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Project 39961.02
19 January 2021
R.005.Rev0
PH:plh

Attention: David Desson

Email: david@multipartproperty.com.au

Dear David

Acid Sulfate Soil Management Plan
Proposed Apartment Development
10 Dangar Street, Wickham

1. Introduction

This Acid Sulfate Soil Management Plan (ASSMP) has been prepared for the proposed apartment development at 10 Dangar Street, Wickham. This ammended Acid Sulphate Management Plan addresses the requirements for the 3rd Basement as required for the S4.55 submission.

It is understood that the proposed development will comprise a 14-storey building which will include three basement car parking levels, ground floor lobby and retail, three office and car parking levels, and 10 levels of residential apartments. It is anticipated that excavations will be required for construction activities including basement construction, service trenches, lift pit and foundations.

DP has conducted acid sulfate soil (ASS) testing at the site. DPs experience in the area, along with the results of the assessment has been used to provide ASS management measures for the subject site and the proposed development.

This ASSMP provides methods and strategies to minimise the potential for adverse impact associated with the disturbance of ASS during construction works associated with the proposed residential development. The Acid Sulfate Soil Management Plan (ASSMP) includes the following information:

- ASS management strategies;
- Monitoring program; and
- Contingency plan.

This ASSMP was prepared with reference to the NSW Acid Sulfate Soil Management Advisory Committee (ASSMAC), Acid Sulfate Soil Manual, August 1998 (Ref 1) and the Queensland Government, Queensland Acid Sulfate Soil Technical Manual, Soil Management Guidelines, V4.0, June 2014 (Ref 2).

2. Site Description and Regional Geology

The site is identified as Lot 1, DP1197377 and is known as 10 Dangar Street Wickham. The site is an irregular-shaped area of approximately 2930 m^2.

The site is bounded to the east by Hannell Street, to the north by Dangar Street, and residential development, to the west by Charles Street, Station Street and commercial development, and to the south by the Newcastle Transport Interchange (i.e. former rail corridor).

The subject lot is shown in Figure 1 below.

Figure 1: Subject site, in yellow

Reference to NSW LiDAR topographic imaging for the site indicates that surface levels are in the order of RL1.5 to RL2.0 (AHD), with the site being generally flat.

Reference to the Newcastle Coalfield Regional Geology 1:100 000 Geological Series Sheet published by the Department of Mineral Resources indicates that the site is underlain by Quaternary aged alluvium which typically comprises gravel, sand, silt and clay.

Reference to the Newcastle Acid Sulphate Soil Risk Map prepared by the Department of Land & Water Conservation indicates that the site has a high probability of occurrence of ASS between 1 m and 3 m below the ground surface.

3. Results of Previous Investigation

DP conducted a contamination assessment on the site in November 2018 (Ref 3).

The DP investigation included the drilling of five boreholes within the subject site with groundwater well installation.

Subsurface conditions generally comprised upper silty sand/sandy gravel/clayey sand filling with various inclusions (slag, building rubble, coal reject) to approximately 0.6 m to 1.4 m below ground level, underlain by sand filling and natural sands to the extent of investigation. Groundwater was encountered in the boreholes at approximately 1.4 m to 2.7 m below ground level.

The results of groundwater field testing during the assessment indicated that groundwater was slightly acidic to neutral (i.e. pH 6.0 to pH 7.0) and generally fresh to slightly brackish (i.e. EC 345 µS/cm to 1144 µS/cm).

The results of ASS screening tests conducted at the property (Ref 3) are summarised in Table 1.

Table 1: Results of Acid Sulphate Screening Tests

Sample ID	Sample Depth [a] (m)	Sample RL (AHD)	Sample Description	Screening Test Results				Laboratory Results							
				pH			Strength of Reaction [b]	pH_{KCL}	Scr %S	s-TAA %S	S_{NAS} %S	s-ANC_{BT} %S	s-C_{IN} %S	Net Acidity[c] %S	Exisiting and Potential Acidity %S
				pH_F	pH_{FOX}	pH_F - pH_{FOX}									
201	1.0-1.2	0.41-0.61	Dark brown silty sand filling	6.6	**3.0**	**3.6**	1								0.00
	1.5-1.6	0.11-0.01	Grey and brown sand	6.6	**1.9**	**4.7**	4 F, H	3.7	0.50	0.06	0.03	<0.05		0.59	0.59
	2.2-2.3	-0.59--0.69	Grey and brown sand	7.4	**2.1**	**5.3**	1								0.00
	2.5-2.7	-0.89--1.09	Grey and brown sand	7.4	**2.2**	**5.2**	4 F, H								0.00
	3.1-3.3	-1.49--1.69	Grey and brown sand	7.0	**2.9**	**4.1**	2 F, H								0.00
	3.3-3.5	-1.69--1.89	Grey and brown sand	7.1	**2.9**	**4.2**	4 F, H								0.00
	3.8-4.0	-2.19--2.39	Grey and brown sand	5.9	**2.3**	**3.6**	1								0.00
	4.3-4.5	-2.69--2.89	Grey and brown sand	6.8	**2.7**	**4.1**	1								0.00
	4.8-5.0	-3.19--3.39	Grey and brown sand	7.6	**2.9**	**4.7**	1								0.00
	5.3-5.5	-3.7--3.9	Grey and brown sand	7.1	**3.0**	**4.1**	1								0.00
	5.8-6.0	-4.2--4.4	Grey and brown sand	7.0	**3.2**	**3.8**	1								0.00
	6.3-6.5	-4.69--4.89	Grey and brown sand	7.0	**3.0**	**4.0**	1								0.00
	6.5-7.0	-4.89--5.39	Grey and brown sand	6.6	**3.0**	**3.6**	1								0.00
	7.3-7.5	-5.7--5.9	Grey and brown sand	6.6	**3.1**	**3.5**	1								0.00
	7.7-7.9	-6.09--6.29	Grey and brown sand	6.5	**2.7**	**3.8**	1	4.7	0.06	<0.01	<0.005	<0.05		0.059	0.059
203	0.7	2.2	Dark grey clay filling some sand and gravel	7.3	**3.1**	**4.2**	1								0.00
	1	1.9	Dark grey clay filling some sand and gravel	8.0	7.3	0.7	2								0.00
	2	0.9	Dark grey to grey brown sand	8.2	6.5	**1.7**	4 F, H								0.00
	2.5	0.4	Dark grey to grey brown sand	8.0	6.2	**1.8**	2								0.00
	3	-0.1	Dark grey to grey brown sand	7.8	4.2	**3.6**	1								0.00
	3.5	-0.6	Dark grey to grey brown sand	7.7	**2.2**	**5.5**	1	4.0	0.17	0.06	<0.005	<0.05		0.23	0.23
	4.1	-1.2	Dark grey to grey brown sand	7.5	**3.4**	**4.1**	1								0.00
	4.8	-1.9	Dark grey to grey brown sand	6.1	**3.4**	**2.7**	1								0.00
	5.4-5.5	-2.5--2.6	Dark grey to grey brown sand	6.2	**3.0**	**3.2**	1								0.00
	6.1	-3.2	Dark grey to grey brown sand	7.0	3.9	**3.1**	2								0.00
	6.8	-3.9	Dark grey to grey brown sand	6.8	3.9	**2.9**	1								0.00
205	1.7	-0.06	Grey brown sand	6.7	**2.0**	**4.7**	2								0.00
	2.1	-0.46	Grey brown sand	7.0	**2.2**	**4.8**	1	4.3	0.18	0.04	<0.005	<0.05		0.23	0.23
	2.7	-1.06	Grey brown sand	7.1	**3.0**	**4.1**	1								0.00
	3.1	-1.46	Grey brown sand	7.2	**3.0**	**4.2**	1								0.00
	3.8	-2.16	Grey brown sand	7.1	**2.9**	**4.2**	1								0.00
	4.1	-2.46	Grey brown sand	6.2	**2.1**	**4.1**	2 F, H								0.00
	5	-3.36	Grey brown sand	6.4	**2.9**	**3.5**	1								0.00
	5.3	-3.66	Grey brown sand	6.4	**2.8**	**3.6**	1								0.00
	5.7	-4.06	Grey brown sand	6.7	**2.8**	**3.9**	1								0.00
	6.1	4.46	Grey brown sand	6.4	**2.7**	**3.7**	1								0.00
Guideline			Coarse sands, poorly buffered	<4[d]	<3.5[e]	≥1[e]	-	-	-	-	-	-	-	-	0.01

Notes to Table 1:

a Depth below ground surface

b Strength of Reaction
- 1 denotes no or slight reaction
- 2 denotes moderate reaction
- 3 denotes high reaction
- 4 denotes very vigorous reaction
- F denotes bubbling/frothy reaction indicative of organics
- H denotes heat generated

c Calculated by the laboratory based on the ABA equation in ASS Laboratory Methods Guidelines (Ref 9)

d For actual acid sulphate soils (ASS)

e Indicative value only for Potential Acid Sulphate Soils (PASS)

Bold results indicative of ASS

Shaded results indicate an exceedence of QASSIT action criteria (Ref 10)

pH_F - Soil pH Test (1:5 soil:distilled water)

pH_{FOX} - Soil Peroxide pH Test (1:4 soil:distilled water following oxidation of soil with 30% hydrogen peroxide (H_2O_2))

*Laboratory methods used to quantify ANC are likely to overestimate environmental effectiveness

The ASSMAC guidelines (Ref 1) suggest that a soil pH<4 in water is an indicator of actual ASS. The results of screening tests therefore suggest the absence of actual ASS at the locations and depths tested.

The ASSMAC guidelines also suggest that indicators of potential acid sulphate soils (PASS) include the following:

- Soil pH <3.5 following oxidation with H_2O_2 (i.e. pH_{FOX});
- Drop of 1 pH unit or more between pH_F and pH_{FOX}.

The results of screening tests indicated that the majority (35 of 36 samples) of soil samples tested exhibited a pH drop equal to or greater than one unit. In addition, 30 of the 36 samples tested also exhibited a soil pH following oxidation below 3.5.

It is noted that ASS screening tests are a qualitative method only and give an indication of the intensity of total acidification (pH). The guidelines indicate that peroxide may also oxidise organic matter (in addition to pyrite) to produce acids which are unlikely to form under natural conditions, thus giving falsely high indication of acid sulphate potential.

Detailed laboratory testing, comprising the Full Chromium Suite, on four selected samples from depths between 1.5 m and 7.9 m (RL2.2 to RL-6.29) on the site indicated all samples exceeded the QASSIT action criteria (Ref 2) for disturbance of less than and greater than 1000 tonnes of material for sand (i.e. Net Acidity values between 0.059%S and 0.59%S). It is noted that screening tests conducted in the sand filling encountered in the current investigation suggested similar results to the underlying natural sand soils in some samples. In the absence of further ASS testing in the filling, it is recommended that the sand filling is assumed to be ASS unless additional testing suggests otherwise.

Based on the above, sandy materials (fill and natural) present on the site (i.e. below upper dark grey sandy filling) were considered to be potential ASS, and if disturbed during development, will require management with reference to the ASSMAC guidelines (Ref 1).

4. Potential for Oxidising ASS

It is anticipated that bulk excavations will be required for construction activities including basement excavation, service trenches, lift pit and foundations, plus during contamination remediation such as removal of underground fuel infrastructure and hydrocarbon-impacted soils.

ASS may also be exposed during dewatering, which is anticipated during basement and foundation excavation.

Acid sulfate soil management should be conducted with due consideration to site remediation requirements and the procedures presented in the remediation action plan (RAP) prepared by DP for the site (Ref 4).

The recommended management option for excavated ASS is neutralisation by full lime treatment and oxidation.

5. Management Strategy

5.1 Soil Treatment Strategy

Neutralisation of ASS, where disturbed, will be required and should be undertaken with reference to the ASSMAC and QASSIT guidelines, as discussed below.

ASS (i.e. 'clean' sand filing and underlying natural soils) should be segregated during excavations and treated within a suitable contained and bunded area prior to re-use on-site or classification for off-site reuse/disposal in approved locations.

Due to the extent of excavation required for basement construction, a staged excavation/treatment program is likely.

The location of the bunded areas should be selected in order to minimise the potential for impact on nearby sensitive receptors, including nearby water bodies (i.e. drains). Any leachate produced in the bunded area should be contained for monitoring and treatment as discussed below.

If a suitable located bunded area is not available on-site, consideration could be given to progressive treatment of soils immediately adjacent to the excavation as the material is excavated (i.e. treated within 4 hours of excavation).

Suitable neutralising agents for actual or potential ASS include agricultural lime ($CaCO_3$), calcined magnesia (MgO or $Mg(OH)_2$) and dolomite ($MgCO_3.CaCO_3$).

An assessment of the dosing rate for lime treatment can be calculated from the results of detailed laboratory testing, using the following equation, which includes a factor of safety.

Alkali Material Required (kg)

per unit volume of soil (m^3) = $\left(\frac{\%S \times 623.7}{19.98}\right) \times \frac{100}{ENV(\%)} \times D \times FOS$

Where: *%S = existing and potential acidity (% S units);*
623.7 = % S to mol H^+ / t;
19.98 = mol H^+ / t to kg $CaCO_3$ / t;
D = Bulk density of soil (t/m^3);
FOS = safety factor (usually 1.5);
ENV = Effective Neutralising Value (e.g. 80% for Grade 1 Agricultural lime).

Note: *The ENV is calculated based on the molecular weight, particle size and purity of the neutralising agent and should be assessed for proposed materials in accordance with QASSIT (Ref 2).*

It is recommended that Grade 1 agricultural lime is used for the neutralisation of ASS excavated during the construction.

5.2 Liming and Monitoring Procedure

The liming and monitoring procedure for the treatment of ASS is as follows:

- The surface of the bunded soil treatment area/stockpile area adjacent to the excavation should be dosed with approximately 1 kg/m^2 of agricultural lime as a precautionary measure;
- All identified and segregated ASS should be contained within a suitably bunded area and kept moist to minimise oxidation, prior to treatment with lime. Progressive neutralisation will minimise the area required for bunding;
- The base of excavations within ASS should be treated with approximately 1 kg/m^2 of agricultural lime.

Based on detailed laboratory testing (existing and potential acidity results) from the site, lime application rates for stockpiled ASS varies between 2.8 kg Grade 1 agricultural lime per tonne of excavated soil (~4.8 kg/m^3) and 28 kg Grade 1 agricultural lime per tonne of excavated soil (~48 kg/m^3). It is recommended, however, that a rate of 10 kg of lime per tonne of soil (i.e. ~17 kg/m^3) is initially trialled to minimise the risk of over-liming. Lime treatment should be conducted as follows:

- Soils should be neutralised as soon as practicable following excavation;
- The neutralising agent and ASS should be thoroughly mixed and aerated. The soil should be treated in layers up to 300 mm thick to encourage aeration;
- Thorough mixing of lime may be difficult where clayey sands are encountered. Improved mixing may be achieved by reducing the thickness of treatment layers, and using a rotary hoe or similar;
- It should be noted that the actual lime rate required will also depend on the results of monitoring during neutralisation. Additional lime will be required if monitoring results indicate that appropriate neutralisation has not been achieved. Conversely the liming rate may decrease if monitoring suggests over-liming is occurring;
- Sampling and testing should be undertaken in accordance with Section 5.5 to confirm the neutralisation treatment. The acceptance criteria are discussed in Section 5.5.2. Depending on the results of testing, re-application of lime may be necessary to gain adequate neutralisation;
- Upon confirmation of treatment, options for the re-use/disposal of the neutralised ASS would be as follows:
    - Re-use on-site subject to contamination and geotechnical suitability
    - Disposal to a licenced landfill following waste classification;
    - Re-use at an approved off-site location, subject to application to the NSW EPA and subsequent approval under a specific exemption.

5.3 Neutralising Leachate

Leachate water collected from the bunded area (if any) should be neutralised as necessary before release. Calcined magnesia (magnesium hydroxide, burnt magnesite, or magnesia) is the recommended neutralising agent as it produces a two-step reaction, which proceeds rapidly at acidic pH and slows down as higher pH is approached, and hence reduces the potential for over neutralisation to occur.

The amount of neutraliser required to be added to the leachate can be calculated from the equation below:

$$\text{Alkali Material Required (kg)} = \frac{M_{Alkali} \times 10^{-pH\,initial}}{2 \times 10^{3}} \times V$$

Where: *pH initial = initial pH of leachate*
V = volume of leachate (litres)
M_{Alkali} = molecular weight of alkali material (g/mole)

Note: *molecular weight of calcined magnesia (M_{MgO}) = 40 g/mole.*

The alkali should be added to the leachate as a slurry. Mixing of the slurry is best achieved using an agitator.

Any discharge / disposal of water (if required) should be conducted in accordance with statutory and regulatory requirements.

5.4 Dewatering

The following procedure is recommended in order to minimise potential adverse impacts resulting from localised dewatering of ASS during construction:

- Minimise the dewatering depth required for construction (i.e. as close as practicable to the invert level of the excavation);
- Minimise the time and volume of exposed ASS (i.e. stage excavation and dewatering);
- Appropriate management of extracted waters to allow monitoring and treatment (if required) prior to release / discharge;
- The extracted groundwater could then be discharged to a nominated bunded area within the site (i.e. for infiltration), re-injected or discharged to sewer / stormwater, subject to regulatory requirements;
- The pH of the extracted water should be monitored prior to discharge. Neutralisation should be undertaken as per the leachate neutralisation procedures, as discussed in Section 5.3, if discharge water pH falls below background levels (for controlled infiltration/re-injection), or falls outside regulatory requirements for discharge;

- Dose the base and walls of the excavation at a rate of approximately 1 kg/m^2 of Agricultural lime in order to counteract the possible generation of acidic leachate following groundwater recovery;
- Segregate and treat the ASS excavated during construction as discussed in Section 5.2;
- Undertake monitoring as recommended in Section 5.5 below.

5.5 Acid Sulfate Monitoring Strategies

5.5.1 Procedures

Soil Neutralisation / Management

The following inspections and monitoring should be undertaken when excavating ASS materials, based on guidelines presented in the ASSMAC and QASSIT manuals (Refs 1 and 2):

- Daily inspection of liming operations during excavation;
- Sampling and screening testing after lime treatment (i.e. measurements of soil pH in distilled water and pH following oxidation with peroxide) should be undertaken initially at a frequency of at least one sample per 50 m^3 excavated soil, or daily (whichever is greater), to assist in confirming the neutralisation treatment;
- Analysis of one soil sample per 50 m^3 for Chromium Suite analysis by a NATA accredited laboratory to confirm appropriate neutralisation;
- The frequency of testing could be reduced depending on the results of monitoring and consistency of excavated ASS.

Leachate Management

Leachate collected within the bunded area should be temporarily stored and neutralised as necessary. The pH of the leachate should be monitored daily, and prior to any discharge to the environment. The neutralised leachate could be discharged overland within the site (i.e. controlled evaporation / infiltration), or discharged to sewer / stormwater, subject to regulatory requirements and licences.

Neutralisation should be undertaken if discharge water pH falls below background levels if overland evaporation/infiltration is proposed, or to within regulatory requirements if discharge is proposed.

Dewatering

Extracted waters should be managed to allow monitoring and treatment (if required) prior to release/discharge. The pH of extracted water associated with areas of ASS should be monitored twice daily (am and pm) prior to discharge. If variable results are detected a higher frequency of testing may be required. The neutralised extracted water could be discharged overland (i.e. infiltration/re-injection), or discharged to sewer / stormwater, subject to regulatory requirements and licences.

Neutralisation should be undertaken if discharge water pH falls below background levels (for infiltration/re-injection), or regulatory requirements for discharge.

Site management procedures should allow for lime / calcined magnesia dosing and monitoring and confirm appropriate neutralisation prior to discharge.

Reporting

A record of treatment of ASS and leachate should be maintained by the contractor and should include the following details:

- Date;
- Location;
- Time stockpile has been exposed prior to treatment;
- Neutralisation process undertaken;
- Lime rate utilised;
- Results of soil, leachate and groundwater monitoring;
- Record of location, level placement and capping details where treated ASS has been re-used on-site.

A record should also be maintained confirming contingency measures and additional treatment if undertaken.

A final report should be issued upon completion of the works presenting the monitoring regime and results, and confirming that appropriate management of ASS has occurred during the works.

5.5.2 Acceptance Criteria

Water

Discharge of waters should be conducted in accordance with statutory and regulatory requirements, and the ANZAST (2018), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', August 2018 (Ref 5).

Measurement of pH and EC of groundwater at the commencement of construction should be conducted to determine baseline conditions at the site.

Soil

Further treatment may be required if monitoring of the material reveals any of the following properties:

- pH of soil in water is less than background values. Applicable background values are those present within the area proposed for re-use of treated ASS (i.e. background pH of soils within re-use areas). At the commencement of ASS construction activities, the background soil pH should be determined within the nominated re-use areas (where required);
- pH in water minus pH in hydrogen peroxide (i.e. pH_F - pH_{FOX}) is greater than 1, and pH in water is less than background values;
- Existing plus potential acidity results are greater than zero.

Depending on the results of testing, re-application of lime may be necessary to gain adequate neutralisation, or additional mixing with ASS may be required if over-liming has occurred. Care should be taken to ensure over-liming does not occur.

5.6 Acid Sulfate Contingency Plan

Remedial action will be required if the standards or acceptance criteria outlined above are not being achieved. Remedial action shall comprise mixing of additional lime through the excavated material and neutralisation of leachate (if under liming has occurred). If monitoring indicates that over-liming has occurred, additional ASS or leachate should be mixed to reduce pH to acceptable levels. The required mixing rate to remediate the soil or leachate should be confirmed by monitoring tests.

During periods of heavy or prolonged rainfall, stockpiled soils should be appropriately contained / covered or temporarily backfilled to minimise leachate generation and runoff.

Sufficient lime should be stored on site during construction for the neutralisation of ASS and contingency measures.

The development should be conducted with due regard to erosion and sediment controls to minimise potential impacts to nearby sensitive receptors, including stormwater drains.

Management of ASS during construction should be conducted by an experienced contractor and qualified environmental consultant.

6. Off-site Re-use of Treated ASS

Given the proposed significant volume of soils to be excavated as part of basement excavation at the site, it is recommended that application to the NSW EPA for a specific exemption/order is considered for treated acid sulfate soils generated from the site. Approval of a specific exemption through the NSW EPA would allow for re-use of the treated ASS on another site, subject to the material being fit for purpose.

The general procedure for application for a specific exemption/order is as follows:

- Selection of an appropriate site(s) to receive the treated soils;
- Consultation with the appropriate consent authority (i.e. Council) to confirm that the proposed end use site is permitted to receive materials under NSW EPA specific order/exemption;
- Satisfy the NSW EPA assessment criteria, namely:
    - Legitimacy of the proposed use of the materials;
    - Consistency with waste management hierarchy;
    - Minimisation of risks to human health and the environment;
    - Physical and chemical homogeneity of the material.
- Preparation of the application to the NSW EPA, which includes the following:
    - Contact details of the entity submitting the application;
    - Background information on the waste;
    - Characterisation of the waste;
    - Mixing or blending of the waste;
    - Proposed use or application of the waste;
    - Information on the receiving environment;
    - Quality assurance and controls;
    - Specifications and standards of the waste.

Acid sulfate soil management should be conducted with due consideration to site remediation requirements and the procedures presented in the remediation action plan (RAP) prepared by DP for the site (Ref 4).

7. References

1. Stone, Y, Ahern CR, and Blunden B (1998), “Acid Sulfate Soil Manual, 1998”, New South Wales Acid Sulfate Soil Management Advisory Committee, August 1998.
2. Dear SE, Ahern CR 2014, O’Brien LE, Dobos SK, McElnea AE, Moore NG and Watling KM “Queensland Acid Sulfate Soil Technical Manual: Soil Management Guidelines”, Department of Science, Information Technology, Innovation and the Arts, Queensland Government, June 2014.
3. Douglas Partners Pty Ltd, ‘Report on Detailed Site Investigation, Proposed Apartment Development, 10 Dangar Street Wickham’, prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated 23 November 2018.
4. Douglas Partners Pty Ltd, ‘Remediation Action Plan, Proposed Apartment Development, 10 Dangar Street Wickham’, prepared for Dangar Street Wickham Pty Ltd, Project 39961.02 dated December 2018.
5. ANZAST (2018), 'Australian and New Zealand Guidelines for Fresh and Marine Water Quality', August 2018.

8. Limitations

Douglas Partners Pty Ltd (DP) has prepared this report for this project at 10 Dangar Street Wickham with reference to DP’s proposal dated 5 July 2018 and acceptance received from Dangar Street Wickham Pty Ltd dated 21 September 2018. The work was carried out under DP’s Conditions of Engagement. This report is provided for the exclusive use of Dangar Street Wickham Pty Ltd for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

The results provided in the report are indicative of the sub-surface conditions on the site only at the specific sampling and/or testing locations, and then only to the depths investigated and at the time the work was carried out. Sub-surface conditions can change abruptly due to variable geological processes and also as a result of human influences. Such changes may occur after DP’s field testing has been completed.

DP’s advice is based upon the conditions encountered during this investigation. The accuracy of the advice provided by DP in this report may be affected by undetected variations in ground conditions across the site between and beyond the sampling and/or testing locations. The advice may also be limited by budget constraints imposed by others or by site accessibility.

This report must be read in conjunction with all of the attached and should be kept in its entirety without separation of individual pages or sections. DP cannot be held responsible for interpretations or conclusions made by others unless they are supported by an expressed statement, interpretation, outcome or conclusion stated in this report.

This report, or sections from this report, should not be used as part of a specification for a project, without review and agreement by DP. This is because this report has been written as advice and opinion rather than instructions for construction.

The contents of this report do not constitute formal design components such as are required, by the Health and Safety Legislation and Regulations, to be included in a Safety Report specifying the hazards likely to be encountered during construction and the controls required to mitigate risk. This design process requires risk assessment to be undertaken, with such assessment being dependent upon factors relating to likelihood of occurrence and consequences of damage to property and to life. This, in turn, requires project data and analysis presently beyond the knowledge and project role respectively of DP. DP may be able, however, to assist the client in carrying out a risk assessment of potential hazards contained in the Comments section of this report, as an extension to the current scope of works, if so requested, and provided that suitable additional information is made available to DP. Any such risk assessment would, however, be necessarily restricted to the environmental components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

Please contact the undersigned if you have any questions on this matter.

Yours faithfully
Douglas Partners Pty Ltd

Reviewed by

Patrick Heads
Associate

Chris Bozinovski
Principal

Attachments:
About this Report
Sampling Methods
Soil Descriptions
Symbols and Abbreviations
Borehole Logs (Bores 201 to 205)
Laboratory Test Results
Drawing 1 – Test Location Plan

About this Report

Douglas Partners

Introduction

These notes have been provided to amplify DP's report in regard to classification methods, field procedures and the comments section. Not all are necessarily relevant to all reports.

DP's reports are based on information gained from limited subsurface excavations and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretive rather than factual documents, limited to some extent by the scope of information on which they rely.

Copyright

Borehole and Test Pit Logs

The borehole and test pit logs presented in this report are an engineering and/or geological interpretation of the subsurface conditions, and their reliability will depend to some extent on frequency of sampling and the method of drilling or excavation. Ideally, continuous undisturbed sampling or core drilling will provide the most reliable assessment, but this is not always practicable or possible to justify on economic grounds. In any case the boreholes and test pits represent only a very small sample of the total subsurface profile.

Interpretation of the information and its application to design and construction should therefore take into account the spacing of boreholes or pits, the frequency of sampling, and the possibility of other than 'straight line' variations between the test locations.

Groundwater

Where groundwater levels are measured in boreholes there are several potential problems, namely:

- In low permeability soils groundwater may enter the hole very slowly or perhaps not at all during the time the hole is left open;
- A localised, perched water table may lead to an erroneous indication of the true water table;
- Water table levels will vary from time to time with seasons or recent weather changes. They may not be the same at the time of construction as are indicated in the report; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must first be washed out of the hole if water measurements are to be made.

More reliable measurements can be made by installing standpipes which are read at intervals over several days, or perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from a perched water table.

Reports

The report has been prepared by qualified personnel, is based on the information obtained from field and laboratory testing, and has been undertaken to current engineering standards of interpretation and analysis. Where the report has been prepared for a specific design proposal, the information and interpretation may not be relevant if the design proposal is changed. If this happens, DP will be pleased to review the report and the sufficiency of the investigation work.

Every care is taken with the report as it relates to interpretation of subsurface conditions, discussion of geotechnical and environmental aspects, and recommendations or suggestions for design and construction. However, DP cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions. The potential for this will depend partly on borehole or pit spacing and sampling frequency;
- Changes in policy or interpretations of policy by statutory authorities; or
- The actions of contractors responding to commercial pressures.

If these occur, DP will be pleased to assist with investigations or advice to resolve the matter.

About this Report

Site Anomalies

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later stage, well after the event.

Information for Contractual Purposes

Where information obtained from this report is provided for tendering purposes, it is recommended that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document. DP would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Site Inspection

The company will always be pleased to provide engineering inspection services for geotechnical and environmental aspects of work to which this report is related. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site.

Sampling

Sampling is carried out during drilling or test pitting to allow engineering examination (and laboratory testing where required) of the soil or rock.

Disturbed samples taken during drilling provide information on colour, type, inclusions and, depending upon the degree of disturbance, some information on strength and structure.

Undisturbed samples are taken by pushing a thin-walled sample tube into the soil and withdrawing it to obtain a sample of the soil in a relatively undisturbed state. Such samples yield information on structure and strength, and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils.

Test Pits

Test pits are usually excavated with a backhoe or an excavator, allowing close examination of the in-situ soil if it is safe to enter into the pit. The depth of excavation is limited to about 3 m for a backhoe and up to 6 m for a large excavator. A potential disadvantage of this investigation method is the larger area of disturbance to the site.

Large Diameter Augers

Boreholes can be drilled using a rotating plate or short spiral auger, generally 300 mm or larger in diameter commonly mounted on a standard piling rig. The cuttings are returned to the surface at intervals (generally not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube samples.

Continuous Spiral Flight Augers

The borehole is advanced using 90-115 mm diameter continuous spiral flight augers which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and sands above the water table. Samples are returned to the surface, or may be collected after withdrawal of the auger flights, but they are disturbed and may be mixed with soils from the sides of the hole. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively low reliability, due to the remoulding, possible mixing or softening of samples by groundwater.

Non-core Rotary Drilling

The borehole is advanced using a rotary bit, with water or drilling mud being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from the rate of penetration. Where drilling mud is used this can mask the cuttings and reliable identification is only possible from separate sampling such as SPTs.

Continuous Core Drilling

A continuous core sample can be obtained using a diamond tipped core barrel, usually with a 50 mm internal diameter. Provided full core recovery is achieved (which is not always possible in weak rocks and granular soils), this technique provides a very reliable method of investigation.

Standard Penetration Tests

Standard penetration tests (SPT) are used as a means of estimating the density or strength of soils and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289, Methods of Testing Soils for Engineering Purposes - Test 6.3.1.

The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm increments and the 'N' value is taken as the number of blows for the last 300 mm. In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form.

- In the case where full penetration is obtained with successive blow counts for each 150 mm of, say, 4, 6 and 7 as:

  4,6,7
  N=13

- In the case where the test is discontinued before the full penetration depth, say after 15 blows for the first 150 mm and 30 blows for the next 40 mm as:

  15, 30/40 mm

The results of the SPT tests can be related empirically to the engineering properties of the soils.

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

Dynamic penetrometer tests (DCP or PSP) are carried out by driving a steel rod into the ground using a standard weight of hammer falling a specified distance. As the rod penetrates the soil the number of blows required to penetrate each successive 150 mm depth are recorded. Normally there is a depth limitation of 1.2 m, but this may be extended in certain conditions by the use of extension rods. Two types of penetrometer are commonly used.

- Perth sand penetrometer - a 16 mm diameter flat ended rod is driven using a 9 kg hammer dropping 600 mm (AS 1289, Test 6.3.3). This test was developed for testing the density of sands and is mainly used in granular soils and filling.
- Cone penetrometer - a 16 mm diameter rod with a 20 mm diameter cone end is driven using a 9 kg hammer dropping 510 mm (AS 1289, Test 6.3.2). This test was developed initially for pavement subgrade investigations, and correlations of the test results with California Bearing Ratio have been published by various road authorities.

Soil Descriptions

Douglas Partners

Description and Classification Methods

The methods of description and classification of soils and rocks used in this report are based on Australian Standard AS 1726-1993, Geotechnical Site Investigations Code. In general, the descriptions include strength or density, colour, structure, soil or rock type and inclusions.

Soil Types

Soil types are described according to the predominant particle size, qualified by the grading of other particles present:

Type	Particle size (mm)
Boulder	>200
Cobble	63 - 200
Gravel	2.36 - 63
Sand	0.075 - 2.36
Silt	0.002 - 0.075
Clay	<0.002

The sand and gravel sizes can be further subdivided as follows:

Type	Particle size (mm)
Coarse gravel	20 - 63
Medium gravel	6 - 20
Fine gravel	2.36 - 6
Coarse sand	0.6 - 2.36
Medium sand	0.2 - 0.6
Fine sand	0.075 - 0.2

The proportions of secondary constituents of soils are described as:

Term	Proportion	Example
And	Specify	Clay (60%) and Sand (40%)
Adjective	20 - 35%	Sandy Clay
Slightly	12 - 20%	Slightly Sandy Clay
With some	5 - 12%	Clay with some sand
With a trace of	0 - 5%	Clay with a trace of sand

Definitions of grading terms used are:

- Well graded - a good representation of all particle sizes
- Poorly graded - an excess or deficiency of particular sizes within the specified range
- Uniformly graded - an excess of a particular particle size
- Gap graded - a deficiency of a particular particle size with the range

Cohesive Soils

Cohesive soils, such as clays, are classified on the basis of undrained shear strength. The strength may be measured by laboratory testing, or estimated by field tests or engineering examination. The strength terms are defined as follows:

Description	Abbreviation	Undrained shear strength (kPa)
Very soft	vs	<12
Soft	s	12 - 25
Firm	f	25 - 50
Stiff	st	50 - 100
Very stiff	vst	100 - 200
Hard	h	>200

Cohesionless Soils

Cohesionless soils, such as clean sands, are classified on the basis of relative density, generally from the results of standard penetration tests (SPT), cone penetration tests (CPT) or dynamic penetrometers (PSP). The relative density terms are given below:

Relative Density	Abbreviation	SPT N value	CPT qc value (MPa)
Very loose	vl	<4	<2
Loose	l	4 - 10	2 -5
Medium dense	md	10 - 30	5 - 15
Dense	d	30 - 50	15 - 25
Very dense	vd	>50	>25

Soil Descriptions

Soil Origin

It is often difficult to accurately determine the origin of a soil. Soils can generally be classified as:

- Residual soil - derived from in-situ weathering of the underlying rock;
- Transported soils - formed somewhere else and transported by nature to the site; or
- Filling - moved by man.

Transported soils may be further subdivided into:

- Alluvium - river deposits
- Lacustrine - lake deposits
- Aeolian - wind deposits
- Littoral - beach deposits
- Estuarine - tidal river deposits
- Talus - scree or coarse colluvium
- Slopewash or Colluvium - transported downslope by gravity assisted by water. Often includes angular rock fragments and boulders.

Symbols & Abbreviations

Introduction

These notes summarise abbreviations commonly used on borehole logs and test pit reports.

Drilling or Excavation Methods

C	Core drilling
R	Rotary drilling
SFA	Spiral flight augers
NMLC	Diamond core - 52 mm dia
NQ	Diamond core - 47 mm dia
HQ	Diamond core - 63 mm dia
PQ	Diamond core - 81 mm dia

Water

▷	Water seep
▽	Water level

Sampling and Testing

A	Auger sample
B	Bulk sample
D	Disturbed sample
E	Environmental sample
U_{50}	Undisturbed tube sample (50mm)
W	Water sample
pp	Pocket penetrometer (kPa)
PID	Photo ionisation detector
PL	Point load strength Is(50) MPa
S	Standard Penetration Test
V	Shear vane (kPa)

Description of Defects in Rock

The abbreviated descriptions of the defects should be in the following order: Depth, Type, Orientation, Coating, Shape, Roughness and Other. Drilling and handling breaks are not usually included on the logs.

Defect Type

B	Bedding plane
Cs	Clay seam
Cv	Cleavage
Cz	Crushed zone
Ds	Decomposed seam
F	Fault
J	Joint
Lam	Lamination
Pt	Parting
Sz	Sheared Zone
V	Vein

Orientation

The inclination of defects is always measured from the perpendicular to the core axis.

h	horizontal
v	vertical
sh	sub-horizontal
sv	sub-vertical

Coating or Infilling Term

cln	clean
co	coating
he	healed
inf	infilled
stn	stained
ti	tight
vn	veneer

Coating Descriptor

ca	calcite
cbs	carbonaceous
cly	clay
fe	iron oxide
mn	manganese
slt	silty

Shape

cu	curved
ir	irregular
pl	planar
st	stepped
un	undulating

Roughness

po	polished
ro	rough
sl	slickensided
sm	smooth
vr	very rough

Other

fg	fragmented
bnd	band
qtz	quartz

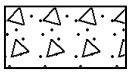
Symbols & Abbreviations

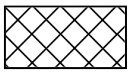
Graphic Symbols for Soil and Rock

General

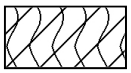

Asphalt

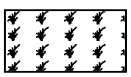

Road base

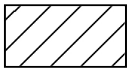

Concrete

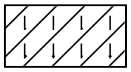

Filling

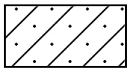
Soils


Topsoil

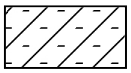

Peat

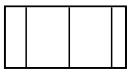

Clay

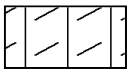

Silty clay

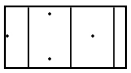

Sandy clay

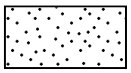

Gravelly clay

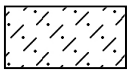

Shaly clay

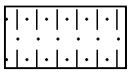

Silt


Clayey silt


Sandy silt

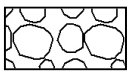

Sand

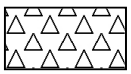

Clayey sand


Silty sand


Gravel

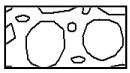

Sandy gravel


Cobbles, boulders

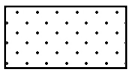

Talus

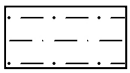
Sedimentary Rocks

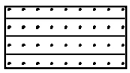

Boulder conglomerate

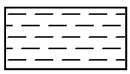

Conglomerate


Conglomeratic sandstone

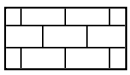

Sandstone


Siltstone

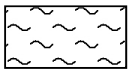

Laminite

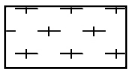

Mudstone, claystone, shale

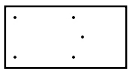

Coal


Limestone

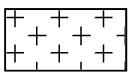
Metamorphic Rocks

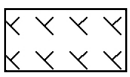

Slate, phyllite, schist

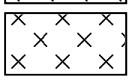

Gneiss

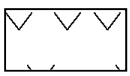

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite


Dacite, epidote


Tuff, breccia


Porphyry

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.61 AHD
EASTING: 384022
NORTHING: 6356508
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.08	ASPHALT - AC7							
	0.16	CONCRETE - Grey							
		FILLING - Generally comprising dark brown silty sand filling, with fine to medium grained sand, with trace ash, fragments up to 10mm in size, sandy clay and rootlets in parts, moist		E	0.4 0.5		PID<1		
				U	1.0				
	1.2	CLAY - Firm, dark grey clay, with some fine to medium grained sand, M>Wp (wet)			1.2				
	1.3	SAND - Grey and brown, fine to medium grained sand, with trace to some subrounded gravel up to 40mm in size and trace silt, moist		E, U	1.5 1.6		PID<1		
		From 1.3m to 3m, slight to moderate sulfur odour, trace organics and rootlets							
		From 2m, no gravel						▼	
		From 2.05m, saturated		U	2.2 2.3		PID<1		
				U	2.5 2.7				
				U	3.1 3.3				
				U	3.5				
		From 3.7m to 4.5m, with indurated / slightly cemented sand bands up to 50mm thick		U	3.8 4.0				
				U	4.3 4.5				
				U	5.0				

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.05m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.61 AHD
EASTING: 384022
NORTHING: 6356508
DIP/AZIMUTH: 90°/--

BORE No: 201
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4	6	SAND - Grey and brown, fine to medium grained sand, with trace to some subrounded gravel up to 40mm in size and trace silt, moist *(continued)*							
				U	5.3				
					5.5				
				U	5.8				
					6.0				
				U	6.3				
					6.5				
-5				U					
	7				7.0				
		From 7.3m, increased drilling resistance / slow progress		U	7.3				
					7.5				
-6				U	7.7				
					7.9				
	8 8.0	Bore discontinued at 8.0m, limit of investigation							
-7	9								
-8									

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.05m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.71 AHD
EASTING: 384028
NORTHING: 6356506
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.08	ASPHALT - AC7							Gatic Cover at Suface
	0.22	CONCRETE							From 0.0m to 0.5m, bentonite From 0.0m to 0.6m, blank 50mm diameter class 18 PVC From 0.6m, machine slotted class 18 PVC
		FILLING - Generally comprising dark grey brown silty sand filling, with fine to medium grained sand and some coal chitter, ash and possible slag fragments up to 20mm in size, some clay in parts, moist		D	0.5				
				U	0.6		PID=3.0		
					0.7				
					0.9				
	1	From 1m, strong hydrocarbon odour		U			PID=2.0		1
					1.1				
					1.2				
	1.3	SAND - Grey, fine to medium grained sand, with trace subrounded to subangular gravel and silt saturated (strong carbon odour)		U			PID=220	▼	
					1.4			09-10-18	
				D	1.6		PID=1		
		From 1.7m to 3m, moderate hydrocarbon odour			1.7				
				U			PID=361		
	2				2.0				2
									From 0.5m to 3.6m, gravel
				U	2.3		PID=33		
					2.4				
		From 2.5m to 3m, with trace organics and some subrounded to subangular gravel up to 40mm in size		D	2.5				
					2.7				
				U			PID=10		
	3				2.9				3
		From 3.0m, brown with trace to some subrounded gravel up to 10mm in size							
		From 3.0m to 4.2m, slight sulfide odour, no hydrocarbon odour			3.2				
				U			PID=1		
					3.4				
				U	3.5				End cap
					3.7				
				E			PID<1		
					3.9				
	4			U	4.0				4
	4.2	SANDY CLAY - Grey mottled orange-brown sandy clay, with fine to medium grained sand and trace organics, M>Wp slight sulfur odour			4.2				
				E			PID<1		
					4.4				
				U	4.45				
	4.5	SAND - Brown, fine to medium grained sand with trace silt, saturated			4.5				
				E			PID=1.2		
		From 4.5m to 4.7m, with some clay			4.7				
				U	4.9				

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil

TYPE OF BORING: 90mm dual tube

WATER OBSERVATIONS: Free groundwater at 1.4m, whilst drilling

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.71 AHD
EASTING: 384028
NORTHING: 6356506
DIP/AZIMUTH: 90°/--

BORE No: 202
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4	6	SAND - Brown, fine to medium grained sand with trace silt, saturated *(continued)*			5.1				6
				E			PID=2		
					5.3				
					5.4				
-5				U	5.5				
				E			PID<1		
					6.0				
	7	7.0 Bore discontinued at 7.0m, blocked inner tube							7
-6	8								8
-7	9								9
-8									

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 1.4m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 2.9 AHD
EASTING: 384051
NORTHING: 6356450
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.17	CONCRETE							Gatic Cover at Suface
		FILLING - Generally comprising dark grey clay filling, with some fine to medium grained sand, gravel and fine to medium grained sand, with possible ash fragments up to 20mm in size, M>Wp		U	0.3 0.4		PID<1		From 0.0m to 1.0m, bentonite
				D	0.7				
				U	0.8 0.9		PID<1		From 0.0m to 1.7m, blank class 18 50mm diameter PVC
2	1			D	1.0				1
				U	1.1 1.3		PID<1		
	1.4	FILLING - Generally comprising dark grey silty sand filling, with fine to medium grained sand, coal chitter and ash fragments up to 20mm in size, moist		U	1.4		PID<1		
	1.65	SAND - Dark grey, fine to medium grained sand with trace to some silt, moist			1.65 1.7				
				U			PID<1		
1	2			D	1.9 2.0				2
		From 2.2m to 2.9m, with trace organics		U	2.2		PID<1		
				D	2.4 2.5				
		From 2.7m, pale grey brown		U	2.7		PID<1	▼	From 1m to 4.7m, gravel
0	3			D	2.9 3.0				3
				U	3.2		PID<1		From 1.7m to 4.7m, blank class 18 50mm diameter machine slotted PVC
				D	3.4 3.5				
-1	4			U	3.8		PID<1		4
				D	4.0 4.1				
				D, U	4.4		PID<1		
					4.6				End cap
-2		From 4.8m to 5.0m, slightly indurated orange brown band		D	4.8				

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.7m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 2.9 AHD
EASTING: 384051
NORTHING: 6356450
DIP/AZIMUTH: 90°/--

BORE No: 203
PROJECT No: 39961.02
DATE: 9/10/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-3	6	SAND - Dark grey, fine to medium grained sand with trace to some silt, moist *(continued)*							6
		From 5.2m to 5.6m, sandy clay / clayey sand band			5.2				
				U			PID<1		
				D	5.4				
					5.5				
		From 5.6m to 6.0m, with trace to some clay							
					5.8				
				U			PID<1		
					6.0				
				D	6.1				
				U	6.5		PID<1		
-4				D	6.8				
	7 7.0	Bore discontinued at 7.0m, limit of investigation							7
-5	8								8
-6	9								9
-7									

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.7m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

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BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 2.9 AHD
EASTING: 384056
NORTHING: 6356475
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 39961.02
DATE: 10/10/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
		FILLING - Generally comprising brown and grey sandy gravel and sandy clay filling, with fine to medium grained sand and subrounded to subangular gravel up to 20mm in size, with trace concrete and steel fragments up to 80mm in size, wet		E	0.2		PID<1		Gatic Cover at Suface
				U	0.4				
	0.6	FILLING - Generally comprising grey sandy clay filling, with fine to medium grained sand and some subangular gravel and concrete fragments up to 20mm in size, M>Wp		E	0.7		PID<1		From 0.0m to 1.1m, bentonite
2					0.9				From 0.0m to 1.7m, blank class 18, 50mm diameter PVC
1				U	1.0				
	1.4			E	1.45				
	1.5	FILLING - Generally comprising dark grey silty sand filling, with some coal chitter ash and gravel fragments up to 20mm in size, moist		E	1.5		PID<1		
	1.7	SILTY SAND - Dark grey silty, fine to medium grained sand, moist		U	1.7				
1		SAND - Brown, fine to medium grained sand with trace silt, moist (possible filling?)		E	1.8		PID<1		
2					1.9				
					2.0				
					2.2				
		From 2.4m, pale grey		E			PID<1		
								10-10-18	
	2.8	From 2.7m to 2.75m, dark grey with coal and gravel fragments up to 10mm in size, moist			2.75				
0		SAND - Brown fine to coarse grained sand, saturated		U	2.9				From 1.1m to 4.7m, gravel pack
3									
	3.15	SAND - Grey brown, fine to coarse grained sand with trace to some silt							From 1.7m to 4.7m, machine slotted class 18, 50mm diameter slotted PVC
		From 3.15m to 3.7m, with some clay and shells and trace subrounded to subangular gravel up to 20mm in size		E	3.3		PID<1		
					3.5				
				U	3.6				
					3.8				
-1				E	3.9		PID<1		
4				U	4.0				
		From 4.3m to 4.5m, with subangular gravel up to 40mm in size		E	4.4		PID<1		
		From 4.5m pale grey brown		E	4.6				End cap
		From 4.8m to 5.0m, slight sulfur odour							
-2				U	5.0				

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.6m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 2.9 AHD
EASTING: 384056
NORTHING: 6356475
DIP/AZIMUTH: 90°/--

BORE No: 204
PROJECT No: 39961.02
DATE: 10/10/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-3	6	SAND - Grey brown, fine to coarse grained sand with trace to some silt *(continued)*		E	5.5		PID<1		6
				U	5.8				
	6.0	Bore discontinued at 6.0m, hole collapse							
-4	7								7
-5	8								8
-6	9								9
-7									

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.6m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.64 AHD
EASTING: 384018
NORTHING: 6356469
DIP/AZIMUTH: 90°/--

BORE No: 205
PROJECT No: 39961.02
DATE: 10/10/2018
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
	0.13	CONCRETE							
	0.3	FILLING - Generally comprising brown sandy gravel filling, with subangular gravel and possible crushed brick fragments up to 20mm in size, moist		U	0.2 0.3		PID<1		
		FILLING - Generally comprising dark grey to black sandy ash and coal chitter filling, with ash and coal chitter fragments up to 40mm in size, with some silt and clay in parts, moist		E	0.5 0.6		PID<1		
		From 0.8m to 0.9m, with some shell and gravel							
	1			E	1.0		PID<1		1
					1.2				
	1.4	SAND - Grey brown fine to medium grained sand, with trace to some silt, moist to wet		E	1.4		PID<1		
		From 1.4m to 2.1m, with some organics, trace clay and subrounded gravel up to 10mm in size			1.6				
				U	1.7		PID<1		
					1.8				
				E			PID<1		
	2	From 2m to 3m, slight sulfar odour			2.0			10-10-18	2
				U	2.1				
					2.4				
				E			PID<1		
					2.6				
				U	2.7				
	3			U	3.1				3
					3.4				
				E			PID<1		
					3.6				
				U	3.8				
	4	From 4.0m to 5.6m, with some clay		U	4.1				4
					4.4				
				E			PID<1		
					4.6				
				U	5.0				

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.0m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Danger Street, Wickham Pty Ltd
PROJECT: Proposed Apartment Development
LOCATION: 10 Dangar Street, Wickham

SURFACE LEVEL: 1.64 AHD
EASTING: 384018
NORTHING: 6356469
DIP/AZIMUTH: 90°/--

BORE No: 205
PROJECT No: 39961.02
DATE: 10/10/2018
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Graphic Log	Sampling & In Situ Testing: Type	Depth	Sample	Results & Comments	Water	Well Construction Details
-4	6	SAND - Grey brown fine to medium grained sand, with trace to some silt, moist to wet *(continued)*		U	5.3				6
					5.4				
				E			PID<1		
					5.6				
				U	5.7				
				U	6.1				
					6.3				
				E			PID<1		
	6.5				6.5				
-5		Bore discontinued at 6.5m, hole collapse							
	7								7
-6									
	8								8
-7									
	9								9
-8									

RIG: Geoprobe 7822 DT **DRILLER:** Terratest **LOGGED:** West **CASING:** Nil
TYPE OF BORING: 90mm dual tube
WATER OBSERVATIONS: Free groundwater at 2.0m, whilst drilling
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	G	Gas sample	PID	Photo ionisation detector (ppm)
B	Bulk sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
BLK	Block sample	U_x	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water sample	pp	Pocket penetrometer (kPa)
D	Disturbed sample	▷	Water seep	S	Standard penetration test
E	Environmental sample	▼	Water level	V	Shear vane (kPa)

Douglas Partners
Geotechnics / Environment / Groundwater

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CERTIFICATE OF ANALYSIS 204047

Client Details

Client	Douglas Partners Newcastle
Attention	Patrick Heads
Address	Box 324 Hunter Region Mail Centre, Newcastle, NSW, 2310

Sample Details

Your Reference	**39961.02**
Number of Samples	4 Soil
Date samples received	26/10/2018
Date completed instructions received	26/10/2018

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	02/11/2018
Date of Issue	01/11/2018

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Results Approved By
Priya Samarawickrama, Senior Chemist

Authorised By

Jacinta Hurst, Laboratory Manager

Chromium Suite					
Our Reference		204047-1	204047-2	204047-3	204047-4
Your Reference	UNITS	201	201	203	205
Depth		1.5-1.6	7.7-7.9	3.5	2.1
Date Sampled		09/10/2018	09/10/2018	09/10/2018	10/10/2018
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	29/10/2018	29/10/2018	29/10/2018	29/10/2018
Date analysed	-	29/10/2018	29/10/2018	29/10/2018	29/10/2018
pH $_{kcl}$	pH units	3.7	4.7	4.0	4.3
s-TAA pH 6.5	%w/w S	0.06	<0.01	0.06	0.04
TAA pH 6.5	moles H^+ /t	36	<5	36	26
Chromium Reducible Sulfur	%w/w	0.50	0.06	0.17	0.18
a-Chromium Reducible Sulfur	moles H^+ /t	310	35	110	110
S_{HCl}	%w/w S	0.17	<0.005	0.094	0.077
S_{KCl}	%w/w S	0.14	0.039	0.096	0.085
S_{NAS}	%w/w S	0.029	<0.005	<0.005	<0.005
ANC_{BT}	% $CaCO_3$	<0.05	<0.05	<0.05	<0.05
s-ANC_{BT}	%w/w S	<0.05	<0.05	<0.05	<0.05
s-Net Acidity	%w/w S	0.59	0.059	0.23	0.23
a-Net Acidity	moles H^+ /t	370	37	140	140
Liming rate	kg $CaCO_3$ /t	28	2.8	11	11
a-Net Acidity without ANCE	moles H^+ /t	370	37	140	140
Liming rate without ANCE	kg $CaCO_3$ /t	28	2.8	11	11
s-Net Acidity without ANCE	%w/w S	0.59	0.059	0.23	0.23

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Based on Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			29/10/2018	1	29/10/2018	29/10/2018		29/10/2018	[NT]
Date analysed	-			29/10/2018	1	29/10/2018	29/10/2018		29/10/2018	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	1	3.7	3.7	0	94	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	1	0.06	0.07	15	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	1	36	42	15	115	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	1	0.50	0.50	0	[NT]	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	1	310	310	0	92	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.17	0.17	0	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	1	0.14	0.13	7	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	1	0.029	0.038	27	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	1	<0.05	<0.05	0	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	1	0.59	0.61	3	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	1	370	380	3	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	28	28	0	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	1	370	380	3	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	1	28	28	0	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	1	0.59	0.61	3	[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.

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.

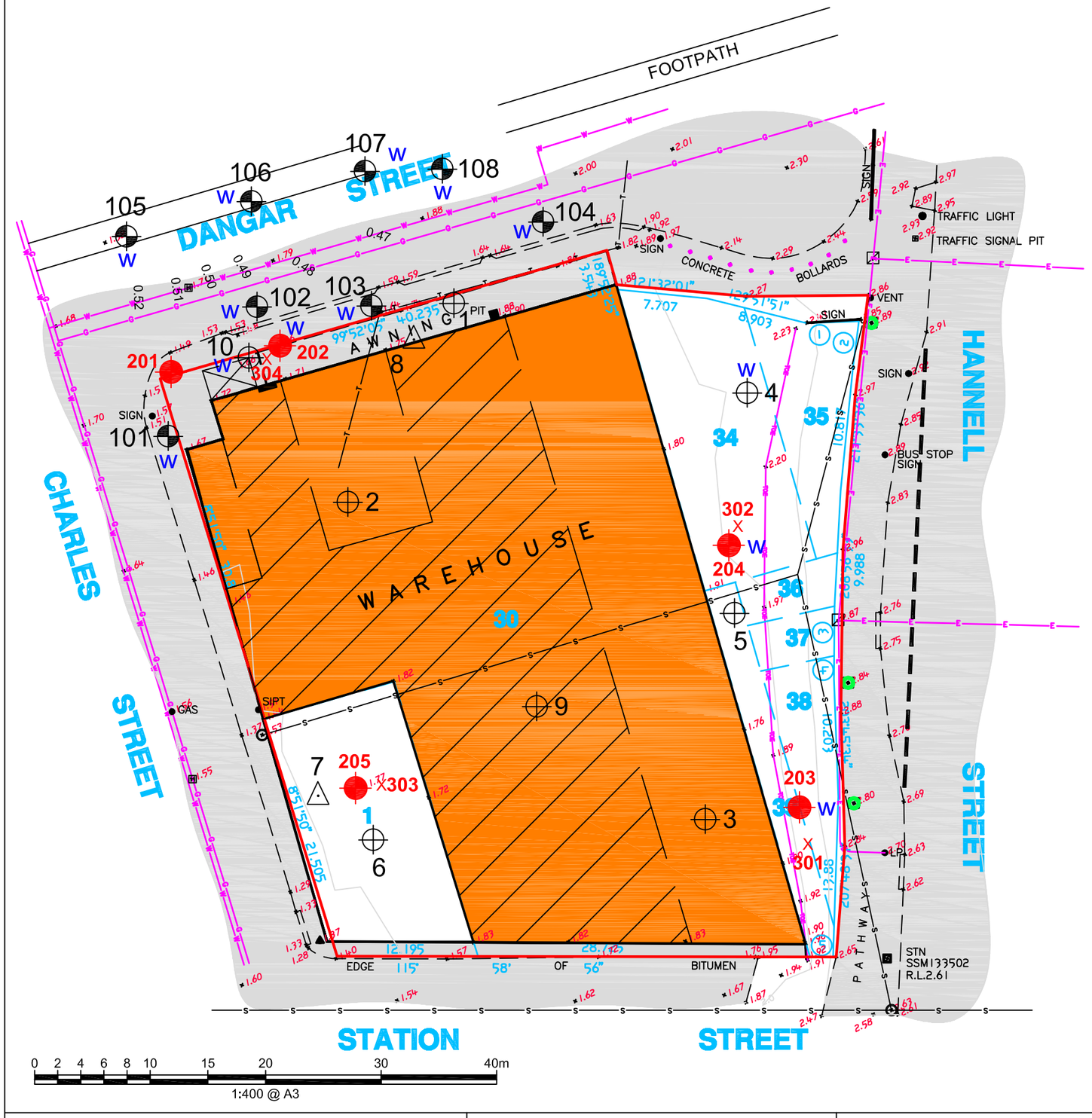
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

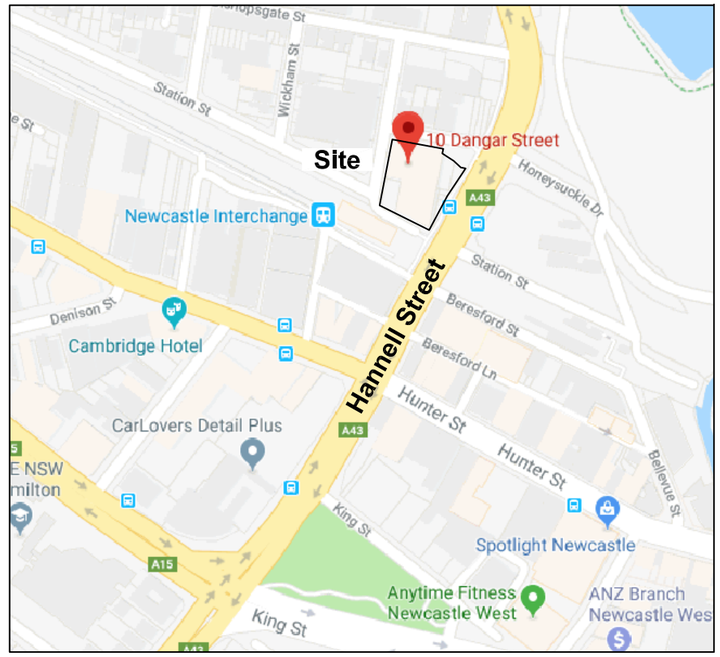
In circumstances where no duplicate and/or sample spike has been reported at 1 in 10 and/or 1 in 20 samples respectively, the sample volume submitted was insufficient in order to satisfy laboratory QA/QC protocols.

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.

Measurement Uncertainty estimates are available for most tests upon request.





Locality Plan

NOTES

1. Drawing adapted from survey plan by Parker Scanlon Pty Ltd, Ref B122 dated 25.1.08.

LEGEND

- Approximate Borehole Location (current investigation)
- Approximate CPT Location (current investigation)
- Approximate Borehole Location (previous investigation 39961.01, Nov 2008)
- Approximate Borehole Location (previous investigation 39961, Sept 2008)
- Approximate Location of Raised Concrete Floor
- Approximate Surface / Near Surface Sampling Location (previous investigation 39961, Sept 2008)
- Approximate Location of Possible Former Bowser(s)
- Approximate of Possible Underground Storage Tank(s)
- W Groundwater Monitoring Well
- Site Boundary

Douglas Partners
Geotechnics / Environment / Groundwater

CLIENT: Dangar Street Wickham Pty Ltd		TITLE: **Test Location Plan** **Proposed Apartment Development** **10 Dangar Street, Wickham**
OFFICE: Newcastle	DRAWN BY: PLH	
SCALE: 1:400@A3 Sheet	DATE: 23.11.2018	

PROJECT No:	39961.02
DRAWING No:	1
REVISION:	0