

Dee Why RSL Club
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Walsh Bay
Sydney NSW 2000

Project 84926.03
13 March 2018
R.006.Rev4
KS/HDS:pc

Attention: Robert Farrell and Terry Coyne (Farrell Coyne Projects)

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Dear Sirs

Groundwater Analysis and Preliminary Modelling
Dee Why RSL Club – Eastern Development
932 Pittwater Road, Dee Why

1. Introduction

This revised report presents an estimate of the groundwater inflow rates expected during construction of a proposed multi-storey car park at the Dee Why RSL Club, 932 Pittwater Road, Dee Why. The report also presents the results of chemical analyses of groundwater samples obtained during 2017 from standpipe piezometers installed within the site. The revised preliminary groundwater modelling was commissioned in an email dated 15 February 2018 by Mr Marcel Batrac of Dee Why RSL Club, and was undertaken in accordance with DP's proposal SYD161224 (Rev2), dated 9 November 2016 and subsequent modifications to the proposed development. The major changes to the proposed development are a revised basement design which incorporates split level parking, which results in a smaller footprint for excavation, slightly deeper basement but overall reduction in excavation of 800 m³. It is understood that the preliminary groundwater modelling is required to support a development application with the Northern Beaches Council.

The revised preliminary groundwater modelling involved the development of four conceptual groundwater models for the site, using information obtained from the site investigations, the proposed basement footprint and depth, and modelling of changes to the groundwater regime as a result of the split-level basement excavation. The preliminary seepage analyses were completed using 'Seep/W', a finite element seepage analysis computer program. The computer analyses were verified using manual flow-net analyses. The Seep/W results are attached as Plates 1 to 8. The methodology and results of the assessment are provided in this report.

Further detailed groundwater modelling will need to be completed at the detailed design stage of the project when further details are known, refining issues such as modelled inflow volumes to the excavation.

Sampling and analysis of groundwater samples was completed as part of the geotechnical investigation in November 2016. The sampling methodology, analytical results and assessment of the results are presented in this report.

2. Background Information

Previous geotechnical, groundwater and environmental investigations have been completed by DP, within and adjacent to the footprint of the proposed basement excavation (refer Drawings 1 and 2). The results of these have been used to develop the conceptual groundwater models. The previous geotechnical and groundwater reports include:

- Douglas Partners Pty Ltd (1974), Report on Geotechnical Investigation, Report 4549 - cored boreholes drilled for the original RSL Club;
- Douglas Partners Pty Ltd (1982), Report on Geotechnical Investigation, Report 7806 - cone penetration tests (CPTs) and boreholes drilled for the two storey car park;
- Douglas Partners Pty Ltd (2000 and 2001), Reports on Geotechnical Investigation, Report 29420 and 29420A - cored boreholes and CPTs for the extensions to the RSL Club;
- Douglas Partners Pty Ltd (2015), Report on Geotechnical Investigation, Report 84926.00 - test pits at the proposed site of a basement, for a groundwater assessment;
- Douglas Partners Pty Ltd (2016a), Report on Geotechnical Investigation, Report 84926.01 - boreholes for the proposed car park upgrade, including three cored boreholes and the installation of one standpipe piezometer;
- Douglas Partners Pty Ltd (2017), Report on Geotechnical Investigation, Report 84926.03.R.002.Rev3, dated March 2017 - boreholes for the proposed car park upgrade, including three cored boreholes, installation of two standpipe piezometers, laboratory testing of soil and rock samples, measurement of water levels and rising head permeability tests within the standpipes;
- Douglas Partners Pty Ltd (2017), Report on Preliminary Waste Classification and Acid Sulfate Soil Assessment, Report 84926.03.R.003.Rev6, dated March 2017 – results of a preliminary waste classification and acid sulfate soil assessment on in situ material; and
- Douglas Partners Pty Ltd (2017), Report on Groundwater Analysis and Preliminary Modelling, Report 84926.03.R.006.Rev3, dated March 2017 – preliminary modelling of groundwater inflows to the proposed basement excavation, and presentation of chemical analyses of groundwater samples from standpipe piezometers installed within the site.

These investigations (total of 57 test locations since 1974) identified that the site has a high groundwater table, that the depth of the underlying sandstone varies across the site (from about RL5 m to RL-10 m, from north to south), and that the estuarine soils, which occur within part of the excavation footprint, are potential acid sulphate soils. It is understood that the currently proposed basement is to be fully 'tanked' for the full height of the excavation (up to about 15.5 m), using a 'cut-off' diaphragm wall, installed through the filling, alluvial and estuarine soils and socketed into the underlying medium strength sandstone below the basement bulk excavation level (BEL: refer

Drawings 3 to 6). Dewatering of seepage flows into the excavation is expected to be required during construction.

It is noted that the lowest basement level is 'split' between Basement Level -4B on the western side of the proposed basement footprint (BEL: RL-4.7 m), and Basement Level -5A on the eastern side of the basement footprint (BEL: RL-6.1 m).

3. Site Description

The site currently accommodates an existing two level above ground car park, which is an irregular shape approximately 80 m long and 50 m wide and the porte cochere. The site is bounded by Clarence Avenue to the east, the existing RSL club building to the north with residential properties to the west (Oceangrove) and residential and commercial properties to the south including a childcare. The car park and porte cochere are located to the south east of the main RSL building and is accessed from Clarence Avenue. The car park consists of two levels with the top level being an open deck. The car park slopes gently from south west to north east towards Clarence Avenue and then Dee Why Lagoon.

It is noted that the proposed basement excavation will be offset from the southern property boundary by about 20 m to 25 m.

4. Geology and Groundwater Observations

Reference to the Sydney 1:100 000 Geological Series Sheet indicates that the site is underlain by Hawkesbury Sandstone, but is close to alluvial deposits associated with the nearby Dee Why Lagoon. Hawkesbury Sandstone is generally a medium to coarse grained, massive and cross-bedded quartz sandstone, horizontally bedded and vertically jointed, with minor shale and laminite layers. The geological map also indicates that there are several igneous dykes in the vicinity of the site. Interbedded sand, clayey sand, organic clay and sandy clay alluvial and estuarine soils (including some areas with boulders) were encountered within the basement footprint during the investigations.

Reference to the 1:25 000 Acid Sulphate Soil Risk map for Sydney Heads indicates that the site is located close to an area with a risk for acid sulphate soils (Dee Why Lagoon).

The conditions encountered during the geotechnical investigations confirmed the presence of Hawkesbury Sandstone within the footprint of the basement, as well as estuarine soils with the potential to become acid sulphate soils (ASS).

Based upon the provided drawings (ALTIS Architecture Pty Ltd, Drawing SK167 (Rev C), May 2017), the perimeter of the excavation will have a length of 196 m.

Observations of groundwater levels in standpipe piezometers is summarised in Table 1.

Table 1: Groundwater Observations in Standpipe Piezometers

Bore-hole ID	SL	Screen interval (m RL)	Standing Water Level Measurements (m RL)						
			11/11/16	21/11/16	24/11/16	23/12/16	10/01/17	23/01/17	10/02/17
205	9.2	3.2 to -0.2	8.1	8.0*	7.9	8.0	7.9	7.8	8.0
301	9.7	8.95 to -9.1	-	8.5	8.5	8.4	8.3	8.2	8.5
304	8.9	-1.1 to -9.1	-	7.8	8.6	8.4	8.3	8.1	8.1

Notes: SL = Surface elevation (RL), * = observations made on 22/11/2016; purging of groundwater from the standpipes occurred on 21/11/2016 and 22/11/2016; elevations are relative to the Australian Height Datum.

5. Groundwater Sampling and Rationale

5.1 Standpipe Locations

Groundwater sampling was completed in November 2016, from three standpipe piezometers (Boreholes 205, 301 and 304) installed between March 2016 (Borehole 205) and November 2016, to depths of between 9 m and 18.75 m. The locations of the groundwater monitoring wells are shown on Drawing 2, attached. The borehole logs are included in DP reports 84926.03.R.002.Rev3a and 84926.03.R.003.Rev6, and are not reproduced herein.

5.2 Sampling Procedures and Quality Control

Groundwater sampling was performed in accordance with DP's standard operating procedures. Samples for laboratory analysis were recorded on DP chain-of-custody (COC) sheets, attached.

Prior to sampling, the groundwater level was measured in each well using an interface meter, and the wells developed by removing a minimum of three bore volumes using a submersible pump. The wells were allowed to recharge for two to three days, and then the groundwater levels were remeasured again, including measurement for phase separated hydrocarbons.

The wells were micro-purged using a low flow pump until all field parameters had stabilised (temperature, dissolved oxygen, electrical conductivity, pH and redox potential), then groundwater samples were collected using the low flow pump and placed with a minimum of aeration into preserved bottles. For analysis of metals, the relevant sample fraction was filtered using an in-line, disposable 0.45 µm filter, changed between samples.

Field replicates were recovered and analysed for a limited suite of contaminants by means of intra-laboratory analysis. These samples were collected in accordance with standard industry practice and guidelines.

The general sampling procedure comprised:

- Decontamination of re-useable sampling equipment using a 3% phosphate free detergent (“Decon90”) and distilled water prior to collecting each sample or use of disposable sampling equipment;
- Use of disposable sampling equipment including nitrile gloves and disposable groundwater tubing;
- Transfer of samples into laboratory-prepared glass jars and bottles (with appropriate preservatives for analytes), and capping immediately with Teflon-lined lids;
- Labelling of sampling containers with individual and unique identification, including project number, sample identification and sample depth;
- Placement of sample containers into a cooled, insulated and sealed container for transport to the laboratory; and
- COC was maintained at all times, being countersigned by the receiving laboratory on transfer of samples to the analytical laboratory.

NATA-accredited analytical laboratories are required to conduct in-house QA / QC procedures, which are normally incorporated into every analytical run, and include reagent blanks, spike recovery, surrogate recovery and duplicate samples. These results are included in the laboratory certificates, attached.

5.3 Analytical Rationale

The analytical scheme was designed to obtain an indication of the potential presence and possible distribution of the contaminants of potential concern, identified in a Preliminary Site Investigation report prepared by DP (Report 84926.02.R.001.Rev0, dated June 2016). These contaminants included metals, total recoverable hydrocarbons (TRH), benzene, toluene, ethylbenzene and xylenes (BTEX), polycyclic aromatic hydrocarbons (PAH), organochlorine pesticides (OCP), organophosphorous pesticides (OPP), phenols, and polychlorinated biphenyls (PCB).

Envirolab Services Pty Ltd, a NATA-accredited analytical laboratory, was employed to conduct the primary sample analysis.

6. Groundwater Assessment Criteria and Laboratory Results

The assessment criteria have been sourced from the National Environment Protection Council (NEPC) *National Environment Protection Measure (Assessment of Site Contamination)* 1999, as amended 2013 (NEPC, 2013: reference 1).

The site assessment criteria comprise management limits for TRH and groundwater investigation levels (GILs) as detailed below. Where no guidance is provided in NEPC (2013) for a specific analyte,

the analytical practical quantitation level (PQL) was used as the initial screening criterion. For concentrations above the PQL, reference criteria sourced from other national and international guidance has been used to determine the significance of the detected analyte.

6.1 Groundwater Investigation Levels

The assessment criteria for groundwater comprise the groundwater investigation levels (GILs) adopted in NEPC (2013), which are based on:

- *Australian Water Quality Guidelines*, 2000;
- *Australian Drinking Water Guidelines*, 2011;
- *Guidelines for Managing Risk in Recreational Waters*, 2008; and
- National water quality management strategy, Australia and New Zealand *Guidelines for Fresh and Marine Water Quality* 2000.

The adopted GILs for the analytes included in this assessment (“Marine Waters”) are shown in the attached Table 2, including the health screening levels for petroleum hydrocarbons. Drinking water thresholds have not been adopted as there is no known drinking water receptor in close proximity to the site.

6.2 Laboratory Results

A summary of the laboratory analyses are presented in Table 2, attached, together with the laboratory test reports, COC and sample receipt information.

7. Conceptual Geotechnical Model

The geotechnical model for the site is characterised by a shallow thickness of filling, thicker in the south-east of the site, overlying very soft to soft, estuarine silty clay or sandy clay with organic matter in the eastern and north-eastern part of the site (absent, up to 3.4 m thick), over loose to dense alluvial sand and clayey sand, and then stiff to hard alluvial clay and sandy clay overlying a sandstone profile which has an apparent slope to the east. The sandstone is initially extremely weathered and extremely low to very low strength, rapidly becoming slightly weathered to fresh and medium or high strength.

The geotechnical models are derived from revised geotechnical cross-sections, prepared following revisions to the proposed basement footprint and BEL, attached as Drawings 3 to 6. Based upon these sections, each preliminary groundwater model varies slightly, due to the varying thickness of alluvial / estuarine soils, elevation of the underlying sandstone, and the cut-off wall toe levels.

It is noted that the cross-sections are aligned parallel to the proposed sides of the basement excavation, with the interpreted profiles accurate at the borehole locations only. Geological interpretation between the boreholes could vary from that shown on the cross-sections, and it is noted that the strata units or layers have been shown on the cross-sections as inferred strata boundaries only.

8. Conceptual Groundwater Model

Based on the observed groundwater levels and the site topography, groundwater is expected to flow towards the north-east. Due to its location within an urban environment, and the prevalence of impermeable concrete surfaces, rainfall recharge is expected to occur on the vegetated, higher elevated ground to the west with some limited recharge on the site, ultimately discharging to the Dee Why Lagoon to the north-east.

Construction of the proposed 'tanked' basement will require excavation below the water table, within the area bounded by the cut-off walls. Groundwater seepage into the excavation is expected, mostly through the floor of the excavation due to the cut-off walls, the rate of which will decrease over time during the excavation period. Increased water table levels may occur following prolonged rainfall, however, these would generally be expected to be limited to increase of up to about 1 m, outside of extreme events and therefore would be unlikely to significantly affect the dewatering requirements.

Due to the variation in rock levels within the excavation footprint, the hydrogeological regime within the excavation footprint has been modelled as a three-layer unconfined aquifer (alluvium, weathered rock, fresh rock), with the groundwater level at RL8.3 m. For a split-level basement excavation to RL-4.7 m (Level -4B) and RL-6.1 m (Level -5A), the four models and their locations are:

- Model 1 – Basement Level -4B: Shallow soil (1 m thick), over 1 m thick weathered sandstone, over fresh sandstone, located at the northern end of excavation – Ch00 m on Geotechnical Cross-Section B-B', Drawing 4 (Rev3);
- Model 2 – Basement Level -4B: Deep soil (9 m thick), over 1 m thick weathered sandstone, over fresh sandstone, located in the southern portion of excavation – Ch68 m on Geotechnical Cross-Section B-B', Drawing 4 (Rev3);
- Model 3 – Basement Level -5A: Moderately deep soil (8 m thick), over 1 m thick weathered sandstone, over fresh sandstone, located at the northern end of the excavation – Ch00 m on Geotechnical Cross-Section A-A', Drawing 3 (Rev3); and
- Model 4 – Basement Level -5A: Deep soil (18.5 m thick), over 1 m thick weathered sandstone, over fresh sandstone, located at the south-eastern end of the excavation – Ch41 m on Geotechnical Cross-Section D-D', Drawing 6 (Rev4).

Hydraulic conductivity (permeability) testing of the soils on site was undertaken as part of the geotechnical investigation, from within standpipe piezometers. Based upon these tests, the calculated hydraulic permeability of the underlying materials are:

- Alluvium (Layer 1): 4.3×10^{-6} m/sec;
- Clay and weathered rock (Layer 2): 1.1×10^{-6} m/sec; and
- Low and medium strength sandstone (Layer 3): 1.0×10^{-6} m/sec.

Allowing for some variability in the materials to be excavated, the adopted hydraulic conductivities for each layer are as follows:

- Alluvium (Layer 1): 5.0×10^{-6} m/sec;
- Clay and weathered rock (Layer 2): 2.0×10^{-6} m/sec; and
- Low and medium strength sandstone (Layer 3): 1.0×10^{-6} m/sec.

9. Numerical Model

In order to provide indicative groundwater inflows to the basement excavation, a simple numerical model was developed. The model was developed using the software Seep/W (Geostudio 2012, Version 8.0.10.6504, GEOSLOPE International Ltd), and using 2D models based upon the cross-sections. The preliminary groundwater models were based on the following assumptions:

- Model domain extends 75 m (in plan dimensions) beyond the excavation footprint;
- Basement excavation excavated to full depth instantaneously;
- Models 1 and 2 are oriented in a north-north-east to south-south-west direction, whereas Models 3 and 4 are oriented in an east-south-east to west-north-west direction;
- Base of model set at an elevation of between RL-10 m and RL-12 m, with the base of the excavation at either RL-4.7 m (Models 1 and 2) or RL-6.1 m (Models 3 and 4);
- A groundwater level of RL8.3 m was adopted for each analysis, with a difference in total head to the excavation floor of between 13 m (Models 1 and 2) and 14.4 m (Models 3 and 4);
- The diaphragm wall taken to 1 m into the medium strength, fresh sandstone, and was taken to be almost impermeable (hydraulic conductivity of 1.0×10^{-12} m/sec);
- Hydraulic conductivity of Layer 1 (alluvium) is 5.0×10^{-6} m/sec, anisotropy (k_y'/k_x') equal to 0.2;
- Hydraulic conductivity of Layer 2 (weathered rock) is 2.0×10^{-6} m/sec, anisotropy (k_y'/k_x') equal to 0.75;
- Hydraulic conductivity of Layer 3 (fresh rock) is 1.0×10^{-6} m/sec, anisotropy (k_y'/k_x') equal to 1, based on testing from one borehole;
- Side boundaries set as no flow;
- Boundary of model (60 m from excavation) set as a fixed head boundary; and
- Basement excavation perimeter measured using ALTIS Architecture drawings dated May 2017.

It is noted that the permeability range for fresh sandstone is in the order of 1.0×10^{-6} m/sec to 1.0×10^{-7} m/sec horizontally, and 1.0×10^{-6} m/sec to 0.2×10^{-7} m/sec vertically.

Analysis of each groundwater model has produced contoured diagrams of total head, including a series of flow paths for the initial and steady state conditions. Flux values into the excavation (through both the excavation floor and walls), are calculated in cubic metres (m^3) per second, per unit width (m) of the section.

The flow into the excavation was then estimated using the transient flow results and the following equations:

Equation 1: $Q_{1d} = ((q_{M1-T1} + q_{M2-T1} + q_{M3-T1} + q_{M4-T1})/4) \times (60 \times 60 \times 24)$ (kL / day: metre length of wall)

Equation 2: $Q_{1dP} = Q_{1d} \times P$ (kL / day / basement perimeter)

Equation 3: $Q_{60d} = Q_{1d} \times 60$ (kL / 60 days / basement perimeter)

Where:

- q = Flux flow per unit width of section into excavation (m^3 /sec/metre length of wall);
- P = Perimeter of excavation, P = 196 m;
- M1-T1 = Model 1 (transient flow, 14.4 hours);
- M2-T1 = Model 2 (transient flow, 14.4 hours);
- M3-T1 = Model 3 (transient flow, 14.4 hours);
- M4-T1 = Model 4 (transient flow, 14.4 hours);
- Q_{1d} = Flow into excavation per day (kilolitres / day / per metre length of wall)
- Q_{60dP} = Flow into excavation over 60 days (kilolitres / 60 days / basement Perimeter)

The Q_{60dP} is an estimated range of water volumes to be removed from the excavation via the dewatering system over the construction period of the proposed building (assumed to be 2 months), to maintain water levels below RL-4.7 m at Basement Level 4B, and below RL-6.1 m at Basement Level 5A within the perimeter of the diaphragm wall, and is calculated using an average of the transient flux for each model (in kL/day/basement perimeter), multiplied by 60. This method of analysis assumes an infinite supply of water, with no drawdown of the groundwater.

10. Results

10.1 Groundwater Laboratory Results

Comparison of the groundwater laboratory test results with groundwater assessment criteria indicate that analyte concentrations were generally within the adopted site assessment criteria, with the exception of copper which is discussed in Section 11.1 below. Groundwater from standpipes installed within Boreholes 301 and 205 both reported a copper concentration of 3 μ g/L (GIL 1.4 μ g/L).

10.2 Preliminary Groundwater Modelling

The results of the preliminary groundwater modelling is summarised in Table 3. The average inflows into the excavation (Q_{1dP} : ML / day) are:

- Transient flow (14.4 hours): 0.054 ML/day;
- Transient flow (60 days): 0.051 ML/day; and
- Steady State flow: 0.048 ML/day.

The flow into the excavation over a 60 day period, based upon average flow values using all four models and a reduction in seepage flow over time, is calculated to range between 3.0 ML and 4.0 ML.

Hand calculation of groundwater inflows, completed as an approximate check of the numerical model using the methods in Harr (Reference 2) and Smith (Reference 3), were within an order of magnitude of those calculated using Seep/W.

Table 3: Summary of preliminary groundwater modelling

Groundwater Model	Flow Case	Flux flow (q: m³/sec / m length of wall)	Flow into excavation, per Model (q x P x 86400: ML / day)
Model 1	Transient (14.4 hours)	2.28×10^{-6}	0.039
	Transient (60 days)	2.23×10^{-6}	0.038
	Steady State	2.19×10^{-6}	0.037
Model 2	Transient (14.4 hours)	3.60×10^{-6}	0.061
	Transient (60 days)	3.61×10^{-6}	0.061
	Steady State	3.59×10^{-6}	0.061
Model 3	Transient (14.4 hours)	6.66×10^{-11}	0.071
	Transient (60 days)	3.60×10^{-6}	0.061
	Steady State	2.96×10^{-6}	0.050
Model 4	Transient (14.4 hours)	2.67×10^{-6}	0.045
	Transient (60 days)	2.57×10^{-6}	0.044
	Steady State	2.56×10^{-6}	0.043

Notes: q : m³/sec/metre length of wall; Q_{1d} : per m wall length. P: perimeter of basement excavation.

11. Comments

11.1 Groundwater Testing Results

Based upon site assessment criteria for Marine Waters (NEPC, 2013: Reference 1), laboratory test results of the groundwater indicate that chemical concentrations of contaminants of concern are generally below the groundwater investigation limits. The reported elevated copper concentration is inferred to be either a regional background level or derived from diffuse urban contamination sources (such as drainage, road runoff, service leakage etc.), rather than from any site specific contamination source. In this regard, it is noted that the two groundwater samples returned the same copper concentration, indicative of there being no obvious down-gradient increase in concentration which might be expected if the contamination source was on site.

While the reported copper concentrations exceed the site assessment criteria for Marine Waters, based on similar experience in urban environments elsewhere, these levels are considered to be a common occurrence and not considered to be significant. Testing and treatment of collected groundwater during construction will be dealt with by the construction contractor prior to off-site discharge / disposal, in accordance with the conditions of their groundwater dewatering licence.

11.2 Preliminary Groundwater Modelling

Based on the results of geotechnical investigations at the site, and numerical modelling based upon hydraulic conductivity testing from site standpipe piezometers, the preliminary groundwater modelling indicates that cumulative groundwater inflows to the basement excavation through the sides and floor of the excavation over an 8-week period may marginally exceed 3 ML. Actual flow rates may be lower than indicated in the models, as the rate of inflow is governed by the rock permeability and the depth of embedment of the cut-off walls. The hydraulic conductivity of the sandstone, measured in the standpipe screened within rock, may have been influenced by inflows along water-bearing joints, possibly in hydraulic connectivity with the overlying unconfined aquifer. If a programme of jet grouting of the rock is undertaken as part of the construction process, a reduction in the inflow to the excavation along such joints could be expected. Following completion of the 'tanked' basement, groundwater inflow to the basement is anticipated to be minimal.

Given the indicated preliminary volumes of water required to be dewatered from the excavation during construction (at or just above 3 ML), it is likely that the construction contractor will need to obtain a dewatering licence from the NSW Office of Water, in accordance with their Aquifer Interference Policy. A detailed groundwater modelling plan will need to be developed at the detailed design stage of the project, when further details are known.

It is considered that the volume of seepage requiring dewatering during construction is in the range which will be readily achieved using conventional "sump and pump" techniques. A number of standard dewatering pumps should be spaced along the excavation, directing the pumped water to an on-site treatment module prior to off-site disposal / discharge. A sufficient number of pumps will be required at the site, to ensure that sufficient pumping capacity is available during construction, in the event of equipment failure or extreme weather events.

12. References

- Reference 1: National Environment Protection Council, 1999, *National Environment Protection Measure (Assessment of Site Contamination)*, amended 2013;
- Reference 2: Harr , M.E., 1990. "Groundwater and Seepage". Dover Publications, New York, USA.
- Reference 3: Smith, I., 2006. "Smith's Elements of Soil Mechanics", 8th edition. Blackwell Publishing, UK.

13. Limitations

Douglas Partners (DP) has prepared this report for this project at the Dee Why RSL Club, Dee Why, in accordance with DP's email proposal dated 9 February 2017 and acceptance received from Mr Marcel Batrac of Dee Why RSL Club dated 15 February 2017. The work was carried out under an amended Dee Why RSL Club Ltd Consultant Agreement, dated 18 November 2016. This report is provided for the exclusive use of the Dee Why RSL Club for this project only and for the purposes as described in the report. It should not be used for other projects 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 pages 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 scope for work for this report includes the assessment of groundwater for contaminants within the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

Although the sampling plan adopted for this investigation is considered appropriate to achieve the stated project objectives, there are necessarily parts of the site that have not been sampled and analysed. This is either due to undetected variations in ground conditions or to budget constraints (as discussed above), or to parts of the site being inaccessible and not available for sampling. It is therefore considered possible that HBM, including asbestos, may be present in unobserved or untested parts of the site, between and beyond sampling locations, and hence no warranty can be given that asbestos is not present.

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

Yours faithfully

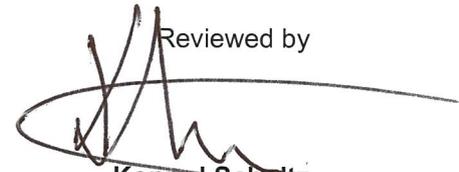
Douglas Partners Pty Ltd



Huw Smith

Associate / Engineering Geologist

Reviewed by



Konrad Schultz

Principal

Attachments: About this Report
 Drawings 1 to 6
 Table 2 - Summary of Laboratory Results for Groundwater
 Seep/W outputs – Figure 1 to 16
 Laboratory Test Results
 Chain of Custody Documentation

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.

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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

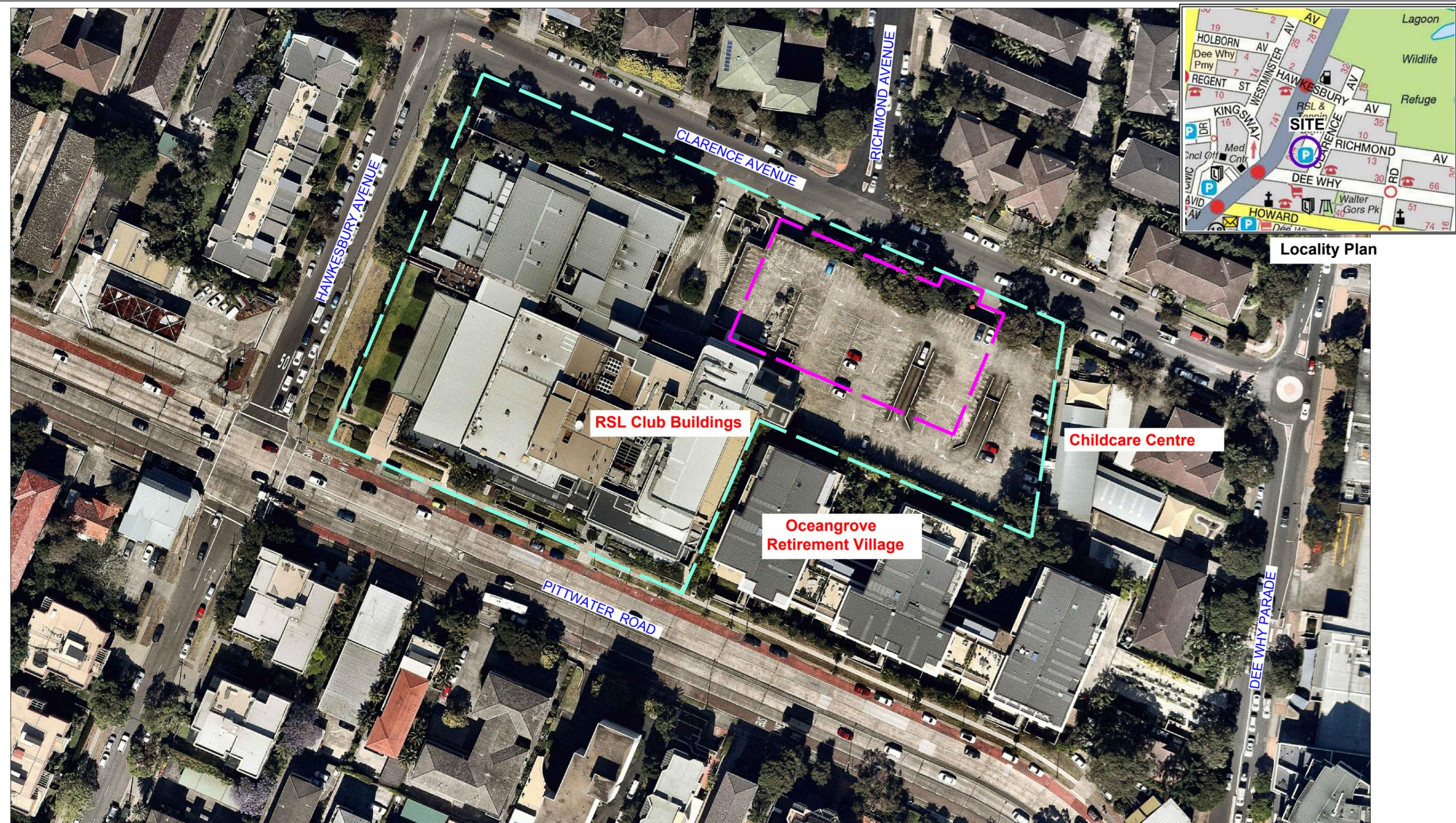
In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, DP requests that it be immediately notified. Most problems are much more readily resolved when conditions are exposed rather than at some later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



RSL Club Buildings

Childcare Centre

Oceangrove Retirement Village

LEGEND

- Dee Why RSL site
- Car park development area (Refer Altis Architecture Drawing SK168, Issue C (Draft), dated May 2017)

NOTE:
 1: Base image from Nearmap.com (Nov.2016)

1:1000 @ A3

CLIENT: Dee Why RSL Club	
OFFICE: Sydney	DRAWN BY: PSCH
SCALE: 1:1000 @ A3	DATE: 2.03.2018

TITLE: **Site Plan**
Dee Why RSL Car Park
932 Pittwater Road, DEE WHY

	PROJECT No: 84926.03
	DRAWING No: 1
	REVISION: 3



NOTE:
 1: Base image from Nearmap.com (Nov.2016)
 2: Test locations are approximate only and are shown with reference to existing features, and from previous DP report 29420, year 2000)



LEGEND

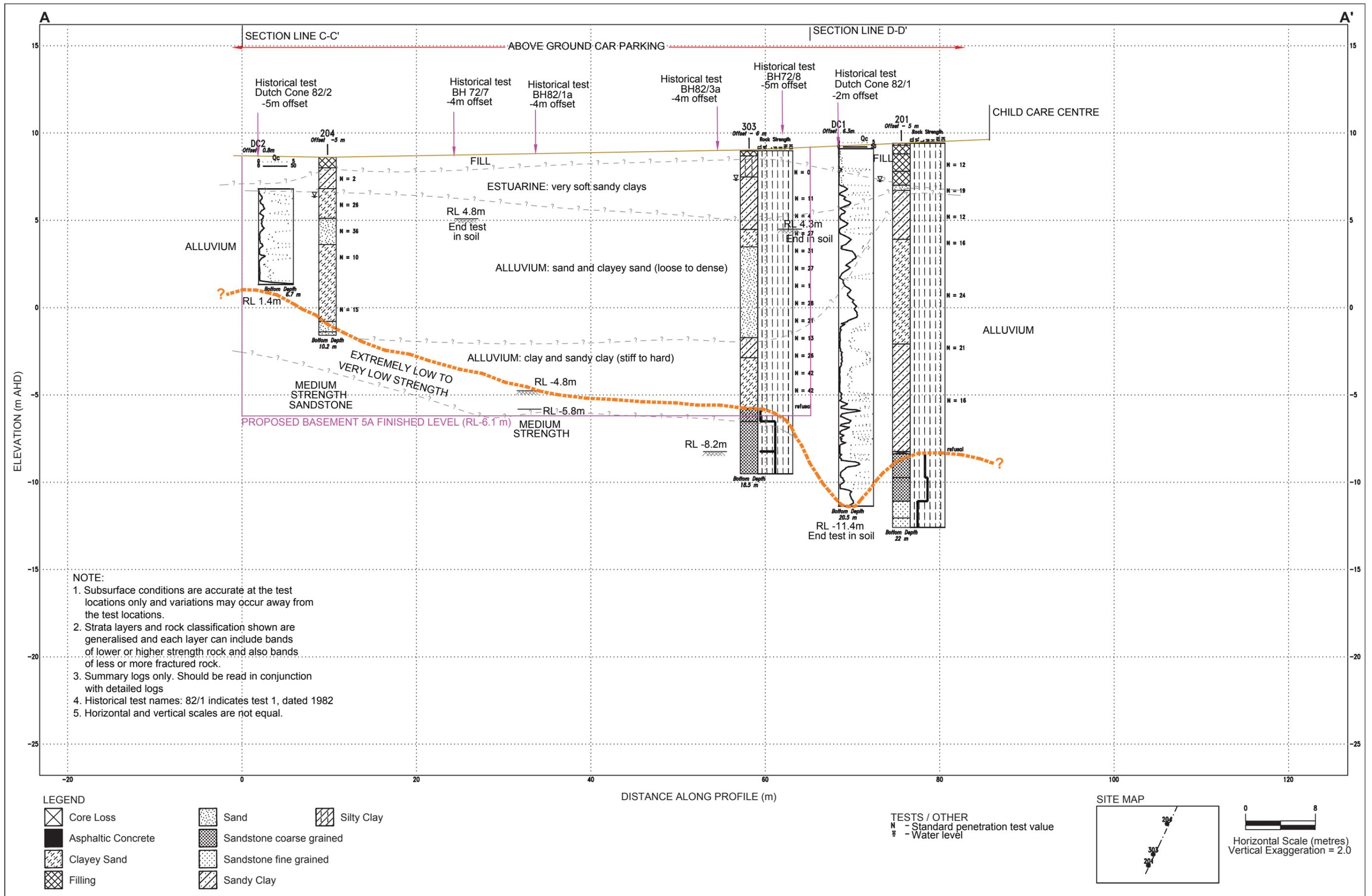
- ◆ Borehole (current report, year 2016)
- ◆ Borehole (DP Report 84926.01, year 2016)
- ◆ Cone penetrometer test (DP report 29420, year 2000)
- Cone penetrometer test location, and other test sites (refer DP report 7806 and 29420)
- ⊕ Borehole (DP report 29420B, year 2001)
- ⊕ Test pit (DP report 84926.00, year 2015)
- P Standpipe piezometer
- 2.8 Elevation of top of rock (metres RL)
- A-A' Geotechnical Cross-section

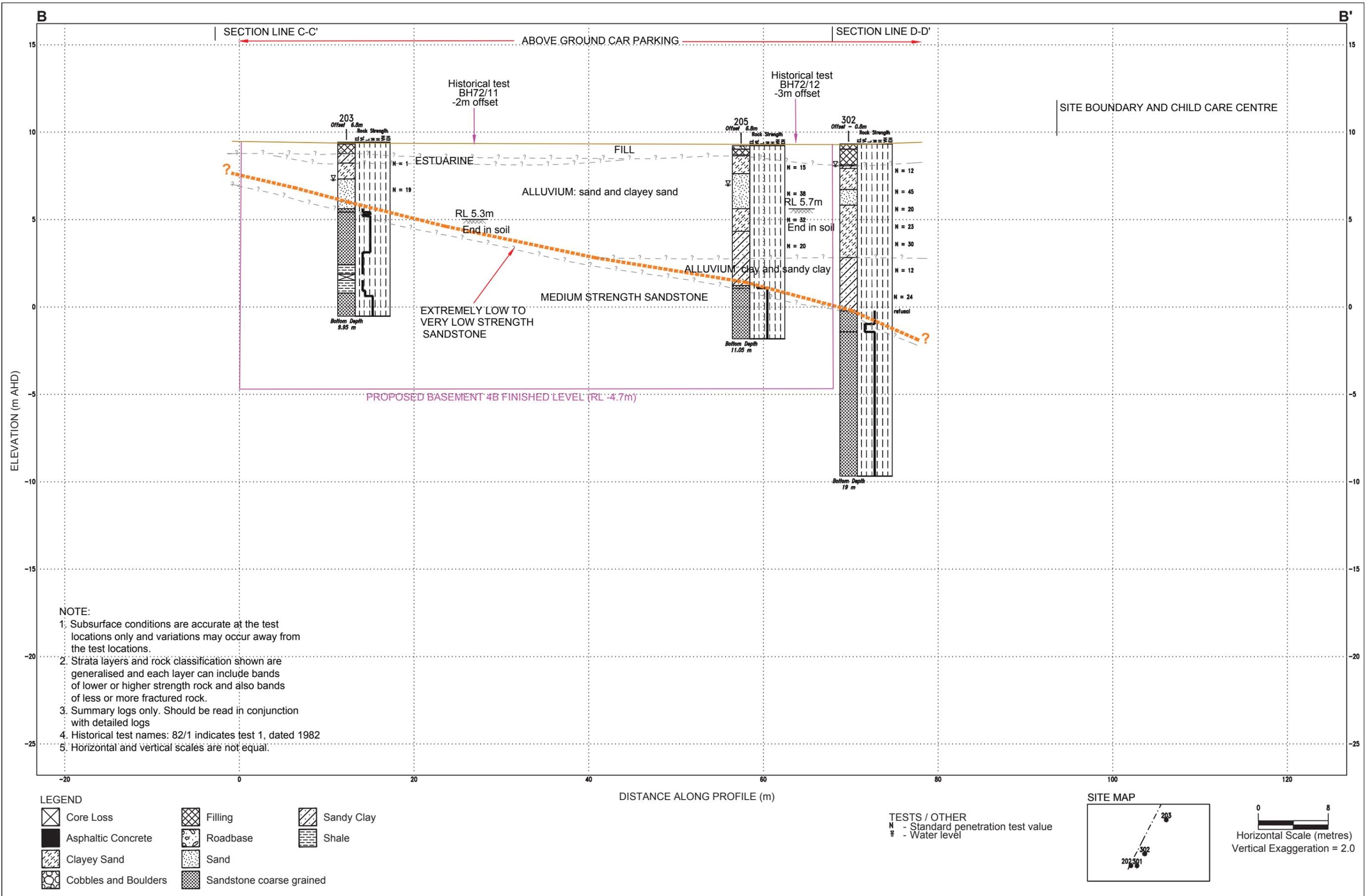


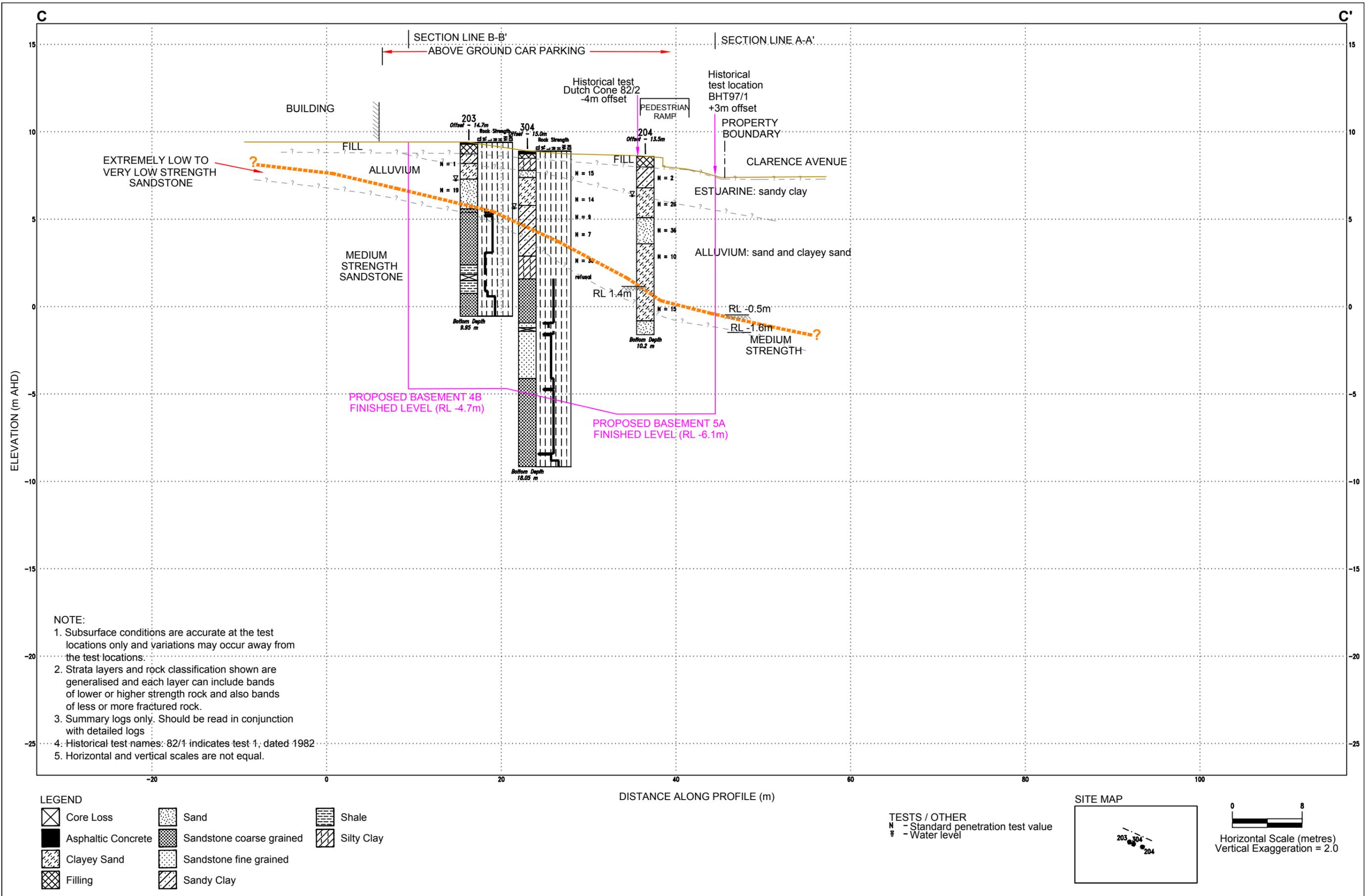
CLIENT: Dee Why RSL Club
 OFFICE: Sydney DRAWN BY: PSCH
 SCALE: 1:1000 @ A3 DATE: 2.03.2018

TITLE: **Geotechnical Test Location Plan**
Dee Why RSL Car Park
932 Pittwater Road, DEE WHY

PROJECT No: 84926.03
 DRAWING No: 2
 REVISION: 2





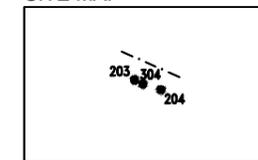


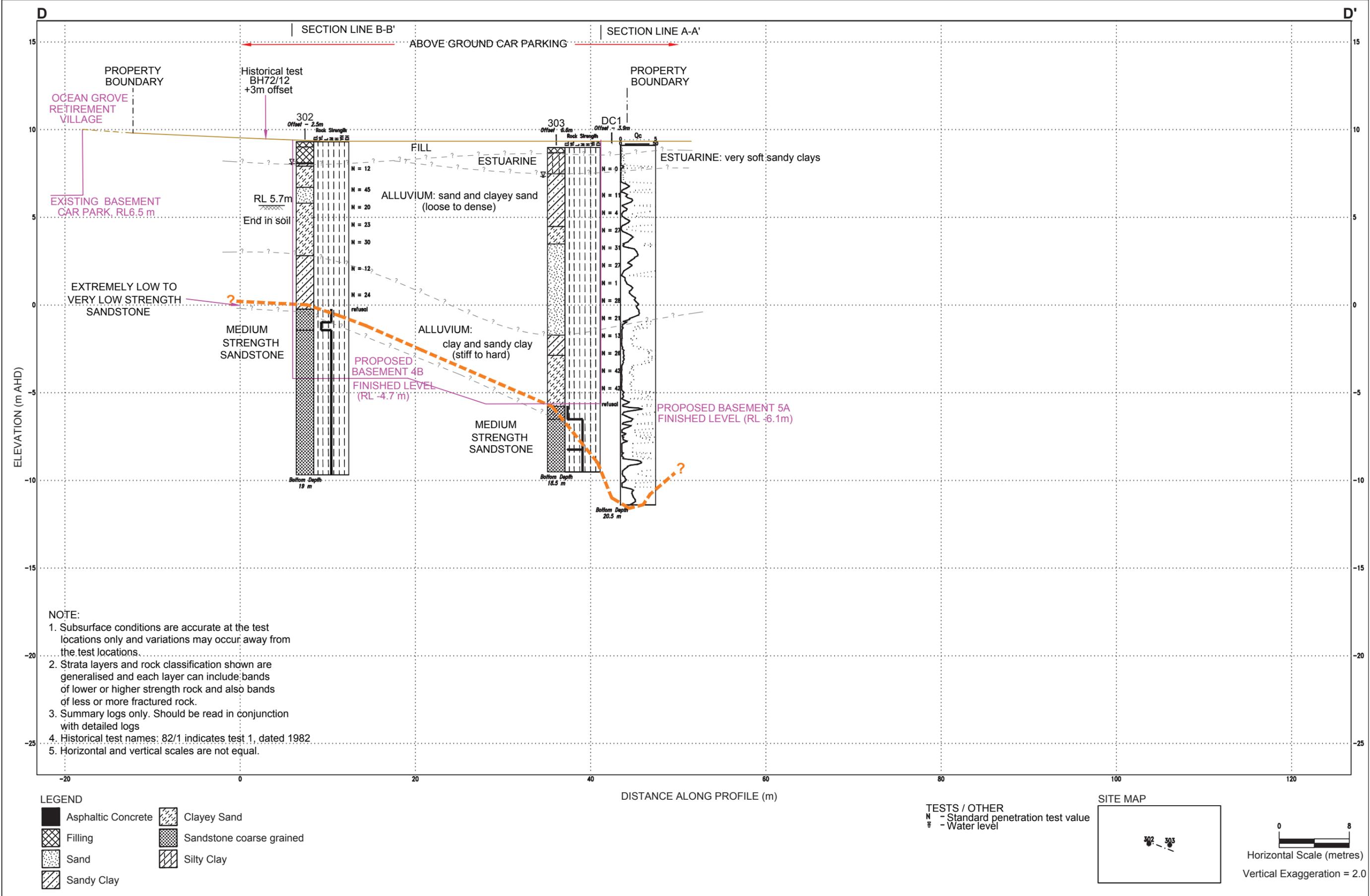
LEGEND

	Core Loss		Sand		Shale
	Asphaltic Concrete		Sandstone coarse grained		Silty Clay
	Clayey Sand		Sandstone fine grained		
	Filling		Sandy Clay		

TESTS / OTHER
 N - Standard penetration test value
 W - Water level

SITE MAP





CLIENT: Dee Why RSL

OFFICE: Sydney DRAWN BY: HDS

SCALE: 1:400 (H) @ A3 DATE: 09.03.2018

1:200 (V)

TITLE: **Geotechnical Cross-Section D-D'**

Proposed Car Park Upgrade

932 Pittwater Road, Dee Why

PROJECT No: 84926.03

DRAWING No: 6

REVISION: 5

Table 2 – Summary of Laboratory Results for Groundwater (all units in µg/L unless otherwise stated)

Sample ID	Date	Metals								TRH				BTEX					PAH			Total Phenol (mg/L)	OCP	OPP	PCB	Hardness (mgCaCO ₃ /L)	
		Arsenic (V)	Cadmium	Chromium (VI)	Copper	Lead	Mercury (Inorganic)	Nickel	Zinc	C6 - C10 ^a	>C10 - C16 ^b	>C16 - C34	>C34 - C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-xylene	B(a)P	Naphthalene	Total PAH						
BH301	24/11/2016	<1	<0.1	<1	3	<1	<0.05	<1	5	<10	<50	<100	<100	<1	<1	<1	<2	<1	<0.1	<0.2	<0.2	<0.05	<0.01	<0.01	<0.01	30	
BH304	24/11/2016	<1	<0.1	<1	<1	<1	<0.05	2	4	30	<50	<100	<100	<1	<1	<1	3	1	<0.1	0.4	0.43	<0.05	<0.01	<0.01	<0.01	64	
BH205	24/11/2016	3	<0.1	<1	3	<1	<0.05	1	5	<10	110	<100	<100	<1	<1	<1	<2	<1	<0.1	<0.2	<0.2	<0.05	<0.01	<0.01	<0.01	50	
R1	24/11/2016	<1	<0.1	<1	<1	<1	<0.05	<1	<1	<10	<50	<100	<100	<1	<1	<1	<2	<1	-	-	-	-	-	-	-	-	
BD1*	24/11/2016	<1	<0.1	<1	<1	<1	<0.05	2	4	-	-	-	-	-	-	-	-	-	<1	<1	<5	-	-	-	-	-	
TS (Trip Spike) ^g	24/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	94%	89%	90%	99%	100%	-	-	-	-	-	-	-	-	
TB (Trip Blank)	24/11/2016	-	-	-	-	-	-	-	-	-	-	-	-	<1	<1	<1	<2	<1	-	-	-	-	-	-	-	-	
Groundwater Investigation Levels (GIL)																											
NEPC (2013) Marine Waters ^d	-	0.7	4.4	1.3	4.4	0.1	7	15	-	-	-	-	500	-	-	-	-	-	-	50	-	400	0.009 ^c	-	-	-	-
NEPC (2013) HSL-D ^g	-	-	-	-	-	-	-	-	7	NL	NL	NL	5	NL	NL	NL	NL	NL	-	NL	-	-	-	-	-	-	-

- Notes:
- * Replicate of sample BH304
 - a TRH C₆-C₁₀ less BTEX (F1)
 - b TRH >C₁₀-C₁₆ less naphthalene (F2)
 - c Chlorpyrifos
 - d NEPC (2013) Schedule B 1 - Table 1C Groundwater Investigation Levels - Marine Waters
 - e Recovery
 - g Health screening levels have been assessed for sand, between 2m and to <4m depth
 - Not analysed/ not defined/ not applicable/in absence of screening levels for petroleum hydrocarbons, concentrations of contaminants below PQL have been adopted as initial screening levels.
- Exceedance of GIL
- * Duplicate of Sample listed directly above
 - NT Not tested
 - NL Not Limiting
 - TRH Total recoverable hydrocarbons, including total petroleum hydrocarbons (TPH)
 - BTEX benzene, toluene, ethyl benzene, total xylenes

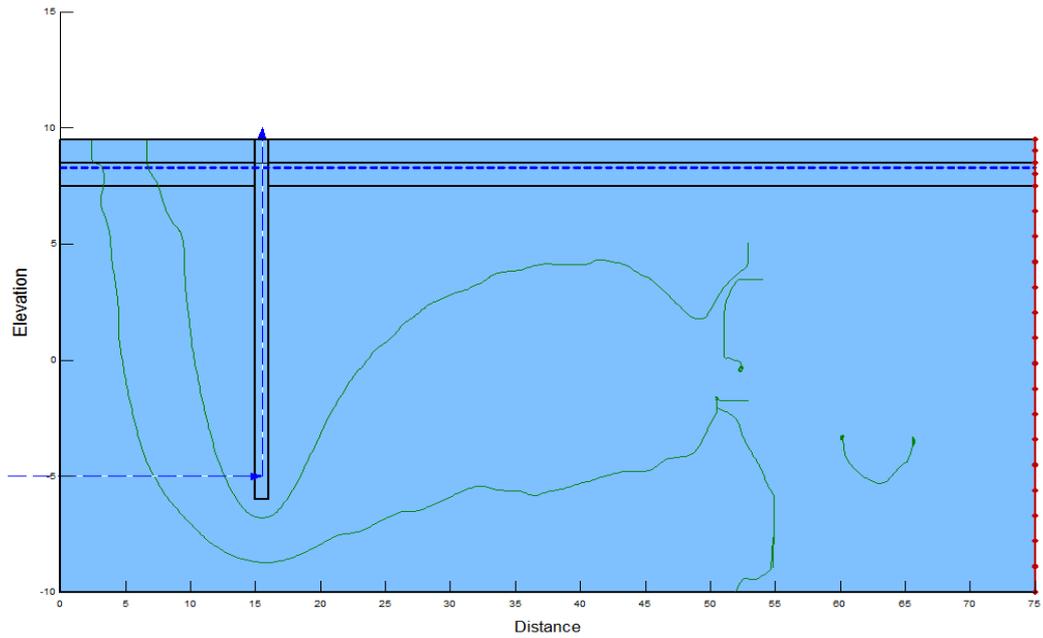


Figure 1 - Model 1 (Basement Level -4B) - Shallow soil, initial condition.

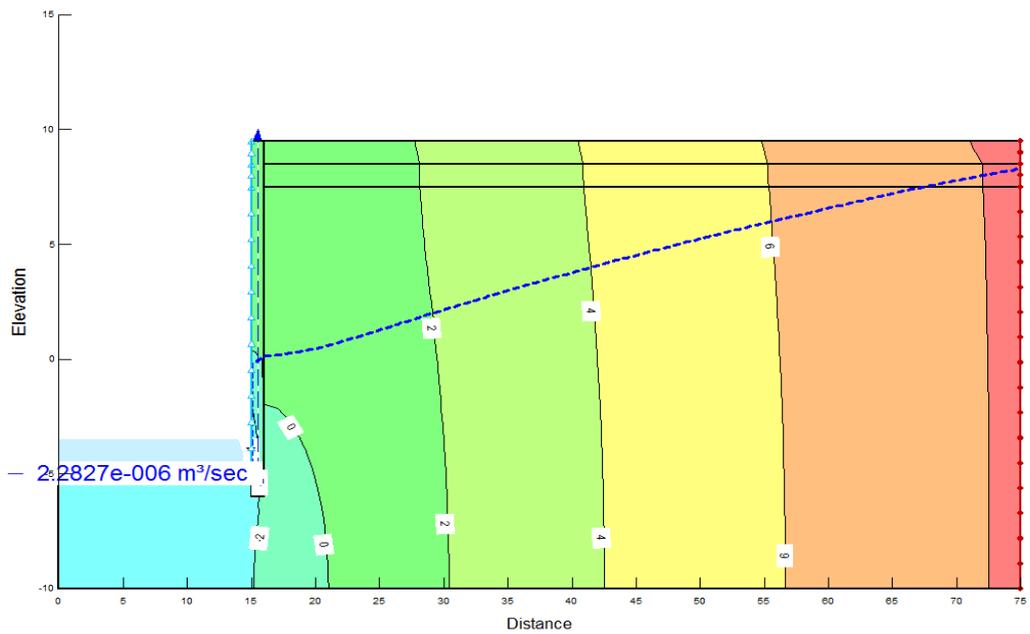


Figure 2 - Model 1 (Basement Level -4B) - Shallow soil, transient condition, 14.4 hours, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 1

REV: 1

DATE: 5-Mar-18

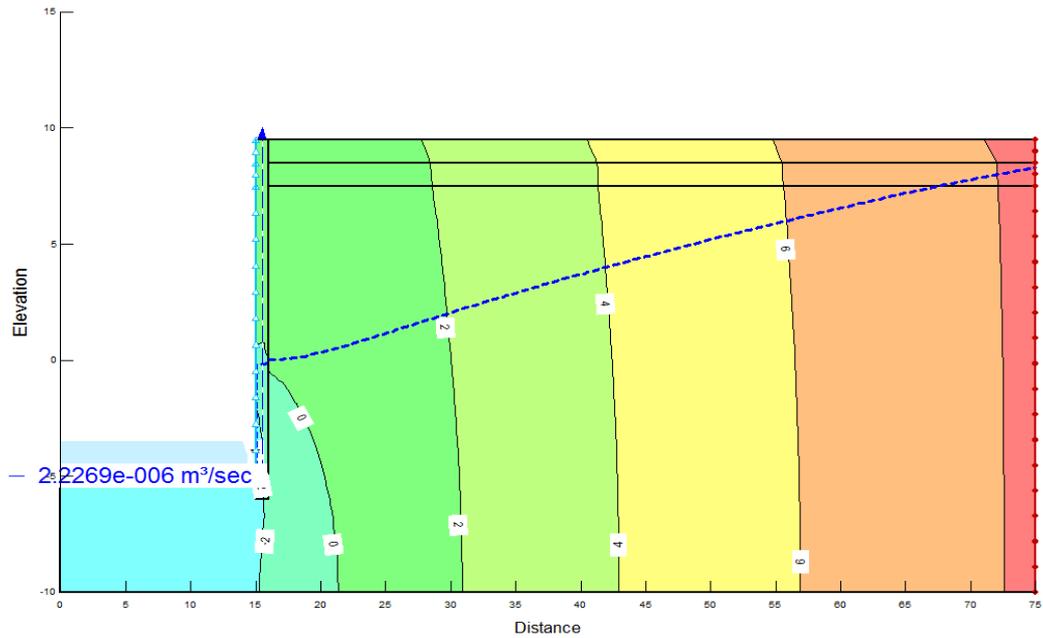
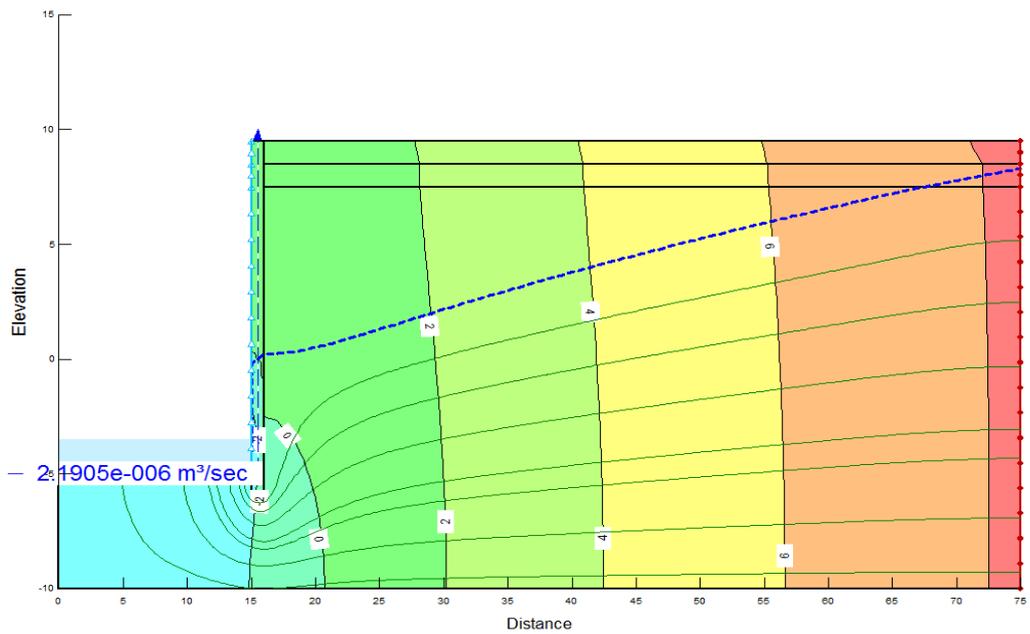


Figure 3 - Model 1 (Basement Level -4B) - Shallow soil, transient condition, 60 days, with contours of Total Head (metres) and flux rate into excavation



Model 1 (Basement Level -4B) - Shallow soil, steady state flow condition, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
 932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 2

REV: 1

DATE: 5-Mar-18

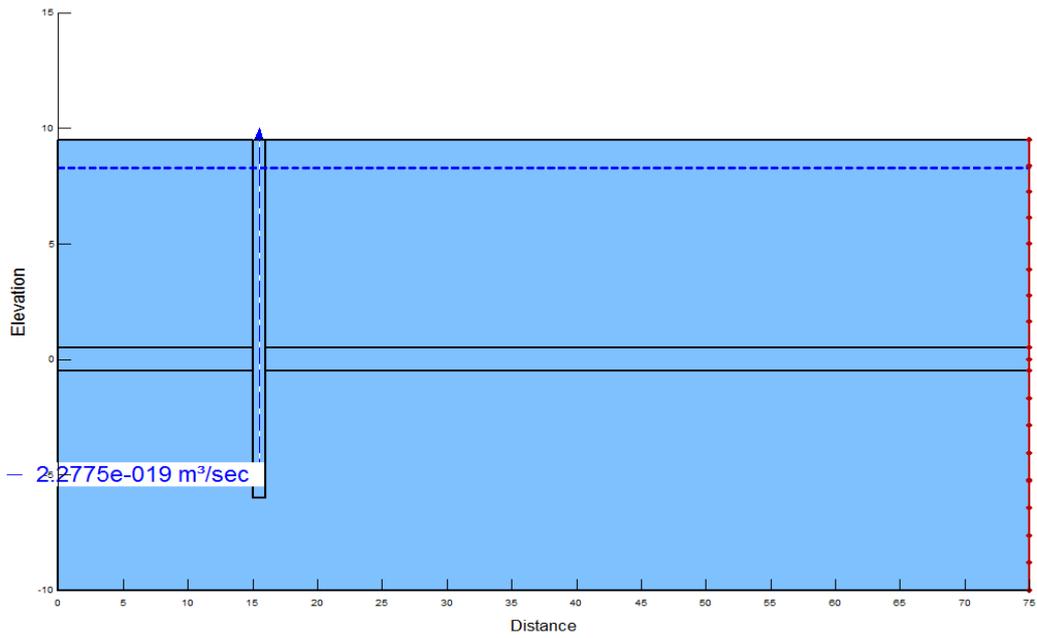


Figure 5 - Model 2 (Basement Level -4B) - Deep soil, initial condition.

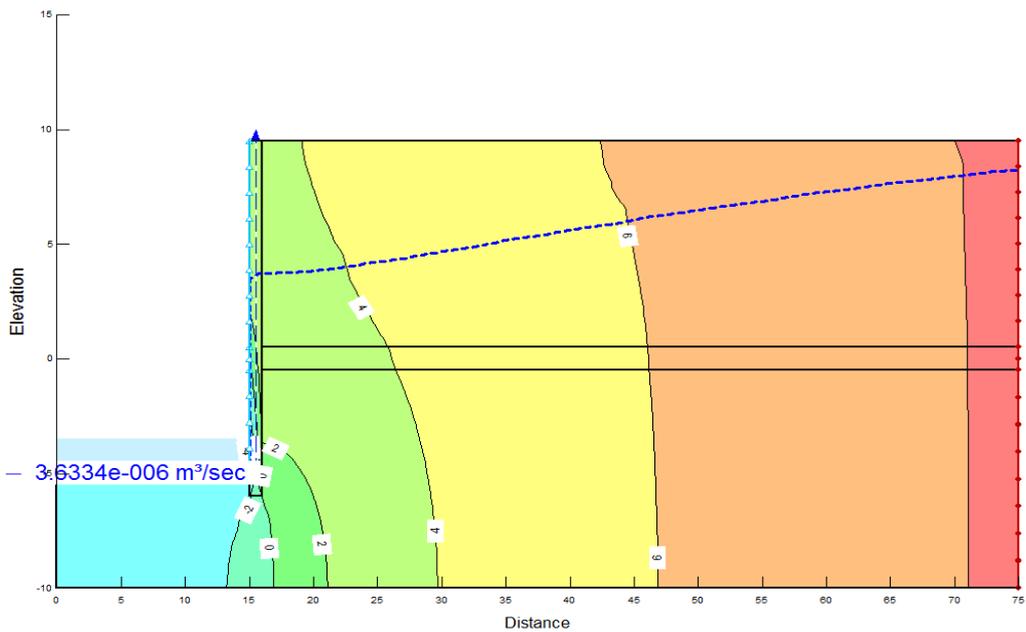


Figure 6 - Model 2 (Basement Level -4B) - Deep soil, transient condition, 14.4 hours, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 3

REV: 1

DATE: 5-Mar-18

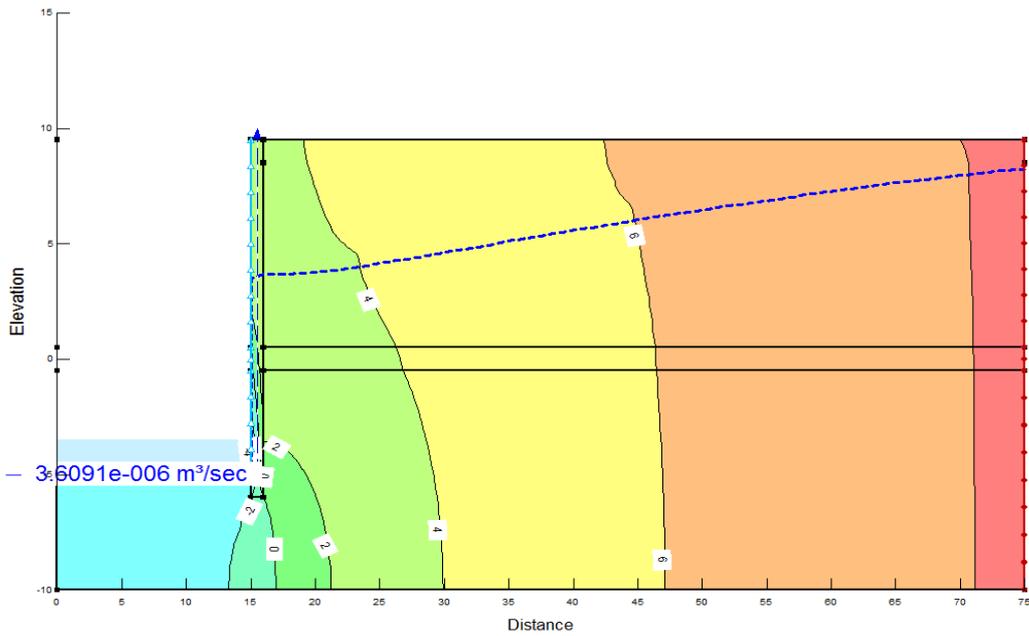


Figure 7 - Model 2 (Basement Level -4B) - Deep soil, transient condition, 60 days, with contours of Total Head (metres) and flux rate into excavation

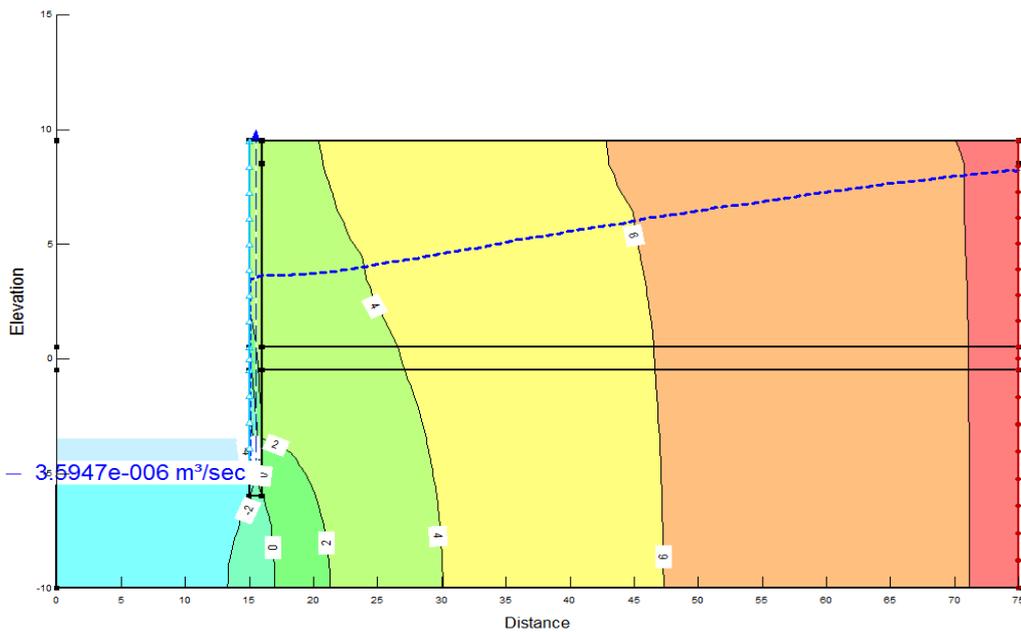


Figure 8 - Model 2 (Basement Level -4B) - Deep soil, steady state flow condition, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 4

REV: 1

DATE: 5-Mar-18

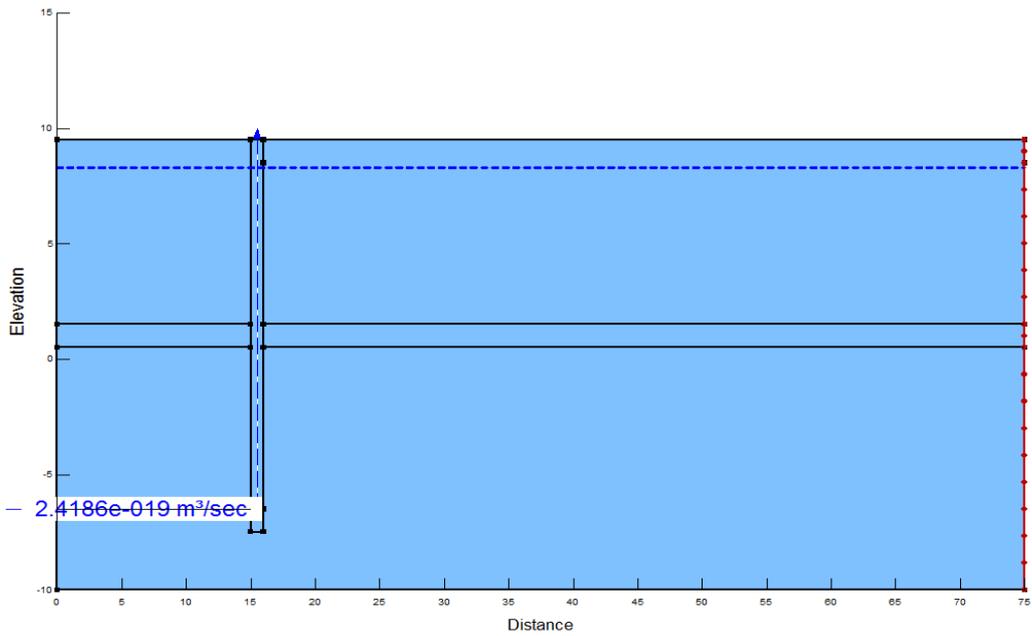


Figure 9 - Model 3 (Basement Level -5A) - Moderately deep soil, initial condition.

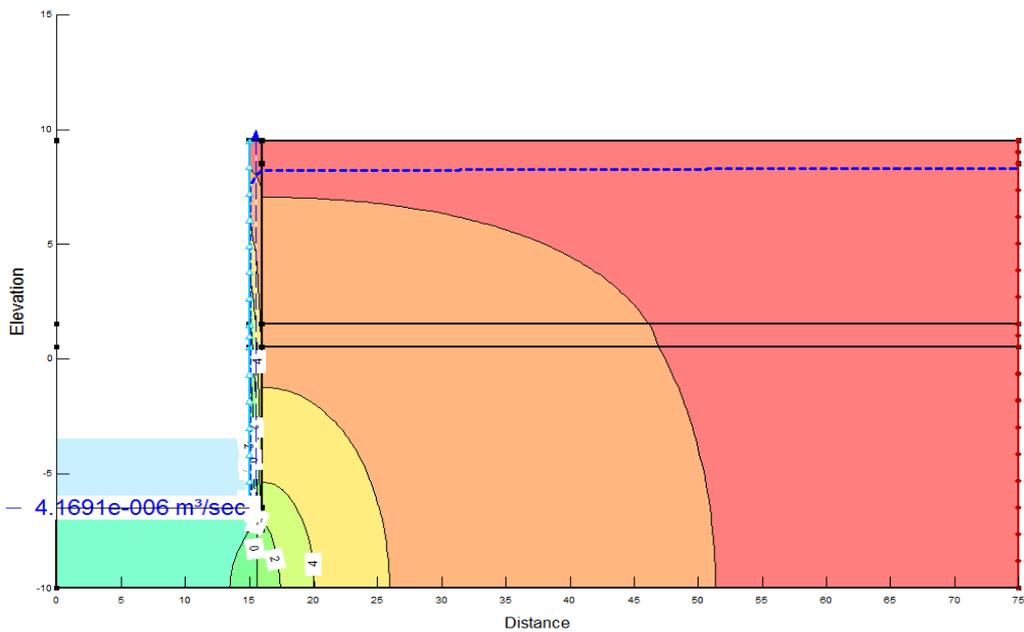


Figure 10 - Model 3 (Basement Level -5A) - Moderately deep soil, transient condition, 14.4 hours, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 5

REV: 1

DATE: 5-Mar-18

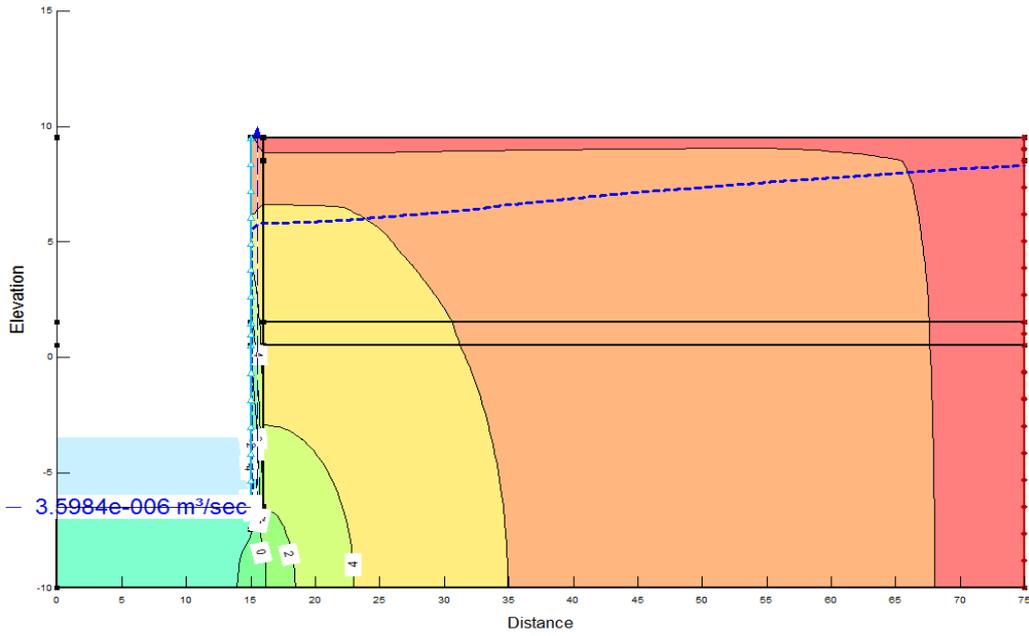


Figure 11 - Model 3 (Basement Level -5A) - Moderately deep soil, transient condition, 60 days, with contours of Total Head (metres) and flux rate into excavation

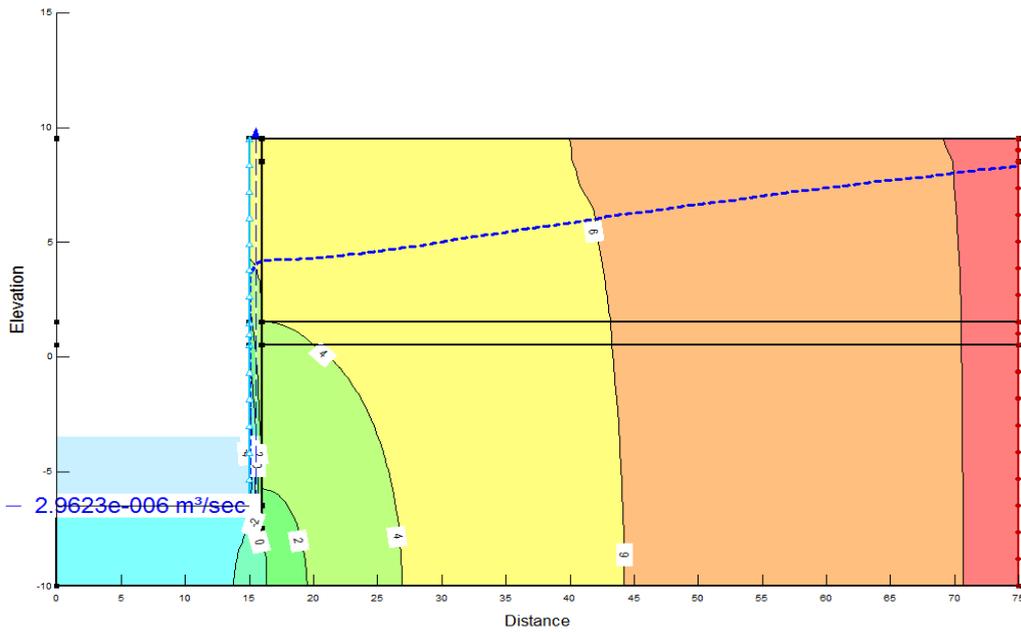


Figure 12 - Model 3 (Basement Level -5A) - Moderately deep soil, steady state flow condition, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 6

REV: 1

DATE: 5-Mar-18

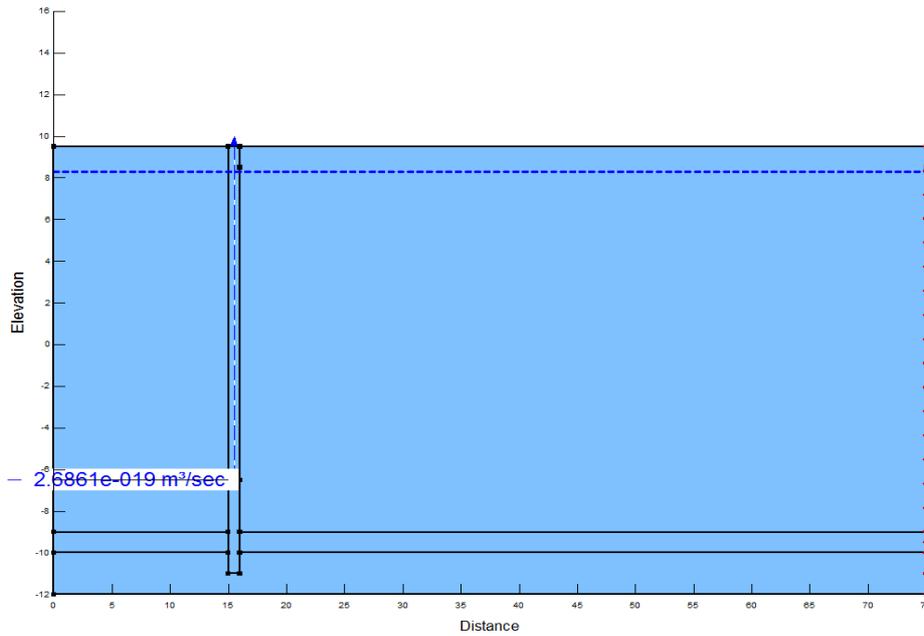


Figure 13 - Model 4 (Basement Level -5A) - Deep soil, initial condition.

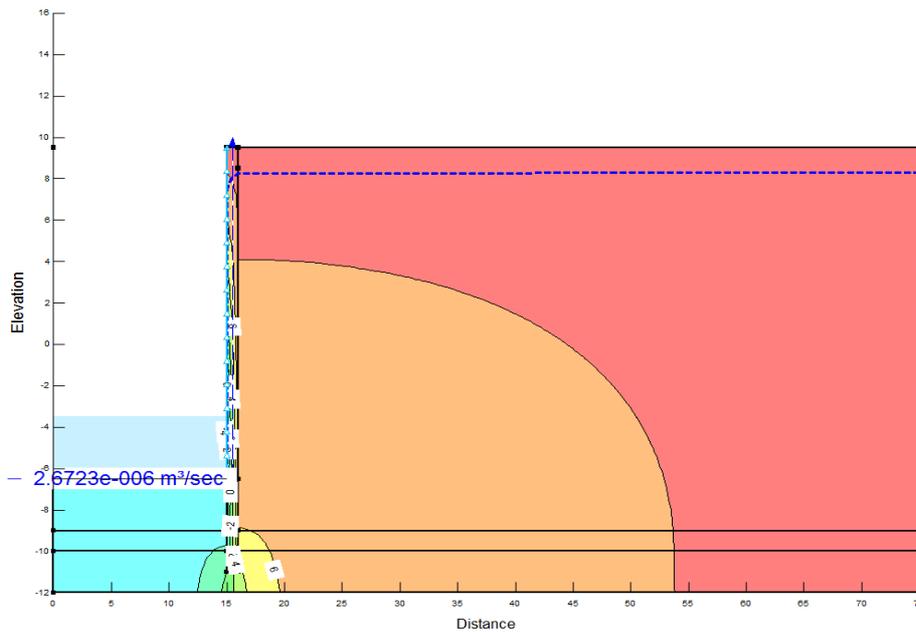


Figure 14 - Model 4 (Basement Level -5A) - Deep soil, transient condition, 14.4 hours, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club
932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 7

REV: 0

DATE: 5-Mar-18

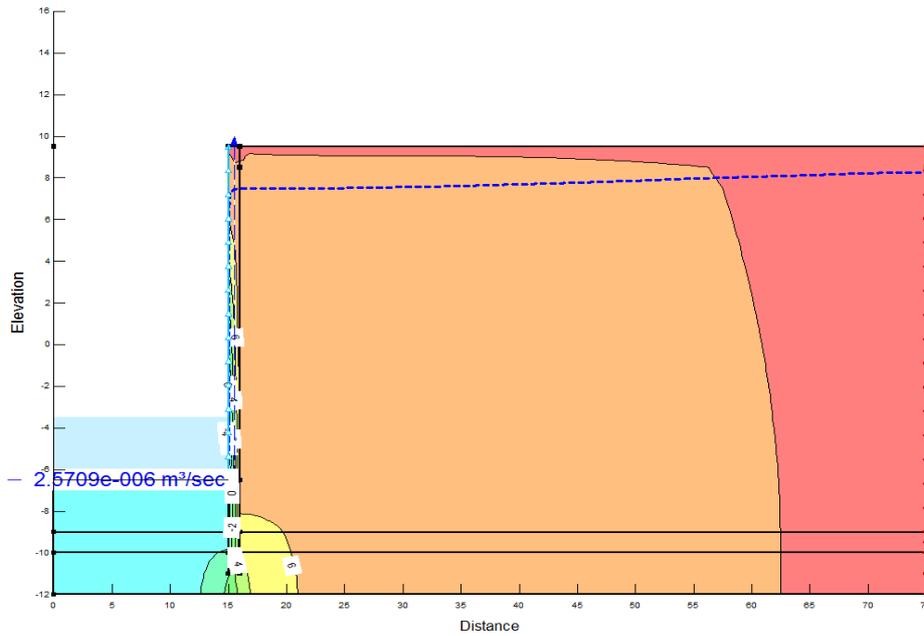


Figure 15 - Model 4 (Basement Level -5A) - Deep soil, transient condition, 60 days, with contours of Total Head (metres) and flux rate into excavation

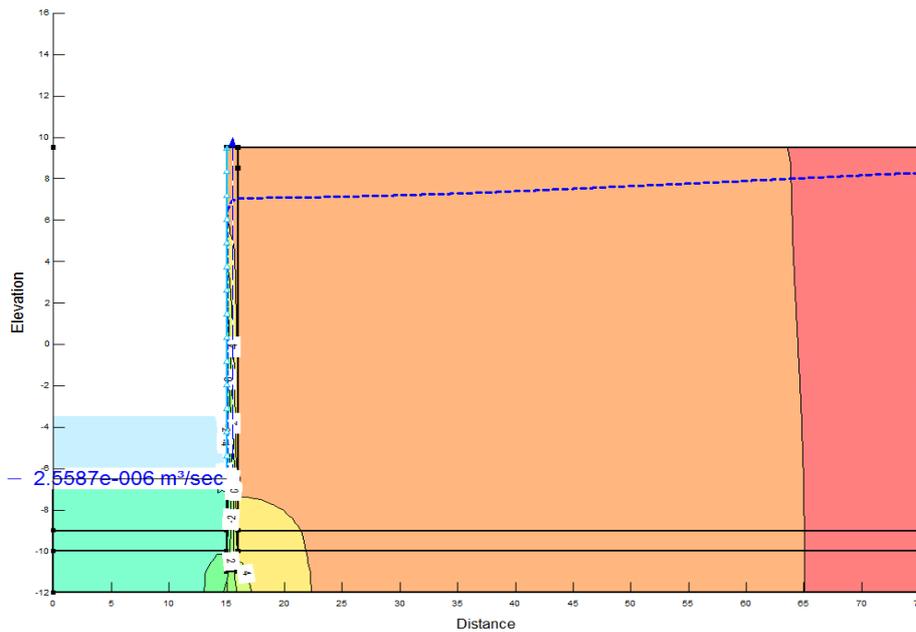


Figure 16 - Model 4 (Basement Level -5A) - Deep soil, steady state flow condition, with contours of Total Head (metres) and flux rate into excavation



Seep/W outputs

Dee Why RSL Club

932 Pittwater Road, Dee Why

CLIENT: Dee Why RSL Club

PROJECT: 84926.03

PLATE No: 8

REV: 0

DATE: 5-Mar-18



CERTIFICATE OF ANALYSIS

157954

Client:

Douglas Partners Pty Ltd
96 Hermitage Rd
West Ryde
NSW 2114

Attention: Veronica Ku, Huw Smith

Sample log in details:

Your Reference:	84926.03, Dee Why	
No. of samples:	7 waters	
Date samples received / completed instructions received	24/11/2016	/ 24/11/2016

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.

Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date: 1/12/16 / 1/12/16
Date of Preliminary Report: Not Issued

NATA accreditation number 2901. This document shall not be reproduced except in full.

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

Results Approved By:

David Springer
General Manager



vTRH(C6-C10)/BTEXN in Water	UNITS	157954-1	157954-2	157954-3	157954-4	157954-6
Our Reference:	-----	BH301	BH304	BH205	R1	TS
Your Reference	-					
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	28/11/2016	28/11/2016	28/11/2016	28/11/2016	28/11/2016
TRHC ₆ - C ₉	µg/L	<10	<10	<10	<10	[NA]
TRHC ₆ - C ₁₀	µg/L	<10	35	<10	<10	[NA]
TRHC ₆ - C ₁₀ less BTEX (F1)	µg/L	<10	30	<10	<10	[NA]
Benzene	µg/L	<1	<1	<1	<1	94%
Toluene	µg/L	<1	<1	<1	<1	89%
Ethylbenzene	µg/L	<1	<1	<1	<1	90%
m+p-xylene	µg/L	<2	3	<2	<2	99%
o-xylene	µg/L	<1	1	<1	<1	100%
Naphthalene	µg/L	<1	<1	<1	<1	[NA]
Surrogate Dibromofluoromethane	%	96	104	104	106	96
Surrogate toluene-d8	%	94	94	95	94	98
Surrogate 4-BFB	%	83	95	83	66	103

vTRH(C6-C10)/BTEXN in Water	UNITS	157954-7
Our Reference:	-----	TB
Your Reference	-	
Date Sampled	-----	24/11/2016
Type of sample		water
Date extracted	-	25/11/2016
Date analysed	-	28/11/2016
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Surrogate Dibromofluoromethane	%	106
Surrogate toluene-d8	%	93
Surrogate 4-BFB	%	83

svTRH (C10-C40) in Water	UNITS	157954-1	157954-2	157954-3	157954-4
Our Reference:	-----	BH301	BH304	BH205	R1
Your Reference:	-				
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016	25/11/2016
TRHC ₁₀ - C ₁₄	µg/L	<50	<50	<50	<50
TRHC ₁₅ - C ₂₈	µg/L	<100	<100	120	<100
TRHC ₂₉ - C ₃₆	µg/L	<100	<100	<100	<100
TRH>C ₁₀ - C ₁₆	µg/L	<50	<50	110	<50
TRH>C ₁₀ - C ₁₆ less Naphthalene (F2)	µg/L	<50	<50	110	<50
TRH>C ₁₆ - C ₃₄	µg/L	<100	<100	<100	<100
TRH>C ₃₄ - C ₄₀	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	86	100	78	93

PAHs in Water - Low Level Our Reference: Your Reference	UNITS ----- -	157954-1 BH301	157954-2 BH304	157954-3 BH205
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016
Naphthalene	µg/L	<0.2	0.4	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	NIL (+)VE	0.43	NIL (+)VE
Surrogate p-Terphenyl-d14	%	125	122	71

PAHs in Water Our Reference: Your Reference	UNITS ----- -	157954-5 BD1
Date Sampled Type of sample	-----	24/11/2016 water
Date extracted	-	25/11/2016
Date analysed	-	25/11/2016
Naphthalene	µg/L	<1
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate <i>p</i> -Terphenyl-d14	%	97

OCP in water - low level				
Our Reference:	UNITS	157954-1	157954-2	157954-3
Your Reference	-----	BH301	BH304	BH205
	-			
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016
HCB	µg/L	<0.01	<0.01	<0.01
alpha-BHC	µg/L	<0.01	<0.01	<0.01
gamma-BHC	µg/L	<0.01	<0.01	<0.01
beta-BHC	µg/L	<0.01	<0.01	<0.01
Heptachlor	µg/L	<0.01	<0.01	<0.01
delta-BHC	µg/L	<0.01	<0.01	<0.01
Aldrin	µg/L	<0.01	<0.01	<0.01
Heptachlor Epoxide	µg/L	<0.01	<0.01	<0.01
gamma-Chlordane	µg/L	<0.01	<0.01	<0.01
alpha-Chlordane	µg/L	<0.01	<0.01	<0.01
Endosulfan I	µg/L	<0.01	<0.01	<0.01
pp-DDE	µg/L	<0.01	<0.01	<0.01
Dieldrin	µg/L	<0.01	<0.01	<0.01
Endrin	µg/L	<0.01	<0.01	<0.01
pp-DDD	µg/L	<0.01	<0.01	<0.01
Endosulfan II	µg/L	<0.01	<0.01	<0.01
DDT	µg/L	<0.006	<0.006	<0.006
Endrin Aldehyde	µg/L	<0.01	<0.01	<0.01
Endosulfan Sulphate	µg/L	<0.01	<0.01	<0.01
Methoxychlor	µg/L	<0.01	<0.01	<0.01
Surrogate TCMX	%	82	85	132

OP Pesticides in water LL				
Our Reference:	UNITS	157954-1	157954-2	157954-3
Your Reference	-----	BH301	BH304	BH205
	-			
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016
Diazinon	µg/L	<0.01	<0.01	<0.01
Dimethoate	µg/L	<0.01	<0.01	<0.01
Chlorpyriphos-methyl	µg/L	<0.01	<0.01	<0.01
Ronnel	µg/L	<0.01	<0.01	<0.02
Chlorpyriphos	µg/L	<0.01	<0.01	<0.02
Fenitrothion	µg/L	<0.01	<0.01	<0.02
Bromophos ethyl	µg/L	<0.01	<0.01	<0.01
Ethion	µg/L	<0.01	<0.01	<0.01
Surrogate TCMX	%	82	85	132

PCBs in Water - Low Level				
Our Reference:	UNITS	157954-1	157954-2	157954-3
Your Reference	-----	BH301	BH304	BH205
	-			
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016
Aroclor 1016	µg/L	<0.1	<0.1	<0.1
Aroclor 1221	µg/L	<0.1	<0.1	<0.1
Aroclor 1232	µg/L	<0.1	<0.1	<0.1
Aroclor 1242	µg/L	<0.1	<0.1	<0.1
Aroclor 1248	µg/L	<0.1	<0.1	<0.1
Aroclor 1254	µg/L	<0.1	<0.1	<0.1
Aroclor 1260	µg/L	<0.1	<0.1	<0.1
Surrogate TCLMX	%	82	85	132

Client Reference: 84926.03, Dee Why

Total Phenolics in Water				
Our Reference:	UNITS	157954-1	157954-2	157954-3
Your Reference	-----	BH301	BH304	BH205
	-			
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date extracted	-	25/11/2016	25/11/2016	25/11/2016
Date analysed	-	25/11/2016	25/11/2016	25/11/2016
Total Phenolics (as Phenol)	mg/L	<0.05	<0.05	<0.05

HM in water - dissolved		157954-1	157954-2	157954-3	157954-4	157954-5
Our Reference:	UNITS	BH301	BH304	BH205	R1	BD1
Your Reference	-----					
	-					
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water	water	water
Date prepared	-	28/11/2016	28/11/2016	28/11/2016	28/11/2016	28/11/2016
Date analysed	-	28/11/2016	28/11/2016	28/11/2016	28/11/2016	28/11/2016
Arsenic-Dissolved	µg/L	<1	<1	3	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	<0.1	<0.1	<0.1
Chromium-Dissolved	µg/L	<1	<1	<1	<1	<1
Copper-Dissolved	µg/L	3	<1	3	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	2	1	<1	2
Zinc-Dissolved	µg/L	5	4	5	<1	4

Cations in water Dissolved				
Our Reference:	UNITS	157954-1	157954-2	157954-3
Your Reference	-----	BH301	BH304	BH205
	-			
Date Sampled	-----	24/11/2016	24/11/2016	24/11/2016
Type of sample		water	water	water
Date digested	-	28/11/2016	28/11/2016	28/11/2016
Date analysed	-	28/11/2016	28/11/2016	28/11/2016
Calcium - Dissolved	mg/L	5.7	13	9.3
Magnesium - Dissolved	mg/L	3.9	7.4	6.4
Hardness	mgCaCO ₃ /L	30	64	50

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-022 ICP-MS	Determination of various metals by ICP-MS.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-020	Determination of various metals by ICP-AES.

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
vTRH(C6-C10)/BTEXN in Water						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			28/11/2016	[NT]	[NT]	LCS-W1	28/11/2016
TRHC ₆ - C ₉	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	90%
TRHC ₆ - C ₁₀	µg/L	10	Org-016	<10	[NT]	[NT]	LCS-W1	90%
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	90%
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	88%
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	87%
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	LCS-W1	93%
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	LCS-W1	92%
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NR]	[NR]
Surrogate Dibromofluoromethane	%		Org-016	101	[NT]	[NT]	LCS-W1	89%
Surrogate toluene-d8	%		Org-016	94	[NT]	[NT]	LCS-W1	102%
Surrogate 4-BFB	%		Org-016	82	[NT]	[NT]	LCS-W1	98%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
svTRH(C10-C40) in Water						Base II Duplicate II %RPD		
Date extracted	-			28/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			28/11/2016	[NT]	[NT]	LCS-W1	28/11/2016
TRHC ₁₀ - C ₁₄	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	108%
TRHC ₁₅ - C ₂₈	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	101%
TRHC ₂₉ - C ₃₆	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	83%
TRH>C ₁₀ - C ₁₆	µg/L	50	Org-003	<50	[NT]	[NT]	LCS-W1	108%
TRH>C ₁₆ - C ₃₄	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	101%
TRH>C ₃₄ - C ₄₀	µg/L	100	Org-003	<100	[NT]	[NT]	LCS-W1	83%
Surrogate o-Terphenyl	%		Org-003	93	[NT]	[NT]	LCS-W1	83%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	LCS-W1	81%
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	85%
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	82%
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	80%
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	83%

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water - Low Level						Base II Duplicate II %RPD		
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(b,j +k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	LCS-W1	107%
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	78	[NT]	[NT]	LCS-W1	79%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PAHs in Water						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Naphthalene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	81%
Acenaphthylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluorene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	85%
Phenanthrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	82%
Anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	80%
Pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	83%
Benzo(a)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Chrysene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Benzo(b,j +k)fluoranthene	µg/L	2	Org-012	<2	[NT]	[NT]	[NR]	[NR]
Benzo(a)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	LCS-W1	107%
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	µg/L	1	Org-012	<1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	78	[NT]	[NT]	LCS-W1	79%

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
OCP in water - low level						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
HCB	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
alpha-BHC	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	72%
gamma-BHC	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
beta-BHC	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	77%
Heptachlor	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	73%
delta-BHC	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
Aldrin	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	71%
Heptachlor Epoxide	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	70%
gamma-Chlordane	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
alpha-Chlordane	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
Endosulfan I	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
pp-DDE	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	73%
Dieldrin	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	70%
Endrin	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	70%
pp-DDD	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	73%
Endosulfan II	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
DDT	µg/L	0.006	Org-005	<0.006	[NT]	[NT]	[NR]	[NR]
Endrin Aldehyde	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
Endosulfan Sulphate	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	LCS-W1	77%
Methoxychlor	µg/L	0.01	Org-005	<0.01	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-005	76	[NT]	[NT]	LCS-W1	73%

QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
OP Pesticides in water LL						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	[NR]	[NR]
Date analysed	-			25/11/2016	[NT]	[NT]	[NR]	[NR]
Diazinon	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Dimethoate	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Chlorpyrifos-methyl	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Ronnel	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Chlorpyrifos	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	LCS-W1	78%
Fenitrothion	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Bromophos ethyl	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Ethion	µg/L	0.01	Org-008	<0.01	[NT]	[NT]	[NR]	[NR]
Surrogate TCMX	%		Org-008	76	[NT]	[NT]	[NR]	[NR]
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
PCBs in Water - Low Level						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Aroclor 1016	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Aroclor 1221	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Aroclor 1232	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Aroclor 1242	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Aroclor 1248	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Aroclor 1254	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	LCS-W1	86%
Aroclor 1260	µg/L	0.1	Org-006	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate TCLMX	%		Org-006	76	[NT]	[NT]	LCS-W1	92%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
Total Phenolics in Water						Base II Duplicate II %RPD		
Date extracted	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Date analysed	-			25/11/2016	[NT]	[NT]	LCS-W1	25/11/2016
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	LCS-W1	96%
QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
HM in water - dissolved						Base II Duplicate II %RPD		
Date prepared	-			28/11/2016	157954-2	28/11/2016 28/11/2016	LCS-W1	28/11/2016
Date analysed	-			28/11/2016	157954-2	28/11/2016 28/11/2016	LCS-W1	28/11/2016
Arsenic-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	<1 <1	LCS-W1	101%
Cadmium-Dissolved	µg/L	0.1	Metals-022 ICP-MS	<0.1	157954-2	<0.1 <0.1	LCS-W1	102%

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QUALITYCONTROL	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results	Spike Sm#	Spike % Recovery
HM in water - dissolved						Base Duplicate %RPD		
Chromium-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	<1 <1	LCS-W1	101%
Copper-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	<1 <1	LCS-W1	100%
Lead-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	<1 <1	LCS-W1	101%
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	157954-2	<0.05 [N/T]	LCS-W1	93%
Nickel-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	2 3 RPD: 40	LCS-W1	101%
Zinc-Dissolved	µg/L	1	Metals-022 ICP-MS	<1	157954-2	4 4 RPD: 0	LCS-W1	103%

QUALITYCONTROL	UNITS	PQL	METHOD	Blank
Cations in water Dissolved				
Date digested	-			28/11/2016
Date analysed	-			28/11/2016
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5
Hardness	mgCaCO ₃ /L	3		[NT]

QUALITYCONTROL	UNITS	Dup. Sm#	Duplicate
HM in water - dissolved			Base + Duplicate + %RPD
Date prepared	-	157954-1	28/11/2016 28/11/2016
Date analysed	-	157954-1	28/11/2016 28/11/2016
Mercury-Dissolved	µg/L	157954-1	<0.05 <0.05

QUALITYCONTROL	UNITS	Dup. Sm#	Duplicate	Spike Sm#	Spike % Recovery
Cations in water Dissolved			Base + Duplicate + %RPD		
Date digested	-	[NT]	[NT]	LCS-W2	28/11/2016
Date analysed	-	[NT]	[NT]	LCS-W2	28/11/2016
Calcium - Dissolved	mg/L	[NT]	[NT]	LCS-W2	102%
Magnesium - Dissolved	mg/L	[NT]	[NT]	LCS-W2	100%
Hardness	mgCaCO ₃ /L	[NT]	[NT]	[NR]	[NR]

QUALITYCONTROL	UNITS	Dup. Sm#	Duplicate	Spike Sm#	Spike % Recovery
HM in water - dissolved			Base + Duplicate + %RPD		
Date prepared	-	[NT]	[NT]	157954-2	28/11/2016
Date analysed	-	[NT]	[NT]	157954-2	28/11/2016
Arsenic-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Cadmium-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Chromium-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Copper-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Lead-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Mercury-Dissolved	µg/L	[NT]	[NT]	157954-2	93%

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QUALITYCONTROL HM in water - dissolved	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Nickel-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]
Zinc-Dissolved	µg/L	[NT]	[NT]	[NR]	[NR]

Report Comments:

OP_W_LL:

PQL has been raised due to interference from analytes(other than those being tested) in the sample/s.

Asbestos ID was analysed by Approved Identifier:

Not applicable for this job

Asbestos ID was authorised by Approved Signatory:

Not applicable for this job

INS: Insufficient sample for this test

PQL: Practical Quantitation Limit

NT: Not tested

NR: Test not required

RPD: Relative Percent Difference

NA: Test not required

<: Less than

>: Greater than

LCS: Laboratory Control Sample

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.

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: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

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.

CHAIN OF CUSTODY



Client: Douglas Partners	Project Number: 84926.03	To: Envirolab Services
Contact Person: Veronica Ku	Project Name: Dee Why	Contact Person: Aileen Hie
Project Mgr: Huw Smith	PO No.:	Address: 12 Ashley Street
Address: 96 Hermitage Road West Ryde NSW 2114	lab Quote No.:	Chatswood NSW 2068
	Date results required:	Phone: 02 9910 6200
Phone: 9809 0666 Mob: 0457820847	Or choose: standard	Fax: 02 9910 6201
	Note: Inform lab in advance if urgent turnaround is required - surcharges apply	Email: ahie@envirolab.com.au
Email: veronica.ku@douglaspartners.com.au	Report format: esdat / PDF / Excel	Laboratory Report No:
	Comments:	Lab Comments:

Sample information						Tests Required										Comments		
Lab Sample ID	Field Sample ID	Depth	Date sampled	Container Type	Type of sample	Combo 4L	Low level OCP, OPP, PCB	hardness	8 metals	PAH	BTEX	TRH					Combo	Provide as much information about the sample as you can
1	BH301	-	24.11.16	bottles/vials	water	X	X	X									4L	
2	BH304	-	24.11.16	bottles/vials	water	X	X	X									4L	
3	BH205	-	24.11.16	bottles/vials	water	X	X	X									4L	
4	R1	-	24.11.16	bottles/vials	water				X		X	X						
5	BD1	-	24.11.16	bottles/vials	water				X	X								
6	TS	-	-	vials	water						X							
7	TB	-	-	vials	water						X							

Envirolab Services
 12 Ashley Street
 Chatswood NSW 2068
 Ph: (02) 9910 6200
 Job No: 157954
 Date Received: 24/11/2016
 Time Received: 18:40
 Received by: PH
 Temp: Cool/Ambient
 Cooling: Ice/Heppack 14
 Security: Intact/Broken/None

Relinquished by: Douglas Partners	Sample Receipt	Lab use only:
Courier (by whom) HUNTER EXPRESS	Received by (Company): PH	Samples Received: Cool or Ambient (circle one)
Condition of Sample at dispatch Cool or Ambient (circle)	Print Name: PH	Temperature Received at: 14 (if applicable)
Temperature (if Applicable):	Date & Time: 24/11/2016 18:40	Transported by: Hand delivered / courier
Print Name: VERONICA KU	Signature: PH	
Date & Time: 24/11/16		
Signature:		

SAMPLE RECEIPT ADVICE

Client Details	
Client	Douglas Partners Pty Ltd
Attention	Veronica Ku, Huw Smith

Sample Login Details	
Your Reference	84926.03, Dee Why
Envirolab Reference	157954
Date Sample Received	24/11/2016
Date Instructions Received	24/11/2016
Date Results Expected to be Reported	01/12/2016

Sample Condition	
Samples received in appropriate condition for analysis	YES
No. of Samples Provided	7 waters
Turnaround Time Requested	Standard
Temperature on receipt (°C)	1.4
Cooling Method	Ice
Sampling Date Provided	YES

Comments
Samples will be held for 1 month for water samples and 2 months for soil samples from date of receipt of samples

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@envirolabservices.com.au	Email: jhurst@envirolabservices.com.au

Sample and Testing Details on following page

