	< 1000 Tonnes Disturbed		> 1000 Tonnes Disturbed	
		Sulfur Content % w/w	Acid Trail mol H^+ /tonne	Sulfur Content % w/w	Acid Trail mol H^+ /tonne
Coarse (sand & gravel)	< 5	0.03	18	0.03	18
Medium (sandy loam - light clay)	5 - 40	0.06	36		
Fine (medium to heavy clays, silty clays)	> 40	0.10	62		

8 Waste Traceability

All work under the Contract will be subdivided into distinct work lots or work items. Work lots or work items shall be chosen by the Contractor, consistent with any specified requirements, but will be subject to approval by the Superintendent.

Each work lot or work item will be assigned a unique identification number, and the Contractor will maintain a register of all allocated work lot or work item numbers. This register will contain as a minimum, the following information:

- Brief description of the work lot or work item;
- Location reference (3 dimensional, where applicable); and
- Lot or item status (ASS conforming or non-conforming).

The Contractor will ensure that traceability is maintained throughout all documented records under this Contract. All test results, where applicable under this Contract, will be positively identified with their respective work lot or work item number. The Contractor will notify the Superintendent in writing 24 hours prior to commencing a new work lot or work item.

The Contractor will be responsible for implementing a traceability programme for neutralisation and off-site transport of the material. The documentation will contain, but not be limited to, the following information:

- Truck registration;
- Truck driver;
- Date and time of departure from site;
- Date and time of arrival at the disposal or beneficial re-use site;
- Source of material (stockpile identification); and,
- Estimated volume of material transported.

Clear records of movements of excavated material to the treatment pads (source and destination), *in-situ* treatment details (aglime volumes and application times) and disposal/reuse destinations are to be kept. Table 11 provides an example of how the records could be tabulated.

Details of dewatering volumes, water quality, and disposal/reinjection destinations and volumes are also to be recorded and summarised in a final compliance report.

Table 11: Example of a Record of Movement

Label	Date	Volume (m^3)	Location	Disposal Location A	Treatment Date	Volume of Agaglime required	pH field testing	Testing Date	Result[1]	Disposal Location B	Disposal Location B
Vol A	5-6-06	150	Channel Ch 0-40	Treatment Pad	7-6-06	160 kg/tonne = 45,600 kg	pH_f = 6.5 pH_{fox} = 6.0	7-6-06	12-6-06 Acceptable (refer lab results)	12-6-04	Existing Drain Ch 0 to Ch 50, 3 m below surface level.
Vol B	6-6-06	330	Channel Ch 40-80	Treatment Pad	8-6-06	220 kg/tonne = 139,940 kg	pH_f = 5.5 pH_{fox} = 5.0	8-6-05	13-6-06 Failed	-	-
					14-6-06	120 kg/tonne = 45,240 kg	pH_f = 6.5 pH_{fox} = 6.0	14-6-06	19-6-06 Acceptable (refer lab results)	19-6-06	Existing Drain Ch 50 to Ch 120, 3 m below surface level.
Vol C	7-6-05	120	Table Drain	Lemura Quarry	NA	NA	NA	25-5-06	27-5-06 Sent to Lemura	NA	NA
Vol D	9-6-05	NA	Existing Drain Ch 20 - Ch 60	*In-situ* guard layer	9-6-06	80 kg/m^3 = 4,800 kg	NA	NA	NA	NA	NA

9 Management of Treated Excavated Materials

9.1 Options Discussion

All management of treated ASS materials must be undertaken in accordance with the *NSW EPA Waste Classification Guidelines, Part 4: Acid Sulfate Soils* (refer Attachment 6), and other applicable EPA guidance documents.

Once the excavated material is treated, and the validation testing results are shown to meet the neutralisation criteria (Section 7.3), the treated material can be re-used on site if required (subject to suitability from a chemical perspective).

It is not possible to beneficially re-use AASS or PASS as virgin excavated natural material (VENM) or excavated natural material (ENM) off-site. This means that any treated excavated material that is surplus to the construction works will need to be disposed of as waste to a nominated landfill, or beneficially re-used as fill material off-site under a 'Specific Exemption' granted by EPA in accordance with the NSW Resource Recovery framework. ENV can prepare an application for this exemption if required. If the application is approved by EPA, the treated excavated material can be transported to the approved receiving site and used as 'engineered fill'. Movement of the treated excavated material to another site is not permissible unless the application for a 'Specific Exemption' for beneficial reuse is granted by the EPA.

If the application to EPA is not approved, or it is considered more cost-effective to dispose of the material to landfill, it can be disposed to a suitably licensed landfill facility.

These management options should be reviewed to ascertain the most cost-effective treatment and/or disposal method for the soils.

9.2 Selected Disposal Options

It is understood that the excavated and treated soil for this current project will be:

1. reused off site where possible (i.e. if not contaminated); or
2. transported offsite to a suitably licensed facility in either NSW or QLD.

If soil is transferred to a waste facility in NSW the material will be further classified in accordance with the *NSW Waste Classification Guidelines (2014)* prior to disposal.

If soil is transferred to QLD, permission will need to be sought from that facility prior to commencement of disposal. ENV understand that a Soil Disposal Permit (SDP) issued by QLD Department of Environment and Science (DES) is not required for the disposal of acid sulfate soils.

10 References

Ahern, C.R, Stone, Y., Blunden, B. (1998) Acid Sulfate Soils Assessment Guidelines, Acid Sulfate Soils Management Advisory Committee, Wollongbar, NSW.

ANZECC and ARMCANZ (2000) Australian and New Zealand Guidelines for Fresh and Marine Water Quality.

Dear, S.E., Ahern, C. R., Obrien, L. E., Dobos, S. K., McElnea, A. E., Moore, N.G., Watling, K.M. (2014) Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines. Brisbane: Department of Science, Information Technology, Innovation and the Arts, Queensland Government.

EIS (2014). Preliminary Waste Classification and Acid Sulfate Soil Assessment, Proposed Service Station Development – BP MacLean, 111 – 117 River Street, MacLean, NSW. Document reference E27334Klet, dated 11 June 2014.

GeoLINK (2007) Sandhills Estate, A Strategic Planning Study.

NSW EPA (2014) Waste Classification Guidelines - Part 4: Acid Sulfate Soils, NSW Environmental Protection Authority (EPA).

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

11 Appendices

Appendix A	Figures
Appendix B	Proposed Site Plans
Appendix C	Bore Logs
Appendix D	Laboratory Results
Appendix E	Laboratory Documentation
Appendix F	Sampling Points GPS Coordinates

Appendix A

Figures

Site Location (Approximate)

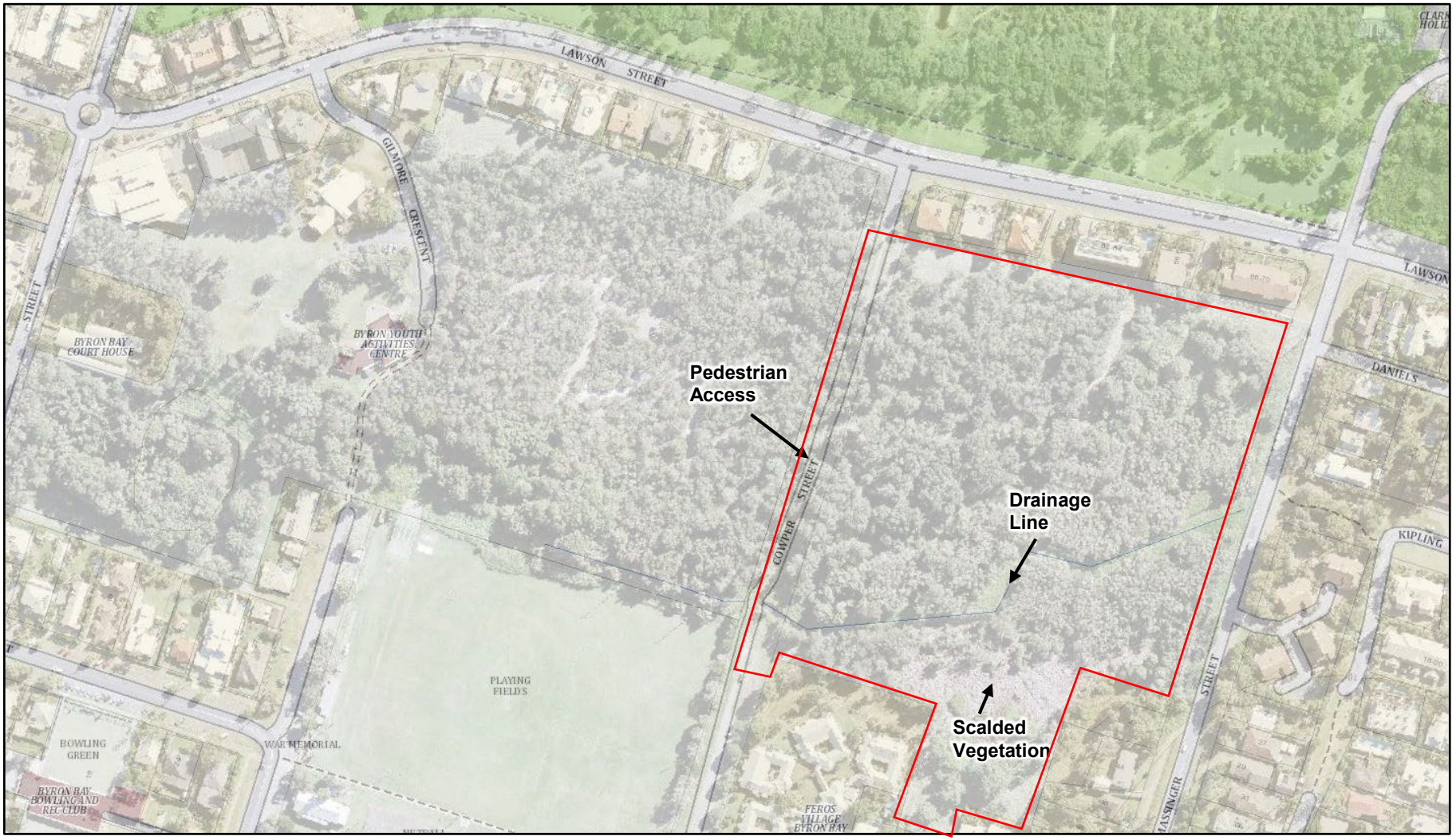
0 200 400 m

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 1 – Site Location
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Image source: SIXMaps (2015)



Site Location (Approximate)

0 30 60 m

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 2 – Existing Site Layout
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Image source: SIXMaps (2015)

Site Location (Approximate)

Sampling Location (Approximate)

0 30 60 m

ENV Solutions
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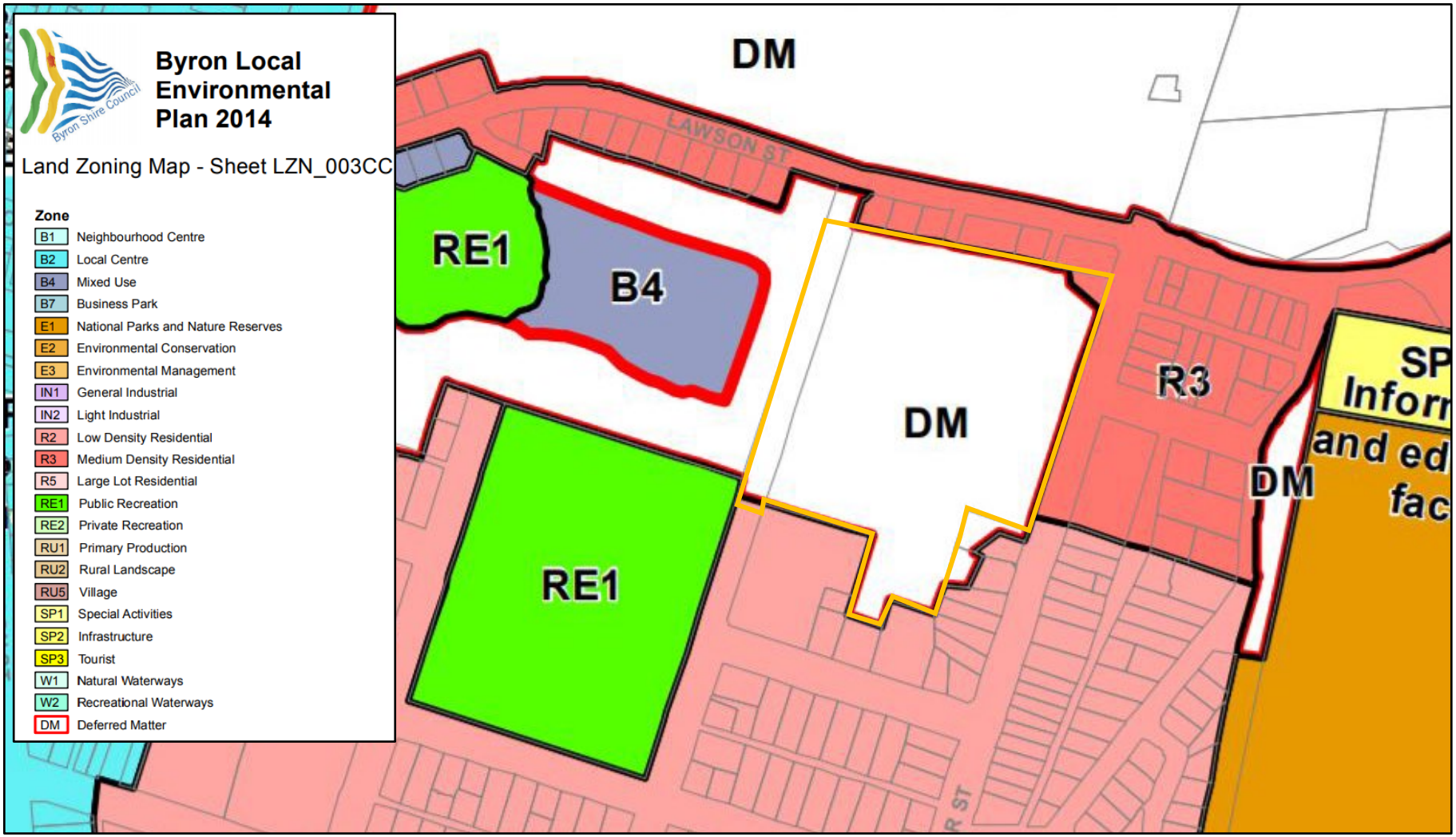
Figure 3 – Acid Sulfate Soil Boreholes
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Image source: SIXMaps (2015) & Planit Consulting (2021)



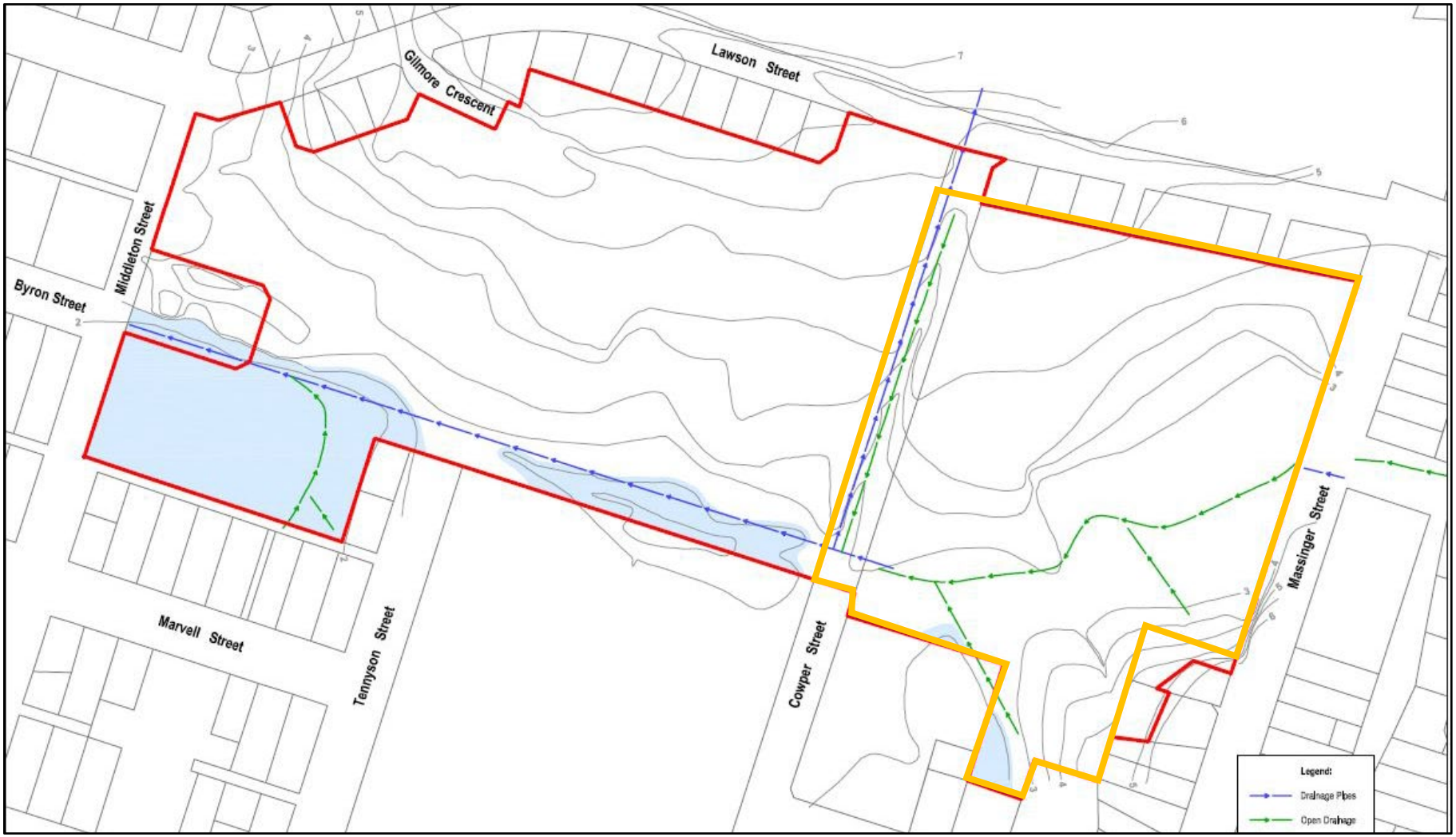
Site Location (Approximate)

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 4 – Landuse Zoning
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Image source: Byron LEP (2014)



Strategic Investigation Boundary (Approximate)

Site Location (Approximate)

Image source: GeoLink (2007)

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Figure 5 – Drainage and Flood Risk
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Site Location (Approximate)

Image source: WaterNSW (2021)

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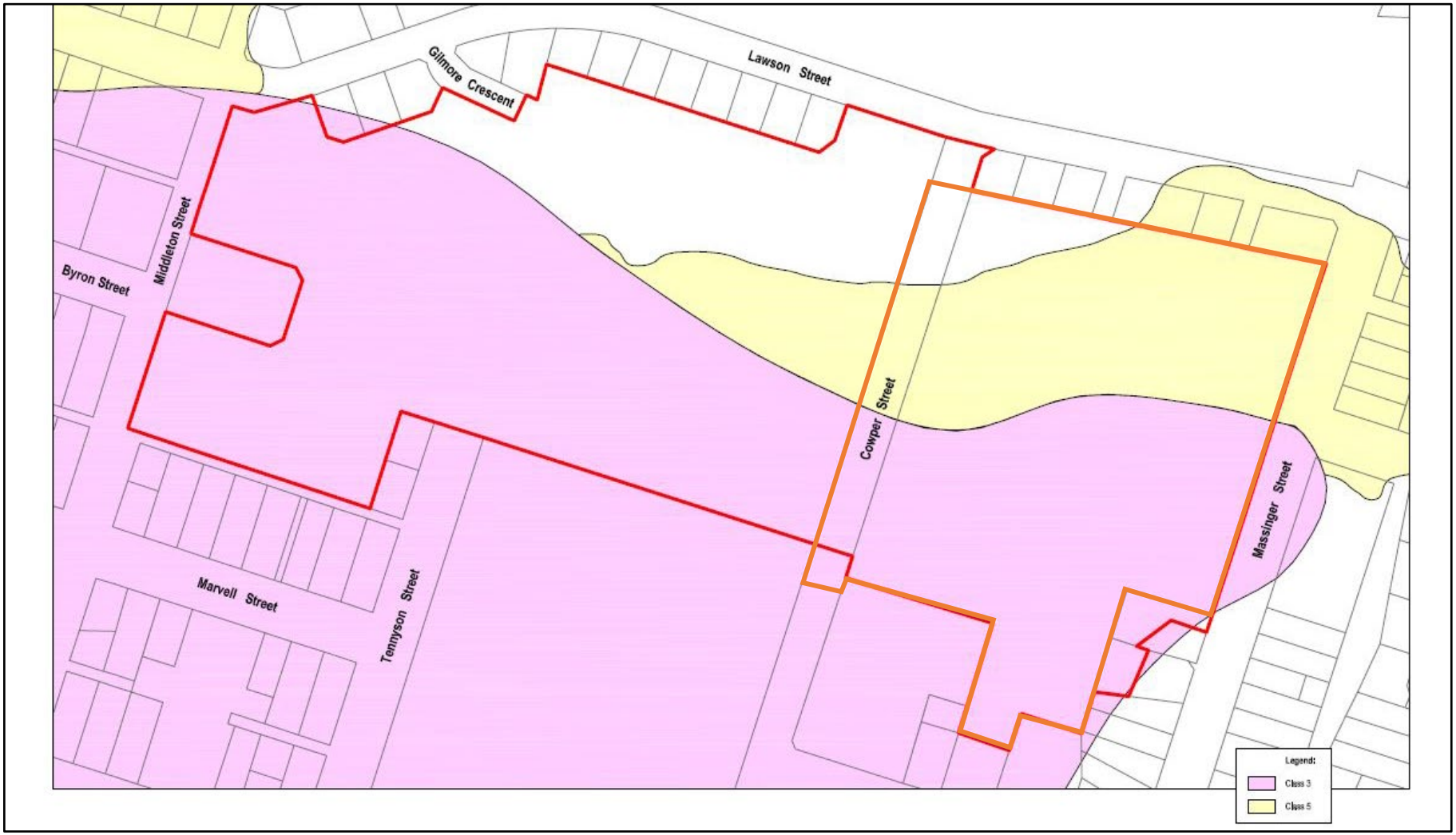
Figure 6 – Groundwater Resources
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023



Site Location (Strategic Planning Study Boundary)

Site Location (Approximate)

Image source: GeoLink (2007)

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ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 7 – Acid Sulfate Soil Risk
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Site Location (Approximate)

Sampling Location (Approximate)

Approximate Unit 1

0 30 60 m

Image source: SIXMaps (2015) & Planit Consulting (2021)

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ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

Figure 8 – Treatment Units 1 and 2
Sandhills Wetland
Cowper Street, Byron Bay, NSW

Project: 216010
Client: Byron Shire Council
Assessment Date: 14/12/2023

Appendix B

Proposed Site Plans

SANDHILLS WETLAND
DETAILED DESIGN PACKAGE

REV F - FOR TENDER 25.08.2023 100%

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST
BANGLOW NSW 2479
P (02) 6685 5466 | 1300 998 514
www.awconsult.com.au

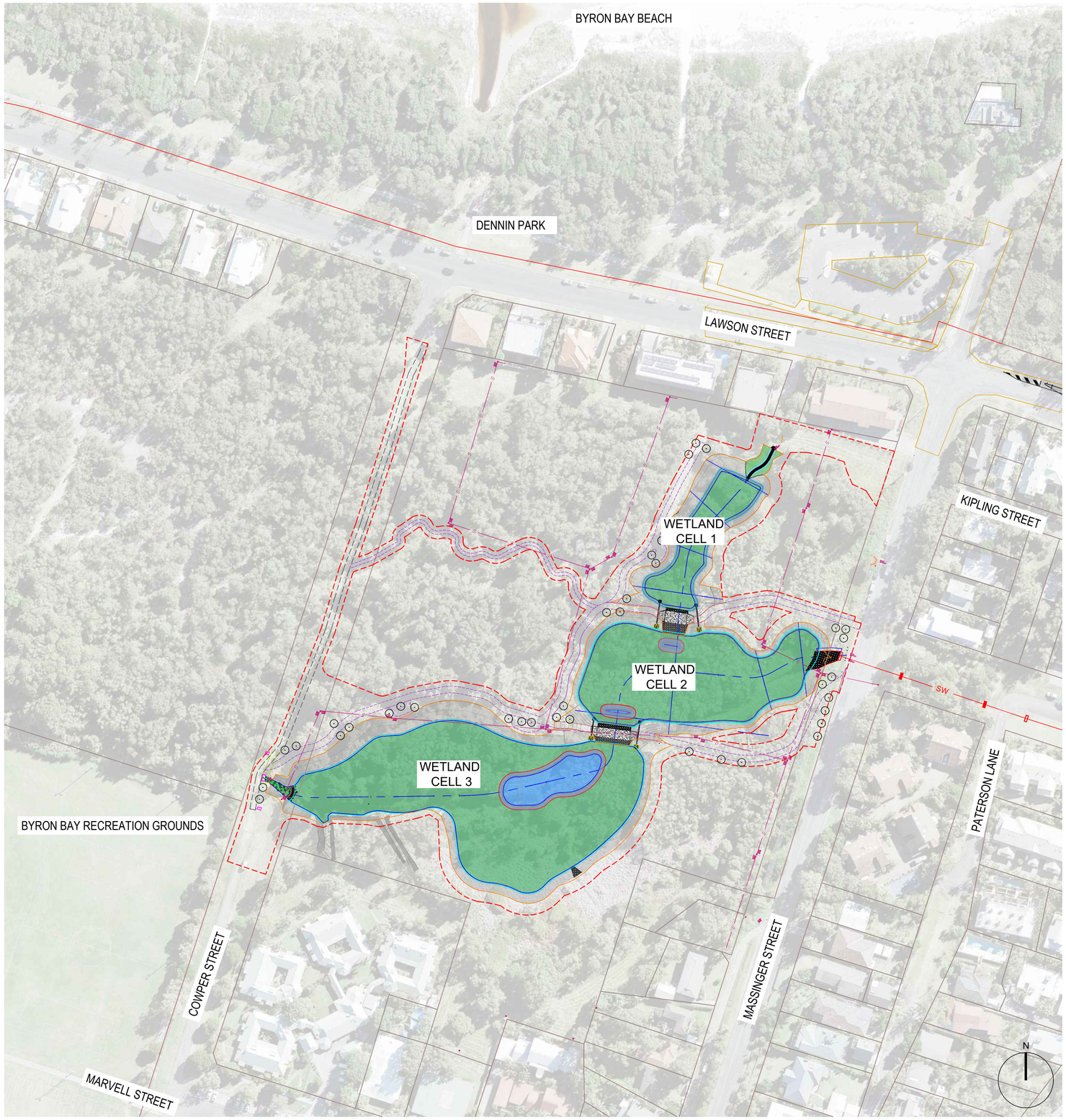
CLIENT

Byron Shire Council

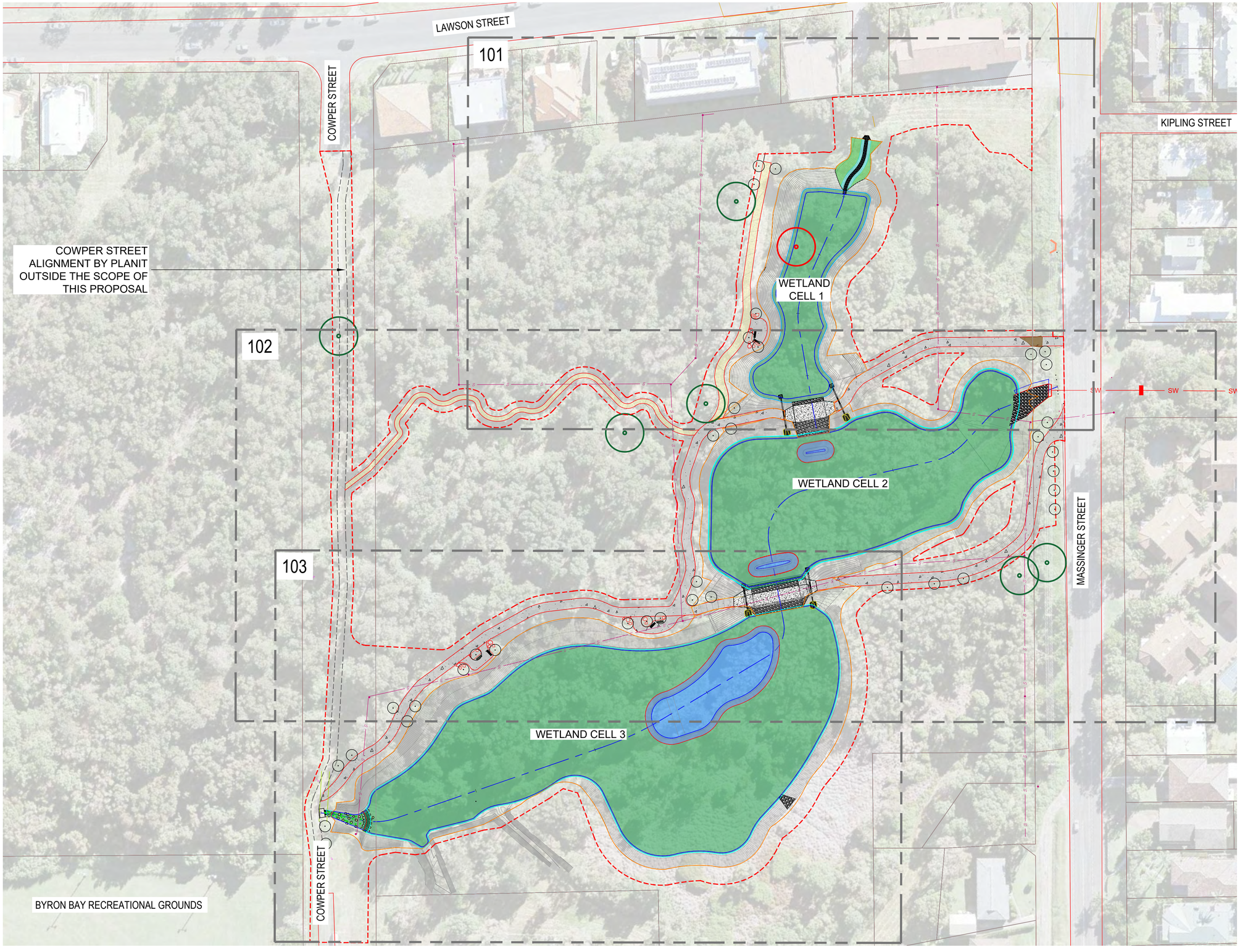
SHEET NO.	DRAWING NAME	SCALE
1-191194_DD_001	COVER SHEET & LOCALITY PLAN	1:1000@A1
1-191194_DD_002	SITE CONTEXT & SHEET LAYOUT PLAN	1:600@A1
1-191194_DD_003	SITE CUT & FILL PLAN	1:600@A1
1-191194_DD_004	SITE EXTENTS	1:600@A1
1-191194_DD_101	EARTHWORKS & LAYOUT PLAN 01	1:250@A1
1-191194_DD_102	EARTHWORKS & LAYOUT PLAN 02	1:250@A1
1-191194_DD_103	EARTHWORKS & LAYOUT PLAN 03	1:250@A1
1-191194_DD_201	EARTHWORKS - SECTIONS CELL 1	AS SHOWN
1-191194_DD_202	EARTHWORKS - SECTIONS CELL 2	AS SHOWN
1-191194_DD_203	EARTHWORKS - SECTIONS CELL 3	AS SHOWN
1-191194_DD_301	CIVIL DETAILS - CELL 1 INLET	AS SHOWN
1-191194_DD_302	CIVIL DETAILS - CELL 1 OUTLETS	AS SHOWN
1-191164_DD_303	CIVIL DETAILS - CELL 2 OUTLETS	AS SHOWN
1-191164_DD_304	CIVIL DETAILS - CELL 3 OUTLET	AS SHOWN
1-191164_DD_305	CIVIL DETAILS - GENERAL	AS SHOWN
1-191194_DD_401	CIVIL & LANDSCAPE SPECIFICATION	NA
1-191194_DD_402	CIVIL & LANDSCAPE SPECIFICATION	NA
1-191194_DD_500	LANDSCAPE PLANTING SCHEDULES	NA
1-191194_DD_501	LANDSCAPE MATERIALS & PLANTING PLAN 01	1:250@A1
1-191194_DD_502	LANDSCAPE MATERIALS & PLANTING PLAN 02	1:250@A1
1-191194_DD_503	LANDSCAPE MATERIALS & PLANTING PLAN 03	1:250@A1
1-191194_DD_601	LANDSCAPE SECTIONS	1:50@A1
1-191194_DD_602	LANDSCAPE SECTIONS	1:50@A1
1-191194_DD_603	LANDSCAPE SECTIONS	1:50@A1
1-191194_DD_701	LANDSCAPE DETAILS - SEATING NODES	AS SHOWN
1-191194_DD_702	LANDSCAPE DETAILS - HARDWORKS	AS SHOWN
1-191194_DD_703	LANDSCAPE DETAILS - SOFTWORKS	AS SHOWN
1-191194_DD_704	LANDSCAPE DETAILS - PLANTING MATRIXES	AS SHOWN
1-191194_DD_801	LANDSCAPE PLANTING SPECIFICATION	NA

NOTES:
Not for Construction. Do not scale off drawings.

SCALE 1:1000 @ A1 0 5 10 25 50m



01/001 **LOCALITY PLAN**



LEGEND

- CONCRETE CYCLEWAY — REFER DETAIL 02_702
- DECOMPOSED GRANITIC SAND PATH — REFER DETAIL 01_702
- EXISTING TREE RETAINED — PROTECTED TO MEET AS 4970-2009
- PROPOSED FEATURE TREE — REFER PLANTING PLANS 501-503
- EXTENT OF EARTH WORKS
- OPERATING WATER LEVEL (OWL)
- FINISHED FLOOR LEVEL (FFL)
- EXTENT OF WORKS
- PROPOSED 0.2m CONTOURS
- SEWER INFRASTRUCTURE
- SEWER ACCESS HOLE
- S/W PIPE HEADWALL
- CADESTRAL BOUNDARIES
- COWPER STREET ALIGNMENT
- EXISTING TREE REMOVED

AWC
Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.au

CLIENT: Byron Shire Council

DRAWING:
SITE CONTEXT & SHEET LAYOUT PLAN

PROJECT:
SANDHILLS WETLAND
DETAILED DESIGN PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*PRE -DETAILED DESIGN PACKAGE COUNCIL REVIEW*	*17.11.2021*
B	*DETAILED DESIGN PACKAGE 70%*	*28.02.2022*
C	*DETAILED DESIGN PACKAGE 100%*	*02.11.2022*
D	*DETAILED DESIGN PACKAGE AMENDMENTS 100%*	*17.11.2022*
E	*DETAILED DESIGN PACKAGE AMENDMENTS 100%*	*13.12.2022*
F	*FOR TENDER*	*25.08.2023*

N

DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

SCALE 1:600 @ A1 (0 5 10 15 20 25m)
REV. F

DESIGNED KC
DRAWN RS/TC
CHECKED DM

CAD FILE No. **1-91194_SANDHILLS_DD.DWG**
SHEET No. **1-191194_DD_002**

LEGEND

- CUT DEPTH 3.0-2.0m
- CUT DEPTH 2.0 - 1.0m
- CUT DEPTH 1.0 - 0.5m
- CUT DEPTH 0.5-0m
- FILL DEPTH 0-0.25m
- FILL DEPTH 0.25-0.5m
- FILL DEPTH 0.5-0.75m
- FILL DEPTH 0.75-1m
- EXTENT OF WORKS
- SEWER INFRASTRUCTURE

SETOUT NOTE:
SETOUT COORDINATES TO BE PROVIDED IN DWG. DIGITAL FORMAT FOR CONSTRUCTION

SERVICES NOTE:
LOCATIONS OF ALL SERVICES TO BE CONFIRMED ON SITE. REFER TO GENERAL ARRANGEMENT PLANS FOR STORMWATER AND SEWAGE PIPES

*** BULKING FACTOR NOTE**:
A BULKING FACTOR HAS NOT BEEN APPLIED TO THESE EARTHWORKS VOLUMES.

CONTAMINATED CUT NOTE:
REFER TO ENV SOLUTIONS (2021) FOR DETAILS ON SITE CUT MATERIALS AND THE ACID SULPHATE SOIL MANAGEMENT PLAN (ENV SOLUTIONS 2021)

CUT & FILL TABLE

WETLAND CELL	Topsoil m³ (300mm assumed)	cut vol m³ 300mm below FSL	fill vol m³	Planting Media m³	Excess spoil m³
1	719	1903	120	725	1783
2	1566	3235	102	1993	3238
3	2785	9700	15	2512	9685
Paths	256	25	625	240	-600
TOTAL	**3636**	**15642**	**1122**	**3437**	**14520**
* This includes the open Water Sections					

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Australian Wetlands Consulting Pty Ltd
25 LESLIE ST, BANGALOW NSW 2479
P (02) 6687 1550 | 1300 998 514
www.awconsult.com.au

CLIENT: Byron Shire Council

DRAWING:
SITE CUT & FILL PLAN

PROJECT:
SANDHILLS WETLAND
DETAILED DESIGN PACKAGE

REV.	ISSUE / AMENDMENTS	DATE
A	*PRE -DETAILED DESIGN PACKAGE COUNCIL REVIEW*	*17.11.2021*
B	*DETAILED DESIGN PACKAGE 70%*	*28.02.2022*
C	*DETAILED DESIGN PACKAGE 100%*	*02.11.2022*
D	*DETAILED DESIGN PACKAGE AMENDMENTS 100%*	*17.11.2022*
E	*DETAILED DESIGN PACKAGE AMENDMENTS 100%*	*13.12.2022*
F	*FOR TENDER*	*25.08.2023*

N

DO NOT SCALE FROM PLANS, TO BE ADAPTED ON SITE BY CONTRACTOR & CONFIRMED BY THE PROJECT SUPERVISOR, SIZING, CALCULATIONS, STRUCTURES, & COMPACTION TO BE CONFIRMED BY ENGINEER OR SUITABLY QUALIFIED PERSONS. ENGINEERS CERTIFICATE BY OTHERS.

SCALE
1:600 @ A1
0 5 10 15 20 25m

REV. **F**

DESIGNED KC
DRAWN RS/TC
CHECKED DM

CAD FILE No.
1-91194_SANDHILLS_DD.DWG

SHEET No.
1-191194_DD_003

Appendix C

Bore Logs

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

BOREHOLE LOG BH01

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 5.0 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Solid Flight Augur

COMMENTS Cowper St, near 'Invert'

LOGGED BY Ben Pieterse

Depth (m)	Graphic Log	Material Description Surface: Grass	Samples (ASS)	Samples (Contam)	Additional Observations
0		CLAY: brown, soft, dense, wet, high organic content	BH1_0.1		No anthropogenic refuse, staining or non-natural odour encountered
0.2		SAND: yellow, dry-moist, fine-medium, loose			
0.4			BH1_0.5		
0.6		Sandy SILT: black, moist, dense, fine, soft	BH1_0.65		
0.8		SAND: grey, moist, fine-medium, loose			
1			BH1_1.0		
1.2		SAND: brown, wet, fine-medium, soft. Saturated from 1.5m			
1.4		▽	BH1_1.5		
1.6					GW from 1.5 m Sulfur odour
1.8					
2			BH1_2.0		
2.2					
2.4			BH1_2.5		
2.6					
2.8					
3			BH1_3.0		
3.2					
3.4			BH1_3.5		
3.6					
3.8		As above, with green-brown colouration			
4			BH1_4.0		
4.2		Sandy CLAY: grey-brown, saturated, medium-firm, dense, fine.			Slight sulfur odour
4.4			BH1_4.5		
4.6					
4.8					
5			BH1_5.0		
5.2		EOH at target depth of 5.0m			
5.4					

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

BOREHOLE LOG BH02

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 5.0 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Solid Flight Augur

COMMENTS In grass verge north of wetland cell 1

LOGGED BY Ben Pieterse

Depth (m)	Graphic Log	Material Description Surface: Grass	Samples (ASS)	Samples (Contam)	Additional Observations
0		Sandy CLAY topsoil, brown, wet, firm, organic. (fill)	BH2_0.1		No anthropogenic refuse, staining or non-natural odour encountered Fill material from surface to 0.55 m
0.2		Sandy CLAY: brown, wet, firm, fine-medium with pale brown CLAY banding (fill)			
0.4			BH2_0.5		
0.6		SAND: yellow, dry-moist, fine-medium, loose (natural)			
0.8					
1			BH2_1.0		
1.2					
1.4			BH2_1.5		
1.6					
1.8					
2		Sandy CLAY: grey, moist, soft-medium, fine. Increasign moisture until saturated at 2.5 m	BH2_2.0		Sulfur odour GW from 2.5 m
2.2					
2.4		▽	BH2_2.5		
2.6					
2.8					
3		Clayey SAND: grey, saturated, soft, medium sands.	BH2_3.0		No odour
3.2					
3.4			BH2_3.5		
3.6					
3.8					
4			BH2_4.0		
4.2					
4.4			BH2_4.5		
4.6					
4.8					
5			BH2_5.0		
5.2		EOH at target depth of 5.0m			
5.4					

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

BOREHOLE LOG BH3 // S-06

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 2.5 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Hand Augur

COMMENTS

LOGGED BY Tony Coyle

Depth (m)	Graphic Log	Material Description	Samples (ASS)	Samples (Contam)	Additional Observations
0		Clayey SAND: organic, dark brown, soft, medium sands	BH3_0.0		No anthropogenic refuse, staining or non-natural odour encountered
0.2		Clayey SAND, brown, firm, medium sands, well sorted, moist		S-06_0.4 + QA1 & QA1A	
0.4			BH3_0.5		
0.6					
0.8					
1			BH3_1.0		
1.2		SAND: yellow, well sorted, increasing moisture until saturated from 2.0			Slight sulfur odour
1.4			BH3_1.5		
1.6					
1.8					
2		▽	BH3_2.0		
2.2					
2.4			BH3_2.5		
2.6		EOH at 2.5 m, borehole collapsing in watertable			
2.8					
3					
3.2					
3.4					
3.6					
3.8					
4					
4.2					
4.4					
4.6					
4.8					
5					
5.2					
5.4					

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BOREHOLE LOG BH4 // S-08

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 2.5 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Hand Augur

COMMENTS

LOGGED BY Tony Coyle

Depth (m)	Graphic Log	Material Description	Samples (ASS)	Samples (Contam)	Additional Observations
0		Sandy CLAY: dark grey, very high organic content, spongy-soft	BH4_0.0		No anthropogenic refuse, staining or non-natural odour encountered
0.2		Clayey SAND: dark brown, well sorted, moist			
0.4			BH4_0.5		
0.6		SAND: brown, moist, firm, medium sands, well-sorted			
0.8					
1			BH4_1.0		
1.2		Clayey SAND: yellow, saturated, firm. No material recovered from 2.0 m			
1.4			BH4_1.5		
1.6					
1.8					
2			BH4_2.0		
2.2					
2.4					
2.6		EOH at 2.5 m, borehole collapsing in watertable			
2.8					
3					
3.2					
3.4					
3.6					
3.8					
4					
4.2					
4.4					
4.6					
4.8					
5					
5.2					
5.4					

ENV Solutions
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BOREHOLE LOG BH5 // S-13

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 2.5 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Hand Augur

COMMENTS

LOGGED BY Tony Coyle

Depth (m)	Graphic Log	Material Description	Samples (ASS)	Samples (Contam)	Additional Observations
0		Silty CLAY: black, moist, fine, spongy	BH5_0.0		No anthropogenic refuse, staining or non-natural odour encountered
0.2		Silty CLAY: black, high silt precentage			
0.4		Clayey SAND: grey, firm	BH5_0.5		
0.6					
0.8					
1			BH5_1.0		
1.2					
1.4		▽	BH5_1.5		
1.6					
1.8					
2			BH5_2.0		
2.2		Silty SAND: black			
2.4			BH5_2.5		
2.6		EOH at 2.5 m, borehole collapsing in watertable			
2.8					
3					
3.2					
3.4					
3.6					
3.8					
4					
4.2					
4.4					
4.6					
4.8					
5					
5.2					
5.4					

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ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

BOREHOLE LOG BH6 // S-25

PROJECT NUMBER 216010
PROJECT NAME Sandhills Wetland Project
CLIENT Byron Shire Council
ADDRESS Cowper St, Byron Bay NSW

DRILLING DATE 29/06/2021
TOTAL DEPTH 2.0 m
DRILLING COMPANY ENV Solutions
DRILLING METHOD Hand Augur

COMMENTS

LOGGED BY Tony Coyle

Depth (m)	Graphic Log	Material Description	Samples (ASS)	Samples (Contam)	Additional Observations
0		Silty CLAY: black, moist, fine, spongy	BH6_0.0		No anthropogenic refuse, staining or non-natural odour encountered
0.2		Silty CLAY: black, high silt precentage			
0.4		Clayey SAND: grey, firm	BH6_0.5		
0.6					
0.8					
1			BH6_1.0		
1.2					
1.4			BH6_1.5		
1.6					
1.8					
2			BH6_2.0		
2.2		EOH at 2.5 m, borehole collapsing in watertable			
2.4					
2.6					
2.8					
3					
3.2					
3.4					
3.6					
3.8					
4					
4.2					
4.4					
4.6					
4.8					
5					
5.2					
5.4					

produced by ESlog.ESdat.net on 02 Jul 2021

CIVILCONSULT

Civil Consult

21 Clark St, Ballina, NSW, 2478

Phone: 0490419541

Geotechnical Log - Borehole

EX01

UTM	: 56J	**Drill Rig**	: Track Rig	**Job Number**	: Sandhills Wetland - Byron Bay
Easting (m)	:	**Driller Supplier**	: RCC	**Client**	: Planit Consulting
Northing (m)	:	**Logged By**	: Trent McManus	**Project**	: Sandhills Wetland
Ground Elevation	: Not Surveyed	**Reviewed By**	:	**Location**	: Byron Bay
Total Depth	: 2 m BGL	**Date**	: 31/08/2023	**Loc Comment**	:

Excavator Attachment	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Consistency/Density	Weathering	Moisture	DCP graph	Testing	Samples: Bulk Sample
			0.1	Topsoil		SC	Clayey to silty SAND (SC) : medium dense, fine to medium grained, dark brown, low plasticity clay, moist, (with organics).	MD		M			
	▶			Alluvial		SM	Silty SAND (SM) : medium dense, fine to medium grained, brown, low plasticity clay, trace high plasticity clay, moist.						
			1										
				Alluvial		SM	Silty SAND (SM) : loose to medium dense, fine to medium grained, brown grey, low plasticity clay, moist.	L-MD					
			2				**EX01 Terminated at 2 m**						

Civil Consult
21 Clark St, Ballina, NSW, 2478
Phone: 0490419541

Geotechnical Log - Borehole

EX02

UTM	: 56J	Drill Rig	: Track Rig	Job Number	: Sandhills Wetland - Byron Bay
Easting (m)	:	Driller Supplier	: RCC	Client	: Planit Consulting
Northing (m)	:	Logged By	: Trent McManus	Project	: Sandhills Wetland
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Byron Bay
Total Depth	: 2 m BGL	Date	: 31/08/2023	Loc Comment	:

Excavator Attachment	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Consistency/Density	Weathering	Moisture	DCP graph	Testing	Samples: Bulk Sample
	▶		0	Alluvial		SM	Silty SAND (SM) : loose, fine to medium grained, brown, wet.	L		W			
			1										
			2				**EX02 Terminated at 2 m**						

Civil Consult
21 Clark St, Ballina, NSW, 2478
Phone: 0490419541

Geotechnical Log - Borehole

EX03

UTM	: 56J	Drill Rig	: Track Rig	Job Number	: Sandhills Wetland - Byron Bay
Easting (m)	:	Driller Supplier	: RCC	Client	: Planit Consulting
Northing (m)	:	Logged By	: Trent McManus	Project	: Sandhills Wetland
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Byron Bay
Total Depth	: 1.7 m BGL	Date	: 31/08/2023	Loc Comment	:

Excavator Attachment	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Consistency/Density	Weathering	Moisture	DCP graph	Testing	Samples: Bulk Sample
				Alluvial		SW	SAND (SW) : medium dense, fine to medium grained, beige, dry.	MD		D			
			0.9	Alluvial		ML	Clayey SILT (ML) : stiff, low plasticity, black, with fine to medium grained sand, moist.	St		M			
			1	Alluvial		SW	SAND (SW) : medium dense, fine to medium grained, beige, dry.	MD		D			
			1.2	Alluvial		ML	Clayey SILT (ML) : stiff, low plasticity, black, with fine to medium grained sand, moist.	St		M			
			1.3	Alluvial		ML	Sandy SILT (ML) : stiff, low plasticity, black grey, fine to medium grained sand, trace high plasticity clay, moist.	St					
							EX03 Terminated at 1.7 m						

Civil Consult
21 Clark St, Ballina, NSW, 2478
Phone: 0490419541

Geotechnical Log - Borehole

EX04

UTM	: 56J	Drill Rig	: Track Rig	Job Number	: Sandhills Wetland - Byron Bay
Easting (m)	:	Driller Supplier	: RCC	Client	: Planit Consulting
Northing (m)	:	Logged By	: Trent McManus	Project	: Sandhills Wetland
Ground Elevation	: Not Surveyed	Reviewed By	:	Location	: Byron Bay
Total Depth	: 2 m BGL	Date	: 31/08/2023	Loc Comment	:

Excavator Attachment	Water	Elevation (m)	Depth (m)	Soil Origin	Graphic Log	Classification Code	Material Description	Consistency/Density	Weathering	Moisture	DCP graph	Testing	Samples: Bulk Sample
			0	Topsoil		CI	Silty CLAY (CI) : firm, medium plasticity, brown, with fine to medium grained sand, trace fine to coarse grained sand, moist to dry.	F		M-D			
			0.5	Alluvial		SM	Silty SAND (SM) : medium dense, fine to medium grained, brown grey, high plasticity clay, high plasticity, trace high plasticity clay, moist.	MD		M			
	▶		1	Alluvial		SM	As above, but loose, wet.	L		W			
			2				**EX04 Terminated at 2 m**						

Appendix D

Laboratory Results

ENV Services Pty Ltd
313 River Street
Ballina
NSW 2478

Attention: **Ben Pieterse**

Report **1023238-S**
Project name SANDHILLS
Project ID 216010
Received Date Sep 05, 2023

Client Sample ID			**EX1_0.1**	**EX1_0.5**	**EX1_1.5**	**EX1_2.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S23-Se0008798**	**S23-Se0008799**	**S23-Se0008800**	**S23-Se0008801**
Date Sampled			**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.6	4.6	5.2	5.2
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	2.9	3.5	4.3	4.0
Reaction Ratings*[S05]	0	-	2.0	2.0	2.0	2.0

Client Sample ID			**EX2_0.1**	**EX2_0.5**	**EX2_1.5**	**EX2_2.0**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S23-Se0008802**	**S23-Se0008803**	**S23-Se0008804**	**S23-Se0008805**
Date Sampled			**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.8	6.0	6.0	5.6
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.3	4.6	4.2	4.0
Reaction Ratings*[S05]	0	-	2.0	2.0	3.0	2.0

Client Sample ID			**EX2_0.5AG**	**EX3_0.1**	**EX3_0.5**	**EX3_0.8**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S23-Se0008806**	**S23-Se0008807**	**S23-Se0008808**	**S23-Se0008809**
Date Sampled			**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	4.5	5.3	5.6	5.5
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.0	3.4	4.5	4.2
Reaction Ratings*[S05]	0	-	3.0	2.0	2.0	4.0

Client Sample ID			EX3_1.0	EX3_1.3	EX3_1.5	EX4_0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Se0008810	S23-Se0008811	S23-Se0008812	S23-Se0008813
Date Sampled			Aug 31, 2023	Aug 31, 2023	Aug 31, 2023	Aug 31, 2023
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.5	5.2	5.4	5.1
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	4.4	2.7	2.8	2.5
Reaction Ratings*[S05]	0	-	2.0	3.0	3.0	3.0

Client Sample ID			EX4_0.5	EX4_1.5	EX4_2.0	EX2_1.0
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			S23-Se0008814	S23-Se0008815	S23-Se0008816	S23-Se0008953
Date Sampled			Aug 31, 2023	Aug 31, 2023	Aug 31, 2023	Aug 31, 2023
Test/Reference	LOR	Unit				
Acid Sulfate Soils Field pH Test						
pH-F (Field pH test)*	0.1	pH Units	5.2	5.8	5.8	5.9
pH-FOX (Field pH Peroxide test)*	0.1	pH Units	3.9	4.3	3.4	3.9
Reaction Ratings*[S05]	0	-	2.0	2.0	2.0	2.0

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

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

Description	Testing Site	Extracted	Holding Time
Acid Sulfate Soils Field pH Test	Sydney	Sep 06, 2023	7 Days

- Method: LTM-GEN-7060 Determination of field pH (pHF) and field pH peroxide (pHFOX) tests

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road	43 Detroit Drive	1277 Cameron Road,
Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: ENV Services Pty Ltd
Address: 313 River Street
Ballina
NSW 2478

Project Name: SANDHILLS
Project ID: 216010

Order No.:
Report #: 1023238
Phone: 1300 861 325
Fax:

Received: Sep 5, 2023 10:05 AM
Due: Sep 7, 2023
Priority: 3 Day
Contact Name: Ben Pieterse

Eurofins Analytical Services Manager : Bonnie Pu

Sample Detail						Acid Sulfate Soils Field pH Test
Sydney Laboratory - NATA # 1261 Site # 18217						X
External Laboratory						
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**	
1	EX1_0.1	Aug 31, 2023		Soil	S23-Se0008798	X
2	EX1_0.5	Aug 31, 2023		Soil	S23-Se0008799	X
3	EX1_1.5	Aug 31, 2023		Soil	S23-Se0008800	X
4	EX1_2.0	Aug 31, 2023		Soil	S23-Se0008801	X
5	EX2_0.1	Aug 31, 2023		Soil	S23-Se0008802	X
6	EX2_0.5	Aug 31, 2023		Soil	S23-Se0008803	X
7	EX2_1.5	Aug 31, 2023		Soil	S23-Se0008804	X
8	EX2_2.0	Aug 31, 2023		Soil	S23-Se0008805	X
9	EX2_0.5AG	Aug 31, 2023		Soil	S23-Se0008806	X
10	EX3_0.1	Aug 31, 2023		Soil	S23-Se0008807	X
11	EX3_0.5	Aug 31, 2023		Soil	S23-Se0008808	X
12	EX3_0.8	Aug 31, 2023		Soil	S23-Se0008809	X
13	EX3_1.0	Aug 31, 2023		Soil	S23-Se0008810	X

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road	43 Detroit Drive	1277 Cameron Road,
Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: ENV Services Pty Ltd
Address: 313 River Street
Ballina
NSW 2478

Project Name: SANDHILLS
Project ID: 216010

Order No.:
Report #: 1023238
Phone: 1300 861 325
Fax:

Received: Sep 5, 2023 10:05 AM
Due: Sep 7, 2023
Priority: 3 Day
Contact Name: Ben Pieterse

Eurofins Analytical Services Manager : Bonnie Pu

Sample Detail						Acid Sulfate Soils Field pH Test
Sydney Laboratory - NATA # 1261 Site # 18217						X
14	EX3_1.3	Aug 31, 2023		Soil	S23-Se0008811	X
15	EX3_1.5	Aug 31, 2023		Soil	S23-Se0008812	X
16	EX4_0.1	Aug 31, 2023		Soil	S23-Se0008813	X
17	EX4_0.5	Aug 31, 2023		Soil	S23-Se0008814	X
18	EX4_1.5	Aug 31, 2023		Soil	S23-Se0008815	X
19	EX4_2.0	Aug 31, 2023		Soil	S23-Se0008816	X
20	EX2_1.0	Aug 31, 2023		Soil	S23-Se0008953	X
Test Counts						20

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Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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

Results <10 times the LOR: No Limit

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

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

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S23-Se0008802	CP	pH Units	5.8	5.8	pass	20%	Pass	
pH-FOX (Field pH Peroxide test)*	S23-Se0008802	CP	pH Units	4.3	4.3	pass	0%	Pass	
Duplicate									
Acid Sulfate Soils Field pH Test				Result 1	Result 2	RPD			
pH-F (Field pH test)*	S23-Se0008812	CP	pH Units	5.4	5.4	pass	20%	Pass	
pH-FOX (Field pH Peroxide test)*	S23-Se0008812	CP	pH Units	2.8	2.8	pass	0%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
S05	Field Screen uses the following fizz rating to classify the rate the samples reacted to the peroxide: 1.0; No reaction to slight. 2.0; Moderate reaction. 3.0; Strong reaction with persistent froth. 4.0; Extreme reaction.

Authorised by:

Adam Bateup — Analytical Services Manager

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

ENV Services Pty Ltd
313 River Street
Ballina
NSW 2478

NATA Accredited
Accreditation Number 1261
Site Number 20794

Accredited for compliance with ISO/IEC 17025 – Testing
NATA is a signatory to the ILAC Mutual Recognition Arrangement for the mutual recognition of the equivalence of testing, medical testing, calibration, inspection, proficiency testing scheme providers and reference materials producers reports and certificates.

Attention: **Ben Pieterse**

Report **1024500-S**
Project name SANDHILLS
Project ID 216010
Received Date Sep 08, 2023

Client Sample ID			**EX1_0.5**	**EX2_2.0**	**EX2_0.5AG**	**EX3_0.5**
Sample Matrix			**Soil**	**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**B23-Se0018657**	**B23-Se0018659**	**B23-Se0018660**	**B23-Se0018661**
Date Sampled			**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**	**Aug 31, 2023**
Test/Reference	LOR	Unit				
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	4.7	5.0	4.7	5.2
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	40	23	56	5.7
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.065	0.037	0.090	0.009
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.006	0.014	0.009	0.007
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	3.7	8.5	5.7	4.4
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	N/A
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	N/A
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A	N/A	N/A
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	0.07	0.05	0.10	< 0.02
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	44	31	62	10
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	3.3	2.4	4.7	< 1
Extraneous Material						
<2mm Fraction	0.005	g	16	16	20	27
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
Sample Properties						
% Moisture	1	%	< 1	< 1	< 1	< 1

Client Sample ID			EX3_0.8	EX3_1.3	EX3_1.5	EX4_0.1
Sample Matrix			Soil	Soil	Soil	Soil
Eurofins Sample No.			B23-Se0018662	B23-Se0018663	B23-Se0018664	B23-Se0018665
Date Sampled			Aug 31, 2023	Aug 31, 2023	Aug 31, 2023	Aug 31, 2023
Test/Reference	LOR	Unit				
Actual Acidity (NLM-3.2)						
pH-KCL (NLM-3.1)	0.1	pH Units	4.8	4.5	5.0	4.4
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	140	200	24	120
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.23	0.32	0.038	0.20
Potential Acidity - Chromium Reducible Sulfur						
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.012	0.036	0.012	0.015
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	7.8	23	7.5	9.1
Extractable Sulfur						
Sulfur - KCl Extractable	0.005	% S	N/A	N/A	N/A	< 0.005
HCl Extractable Sulfur	0.005	% S	N/A	N/A	N/A	0.012
Retained Acidity (S-NAS)						
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A	N/A	N/A	0.023
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A	N/A	N/A	0.017
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A	N/A	N/A	11
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0	2.0	2.0
Acid Neutralising Capacity (ANCbt)						
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	N/A	N/A	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A	N/A	N/A
ANC Fineness Factor		factor	1.5	1.5	1.5	1.5
Net Acidity (Including ANC)						
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	0.24	0.35	0.05	0.23
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	150	220	31	140
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	11	16	2.3	11
Extraneous Material						
<2mm Fraction	0.005	g	12	5.9	29	20
>2mm Fraction	0.005	g	< 0.005	< 0.005	< 0.005	< 0.005
Analysed Material	0.1	%	100	100	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1	< 0.1	< 0.1
Sample Properties						
% Moisture	1	%	2.3	9.8	< 1	< 1

Client Sample ID			EX4_0.5	EX4_1.5
Sample Matrix			Soil	Soil
Eurofins Sample No.			B23-Se0018666	B23-Se0018667
Date Sampled			Aug 31, 2023	Not Provided[I12]
Test/Reference	LOR	Unit		
Actual Acidity (NLM-3.2)				
pH-KCL (NLM-3.1)	0.1	pH Units	4.3	4.8
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	57	38
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.092	0.060
Potential Acidity - Chromium Reducible Sulfur				
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.007	0.008
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	4.2	5.1
Extractable Sulfur				
Sulfur - KCl Extractable	0.005	% S	< 0.005	N/A
HCl Extractable Sulfur	0.005	% S	< 0.005	N/A

Client Sample ID			EX4_0.5	EX4_1.5
Sample Matrix			Soil	Soil
Eurofins Sample No.			B23-Se0018666	B23-Se0018667
Date Sampled			Aug 31, 2023	Not Provided[I12]
Test/Reference	LOR	Unit		
Retained Acidity (S-NAS)				
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	0.009	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	0.007	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	4.4	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0	2.0
Acid Neutralising Capacity (ANCbt)				
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A	N/A
ANC Fineness Factor		factor	1.5	1.5
Net Acidity (Including ANC)				
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	0.11	0.07
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	66	43
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	4.9	3.2
Extraneous Material				
<2mm Fraction	0.005	g	28	17
>2mm Fraction	0.005	g	< 0.005	< 0.005
Analysed Material	0.1	%	100	100
Extraneous Material	0.1	%	< 0.1	< 0.1
Sample Properties				
% Moisture	1	%	< 1	< 1

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

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

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Sep 08, 2023	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Sep 08, 2023	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Brisbane	Sep 08, 2023	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road	43 Detroit Drive	1277 Cameron Road,
Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: ENV Services Pty Ltd
Address: 313 River Street
Ballina
NSW 2478

Project Name: SANDHILLS
Project ID: 216010

Order No.:
Report #: 1024500
Phone: 1300 861 325
Fax:

Received: Sep 8, 2023 4:13 PM
Due: Sep 13, 2023
Priority: 3 Day
Contact Name: Ben Pieterse

Eurofins Analytical Services Manager : Bonnie Pu

Sample Detail						Chromium Reducible Sulfur Suite	Moisture Set
Brisbane Laboratory - NATA # 1261 Site # 20794						X	X
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	EX1_0.5	Aug 31, 2023		Soil	B23-Se0018657	X	X
2	EX2_0.5	Aug 31, 2023		Soil	B23-Se0018658	X	X
3	EX2_2.0	Aug 31, 2023		Soil	B23-Se0018659	X	X
4	EX2_0.5AG	Aug 31, 2023		Soil	B23-Se0018660	X	X
5	EX3_0.5	Aug 31, 2023		Soil	B23-Se0018661	X	X
6	EX3_0.8	Aug 31, 2023		Soil	B23-Se0018662	X	X
7	EX3_1.3	Aug 31, 2023		Soil	B23-Se0018663	X	X
8	EX3_1.5	Aug 31, 2023		Soil	B23-Se0018664	X	X
9	EX4_0.1	Aug 31, 2023		Soil	B23-Se0018665	X	X
10	EX4_0.5	Aug 31, 2023		Soil	B23-Se0018666	X	X
11	EX4_1.5	Not Provided		Soil	B23-Se0018667	X	X
Test Counts						11	11

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Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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

Results <10 times the LOR: No Limit

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

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

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Actual Acidity (NLM-3.2)							
pH-KCL (NLM-3.1)	%	100			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)	%	107			80-120	Pass	
LCS - % Recovery							
Potential Acidity - Chromium Reducible Sulfur							
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	%	117			80-120	Pass	
LCS - % Recovery							
Extractable Sulfur							
HCl Extractable Sulfur	%	95			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	B23-Se0018657	CP	pH Units	4.7	4.8	1.3	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	B23-Se0018657	CP	mol H+/t	40	41	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	B23-Se0018657	CP	% pyrite S	0.065	0.065	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	B23-Se0018657	CP	% S	0.006	0.006	6.7	20%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	B23-Se0018657	CP	mol H+/t	3.7	3.9	6.7	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	B23-Se0018657	CP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	B23-Se0018657	CP	% S	N/A	N/A	N/A	20%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	B23-Se0018657	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	B23-Se0018657	CP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	B23-Se0018657	CP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	B23-Se0018657	CP	% CaCO3	N/A	N/A	N/A	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	B23-Se0018657	CP	% S	N/A	N/A	N/A	30%	Pass	
ANC Fineness Factor	B23-Se0018657	CP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	B23-Se0018657	CP	% S	0.07	0.07	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	B23-Se0018657	CP	mol H+/t	44	45	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	B23-Se0018657	CP	kg CaCO3/t	3.3	3.3	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	B23-Se0018395	NCP	%	18	18	2.4	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
G03	Insufficient sample was supplied to conduct this analysis
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Adam Bateup	Analytical Services Manager
Jonathon Angell	Senior Analyst-Sample Properties
Jonathon Angell	Senior Analyst-SPOCAS

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

ENV Services Pty Ltd
313 River Street
Ballina
NSW 2478

Attention: **Ben Pieterse**

Report **1029280-S**
Project name SANDHILLS
Project ID 216010
Received Date Sep 26, 2023

Client Sample ID			**EX2_0.5**
Sample Matrix			**Soil**
Eurofins Sample No.			**S23-Se0059753**
Date Sampled			**Aug 31, 2023**
Test/Reference	LOR	Unit	
Actual Acidity (NLM-3.2)			
pH-KCL (NLM-3.1)	0.1	pH Units	5.5
Titratable Actual Acidity (NLM-3.2)	2	mol H+/t	8.7
Titratable Actual Acidity (NLM-3.2)	0.003	% pyrite S	0.014
Potential Acidity - Chromium Reducible Sulfur			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)[S04]	0.005	% S	0.018
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	3	mol H+/t	11
Extractable Sulfur			
Sulfur - KCl Extractable	0.005	% S	N/A
HCl Extractable Sulfur	0.005	% S	N/A
Retained Acidity (S-NAS)			
Net Acid soluble sulfur (SNAS) NLM-4.1	0.005	% S	N/A
Net Acid soluble sulfur (s-SNAS) NLM-4.1[S02]	0.005	% S	N/A
Net Acid soluble sulfur (a-SNAS) NLM-4.1	2	mol H+/t	N/A
HCl Extractable Sulfur Correction Factor	1	factor	2.0
Acid Neutralising Capacity (ANCbt)			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	0.01	% CaCO3	N/A
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)[S03]	0.02	% S	N/A
Acid Neutralising Capacity - (a-ANCbt) (NLM-5.2)	2	mol H+/t	N/A
ANC Fineness Factor		factor	1.5
Net Acidity (Including ANC)			
CRS Suite - Net Acidity - NASSG (Including ANC)	0.02	% S	0.03
CRS Suite - Net Acidity - NASSG (Including ANC)	10	mol H+/t	20
CRS Suite - Liming Rate - NASSG (Including ANC)[S01]	1	kg CaCO3/t	1.5
Extraneous Material			
<2mm Fraction	0.005	g	41
>2mm Fraction	0.005	g	0.60
Analysed Material	0.1	%	99
Extraneous Material	0.1	%	1.5
Sample Properties			
% Moisture	1	%	21

Sample History

Where samples are submitted/analysed over several days, the last date of extraction is reported.

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

Description	Testing Site	Extracted	Holding Time
Chromium Reducible Sulfur Suite			
Chromium Suite	Brisbane	Sep 27, 2023	6 Week
- Method: LTM-GEN-7070 Chromium Reducible Sulfur Suite			
Extraneous Material	Brisbane	Sep 27, 2023	6 Week
- Method: LTM-GEN-7050/7070			
% Moisture	Sydney	Sep 26, 2023	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins

web: www.eurofins.com.au
email: EnviroSales@eurofins.com

Eurofins Environment Testing Australia Pty Ltd
ABN: 50 005 085 521

Melbourne	Geelong	Sydney	Canberra	Brisbane	Newcastle
6 Monterey Road	19/8 Lewalan Street	179 Magowar Road	Unit 1,2 Dacre Street	1/21 Smallwood Place	1/2 Frost Drive
Dandenong South	Grovedale	Girraween	Mitchell	Murarrie	Mayfield West NSW 2304
VIC 3175	VIC 3216	NSW 2145	ACT 2911	QLD 4172	Tel: +61 2 4968 8448
Tel: +61 3 8564 5000	Tel: +61 3 8564 5000	Tel: +61 2 9900 8400	Tel: +61 2 6113 8091	Tel: +61 7 3902 4600	NATA# 1261
NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	NATA# 1261	Site# 25079 & 25289
Site# 1254	Site# 25403	Site# 18217	Site# 25466	Site# 20794	

Eurofins ARL Pty Ltd
ABN: 91 05 0159 898

Perth
46-48 Banksia Road
Welshpool
WA 6106
Tel: +61 8 6253 4444
NATA# 2377
Site# 2370

Eurofins Environment Testing NZ Ltd
NZBN: 9429046024954

Auckland	Christchurch	Tauranga
35 O'Rorke Road	43 Detroit Drive	1277 Cameron Road,
Penrose,	Rolleston,	Gate Pa,
Auckland 1061	Christchurch 7675	Tauranga 3112
Tel: +64 9 526 4551	Tel: +64 3 343 5201	Tel: +64 9 525 0568
IANZ# 1327	IANZ# 1290	IANZ# 1402

Company Name: ENV Services Pty Ltd
Address: 313 River Street
Ballina
NSW 2478

Project Name: SANDHILLS
Project ID: 216010

Order No.:
Report #: 1029280
Phone: 1300 861 325
Fax:

Received: Sep 26, 2023 12:00 AM
Due: Sep 29, 2023
Priority: 3 Day
Contact Name: Ben Pieterse

Eurofins Analytical Services Manager : Bonnie Pu

Sample Detail						Chromium Reducible Sulfur Suite	Moisture Set
Sydney Laboratory - NATA # 1261 Site # 18217							X
Brisbane Laboratory - NATA # 1261 Site # 20794						X	
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	EX2_0.5	Aug 31, 2023		Soil	S23-Se0059753	X	X
Test Counts						1	1

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Internal Quality Control Review and Glossary

General

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

Holding Times

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

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

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

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

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

Units

mg/kg: milligrams per kilogram	**mg/L:** milligrams per litre	**µg/L:** micrograms per litre
ppm: parts per million	**ppb:** parts per billion	**%:** Percentage
org/100 mL: Organisms per 100 millilitres	**NTU:** Nephelometric Turbidity Units	**MPN/100 mL:** Most Probable Number of organisms per 100 millilitres
CFU: Colony forming unit		

Terms

APHA	American Public Health Association
COC	Chain of Custody
CP	Client Parent - QC was performed on samples pertaining to this report
CRM	Certified Reference Material (ISO17034) - reported as percent recovery.
Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
LOR	Limit of Reporting.
LCS	Laboratory Control Sample - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
SRA	Sample Receipt Advice
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
TBTO	Tributyltin oxide (*bis*-tributyltin oxide) - individual tributyltin compounds cannot be identified separately in the environment however free tributyltin was measured and its values were converted stoichiometrically into tributyltin oxide for comparison with regulatory limits.
TCLP	Toxicity Characteristic Leaching Procedure
TEQ	Toxic Equivalency Quotient or Total Equivalence
QSM	US Department of Defense Quality Systems Manual Version 5.4
US EPA	United States Environmental Protection Agency
WA DWER	Sum of PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC - Acceptance Criteria

The acceptance criteria should be used as a guide only and may be different when site specific Sampling Analysis and Quality Plan (SAQP) have been implemented

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

Results <10 times the LOR: No Limit

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

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

NOTE: pH duplicates are reported as a range not as RPD

Surrogate Recoveries: Recoveries must lie between 20-130% for Speciated Phenols & 50-150% for PFAS. SVOCs recoveries 20 – 150%

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.4 where no positive PFAS results have been reported have been reviewed and no data was affected.

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling. Therefore, laboratory analysis is unlikely to be completed within holding time.Analysis will begin as soon as possible after sample receipt.
4. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of recovery the term "INT" appears against that analyte.
5. For Matrix Spikes and LCS results a dash "-" in the report means that the specific analyte was not added to the QC sample.
6. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
LCS - % Recovery							
Actual Acidity (NLM-3.2)							
pH-KCL (NLM-3.1)	%	104			80-120	Pass	
Titratable Actual Acidity (NLM-3.2)	%	110			80-120	Pass	
LCS - % Recovery							
Potential Acidity - Chromium Reducible Sulfur							
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	%	104			80-120	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
Actual Acidity (NLM-3.2)				Result 1	Result 2	RPD			
pH-KCL (NLM-3.1)	S23-Se0055468	NCP	pH Units	5.0	5.0	1.00	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	S23-Se0055468	NCP	mol H+/t	26	26	<1	20%	Pass	
Titratable Actual Acidity (NLM-3.2)	S23-Se0055468	NCP	% pyrite S	0.042	0.042	<1	30%	Pass	
Duplicate									
Potential Acidity - Chromium Reducible Sulfur				Result 1	Result 2	RPD			
Chromium Reducible Sulfur (s-SCr) (NLM-2.1)	S23-Se0055468	NCP	% S	0.006	0.006	<1	20%	Pass	
Chromium Reducible Sulfur (a-SCr) (NLM-2.1)	S23-Se0055468	NCP	mol H+/t	3.7	3.7	<1	30%	Pass	
Duplicate									
Extractable Sulfur				Result 1	Result 2	RPD			
Sulfur - KCl Extractable	S23-Se0055468	NCP	% S	N/A	N/A	N/A	30%	Pass	
HCl Extractable Sulfur	S23-Se0055468	NCP	% S	N/A	N/A	N/A	20%	Pass	
Duplicate									
Retained Acidity (S-NAS)				Result 1	Result 2	RPD			
Net Acid soluble sulfur (SNAS) NLM-4.1	S23-Se0055468	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (s-SNAS) NLM-4.1	S23-Se0055468	NCP	% S	N/A	N/A	N/A	30%	Pass	
Net Acid soluble sulfur (a-SNAS) NLM-4.1	S23-Se0055468	NCP	mol H+/t	N/A	N/A	N/A	30%	Pass	
Duplicate									
Acid Neutralising Capacity (ANCbt)				Result 1	Result 2	RPD			
Acid Neutralising Capacity - (ANCbt) (NLM-5.2)	S23-Se0055468	NCP	% CaCO3	N/A	N/A	N/A	20%	Pass	
Acid Neutralising Capacity - (s-ANCbt) (NLM-5.2)	S23-Se0055468	NCP	% S	N/A	N/A	N/A	30%	Pass	
ANC Fineness Factor	S23-Se0055468	NCP	factor	1.5	1.5	<1	30%	Pass	
Duplicate									
Net Acidity (Including ANC)				Result 1	Result 2	RPD			
CRS Suite - Net Acidity - NASSG (Including ANC)	S23-Se0055468	NCP	% S	0.05	0.05	<1	30%	Pass	
CRS Suite - Net Acidity - NASSG (Including ANC)	S23-Se0055468	NCP	mol H+/t	30	30	<1	30%	Pass	
CRS Suite - Liming Rate - NASSG (Including ANC)	S23-Se0055468	NCP	kg CaCO3/t	2.2	2.3	<1	30%	Pass	
Duplicate									
Sample Properties				Result 1	Result 2	RPD			
% Moisture	S23-Se0059383	NCP	%	3.6	4.7	27	30%	Pass	

Comments

Sample Integrity

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

Qualifier Codes/Comments

Code	Description
S01	Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO3) and using a safety factor of 1.5 to allow for non-homogeneous mixing and poor reactivity of lime. For conversion of Liming Rate from 'kg/t dry weight' to 'kg/m3 in-situ soil' multiply 'reported results' x 'wet bulk density of soil in t/m3'
S02	Retained Acidity is Reported when the pHKCl is less than pH 4.5
S03	Acid Neutralising Capacity is only required if the pHKCl if greater than or equal to pH 6.5
S04	Acid Sulfate Soil Samples have a 24 hour holding time unless frozen or dried within that period

Authorised by:

Ursula Long	Analytical Services Manager
Jonathon Angell	Senior Analyst-SPOCAS

Glenn Jackson
Managing Director

Final Report – this report replaces any previously issued Report

- Indicates Not Requested

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

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

RESULTS OF ACID SULFATE SOIL ANALYSIS

45 samples supplied by Env Solutions Pty Ltd on 30th June, 2021. Lab Job No.K8714
Analysis requested by Ben Pieterse. Your Job: 216010

PO Box 248 BALLINA NSW 2478

Sample Identification	EAL Lab Code	Texture	Moisture Content		pH$_F$ and pH$_{FOX}$				KCl-extractable sulfur (S_{KCl})		Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)			Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Non-treated soil: Acid Neutralising Capacity (ANC_{BT})		Non-treated soil: Net Acidity	Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH$_F$	pH$_{FOX}$	pH change	Reaction	(% S_{KCl})	(equiv. mol H$^+$/t)	(% S_{Cr})	(mol H$^+$/t)	pH$_{KCl}$	(mol H$^+$/t)	(%S_{NAS})	(mol H$^+$/t)	(% $CaCO_3$)	(mol H$^+$/t)	(mol H$^+$/t)	(kg $CaCO_3$/t DW)
Method Info.			**	**	*(In-house method S21)*					**	*(In-house method S20)*		*(In-house method 16b)*		**		*(In-house method S14)*		**	**
BH1 0.1	*K8714/1*	Coarse	18.0	0.22	6.58	3.37	-3.21	Medium	..	..	<0.005	0	6.16	5	..	..	..	..	5	0
BH1 0.5	*K8714/2*	Coarse	9.3	0.10	7.14	5.48	-1.66	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH1 0.65	*K8714/3*	Fine	38.8	0.63	5.05	2.60	-2.45	High	0.005	3	0.041	25	4.44	135	0.042	20	..	..	180	14
BH1 1.0	*K8714/4*	Coarse	15.9	0.19	5.77	2.88	-2.89	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH1 1.5	*K8714/5*	Coarse	21.0	0.27	5.77	3.53	-2.24	Medium	..	..	0.012	7	5.15	27	..	..	..	..	34	3
BH1 2.0	*K8714/6*	Coarse	20.1	0.25	5.72	3.73	-1.99	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH1 2.5	*K8714/7*	Coarse	24.2	0.32	5.95	3.93	-2.02	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH1 3.0	*K8714/8*	Coarse	24.3	0.32	5.20	3.10	-2.10	Extreme	..	..	0.233	145	4.83	38	..	..	..	..	184	14
BH1 3.5	*K8714/9*	Coarse	24.3	0.32	5.25	3.18	-2.07	Extreme	..	..	..	..	..	..	..	..	..	..	..	..
BH1 4.0	*K8714/10*	Coarse	20.2	0.25	4.50	2.22	-2.28	Volcanic	..	..	..	..	..	..	..	..	..	..	..	..
BH1 4.5	*K8714/11*	Fine	21.0	0.27	4.14	1.65	-2.50	Volcanic	..	..	1.008	629	4.58	95	..	..	..	..	724	54
BH1 5.0	*K8714/12*	Fine	20.1	0.25	4.37	1.89	-2.48	Volcanic	..	..	..	..	..	..	..	..	..	..	..	..
BH2 0.1	*K8714/13*	Fine	16.1	0.19	4.99	2.62	-2.37	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH2 0.5	*K8714/14*	Medium	9.1	0.10	5.02	2.15	-2.87	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH2 1.0	*K8714/15*	Coarse	12.4	0.14	5.05	3.42	-1.63	Medium	0.003	2	<0.005	0	4.41	38	0.015	7	..	..	45	3
BH2 1.5	*K8714/16*	Coarse	9.1	0.10	5.93	3.54	-2.39	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH2 2.0	*K8714/17*	Fine	29.1	0.41	5.69	1.77	-3.92	High	..	..	..	..	..	..	..	..	..	..	..	..
BH2 2.5	*K8714/18*	Fine	27.4	0.38	6.03	1.99	-4.04	High	..	..	0.015	9	5.09	27	..	..	..	..	36	3
BH2 3.0	*K8714/19*	Coarse	17.7	0.21	6.05	3.20	-2.85	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH2 3.5	*K8714/20*	Coarse	19.9	0.25	6.10	2.90	-3.20	Medium	..	..	0.029	18	5.34	23	..	..	..	..	41	3
BH2 4.0	*K8714/21*	Coarse	20.6	0.26	5.99	2.42	-3.57	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH2 4.5	*K8714/22*	Coarse	15.6	0.19	5.93	2.52	-3.41	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH2 5.0	*K8714/23*	Fine	19.1	0.24	5.96	2.31	-3.65	Medium	..	..	0.011	7	4.98	28	..	..	..	..	35	3
BH3 0.0	*K8714/24*	Fine	31.3	0.46	5.14	2.07	-3.07	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH3 0.5	*K8714/25*	Coarse	15.8	0.19	5.13	2.62	-2.51	Medium	..	..	0.009	6	4.72	41	..	..	..	..	46	3
BH3 1.0	*K8714/26*	Coarse	23.2	0.30	5.65	4.24	-1.41	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH3 1.5	*K8714/27*	Coarse	23.5	0.31	5.89	4.17	-1.72	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH3 2.0	*K8714/28*	Coarse	22.1	0.28	5.84	3.08	-2.76	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH3 2.5	*K8714/29*	Coarse	21.2	0.27	5.84	3.04	-2.80	Low	..	..	0.019	12	5.48	10	..	..	..	..	22	2
BH4 0.0	*K8714/30*	Fine	28.5	0.40	5.40	1.91	-3.49	High	..	..	0.017	11	4.62	58	..	..	..	..	68	5
BH4 0.5	*K8714/31*	Fine	19.2	0.24	5.30	3.49	-1.81	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH4 1.0	*K8714/32*	Coarse	25.4	0.34	5.70	4.40	-1.30	Low	..	..	0.010	6	5.04	36	..	..	..	..	42	3
BH4 1.5	*K8714/33*	Coarse	21.0	0.27	5.80	4.35	-1.45	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH4 2.0	*K8714/34*	Coarse	20.2	0.25	5.83	4.16	-1.67	Low	..	..	0.008	5	5.36	20	..	..	..	..	25	2
BH5 0.0	*K8714/35*	Fine	50.3	1.01	4.49	2.66	-1.83	Extreme	0.008	5	0.033	21	4.17	294	0.063	29	..	..	344	26
BH5 0.5	*K8714/36*	Fine	15.3	0.18	4.95	2.51	-2.44	Medium	0.003	2	0.006	4	4.33	103	0.007	3	..	..	111	8
BH5 1.0	*K8714/37*	Fine	16.0	0.19	5.21	3.32	-1.89	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH5 1.5	*K8714/38*	Coarse	7.3	0.08	5.40	3.23	-2.17	Medium	0.003	2	<0.005	0	4.34	42	0.019	9	..	..	51	4
BH5 2.0	*K8714/39*	Coarse	36.6	0.58	5.53	3.84	-1.69	Medium	..	..	..	..	..	..	..	..	..	..	..	..
BH5 2.5	*K8714/40*	Coarse	21.5	0.27	5.31	4.02	-1.29	Low	..	..	0.009	6	5.02	31	..	..	..	..	36	3
BH6 0.0	*K8714/41*	Fine	35.0	0.54	4.37	2.70	-1.67	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH6 0.5	*K8714/42*	Fine	21.9	0.28	4.73	3.34	-1.39	Low	..	..	0.017	11	4.52	65	..	..	..	..	76	6
BH6 1.0	*K8714/43*	Coarse	18.3	0.22	4.86	3.78	-1.08	Low	..	..	..	..	..	..	..	..	..	..	..	..
BH6 1.5	*K8714/44*	Fine	24.6	0.33	4.65	3.32	-1.33	Medium	..	..	0.012	8	4.76	47	..	..	..	..	55	4
BH6 2.0	*K8714/45*	Fine	20.2	0.25	4.93	3.87	-1.06	Low	..	..	..	..	..	..	..	..	..	..	..	..

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity** (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is **Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity)** (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.
   The Initial Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pH$_{KCl}$ < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H$^+$/t; medium texture ≥ 0.06% S or 36 mol H$^+$/t; fine texture ≥ 0.1% S or 62 mol H$^+$/t)** (Table 1.1; Sullivan et al. 2018 - full reference above)
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H$^+$/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pH$_{KCl}$ is < 4.5 or > 6.5, zero is reported for S_{NAS} and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
21. Results relate to the samples tested.
22. This report was issued on 14/07/2021 and replaces the report published 05/07/2021. Net acidity has been added to selected samples.

NATA
Accreditation No. 14560
Accredited for compliance with ISO/IEC 17025 - Testing

checked: .....
Graham Lancaster
Laboratory Manager

RESULTS OF ACID SULFATE SOIL ANALYSIS

5 samples supplied by ENV Services Pty Ltd on 30/11/2021. Lab Job No. M3991.
Analysis requested by Ben Pieterse. Your Job: Ref: 216010.

PO Box 248 BALLINA NSW 2478

Sample Identification	EAL Lab Code	Texture	Moisture Content		pH_F and pH_{FOX}				KCl-extractable sulfur (S_{KCl})		Potential Sulfidic Acidity (Chromium Reducible Sulfur - CRS)			Actual Acidity (Titratable Actual Acidity - TAA)	Retained Acidity		Non-treated soil: Acid Neutralising Capacity (ANC_{BT})		Non-treated soil: Net Acidity	Non-treated soil: Lime Calculation
			(% moisture of total wet weight)	(g moisture / g of oven dry soil)	pH_F	pH_{FOX}	pH change	Reaction	(% S_{KCl})	(equiv. mol H^+/t)	(% S_{cr})	(mol H^+/t)	pH_{KCl}	(mol H^+/t)	(%S_{NAS})	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**	**		(In-house method S21)				**		(In-house method S20)		(In-house method 16b)		**		(In-house method S14)		**	**
EA-1 _0.1 25/11/21	*M3991/1*	Fine	39.4	0.65	6.23	2.44	-3.79	Medium	..	..	..	..	..	..	..	..	..	..	..	..
EA-1 _0.5 25/11/21	*M3991/2*	Fine	51.7	1.07	6.11	2.45	-3.66	High	..	..	0.018	11	4.94	67	..	..	..	..	78	6
EA-1 _1.0 25/11/21	*M3991/3*	Fine	63.2	1.71	5.22	1.81	-3.41	Volcanic	0.006	4	0.038	23	4.46	130	0.019	9	..	..	163	12
EA-1 _1.5 25/11/21	*M3991/4*	Fine	30.3	0.43	5.41	2.61	-2.80	Medium	..	..	..	..	..	..	..	..	..	..	..	..
EA-1 _2.0 25/11/21	*M3991/5*	Fine	33.7	0.51	5.88	2.97	-2.91	Medium	..	..	0.029	18	4.94	56	..	..	..	..	73	6

NOTES:

1. All analysis is reported on a dry weight (DW) basis, unless wet weight (WW) is specified.
2. Samples are dried and ground immediately upon arrival (unless supplied dried and ground).
3. Analytical procedures are sourced from Sullivan L, Ward N, Toppler N and Lancaster G. 2018. National acid sulfate soils guidance: national acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT. CC BY 4.0.
4. The Acid Base Accounting Equation, where Acid Neutralising Capacity has not been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity (Eq. 3.2; Sullivan et al. 2018 - full reference above).
5. The Acid Base Accounting Equation for post-limed soil materials is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - (post treatment Acid Neutralising Capacity - initial Acid Neutralising Capacity) (Eq. 3.3; Sullivan et al. 2018 - full reference above).
   While the Acid Neutralising Capacity of a soil material may not be included in the Net Acidity calculation (Note 4), it must be measured to give an Initial Acid Neutralising Capacity if verification testing is planned post-liming.
   The Inital Acid Neutralising Capacity must be provided by the client to enable EAL to produce Verification Net Acidity and Liming calculations for post-limed soil materials.
6. The Acid Base Accounting Equation, where Acid Neutralising Capacity has been corroborated by other data, is Net Acidity = Potential Acidity + Actual Acidity + Retained Acidity - Acid Neutralising Capacity (Eq. 3.1; Sullivan et al. 2018 - full reference above).
7. The lime calculation includes a Safety Factor of 1.5 as a safety margin for acid neutralisation (Sullivan et al. 2018). This is only applied to positive values. An increased Safety Factor may be required in some cases.
8. Retained Acidity is required when the pHKCl < 4.5 or where jarosite has been visually observed.
9. A negative Net Acidity result indicates an excess acid neutralising capacity.
10. If insufficient mixing occurs during intial sampling, or during post-liming, or both: the Potential Sulfidic Acidity may be greater in the post-limed sample than in the intial sample; the post-liming Acid Neutralising Capacity may be lower in the post-limed sample than in the intial sample.
11. **An acid sulfate soil management plan is triggered by Net Acidity results greater than the texture dependent criterion: coarse texture ≥ 0.03% S or 18 mol H+/t; medium texture ≥ 0.06% S or 36 mol H+/t; fine texture ≥ 0.1% S or 62 mol H+/t) (Table 1.1; Sullivan et al. 2018 - full reference above)**
12. For projects that disturb > 1000 t of soil material, the coarse trigger of ≥ 0.03% S or ≥ 18 mol H+/t must be applied in accordance with Sullivan et al. (2018) (full reference above).
13. Acid sulfate soil texture triggers can be related to NCST (2009) textures: coarse and peats = sands to loamy sands; medium = clayey sand to light clays; fine = light medium to heavy clays (Sullivan et al. 2018 - full reference above).
14. Bulk density is required to convert liming rates to soil volume based results. Field bulk density rings can be submitted to EAL for bulk density determination.
15. A negative Net Acidity result indicates an excess acid neutralising capacity.
16. '..' is reported where a test is either not requested or not required. Where pHKCl is < 4.5 or > 6.5, zero is reported for SNAS and ANC in Net Acidity calculations, respectively.
17. Results refer to samples as received at the laboratory. This report is not to be reproduced except in full.
18. ** NATA accreditation does not cover the performance of this service.
19. Analysis conducted between sample arrival date and reporting date.
20. All services undertaken by EAL are covered by the EAL Laboratory Services Terms and Conditions (refer SCU.edu.au/eal/t&cs or on request).
21. Results relate to the samples tested.
22. This report was issued on 13/12/2021 and replaces the report published 02/12/2021. Net acidity has been added to selected samples.

NATA
WORLD RECOGNISED ACCREDITATION
Accreditation No. 14960
Accredited for compliance with ISO/IEC 17025 - Testing

checked: .....
Graham Lancaster
Laboratory Manager

Appendix E

Laboratory Documentation

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

- ☑ **Sydney Laboratory** 179 Magowar Road, Girraween, NSW 2145 +61 2 9900 8400 EnviroSampleNSW@eurofins.com
- ☐ **Brisbane Laboratory** Unit 1/21 Smallwood Place, Murarrie, QLD 4172 +61 7 3902 4600 EnviroSampleQLD@eurofins.com
- ☐ **Perth Laboratory** 46-48 Banksia Road, Welshpool, WA 6106 +61 8 6253 4444 EnviroSampleWA@eurofins.com
- ☐ **Melbourne Laboratory** 6 Monterey Road Dandenong South VIC 3175 +61 3 8564 5000 EnviroSampleVic@eurofins.com

Company	ENV Solutions
Address	313 River St Ballina PO Box 248 Ballina NSW 2478
Contact Name	Ben Pieterse
Phone №	0478 170 771
Special Directions	
Purchase Order	
Quote ID №	220829ESON
Project №	216010
Project Name	Sandhills
Project Manager	Ben Pieterse
EDD Format (ESdat, EQuIS etc)	esdat
Sampler(s)	
Handed over by	
Email for Invoice	accounts@envsolutions.com.au
Email for Results	ben@envsolutions.com.au cc labresults@envsolutions.c

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

Containers: Change container type & size if necessary. 500mL Plastic, 250mL Plastic, 125mL Plastic, 200mL Amber Glass, 40mL VOA vial, 500mL PFAS Bottle, Jar (Glass or HDPE), Other (Asbestos AS4964, WA Guidelines)

Required Turnaround Time (TAT) — Default will be 5 days if not ticked. ♦Surcharge will apply
- ☐ Overnight (reporting by 9am)♦
- ☐ Same day♦
- ☐ 1 day♦
- ☐ 2 days♦
- ☑ 3 days♦
- ☐ 5 days (Standard)
- ☐ Other( )

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	ASS pH Field Test	Sample Comments / Dangerous Goods Hazard Warning
1	EX1_0.1	31.8.23	S	X	
2	EX1_0.5	31.8.23	S	X	
3	EX1_1.5	31.8.23	S	X	
4	EX1_2.0	31.8.23	S	X	
5	EX2_0.1	31.8.23	S	X	
6	EX2_0.5	31.8.23	S	X	
7	EX2_1.0	31.8.23	S	X	
8	EX2_1.5	31.8.23	S	X	
9	EX2_2.0	31.8.23	S	X	
10	EX2_0.5AG	31.8.23	S	X	
	Total Counts			10	

Method of Shipment: ☑ Courier (#) ☐ Hand Delivered ☐ Postal — Name: ben pieterse — Signature: BP — Date: 04.09.23 — Time:

Laboratory Use Only					
Received By: Braneus	(SYD) | BNE | MEL | PER | ADL | NTL | DRW	Signature: [signature]	Date: 5/9	Time: 10:05	Temperature: 12.8
Received By	SYD | BNE | MEL | PER | ADL | NTL | DRW	Signature	Date	Time	Report №

31 1023238

CHAIN OF CUSTODY RECORD

Eurofins | Environment Testing ABN 50 005 085 521

☑ Sydney Laboratory
179 Magowar Road, Girraween, NSW 2145
+61 2 9900 8400 EnviroSampleNSW@eurofins.com

☐ Brisbane Laboratory
Unit 1/21 Smallwood Place, Murarrie, QLD 4172
+61 7 3902 4600 EnviroSampleQLD@eurofins.com

☐ Perth Laboratory
46-48 Banksia Road, Welshpool, WA 6106
+61 8 6253 4444 EnviroSampleWA@eurofins.com

☐ Melbourne Laboratory
6 Monterey Road Dandenong South VIC 3175
+61 3 8564 5000 EnviroSampleVic@eurofins.com

Company	ENV Solutions	Project №	216010	Project Manager	Ben Pieterse
Address	313 River St Ballina PO Box 248 Ballina NSW 2478	Project Name	Sandhills	EDD Format (Esdat, EQUIS etc)	esdat
Contact Name	Ben Pieterse				
Phone №	0478 170 771				
Special Directions					
Purchase Order					
Quote ID №	220829ESON				

Sampler(s)	
Handed over by	
Email for Invoice	accounts@envsolutions.com.au
Email for Results	ben@envsolutions.com.au cc labresults@envsolutions.c

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

№	Client Sample ID	Sampled Date/Time dd/mm/yy hh:mm	Matrix Solid (S) Water (W)	ASS pH Field Test	Containers (Change container type & size if necessary): 500mL Plastic	250mL Plastic	125mL Plastic	200mL Amber Glass	40mL VOA vial	500mL PFAS Bottle	Jar (Glass or HDPE)	Other (Asbestos AS4964, WA Guidelines)	Sample Comments / Dangerous Goods Hazard Warning
1	EX3_0.1	31.8.23	S	X									
2	EX1_0.5	31.8.23	S	X									
3	EX1_0.8	31.8.23	S	X									
4	EX1_1.0	31.8.23	S	X									
5	EX2_1.3	31.8.23	S	X									
6	EX2_1.5	31.8.23	S	X									
7	EX4_0.1	31.8.23	S	X									
8	EX4_0.5	31.8.23	S	X									
9	EX4_1.0	31.8.23	S	X									
10	EX4_2.0	31.8.23	S	X									
	Total Counts			10									

Required Turnaround Time (TAT) — Default will be 5 days if not known.
♦Surcharge will apply
☐ Overnight (reporting by 9am)♦
☐ Same day♦ ☐ 1 day♦
☐ 2 days♦ ☑ 3 days♦
☐ 5 days (Standard)
☐ Other( )

Method of Shipment											
	☑ Courier (#)	☐ Hand Delivered	☐ Postal	Name	ben pieterse	Signature	BP	Date	04.09.23	Time	

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

1024500

RE: Eurofins Test Results - Report 1023238 : Site SANDHILLS (216010)

Adam Bateup <AdamBateup@eurofins.com>

Fri 08/09/23 4:13 PM

To:#AU03_EnviroSampleBris <EnviroSampleBris@eurofins.com>

INFO: INTERNAL EMAIL - Sent from your own Eurofins email domain.

Slight change – this'll be a 3-day TAT rather than a standard TAT please 😈

Kind Regards,

Adam Bateup
Assistant Analytical Services Manager
My hours are 3 pm - 11 pm

Eurofins Environment Testing Australia Pty Ltd
179 Magowar Road
Girraween, NSW, 2145

Email: adambateup@eurofins.com
Phone: 0413 917 819
Website: www.eurofins.com.au/environmental-testing

From: Adam Bateup
Sent: Friday, 8 September 2023 3:31 PM
To: #AU03_EnviroSampleBris <EnviroSampleBris@eurofins.com>
Subject: FW: Eurofins Test Results - Report 1023238 : Site SANDHILLS (216010)

Good afternoon & happy Friday!

Could I get the below logged as an additional for CRS on a standard TAT please?

Kind Regards,

Adam Bateup
Assistant Analytical Services Manager
My hours are 3 pm - 11 pm

Eurofins Environment Testing Australia Pty Ltd
179 Magowar Road
Girraween, NSW, 2145

Email: adambateup@eurofins.com

Phone: 0413 917 819
Website: www.eurofins.com.au/environmental-testing

From: Ben Pieterse <ben@envsolutions.com.au>
Sent: Friday, 8 September 2023 8:27 AM
To: Adam Bateup <AdamBateup@eurofins.com>
Cc: Lab Results <labresults@envsolutions.com.au>
Subject: RE: Eurofins Test Results - Report 1023238 : Site SANDHILLS (216010)

Hi Adam,

Could you please schedule these ones for Chromium Reducible Sulfur suite

EX1_0.5	S23-Se0008799
EX2_0.5	S23-Se0008803
EX2_2.0	S23-Se0008805
EX2_0.5AG	S23-Se0008806
EX3_0.5	S23-Se0008808
EX3_0.8	S23-Se0008809
EX3_1.3	S23-Se0008811
EX3_1.5	S23-Se0008812
EX4_0.1	S23-Se0008813
EX4_0.5	S23-Se0008814
EX4_1.5	S23-Se0008815

Thanks,

Ben Pieterse
Senior Environmental Scientist | **ENV Solutions**
313 River St Ballina
PO Box 248 Ballina NSW 2478 | M: 0478 170 771
ben@envsolutions.com.au | www.envsolutions.com.au

ENV Solutions
ENVIRONMENTAL | ASBESTOS | REMEDIATION | RESOURCE RECOVERY

LinkedIn | Facebook | Instagram

The Bundjalung are the traditional owners of the land on which I live and work. I respectfully acknowledge their unique cultural and spiritual relationship to the land, waters and seas and their significant contribution to our society.

From: AdamBateup@eurofins.com <AdamBateup@eurofins.com>
Sent: Thursday, September 7, 2023 6:50 PM
To: Ben Pieterse <ben@envsolutions.com.au>
Cc: Lab Results <labresults@envsolutions.com.au>
Subject: Eurofins Test Results - Report 1023238 : Site SANDHILLS (216010)

Please find the attached report

Kind regards,
Adam Bateup
Assistant Analytical Services Manager
My hours are 3 pm - 11 pm

Eurofins Environment Testing Australia Pty Ltd
179 Magowar Road
Girraween, NSW, 2145

Email: AdamBateup@eurofins.com
Website: www.eurofins.com/environmental-testing
View our latest EnviroNotes

Environmental Analysis Laboratory

PO Box 157 (Military Road)
LISMORE NSW 2480
T: 02 6620 3678 E: eal@scu.edu.au W: www.scu.edu.au

Sample Submission Form (SSF) - Chain of Custody (COC)

Submitting Client Details

Quote Id: EALQ5258
Job Ref: 216010
Company: ENV Solutions
Contact: Ben Pieterse
Phone:
Mobile: 0478 170 771
Email: Ben@envsolutions.com.au
Postal address: PO Box 248. Ballina. NSW 247

Billing Client Details

☐ Tick if same as submitting details
ABN:
Company:
Contact:
Phone:
Mobile:
Email:
Postal address:

Payment Method:

☐ Purchase Order
☐ Cheque
☐ Credit/Debit Card (EAL staff will phone for details)
☐ Invoice (prior approval)

Relinquished: 30.6.21 Time/Date: 16:00 30.6.21
Received: Time/Date: 30/6

Preservation: none - freezer bricks - ice - acidified - filtered - other
Condition on receipt: ambient - cool - frozen - other

Please note compositing or mixing of samples MUST be written on the Sample Submission Form. Otherwise, each sample listed will be analysed and charged seperately.

In submitting samples, the Client agrees to the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

Comments:

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	Total number of samples	Sample Analysis Request: Price list code (e.g. SW-PACK-06) SS-PACK-051 ENM Contamination	SS-PACK-023 Rec Agg Exemp RAE	AS-PACK-007 ASS Screening	AS-PACK-008 ASS Full Net Acidity (CRS)	SS-PACK-008 Metals/ Pesticides	SS-PACK-015 Aggressivity
1	BH1_0.1	0.1	29.6.21	bp/tc	bsc		SOIL				X			
2	BH1_0.5	0.5	29.6.21	bp/tc	bsc		SOIL				X			
3	BH1_0.65	0.65	29.6.21	bp/tc	bsc		SOIL				X			
4	BH1_1.0	1	29.6.21	bp/tc	bsc		SOIL				X			
5	BH1_1.5	1.5	29.6.21	bp/tc	bsc		SOIL				X			

Comments:

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request Price List Code (e.g. SW-PACK-06) SS-PACK-051 ENM Contamination	SS-PACK-023 Rec Agg Exemp RAE	AS-PACK-007 ASS Screening	AS-PACK-008 ASS Full Net Acidity (CRS)	SS-PACK-008 Metals/ Pesticides	SS-PACK-015 Aggressivity
6	BH1_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			
7	BH1_2.5	2.5	29.6.21	bp/tc	bsc		SOIL			X			
8	BH1_3.0	3	29.6.21	bp/tc	bsc		SOIL			X			
9	BH1_3.5	3.5	29.6.21	bp/tc	bsc		SOIL			X			
10	BH1_4.0	4	29.6.21	bp/tc	bsc		SOIL			X			
11	BH1_4.5	4.5	29.6.21	bp/tc	bsc		SOIL			X			
12	BH1_5.0	5	29.6.21	bp/tc	bsc		SOIL			X			
13	BH2_0.1	0.1	29.6.21	bp/tc	bsc		SOIL			X			
14	BH2_0.5	0.5	29.6.21	bp/tc	bsc		SOIL			X			
15	BH2_1.0	1	29.6.21	bp/tc	bsc		SOIL			X			
16	BH2_1.5	1.5	29.6.21	bp/tc	bsc		SOIL			X			
17	BH2_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			
18	BH2_2.5	2.5	29.6.21	bp/tc	bsc		SOIL			X			
19	BH2_3.0	3	29.6.21	bp/tc	bsc		SOIL			X			
20	BH2_3.5	3.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH2_4.0	4	29.6.21	bp/tc	bsc		SOIL			X			
20	BH2_4.5	4.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH2_5.0	5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_0.0	0	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_0.5	0.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_1.0	1	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_1.5	1.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			
20	BH3_2.5	2.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH4_0.0	0	29.6.21	bp/tc	bsc		SOIL			X			
20	BH4_0.5	0.5	29.6.21	bp/tc	bsc		SOIL			X			

Comments:

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	Sample Analysis Request Price List Code (e.g. SW-PACK-06) SS-PACK-051 ENM Contamination	SS-PACK-023 Rec Agg Exemp RAE	AS-PACK-007 ASS Screening	AS-PACK-008 ASS Full Net Acidity (CRS)	SS-PACK-008 Metals/ Pesticides	SS-PACK-015 Aggressivity
20	BH4_1.0	1	29.6.21	bp/tc	bsc		SOIL			X			
20	BH4_1.5	1.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH4_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_0.0	0	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_0.5	0.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_1.0	1	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_1.5	1.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			
20	BH5_2.5	2.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH6_0.0	0	29.6.21	bp/tc	bsc		SOIL			X			
20	BH6_0.5	0.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH6_1.0	1	29.6.21	bp/tc	bsc		SOIL			X			
20	BH6_1.5	1.5	29.6.21	bp/tc	bsc		SOIL			X			
20	BH6_2.0	2	29.6.21	bp/tc	bsc		SOIL			X			

EAL Environmental Analysis Laboratory

PO Box 157 (Military Road)
LISMORE NSW 2480
T: 02 6620 3678 E: eal@scu.edu.au W: www.scu.edu.au

Sample Submission Form (SSF) - Chain of Custody (COC)

Submitting Client Details

Quote Id: EALQ5258
Job Ref: 216010
Company: ENV Solutions
Contact: Ben Pieterse
Phone:
Mobile: 0478 170 771
Email: Ben@envsolutions.com.au
Postal address: PO Box 248. Ballina. NSW 247

Billing Client Details

□ Tick if same as submitting details
ABN:
Company:
Contact:
Phone:
Mobile:
Email:
Postal address:

Payment Method:

□ Purchase Order
□ Cheque
□ Credit/Debit Card (EAL staff will phone for details)
□ Invoice (prior approval)

Relinquished: 29/11/2021 BP Time/Date:
Received: P.M Time/Date: 30/11

Preservation: none - freezer bricks - ice - acidified - filtered - other
Condition on receipt: ambient - cool - frozen - other

Please note compositing or mixing of samples MUST be written on the Sample Submission Form. Otherwise, each sample listed will be analysed and charged seperately.

In submitting samples, the Client agrees to the EAL Laboratory Services Terms and Conditions. These Terms and Conditions are available on the EAL website: scu.edu.au/eal, or on request.

Comments:

PRIORITY Due 2/12

Likelihood and nature of Hazardous material:

Lab ID	Sample ID	Sample Depth	Sampling Date	Sampler	Your Client	Crop ID	Sample Type (e.g. water, leaf, soil)	Total number of samples: 5 — Sample Analysis Request — Price list code (e.g. SW-PACK-06): ASS-007					
1	EA-1_0.1		25.11.21	BP	BSC		soil	x					
2	EA-1_0.5		25.11.21	BP	BSC		soil	x					
3	EA-1_1.0		25.11.21	BP	BSC		soil	x					
4	EA-1_1.5		25.11.21	BP	BSC		soil	x					
4	EA-1_2.0		25.11.21	BP	BSC		soil	x					

Appendix F

Sampling Points GPS Coordinates

Coordinates	Easting	Northing
BH-1	560531.00 m E	6831175.00 m S
BH-2	560740.00 m E	6831303.00 m S
BH-3	560732.00 m E	6831235.00 m S
BH-4	560698.00 m E	6831192.00 m S
BH-5	560709.00 m E	6831143.00 m S
BH-6	560637.00 m E	6831128.00 m S
EA-1	560724.00 m E	6831280.00 m S
EX1	560595.00 m E	6831151.00 m S
EX2	560634.00 m E	6831160.00 m S
EX3	560681.00 m E	6831255.00 m S
EX4	560709.00 m E	6831171.00 m S

Coordinate Reference System: WGS84