ENVIRONMENTAL CONSULTING Pty Ltd

PRELIMINARY ACID SULFATE SOIL INVESTIGATION

PROPOSED SHOP-TOP DEVELOPMENT

November 2023

Prepared For: 17 The Evans Trust

Lot 7 DP 14089
17 McDonald Place
Evans Head NSW

HMC2023.531.01

RE: Lot 7 DP 14089, 17 McDonald Place, Evans Head NSW.

HMC Environmental Consulting Pty Ltd is pleased to present our report for a Preliminary Acid Sulfate Soil Investigation for the abovementioned site.

We trust this report meets with your requirements. If you require further information, please contact HMC Environmental Consulting directly on the numbers provided.

HMC Environmental Consulting		PH:	0755368863
Suite 29, Level 2, 75-77 Wharf Street		Email:	admin@hmcenvironment.com.au
PO Box 311		Web:	www.hmcenvironment.com.au
Tweed Heads NSW 2485		ABN:	60 108 085 614
Title:	Preliminary Acid Sulfate Soil Investigation		
Job No:	2023.531.01		
Client:	17 The Evans Trust		

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L. Barakat, NDC	3.10.2023	Draft Issue A	For review
L. Barakat, NDC	3.11.2023	Final Issue A	Final

This report should be cited as '*HMC Environmental Consulting (2023). Preliminary Acid Sulfate Soil Investigation, Proposed Shop-Top Development - Lot 7 DP 14089, 17 McDonald Place, Evans Head NSW. Report No. HMC2023.531.01."*

EXECUTIVE SUMMARY

A proposed shop-top development to be located at 17 McDonald Place, Evans Head NSW would require excavation for the lift well, footings and services. The site is mapped as Class 3 acid sulfate soil (ASS), and any soil disturbance below 1m depth within the Class 3 area requires a preliminary ASS investigation.

The site is generally level and the elevation ranges from approximately RL 4.75m AHD (north) to RL 5.36m AHD (south). Excavation is proposed for the lift well along with footings and services. To ensure the potential excavation zone has been assessed, a general excavation depth of 1m BGL has been assumed. There will be minor excavations extending beyond this for the construction of the lift well (1.5m BGL).

This ASS investigation, and the previous ASS investigation in June 2023 by ASCT, did not record ASS exceeding action criteria within the excavation zone.

The four selected samples subjected to the qualitative chromium reducible sulfur (%S_{CR})/titratable actual acidity (TAA) analyses recorded results generally below the action criteria for sandy soil. A single result at 2m depth BGL recorded a TAA of 211 mol (H+/t) which was above the action criteria of 18 mol (H+/t) in sandy soils. However, this sample was recorded in indurated sand below the maximum depth of excavation and the elevated TAA was not associated with a field pH indicative of ASS. In fact, the field pH was close to neutral. It appears that as there was no reduced inorganic sulfur (RIS) recorded in this sample, or other selected samples in the soil profile, the acidity may have been due to non-ASS sources, including organic acids associated with indurated sand.

The results would appear to reflect the site conditions including the topography with the site elevation ranging from approximately RL 4.75 – 5.36m AHD. The base of the proposed excavation would not be expected to generally extend below RL 3.25m AHD, above the expected upper elevation of ASS (mean high tide sea level or ~RL 1.0m AHD) on the south-eastern coast of Australia.

Acid sulfate soils have not been identified as being a constraint to proposed earthworks associated with the proposed shop-top development to be located Lot 7 DP 14089, 17 McDonald Place, Evans Head NSW. No further investigation or ASS management is required.

TABLE OF CONTENTS

1 INTRODUCTION

A proposed shop-top development to be located at 17 McDonald Place, Evans Head NSW would require excavation for the lift well, footings and services. The site is mapped as Class 3 acid sulfate soil (ASS), and any soil disturbance below 1m depth within the Class 3 area requires a preliminary ASS investigation.

An *Acid Sulfate Soil Investigation for Multi Use Development 17 McDonald Place, Evans Head*. was previously undertaken by Australian Soil & Concrete Testing Pty Ltd in June 2023 (H23-3755), at a single location on the southern part of the site, to 3m depth below the ground surface (BGL). Assuming a maximum general excavation depth of 1.5m BGL, to provide further information, an additional borehole was drilled on 31 August 2023 to a maximum 2.5m BGL on the eastern, central part of the site. Samples were collected at 0.25m intervals to match the previous investigation. The collected samples were subjected to qualitative laboratory testing, with selected samples subjected to quantitative laboratory testing to assess potential and actual acidity.

This report addresses an investigation to determine the presence of, and any measures to be implemented to ameliorate any existing acidity or acid generation due to the possible disturbance of acid sulfate soils during the proposed development.

2 SITE INFORMATION

Table 1 – Project Summary

Site Address	17 McDonald Place, Evans Head
Property description	Lot 7 DP 14089
Report commissioned by	17 The Evans Trust
Proposed development	Three-storey shop-top development including a ground floor café and two levels or residential units.
Estimated maximum depth of excavation	Excavation depth generally <1m BGL. Minor excavation for lift well extending to 1.5m BGL.
ASS interception depth	Nil
Investigator	Mark Tunks
Local Government Authority	Richmond Valley Council
Investigation date	31 August 2023

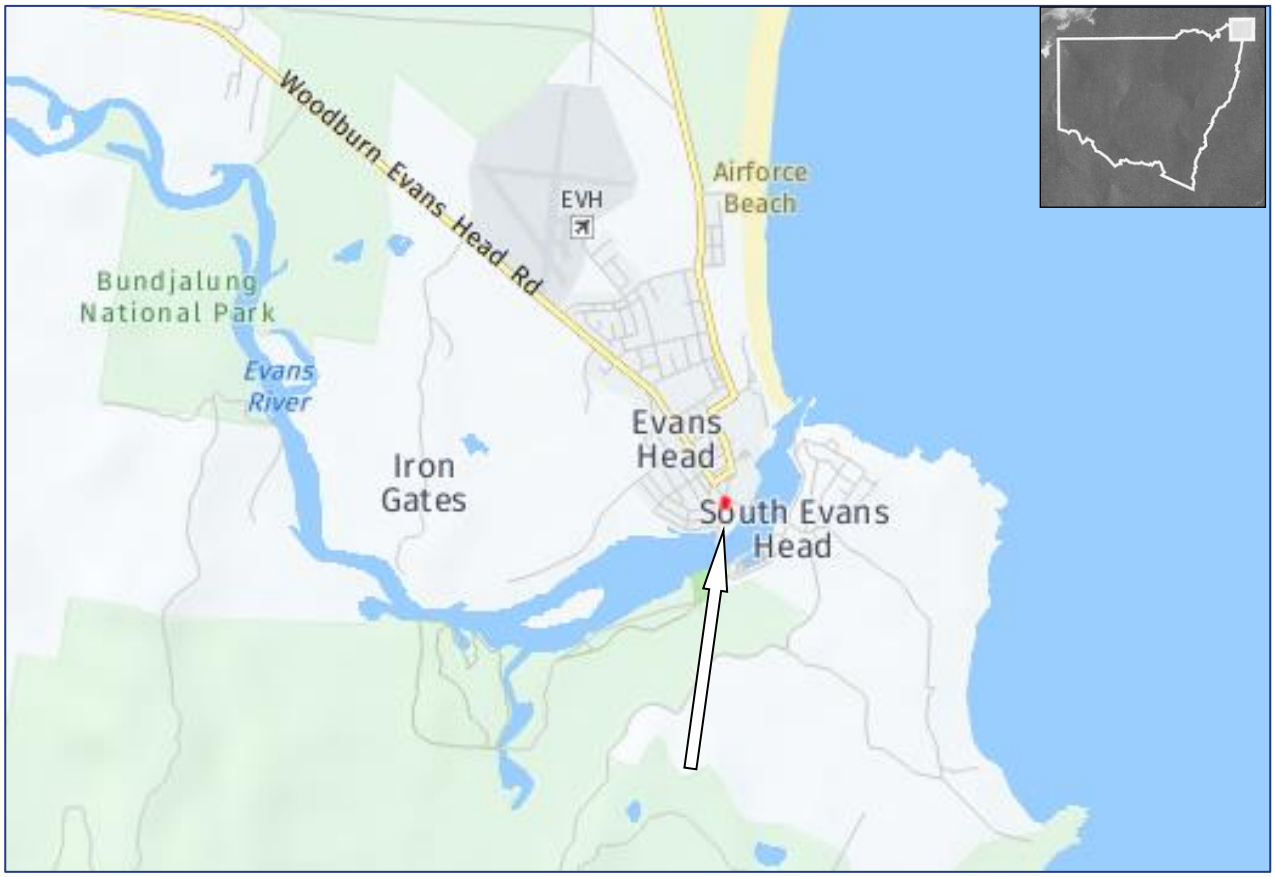


Figure 1 - Locality Map

3 PROJECT DESCRIPTION

A shop-top development is proposed for the site located on the corner of McDonald Place and Elm Street, Evans Head NSW.

The project would extend across the entire site and include the following features:

- Demolition of existing single storey timber-framed general store
- Construction of a three-storey mixed development comprising:
  - Ground Floor – commercial tenancy (café or similar)
  - Carparking
  - Amenities
  - Storage
- Level 1 – five residential units
- Level 2 – five residential units

4 PROPOSED EARTHWORKS

The site is generally level and the elevation ranges from approximately RL 4.75m AHD (north) to RL 5.36m AHD (south). Excavation is proposed for the lift well along with footings and services. To ensure the potential excavation zone has been assessed, a general excavation depth of 1m BGL has been assumed. There will be minor excavations extending beyond this for the construction of the lift well (1.5m BGL).

5 RICHMOND VALLEY ENVIRONMENT PLAN 2012

The NSW Legislation 1:25 000 Acid Sulfate Soil Planning Maps – *ASS_001* indicates the site is located within a Class 3 area. Table 2.1 in the Assessment Guidelines of the Acid Sulfate Soil Manual (ASSMAC, 1998) and Clause 6.1 of Richmond Valley Environment Plan 2012 (RVLEP 2012) indicate for each class of land the types of works likely to present an environmental risk if undertaken in the particular class of land. The maps do not describe the actual severity of ASS in a particular area but provide a first indication that ASS **may** be present.

Figure 2 – Class 2 & Class 5 ASS (TSC LEP 2014)

Clause 6.1 of the RVLEP 2012 requires that works more than 1 metre below the ground surface proposed in Class 3 areas, require a preliminary acid sulfate soil assessment prior to consent. A management plan is required should it be confirmed that acid sulfate soil is present above action criteria and likely to be disturbed. If a management plan is required, it must be prepared in accordance with the Acid Sulfate Soil Manual produced by the Acid Sulfate Soil Management Advisory Committee (ASSMAC).

6 GEOLOGY & SOIL LANDSCAPE

According to the NSW Department of Land & Water Conservation *Soil Landscapes of the Murwillumbah-Tweed Heads* 1:100 000 Sheet (Morand, 1996), the site is generally located within a Disturbed Terrain variant a (xxa) soil landscape characterised by old sand mining areas and other areas of disturbed sand by which the terrain has been disturbed by human activity to a depth of at least 100cm. The soils are expected to be deep (>200 cm) Spolic Anthroposols (very disturbed Humus Podzols).

The *Surface Quaternary Geology Map* (Geoscience Australia, 2016) shows the site is within a Quarternary Coastal Dune Deposits geology unit characterised by sand dune systems in which sand is deposited by both wind (aeolian) and ocean currents. Older (Pleistocene) dunes are vegetated and stable.

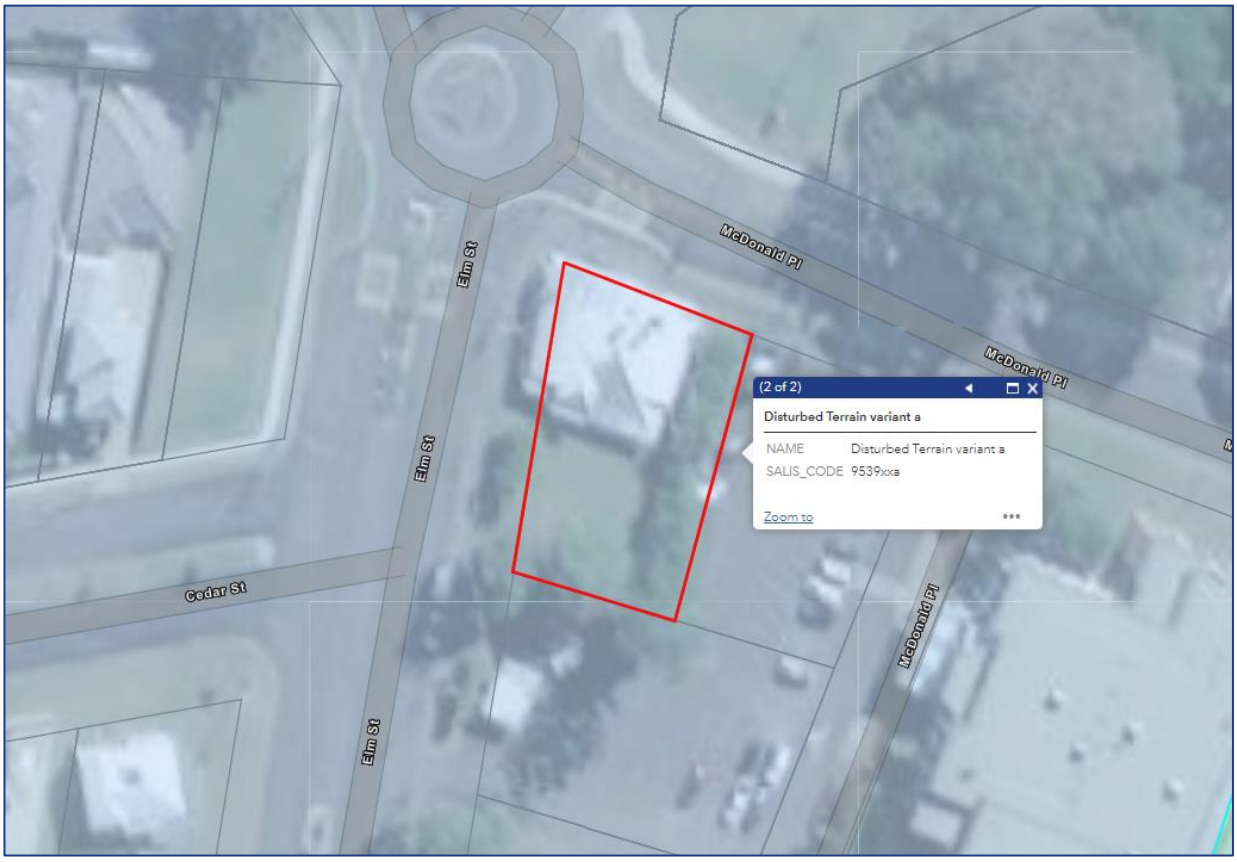


Figure 3 - Soil landscape map (eSPADE NSW)

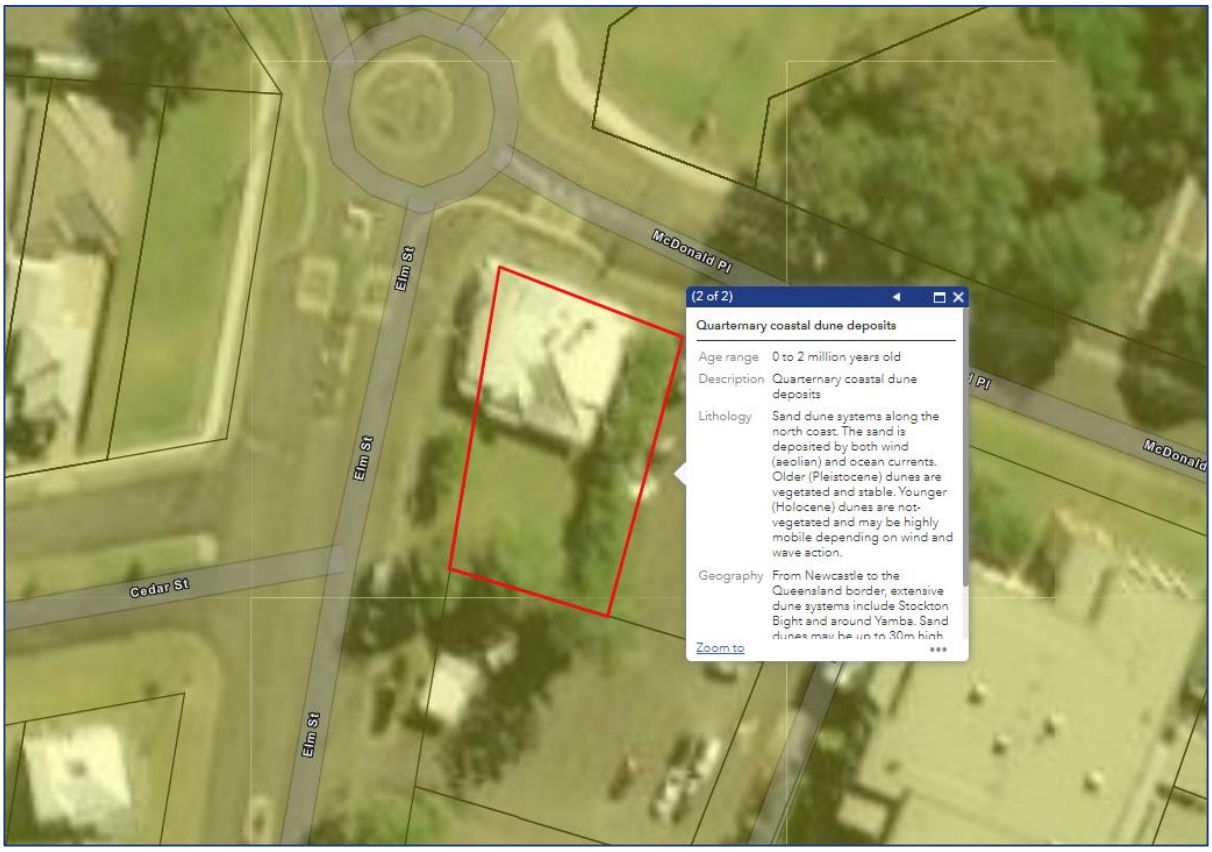


Figure 4 - Geology map (Geoscience Australia)

7 ASS ELEVATION

White et al (1997) note that "*the top of the sulfidic horizon should be close to where it was last formed, at about mean high tide sea level (about **1m AHD** in eastern Australia).* Naylor et al (1998) also conclude following the extensive ASS mapping project across NSW that an "*analysis of the relationships between elevation levels (AHD) and soil data established the critical level at which the upper limit of ASS occurs. This is at or less than about **1m AHD***". The 1m AHD benchmark can also be confirmed via the wording of provisions relating to class 5 land and water table elevation.

Wilson (2005) also reports a maximum elevation of ASS of 1m AHD after reviewing soil investigation results for the NSW ASS mapping program (see appendix 3).

The base of the site excavation would appear to be generally above RL 3.25m AHD assuming liftwell depth of 1.5m.

8 PREVIOUS INVESTIGATION

Australia Soil & Concrete Testing Pty Ltd previously conducted an Acid Sulfate Soil Investigation for the proposed development in June 2023 (H23-3755). One borehole was drilled in the proposed building location to a depth of 3m. Soil Samples were collected within vertical intervals of 0.25m with all samples field tested for pH_F and pH_{FOX} and one sample submitted for laboratory analysis. No samples triggered the action criteria and were therefore determined to be Non-ASS. The report concluded that "*These soils materials do not pose an environmental hazard*".

9 SOIL INVESTIGATION

To assess ASS within the local soil profile, Mazlab completed drilling on 31 August September 2023, with samples collected by M. Tunks of HMC. One borehole was drilled to a maximum 2.5m depth, with samples generally collected at 0.25m intervals through the soil profile to 2.5m. Locations are shown in Appendix 4.

The soil profile was recorded as surface silty sand to 0.75m depth, overlaying whiteish pale grey sand from 0.75 – 1.85m depth. Dark grey brown indurated sand was encountered from 1.85m to the termination depth.

All samples (10) were subjected to preliminary qualitative screening using the field pH (pH_F), oxidised field pH (pH_{FOX}), and reaction to both acid and hydrogen peroxide tests.

Appendix 1 of the ASSMAC (1998) Assessment Guidelines states that pH_F readings of pH≤4 indicate that actual acid sulfate soil (AASS) may be present. pH_{FOX} readings of pH<3, with a level at least one unit below pH_F, and a strong reaction to the hydrogen peroxide indicate a high level of certainty of a potential acid sulfate soil (PASS). The greater the drop in pH_{FOX} below 3, the more positive the presence of oxidisable sulfur [reduced inorganic sulfur (RIS)].

Four (4) soil samples were also subjected to Chromium Reducible Sulfur (S_{CR}) and Titratable Actual Acidity (TAA) tests to for quantitative results and to confirm initial screening.

The S_{CR} test measures the oxidisable sulfur (reduced inorganic sulfur – RIS) in the soil and is particularly suited to coarse sediments (sand) with low levels of oxidisable sulfur. The TAA test measures the existing actual acidity in the soil. It is noted that sources other than the oxidation of sulfidic sediments e.g., organic acids and metal oxyhydroxides may account for elevated TAA levels.

Action criteria thresholds are shown in Table 2.

Table 2 - Texture based ASS action criteria (Table 4 ASSMAC, 1998)

Type of Material		Action Criteria 1-1000 tonnes disturbed. Existing + Potential Acidity		Action Criteria if more than 1000 tonnes disturbed. Existing + Potential Acidity	
Texture Range	Approx. clay Content (%<0.002 mm)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven dry basis)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent acidity (mol H^+/tonne) (oven dry basis)
Coarse Texture Sands to loamy sands	≤0.5	0.03	18	0.03	18
Medium Texture Sandy loams to light clays	5 – 40	0.06	36	0.03	18
Fine Texture Medium to heavy clays and silty clays	≥ 40	0.1	62	0.03	18

10 RESULTS

The results of the preliminary screening tests are summarised in Tables 2 and 3. pH_F results ranged from 5.1 – 6.8, which does not indicate the presence of actual ASS. The pH_{FOX} results ranged from 3.8 – 5.9, with all results above action criteria and therefore not indicative of ASS.

There was no reaction to hydrogen peroxide. Reaction to hydrochloric acid was nil to slight, indicating buffering capacity was not present.

To confirm the screening results, 4 samples were subjected to the Chromium Reducible Sulfur (S_{CR}) and Titratable Actual Acidity (TAA) tests to assess RIS and actual acidity levels.

The S_{CR} results for the selected samples were all below the action criteria with all $\%S_{CR}$ results <0.01. TAA (211 mol H+/T) exceeding the action criteria (18 mol H+/T) was recorded in a single sample collected from 2.0m depth BGL in the dark brown indurated sand. The result from the overlying pale grey sand at 1.75m depth BGL was 0 mol H+/T. The excavation would not extend to this depth.

In indurated sands, if there is an absence of sulfide minerals and the organic matter content is high, organic acids produced by the decomposition of organic matter can contribute to the acidity of the soil. However, it's important to note that the acidity resulting from organic acids is usually mild in comparison to the extreme acidity produced by sulfuric acid in acid sulfate soils. As no oxidisable sulfur was recorded and the field pH was 6.7, it appears the acidity in this sample is probably not related to ASS.

Table 3 – Soil Analysis Summary

Test	Range	Action Criteria
pH_F	5.1 – 6.8	<4.0
pH_{FOX}	3.0 – 5.1	<3.0 & min 1 unit < pH_F
Reaction to HCl	Nil	Indicative of shell, carbonate
Reaction to H_2O_2	Nil – Slight	Vigorous
%SCR	<0.01	>0.03 (coarse texture)
TAA mol H^+/t	Nil – **211**	>18 (coarse texture)
ANC mol H^+/t	Nil	Indicative of shell, carbonate

Table 4 - Soil Laboratory Analysis Results

Depth (m)	Borehole ID (BH1)			
	pH_F	pH_{FOX}	$\%S_{CR}$	TAA (mol H^+/T)
0.25	6.2	5.1		
0.50	6.4	4.8	<0.01	-
0.75	6.4	5.2	<.01	-
1.00	6.6	5.6		
1.25	6.7	5.9		
1.50	6.8	5.8		
1.75	6.7	5.3	<0.01	-
2.00	6.7	4.0	<0.01	**211**
2.25	5.3	3.8		
2.50	5.1	3.8		

Bold = Indicative of ASS or exceeds action criteria

11 DISCUSSION

This ASS investigation, and the previous ASS investigation in June 2023 by ASCT, did not record ASS exceeding action criteria within the excavation zone.

The four selected samples subjected to the qualitative S_{CR}/TAA analysis recorded generally all results below the action criteria for the sandy soil. A single result at 2m depth BGL recorded a TAA of 211 mol (H+/t) which was above the action criteria of 18 mol (H+/t) in sandy soils. However, this sample was recorded in indurated sand below the maximum depth of excavation and the elevated TAA was not associated with a field pH indicative of ASS. In fact, the field pH was close to neutral. It appears that as there was no reduced inorganic sulfur recorded in this sample, or other selected samples in the soil profile, the acidity may have been due to non-ASS sources, including organic acids associated with indurated sand.

The results would appear to reflect the site conditions including the topography with the site elevation ranging from approximately RL 4.75 – 5.36m AHD. The base of the proposed excavation would not be expected to generally extend below RL 3.25m AHD, above the expected upper elevation of ASS (mean high tide sea level or ~RL 1.0m AHD) on the south-eastern coast of Australia.

12 ASS CONCLUSION

Acid sulfate soils have not been identified as being a constraint to proposed earthworks associated with the proposed shop-top development to be located Lot 7 DP 14089, 17 McDonald Place, Evans Head NSW. No further investigation or ASS management is required.

13 SIGNATURE

This report has been prepared by Mark Tunks of HMC Environmental Consulting, a suitably qualified environmental consultant, in accordance with the *Protection of the Environment and Operations Act 1997, NSW Acid Sulfate Soil Manual 1998* and other relevant statutes, policy and guidelines.

…

03 November 2023
Completion Date

Mark Tunks
Principal

14 LIMITATIONS

Any conclusions presented in this report are relevant to the site condition at the time of inspection and legislation enacted as at date of this report. Actions or changes to the site after time of inspection or in the future will void this report as will changes in relevant legislation.

The findings of this report are based on the objectives and scope of work outlined in Section 1. HMC Environmental has performed the services in a manner consistent with the normal level of care and expertise exercised by members of the environmental assessment profession. No warranties or guarantees expressed or implied, are given. This report does not comment on any regulatory issues arising from the findings, for which a legal opinion should be sought. This report relates only to the objectives and scope of work stated and does not relate to any other works undertaken for the client. The report and conclusions are based on the information obtained at the time of the assessment.

The results of this assessment are based upon site inspections and fieldwork conducted by HMC Environmental personnel and information provided by the client. All conclusions regarding the property area are the professional opinions of the HMC Environmental personnel involved with the project, subject to the qualifications made above. HMC Environmental assume no responsibility or liability for errors in any data obtained from regulatory agencies, information from sources outside of HMC Environmental, or developments resulting from situations outside the scope of this project.

15 REFERENCES

- Acid Sulfate Soil Management Advisory Committee, "Acid Sulfate Soil Manual", Wollongbar, 1998.
- Ahern CR, McElnea A E, Sullivan L A,. (2004). *Acid Sulfate Soils Laboratory Methods Guidelines. In Queensland Acid Sulfate Soils Manual 2004*. Department of Natural Resources, Mines and Energy. Indoorapilly, Queensland, Australia
- Armstrong T. J. Determination of Aquifer properties and Heterogeneity in a Large Coastal Sand Mass: Bribie Island, Southeast Queensland, 2006. A thesis submitted in partial fulfilment of the requirements for the Degree of Master of Applied Science. School of Natural Resource Sciences, QUT.
- Hashimoto T.R & Troedson A.I. 2008 *Tweed Heads 1:100 000 and 1:25 000, Coastal Quaternary Geology Map Series*. Geological Survey of New South Wales, Maitland
- Morand, D.T., Soil Landscapes of the Tweed Heads - Murwillumbah 1:100 000 Sheet", 1996.
- Naylor,S.D., Chapman,G.A., Atkinson,G., Murphy,C.I., Tulau,M.J., Flewin,T.C., Milford,H.B., Morand,D.T.1998 *Guidelines for the Use of Acid Sulfate Soil Risk Maps*. 2nd ed. Department of Natural

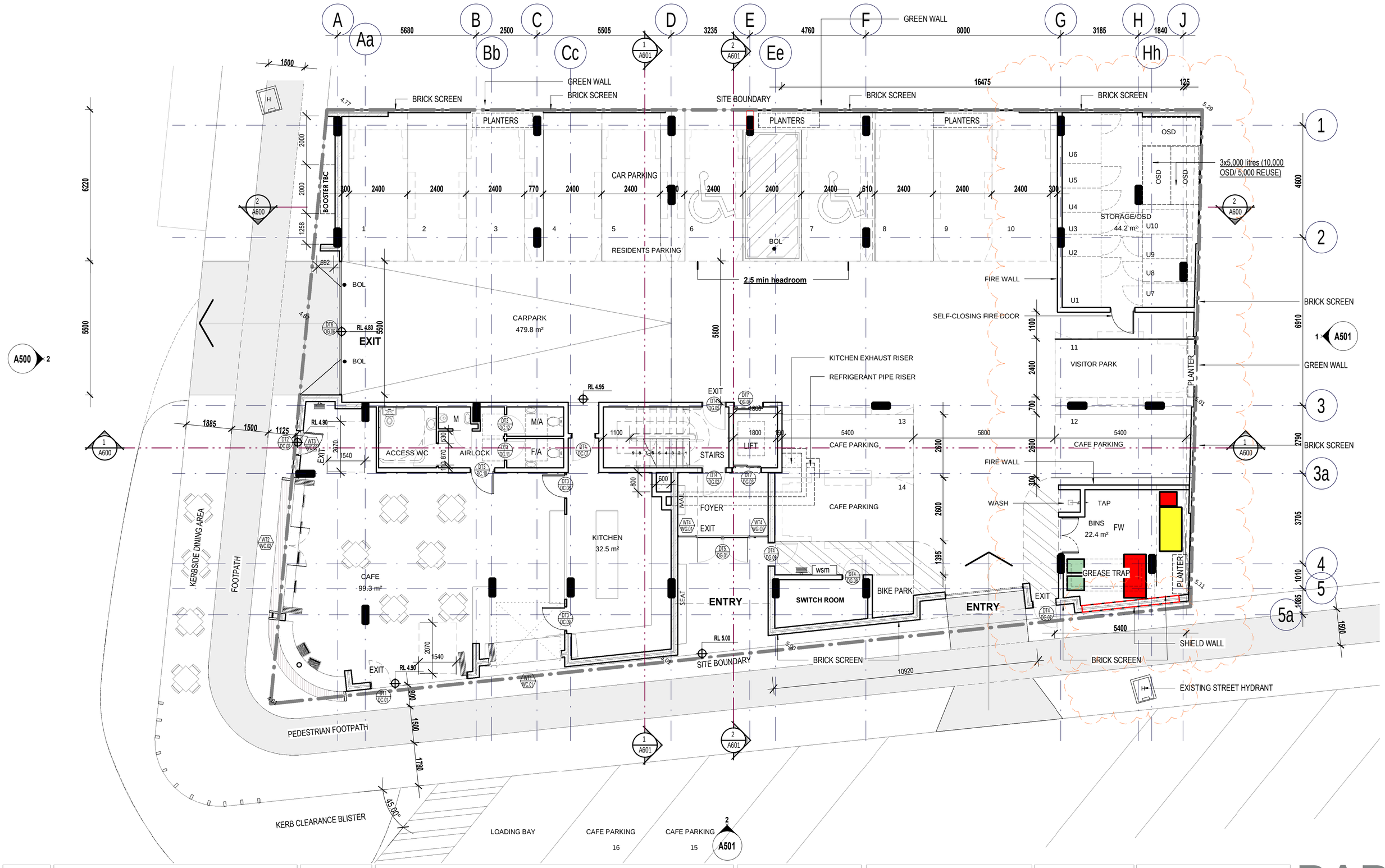
  Sullivan. L. et al, 2018. *National Acid Sulfate Soils guidance: National acid sulfate soils sampling and identification methods manual*
- White, I. et al, "Fixing Problems Caused by Acid Sulphate Estuarine Soils," *In* C. Copeland, C. (Ed.) Ecosystem Management: the Legacy of Science, Halstead Press, Sydney 1995.
- White, I., Melville, M.D., Wilson, B.P., and Sammut, J. 1997 *Reducing Acidic Discharges from Coastal Wetlands in Eastern Australia.* Wetlands Ecology and Management 5 : 55-72
- Wilson, B. (2005). *Elevations of sulfurous layers in acid sulfate soils: What do they indicate about sea levels during the Holocene in eastern Australia?* Catena 45-56

APPENDIX 1 - LOCATION MAPS

Figure 5 - Surrounding Area (Source: Nearmap 2023)

Figure 6 – Subject Site (Source: Nearmap 2023)

APPENDIX 2 - SITE PLAN PROPOSED DEVELOPMENT



No.	DESCRIPTION	DATE
I	RLs	13.09.23
J	Update	22.09.23
K	Update	5.10.23
L	Update	16.10.23

NOTES

GROUND FLOOR

2205 Multi Use Development

17 McDonald Place Evans Head

sheet no.	A200
scale @A2:	1 : 100
date:	
drawn:	HS
revision	L

Barker Architects
02 6682 602
contact@barkerarchitects.com.au
www.barkerarchitects.com.au

BARKER ARCHITECTS

APPENDIX 3 - ELEVATION OF ASS IN NSW (WILSON ET AL FIG. 2)

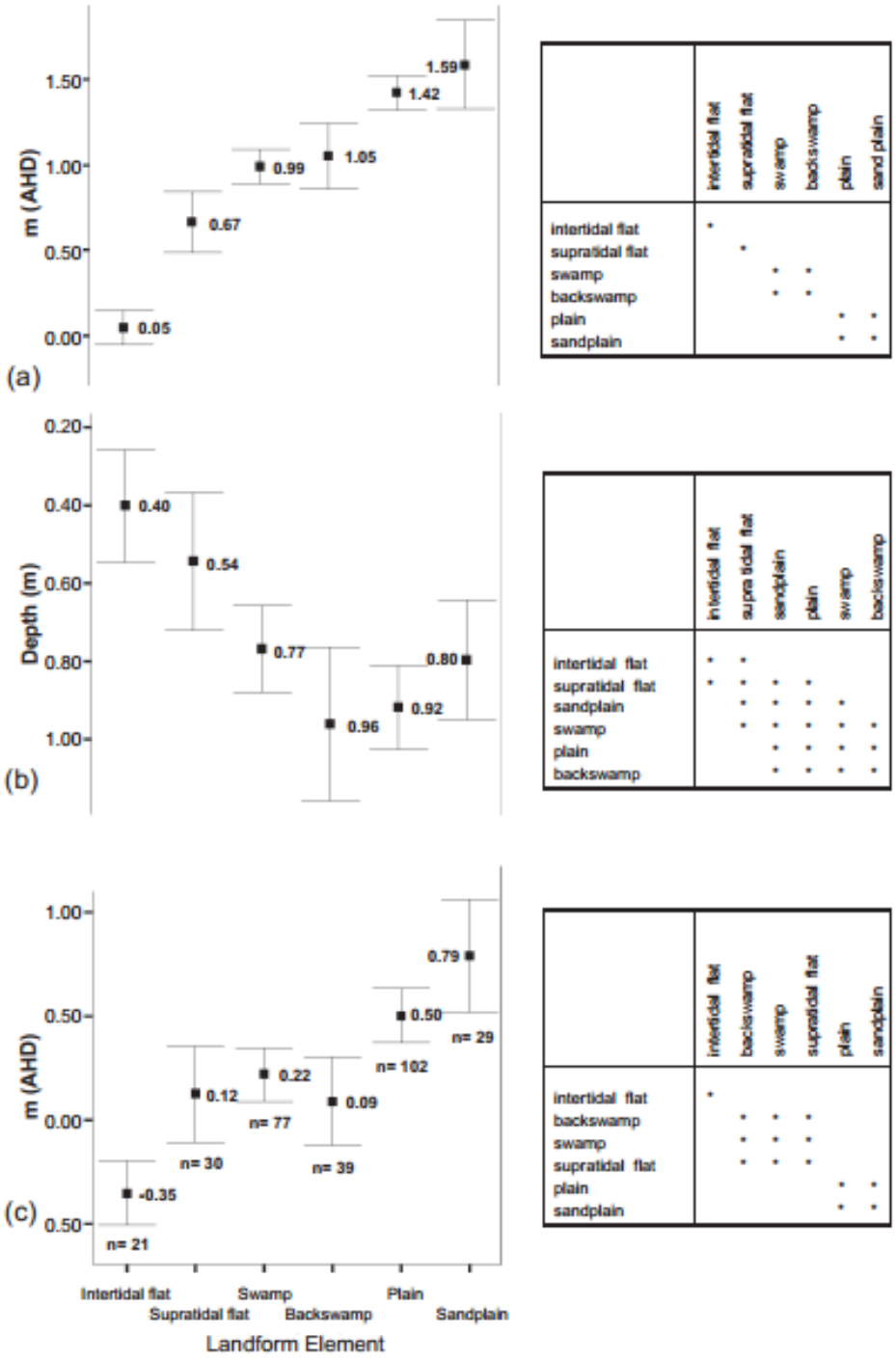


Fig. 2. Stratigraphic characteristics of all ASS profiles. Surface elevation (a), depth to sulfurous materials (b), and elevation of sulfurous materials (c). Error bars are 95% confidence interval of the mean. An asterisk (*) in similarity matrices indicates that mean difference between landforms is not significant (P<0.05).

APPENDIX 4 - INVESTIGATION AREA - ASS BOREHOLE LOCATIONS

ACID SULFATE SOIL INVESTIGATION

SAMPLING LOCATIONS

HMC Sampling Location
23.08.2023

Previous Australian Soil & Concrete Testing Pty Ltd (ASCT) Borehole Location - June 2023

Lot 7 DP 14089
17 McDonald Place
Evans Head NSW

HMC2023.531.01
Date: October 2023
VERSION: 03/10/2023
DRAWN: MF
BASE: Nearmap 2023

ENVIRONMENTAL CONSULTING Pty Ltd
HMC Environmental Consulting Pty Ltd
Tweed Heads NSW
0755368863
www.hmcenvironment.com.au
admin@hmcenvironment.com.au

APPENDIX 5 - PHOTOGRAPHIC LOG

Photo No. 1	Date 31.08.2023
Description: Existing structure on subject site	

Photo No. 2	Date 31.08.2023
Description: Drilling rig onsite	

Photo No. 3	Date 31.08.2023
Description: Drilling rig onsite	

APPENDIX 6 - BORELOGS

MAZLAB Pty Ltd
Environmental Testing, Sampling and Drilling (Vibracore)

33B Machinery Dve, Tweed Heads South NSW 2486
PO Box 6879, Tweed Heads South NSW 2486
Phone: 07 5523 9922
Mobile: 0481 724 501
Email: mazlab@bigpond.com.

ABN 58 706 135 201 ACN 654 173 529

CLIENT: HMC Environmental	**DATE:** 23/08/23	**BH#:** 1
MAZLAB JOB NO: HMC 3272	**PROJECT:** 17 McDonald St, Evans Head	

DEPTH	DESCRIPTION	TEST	DEPTH / RESULT
	Borehole 1		
0.00	Silty SAND(SM); grey / grey-brown; fine to medium grained; just moist		
0.30	As above only pale grey / grey		
0.55	As above only pale grey		
0.75	SAND(SP); whitish pale grey; fine to medium grain; just moist		
1.50	As above only very moist becoming wet		
1.85	Indurated SAND(SP); dark brown; fine grained; some cemented nodules; wet		
2.00	As above only medium dense		
2.50	As above only dense		
	Hole terminated. Water / hole collapsed at 1.55m.		

JACMAZ 500 (105mm SOLID FLIGHT AUGER) **DRILLED BY: Matt Mialkovsky**

APPENDIX 7 - LABORATORY CERTIFICATES

MAZLAB Pty Ltd
Environmental Testing, Sampling and Drilling (Vibracore)
ABN 58 706 135 201 ACN 654 173 529

U1/ 33 MACHINERY DR., TWEED HEADS SOUTH, 2486
PO BOX 6879 TWEED HEADS SOUTH, 2486
PHONE: 0481 724 501
EMAIL: mazlab@bigpond.com

Client: HMC Environmental **Project:** 17 McDonald St, Evans Head

Mazlab Job No: HMC3272 **Date:** 29/08/23

LABORATORY TEST RESULTS
Certificate of Test Results – ASS Screening

Sample No.	Client I.D	Soil Description (truncated)	Reaction to H_2O_2	Reaction to HCL	pHf	pH fox
48697	BH1-0.25	Silty SAND(SM); grey / grey-brown	1	Nil	6.2	5.1
48698	BH1-0.50	Silty SAND(SM); pale grey / grey	Nil	Nil	6.4	4.8
48699	BH1-0.75	SAND(SP); whitish pale grey	Nil	Nil	6.4	5.2
48700	BH1-1.00	SAND(SP); whitish pale grey	Nil	Nil	6.6	5.6
48701	BH1-1.25	SAND(SP); whitish pale grey	Nil	Nil	6.7	5.9
48702	BH1-1.50	SAND(SP); whitish pale grey	Nil	Nil	6.8	5.8
48703	BH1-1.75	SAND(SP); whitish pale grey	Nil	Nil	6.7	5.3
48704	BH1-2.00	Indurated SAND(SP); dark grey brown	Nil	Nil	6.7	4.0
48705	BH1-2.25	Indurated SAND(SP); dark grey brown	Nil	Nil	5.3	3.8
48706	BH1-2.50	Indurated SAND(SP); dark grey brown	Nil	Nil	5.1	3.8

Reactivity Codes

1. None to slight
2. Moderate
3. Vigorous
4. Very Vigorous (gas & heat generated)

Laboratory Test Methods follow procedures described in: QASSTM–Acid Sulphate Soils Technical Manual -Version 4.0

MAZLAB Pty Ltd
Environmental Testing, Sampling and Drilling (Vibracore)
ABN 58 706 135 201 ACN 151 684 436

U1/ 33 MACHINERY DR., TWEED HEADS SOUTH, 2486
PO BOX 6879 TWEED HEADS SOUTH MC., 2486
PHONE: 0481724501
EMAIL: mazlab@bigpond.com

Client: HMC Environmental **Project:** 17 McDonald St, Evans Head

Mazlab Job No: HMC3272 **Date:** 05/09/2023

LABORATORY TEST RESULTS
Certificate of Test Results – Chromium Reducible Sulphur

Sample No.	Client I.D	Soil Description (truncated)	pH KCL	SCr mol (H+/t) %S	TAA mol (H+/t)	SNAS %S mol (H+/t)	ANC mol (H+/t) NA= Scr< action limit	Net Acidity mol (H+/t)	Liming Rate (Kg/ dry/ t)
48698	BH1-0.50	Silty SAND(SM); pale grey / grey	6.5	<2 <0.01%	-	-	-	<2	Nil
48699	BH1-0.75	SAND(SP); whitish pale grey	6.7	<2 <0.01%	-	-	-	<2	Nil
48703	BH1-1.75	SAND(SP); whitish pale grey	6.5	<2 <0.01%	-	-	-	<2	Nil
48704	BH1-2.00	Indurated SAND(SP); dark grey brown	4.0	3 <0.01%	211	<0.02%	-	214	16.1

Laboratory Test Methods follow procedures described in: AS 4969.7-2008

Form Number MAZREP08

APPENDIX 8 - ASCT ASS REPORT - JUNE 2023

Northern Rivers
Lab: 70 Lancaster Drive, Goonellabah NSW 2480
(02) 6686 8567
office@asct.com.au

Acid Sulfate Soil Investigation for Multi Use Development at 17 McDonald Place, Evans Head.

ASCT Register: H23-3755

Prepared for Lewis Barakat

07-June-2023

Northern Rivers
Lab: 70 Lancaster Drive, Goonellabah NSW 2480
(02) 6686 8567
office@asct.com.au

Table of Contents

1.0 Introduction & Understanding

As commissioned Australian Soil and Concrete Testing (ASCT) has undertaken the Acid Sulfate Soil (ASS) investigation, at the project site.

The work has been executed under the guidance provided within:

National Acid Sulfate Soils Sampling and Identification Methods Manual (NASS SIMM), and

National Acid Sulfate Soils Identification and Laboratory Methods Manual (NASS ILMM).

This report presents the results & findings of that ASS investigation.

2.0 Desktop Assessment

A desktop assessment was undertaken to determine the likelihood of ASS materials being present at the site. This assessment included a review of available ASS risk mapping, aerial photography, topographic mapping, geological mapping and ASCT experience.

A summary of the desktop assessment findings is provided in Table 1, below.

Table 1: Desktop Findings.

Element	Reference	Desktop Finding
ASS Risk Mapping	Richmond Valley Council NSW SEED Mapping	Zone L2 (Planning Instrument). Low Probability.
Photography	Google Earth	Old Dunes
Topography	Google Earth	<10m AHD
Geological	NSW – Tweed Heads 1:250k	Qx – Coastal & Estuarine Plain
ASCT Experience	H22-3124	ASS not likely

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3.0 Site Inspection

With knowledge of the desktop assessment findings, a site inspection was conducted. The site inspection provided further ASS/PASS indicators as listed in Table 2, below.

Table 2: Site Inspection Indicators.

Characteristic	Indicators (if any)	Inspection Result
Soil	Dark grey silty sands. Sulphurous smell.	Grey Sand Observed.
Water	Iron staining of surface drainage.	Not Observed
Vegetation	Salt/acid tolerant vegetation (paperbarks).	Not Observed
Infrastructure	Corrosion of concrete pipe outlets.	Not Observed

4.0 Soil Sampling, Field Testing and Collection

4.1 Soil Sampling

One (1) borehole was drilled in the proposed building location at the site, on 23 May 2023.

A figure, showing the location of the borehole, is included in Appendix A.

As groundwater alteration might reasonably be expected, the boreholes were extended to a depth of 3.0m (i.e.: 1m below the lowest estimated groundwater drawdown).

Starting from the existing ground surface, soil samples were representatively collected within vertical intervals not exceeding 0.25m. Where soil layers less than 0.25m in thickness were encountered, additional samples were collected to ensure that at least one sample represents each layer encountered.

All collected samples were handled, transported and stored to preserve their condition.

4.2 Field Testing

All field samples (above) were tested for *field pH* (pH_F) and *field pH peroxide* (pH_{FOX}) in accordance with the *National acid sulfate soils sampling and identification methods manual: Appendix A*.

The results of field testing are contained within the attached Borelogs/Lab Reports, provided in Appendix B.

4.3 Collection

The NASS SIM document, clause 6.7.4, defines the proposed site works as a 'Small-scale disturbance'.

As such, a limited number of samples were collected based on their likelihood to have the highest potential of an acidity hazard. These samples were collected from the 'pool' of field samples (obtained under section 4.1, above).

The resultant soil sample collection was detailed in a *Chain of Custody* (CoC) and forwarded to the laboratory for quantitative analysis.

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5.0 Laboratory Analysis

The collection of soil samples (detailed above) were submitted to the Environmental Analysis Laboratory (EAL, Lismore).

The sample collection was submitted with a request for analysis of:

- Moisture Content,
- Potential Sulfidic Acidity by chromium reducible sulfur (CRS),
- Actual Acidity by Titratable Actual Acidity (TAA),
- Net acidity, and
- Liming rate.

A summary of the Laboratory Results is provided in Table 3, below.

A complete copy of the laboratory report is included in Appendix C.

Table 3: Summary of Laboratory Results.

Field Sample Number	**1**
Sample Source (Borehole)	BH1
Depth (m)	1
Material Description (Texture)	Coarse
Potential Sulfidic Acidity (mole H^+/tonne)	0
Actual Acidity (mole H^+/tonne)	2
Retained Acidity (mole H^+/tonne)	-
Net Acidity (mole H^+/tonne)	2
NASS ILMM Action Criteria[1] (mole H^+/tonne)	18
ASS Management Plan Triggered	No
Liming Rate (kg $CaCO_3$/tonne DW[2])	NA

[1] Action criteria taken from the *National Acid Sulfate Soils Identification and Laboratory Methods Manual* (NASS ILMM) Table 1.1, based on less than 1000 tonnes of soil to be disturbed and dependent on soil texture.

[2] DW denotes Dry Weight.

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6.0 Conclusion

The laboratory analysis indicates that none of the soil materials has triggered the NASS ILMM action criteria based on their Net Acidity. As such, these soil materials are:

- **Non ASS** (NASS: Non acid sulfate soils).

These soils materials do not pose an environmental hazard.

The laboratory results indicate mild actual acidity. This acidity may be the result of previously oxidised ASS soil or soluble aluminium and iron from other acid forming coastal processes. Soils with actual acidity are common in coastal areas of eastern Australia and based on the data available the soils investigated would be classed as "acidic" rather than "acid sulfate". Liming of naturally acidic ecosystems, leading to un-naturally alkaline environments, can result in ecological damage to the acidophilic organisms that relied on the acidic nature of those ecosystems.

We have taken every care to be to accurate, complete & objective in the execution of your commission. Should you have any queries, or require further assistance, please do not hesitate to contact our office. This report is your intellectual property, and we will not provide it to any 3rd party without your permission. May we also respectfully request that if you provide this report to others (e.g.: Designer): you provide it in its' entirety, to avoid any miscommunication.

Yours faithfully,
Australian Soil & Concrete Testing Pty Ltd

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Limitations

This report relies on information supplied by the client and the results of investigations conducted in accordance with accepted practices and standards. The report is intended to represent a reasonable interpretation of the appropriate legislation and the condition of the site at the time of the investigation. However, due to these elements being subject to change over time the report under no circumstances can be considered to represent the definitive state of the site at all times.

This site investigation report ("The Report") has been prepared in accordance with the commission set out in the contract or quote, or as otherwise agreed between the Customer and Australian Soil & Concrete Testing (ASCT). The commission may be limited by a range of factors such as time, cost, accessibility or site constraints and conditions.
In preparing the report, ASCT has relied upon information provided, surveys, analyses, designs, plans and other documentation provided by the customer or other individuals and organisations, most of which are referred to in preparing the report. Except as otherwise stated in the report, ASCT has not verified the accuracy or completeness of the information provided to the extent that the statements, opinions, facts, information, conclusions and recommendations in the report are based in whole or in part on the information provided. The recommendations and conclusions are contingent upon the accuracy and completeness of the information provided. ASCT will not be liable in relation to incorrect conclusions should any provided information or site condition be incorrect or have been concealed, withheld, mis-represented or otherwise not fully disclosed to ASCT.

Geotechnical site classification is based extensively on judgment and opinion. It is far less exact than other engineering disciplines. This report was prepared expressly for the Customer and expressly for the purposes indicated. Use by any other persons for any purpose or by the customer for a different purpose, may result in problems which ASCT cannot be responsible for. The Customer should not use this report for other than its intended purpose without seeking additional geotechnical advice.

This geotechnical report is based on a subsurface investigation which only identifies the conditions at the locations and time when the investigation was undertaken.

The *Limitations of Geotechnical Site Investigation* in making an assessment of a site from a limited number of boreholes or test pits is the possibility that actual conditions may vary from those identified at the investigation locations. The Site investigation identifies specific subsurface conditions only at those points from which samples have been taken. The investigation programme undertaken is used to provide a general profile of the subsurface condition. The information obtained from the site investigation and subsequent laboratory testing is used to form a presumed opinion regarding the overall subsurface conditions and their likely behaviour. The borehole logs are the subjective interpretation of the limited site investigation and cannot always be definitive.

A geotechnical report is based on conditions which existed at the time of site investigation. The subsurface conditions may change due to natural forces or man-made influences. Civil works at or adjacent to the site and natural events such as floods or groundwater fluctuations may also affect subsurface conditions and the relevance of the geotechnical report.

The geotechnical report may be misinterpreted by other design professionals. ASCT should be retained to explain relevant geotechnical findings and to review the adequacy of plans and specifications and the implications to the report. The geotechnical report should be maintained as a whole and should not be copied, divided or altered.

It is recommended that ASCT should be retained through the construction stage to confirm the actual subsurface conditions are consistent with the geotechnical report. If variations are encountered additional tests may be required to confirm conditions comply with the design specifications and advise on changes to the construction if required.

The geotechnical report has been prepared for the benefit of the customer and no other party. ASCT assumes no responsibility and will not be liable to any other person or organisation for, or in relation to, any matter dealt with or conclusion expressed in the report. ASCT will not be responsible for any loss or damage suffered by any other person or organisation arising from matters dealt with or conclusion expressed in the report (including, without limitation, matters arising from any negligent act or omission of ASCT or any loss or damage suffered by any other party relying upon the matters dealt with or conclusions expressed in the report). Other parties should not rely upon the report or the accuracy and completeness of any conclusions and should make their own enquiries and obtain independent advice in relation to such matters.

ASCT will not be liable to update or revise the report to take into account any events of emergent circumstances or facts occurring or becoming apparent after the date of the report.

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APPENDIX A – Borehole Locations

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APPENDIX B – Borehole Logs / Field Reports

ASS TEST HOLE LOG - BH 1

Client:	Lewis Barakat	**ASCT Ref No:**	H23-3755
Project:	Street# 17, McDonald Place, Evans Head	**Sample Date:**	23/05/2023
Latitude/Longitude:	See Plan	**Sample Team:**	Jake Vincent
Surface Elevation:	Exisiting Surface, Australian Height Datum (AHD) =	**Sample Equipment:**	Spiral auger
Watertable Depth:	1.7m	**Sample Method:**	Push tube
Lab Testing:	Denotes samples submitted to Lab for quantitative testing.		

Depth	Symbol	Texture	Soil Description	pH	pH	pH	Reaction
m		NSM-3.1	Australian Soil and Land Survey Field Handbook	F	FOX	Δ	
0.00-0.25	**S**	**Coarse**	Sand	6.5	5.9	0.6	Low
0.25-0.50				6.8	5.8	1.0	Low
0.50-0.75				6.9	5.8	1.1	Low
0.75-1.00				7.2	5.8	1.4	Low
1.00-1.25				7.5	5.8	1.7	Low
1.25-1.50				7.4	5.9	1.5	Low
1.50-1.75				7.4	6.0	1.4	Low
1.75-2.00				7.3	6.0	1.3	Low
2.00-2.25				7.2	5.9	1.3	Low
2.25-2.50				7.1	5.6	1.5	Low
2.50-2.75				6.2	4.6	1.6	Low
2.75-3.00				6.1	5.0	1.1	Low
				6.3	5.1	1.2	Low

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APPENDIX C – Laboratory Reports

RESULTS OF ACID SULFATE SOIL ANALYSIS

1 sample supplied by Australian Soil & Concrete Testing on 29/05/2023. Lab Job No. P1290.
Analysis requested by Darran Kennedy. Your Job: H23-3755 #19644.

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Sample Identification	EAL Lab Code	Texture	Moisture Content		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)	(% S_{Cr})	(mol H^+/t)	pH_{KCl}	(mol H^+/t)	(%S_{RAS})	(mol H^+/t)	(% $CaCO_3$)	(mol H^+/t)	(mol H^+/t)	(kg $CaCO_3$/t DW)
Method Info.		**		**	*(In-house method S20)*		*(In-house method 16b)*		**		*(In-house method S14)*		**	**
BH1	*P1290/1*	Coarse	17.4	0.21	<0.005	0	6.34	2	..	..	..	..	2	0

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 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. 201**
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 31/05/2023.

NATA
Accredited for compliance with ISO/IEC 17025 – Testing

checked: .....
Graham Lancaster
Laboratory Manager

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