



# ACID SULFATE SOIL MANAGEMENT PLAN

PROPOSED APARTMENT BUILDING

December 2024

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Prepared for: The Trustee ATF WAFI Property Trust

Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515  
12-16 Florence Street  
Tweed Heads NSW

**HMC2024.1001.02**

**RE: Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515, 12-16 Florence Street, Tweed Heads NSW.**

HMC Environmental Consulting Pty Ltd is pleased to present our report for an Acid Sulfate Soil Management Plan 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.

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Title:	Acid Sulfate Soil Management Plan
Job No:	2024.1001.02
Client:	The Trustee ATF WAFI Property Trust

Document Record:				
Version	Date	Prepared by	Checked by	Issued by
Draft Issue A	9.12.2024	MF	MT	KH
Final Issue A	12.12.2024	KH		

Distribution List	Date	Version	Comments
S. Macri; Dreambuild	9.12.2024	Draft Issue A	For review
S. Macri; Dreambuild	12.12.24	Final Issue A	For lodgement
S. Macri; Dreambuild	14.03.2025	Final Issue B	Final for lodgement (client update)

This report should be cited as '*HMC Environmental Consulting (2024). Preliminary Acid Sulfate Soil Investigation, Proposed Apartment Building: Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515, 12-16 Florence Street, Tweed Heads NSW. Report No. HMC2024.1001.02, December 2024*'

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## 1 INTRODUCTION

A residential re-development is proposed for the site located at Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515, 12-16 Florence Street, Tweed Heads NSW. The proposal would require the demolition of two dwellings and a funeral home, and the construction of a 14-storey residential apartment building, with a double level basement carpark. Earthworks are required for the construction of the double basement, together with the proposed lift wells and services.

The site, including the development area is mapped as Class 2 acid sulfate soil (ASS), and any works below the ground surface or works by which the watertable is likely to be lowered requires a preliminary ASS investigation.

Assuming a maximum excavation depth of 7.5m below the existing ground surface (BGL), to assess the presence of ASS, soil samples were collected to a maximum 8.5m BGL from 5 boreholes located across the development area. Due to the difficulties with access, and dense indurated material, the boreholes were drilled on 3 days (11.9.24, 4.10.2024 & 11.10.24) over a month using differing drilling rigs.

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	12-16 Florence Street Tweed Heads NSW
Property description	Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515
Report commissioned by	The Trustee ATF WAFI Property Trust
Proposed development	Proposed multi-level apartment building
Estimated maximum depth of excavation	Maximum depth approximately 7.5m BGL
ASS interception depth	Approx. >4.0m BGL
Investigator	Mark Tunks and Helen Tunks
Local Government Authority	Tweed Shire
Investigation date	11 September 2024, 4 October 2024 and 11 October 2024

## 3 PROJECT DESCRIPTION

An apartment building development is proposed for the site located at Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515, 12-16 Florence Street, Tweed Heads NSW. It is proposed to construct a 14-storey residential apartment building (57 units), along with a proposed double basement carpark and ancillary works including landscaping.

Currently the properties are occupied by existing dwellings on No. 12 and 14, together with a funeral home on No. 16. All existing structures are to be demolished prior to the construction of the proposed development.

## 4 PROPOSED EARTHWORKS

Earthworks into the existing ground surface would include excavation for the construction of the double level basement, together with the installation of the lift well and site services. The proposed ground level would be approximately RL 4.3m AHD. The floor level of the lower basement is proposed to be RL -1.9m AHD (6.2m BGL), and assuming a footing depth of 0.5m, the general minimum excavation elevation would be RL -2.4m AHD (6.7m BGL). The lift wells overruns are proposed to extend up to 1.2m beyond the basement floor level, to a minimum elevation of RL -3.1m AHD (7.4m BGL).

## 5 SITE CHARACTERISTICS

Table 2 – Site Characteristics

<b>Acid Sulfate Soil Class</b> <i>(NSW Legislation 1:25 000 Acid Sulfate Soil Planning Maps – ASS_001)</i>	<b>Class 2</b> Any works below the ground surface or works by which the watertable is likely to be lowered
<b>Regional Geology</b> <i>The Surface Quaternary Geology Map (Geoscience Australia, 2016)</i>  <i>Coastal Quaternary Geology Tweed Heads 1:25000 Quaternary Geology Geological Survey of NSW</i>	<b>Cenozoic Undifferentiated Sediments/Sedimentary Rocks</b> Unconsolidated mud, silt, sand and gravel of an uncertain age and origin.  <b>Qhef</b> Holocene tidal-delta flat: marine sand, silt, clay, shell, gravel
<b>Soil Landscape</b> <i>NSW Department of Land &amp; Water Conservation Soil Landscapes of the 1:100 000 Sheet (Morand, 1996)</i>	<b>Kingscliff (ki) landscape:</b> Extremely low, level to gently undulating Pleistocene sand sheets. Extensively cleared and disturbed open-heathland and forest. <b>Soils:</b> Deep, generally well-drained Podzols. <b>Geology:</b> Aeolian and marine quartz sand sheets and dunes of the Pleistocene inner barrier system.
<b>Australian Soil Classification</b>	<b>Podosols (PO)</b> Soils with B horizons dominated by the accumulation of compounds of organic matter, aluminium and/or iron.
<b>Regional Hydrogeology</b> <i>(Tweed Shire Council planning &amp; mapping: Ground Water Vulnerability)</i>	Groundwater vulnerability is mapped as High for the site. The property is located nearby to Tweed Marina, however, given the elevated site, it would not generally be expected that shallow groundwater would be present. In this circumstance, indurated sands have been recorded at shallow depths in the general location with apparent perched groundwater table.
<b>Groundwater Database Search</b> <a href="http://allwaterdata.water.nsw.gov.au/water.stm">http://allwaterdata.water.nsw.gov.au/water.stm</a>	The online Water NSW groundwater mapping shows the nearest mapped registered groundwater bore is GW303657 located approximately 250m east of the site. The bore is registered for domestic use.

## 6 TWEED CITY CENTRE LOCAL ENVIRONMENTAL PLAN 2012

The NSW Legislation 1:25 000 Acid Sulfate Soil Planning Maps – *Tweed Heads 9641S4* indicates the majority of the site is located within a Class 2 mapped area. Table 2.1 in the Assessment Guidelines of the Acid Sulfate Soil Manual (ASSMAC, 1998) and Clause 6.1 of Tweed City Centre Local Environment Plan 2012 (TCCLEP 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 1 - ASS Planning Map (<https://www.legislation.nsw.gov.au/maps.pdf>)

Clause 6.1 of Tweed City Centre Local Environment Plan 2012 (TCCLEP 2012) requires that works below the ground surface proposed in Class 2 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).

## 7 GEOLOGY & SOIL LANDSCAPE

According to the NSW Department of Land & Water Conservation *Soil Landscapes of the Murwillumbah - Tweed* 1:100 000 Sheet (Morand, 1996), the site is located within a Kingscliff (ki) soil landscape: extremely low, level to gently undulating Pleistocene sand sheets.

The 1:25000 *The Surface Quaternary Geology Map (Geoscience Australia, 2016)* shows the site is located within a Cenozoic Undifferentiated Sediments/Sedimentary Rocks geology unit characterised by unconsolidated mud, silt, sand and gravel of an uncertain age and origin.

A review of the NSW Department of Primary Industry (2008) *Coastal Quaternary Geology Tweed Heads 1:25000 Quaternary Geology Geological Survey of NSW* mapping shows the site is within the Estuarine Plain System Qhef geology unit described as Holocene tidal-delta flat characterised by marine sand, silt, clay, shell, gravel. This mapping also shows the old back channel (filled in the 1960s during the Greenbank reclamation work) running parallel and east of Wharf Street. Historically groundwater would be expected to flow away from the elevated Razorback area to the west towards the tidal back channel.

## 8 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 7).

The base of the excavation would appear to be generally RL -2.4m AHD assuming a lift well overrun of 0.5m.

## 9 SOIL INVESTIGATION

To assess ASS within the local soil profile, 5 borehole(s) were excavated by Pacific Geotech on the 11 September 2024, 4 October 2024 and 11 October 2024, to a maximum depth of approximately 8.5m depth, with samples generally collected at 0.5m depth intervals through the soil profile. Sampling locations are shown in Appendix 9. Boreholes BH1, BH3 and BH5 were excavated to approximately 8.5m depth, while boreholes 2 and 4 were terminated at 3.8 and 4.4m depth due to the dense indurated material.

### 11 September 2024

Due to difficulties with accessing parts of the site, the drilling program extended over several days with initially Pacific Geotech providing a small tracked rig on 11 September 2024 to access available areas. As very dense indurated sand was intercepted during this initial drilling program, the small rig was only able to drill to 4.0-4.4m in three of the 4 boreholes.

BH1 – 0.0-8.5m

BH2 – 0.0-4.3m terminated due to dense indurated sand

BH3 – 0.0-4.4m terminated due to dense indurated sand

BH4 – 0.0-4.0m terminated due to dense indurated sand

### 4 October 2024

A return to site on 4 October 2024 with a larger rig, enabled BH3 to be located immediately beside the 11 September 2024 location and extended to 8.5m depth.

### 11 October 2024

HMC returned to site with Pacific Geotech and, again, after exploring drilling locations, it was decided to continue BH4 in a final location near BH3. This relocation of BH4 was recorded as BH5 with ASS sampling beginning at 4m.

The soil profile was generally similar between boreholes and generally recorded grey sand overlying brown/dark brown sand to the termination depth. Groundwater seepage was encountered between 1.5– 2.5m BGL, with the soil being wet below these depths. Groundwater monitoring bores were installed in BH2, BH3 and BH5.

All samples (51) 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  $pH \leq 4$  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)].

Twenty six (26) 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 non ASS TAA levels.

Action criteria thresholds are shown in Table 3.

**Table 3 - 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 <sup>+</sup> /tonne) (oven dry basis)	Equivalent sulfur (%S) (oven-dry basis)	Equivalent acidity (mol H <sup>+</sup> /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 (51) are summarised in Tables 5, 6 and 7.

The pH<sub>F</sub> results ranged from 5.0 – 7.5, which does not indicate the presence of actual ASS. The pH<sub>FOX</sub> results ranged from 1.5 – 4.2, with a number of samples recording a pH<sub>FOX</sub> below the 3.0 criteria, indicative of potential ASS or RIS. The results ranged through the soil profile over the five boreholes.

Reaction to hydrogen peroxide was moderate to strong.

The TAA results ranged from <2-49 mol H<sup>+</sup>/T. Three samples recorded TAA exceeding the action criteria 19-46 mol H<sup>+</sup>/T. These results were associated with SCR results also exceeding the action criteria and may indicate some acidification due to oxidation of RIS.

The S<sub>CR</sub> results for the selected samples (26) were generally below the action criteria. Samples collected below 5.0m depth in boreholes BH3 and BH5 located adjacent to each other recorded S<sub>CR</sub> exceeding the action criteria, with results ranging from 0.04%– 0.10%. Borehole BH1 also recorded S<sub>CR</sub> exceeding the action criteria below 7.0m depth. All results ≥0.10% were at or below 7.4m depth. Minimal if any excavation is proposed to this depth.

Six TAA results exceeded the action criteria for coarse texture soils.

Table 4 – Soil Analysis Summary

Test	Range	Action Criteria
pH <sub>F</sub>	5.0 – 7.5	<4.0
pH <sub>FOX</sub>	1.5 – 4.2	<3.0 & min 1 unit < pH <sub>F</sub>
Reaction to H <sub>2</sub> O <sub>2</sub>	Moderate - Strong	Strong
%S <sub>CR</sub>	<0.01 – <b>0.18</b>	0.03 (coarse texture)
TAA mol H <sup>+</sup> /t	<2 - <b>49</b>	18 (coarse texture)
ANC mol H <sup>+</sup> /t	Nil	Indicative of shell, carbonate

Table 5 - Soil Laboratory Analysis Results - BH1 & BH2

Depth (m)	Borehole ID							
	(BH1)				(BH2)			
	pH <sub>F</sub>	pH <sub>FOX</sub>	%S <sub>CR</sub>	TAA (mol H <sup>+</sup> /T)	pH <sub>F</sub>	pH <sub>FOX</sub>	%S <sub>CR</sub>	TAA (mol H <sup>+</sup> /T)
0.4 - 0.5	5.0	<b>2.5</b>	0.01	3	5.6	<b>2.5</b>	0.01	3
0.9 – 1.0	5.1	3.2	0.01	<2	5.7	<b>2.6</b>	0.01	2
1.4 – 1.5	6.0	3.8			5.9	3.3		
1.9 – 2.0	6.1	3.9			5.9	3.6		
2.4 - 2.5	6.6	3.4	0.01	<2	6.1	3.3	0.01	<2
2.9 – 3.0	6.4	4.0			6.2	3.8		
3.4 – 3.5	5.8	3.5			5.8	3.8		
3.9 – 4.0	5.6	3.2	0.01	13	5.5	3.1	0.01	16
4.2 – 4.3					5.2	<b>2.3</b>	0.01	12
4.4 – 4.5	5.3	<b>2.6</b>	0.02	<b>43</b>				
4.9 – 5.0	5.2	<b>2.7</b>						
5.4 – 5.5	5.7	3.0						
5.9 – 6.0	5.6	3.2	0.01	16				
6.4 – 6.5	5.6	<b>2.5</b>	0.02	12				

<b>6.9 – 7.0</b>	5.5	<b>2.3</b>		
<b>7.4 – 7.5</b>	5.6	<b>2.1</b>	<b>0.11</b>	12
<b>7.9 – 8.0</b>	5.8	<b>1.7</b>		
<b>8.4 – 8.5</b>	5.7	<b>1.5</b>	<b>0.18</b>	<b>19</b>

**Bold** = Indicative of ASS or exceeds action criteria

**Table 6 - Soil Laboratory Analysis Results – BH3 & BH4**

Depth (m)	Borehole ID							
	(BH3)				(BH4)			
	pH <sub>F</sub>	pH <sub>FOX</sub>	%S <sub>CR</sub>	TAA (mol H <sup>+</sup> /T)	pH <sub>F</sub>	pH <sub>FOX</sub>	%S <sub>CR</sub>	TAA (mol H <sup>+</sup> /T)
<b>0.4 - 0.5</b>	7.1	3.3			6.0	<b>2.6</b>	0.01	6
<b>0.9 – 1.0</b>	6.6	4.2			5.8	<b>2.7</b>	0.01	<2
<b>1.4 – 1.5</b>	6.7	4.2			6.2	3.1		
<b>1.9 – 2.0</b>	7.5	4.1			6.3	3.6	0.01	<2
<b>2.4 - 2.5</b>	5.1	<b>2.6</b>	0.01	<b>24</b>	5.6	<b>2.8</b>	0.01	18
<b>2.9 – 3.0</b>	5.2	<b>2.9</b>			5.7	<b>2.9</b>		
<b>3.4 – 3.5</b>	5.1	<b>2.7</b>			5.7	3.3		
<b>3.9 – 4.0</b>	5.1	<b>2.3</b>	0.01	<b>29</b>	5.6	3.0	0.01	8
<b>4.4 - 4.5</b>	5.0	<b>2.8</b>						
<b>4.9 – 5.0</b>	4.9	<b>2.6</b>						
<b>5.4 - 5.5</b>	5.2	<b>2.1</b>	<b>0.06</b>	<b>46</b>				
<b>5.9 - 6.0</b>	5.4	<b>2.2</b>						
<b>6.4 – 6.5</b>	5.8	<b>2.1</b>	<b>0.05</b>	<b>13</b>				
<b>6.9 – 7.0</b>	5.8	<b>2.2</b>						
<b>7.4 – 7.5</b>	5.6	<b>2.8</b>						
<b>7.9 – 8.0</b>	5.8	<b>2.2</b>	<b>0.08</b>	<b>10</b>				
<b>8.4 – 8.5</b>	6.0	<b>1.8</b>	<b>0.08</b>	<b>12</b>				

**Bold** = Indicative of ASS or exceeds action criteria

**Table 7 - Soil Laboratory Analysis Results – BH5**

Depth (m)	Borehole ID			
	(BH5)			
	pH <sub>F</sub>	pH <sub>FOX</sub>	%S <sub>CR</sub>	TAA (mol H <sup>+</sup> /T)
<b>3.9 – 4.0</b>	5.5	<b>2.0</b>	0.03	<b>49</b>
<b>4.4 – 4.5</b>	5.5	<b>2.0</b>		
<b>5.4 – 5.5</b>	5.6	<b>2.1</b>	<b>0.04</b>	<b>24</b>
<b>5.9 – 6.0</b>	5.4	<b>2.1</b>		
<b>6.4 – 6.5</b>	6.0	<b>2.2</b>	<b>0.03</b>	13

<b>6.9 – 7.0</b>	5.6	<b>2.1</b>		
<b>7.4 – 7.5</b>	5.9	<b>2.1</b>	<b>0.05</b>	11
<b>7.9 – 8.0</b>	6.3	<b>1.8</b>		
<b>8.4 – 8.5</b>	6.0	<b>2.1</b>	<b>0.10</b>	8

**Bold** = Indicative of ASS or exceeds action criteria

## 11 DISCUSSION

The drilling program was disjointed due to access issues on these commercial (No.16 - funeral home) and residential properties (Nos. 12-14). The ASS investigation extended to 8.5m depth BGL across the accessible areas of the proposed apartment building location. Very dense indurated sand was intercepted in all boreholes

BH1 and BH3 extended to 8.5m depth BGL. Borehole BH2 extended to 4.3m depth before refusal due to very dense indurated sand, and inability to locate a larger rig on this part of the site. Borehole BH4, located on No.12 extended to 4m depth BGL before refusal and this borehole provide information on the western part of the site. Borehole BH5 was located near BH3 and approximately 12m east of BH4.

The qualitative  $pH_F$  results were not indicative of actual ASS, and the  $pH_{FOX}$  results were slightly indicative of potential ASS to 0.5m depth BGL. Samples greater than 7.5m BGL in BH1, and greater than 5.5m BGL in BH5 returned quantitative  $S_{CR}$  results indicative of RIS, and require management.

## 12 MANAGEMENT METHOD

Neutralisation with agricultural lime is a widely accepted method to minimise the generation of acid and acid products associated with the disturbance of ASS. Agricultural lime is readily available, relatively easy to handle and less hazardous than some other agents. It is extensively used in both the agricultural and construction industries.

Using the maximum combined actual (TAA) + potential acidity ( $S_{CR}$ ) level recorded in samples collected and subjected to laboratory analysis, calculations for proposed agricultural lime application rates are shown in Table 8.

Using the Acid Base Accounting [**Net acidity = potential acidity + existing acidity – acid neutralising capacity (ANC)**] to assess all sources of acidity and neutralising capacity, the calculated agricultural lime application rate would be:

The calculations for proposed agricultural lime application rates are shown in Table 8.

Table 8 – Lime application rate calculations (adapted from Table 4.6 ASSMAC 1998)

Location	Depth (m)/Soil type	% $S_{CR}$	TAA	kg $CaCO_3$ /tonne soil (safety factor 1.5)	Min. Kg $CaCO_3/m^3$ soil (assume BD = 1.6 kg/m <sup>3</sup> )	Min. Kg $CaCO_3/m^2$ soil /300mm depth
Dark Brown Sand	>4.0	0.06	46	6.3	10	3.1
	>7.5	0.18	19	10	15.8	4.8

The adopted lime application rates would appear adequate to neutralise all actual acidity and potential acid generation due to oxidation of sulfidic sediments disturbed during the proposed stormwater outlet installation. It is recognised that the calculated lime application rate includes a 50% safety factor to cater for inefficient mixing and isolated “hotspots”.

There are a number of management strategies available for ASS where the soil is to be removed from the site.

If the material is treated on site, then the material may be:

- classified in accordance with the NSW *Waste Classification Guidelines Part 4 Acid Sulfate Soils* and transported to an approved landfill facility; or
- managed in accordance with a specific resource recovery order and exemption issued by the NSW EPA under sections 91-93 of the *Protection of the Environment Operations (Waste) Regulation 2014* for beneficial reuse on an approved site.

If the material is to be treated off-site, then:

- classified in accordance with the NSW *Waste Classification Guidelines Part 4 Acid Sulfate Soils* and transported to an approved resource recovery facility and placement is a borrow pit or similar below 2m depth in water. There are restrictions on holding times and actual acidity.

### 13 ASS CONCLUSION

Acid sulfate soils have been identified as being a constraint for earthworks associated with the proposed development of Lot 1 DP 781624, Lot 1 DP 419177 & Lot 2 DP 300515, 12-16 Florence Street, Tweed Heads NSW. The proposed earthworks associated with the basement carpark are likely to intercept ASS, and the excavated material is to be managed in accordance with the Acid Sulfate Soil Management Plan as attached in Appendix 1 of this report.

### 14 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.

 ...

9 December 2024  
Completion Date

Mark Tunks  
Principal

## 15 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.

## 16 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.
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- 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

## 17 APPENDICES

See following pages

# **APPENDIX 1 - ACID SULFATE SOIL MANAGEMENT STRATEGY**



This acid sulfate soils management plan applies to all of the proposed works of the development application in compliance with the NSW Acid Sulfate Soil Manual 1998.

Any amendments to any of the referenced drawings or scope of works will necessitate a further review and an update of HMC2024.1001.02 Acid Sulfate Soil Management Plan.

ELEMENT ASS1	Acid Sulfate Soil Treatment																				
Policy	<ul style="list-style-type: none"> <li>To minimise acid generation and acid products due to exposure and oxidation of ASS</li> <li>To treat actual acidity within excavated material present on the site</li> </ul>																				
Performance Objective	<ul style="list-style-type: none"> <li>Prepared in accordance with the <i>Protection of the Environment and Operations Act 1997</i>, <i>NSW Acid Sulfate Soil Manual 1998</i> and other relevant statutes, policy and guidelines.</li> <li>Implement best practice environmental management of ASS</li> </ul>																				
Responsible Person	Site Manager																				
Control Actions	<ul style="list-style-type: none"> <li>Minimise disturbance of ASS</li> <li>Identify proposed ASS Treatment Area on site as shown in Appendix 10.</li> <li>If to the treated on site                             <ul style="list-style-type: none"> <li>Prior to disturbance of ASS, install ASS Treatment Area &amp; provide agricultural lime guard layer min 5 kg/m<sup>2</sup> to base of area.</li> </ul> </li> <li>Excavated natural material to be placed in ASS Treatment Area</li> <li>Any stockpiling pad will require the placement of an agricultural lime guard layer under the stockpile. The guard layer shall be 0.3 times the average liming rate/m<sup>2</sup> for each vertical metre of the stockpile. Maximum stockpiling period will depend on required dewatering.</li> <li>Place all excavated natural material in bunded ASS treatment area in maximum 300mm depth layers, and incorporate lime at nominated application rate as shown in table 9.</li> </ul> <p><b>Table 9 - Lime application rate calculations (adapted from Table 4.6 ASSMAC 1998)</b></p> <table border="1"> <thead> <tr> <th>Location</th> <th>Depth (m)/Soil type</th> <th>%SCR</th> <th>TAA</th> <th>kg CaCO<sub>3</sub>/tonne soil (safety factor 1.5)</th> <th>Min. Kg CaCO<sub>3</sub>/m<sup>3</sup> soil (assume BD = 1.6 kg/m<sup>3</sup>)</th> <th>Min. Kg CaCO<sub>3</sub>/m<sup>2</sup> soil /300mm depth</th> </tr> </thead> <tbody> <tr> <td rowspan="2">Dark Brown Sand</td> <td>&gt;4.0</td> <td>0.06</td> <td>46</td> <td>6.3</td> <td>10</td> <td>3.1</td> </tr> <tr> <td>&gt;7.5</td> <td>0.18</td> <td>19</td> <td>10</td> <td>15.8</td> <td>4.8</td> </tr> </tbody> </table> <ul style="list-style-type: none"> <li>ASS treatment area to be in accordance with Appendix 10</li> <li>Leachate from dewatered ASS to be contained and treated in the treatment bund prior to discharge.</li> <li>Sump with limestone or similar may provide passive water treatment.</li> <li>Validate treated soil (1 test/25m<sup>3</sup>) – %S<sub>CR</sub>/TAA. No treated ASS to be removed from ASS treatment area until validation criteria has been met</li> <li>Validation criteria                             <ul style="list-style-type: none"> <li>&lt;S<sub>CR</sub> 0.03%</li> <li>&lt;TAA 18 mol H<sup>+</sup>/T</li> </ul> </li> <li>If TAA or S<sub>CR</sub> do not meet validation criteria, additional lime application and validation sampling would be required. This process to continue until validation criteria are met.</li> <li>Material removed from the site to be-                             <ul style="list-style-type: none"> <li>classified in accordance with the <i>NSW Waste Classification Guidelines Part 4 Acid Sulfate Soils</i>; or</li> </ul> </li> </ul>	Location	Depth (m)/Soil type	%SCR	TAA	kg CaCO <sub>3</sub> /tonne soil (safety factor 1.5)	Min. Kg CaCO <sub>3</sub> /m <sup>3</sup> soil (assume BD = 1.6 kg/m <sup>3</sup> )	Min. Kg CaCO <sub>3</sub> /m <sup>2</sup> soil /300mm depth	Dark Brown Sand	>4.0	0.06	46	6.3	10	3.1	>7.5	0.18	19	10	15.8	4.8
Location	Depth (m)/Soil type	%SCR	TAA	kg CaCO <sub>3</sub> /tonne soil (safety factor 1.5)	Min. Kg CaCO <sub>3</sub> /m <sup>3</sup> soil (assume BD = 1.6 kg/m <sup>3</sup> )	Min. Kg CaCO <sub>3</sub> /m <sup>2</sup> soil /300mm depth															
Dark Brown Sand	>4.0	0.06	46	6.3	10	3.1															
	>7.5	0.18	19	10	15.8	4.8															

	<ul style="list-style-type: none"> <li>● managed in accordance with a specific resource recovery order and exemption issued by the NSW EPA under sections 91-93 of the <i>Protection of the Environment Operations (Waste) Regulation 2014</i>.</li> </ul> <p>If material qualifies for untreated removal from site, special management applies including additional ongoing analysis for each load, maximum 16 hours holding time once excavated, and placement in approved facility below water. Specialist advice from a suitably qualified environmental consultant required.</p>
Monitoring	<ul style="list-style-type: none"> <li>● Site Manager or representative shall monitor the works daily for evidence of:             <ol style="list-style-type: none"> <li>1. Yellow efflorescence on soil surface</li> <li>2. Iron staining</li> <li>3. Sulphurous odour.</li> </ol> </li> <li>● Regular monitoring of any leachate (see ELEMENT ASS2)</li> </ul>
Reporting	<ul style="list-style-type: none"> <li>● Records to be kept by the Site Manager on the monitoring activities, complaints received, and control actions subsequently taken. Records to be made available to Tweed Shire Council, NSW EPA, and Water NSW as requested.</li> </ul>

ELEMENT ASS2	ASS Leachate Treatment <sup>(2)</sup>
Policy	<ul style="list-style-type: none"> <li>● To avoid negative off-site impacts on water quality from acid generation or acid products</li> </ul>
Performance Objective	<ul style="list-style-type: none"> <li>● Prepared 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.</li> <li>● Implement best practice environmental management of ASS</li> </ul>
Responsible Person	<ul style="list-style-type: none"> <li>● Site Manager</li> </ul>
Control Actions	<ul style="list-style-type: none"> <li>● Provide surface water controls to divert surface water run-on</li> <li>● All water discharged from the site to be contained, collected and treated to meet adopted water quality criteria.</li> <li>● Treatment of water within bunded areas may include dosing with hydrated lime at appropriate rates to ensure discharge pH 6.5 – 8.5. (Note extreme care required with hydrated lime to avoid “overshooting” target pH)</li> <li>● Soda ash or other amendments may be more appropriate to control pH.</li> </ul>
Monitoring <sup>(1)</sup>	<ul style="list-style-type: none"> <li>● Daily monitor leachate pH and Electrical Conductivity in treatment areas</li> </ul>
Action Criteria <sup>(1)</sup>	<ul style="list-style-type: none"> <li>● pH &lt;6.5 or &gt;8.5</li> </ul>
Discharge Criteria	<ul style="list-style-type: none"> <li>● pH 6.5 - 8.5</li> <li>● Total Titratable Acidity &lt;40 mg/L</li> <li>● Suspended solids &lt;50 mg/L</li> </ul>
Reporting	<ul style="list-style-type: none"> <li>● Records to be kept by the Site Manager on the monitoring activities, complaints received, and control actions subsequently taken. Records to be made available to Tweed Shire Council, NSW EPA, and NSW Water as requested.</li> <li>● Event =&gt;25mm rainfall in 24hrs</li> </ul>
ELEMENT ASS3	Contingency
	<ul style="list-style-type: none"> <li>● A minimum of 1000kg of agricultural lime (CaCO<sub>3</sub>) + 50kg of hydrated lime shall be kept on site at all times for the treatment of ASS.</li> </ul>

(1) if leachate present in bunded area

(2) treatment on site only. Special provisions apply for off-site treatment.

# APPENDIX 2 - LOCATION MAPS





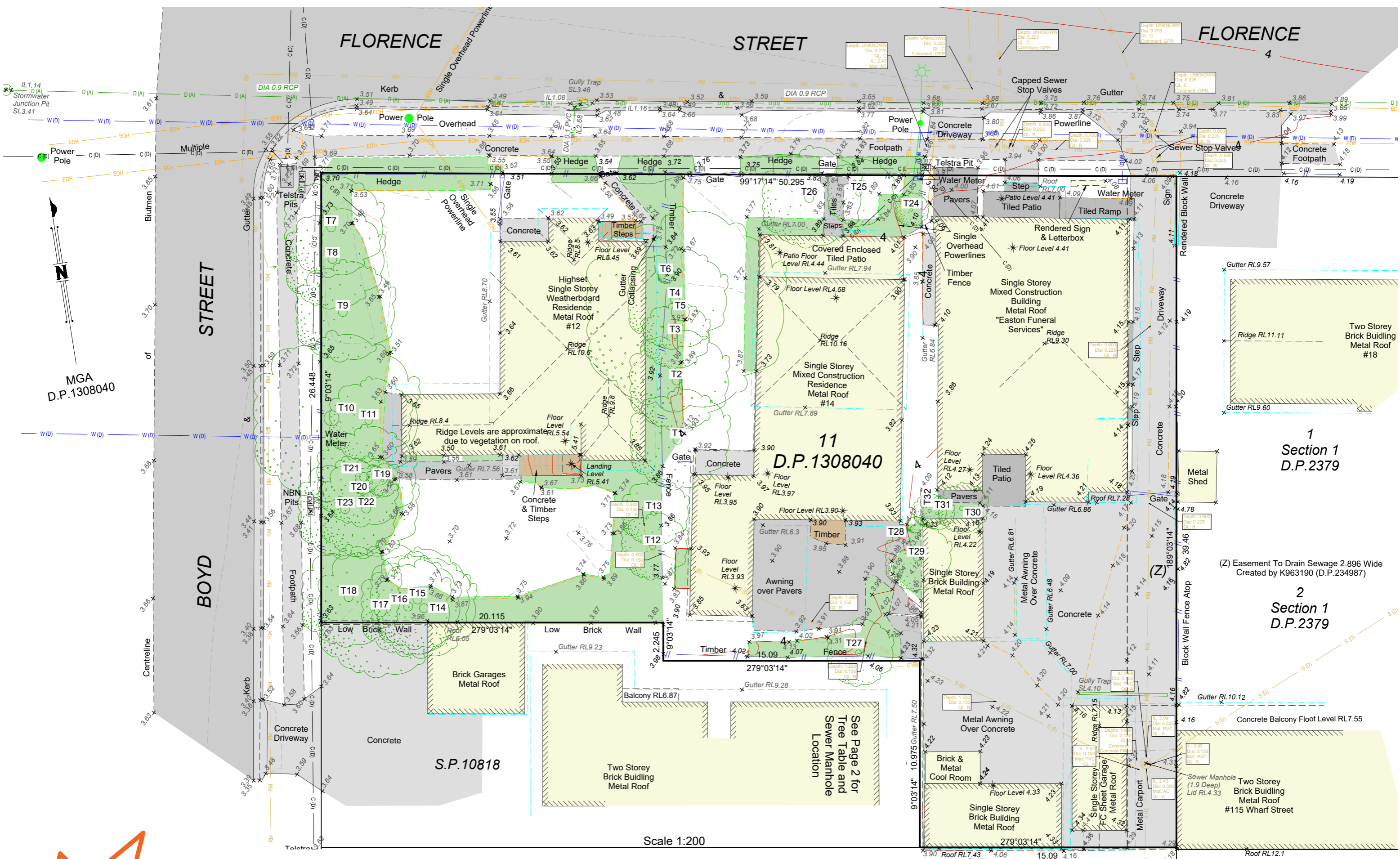
Figure 2 - Surrounding Area (Source: Nearmap 2024)



Figure 3 – Subject Site (Source: Nearmap 2024)

# **APPENDIX 3 - SITE PLAN PROPOSED DEVELOPMENT**





Scale 1:200



5 / 505 BALMAIN RD LILYFIELD NSW 2040  
 +61 2 9818 0777  
 WWW.BENSONMCCORMACK.COM  
 ENQUIRIES@BENSONMCCORMACK.COM

NOMINATED ARCHITECTS  
 D. BENSON ARB NSW 7285, WA ARB 3301  
 G. MCCORMACK ARB NSW 7536, ARB 20415

CLIENT  
**DREAMBUILD**  
 6/37A KING ROAD,  
 HORNSBY NSW 2077

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LEGEND

AMENDMENTS  
 REV DESCRIPTION

DRAWN CHK DATE

NORTH

SITE INFORMATION  
**Site Survey**

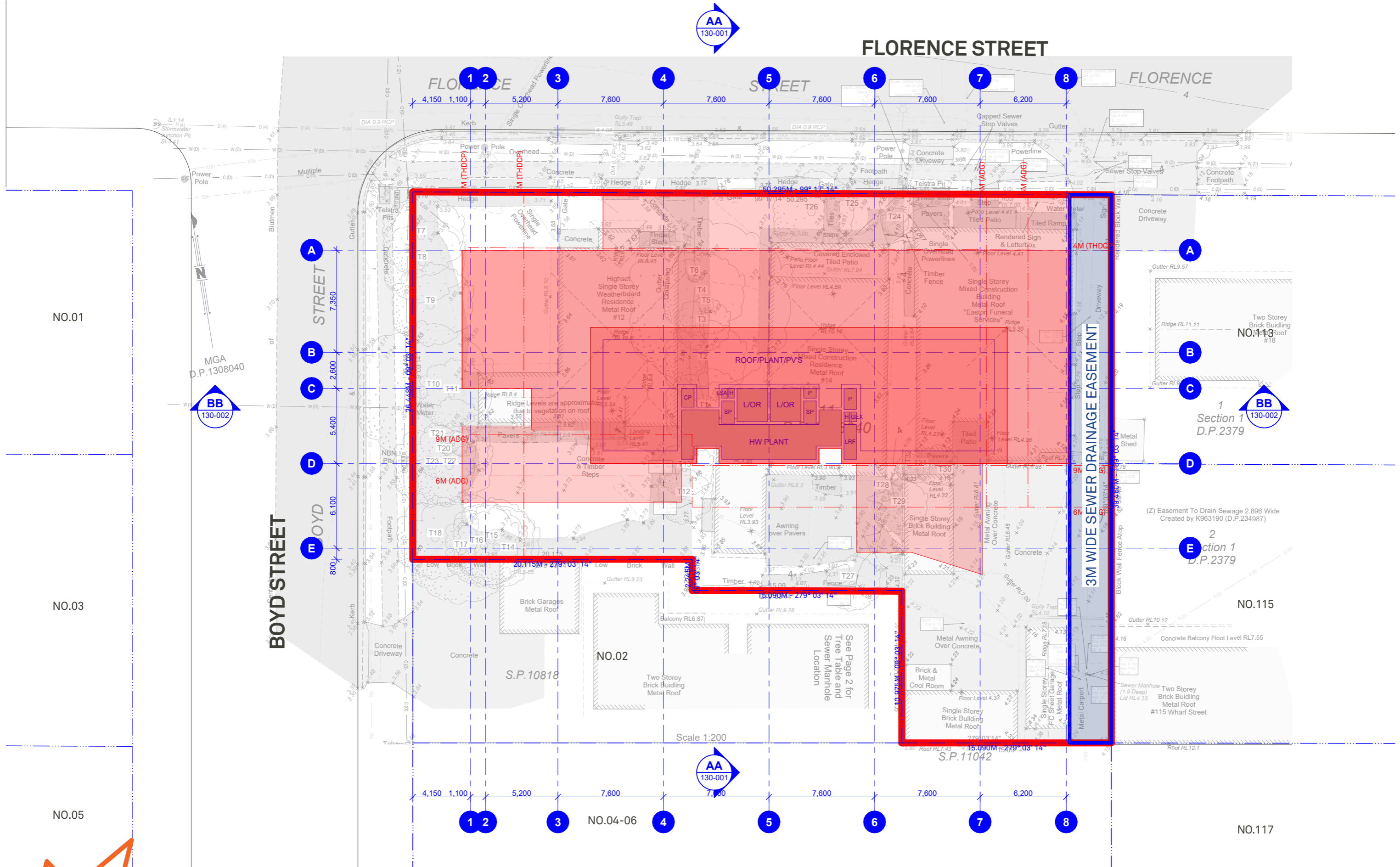
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**2408A - 12-16F**  
 12-16 FLORENCE STREET,  
 TWEED HEADS NSW 2485  
 BUNDJALUNG COUNTRY

STATUS  
 PRELIMINARY DESIGN

DRAWING NUMBER  
**DA-001-001**

SCALE  
 1:1 @ A3

REVISION



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 6/37A KING ROAD,  
 HORNSBY NSW 2077

LEGEND

AMENDMENTS  
 REV DESCRIPTION DRAWN CHK DATE

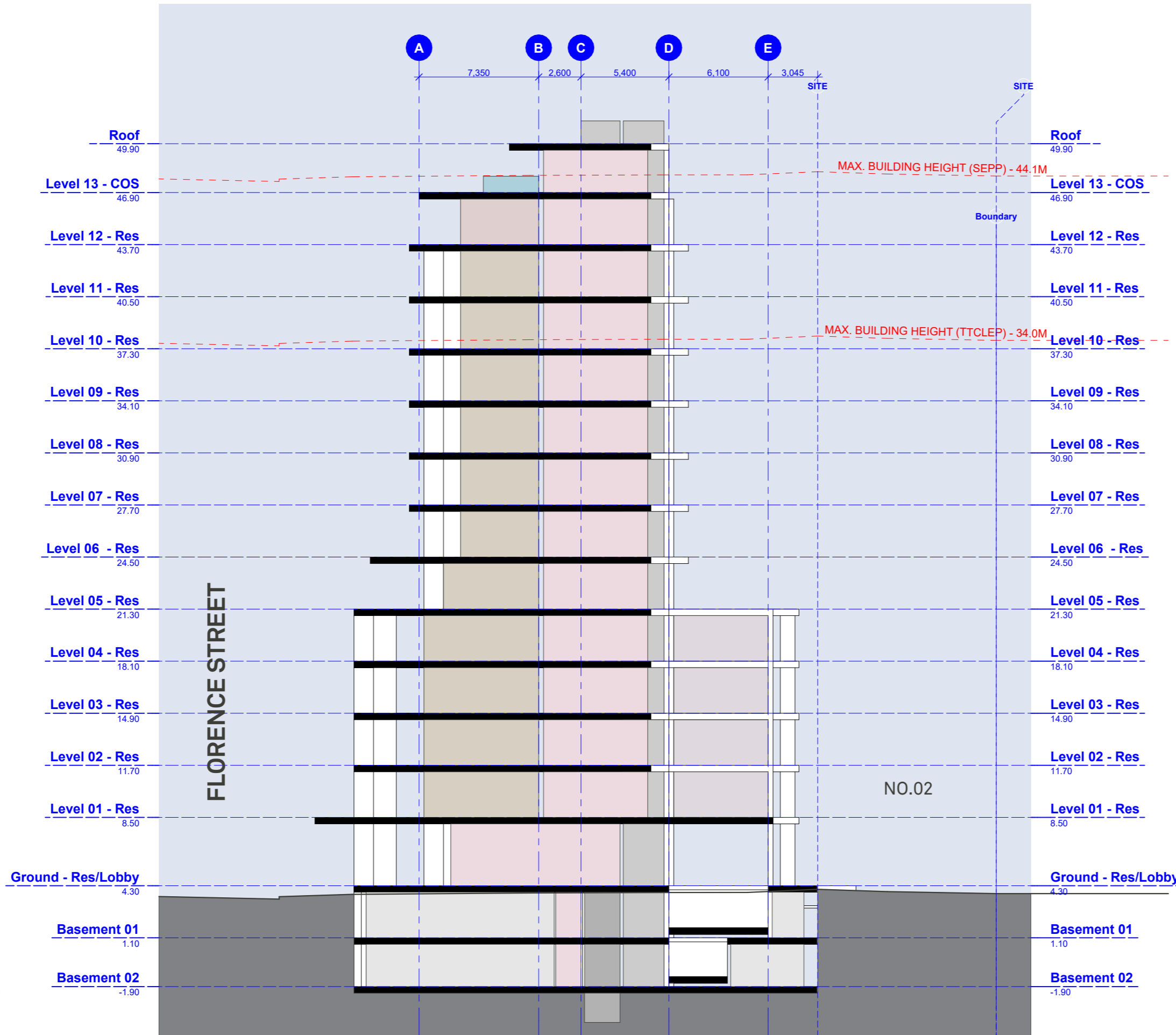


SITE INFORMATION  
**Site Plan**

PROJECT NAME  
**2408A - 12-16F**  
 12-16 FLORENCE STREET,  
 TWEED HEADS NSW 2485  
 BUNDJALUNG COUNTRY

STATUS PRELIMINARY DESIGN SCALE 1:1.25, 1:250 @ A3  
 DRAWING NUMBER DA-001-002 REVISION

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FLORENCE STREET

NO.02

CLIENT  
**DREAMBUILD**  
 6/37A KING ROAD,  
 HORNSBY NSW 2077

LEGEND

AMENDMENTS  
 REV DESCRIPTION DRAWN CHK DATE

PROJECT NAME  
**2408A - 12-16F**  
 12-16 FLORENCE STREET,  
 TWEED HEADS NSW 2485  
 BUNDJALUNG COUNTRY

STATUS  
 PRELIMINARY DESIGN

SCALE  
 1:250 @ A3

DRAWING NUMBER  
**DA-130-001**

REVISION

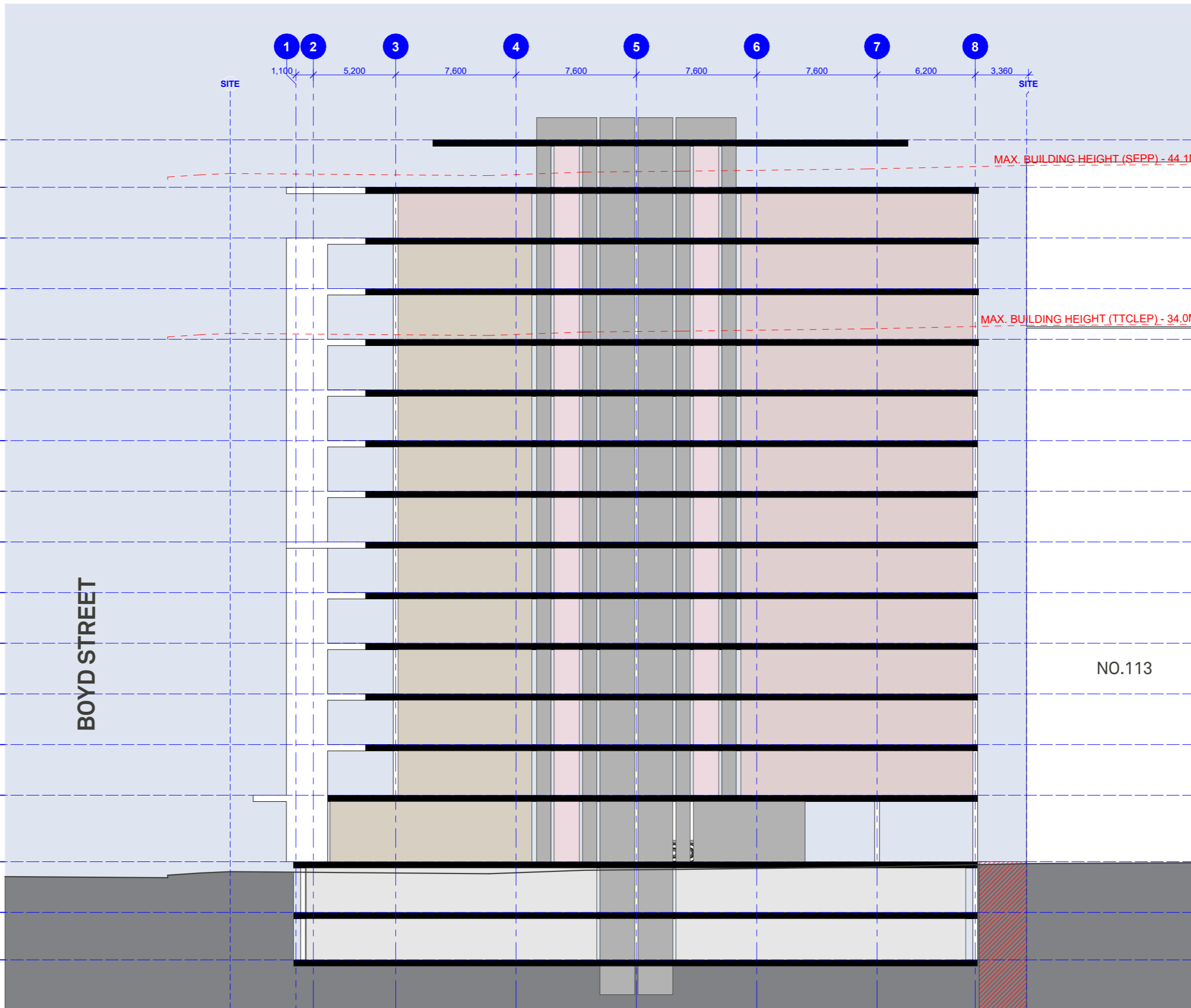
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NOMINATED ARCHITECTS  
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 G. MCCORMACK ARB NSW 7536, ARBV 20415

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GENERAL ARRANGEMENT SECTIONS  
**Section AA**





CLIENT  
**DREAMBUILD**  
 6/37A KING ROAD,  
 HORNSBY NSW 2077

LEGEND

AMENDMENTS  
 REV DESCRIPTION DRAWN CHK DATE

PROJECT NAME  
**2408A - 12-16F**  
 12-16 FLORENCE STREET,  
 TWEED HEADS NSW 2485  
 BUNDJALUNG COUNTRY

STATUS  
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REVISION

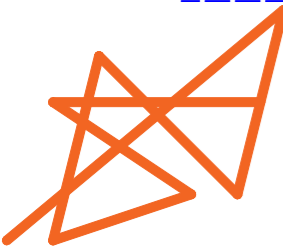
5 / 505 BALMAIN RD LILYFIELD NSW 2040  
 +61 2 9818 0777  
 WWW.BENSONMCCORMACK.COM  
 ENQUIRIES@BENSONMCCORMACK.COM

NOMINATED ARCHITECTS  
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 G. MCCORMACK ARB NSW 7536, ARBV 20415

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GENERAL ARRANGEMENT SECTIONS  
**Section BB**

**BENSON McCORMACK**  
 ARCHITECTURE



# **APPENDIX 4 - GEOLOGY AND SOIL LANDSCAPE**





Figure 4 - Soil Landscape (Source: eSPADE NSW)



Figure 5 - Geology Map Cenozoic (Source: Geoscience Australia)

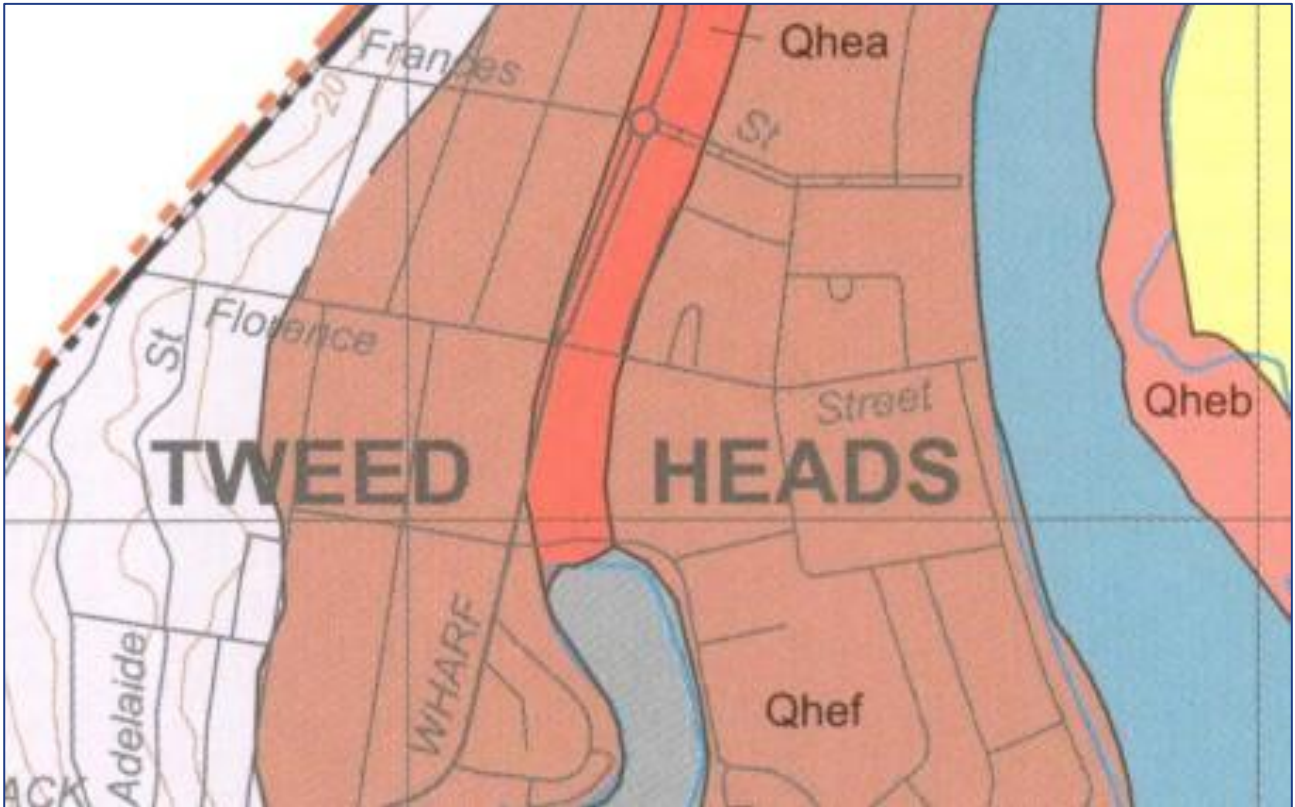


Figure 6 – Geology Map Qhef (Source: *Coastal Quaternary Geology Tweed Heads 1:25000*)

Estuarine Plain System

Qhek	Holocene coastal lagoon: organic mud, marine sand, clay, silt, shell
Qhei	Holocene interbarrier creek deposits: marine sand, silt, clay, organic mud, peat, gravel, shell
Qhes	Holocene saline swamp: organic mud, peat, clay, silt, marine sand, fluvial sand
Qhef	Holocene tidal-delta flat: marine sand, silt, clay, shell, gravel
Qher	Holocene estuarine shoreline ridge and dune: fluvial sand, marine sand, gravel, silt, clay, shell
Qhem	Holocene estuarine basin and bay: clay, silt, shell, fluvial or marine sand
Qheb	Holocene estuarine in-channel bar and beach: marine sand, silt, clay, shell, gravel
Qhea	Holocene estuarine palaeochannel fill: organic mud, peat, clay, silt, marine sand
Qpef	Pleistocene tidal-delta flat: marine sand, silt, minor clay, indurated sand, shell

# **APPENDIX 5 - LICENSED GROUNDWATER BORES**





Figure 7 – Groundwater Bore Locations (Source: <http://allwaterdata.water.nsw.gov.au/water.stm>)

# APPENDIX 6 - ZONE MAPPING



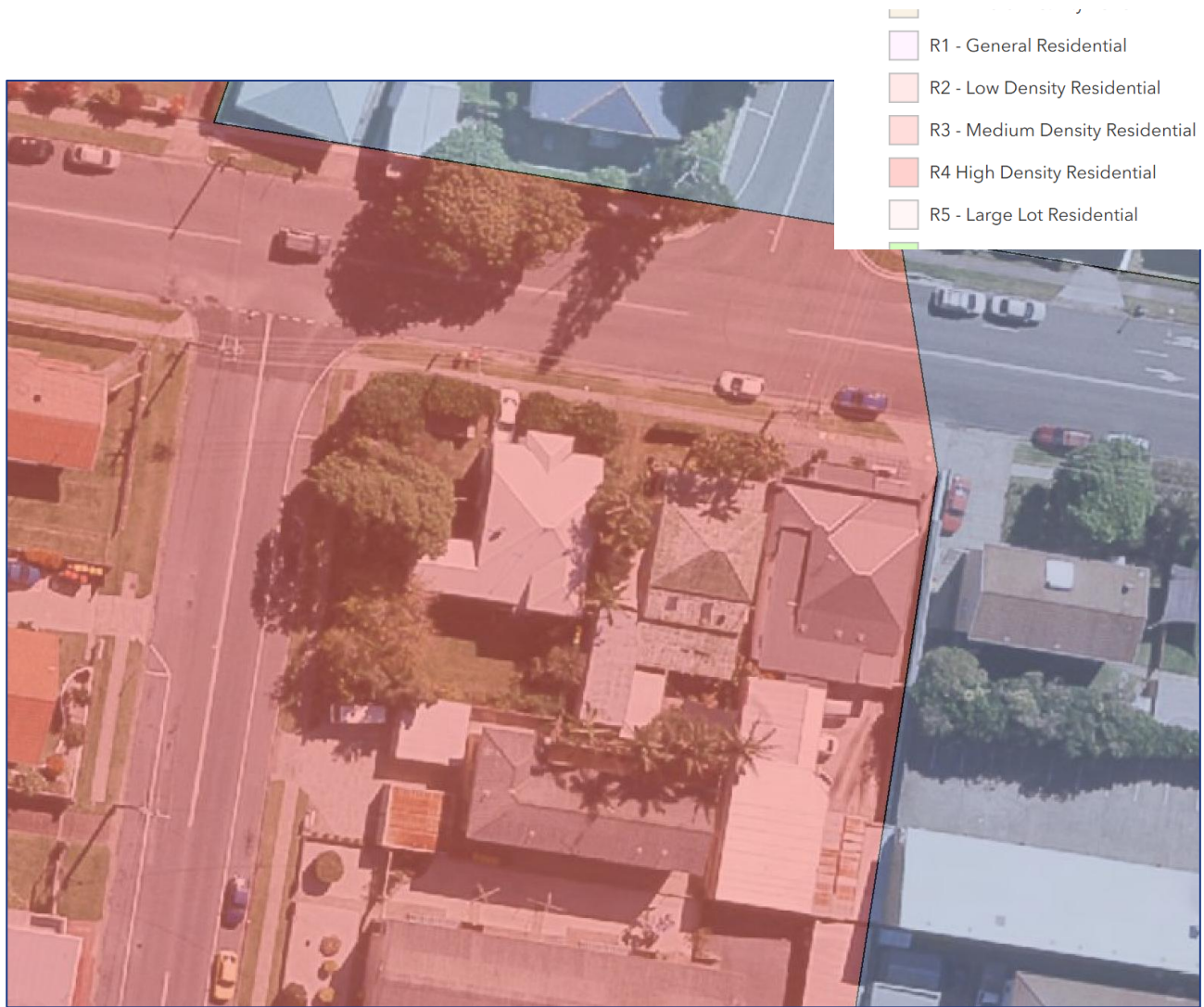


Figure 8 – NSW Legislation Zone Plan

(Source: <https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address>)

# **APPENDIX 7 - ELEVATION OF ASS IN NSW (WILSON ET AL FIG. 2)**



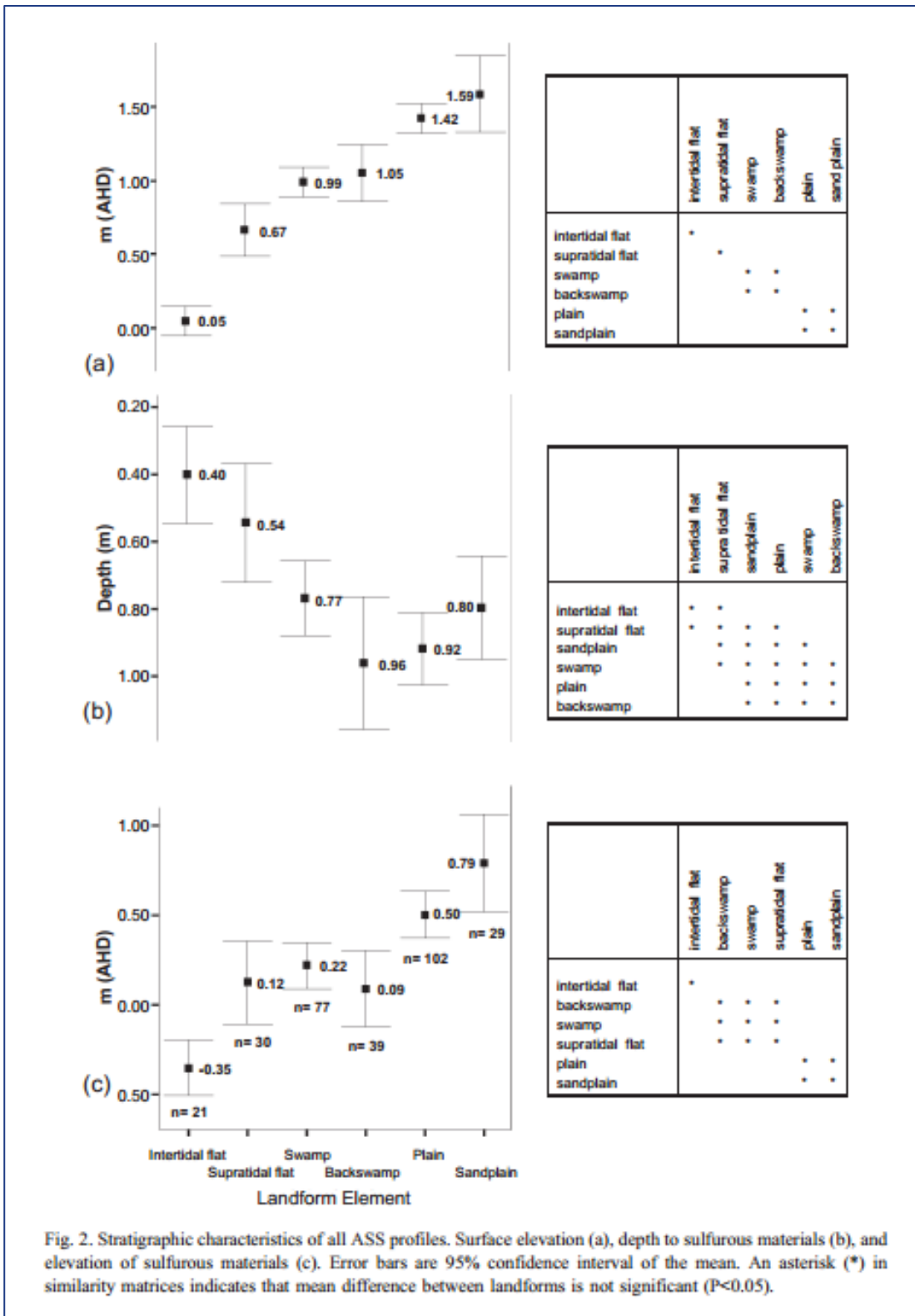


Fig. 2. Stratigraphic characteristics of all ASS profiles. Surface elevation (a), depth to sulfurous materials (b), and elevation of sulfurous materials (c). Error bars are 95% confidence interval of the mean. An asterisk (\*) in similarity matrices indicates that mean difference between landforms is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

# APPENDIX 8 - PHOTOGRAPHIC LOG



Photo No.	Date
1	11/9/24
<b>Description:</b> BH1	



Photo No.	Date
2	11/9/24
<b>Description:</b> BH2	

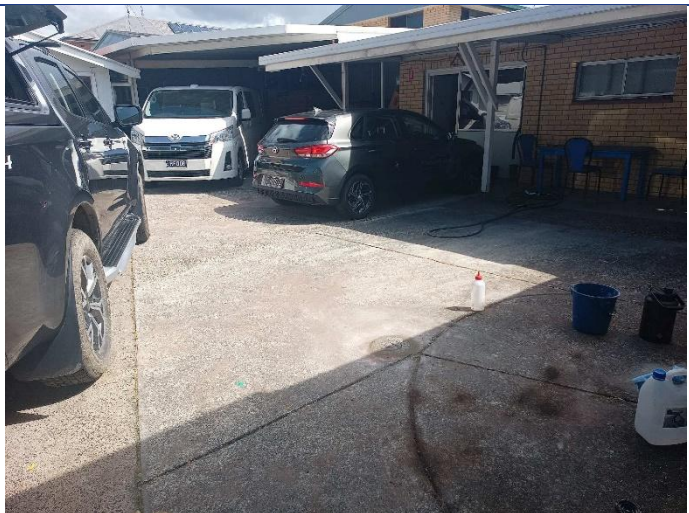
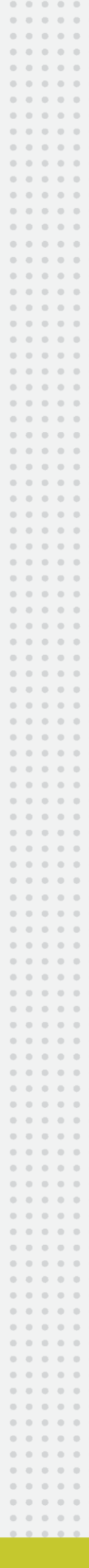


Photo No. 3	Date 4/10/24	
<p><b>Description:</b> BH5</p>		

# **APPENDIX 9 - SITE PLAN - SAMPLING LOCATIONS**



# ACID SULFATE SOIL INVESTIGATION

## SAMPLING LOCATIONS

 HMC Sampling Locations



Lot 1 DP781624, Lot 1 DP419177  
& Lot 2 DP 300515  
12-14 Florence Street  
Tweed Heads NSW

HMC2024.1001  
DATE: October 2024  
VERSION: 30/10/2024  
DRAWN: MF  
BASE: Nearmap 2024

HMC Environmental Consulting Pty Ltd  
Tweed Heads NSW  
0755368863  
[www.hmcenvironment.com.au](http://www.hmcenvironment.com.au)  
[admin@hmcenvironment.com.au](mailto:admin@hmcenvironment.com.au)



Scale:  
0 5 10m

# **APPENDIX 10 - SITE PLAN - TREATMENT AREA**





# APPENDIX 11 - BORELOGS





PROJECT: <b>HMC2024.1001</b>	BORING ID: <b>ASS</b>	
	WELL ID: <b>BH1</b>	
	NORTHING: <b>68833183.73 S</b>	EASTING: <b>553081.29E</b>
	GROUND SURFACE ELEV.: <b>4.2m AHD</b>	TOC ELEVATION:
	TOTAL DEPTH: <b>8.5m</b>	DEPTH TO WATER: <b>8.5m</b>
LOGGED BY: <b>MT</b>	DATE STARTED: <b>11.9.24</b>	DATE COMPLETED: <b>11.9.24</b>

Depth (feet)	USCS	Graphic Log	Description	Sampling Interval
0	SM		SAND Silty, loose, medium grained, dark brown, dry	
1			SAND Dense fine grained, pale grey, dry	
2	SP			
3	SP		SAND, Dense, fine grained, grey brown, moist to wet	
4			SAND Dense to very dense, dark brown fine grained, wet	
5	SM			
6				
7	SM		SAND Dense, light brown, wet	
			SAND Dense, brown, wet	
	SM			
8	SM		SAND Dense, light brown, wet	
			Hole terminated at 8.5m	
9				

2.5

NOTES:



NOTES:



PROJECT:  
**HMC2024.1001**

BORING ID:  
**ASS**

LOCATION:  
**12-16 Florence Street**

WELL ID:  
**BH3**

DRILLING CONTRACTOR:  
**Pacific Geotech**

NORTHING:  
**6883215.11 S**

EASTING:  
**553081.29 E**

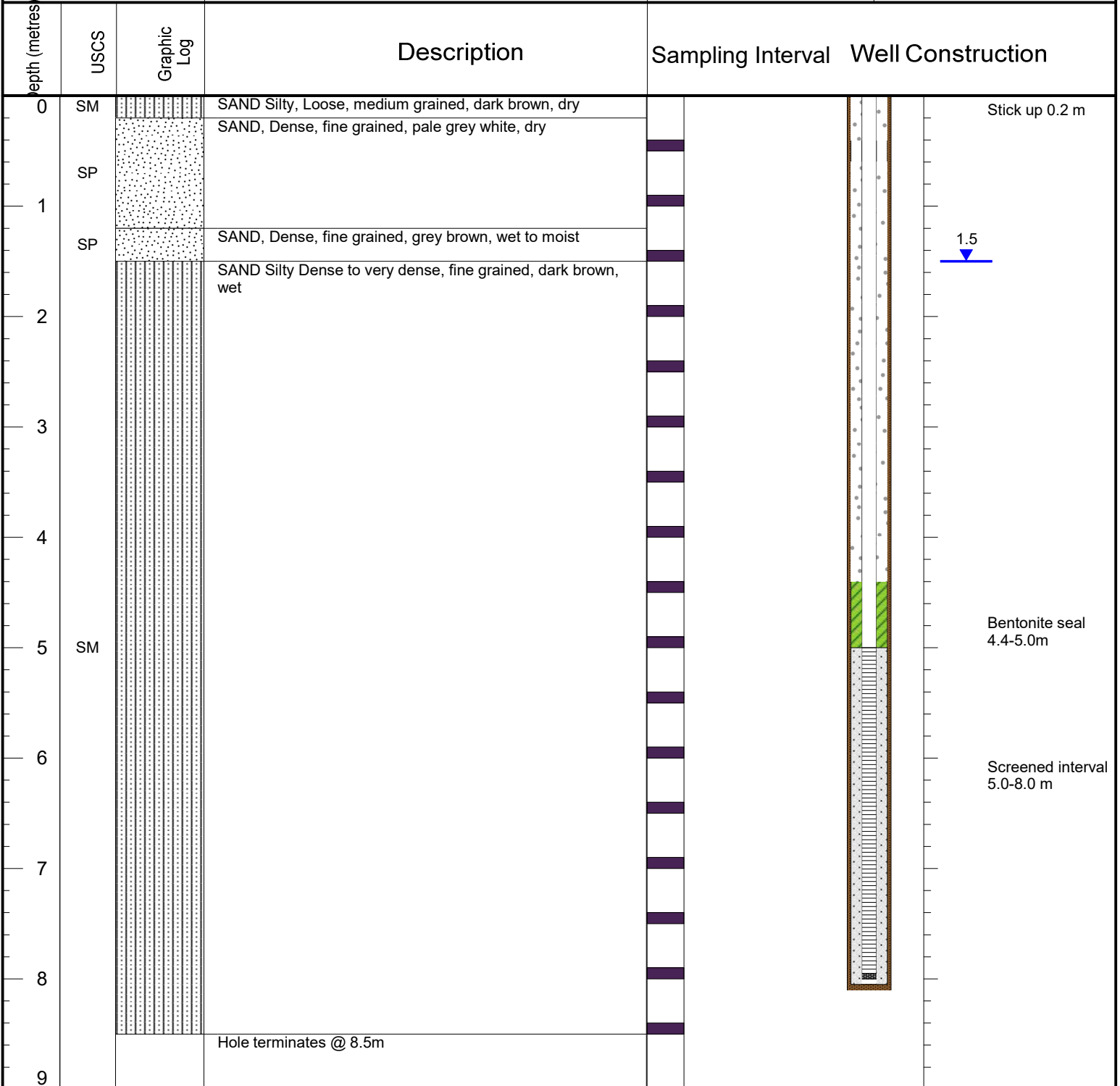
GROUND SURFACE ELEV.: **3.6m AHD**      TOC ELEVATION:

TOTAL DEPTH: **9**      DEPTH TO WATER: **1.5 m**

LOGGED BY:  
**JF**

DATE STARTED:  
**4.10.24**

DATE COMPLETED:  
**4.10.24**



NOTES:



PROJECT: <b>HMC2024.1001</b>	BORING ID: <b>ASS</b>	
	WELL ID: <b>BH4</b>	
	NORTHING: <b>6883213.77</b>	EASTING: <b>553063.35 E</b>
	GROUND SURFACE ELEV.: <b>3.6m AHD</b>	TOC ELEVATION:
	TOTAL DEPTH: <b>4</b>	DEPTH TO WATER: <b>2.5m</b>
LOGGED BY: <b>MT</b>	DATE STARTED: <b>11.09.24</b>	DATE COMPLETED: <b>11.09.24</b>

depth (metres)	USCS	Graphic Log	Description	Sampling Interval
0	SM		SAND Silty, Loose, medium grained, dark brown, moist	
1	SP		SAND, Dense, fine grained, pale grey white, moist	
2	SP		SAND, Dense, fine grained, grey, moist to wet	
3	SM		SAND Dense to very dense, dark brown fine grained, wet	
4			Hole terminated at 4m very dense indurated sand	

2.5

NOTES:



PROJECT:  
**HMC2024.1001**

LOCATION:  
**12-16 Florence Street**

DRILLING CONTRACTOR:  
**Pacific Geotech**

BORING ID:  
**ASS**

WELL ID:  
**BH5**

NORTHING:  
**6883213.77**

EASTING:  
**553063.35 E**

GROUND SURFACE ELEV.: **3.6m AHD**

TOC ELEVATION:

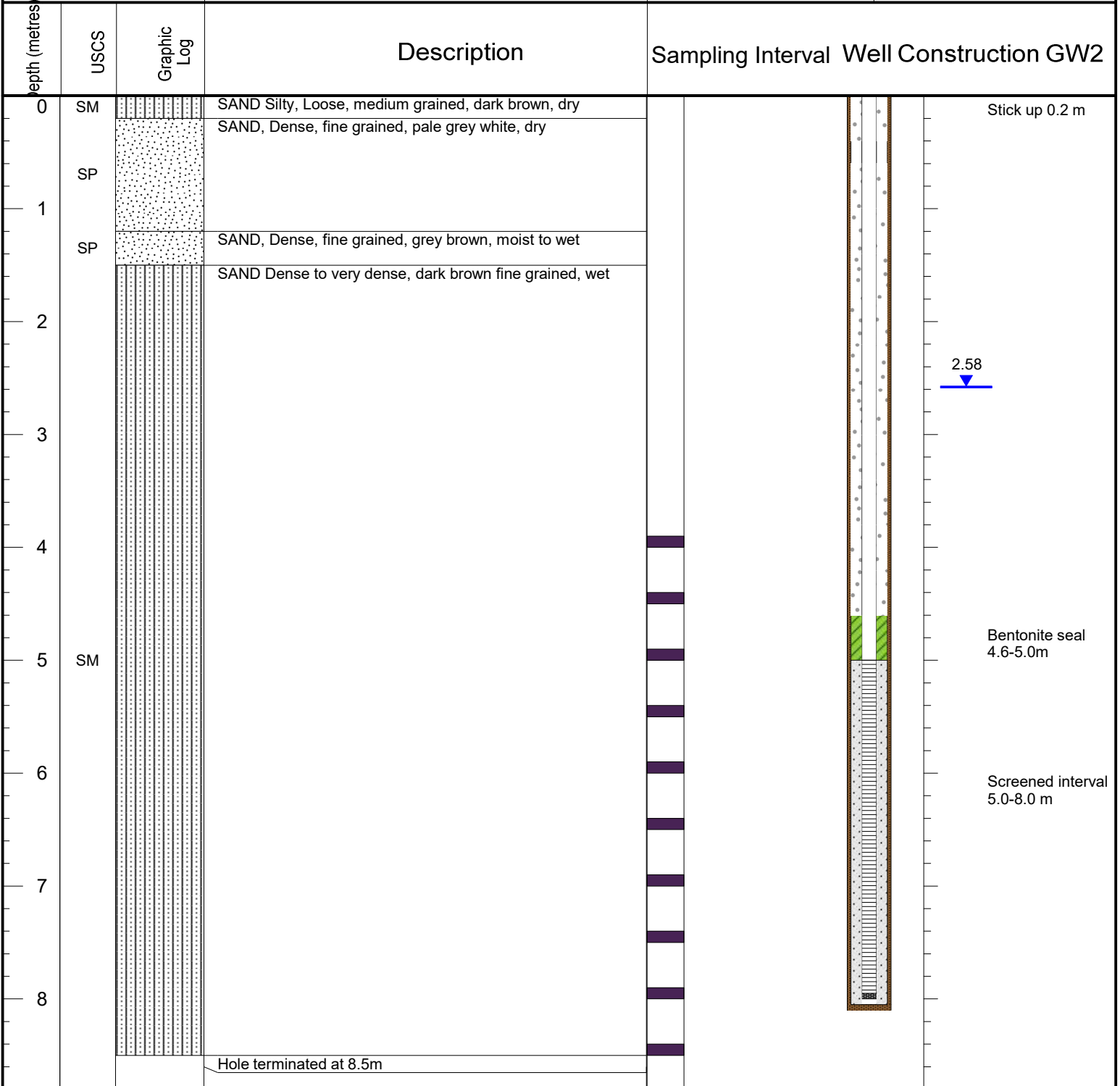
TOTAL DEPTH:  
**8.5**

DEPTH TO WATER:  
**2.58**

LOGGED BY:  
**MT**

DATE STARTED:  
**11.10.24**

DATE COMPLETED:  
**11.10.24**



NOTES:

# **APPENDIX 12 - LABORATORY CERTIFICATES**





**CHAIN OF CUSTODY**

ALS Laboratory: please tick →

ADLAIDE 311 Burma Road Puerba SA 5095  
Ph: 08 8162 9130 E: adelaide@alsglobal.com

BRISBANE 2 Byth Street Stinson QLD 4057  
Ph: 07 3243 7223 E: samples.brisbane@alsglobal.com

GLADSTONE 48 Calkin Road Gladstone QLD 4680  
Ph: 07 4973 7844 E: ALS@enviro.gladstone@alsglobal.com

ORACANY 222 Caterpillar Drive Paget QLD 4740  
Ph: 07 4652 8785 E: ALS@enviro Mackay@alsglobal.com

MELBOURNE 2-4 Westal Road Springvale VIC 3171  
Ph: 03 8549 0600 E: samples.melbourne@alsglobal.com

MUDGEE 12/19 Hydrex Road Mudgen NSW 2850  
Ph: 02 6372 0735 E: mudgen.m3@alsglobal.com

NEWCASTLE 5496 Maitland Road Mayfield West NSW 2304  
Ph: 02 4014 2500 E: samples.newcastle@alsglobal.com

NOOWRA 413 Geary Place North Nowra NSW 2541  
Ph: 02 4473 2883 E: nowra@alsglobal.com

PERTH 13 Hod Way Malaga WA 6060  
Ph: 08 9269 7855 E: samples.perth@alsglobal.com

SYDNEY 277  
Ph: 02 8784 831

TOWNSVILLE  
Ph: 07 4759 050

WOLLONGONG  
Ph: 02 4225 211



Telephone: +61-7-3552-8687

CLIENT: HMC ENVIRONMENTAL CONSULTING		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List due date): (Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		FOR LABORATOR	
OFFICE: SUITE 29/LEVEL 2, 75 WHARF STREET TWEED HEADS		<input type="checkbox"/> Non Standard or urgent TAT (List due date):		Custody Seal Intact?	
PROJECT: FLORENCE STREET TWEED HEADS	PROJECT NO 2024.1001.1	ALS QUOTE NO.:		Free ice / frozen ice by receipt?	
ORDER NUMBER:	PURCHASE ORDER NO.: 2024.1011.1	COUNTRY OF ORIGIN: AUSTRALIA		Random Sample Tem:	
PROJECT MANAGER: MARK TUNKS	CONTACT PH: 0755 368863	COC SEQUENCE NUMBER (Circle)		Other comment:	
SAMPLER:	SAMPLER MOBILE: 0408 279212	RECEIVED BY: <i>Eti</i>		RECEIVED BY:	
COC Emailed to ALS? ( YES / NO)	EDD FORMAT (or default):	DATE/TIME: <i>20/09/2024 1540</i>		DATE/TIME:	
Email Reports to (will default to PM if no other addresses are listed):		DATE/TIME: <i>20/9/2024</i>		DATE/TIME:	
Email Invoice to (will default to PM if no other addresses are listed):					

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: EA003 ANALYSIS ON SELECTED SAMPLES WILL BE IDENTIFIED AFTER INITIAL EA003 SCREENING

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)							Additional Information	
	LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA003 - pHf & pHtox							
1	BH1_0.5	11/09/2024 0:00	S	ASS			x							
2	BH1_1.0	11/09/2024 0:00	S	ASS			x							
3	BH1_1.5	11/09/2024 0:00	S	ASS			x							
4	BH1_2.0	11/09/2024 0:00	S	ASS			x							
5	BH1_2.5	11/09/2024 0:00	S	ASS			x							
6	BH1_3.0	11/09/2024 0:00	S	ASS			x							
7	BH1_3.5	11/09/2024 0:00	S	ASS			x							
8	BH1_4.0	11/09/2024 0:00	S	ASS			x							
9	BH1_4.5	11/09/2024 0:00	S	ASS			x							
10	BH1_5.0	11/09/2024 0:00	S	ASS			x							
11	BH1_5.5	11/09/2024 0:00	S	ASS			x							
12	BH1_6.0	11/09/2024 0:00	S	ASS			x							
TOTAL						12	12							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Luquols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

QUEENSLAND 311 Burns Road, Ipswich QLD 4705  
Ph: 07 4662 5100 E: adeelaide@alsglobal.com

QUEENSLAND 2 Byth Street, Stafford QLD 4052  
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

QUEENSLAND 48 Collemann Drive, Gladstone QLD 4680  
Ph: 07 4678 7944 E: ALS@enviro.gladstone@alsglobal.com

QUEENSLAND 203 Cleopatra Drive, Paget QLD 4740  
Ph: 07 4552 5795 E: ALS@enviro Mackay@alsglobal.com

VICTORIA 2-4 Westall Road, Springvale VIC 3171  
Ph: 03 8949 9800 E: samples.melb.vic@alsglobal.com

VICTORIA 1/29 Sydney Road, Mudgee NSW 2850  
Ph: 02 6372 6735 E: mudgee.mel@alsglobal.com

NEWCASTLE 5/566 Marand Road, Mayfield West NSW 2304  
Ph: 02 4614 2505 E: samples.newcastle@alsglobal.com

NSW 4/13 Quarry Place, North Nowra NSW 2541  
Ph: 02 4423 3663 E: nowra@alsglobal.com

WESTERN AUSTRALIA 10 Hud Way, Malaga WA 6060  
Ph: 08 9209 7655 E: samples.perth@alsglobal.com

SYDNEY 277 289 Woodpeck Road, Smithfield NSW 2164  
Ph: 02 8784 2555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Deane Court, Bohra QLD 4918  
Ph: 07 4780 0500 E: ALS@enviro.Townsville@alsglobal.com

WISCONSIN 1115-21 Ralph Blank Drive, Nih Wielongong NSW 2500  
Ph: 02 4223 3125 E: wclongong@alsglobal.com

CLIENT: HMC ENVIRONMENTAL CONSULTING		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: SUITE 29/LEVEL 2, 75 WHARF STREET TWEED HEADS		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		Custody Seal Intact? Yes No N/A	
PROJECT: FLORENCE STREET TWEED HEADS PROJECT NO 2024.1001.1		ALS QUOTE NO.:		Free ice / frozen ice bricks present upon receipt? Yes No N/A	
ORDER NUMBER: PURCHASE ORDER NO.: 2024.1011.1		COUNTRY OF ORIGIN: AUSTRALIA		Random Sample Temperature on Receipt. °C	
PROJECT MANAGER: MARK TUNKS CONTACT PH: 0755 368863		COC SEQUENCE NUMBER (Circle)		Other comment:	
SAMPLER: SAMPLER MOBILE: 0408 279212		COC: 1 2 3 4 5 6 7		RECEIVED BY: EB	
COC Emailed to ALS? ( YES / NO) EDD FORMAT (or default):		OF: 1 2 3 4 5 6 7		DATE/TIME: 20.09.24	
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY: [Signature]		DATE/TIME: 15:40	
Email Invoice to (will default to PM if no other addresses are listed):		DATE/TIME: 20/9/2024		RECEIVED BY:	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: EA033 ANALYSIS ON SELECTED SAMPLES WILL BE IDENTIFIED AFTER INITIAL EA003 SCREENING

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)						Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA003 - PHF & PHOX							Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
13	BH1_6.5	11/09/2024 0:00	S	ASS		x							
14	BH1_7.0	11/09/2024 0:00	S	ASS		x							
15	BH1_7.5	11/09/2024 0:00	S	ASS		x							
16	BH1_8.0	11/09/2024 0:00	S	ASS		x							
17	BH1_8.5	11/09/2024 0:00	S	ASS		x							
18	BH2_0.5	11/09/2024 0:00	S	ASS		x							
19	BH2_1.0	11/09/2024 0:00	S	ASS		x							
20	BH2_1.5	11/09/2024 0:00	S	ASS		x							
21	BH2_2.0	11/09/2024 0:00	S	ASS		x							
22	BH2_2.5	11/09/2024 0:00	S	ASS		x							
23	BH2_3.0	11/09/2024 0:00	S	ASS		x							
24	BH2_3.5	11/09/2024 0:00	S	ASS		x							
<b>TOTAL</b>					12	12							

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved, Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.



# CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 3/1 Burnside Road Roseworthy SA 5095  
Ph: 08 8362 5130 E: adelaide@alsglobal.com

BIRKBECK 7 Byth Street Sturtford QLD 4051  
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 48 Capemendah Drive Gladstone QLD 4690  
Ph: 07 4678 7944 E: ALS.Enquiries.Gladstone@alsglobal.com

MACRAE Unit 2/20 Casperlin Drive Paget QLD 4749  
Ph: 07 4652 6785 E: Al.Nevins.Mackay@alsglobal.com

MELBOURNE 7-4 Westall Road Springvale VIC 3171  
Ph: 03 8548 9604 E: samples.melbourne@alsglobal.com

MUDGEES 1/29 Sydney Road Mudgee NSW 2855  
Ph: 02 6372 6735 E: mudgee.mel@alsglobal.com

NEWCASTLE 5/565 Mermaid Road Mayfield West NSW 2304  
Ph: 02 4914 2609 E: samples.newcastle@alsglobal.com

NEWRA 4/13 Geary Place North Newra NSW 2541  
Ph: 02 4423 2693 E: newra@alsglobal.com

PERTH 10 Hood Way Malaga WA 6090  
Ph: 08 5209 7653 E: samples.perth@alsglobal.com

SYDNEY 277-289 Wentworth Road Smithfield NSW 2169  
Ph: 02 8794 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-16 Desma Court Drake QLD 4781  
Ph: 07 4766 8659 E: ALS.enquiries.townsville@alsglobal.com

WOLLONGONG 1/19-21 Ralph Black Drive Hih Wollongong NSW 2519  
Ph: 02 4225 3125 E: wollongong@alsglobal.com

CLIENT: HMC ENVIRONMENTAL CONSULTING		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)		
OFFICE: SUITE 29/LEVEL 2, 75 WHARF STREET TWEED HEADS		(Standard TAT may be longer for some tests e.g., Ultra Trace Organics)		Custody Seal Intact? Yes No N/A		
PROJECT: FLORENCE STREET TWEED HEADS PROJECT NO 2024.1001.1		ALS QUOTE NO.:		Free ice / frozen ice bricks present upon receipt? Yes No N/A		
ORDER NUMBER:	PURCHASE ORDER NO.: 2024.1011.1	COUNTRY OF ORIGIN: AUSTRALIA		Random Sample Temperature on Receipt: °C		
PROJECT MANAGER: MARK TUNKS CONTACT PH: 0755 368863		COC SEQUENCE NUMBER (Circle)		Other comment:		
SAMPLER: SAMPLER MOBILE: 0408 279212		RELINQUISHED BY:		RECEIVED BY: EK		RECEIVED BY:
COC Emailed to ALS? ( YES / NO) EDD FORMAT (or default):		DATE/TIME: 10.50 20/7/2024		DATE/TIME: 20.09.24 1540		DATE/TIME:
Email Reports to (will default to PM if no other addresses are listed):						
Email Invoice to (will default to PM if no other addresses are listed):						

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: EA033 ANALYSIS ON SELECTED SAMPLES WILL BE IDENTIFIED AFTER INITIAL EA003 SCREENING

ALS USE ONLY	SAMPLE DETAILS MATRIX: Solid(S) Water(W)			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB, Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required)							Additional Information	
LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA003 - pH & pHox								Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
25	BH2_4.0	11/09/2024 0:00	S	ASS		x								
26	BH2_4.3	11/09/2024 0:00	S	ASS		x								
27	BH3_0.5	11/09/2024 0:00	S	ASS		x								
28	BH3_1.0	11/09/2024 0:00	S	ASS		x								
29	BH3_1.5	11/09/2024 0:00	S	ASS		x								
30	BH3_2.0	11/09/2024 0:00	S	ASS		x								
31	BH3_2.5	11/09/2024 0:00	S	ASS		x								
32	BH3_3.0	11/09/2024 0:00	S	ASS		x								
33	BH3_3.5	11/09/2024 0:00	S	ASS		x								
34	BH3_4.0	11/09/2024 0:00	S	ASS		x								
TOTAL					10	10								

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic  
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;  
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.





# CHAIN OF CUSTODY

ALS Laboratory: please tick →

QUADELANDE 311 Bama Road Inverack SA 4805  
Ph: 08 19192 5130 E: adelaide@alsglobal.com

QUEENSLAND 2 Ilyin Street Stafford QLD 4065  
Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 48 Callenloch Drive Gladstone QLD 4685  
Ph: 07 4978 7944 E: A.SF@nere Gladstone@alsglobal.com

QUEENSLAND 2120 Caterpillar Drive Page Rd 4740  
Ph: 07 4862 5755 E: A.SF@nere Mackay@alsglobal.com

QUEENSLAND 2-4 Westall Road Springvale VIC 3171  
Ph: 03 9548 9626 E: samples.melbourne@alsglobal.com

QUEENSLAND 1229 Sydney Road Mudgee NSW 2850  
Ph: 02 6372 6735 E: mudgee.mai@alsglobal.com

NEWCASTLE 6/585 Maitland Road Mayfield West NSW 2304  
Ph: 02 4014 2600 E: samples.newcastle@alsglobal.com

NEWCASTLE 4/13 Geary Place North Maitland NSW 2341  
Ph: 02 4423 2063 E: newra@alsglobal.com

PERTH 10 Ross Way Melina WA 2009  
Ph: 08 0260 7655 E: samples.perth@alsglobal.com


SYDNEY 27-288 Woodpark Road Smithfield NSW 2164  
Ph: 02 8714 8555 E: samples.sydney@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bahra QLD 4610  
Ph: 07 4750 0500 E: ALS@nere Townsville@alsglobal.com

WOLLONGONG 1/10-21 Pulpin Black Drive Nth Wollongong NSW 2509  
Ph: 02 4225 2125 E: wollongong@alsglobal.com

CLIENT: HMC ENVIRONMENTAL CONSULTING		TURNAROUND REQUIREMENTS : <input checked="" type="checkbox"/> Standard TAT (List due date):		FOR LABORATORY USE ONLY (Circle)	
OFFICE: SUITE 29/LEVEL 2, 75 WHARF STREET TWEED HEADS		(Standard TAT may be longer for some tests e.g. Ultra Trace Organics) <input type="checkbox"/> Non Standard or urgent TAT (List due date):		Custody Seal Intact? Yes No N/A	
PROJECT: FLORENCE STREET TWEED HEADS PROJECT NO.:		ALS QUOTE NO.:		Free ice / frozen ice bricks present upon receipt? Yes No N/A	
ORDER NUMBER: HMC2024.1001 PURCHASE ORDER NO.:		COUNTRY OF ORIGIN: AUSTRALIA		Random Sample Temperature on Receipt: °C	
PROJECT MANAGER: MARK TUNKS CONTACT PH: 0755 368863		COC SEQUENCE NUMBER (Circle)		Other comment:	
SAMPLER: SAMPLER MOBILE: 0408 279212		COC: ① 2 3 4 5 6 7		RECEIVED BY: 9/10	
COC Emailed to ALS? ( YES / NO)		OF: ① 2 3 4 5 6 7		RECEIVED BY:	
Email Reports to (will default to PM if no other addresses are listed):		RELINQUISHED BY: [Signature]		DATE/TIME: 8/10/2024 10:30	
Email Invoice to (will default to PM if no other addresses are listed):		RECEIVED BY: [Signature]		DATE/TIME: 13/1	

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL: EA033 - CHROMIUM SUITE SCREENING TO BE DETERMINED AFTER INITIAL EA093 ANALYSIS

ALS USE ONLY	SAMPLE DETAILS			CONTAINER INFORMATION		ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price)					Additional Information	
	LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL BOTTLES	EA003 - PHIF & PHFOX	EA033 - CHROMIUM SUITE	Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (fold filtered bottle required):			
1	BH3_4.5	4/10/2024 0:00	S	B	1	X						Environmental Division Brisbane Work Order Reference <b>EB2434685</b>  Telephone : + 61-7-3552-8686
2	BH3_5.0	4/10/2024 0:00	S	B	1	X						
3	BH3_5.5	4/10/2024 0:00	S	B	1	X						
4	BH3_6.0	4/10/2024 0:00	S	B	1	X						
5	BH3_6.5	4/10/2024 0:00	S	B	1	X						
6	BH3_7.0	4/10/2024 0:00	S	B	1	X						
7	BH3_7.5	4/10/2024 0:00	S	B	1	X						
8	BH3_8.0	4/10/2024 0:00	S	B	1	X						
9	BH3_8.5	4/10/2024 0:00	S	B	1	X						
TOTAL					9	9						

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP = Airfreight Unpreserved Plastic; V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass; Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag; LI = Lugols Iodine Preserved Bottles; STT = Sterile Sodium Thiosulfate Preserved Bottles.





## CERTIFICATE OF ANALYSIS

**Work Order** : **EB2432542**  
**Client** : **HMC ENVIRONMENTAL**  
**Contact** : **MARK TUNKS**  
**Address** : **SUITE 29, LEVEL 2 75-77 WHARF STREET  
TWEED HEADS 2485**  
**Telephone** : **07 5536 8863**  
**Project** : **2024.1001.1 FLORENCE STREET TWEED HEADS**  
**Order number** : **2024.1011.1**  
**C-O-C number** : **----**  
**Sampler** : **----**  
**Site** : **----**  
**Quote number** : **EN/222**  
**No. of samples received** : **43**  
**No. of samples analysed** : **42**

**Page** : 1 of 11  
**Laboratory** : Environmental Division Brisbane  
**Contact** : Customer Services EB  
**Address** : 2 Byth Street Stafford QLD Australia 4053  
**Telephone** : +61-7-3552-8685  
**Date Samples Received** : 20-Sep-2024 15:40  
**Date Analysis Commenced** : 26-Sep-2024  
**Issue Date** : 27-Sep-2024 16:37



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



## General Comments

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

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

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

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

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

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

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

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_0.5	BH1_1.0	BH1_1.5	BH1_2.0	BH1_2.5
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2432542-001	EB2432542-002	EB2432542-003	EB2432542-004	EB2432542-005	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	5.0	5.1	6.0	6.1	6.6	
pH (Fox)	----	0.1	pH Unit	2.5	3.2	3.8	3.9	3.4	
Reaction Rate	----	1	Reaction Unit	2	2	2	2	2	



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_3.0	BH1_3.5	BH1_4.0	BH1_4.5	BH1_5.0
				Sampling date / time	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Compound	CAS Number	LOR	Unit		EB2432542-006	EB2432542-007	EB2432542-008	EB2432542-009	EB2432542-010
					Result	Result	Result	Result	Result
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		6.4	5.8	5.6	5.3	5.2
pH (Fox)	----	0.1	pH Unit		4.0	3.5	3.2	2.6	2.7
Reaction Rate	----	1	Reaction Unit		2	2	2	2	2



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_5.5	BH1_6.0	BH1_6.5	BH1_7.0	BH1_7.5
				Sampling date / time	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Compound	CAS Number	LOR	Unit		EB2432542-011	EB2432542-012	EB2432542-013	EB2432542-014	EB2432542-015
					Result	Result	Result	Result	Result
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		5.7	5.6	5.6	5.5	5.6
pH (Fox)	----	0.1	pH Unit		3.0	3.2	2.5	2.3	2.1
Reaction Rate	----	1	Reaction Unit		2	2	2	2	3



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_8.0	BH1_8.5	BH2_0.5	BH2_1.0	BH2_1.5
				Sampling date / time	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Compound	CAS Number	LOR	Unit		EB2432542-016	EB2432542-017	EB2432542-018	EB2432542-019	EB2432542-020
					Result	Result	Result	Result	Result
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		5.8	5.7	5.6	5.7	5.9
pH (Fox)	----	0.1	pH Unit		1.7	1.5	2.5	2.6	3.3
Reaction Rate	----	1	Reaction Unit		3	3	2	2	2



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH2_2.0	BH2_2.5	BH2_3.0	BH2_3.5	BH2_4.0
				Sampling date / time	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Compound	CAS Number	LOR	Unit		EB2432542-021	EB2432542-022	EB2432542-023	EB2432542-024	EB2432542-025
					Result	Result	Result	Result	Result
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		<b>5.9</b>	<b>6.1</b>	<b>6.2</b>	<b>5.8</b>	<b>5.5</b>
pH (Fox)	----	0.1	pH Unit		<b>3.6</b>	<b>3.3</b>	<b>3.8</b>	<b>3.8</b>	<b>3.1</b>
Reaction Rate	----	1	Reaction Unit		<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>	<b>2</b>



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH2_4.3	BH3_0.5	BH3_1.0	BH3_1.5	BH3_2.0
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2432542-026	EB2432542-027	EB2432542-028	EB2432542-029	EB2432542-030	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	<b>5.2</b>	<b>7.1</b>	<b>6.6</b>	<b>6.7</b>	<b>7.5</b>	
pH (Fox)	----	0.1	pH Unit	<b>2.3</b>	<b>3.3</b>	<b>4.2</b>	<b>4.2</b>	<b>4.1</b>	
Reaction Rate	----	1	Reaction Unit	<b>2</b>	<b>3</b>	<b>2</b>	<b>2</b>	<b>2</b>	



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH3_2.5	BH3_3.0	BH3_3.5	BH3_4.0	BH4_0.5
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2432542-031	EB2432542-032	EB2432542-033	EB2432542-034	EB2432542-035	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	5.1	5.2	5.1	5.1	6.0	
pH (Fox)	----	0.1	pH Unit	2.6	2.9	2.7	2.3	2.6	
Reaction Rate	----	1	Reaction Unit	2	2	2	2	3	



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH4_1.0	BH4_1.5	BH4_2.0	BH4_2.5	BH4_3.0
				Sampling date / time	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00
Compound	CAS Number	LOR	Unit		EB2432542-036	EB2432542-037	EB2432542-038	EB2432542-039	EB2432542-040
					Result	Result	Result	Result	Result
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		5.8	6.2	6.3	5.6	5.7
pH (Fox)	----	0.1	pH Unit		2.7	3.1	3.6	2.8	2.9
Reaction Rate	----	1	Reaction Unit		2	2	2	2	2



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH4_3.5	BH4_4.0	----	----	----
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	----	----	----	
Compound	CAS Number	LOR	Unit	EB2432542-041	EB2432542-042	-----	-----	-----	
				Result	Result	----	----	----	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	<b>5.7</b>	<b>5.6</b>	----	----	----	
pH (Fox)	----	0.1	pH Unit	<b>3.3</b>	<b>3.0</b>	----	----	----	
Reaction Rate	----	1	Reaction Unit	<b>2</b>	<b>2</b>	----	----	----	



## CERTIFICATE OF ANALYSIS

**Work Order** : **EB2435475**  
**Client** : **HMC ENVIRONMENTAL**  
**Contact** : **MARK TUNKS**  
**Address** : **SUITE 29, LEVEL 2 75-77 WHARF STREET  
TWEED HEADS 2485**  
**Telephone** : **07 5536 8863**  
**Project** : **FLORENCE STREET TWEED HEADS**  
**Order number** : **HMC2024.1001**  
**C-O-C number** : **----**  
**Sampler** : **----**  
**Site** : **----**  
**Quote number** : **EN/222**  
**No. of samples received** : **9**  
**No. of samples analysed** : **9**

**Page** : 1 of 4  
**Laboratory** : Environmental Division Brisbane  
**Contact** : Customer Services EB  
**Address** : 2 Byth Street Stafford QLD Australia 4053  
**Telephone** : +61-7-3552-8685  
**Date Samples Received** : 15-Oct-2024 12:45  
**Date Analysis Commenced** : 22-Oct-2024  
**Issue Date** : 23-Oct-2024 13:53



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



## General Comments

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

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

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

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

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

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

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

- ASS: EA003 (NATA Field and F(ox) screening): pH F(ox) Reaction Rate: 1 - Slight; 2 - Moderate; 3 - Strong; 4 - Extreme



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH5_4.0	BH5_4.5	BH5_5.5	BH5_6.0	BH5_6.5
Sampling date / time				11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2435475-001	EB2435475-002	EB2435475-003	EB2435475-004	EB2435475-005	
				Result	Result	Result	Result	Result	
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit	<b>5.5</b>	<b>5.5</b>	<b>5.6</b>	<b>5.4</b>	<b>6.0</b>	
pH (Fox)	----	0.1	pH Unit	<b>2.0</b>	<b>2.0</b>	<b>2.1</b>	<b>2.1</b>	<b>2.2</b>	
Reaction Rate	----	1	Reaction Unit	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	



### Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH5_7.0	BH5_7.5	BH5_8.0	BH5_8.5	----
				Sampling date / time	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	----
Compound	CAS Number	LOR	Unit		EB2435475-006	EB2435475-007	EB2435475-008	EB2435475-009	-----
					Result	Result	Result	Result	----
<b>EA003 :pH (field/fox)</b>									
pH (F)	----	0.1	pH Unit		<b>5.6</b>	<b>5.9</b>	<b>6.3</b>	<b>6.0</b>	----
pH (Fox)	----	0.1	pH Unit		<b>2.1</b>	<b>2.1</b>	<b>1.8</b>	<b>2.1</b>	----
Reaction Rate	----	1	Reaction Unit		<b>3</b>	<b>3</b>	<b>3</b>	<b>3</b>	----



## CERTIFICATE OF ANALYSIS

**Work Order** : **EB2433603**  
**Client** : **HMC ENVIRONMENTAL**  
**Contact** : **MARK TUNKS**  
**Address** : **SUITE 29, LEVEL 2 75-77 WHARF STREET  
TWEED HEADS 2485**  
**Telephone** : **07 5536 8863**  
**Project** : **2024.1001.1 FLORENCE STREET TWEED HEADS**  
**Order number** : **2024.1001.1**  
**C-O-C number** : **----**  
**Sampler** : **----**  
**Site** : **----**  
**Quote number** : **EN/222**  
**No. of samples received** : **21**  
**No. of samples analysed** : **21**

**Page** : 1 of 7  
**Laboratory** : Environmental Division Brisbane  
**Contact** : Customer Services EB  
**Address** : 2 Byth Street Stafford QLD Australia 4053  
**Telephone** : +61-7-3552-8685  
**Date Samples Received** : 30-Sep-2024 11:42  
**Date Analysis Commenced** : 04-Oct-2024  
**Issue Date** : 08-Oct-2024 16:42



Accreditation No. 825  
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ISO/IEC 17025 - Testing

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This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



## General Comments

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

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

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

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

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

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

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

- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO<sub>3</sub>) 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/m<sup>3</sup> in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m<sup>3</sup>'.



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH2_4.0	BH2_4.3	BH3_2.5	BH3_4.0	BH4_0.5
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2433603-001	EB2433603-002	EB2433603-003	EB2433603-004	EB2433603-005	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	5.2	5.3	5.0	4.9	6.0	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	16	12	24	29	6	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.03	<0.02	0.04	0.05	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.008	0.009	0.008	0.008	0.007	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	0.03	0.03	0.05	0.06	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	21	17	29	34	10	
Liming Rate	----	1	kg CaCO3/t	2	1	2	2	<1	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.03	0.03	0.05	0.06	<0.02	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	21	17	29	34	10	
Liming Rate excluding ANC	----	1	kg CaCO3/t	2	1	2	2	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH4_1.0	BH4_2.0	BH4_2.5	BH4_4.0	BH1_0.5
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2433603-006	EB2433603-007	EB2433603-008	EB2433603-009	EB2433603-010	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	<b>6.0</b>	<b>6.2</b>	<b>5.0</b>	<b>5.5</b>	<b>5.8</b>	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<b>18</b>	<b>8</b>	<b>3</b>	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<b>0.03</b>	<0.02	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	<b>0.007</b>	<b>0.008</b>	<b>0.011</b>	<b>0.007</b>	<b>0.011</b>	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<10	<10	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<b>0.04</b>	<0.02	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<b>26</b>	<b>12</b>	<b>10</b>	
Liming Rate	----	1	kg CaCO3/t	<1	<1	<b>2</b>	<1	<1	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	<b>0.04</b>	<0.02	<0.02	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	<b>26</b>	<b>12</b>	<b>10</b>	
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<b>2</b>	<1	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_1.0	BH1_2.5	BH1_4.0	BH1_4.5	BH1_6.0
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2433603-011	EB2433603-012	EB2433603-013	EB2433603-014	EB2433603-015	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	<b>6.0</b>	<b>6.2</b>	<b>5.1</b>	<b>4.4</b>	<b>5.1</b>	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	<2	<b>13</b>	<b>43</b>	<b>16</b>	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	<b>0.02</b>	<b>0.07</b>	<b>0.02</b>	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	<b>0.006</b>	<b>0.010</b>	<b>0.009</b>	<b>0.019</b>	<b>0.007</b>	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	<10	<10	<b>12</b>	<10	
<b>EA033-D: Retained Acidity</b>									
KCl Extractable Sulfur (23Ce)	----	0.02	% S	----	----	----	<0.02	----	
HCl Extractable Sulfur (20Be)	----	0.02	% S	----	----	----	<0.02	----	
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	----	----	----	<0.02	----	
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	----	----	----	<10	----	
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	----	----	----	<0.02	----	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	<b>1.5</b>	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	<0.02	<b>0.03</b>	<b>0.09</b>	<b>0.03</b>	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	<10	<b>19</b>	<b>57</b>	<b>20</b>	
Liming Rate	----	1	kg CaCO3/t	<1	<1	<b>1</b>	<b>4</b>	<b>2</b>	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	<0.02	<b>0.03</b>	<b>0.09</b>	<b>0.03</b>	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	<10	<b>19</b>	<b>57</b>	<b>20</b>	
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	<1	<b>1</b>	<b>4</b>	<b>2</b>	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Sample ID	BH1_6.5	BH1_7.5	BH1_8.5	BH2_0.5	BH2_1.0
Sampling date / time				11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	11-Sep-2024 00:00	
Compound	CAS Number	LOR	Unit	EB2433603-016	EB2433603-017	EB2433603-018	EB2433603-019	EB2433603-020	
				Result	Result	Result	Result	Result	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	5.2	5.2	5.1	5.6	5.8	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	12	12	19	3	2	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	<0.02	0.03	<0.02	<0.02	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.020	0.110	0.175	0.014	0.008	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	12	69	109	<10	<10	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5	
Net Acidity (sulfur units)	----	0.02	% S	0.04	0.13	0.21	<0.02	<0.02	
Net Acidity (acidity units)	----	10	mole H+ / t	24	81	128	12	<10	
Liming Rate	----	1	kg CaCO3/t	2	6	10	<1	<1	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.04	0.13	0.21	<0.02	<0.02	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	24	81	128	12	<10	
Liming Rate excluding ANC	----	1	kg CaCO3/t	2	6	10	<1	<1	



## Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)		Sample ID			BH2_2.5	----	----	----	----
		Sampling date / time			11-Sep-2024 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EB2433603-021	-----	-----	-----	-----	
				Result	---	---	---	---	
<b>EA033-A: Actual Acidity</b>									
pH KCl (23A)	----	0.1	pH Unit	<b>6.2</b>	----	----	----	----	
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	<2	----	----	----	----	
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	<0.02	----	----	----	----	
<b>EA033-B: Potential Acidity</b>									
Chromium Reducible Sulfur (22B)	----	0.005	% S	<b>0.009</b>	----	----	----	----	
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	<10	----	----	----	----	
<b>EA033-E: Acid Base Accounting</b>									
ANC Fineness Factor	----	0.5	-	<b>1.5</b>	----	----	----	----	
Net Acidity (sulfur units)	----	0.02	% S	<0.02	----	----	----	----	
Net Acidity (acidity units)	----	10	mole H+ / t	<10	----	----	----	----	
Liming Rate	----	1	kg CaCO3/t	<1	----	----	----	----	
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	<0.02	----	----	----	----	
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	<10	----	----	----	----	
Liming Rate excluding ANC	----	1	kg CaCO3/t	<1	----	----	----	----	



## CERTIFICATE OF ANALYSIS

**Work Order** : **EB2436913**  
**Client** : **HMC ENVIRONMENTAL**  
**Contact** : **KERRY HAWKEN**  
**Address** : **SUITE 29, LEVEL 2 75-77 WHARF STREET  
TWEED HEADS 2485**  
**Telephone** : **07 5536 8863**  
**Project** : **FLORENCE STREET TWEED HEADS**  
**Order number** : **HMC2024.1001**  
**C-O-C number** : **----**  
**Sampler** : **----**  
**Site** : **----**  
**Quote number** : **EN/222**  
**No. of samples received** : **5**  
**No. of samples analysed** : **5**

**Page** : 1 of 3  
**Laboratory** : Environmental Division Brisbane  
**Contact** : Customer Services EB  
**Address** : 2 Byth Street Stafford QLD Australia 4053  
**Telephone** : +61-7-3552-8685  
**Date Samples Received** : 24-Oct-2024 13:28  
**Date Analysis Commenced** : 31-Oct-2024  
**Issue Date** : 01-Nov-2024 09:46



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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results

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

### Signatories

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

<i>Signatories</i>	<i>Position</i>	<i>Accreditation Category</i>
Layla Hafner	Acid Sulphate Soils - Chemist	Brisbane Acid Sulphate Soils, Stafford, QLD



## General Comments

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

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

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

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

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

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

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

- ASS: EA033 (CRS Suite): Analysis is performed as per the Acid Sulfate Soils Laboratory Methods Guidelines (2004) and the updated National Acid Sulfate Soils Guidance: National acid sulfate soils identification and laboratory methods manual, Department of Agriculture and Water Resources, Canberra, ACT (2018)
- ASS: EA033 (CRS Suite): ANC not required because pH KCl less than 6.5
- ASS: EA033 (CRS Suite): Liming rate is calculated and reported on a dry weight basis assuming use of fine agricultural lime (CaCO<sub>3</sub>) 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/m<sup>3</sup> in-situ soil', multiply 'reported results' x 'wet bulk density of soil in t/m<sup>3</sup>'.



## Analytical Results

Sub-Matrix: SOIL  
 (Matrix: SOIL)

Sample ID

				BH5_4.0 EB2435475-001	BH5_5.5 EB2435475-003	BH5_6.5 EB2435475-005	BH5_7.5 EB2435475-007	BH5_8.0 EB2435475-008
Sampling date / time				11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00	11-Oct-2024 00:00
Compound	CAS Number	LOR	Unit	EB2436913-001	EB2436913-002	EB2436913-003	EB2436913-004	EB2436913-005
				Result	Result	Result	Result	Result
<b>EA033-A: Actual Acidity</b>								
pH KCl (23A)	----	0.1	pH Unit	4.4	4.9	5.3	5.4	5.4
Titrateable Actual Acidity (23F)	----	2	mole H+ / t	49	24	13	11	8
sulfidic - Titrateable Actual Acidity (s-23F)	----	0.02	% pyrite S	0.08	0.04	0.02	<0.02	<0.02
<b>EA033-B: Potential Acidity</b>								
Chromium Reducible Sulfur (22B)	----	0.005	% S	0.028	0.040	0.033	0.049	0.096
acidity - Chromium Reducible Sulfur (a-22B)	----	10	mole H+ / t	17	25	20	31	60
<b>EA033-D: Retained Acidity</b>								
KCl Extractable Sulfur (23Ce)	----	0.02	% S	<0.02	----	----	----	----
HCl Extractable Sulfur (20Be)	----	0.02	% S	<0.02	----	----	----	----
Net Acid Soluble Sulfur (20Je)	----	0.02	% S	<0.02	----	----	----	----
acidity - Net Acid Soluble Sulfur (a-20J)	----	10	mole H+ / t	<10	----	----	----	----
sulfidic - Net Acid Soluble Sulfur (s-20J)	----	0.02	% pyrite S	<0.02	----	----	----	----
<b>EA033-E: Acid Base Accounting</b>								
ANC Fineness Factor	----	0.5	-	1.5	1.5	1.5	1.5	1.5
Net Acidity (sulfur units)	----	0.02	% S	0.11	0.08	0.05	0.07	0.11
Net Acidity (acidity units)	----	10	mole H+ / t	70	49	33	42	68
Liming Rate	----	1	kg CaCO3/t	5	4	2	3	5
Net Acidity excluding ANC (sulfur units)	----	0.02	% S	0.11	0.08	0.05	0.07	0.11
Net Acidity excluding ANC (acidity units)	----	10	mole H+ / t	70	49	33	42	68
Liming Rate excluding ANC	----	1	kg CaCO3/t	5	4	2	3	5