FOUNDATION EARTH SCIENCES

ACID SULPHATE SOIL ASSESSMENT (ASSA)

Property Address

105, 109, 111, 121 Hunter Street, 3 Morgan Street, 66-74 King Street & 22 Newcomen Street,
Newcastle NSW

Prepared for

East End Stage 3 Pty Ltd

Date

April 2023

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Prepared		Ray Liu B. Env Eng	13/04/2023
Authorised		Benjamin Buckley B.Env Sc., BSc (Forensics)	20/04/2023

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ABBREVIATIONS

AASS	Actual Acid Sulphate Soils
AHD	Above Height Datum
ANC	Acid Neutralising Capacity
ASS	Acid Sulphate Soils
ASSMAC	Acid Sulphate Soils Management Advisory Committee
ASSMP	Acid Sulphate Soils Management Plan
BGL	Below Ground Level
DNR&M	Department of Natural resources and Mines
DO	Dissolved Oxygen
EC	Electric Conductivity
EIL	Ecological Investigation Level
EPA	Environmental Protection Authority
HIL	Health-based Investigation Level
LOR	Limit of reporting
NV	Neutralising Value
PASS	Potential Acid Sulphate Soils
POCAS	Peroxide Oxidation Combined Acidity and Sulphate
PSI	Preliminary Site Investigation
QA/QC	Quality Assurance/Quality Control
QASSIT	Queensland Acid Sulphate Soils Investigation Team
SPOCAS	Suspended Peroxide Oxidation Combined Acidity and Sulphate
SPOS	Peroxide Oxidisable
TAA	Total Actual Acidity
TCLP	Toxicity Characteristic Leaching Procedure
TPA	Total Potential Acidity
TSA	Total Sulfidic Acidity
TSS	Total Suspended Solids
VENM	Virgin Excavated Natural Material

1.0 INTRODUCTION

Foundation Earth Sciences (FES) was appointed by East End Stage 3 Pty Ltd to prepare an Acid Sulphate Soil Assessment (ASSA) for the property located at 105, 109, 111, 121 Hunter Street, 3 Morgan Street, 66-74 King Street & 22 Newcomen Street, Newcastle NSW ("the site"). The site is in the The City of Newcastle Council municipality.

Refer to **Figure 1** – Site Locality and **Figure 2** – Site Features and Borehole Location Plan.

The site is currently occupied by mixed use buildings including commercial shops, offices, basement car parking, church and residential properties. The approved masterplan encompasses:

- Staged Concept Development Application for a major redevelopment of Hunter Street Mall, a mixed-use development comprising retail, commercial, public spaces, residential apartments, associated car parking & site works.

An ASS assessment is required as disturbances to Potential Acid Sulphate Soil (PASS) or Actual Acid Sulphate Soils, which may occur during construction and excavation works, can result in the formation of acid. The acid, once formed, could then damage infrastructure or harm ecological systems. The results of the field parameters from this assessment should only be used as a preliminary study to determine if further investigations are required. If results exceed the criteria, then further work, including an ASS Management Plan, may be required.

2.0 OBJECTIVES

The purpose of the ASS Assessment is to determine the presence or absence of ASS at the site. In the absence of ASS, it is essential to assess for the presence of Potential Acid Sulphate Soils (PASS). If the results do not meet criteria an Acid Sulphate Soil Management Plan will be required.

This assessment reviewed the presence of ASS / PASS in the portion of the site that may require excavation.

3.0 SCOPE OF WORKS

The scope of works of the ASS Assessment included:

- Review of previous environmental assessments;
- Site walkover;
- Targeted soil boring, sampling and testing for ASS at the site;
- Groundwater sampling;
- Interpretation of field test analysis and findings;
- NATA Accredited laboratory testing; and
- Reporting in accordance with relevant assessment guidelines / regulations

4.0 ASSESSMENT CRITERIA

When assessing ASS at sites in NSW Acid Sulphate Soils Management Advisory Committee (ASSMAC) (1998) Acid Sulphate Soils Assessment Guidelines apply.

A review of NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000) was undertaken**.** The

risk maps do not detail the severity of the ASS, but only provide an indication that they may be present. The decision to classify certain areas as ASS is based on a number of geomorphic conditions and site criteria. The following points are used to determine if ASS is likely to exist (extracted from ASSMAC (1998) Acid Sulphate Soils Assessment Guidelines):

- Sediments of recent geological age (Holocene) ~ 10 000 yr.
- Soil horizons less than 5m AHD (Australian Height Datum).
- Marine or estuarine sediments and tidal lakes.
- In coastal wetlands or back swamp areas; waterlogged or scalded areas; interdune swales or coastal sand dunes.
- In areas where the dominant vegetation is mangroves, reeds, rushes and other swamp tolerant and marine vegetation.
- In areas identified in geological descriptions or in maps bearing sulphide minerals, coal deposits or former marine shales/sediments.
- Deeper older estuarine sediments >10m below the ground surface, Holocene or Pleistocene age.

Based on the above information in order to determine whether there is a potential for acid sulphate soils to be present within a site, reference was made to the NSW Department of Land & Water Conservation (DLWC) Acid Sulphate Soil Risk Maps (Edition Two, December 1997, Scale 1:250,000). A review of the “Newcastle” map indicated that the site is located in an area of “No Known Occurrence” of acid sulphate soil material within the soil profile.

A review of the Acid Sulphate Maps included in the Newcastle Local Environmental Plan 2012 (Acid Sulphate Soils Map – Sheet ASS_2004) indicated the site was Class 5.

The following soil indicators are used to determine if ASS is actually present on a site:

- field pH ≤4 in soils

- presence of shell
- any jarosite horizons or substantial iron oxide mottling in auger holes, in surface encrustations or in any material dredged or excavated and left exposed. Jarosite is not always found, however, in actual acid sulphate soils.

The following soil indicators are used to determine if PASS is actually present on a site:

- waterlogged soils, unripe muds (soft, buttery, blue grey or dark greenish grey) or estuarine silty sands or sands (mid to dark grey) or bottom sediments of estuaries or tidal lakes (dark grey to black)
- presence of shell
- soil pH usually neutral but may be acid -positive Peroxide Test (see section 7.2 Field pH results).

5.0 SITE INFORMATION

5.1 Site Identification

The site is identified as follows:

Table 1: Site Identification Review

Site Identifier	Site Details	
Site Location	105, 109, 111, 121 Hunter St, 3 Morgan St, 66-74 King St & 22 Newcomen St, Newcastle NSW	
Lot/DP	Lot 31-32 in DP864001 (121 Hunter St), Lot 1 in DP77846 (105 Hunter St), Lot B in DP388647 (109 Hunter St), Lot A in DP388647 (111 Hunter St); Lot 100 in DP1098095, Lot 1 in DP723967, Lot 2 in DP1098034 (3 Morgan St); Lot 1 in DP819134 (66-74 King St); Lot 1 in DP331535 (22 Newcomen St)	
Site Coordinates #	SE corner: Latitude: -32.928145, Longitude: 151.781646	
Parish	Newcastle	
County	Northumberland	
Site Area	Approximately 6,698m^2	
Local Government Area (LGA)	The City of Newcastle Council	
Zoning##	B4 – Mixed Use	
Surrounding Land Uses	*North*	Mixed Use (Mainly Commercial)
	South	Mixed Use (Mainly Commercial)
	East	Mixed Use (Mainly Commercial)
	West	Mixed Use (Mainly Commercial)

Notes: # Six Maps
refer to NSW Planning Portal
https://www.planningportal.nsw.gov.au/spatialviewer/#/find-a-property/address
//www.planningportal.nsw.gov.au/find-a-property

5.2 Topography

The Soil Landscape Map viewed on NSW ESPADE indicates that the site is located within the Killingworth landscape area. These soils have undulating to rolling hills and low hills on the Newcastle Coal Measures of the Awaba Hills region. Elevation 50-160m, local relief 30-100m, slopes are 3-20%. Predominantly uncleared tall open-forest.

The topography viewed on NSW ESPADE indicated the following for the Killingworth landscape:

Rolling low hills to hills. Slope gradients 3-20%, local relief is 30-100m, elevation 50-160m. Crests are generally broad (250m), sideslopes are long (>500m) and grade into narrow (<3m) drainage lines. Drainage plains are long (>500m) and gently inclined. Short, steep (>20%) lower slopes often lead to gullies. Rock outcrop occurs occasionally in the upper catchment.

5.3 Local Geology & Surface Waters

The Geological Map of Newcastle (Geological Series Sheet 9231-9129, Scale 1:100,000, Edition 1, 1995), published by the NSW Department of Mineral Resources indicates the site is located within Pnl:

- Pnl indicates the residual soils with the site to be underlain by Permian Age of Lambton subgroup, comprising sandstone, siltstone, claystone, coal & tuff.

The nearest watercourse is Hunter River located approximate 155m North of the site, which discharges into the Ocean/sea.

5.4 Proposed Development

The site is currently occupied by mixed use buildings including commercial shops, offices, basement car parking, church, and residential properties. The following information further summarises the proposed development:

- The proposed Stage 3 will have
    - Three level basements across whole site;
    - Eight levels above ground including retail and residential in the western portion;
    - Market Square in the middle;
    - Three levels above ground at the northeast portion; and
    - Twelve levels above ground at the southeast portion.
- The proposed Stage 4 will have.
    - Three level basements across majority in the site- southern portion;
    - Eight levels above ground including retail and residential;
- As per ground floor plan, the area contains services/plant, landscaped entry, retail, communal open space & market centre.

Refer to **Appendix C** - Proposed Development Plans.

6.0 SOIL BORING AND SAMPLING

A soil sampling and analysis program was used to consolidate the nature and degree of Acid Sulphate Soils present in the surface and subsurface geology. Samples were collected from four boreholes within the site. The borehole locations are presented in **Figure 2** – Site Features and Borehole Location Plan.

Field analysis was performed on the collected samples for pH_f and pH_{fox} in accordance with the required sampling techniques of the *ASSMAC (1998) Assessment Guidelines* – ASSMAC (1998) Field pH and peroxide test protocol).

6.1 Quality Assurance/Quality Control (QA/QC)

Standard QA/QC procedures were followed. The decontamination of sampling equipment and the hand auger was achieved by washing with phosphate-free detergent and tap water, followed by final rinsing with distilled water. This was conducted after the collection of samples.

Standard sampling and analysing procedures are in accordance with and set out in the *NSW ASSMAC (1998) "Acid Sulphate Soils Assessment Guidelines".*

7.0 FIELD RESULTS

7.1 Soil Observations

Based on information from all boreholes, the surface and sub-surface profile across the site is generalised as follows:

- Fill: Silty Clayey Sand, Silty Sand,
- Natural: Clayey SAND, Silty Clayey SAND, Silty SAND

No unusual colouring or shells were detected in the soil suggesting the presence of pyrite (iron sulphide) or jarosite was unlikely.

Additional analysis was undertaken on the 20/4/2023 in BH4 location in order to further assess the site.

Refer to **Appendix B** – Borehole Logs.

7.2 Field pH Results

The results of the field pH tests are presented in the table below:

Table 2: Summary of field analysis results

Sample	Depth (m)	pH		pH		Change in pH (pH_f – pH_{fox})	Effervescence Reaction Rate
		H_2O	Soil pH_f	H_2O_2	Soil pH_{fox}		
BH1	0.2	-	8.9	-	7.5	1.4	Low
BH1	0.5	-	8.2	-	7.1	1.1	Medium
BH1	1	-	8.3	-	7.0	1.3	High
BH1	1.5	-	7.1	-	6	1.1	Medium
BH1	2	-	6.9	-	6.4	0.5	Medium
BH1	2.5	-	6.3	-	5.4	0.9	Medium
BH1	3	-	6.9	-	6.3	0.6	Medium
BH1	3.5	-	5.8	-	5.7	0.1	Low
BH1	4	-	5.6	-	5.2	0.4	Low
BH1	4.5	-	5.3	-	4.7	0.6	Low
BH1	5	-	5.2	-	4.7	0.5	Low
BH1	5.5	-	5.2	-	4.6	0.6	Low
BH1	6	-	5.1	-	4.5	0.6	Low
BH1	6.5	-	5.1	-	5.3	-0.2	Low
BH1	7	-	5.1	-	5.1	0	Low
BH1	7.5	-	5.2	-	4.5	0.7	Low
BH1	8	-	5.2	-	5.2	0	Low
BH1	8.5	-	5.2	-	4.3	0.9	Low
BH1	9	-	5.3	-	4.3	1	Low
BH2	0.2	-	9.2	-	7.4	1.8	Low
BH2	0.5	-	9.1	-	7.0	2. 1	Low
BH2	1	-	9.1	-	5.7	3.4	Medium
BH2	1.5	-	9.2	-	7.3	1.9	Medium
BH2	2	-	9.2	-	8.0	1.2	Low
BH2	2.5	-	8.9	-	7.4	1.5	Low
BH2	3	-	8.9	-	8.3	0.6	Low
BH2	3.5	-	8.6	-	7.7	0.9	Low
BH2	4	-	7.8	-	7.9	-0.1	Low

BH2	**4.5**	**-**	**7.0**	**-**	**7.8**	**-0.8**	**Low**
BH2	**5**	**-**	**8.3**	**-**	**7.4**	**0.9**	**Low**
BH2	**5.5**	**-**	**8.4**	**-**	**7.3**	**1.1**	**Medium**
BH2	**6**	**-**	**8.6**	**-**	**8.0**	**0.6**	**Low**
BH3	**0.2**	**-**	**10.1**	**-**	**9.6**	**0.5**	**Volcanic**
BH3	**0.45**	**-**	**9.3**	**-**	**6.9**	**2.4**	**Low**
BH4	**0.05**	**-**	**9.4**	**-**	**9.2**	**0.2**	**Volcanic**
BH4	**0.4**	**-**	**8.9**	**-**	**8.0**	**0.9**	**Volcanic**
BH4	**0.7-0.8**	**-**	**8.0**	**-**	**7.1**	**0.9**	**Low**

Notes:

- pH_f refers to pH field (soil and distilled H_2O).
- pH_{fox} refers to pH field oxidised (soil and peroxide).
- Change in pH refers to pH field minus pH field oxidised.
- **Bold and highlighted** refers to detections.

To investigate the pH of the soils (pH_f) water was added to the soil samples. pH_f of the investigated samples was above 4. This indicates the soils from which the samples were collected did not contain actual ASS.

To investigate the presence of PASS, 30% peroxide (H_2O_2) was added to soil samples and the resulting pH of the mixture was measured (field test protocols are presented in Appendix D of the ASSMAC (1998) Field pH and peroxide test protocol). The pH of the soil peroxide solution (pH_{fox}) did not decrease below pH 3.5. The pH dropped by at least one unit in several samples and the reaction rate was volcanic in BH3 & BH4 as per Table 2. Based on the field analysis further laboratory investigation was conducted.

8.0 SUSPENDED PEROXIDE OXIDATION COMBINED ACIDITY & SULPHATE (SPOCAS) RESULTS

Following the field tests undertaken by FES (administered Envirolab), eleven (11) soil samples from FES (collected from 21st to 22nd March 2023) were submitted to the NATA certified laboratory of Envirolab for the SPOCAS test.

The soils were assessed against the guidelines set out in Acid Sulphate Soils Management Advisory Committee (ASSMAC) (1998) *Acid Sulphate Soils Assessment Guidelines*. The action criteria selected was based on excavation of more than 1,000 tonnes of soils disturbed within the site. The results are assessed against the available criteria, those being:

Coarse to Fine Texture Soils

- Sulphur Trail (S_{pos}) = 0.03%
- Acid Trail (TPA) = 18 mol H^+/tonne

The laboratory analysis results are presented in the following table:

Table 3: Laboratory Results - SPOCAS

Sample	Profile	Depth (m)	S-POS (%) (sulphur trail)	TAA (mol H^+/ tonne)	TPA (mol H^+/ tonne) (acid trail)	TSA (mol H^+/tonne) (acid trail)	Lime Calculation (kg $CaCO_3$/t includes 1.5 safety factor).
Sampling dated 21st March 2023							
BH1	Silty Clayey Sand	1.0	<0.005	<5	<5	<5	<0.75
BH1	Silty Sand	2.5	0.02	<5	<5	<5	1.1
BH1	Silty Sand	4.5	<0.005	7	<5	<5	<0.75
BH1	Silty Sand	6.0	<0.005	6	<5	<5	<0.75
BH1	Sandy CLAY	8.5	<0.005	<5	<5	<5	<0.75
BH2	Clayey Sand	1.0	0.006	<5	<5	<5	<0.75
BH2	Silty SAND	2.5	<0.005	<5	<5	<5	<0.75
BH2	Silty SAND	3.5	<0.005	<5	<5	<5	<0.75
BH2	Sandy CLAY	5.5	<0.005	<5	<5	<5	<0.75
Sampling dated 22nd March 2023							
BH3	Sand	0.2	<0.005	<5	<5	<5	<0.75
BH4	Silty Sand	0.4	0.006	<5	<5	<5	<0.75
ASSMAC Guidelines ***Fine to Coarse Texture***		-	***0.03***	**-**	***18***	***18***	**-**

Notes:

- Guidelines follow the ASSMAC "Acid Sulphate Soils Assessment Guidelines 1998".
- Fine Texture Criteria based upon clay content of > or equal to 40%
- Medium Texture Criteria based upon clay content of 5-40%
- Criteria based upon more than 1000 tonnes disturbed
- **Bold values exceed ASSMAC guidelines**

When comparing the results summarised above in Table 4 to Table 4.4 (ASSMAC) for fine to coarse texture soils it can be determined that the percentage of oxidisable Sulphur (SPOS) & acid trail (TPA/TSA) did not exceed the action criteria for all locations. The results are indicative that the soil material has little to no acid sulphate potential within the soil matrix.

9.0 CHROMIUM REDUCIBLE SULPHUR RESULTS

Chromium Reducible sulphur method calculates the potential acidity from analysis of sulphide content. This method does not include sulphur from organics and sulphates (e.g. gypsum) and detects as low sulphide content and is therefore suitable to determine potential interferences caused by naturally occurring acidity within the soils. The laboratory results are presented in the following table:

Table 4: Laboratory Results – Chromium Reducible Sulphur

Sample	Depth	Chromium Reducible Sulphur (%)
Sampling dated 21st to 22nd March 2023		
BH1	1.0	<0.005
BH1	2.5	<0.005
BH1	4.5	<0.005
BH1	6.0	<0.005
BH1	8.5	<0.005
BH2	1.0	0.02
BH2	2.5	0.007
BH2	3.5	<0.005
BH2	5.5	0.005
BH3	0.2	0.008
BH4	0.4	0.009
SPOS Action Criteria		**0.03**

The results from the Table 5 indicated the following:

- Oxidisable sulphur compounds were not detected above to the SPOS action criteria within the samples.

10.0 DISCUSSION AND CONCLUSION

The assessment of acid sulphate material can be quite complex and can have a lot of interferences associated with the test methods and soil matrix. The following points outline the evidence to support the site is not impacted to the maximum depth of sampling:

- Analysis using the phF & phfox field test protocol showed the Ph of the soil to be absence for AASS / PASS;
- The results of the SPOCAS test determined that the percentage of oxidisable Sulphur (SPOS) & acid trail (TPA/TSA) did not exceed the action criteria in any of the samples from borehole locations investigated. The results are indicative that the soil material unlikely has acid sulphate potential within the soil matrix.
- The chromium reducible analysis indicated the oxidisable sulphur compounds were not detected above to the SPOS action criteria within the samples.

Therefore, it has been determined through laboratory testing that the *site is not impacted by AASS (Actual Acid Sulphate Soil) or PASS (Potential Acid Sulphate Soil)* in the vicinity of the borehole locations (BH1 to BH4) investigated at the site to a maximum depth of 8.5m BGL.

REFERENCES

- Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZG) (2018).
- Australian Government Department of Agriculture and Water Resources (2018), National Acid Sulfate Soils Guidance – National Acid Sulfate Soil Sampling and Identification Methods Manual, June 2018.
- Stone Y, Ahern C.R and Blunden B (1998), 'Acid Sulphate Soil Manual 1998', Acid Sulphate Soils Management Advisory Committee, Wollongbar, NSW, Australia.

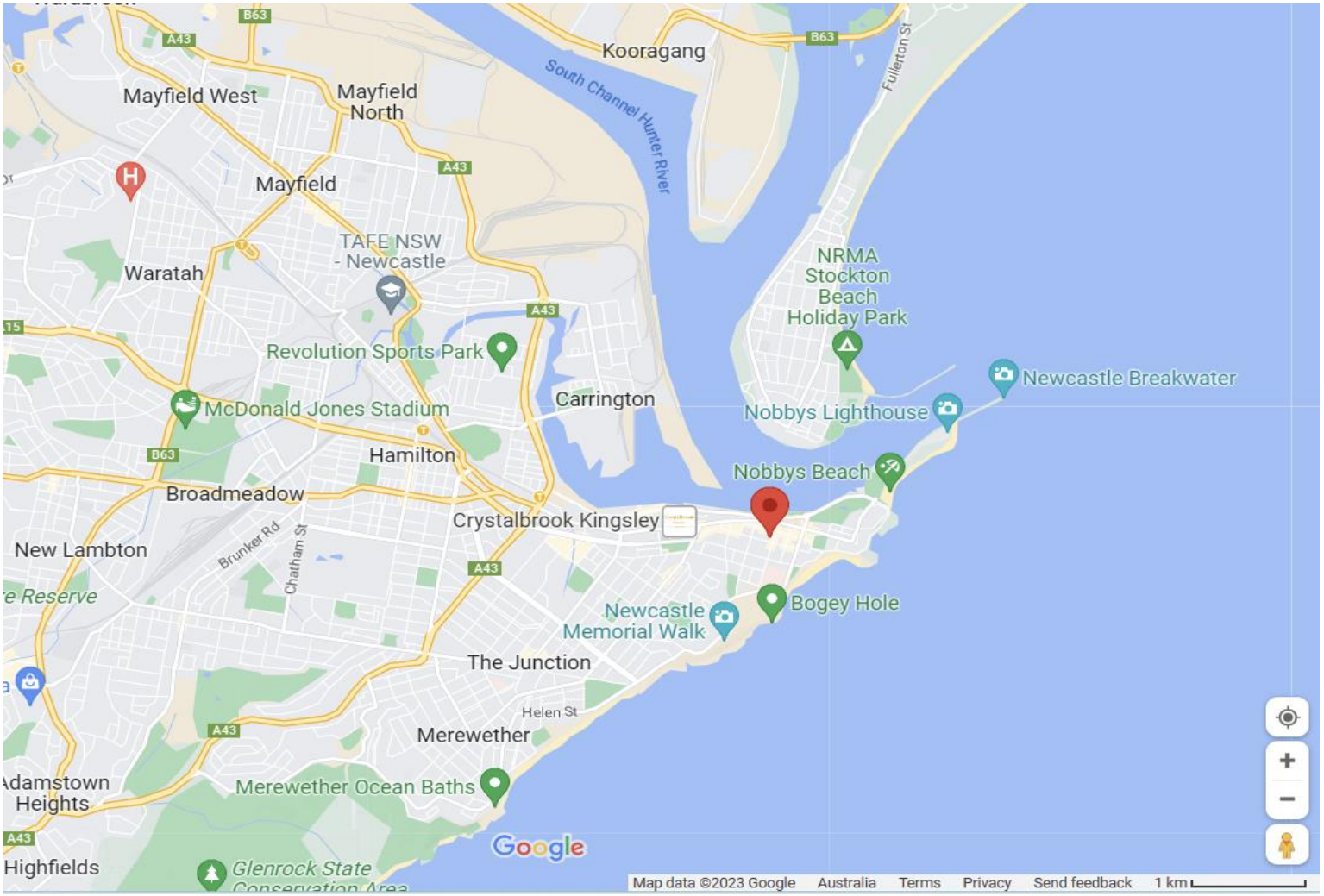
LIMITATIONS

Whilst to the best of our knowledge, information contained in this report is accurate at the date of issue, although subsurface conditions, including groundwater levels and contaminant concentrations, can change in a limited time. This should be borne in mind if the report is used after a protracted delay. There is always some disparity in subsurface conditions across a site that cannot be fully defined by investigation. Hence it is unlikely that measurements and values obtained from sampling and testing during environmental works carried out at a site will characterise the extremes of conditions that exist within the site.

There is no investigation that is thorough enough to preclude the presence of material that presently or in the future, may be considered hazardous at the site. Since regulatory criteria are constantly changing, concentrations of contaminants presently considered low may, in the future, fall under different regulatory standards that require remediation.

Opinions are judgements that are based on our understanding and interpretation of current regulatory standards, and should not be construed as legal opinions. Although the information provided by an Acid Sulphate Soils Assessment and Management Plan can reduce exposure to risks, no assessment, however diligently carried out, can eliminate them. It must be noted that these findings are professional findings and have limitations. Even a rigorous professional assessment may fail to detect all ASS and/or PASS on a site. Sulphates may be present in areas that were not surveyed or sampled.

FIGURE 1: SITE LOCATION

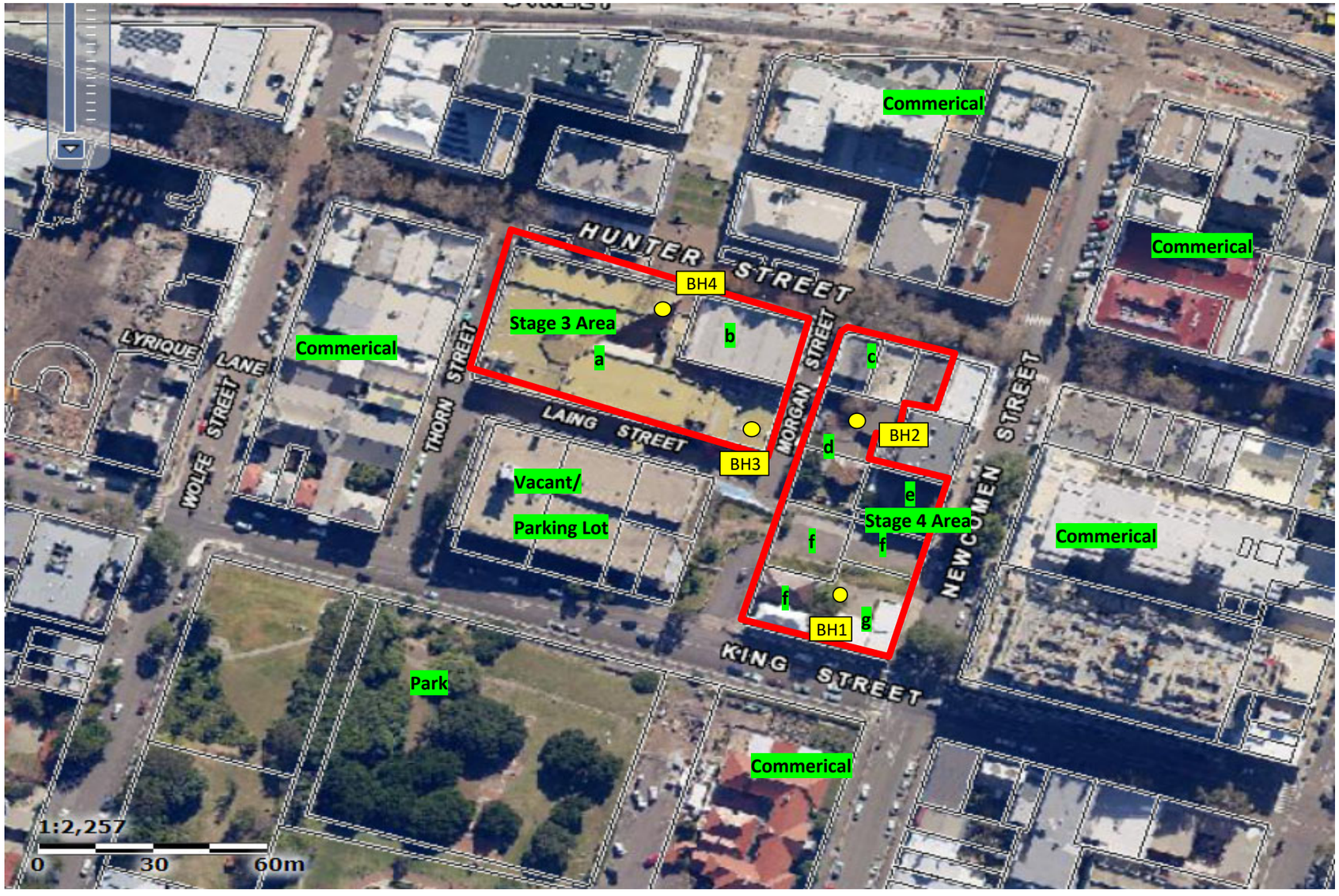


Key Site Location	FOUNDATION EARTH SCIENCES	**DRAWN** MT	**SITE LOCATION**
		FIGURE 1	East End Stage 3 Pty Ltd & East End Stage 4 Pty Ltd
		Job # E2970-3	105, 109, 111, 121 Hunter Street, 3 Morgan Street, 66-74 King Street & 22 Newcomen Street, Newcastle NSW

FIGURE 2: SITE FEATURES AND BOREHOLE LOCATION PLAN

N

Feature No	Details
a	Commercial & Office
b	Commercial & Basement
c	Residential & Commercial
d	Church
e	Dance Hall
f	Residential
g	Commercial / Office



Key

Site Location

FES ASSA Soil Location 2023

FOUNDATION EARTH SCIENCES

DRAWN MT	**Site Features & Borehole Location Plan**
Figure 2	East End Stage 3 Pty Ltd
Job # E2970-3	105, 109, 111, 121 Hunter Street, 3 Morgan Street, 66-74 King Street & 22 Newcomen Street, Newcastle NSW

APPENDIX A: NATA ACCREDITED LABORATORY CERTIFICATES

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 319450

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Michael Silk
Address	PO Box 4405, East Gosford, NSW, 2250

Sample Details

Your Reference	**E2970-3, Newcastle**
Number of Samples	37 Soil
Date samples received	24/03/2023
Date completed instructions received	24/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	29/03/2023
Date of Issue	29/03/2023

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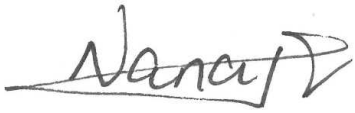
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS field test						
Our Reference		319450-1	319450-2	319450-3	319450-4	319450-5
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH1
Depth		0.2	0.5	1	1.5	2
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	8.9	8.2	8.3	7.1	6.9
pH_{FOX} (field peroxide test)	pH Units	7.5	7.1	7.0	6.0	6.4
Reaction Rate*	-	Low reaction	Medium reaction	High reaction	Medium reaction	Medium reaction

sPOCAS field test						
Our Reference		319450-6	319450-7	319450-8	319450-9	319450-10
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH1
Depth		2.5	3	3.5	4	4.5
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	6.3	6.9	5.8	5.6	5.3
pH_{FOX} (field peroxide test)	pH Units	5.4	6.3	5.7	5.2	4.7
Reaction Rate*	-	Medium reaction	Medium reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		319450-11	319450-12	319450-13	319450-14	319450-15
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH1
Depth		5	5.5	6	6.5	7
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	5.2	5.2	5.1	5.1	5.1
pH_{FOX} (field peroxide test)	pH Units	4.7	4.6	4.5	5.3	5.1
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		319450-16	319450-17	319450-18	319450-19	319450-20
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH2
Depth		7.5	8	8.5	9	0.2
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	5.2	5.2	5.2	5.3	9.2
pH_{FOX} (field peroxide test)	pH Units	4.5	5.2	4.3	4.3	7.4
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		319450-21	319450-22	319450-23	319450-24	319450-25
Your Reference	UNITS	BH2	BH2	BH2	BH2	BH2
Depth		0.5	1	1.5	2	2.5
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	9.1	9.1	9.2	9.2	8.9
pH_{FOX} (field peroxide test)	pH Units	7.0	5.7	7.3	8.0	7.4
Reaction Rate*	-	Low reaction	Medium reaction	Medium reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		319450-26	319450-27	319450-28	319450-29	319450-30
Your Reference	UNITS	BH2	BH2	BH2	BH2	BH2
Depth		3	3.5	4	4.5	5
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	8.9	8.6	7.8	7.0	8.3
pH_{FOX} (field peroxide test)	pH Units	8.3	7.7	7.9	7.8	7.4
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Low reaction

sPOCAS field test						
Our Reference		319450-31	319450-32	319450-33	319450-34	319450-35
Your Reference	UNITS	BH2	BH2	BH3	BH3	BH4
Depth		5.5	6	0.2	0.45	0.05
Date Sampled		21/03/2023	21/03/2023	22/03/2023	22/03/2023	22/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023	29/03/2023	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	8.4	8.6	10.1	9.3	9.4
pH_{FOX} (field peroxide test)	pH Units	7.3	8.0	9.6	6.9	9.2
Reaction Rate*	-	Medium reaction	Low reaction	Volcanic reaction	Low reaction	Volcanic reaction

sPOCAS field test			
Our Reference		319450-36	319450-37
Your Reference	UNITS	BH4	BH4
Depth		0.4	0.7-0.8
Date Sampled		22/03/2023	22/03/2023
Type of sample		Soil	Soil
Date prepared	-	29/03/2023	29/03/2023
Date analysed	-	29/03/2023	29/03/2023
pH_F (field pH test)	pH Units	8.9	8.0
pH_{FOX} (field peroxide test)	pH Units	8.0	7.1
Reaction Rate*	-	Volcanic reaction	Low reaction

Method ID	Methodology Summary
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/03/2023	[NT]	[NT]	[NT]	[NT]	29/03/2023	[NT]
Date analysed	-			29/03/2023	[NT]	[NT]	[NT]	[NT]	29/03/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	[NT]
Date prepared	-			[NT]	[NT]	[NT]	[NT]	[NT]	29/03/2023	[NT]
Date analysed	-			[NT]	[NT]	[NT]	[NT]	[NT]	29/03/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	98	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 319450-A

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Ray Liu
Address	PO Box 4405, East Gosford, NSW, 2250

Sample Details

Your Reference	**E2970-3, Newcastle**
Number of Samples	Additional Testing on 11 Soils
Date samples received	24/03/2023
Date completed instructions received	30/03/2023

Analysis Details

Please refer to the following pages for results, methodology summary and quality control data.

Samples were analysed as received from the client. Results relate specifically to the samples as received.

Results are reported on a dry weight basis for solids and on an as received basis for other matrices.

Report Details

Date results requested by	06/04/2023
Date of Issue	06/04/2023

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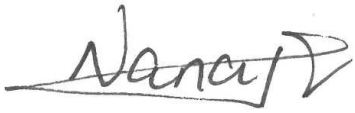
Results Approved By
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

sPOCAS + %S w/w						
Our Reference		319450-A-3	319450-A-6	319450-A-10	319450-A-13	319450-A-18
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH1
Depth		1	2.5	4.5	6	8.5
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Date analysed	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
pH $_{kcl}$	pH units	8.4	6.2	4.8	4.8	5.0
TAA pH 6.5	moles H^+ /t	<5	<5	7	6	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	0.01	<0.01	<0.01
pH $_{Ox}$	pH units	7.0	5.5	6.0	6.1	6.5
TPA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	1.1	[NT]	[NT]	[NT]	[NT]
a-ANC_E	moles H^+ /t	210	[NT]	[NT]	[NT]	[NT]
s-ANC_E	%w/w S	0.34	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.02	0.02	0.02	0.02	0.01
S_P	%w/w	<0.005	0.04	0.02	0.03	0.02
S_{POS}	%w/w	<0.005	0.02	<0.005	<0.005	<0.005
a-S_{POS}	moles H^+ /t	<5	15	<5	<5	<5
Ca_{KCl}	%w/w	0.37	0.20	0.02	0.02	0.02
Ca_P	%w/w	<0.005	0.16	0.03	0.03	0.02
Ca_A	%w/w	<0.005	<0.005	<0.005	<0.005	0.005
Mg_{KCl}	%w/w	0.010	0.007	<0.005	<0.005	0.005
Mg_P	%w/w	<0.005	0.007	<0.005	<0.005	0.005
Mg_A	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
a-S_{NAS}	moles H^+ /t	[NT]	[NT]	[NT]	[NT]	[NT]
s-S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+ /t	<5	15	9	8	7
s-Net Acidity	%w/w S	<0.01	0.02	0.02	0.01	0.01
Liming rate	kg $CaCO_3$ /t	<0.75	1.1	<0.75	<0.75	<0.75
s-Net Acidity without -ANCE	%w/w S	<0.01	0.02	0.02	0.01	0.01
a-Net Acidity without ANCE	moles H^+ /t	<5	15	9.3	8.4	7.0
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	1.1	<0.75	<0.75	<0.75

sPOCAS + %S w/w						
Our Reference		319450-A-22	319450-A-25	319450-A-27	319450-A-31	319450-A-33
Your Reference	UNITS	BH2	BH2	BH2	BH2	BH3
Depth		1	2.5	3.5	5.5	0.2
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	22/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Date analysed	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
pH $_{kcl}$	pH units	9.4	9.4	9.2	9.4	9.9
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
pH $_{Ox}$	pH units	7.7	7.5	7.2	7.5	7.7
TPA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TPA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
TSA pH 6.5	moles H^+ /t	<5	<5	<5	<5	<5
s-TSA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
ANC_E	% $CaCO_3$	1.6	0.50	0.12	0.38	0.56
a-ANC_E	moles H^+ /t	310	100	25	75	110
s-ANC_E	%w/w S	0.50	0.16	<0.05	0.12	0.18
S_{KCl}	%w/w S	<0.005	<0.005	<0.005	0.005	0.006
S_P	%w/w	0.01	0.005	0.005	0.009	0.008
S_{POS}	%w/w	0.006	<0.005	<0.005	<0.005	<0.005
a-S_{POS}	moles H^+ /t	<5	<5	<5	<5	<5
Ca_{KCl}	%w/w	0.23	0.11	0.06	0.12	0.13
Ca_P	%w/w	0.58	0.18	0.08	0.21	0.21
Ca_A	%w/w	0.35	0.070	0.018	0.088	0.077
Mg_{KCl}	%w/w	0.008	<0.005	<0.005	0.011	<0.005
Mg_P	%w/w	0.010	0.006	0.005	0.015	0.008
Mg_A	%w/w	<0.005	<0.005	<0.005	<0.005	0.005
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
a-S_{NAS}	moles H^+ /t	[NT]	[NT]	[NT]	[NT]	[NT]
s-S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]	[NT]
Fineness Factor	-	1.5	1.5	1.5	1.5	1.5
a-Net Acidity	moles H^+ /t	<5	<5	<5	<5	<5
s-Net Acidity	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without -ANCE	%w/w S	<0.01	<0.01	<0.01	<0.01	<0.01
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	<5	<5	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75	<0.75

sPOCAS + %S w/w		
Our Reference		319450-A-36
Your Reference	UNITS	BH4
Depth		0.4
Date Sampled		22/03/2023
Type of sample		Soil
Date prepared	-	06/04/2023
Date analysed	-	06/04/2023
pH $_{kcl}$	pH units	9.9
TAA pH 6.5	moles H^+ /t	<5
s-TAA pH 6.5	%w/w S	<0.01
pH $_{Ox}$	pH units	8.7
TPA pH 6.5	moles H^+ /t	<5
s-TPA pH 6.5	%w/w S	<0.01
TSA pH 6.5	moles H^+ /t	<5
s-TSA pH 6.5	%w/w S	<0.01
ANC_E	% $CaCO_3$	0.19
a-ANC_E	moles H^+ /t	38
s-ANC_E	%w/w S	0.06
S_{KCl}	%w/w S	<0.005
S_P	%w/w	0.007
S_{POS}	%w/w	0.006
a-S_{POS}	moles H^+ /t	<5
Ca_{KCl}	%w/w	0.19
Ca_P	%w/w	0.20
Ca_A	%w/w	0.014
Mg_{KCl}	%w/w	0.023
Mg_P	%w/w	0.019
Mg_A	%w/w	<0.005
S_{HCl}	%w/w S	[NT]
S_{NAS}	%w/w S	[NT]
a-S_{NAS}	moles H^+ /t	[NT]
s-S_{NAS}	%w/w S	[NT]
Fineness Factor	-	1.5
a-Net Acidity	moles H^+ /t	<5
s-Net Acidity	%w/w S	<0.01
Liming rate	kg $CaCO_3$ /t	<0.75
s-Net Acidity without -ANCE	%w/w S	<0.01
a-Net Acidity without ANCE	moles H^+ /t	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75

SCr						
Our Reference		319450-A-3	319450-A-6	319450-A-10	319450-A-13	319450-A-18
Your Reference	UNITS	BH1	BH1	BH1	BH1	BH1
Depth		1	2.5	4.5	6	8.5
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	21/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Date analysed	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	<0.005	<0.005	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	<3	<3	<3

SCr						
Our Reference		319450-A-22	319450-A-25	319450-A-27	319450-A-31	319450-A-33
Your Reference	UNITS	BH2	BH2	BH2	BH2	BH3
Depth		1	2.5	3.5	5.5	0.2
Date Sampled		21/03/2023	21/03/2023	21/03/2023	21/03/2023	22/03/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Date analysed	-	06/04/2023	06/04/2023	06/04/2023	06/04/2023	06/04/2023
Chromium Reducible Sulfur	%w/w	0.02	0.007	<0.005	0.005	0.008
a-Chromium Reducible Sulfur	moles H^+ /t	10	4	<3	3	5

SCr		
Our Reference		319450-A-36
Your Reference	UNITS	BH4
Depth		0.4
Date Sampled		22/03/2023
Type of sample		Soil
Date prepared	-	06/04/2023
Date analysed	-	06/04/2023
Chromium Reducible Sulfur	%w/w	0.009
a-Chromium Reducible Sulfur	moles H^+ /t	6

Method ID	Methodology Summary
Inorg-064	sPOCAS determined using titrimetric and ICP-AES techniques. Based on National acid sulfate soils identification and laboratory methods manual June 2018. Ideally samples should be received in the laboratory at <4oC. Please refer to SRA for sample temperature on receipt. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. Based on National acid sulfate soils identification and laboratory methods manual June 2018. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.

QUALITY CONTROL: sPOCAS + %S w/w					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/04/2023	3	06/04/2023	06/04/2023		06/04/2023	[NT]
Date analysed	-			06/04/2023	3	06/04/2023	06/04/2023		06/04/2023	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	3	8.4	8.4	0	97	[NT]
TAA pH 6.5	moles H^+/t	5	Inorg-064	<5	3	<5	<5	0	96	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	3	<0.01	<0.01	0	[NT]	[NT]
pH $_{Ox}$	pH units		Inorg-064	[NT]	3	7.0	7.2	3	100	[NT]
TPA pH 6.5	moles H^+/t	5	Inorg-064	<5	3	<5	<5	0	81	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	3	<0.01	<0.01	0	[NT]	[NT]
TSA pH 6.5	moles H^+/t	5	Inorg-064	<5	3	<5	<5	0	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	<0.01	3	<0.01	<0.01	0	[NT]	[NT]
ANC_E	% $CaCO_3$	0.05	Inorg-064	<0.05	3	1.1	1.2	9	[NT]	[NT]
a-ANC_E	moles H^+/t	5	Inorg-064	<5	3	210	240	13	[NT]	[NT]
s-ANC_E	%w/w S	0.05	Inorg-064	<0.05	3	0.34	0.38	11	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-064	<0.005	3	0.02	0.02	0	[NT]	[NT]
S_P	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
S_{POS}	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
a-S_{POS}	moles H^+/t	5	Inorg-064	<5	3	<5	<5	0	[NT]	[NT]
Ca_{KCl}	%w/w	0.005	Inorg-064	<0.005	3	0.37	0.34	8	[NT]	[NT]
Ca_P	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
Ca_A	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
Mg_{KCl}	%w/w	0.005	Inorg-064	<0.005	3	0.010	0.009	11	[NT]	[NT]
Mg_P	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
Mg_A	%w/w	0.005	Inorg-064	<0.005	3	<0.005	<0.005	0	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-064	<0.005	3	[NT]	[NT]		[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-064	<0.005	3	[NT]	[NT]		[NT]	[NT]
a-S_{NAS}	moles H^+/t	5	Inorg-064	<5	3	[NT]	[NT]		[NT]	[NT]
s-S_{NAS}	%w/w S	0.01	Inorg-064	<0.01	3	[NT]	[NT]		[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	<1.5	3	1.5	1.5	0	[NT]	[NT]
a-Net Acidity	moles H^+/t	5	Inorg-064	<5	3	<5	<5	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	<0.01	3	<0.01	<0.01	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	<0.75	3	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	<0.01	3	<0.01	<0.01	0	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-064	<5	3	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-064	<0.75	3	<0.75	<0.75	0	[NT]	[NT]

QUALITY CONTROL: sPOCAS + %S w/w						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	33	06/04/2023	06/04/2023		[NT]	[NT]
Date analysed	-			[NT]	33	06/04/2023	06/04/2023		[NT]	[NT]
pH $_{kcl}$	pH units		Inorg-064	[NT]	33	9.9	9.0	10	[NT]	[NT]
TAA pH 6.5	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-064	[NT]	33	<0.01	<0.01	0	[NT]	[NT]
pH $_{Ox}$	pH units		Inorg-064	[NT]	33	7.7	7.7	0	[NT]	[NT]
TPA pH 6.5	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
s-TPA pH 6.5	%w/w S	0.01	Inorg-064	[NT]	33	<0.01	<0.01	0	[NT]	[NT]
TSA pH 6.5	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
s-TSA pH 6.5	%w/w S	0.01	Inorg-064	[NT]	33	<0.01	<0.01	0	[NT]	[NT]
ANC_E	% $CaCO_3$	0.05	Inorg-064	[NT]	33	0.56	0.56	0	[NT]	[NT]
a-ANC_E	moles H^+/t	5	Inorg-064	[NT]	33	110	110	0	[NT]	[NT]
s-ANC_E	%w/w S	0.05	Inorg-064	[NT]	33	0.18	0.18	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-064	[NT]	33	0.006	0.006	0	[NT]	[NT]
S_P	%w/w	0.005	Inorg-064	[NT]	33	0.008	0.008	0	[NT]	[NT]
S_{POS}	%w/w	0.005	Inorg-064	[NT]	33	<0.005	<0.005	0	[NT]	[NT]
a-S_{POS}	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
Ca_{KCl}	%w/w	0.005	Inorg-064	[NT]	33	0.13	0.11	17	[NT]	[NT]
Ca_P	%w/w	0.005	Inorg-064	[NT]	33	0.21	0.23	9	[NT]	[NT]
Ca_A	%w/w	0.005	Inorg-064	[NT]	33	0.077	0.12	44	[NT]	[NT]
Mg_{KCl}	%w/w	0.005	Inorg-064	[NT]	33	<0.005	<0.005	0	[NT]	[NT]
Mg_P	%w/w	0.005	Inorg-064	[NT]	33	0.008	0.009	12	[NT]	[NT]
Mg_A	%w/w	0.005	Inorg-064	[NT]	33	0.005	0.006	18	[NT]	[NT]
Fineness Factor	-	1.5	Inorg-064	[NT]	33	1.5	1.5	0	[NT]	[NT]
a-Net Acidity	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.01	Inorg-064	[NT]	33	<0.01	<0.01	0	[NT]	[NT]
Liming rate	kg $CaCO_3$/t	0.75	Inorg-064	[NT]	33	<0.75	<0.75	0	[NT]	[NT]
s-Net Acidity without -ANCE	%w/w S	0.01	Inorg-064	[NT]	33	<0.01	<0.01	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+/t	5	Inorg-064	[NT]	33	<5	<5	0	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$/t	0.75	Inorg-064	[NT]	33	<0.75	<0.75	0	[NT]	[NT]

QUALITY CONTROL: SCr						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			06/04/2023	3	06/04/2023	06/04/2023		06/04/2023	[NT]
Date analysed	-			06/04/2023	3	06/04/2023	06/04/2023		06/04/2023	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	3	<0.005	<0.005	0	103	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	3	<3	<3	0	[NT]	[NT]

QUALITY CONTROL: SCr						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	33	06/04/2023	06/04/2023		[NT]	[NT]
Date analysed	-			[NT]	33	06/04/2023	06/04/2023		[NT]	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	[NT]	33	0.008	<0.005	46	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	[NT]	33	5	<3	50	[NT]	[NT]

Result Definitions

NT	Not tested
NA	Test not required
INS	Insufficient sample for this test
PQL	Practical Quantitation Limit
<	Less than
>	Greater than
RPD	Relative Percent Difference
LCS	Laboratory Control Sample
NS	Not specified
NEPM	National Environmental Protection Measure
NR	Not Reported

Quality Control Definitions

Blank	This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.
Duplicate	This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.
Matrix Spike	A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.
LCS (Laboratory Control Sample)	This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.
Surrogate Spike	Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Australian Drinking Water Guidelines recommend that Thermotolerant Coliform, Faecal Enterococci, & E.Coli levels are less than 1cfu/100mL. The recommended maximums are taken from "Australian Drinking Water Guidelines", published by NHMRC & ARMC 2011.

The recommended maximums for analytes in urine are taken from “2018 TLVs and BEIs”, as published by ACGIH (where available). Limit provided for Nickel is a precautionary guideline as per Position Paper prepared by AIOH Exposure Standards Committee, 2016.

Guideline limits for Rinse Water Quality reported as per analytical requirements and specifications of AS 4187, Amdt 2 2019, Table 7.2

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.

Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.

Spikes for Physical and Aggregate Tests are not applicable.

For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: >10xPQL - RPD acceptance criteria will vary depending on the analytes and the analytical techniques but is typically in the range 20%-50% – see ELN-P05 QA/QC tables for details; <10xPQL - RPD are higher as the results approach PQL and the estimated measurement uncertainty will statistically increase.

Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals (not SPOCAS); 60-140% for organics/SPOCAS (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

When samples are received where certain analytes are outside of recommended technical holding times (THTs), the analysis has proceeded. Where analytes are on the verge of breaching THTs, every effort will be made to analyse within the THT or as soon as practicable.

Where sampling dates are not provided, Envirolab are not in a position to comment on the validity of the analysis where recommended technical holding times may have been breached.

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

Analysis of aqueous samples typically involves the extraction/digestion and/or analysis of the liquid phase only (i.e. NOT any settled sediment phase but inclusive of suspended particles if present), unless stipulated on the Envirolab COC and/or by correspondence. Notable exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, total recoverable metals and PFAS where solids are included by default.

Samples for Microbiological analysis (not Amoeba forms) received outside of the 2-8°C temperature range do not meet the ideal cooling conditions as stated in AS2031-2012.

FOUNDATION EARTH SCIENCES

Chain of Custody Record

Client Details:	Foundation Earth Sciences PO Box 4405, East Gosford NSW 2250 email: ben@foundationes.com.au michael@foundationes.com.au; ray@foundationes.com.au ph: +61466 385 221	**Project Manager:** Michael Silk	**Project #:** E2970-3
		Sampled By: RL/RW	**Project Name:** Newcastle
Delivery Details:	Envirolab Pty Ltd 12 Ashley Street, Chatswood NSW 2067 email: ahie@envirolab.com.au ph: +612 9910 6200	**Purchase Order #:** N/A	**Quote #:**
		Page #: 1 of 1	**Turnaround:** Standard

	#	Sample ID	Depth	Date Sampled	Matrix	Analytes: ph	CEC	%CLAY	ASS Field Test pH f & pH fox	TRH	BTEXN	PAH	OC	PCB	Asbestos ID	SPOCAS	Chromium Reducible		Envirolab Suites	Sample Comments
	1	BH1	0.2	21.3.2023	Soil															Keep
	2	BH1	0.5	21.3.2023	Soil															Keep
3	3	BH1	1	21.3.2023	Soil											x	x			Keep
	4	BH1	1.5	21.3.2023	Soil															Keep
	5	BH1	2	21.3.2023	Soil															Keep
6	6	BH1	2.5	21.3.2023	Soil											x	x			Keep
	7	BH1	3	21.3.2023	Soil															Keep
	8	BH1	3.5	21.3.2023	Soil															Keep
	9	BH1	4	21.3.2023	Soil															Keep
10	10	BH1	4.5	21.3.2023	Soil											x	x			Keep
	11	BH1	5	21.3.2023	Soil															Keep
	12	BH1	5.5	21.3.2023	Soil															Keep
13	13	BH1	6	21.3.2023	Soil											x	x			Keep
	14	BH1	6.5	21.3.2023	Soil															Keep
	15	BH1	7	21.3.2023	Soil															Keep
	16	BH1	7.5	21.3.2023	Soil															Keep
	17	BH1	8	21.3.2023	Soil															Keep
18	18	BH1	8.5	21.3.2023	Soil											x	x			Keep
	19	BH1	9	21.3.2023	Soil															Keep
	20	BH2	0.2	21.3.2023	Soil															Keep
	21	BH2	0.5	21.3.2023	Soil															Keep
22	22	BH2	1	21.3.2023	Soil											x	x			Keep
	23	BH2	1.5	21.3.2023	Soil															Keep
	24	BH2	2	21.3.2023	Soil															Keep
25	25	BH2	2.5	21.3.2023	Soil											x	x			Keep
	26	BH2	3	21.3.2023	Soil															Keep
27	27	BH2	3.5	21.3.2023	Soil											x	x			Keep
	28	BH2	4	21.3.2023	Soil															Keep
	29	BH2	4.5	21.3.2023	Soil															Keep
	30	BH2	5	21.3.2023	Soil															Keep
31	31	BH2	5.5	21.3.2023	Soil											x	x			Keep
	32	BH2	6	21.3.2023	Soil															Keep
33	33	BH3	0.2	22.3.2023	Soil											x	x			Keep
	34	BH3	0.45	22.3.2023	Soil															Keep
	35	BH4	0.05	22.3.2023	Soil															Keep
36	36	BH4	0.4	22.3.2023	Soil											x	x			Keep
	37	BH4	0.7-0.8	22.03.2023	Soil															

Special Directions and Coments: Keep in freezer within same day of sampling, please refer to Envirolab Ref 319450

Relinquished by	RL	Received By	
Signature		Signature	30/3/23
Date	30.03.2023	Date	

319450 A Due: 6/4

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Ray Liu

Sample Login Details

Your reference	E2970-3, Newcastle
Envirolab Reference	319450-A
Date Sample Received	24/03/2023
Date Instructions Received	30/03/2023
Date Results Expected to be Reported	06/04/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	Additional Testing on 11 Soils
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	sPOCAS + %S w/w	SCr	On Hold
BH1-0.2			✓
BH1-0.5			✓
BH1-1	✓	✓	
BH1-1.5			✓
BH1-2			✓
BH1-2.5	✓	✓	
BH1-3			✓
BH1-3.5			✓
BH1-4			✓
BH1-4.5	✓	✓	
BH1-5			✓
BH1-5.5			✓
BH1-6	✓	✓	
BH1-6.5			✓
BH1-7			✓
BH1-7.5			✓
BH1-8			✓
BH1-8.5	✓	✓	
BH1-9			✓
BH2-0.2			✓
BH2-0.5			✓
BH2-1	✓	✓	
BH2-1.5			✓
BH2-2			✓
BH2-2.5	✓	✓	
BH2-3			✓
BH2-3.5	✓	✓	
BH2-4			✓
BH2-4.5			✓
BH2-5			✓
BH2-5.5	✓	✓	
BH2-6			✓

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Sample ID	sPOCAS + %S w/w	SCr	On Hold
BH3-0.2	✓	✓	
BH3-0.45			✓
BH4-0.05			✓
BH4-0.4	✓	✓	
BH4-0.7-0.8			✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

FOUNDATION EARTH SCIENCES

Chain of Custody Record

Client Details:	Foundation Earth Sciences PO Box 4405, East Gosford NSW 2250 email: ben@foundationes.com.au michael@foundationes.com.au; ray@foundationes.com.au ph: +61466 385 221	**Project Manager:** Michael Silk **Sampled By:** RL/RW **Purchase Order #:** N/A **Page #:** 1 of 1	**Project #:** E2970-3 **Project Name:** Newcastle **Quote #:** **Turnaround:** Standard
Delivery Details:	Envirolab Pty Ltd 12 Ashley Street, Chatswood NSW 2067 email: ahie@envirolab.com.au ph: +612 9910 6200		

#	Sample ID	Depth	Date Sampled	Matrix	Analytes: ph	CEC	%CLAY	ASS Field Test pH f & pH fox	TRH	BTEXN	PAH	OC	PCB	Asbestos ID	Asbestos %w/w (NEPM /WA)	TRH C6-C10 & BTEXN		Envirolab Suites	Sample Comments
1	BH1	0.2	21.3.2023	Soil				x											Keep
2	BH1	0.5	21.3.2023	Soil				x											Keep
3	BH1	1	21.3.2023	Soil				x											Keep
4	BH1	1.5	21.3.2023	Soil				x											Keep
5	BH1	2	21.3.2023	Soil				x											Keep
6	BH1	2.5	21.3.2023	Soil				x											Keep
7	BH1	3	21.3.2023	Soil				x											Keep
8	BH1	3.5	21.3.2023	Soil				x											Keep
9	BH1	4	21.3.2023	Soil				x											Keep
10	BH1	4.5	21.3.2023	Soil				x											Keep
11	BH1	5	21.3.2023	Soil				x											Keep
12	BH1	5.5	21.3.2023	Soil				x											Keep
13	BH1	6	21.3.2023	Soil				x											Keep
14	BH1	6.5	21.3.2023	Soil				x											Keep
15	BH1	7	21.3.2023	Soil				x											Keep
16	BH1	7.5	21.3.2023	Soil				x											Keep
17	BH1	8	21.3.2023	Soil				x											Keep
18	BH1	8.5	21.3.2023	Soil				x											Keep
19	BH1	9	21.3.2023	Soil				x											Keep
20	BH2	0.2	21.3.2023	Soil				x											Keep
21	BH2	0.5	21.3.2023	Soil				x											Keep
22	BH2	1	21.3.2023	Soil				x											Keep
23	BH2	1.5	21.3.2023	Soil				x											Keep
24	BH2	2	21.3.2023	Soil				x											Keep
25	BH2	2.5	21.3.2023	Soil				x											Keep
26	BH2	3	21.3.2023	Soil				x											Keep
27	BH2	3.5	21.3.2023	Soil				x											Keep
28	BH2	4	21.3.2023	Soil				x											Keep
29	BH2	4.5	21.3.2023	Soil				x											Keep
30	BH2	5	21.3.2023	Soil				x											Keep
31	BH2	5.5	21.3.2023	Soil				x											Keep
32	BH2	6	21.3.2023	Soil				x											Keep
33	BH3	0.2	22.3.2023	Soil				x											Keep
34	BH3	0.45	22.3.2023	Soil				x											Keep
35	BH4	0.05	22.3.2023	Soil				x											Keep
36	BH4	0.4	22.3.2023	Soil				x											Keep
37	BH4	0.7-0.8	22.03.2023	Soil				X											

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200

Job No: 319450
Date Received: 24/3/23
Time Received: 1535
Received By: CD
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Special Directions and Coments: Keep in freezer within same day of sampling

Relinquished by	RL	Received By	
Signature		Signature	
Date	24.03.2023	Date	

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Foundation Earth Sciences Pty Ltd
Attention	Michael Silk

Sample Login Details

Your reference	E2970-3, Newcastle
Envirolab Reference	319450
Date Sample Received	24/03/2023
Date Instructions Received	24/03/2023
Date Results Expected to be Reported	29/03/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	37 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	2
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	sPOCAS field test
BH1-0.2	✓
BH1-0.5	✓
BH1-1	✓
BH1-1.5	✓
BH1-2	✓
BH1-2.5	✓
BH1-3	✓
BH1-3.5	✓
BH1-4	✓
BH1-4.5	✓
BH1-5	✓
BH1-5.5	✓
BH1-6	✓
BH1-6.5	✓
BH1-7	✓
BH1-7.5	✓
BH1-8	✓
BH1-8.5	✓
BH1-9	✓
BH2-0.2	✓
BH2-0.5	✓
BH2-1	✓
BH2-1.5	✓
BH2-2	✓
BH2-2.5	✓
BH2-3	✓
BH2-3.5	✓
BH2-4	✓
BH2-4.5	✓
BH2-5	✓
BH2-5.5	✓
BH2-6	✓

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customerservice@envirolab.com.au
www.envirolab.com.au

Sample ID	sPOCAS field test
BH3-0.2	✓
BH3-0.45	✓
BH4-0.05	✓
BH4-0.4	✓
BH4-0.7-0.8	✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

APPENDIX B: BOREHOLE LOGS

BOREHOLE : BH1/GW1

FOUNDATION EARTH SCIENCES

CLIENT NAME: East End Stage 3 Pty Ltd & East End Stage 4 Pty Ltd **JOB NUMBER:** E2970-3

SITE ADDRESS: Hunter St, Morgan St, King St & Newcomen St, Newcastle NSW **PROJECT:** Acid Sulphate Soil Assessment

Date Started : 21/03/2023 **Completed :** 21/03/2023 **Logged By :** RL **Checked By :** MS

Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD

Equipment : Drill Rig **Borehole Size :** 100mm **Slope :** -90°

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
DT				0.15			Concrete			0.2		
							FILL, Silty Clayey Sand, fine to medium grained, brown - orange- dark brown	M	L-MD	0.5		
				1						1		1
				1.50			FILL, Silty Sand, fine to medium grained, light black - orange	M	MD-D	1.5		
				2						2		2
				2.80						2.5		
				3		SC	Clayey SAND, fine to medium grained, orange - brown with possibly some peat between 3.5 & 4.5m	M	F-St	3		3
										3.5		
				4						4		4
ADT										4.5		
				5						5		5
										5.5		
				6						6		6
										6.5		
				7						7		7
	▶									7.5	Water seepage @ app 7.5m BGL	
				8						8		8
				8.00		CH	Sandy CLAY, medium to high plasticity, orange -brown	M-W	St-VSt			
				9						8.5		
				9.00			Borehole BH1/GW1 terminated at 9.00m			9		9
				10								10

Comments:

D - Dry, M - Moist, W - Wet

VS - Very Soft, S - Soft, F - Firm, St - Stiff, VSt - Very Stiff, H - Hard

VL - Very Loose, L - Loose, MD - Medium Dense, D - Dense, VD - Very Dense

BOREHOLE : BH2/GW2

FOUNDATION EARTH SCIENCES

CLIENT NAME: East End Stage 3 Pty Ltd & East End Stage 4 Pty Ltd **JOB NUMBER:** E2970-3

SITE ADDRESS: Hunter St, Morgan St, King St & Newcomen St, Newcastle NSW **PROJECT:** Acid Sulphate Soil Assessment

Date Started : 21/03/2023 **Completed :** 21/03/2023 **Logged By :** RL **Checked By :** MS

Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD

Equipment : Drill Rig **Borehole Size :** 100mm **Slope :** -90°

Method	Water	Well Details	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
DT				0.10			Concrete					
							FILL, Sand, fine to medium grained, brown	D	L-MD	0.2 0.5		
				1.00			FILL, Silty Sand, fine to coarse grained, dark brown with some gravels	D	MD-D	1 1.5		1
ADT				1.80		SW-SM	Silty SAND, fine to medium grained, light brown, brown- orange-grey	D	D	2 2.5 3 3.5		2 3
	▼									4	SWL@ 3.8m BGL on 27.03.2023	4
				4.50		CH	Sandy CLAY, medium to high plasticity, orange -brown	M-W	St-VSt	4.5		
	►									5 5.5	Water seepage @ app5.0m BGL	5
				6.00			Borehole BH2/GW2 terminated at 6.00m			6		6 7 8 9 10

Comments:

D - Dry, M - Moist, W - Wet

VS - Very Soft, S - Soft, F - Firm, St - Stiff, VSt - Very Stiff, H - Hard

VL - Very Loose, L - Loose, MD - Medium Dense, D - Dense, VD - Very Dense

FOUNDATION EARTH SCIENCES

BOREHOLE : BH3

CLIENT NAME: East End Stage 3 Pty Ltd & East End Stage 4 Pty Ltd **JOB NUMBER:** E2970-3

SITE ADDRESS: Hunter St, Morgan St, King St & Newcomen St, Newcastle NSW **PROJECT:** Acid Sulphate Soil Assessment

Date Started : 22/03/2023 **Completed :** 22/03/2023 **Logged By :** RL **Checked By :** MS

Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD

Equipment : Drill Rig **Borehole Size :** 100mm **Slope :** -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
DT						Concrete					
			0.15								
ADT						FILL, Sand, fine to medium grained, brown	D	L	0.2		
			0.5						0.45		0.5
			0.50								
			0.60			Refusal on concrete slab(potential underground services) Borehole BH3 terminated at 0.50m					
			1.0								1.0
			1.5								1.5
			2.0								2.0
			2.5								2.5
			3.0								3.0

Comments:

D - Dry, M - Moist, W - Wet

VS - Very Soft, S - Soft, F - Firm, St - Stiff, VSt - Very Stiff, H - Hard

VL - Very Loose, L - Loose, MD - Medium Dense, D - Dense, VD - Very Dense

FOUNDATION EARTH SCIENCES

BOREHOLE : BH4

CLIENT NAME: East End Stage 3 Pty Ltd & East End Stage 4 Pty Ltd **JOB NUMBER:** E2970-3

SITE ADDRESS: Hunter St, Morgan St, King St & Newcomen St, Newcastle NSW **PROJECT:** Acid Sulphate Soil Assessment

Date Started : 22/02/2023 **Completed :** 22/02/2023 **Logged By :** RL **Checked By :** MS

Borehole Location : Refer to Site Plan **Surface RL :** --- **Datum :** m AHD

Equipment : Hand Auger **Borehole Size :** 75mm **Slope :** -90°

Method	Water	RL (m)	Depth (m)	Graphic Log	Classification Symbol	Material Description	Moisture	Consistence	Samples Tests Remarks	Additional Observations	Depth (m)
HA			0.05			Bricks Paver			0.05		
DT			0.10			FILL, Silty Sand, medium to coarse grained, brown with some gravels	D-M	L-D			
			0.15			Concrete	D-M	L-D			
HA			0.5			FILL, Silty Sand, medium to coarse grained, brown with a lot of gravels			0.4		0.5
			0.80						0.7-0.8		
			0.90			Hand Auger Refusal due to gravel layer & collapse of sand. Service locater required no mechanic drilling within this courtyard area due to too many undergorund service Borehole BH4 terminated at 0.80m					
			1.0								1.0
			1.5								1.5
			2.0								2.0
			2.5								2.5
			3.0								3.0

Comments:

D - Dry, M - Moist, W - Wet

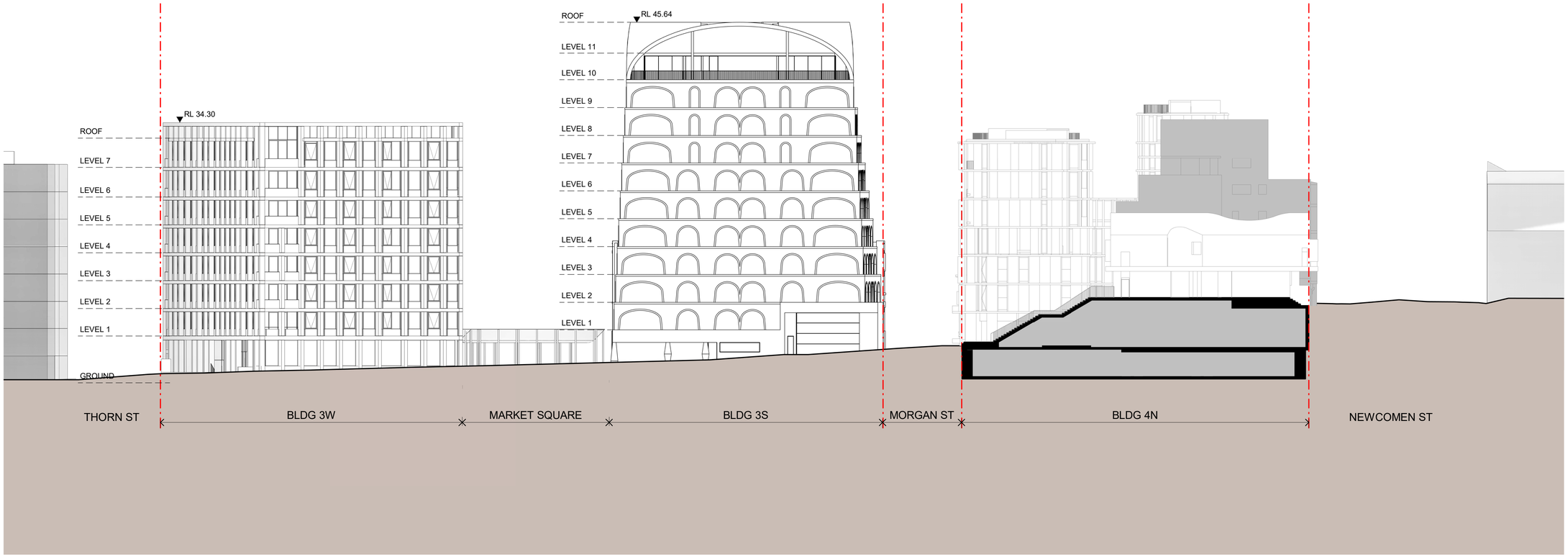
VS - Very Soft, S - Soft, F - Firm, St - Stiff, VSt - Very Stiff, H - Hard

VL - Very Loose, L - Loose, MD - Medium Dense, D - Dense, VD - Very Dense

APPENDIX C: PROPOSED DEVELOPMENT PLANS

FOR INFORMATION

Rev	Date	Revision	By	Chk.
1	2022/09/09	FOR INFORMATION	JG	WG
2	2022/09/28	FOR INFORMATION	JG	RY
3	2022/12/05	FOR INFORMATION	JG	RY
4	2023/02/28	FOR INFORMATION	JG	RY



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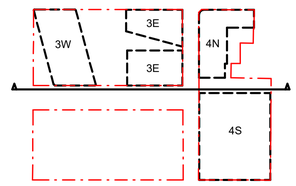

Client

Project
EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name
OVERALL SECTIONS - PRECINCT - SHEET 1

Drawn

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Date	Scale	Sheet Size
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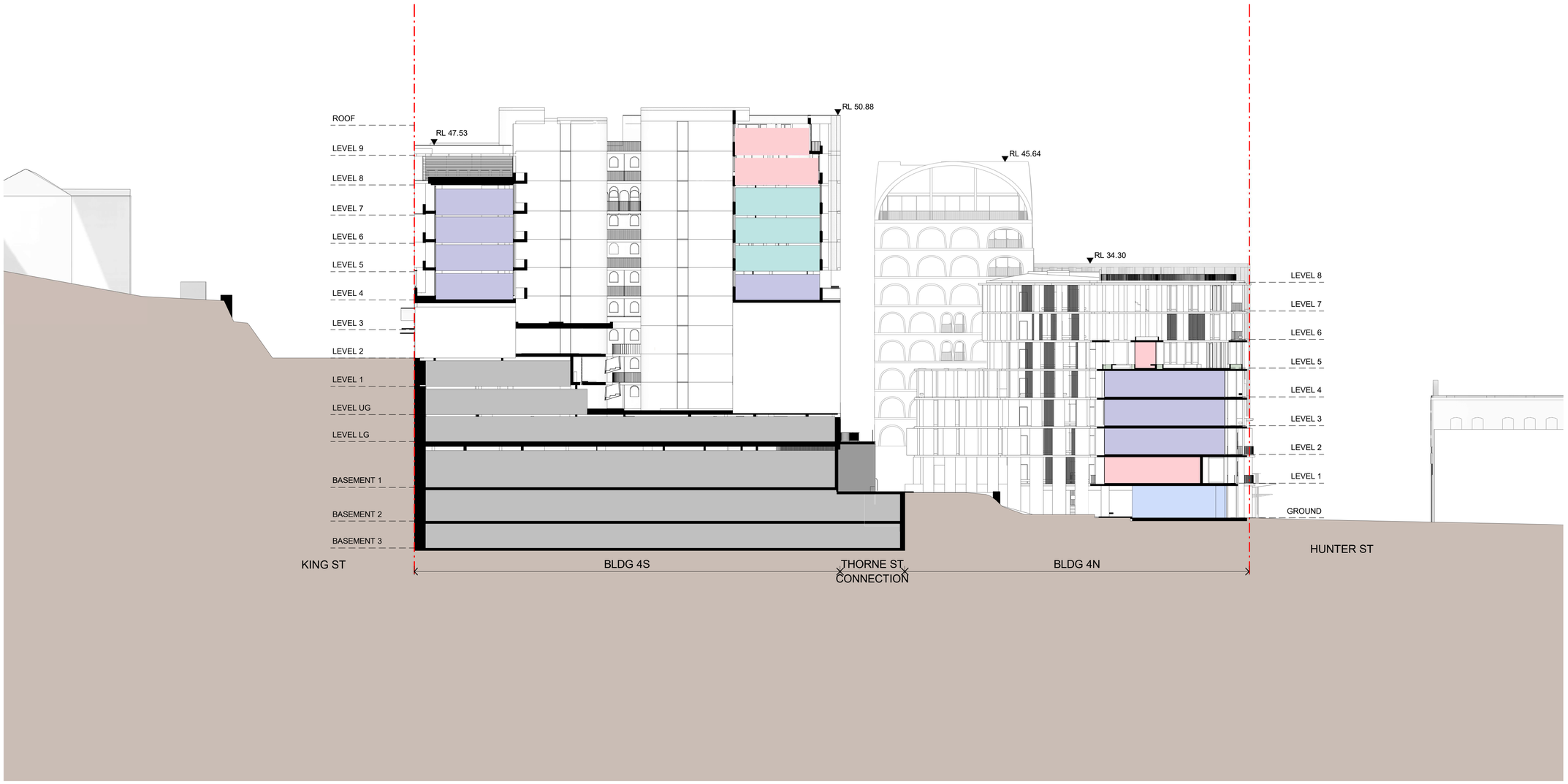
Drawn.	Chk.	Revision
JG	RY	4
Job No.	Drawing No.	
6668	DA-PR-0361	

FOR INFORMATION

Rev	Date	Revision	By	Chk.
1	2022/09/09	FOR INFORMATION	JG	WG
2	2022/09/28	FOR INFORMATION	JG	RY
3	2022/12/05	FOR INFORMATION	JG	RY
4	2023/02/28	FOR INFORMATION	JG	RY



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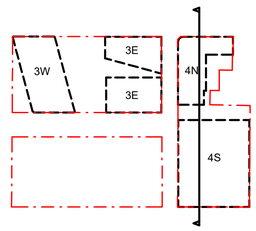

Client

Project

EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name

OVERALL SECTIONS - PRECINCT - SHEET 2

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Drawn.	Chk.	Revision
JG	RY	4
Job No.	Drawing No.	
6668	DA-PR-0362	

FOR INFORMATION

Rev	Date	Revision	By	Chk.
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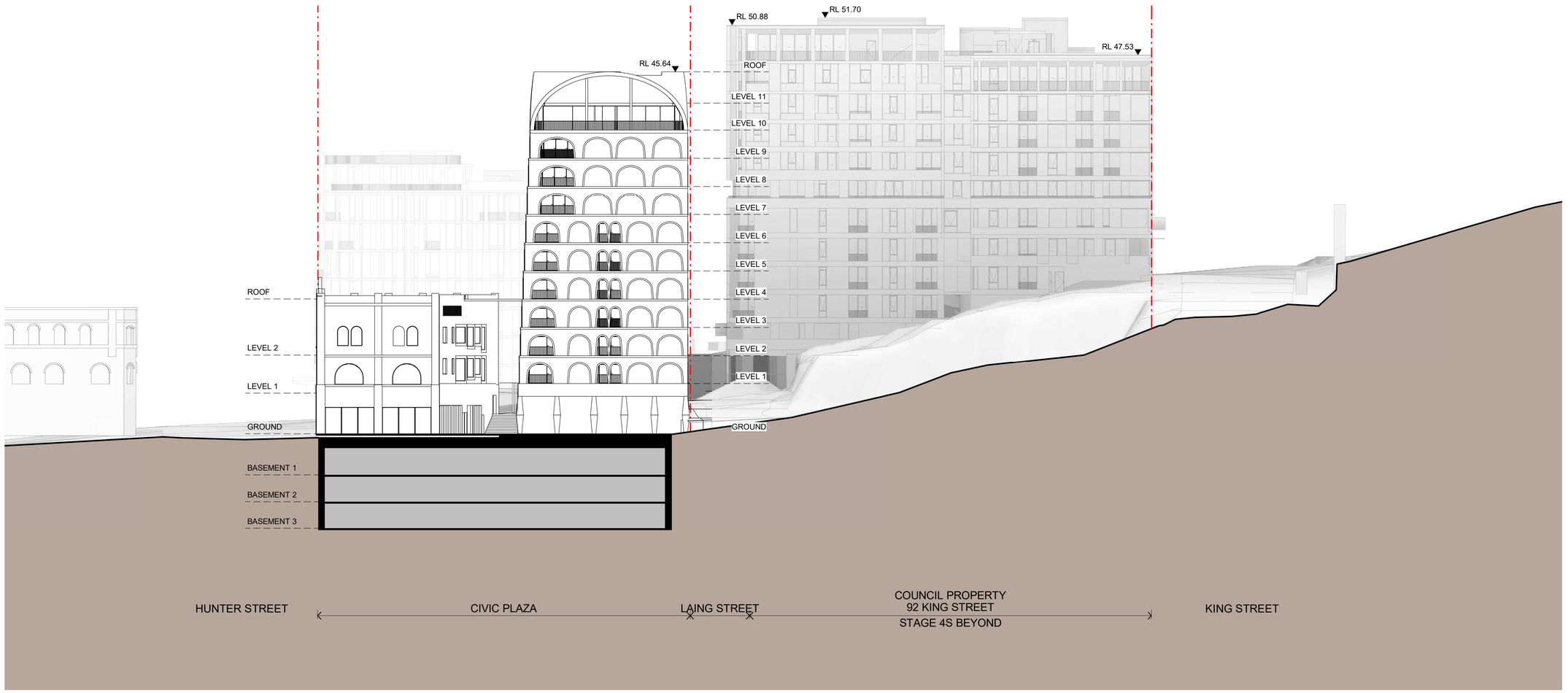
2	2022/12/05	FOR INFORMATION	JG	RY
3	2023/02/28	FOR INFORMATION	JG	RY



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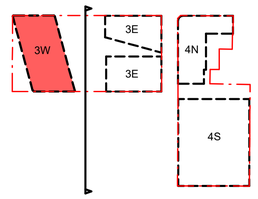

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EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name

OVERALL SECTIONS - PRECINCT - SHEET 3

Drawn

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Job No.	Drawing No.
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FOR INFORMATION

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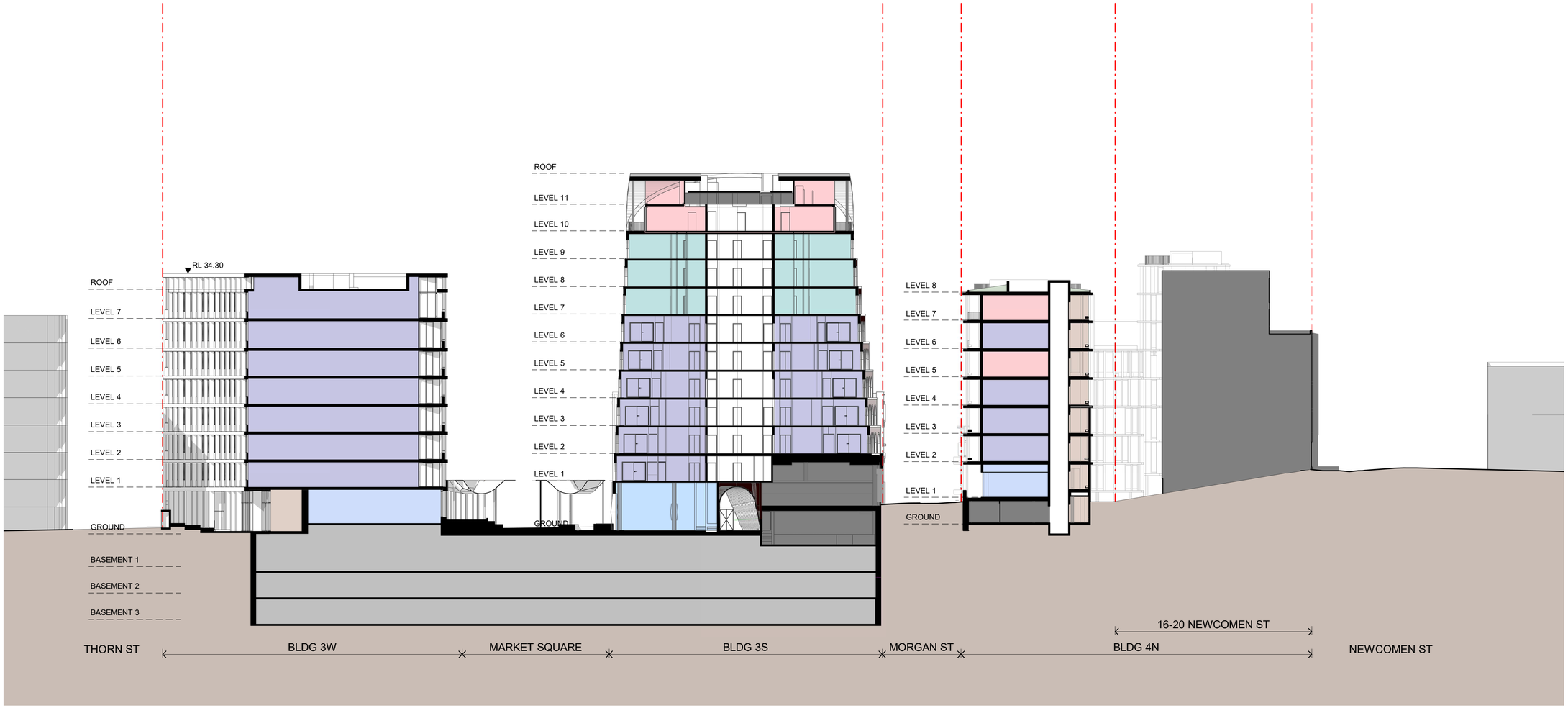
2	2023/02/28	FOR INFORMATION	JG	RY



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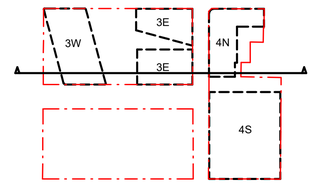

Client

Project

EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name

OVERALL SECTIONS - PRECINCT - SHEET 4

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Drawn.	Chk.	Revision
JG	RY	2

Job No.	Drawing No.
6668	DA-PR-0364

FOR INFORMATION

Rev	Date	Revision	By	Chk.
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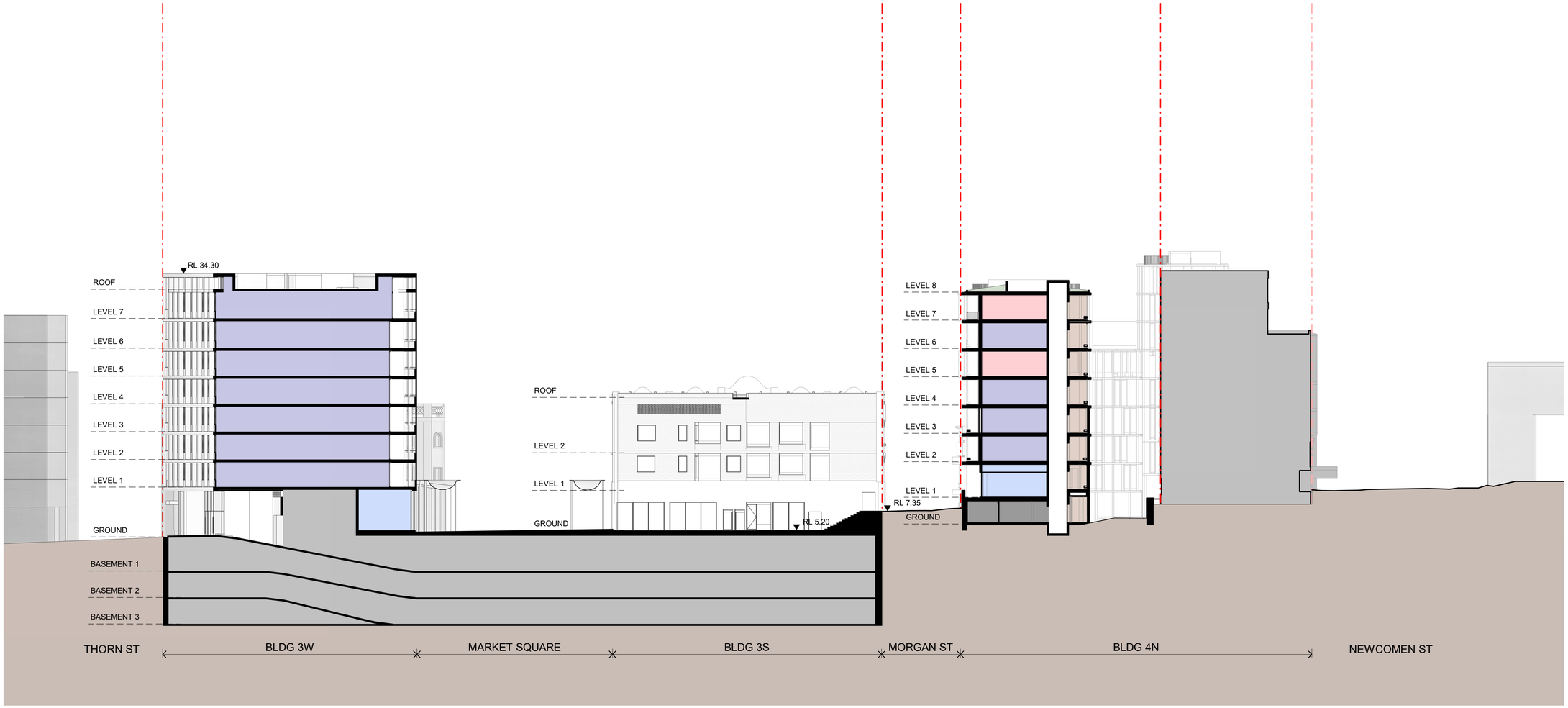
2	2023/02/28	FOR INFORMATION	JG	RY



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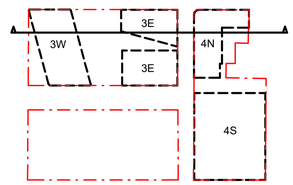

Client

Project

EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name

OVERALL SECTIONS - PRECINCT - SHEET 5

Drawn

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Date	Scale	Sheet Size
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Drawn.	Chk.	Revision
JG	RY	2
Job No.	Drawing No.	
6668	DA-PR-0365	

FOR INFORMATION

Rev	Date	Revision	By	Chk.
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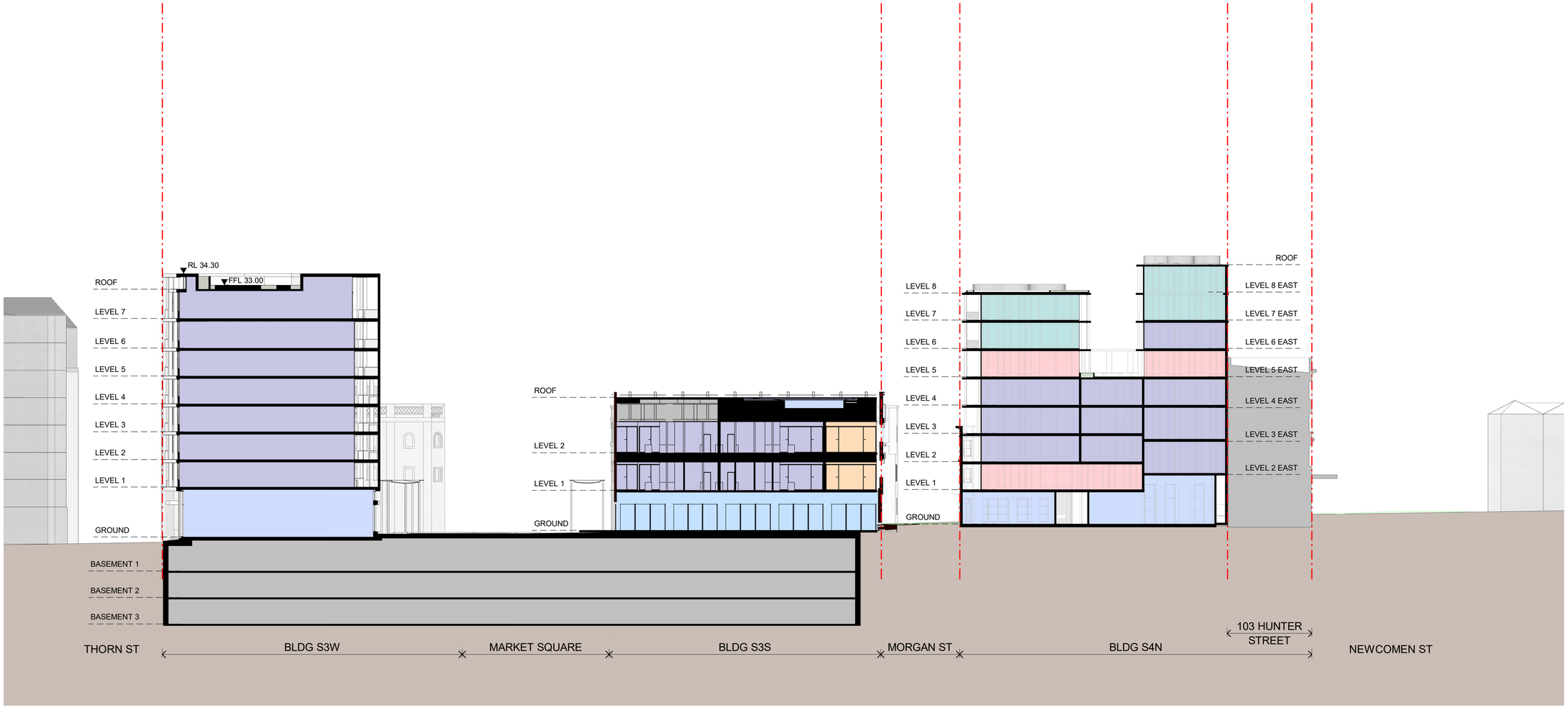
2	2023/02/28	FOR INFORMATION	JG	RY



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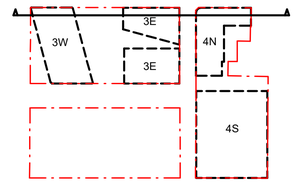

Client

iris

Project

EAST END STAGE 3 & 4

Hunter, Morgan, Newcomen, King Streets NEWCASTLE NSW 2300

Country: AWABAKAL

Drawing Name

OVERALL SECTIONS - PRECINCT - SHEET 6

Drawn

0 2.5 5 12.5m
1:250 @A1

Date	Scale	Sheet Size
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Drawn.	Chk.	Revision
JG	RY	2

Job No.	Drawing No.
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