



Integrated Practical Solutions

Report on
Geotechnical and Prelim. Environmental Investigation

Multi Storey Car Park Redevelopment
30-36 Jackson Street, St Kilda

Prepared for
City of Port Phillip

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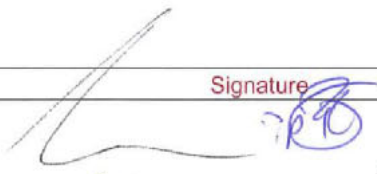

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The undersigned, on behalf of Douglas Partners Pty Ltd, confirm that this document and all attached drawings, logs and test results have been checked and reviewed for errors, omissions and inaccuracies.

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Report on Geotechnical and Prelim. Environmental Investigation
Multi Storey Car Park Redevelopment
30-36 Jackson Street, St Kilda

1. Introduction

This report presents the results of a geotechnical investigation and preliminary environmental investigation undertaken for a proposed multi storey car park redevelopment, located at 30-36 Jackson Street, St Kilda. The investigation was commissioned via a purchase order dated 17 December 2018 by Mr Anthony Savenkov of City of Port Phillip (CoPP). The investigation was undertaken in general accordance with Douglas Partners' (DP) proposal MEL180489.P.001 Rev1 dated 12 December 2018.

The details of the proposed development of the site are not yet finalised, but it is understood that it is likely to comprise the construction of a three storey car park facility with a single level basement. A single level basement is expected to extend about 3 m below the existing ground surface.

The aims of the investigation were to assess the subsurface conditions across the site and to provide comments and recommendations regarding the following:

- Soil, rock and groundwater conditions, including the presence of filling;
- Allowable bearing pressures for spread footings and estimated settlements;
- Recommended design parameters for lateral earth pressures and retaining wall options;
- Discussion of excavation conditions;
- Estimated subgrade CBR and modulus values for use in the design of floor slabs and pavements, subgrade preparation and compaction requirements;
- Earthquake classification in accordance with AS1170.4 - 2007, Part 4;
- Advice on potential construction difficulties related to the site conditions;
- Comparison of soil contamination data to EPA Victoria waste categorisation criteria for off-site disposal; and
- Recommendations for further environmental investigation, remediation or specific soil management, as appropriate.

This report must be read in conjunction with the attached notes provided in Appendix A and other explanatory information, and should be kept in its entirety without separation of individual pages or sections.

2. Site Description

Drawing 1 in Appendix B shows the location of the site at 30-36 Jackson Street, St Kilda. The site was bound to the north east and south east by Jackson Street. The remaining site boundaries comprise a combination of residential and commercial buildings and associated car parking areas to the north west and south west.

The site covers an area of approximately 1,040 m², approximately 31 m by 33 m in plan dimension, with a fall across the site from the south corner to the north at about 1V:30H grade.

At the time of the investigation, the majority of the site was occupied by an at grade car park, which was bordered on the southern three sides by garden beds planted with trees and shrubs.

3. Published Geology and Nearby Investigation Data

Published maps show that the site is underlain by a thin capping layer of Tertiary age sands overlying siltstone and sandstone of the Silurian age Melbourne Formation.

Tertiary age sands, referred to as Brighton Group sediments, typically comprise marine and non-marine sands, clays, ferruginous sandstones and gravels.

The Melbourne Formation comprises variably weathered, thinly bedded siltstone and sandstone. It is referred to as the basement geology for this region. The formation is heavily faulted and folded with dyke intrusions. Dykes in this unit are often highly decomposed i.e. soil-like strength materials, but occasionally are of very high strength if fresh.

The published maps also indicate that the bedding (primary discontinuity of the rock mass) is dipping towards the north-west, although significant variation can occur at a local level.

A geotechnical investigation located approximately 100 m north of the site, showed the Brighton Group soils to extend to depths of between 7.5 m and 8.6 m below the existing ground level, underlain by Melbourne Formation.

4. Scope of Works and Methodology

4.1 Overview

This investigation included office studies, field work and laboratory testing. The office studies included a review of published maps, internal DP files and reporting. Field work included the drilling of boreholes, in-situ strength testing, standpipe installation and groundwater measurement. Geotechnical and environmental laboratory testing was undertaken on samples of soil and rock collected from site.

4.2 Field Investigation

The field investigation was performed on 17 and 18 January 2019 and comprised the drilling of 3 boreholes, designated BH01, BH02 and BH03.

The boreholes were originally proposed to be drilled to 12 m depth with soils anticipated to be encountered over the majority of the drill depth. However, as rock was encountered at shallow depths in two of the boreholes (BH01 & BH03), the drill depths were reduced to 8 m and this was communicated to Mr Anthony Savenkov of COPP at the time of the investigation.

The drilling rig used for the boreholes was a truck mounted Hydro Power Scout drilling rig supplied and operated by Rockwell Drilling Pty Ltd. Drawing No. 1 in Appendix B shows the borehole locations. The boreholes were advanced using a combination of solid flight augering, wash boring and rotary NMLC diamond coring techniques. Standard Penetration Tests (SPT) and undisturbed tube samples were recovered from the boreholes to assist in the assessment of soil consistency and for laboratory testing.

Slotted PVC standpipes were installed in boreholes BH02 & BH03 to allow the measurement of groundwater levels and groundwater sampling. The standpipe boreholes were finished at the surface with a flush mounted gatic cover. Borehole BH01 was backfilled with drill cuttings and surface reinstated similar to the existing. Construction details of the standpipe installations are provided in Drawings 2 & 3.

The borehole locations were recorded by a hand held GPS unit with the coordinates referenced to the WGS 84 datum. Borehole collar levels were assessed by level survey to an estimated accuracy of +/- 0.1 m with reference to a temporary benchmark. This temporary benchmark was marked on the supplied site survey plan, 'Re-Establishment Feature & Level Plan', BPD REF 10134.

The field work was supervised by a DP engineer who was responsible for occupant liaison, field work co-ordination, logging of the strata encountered, sampling and sample handling.

Details of the drilling, sampling and description of the conditions encountered in the boreholes are presented on the borehole logs in Appendix C. Photographs of the recovered rock core are presented in Appendix C. The borehole logs should be read in conjunction with the notes 'About this Report' and accompanying explanatory notes contained in Appendix A. General photographs of the field work undertaken are presented in Appendix B.

4.3 Environmental Sampling

Soil samples were collected during the geotechnical drilling according to standard operating procedures outlined in the DP *Field Procedures Manual*. The general sampling and sample management procedures comprised:

- Collection of disturbed soil samples into laboratory-prepared glass jars with Teflon-lined lids by hand, capping immediately and ensuring headspace within the sample jar was minimised;
- Samples were collected directly from the decontaminated lead auger during drilling. A new disposable nitrile glove was also worn by the field engineer for each sample collected thereby minimising potential cross-contamination;
- Labelling of sample containers with individual and unique identification details, including project number, sample location and sample depth;
- Placement of the sample jars into a cooled, insulated and sealed container for transport to the laboratory;
- Chain of custody documentation was maintained at all times and countersigned by the receiving laboratory on transfer of samples; and
- A National Association of Testing Authorities (NATA) accredited laboratory was engaged to undertake all analyses.

4.4 Laboratory Testing

4.4.1 Geotechnical

Samples of soil and rock collected from the boreholes were submitted to DP's NATA accredited Melbourne laboratory. The laboratory testing comprised a particle size distribution on one soil sample. Samples of the rock were selected for laboratory strength and moisture content testing. The test certificates are presented in Appendix D.

4.4.2 Environmental

Ten representative soil samples of the encountered ground conditions were selected for environmental analysis at ALS Water Resources Group (ALS) in Scoresby. All analyses were conducted within the holding times recommended by EPA Victoria publication IWRG701, *Sampling and Analysis of Waters, Wastewaters, Soils and Wastes*, June 2009. Table 1 presents the environmental analytical program undertaken.

Table 1: Environmental Analytical Program

Borehole Number	Sample and Depth (m)	Sample Type	Analysis
BH01	BH01 - 0.1	Crushed Rock	EPA Screen ¹
	BH01 - 0.5	Filling	Metals ² , TRH and PAH Leachable metals and PAH
	BH01 - 1.0	Natural	Metals ² , TRH and PAH
BH2	BH02 - 0.1	Crushed Rock	Metals ² , TRH and PAH
	BH02 - 0.5	Filling	Metals ² , TRH and PAH
	BH02 - 1.5	Natural	Metals ² , TRH and PAH
	BH02 - 3.0	Natural	Metals ² , TRH and PAH
BH3	BH03 - 0.1	Crushed Rock	Metals ² , TRH and PAH
	BH03 - 0.5	Filling	Metals ² , TRH and PAH Leachable metals and PAH
	BH03 - 1.5	Natural	Metals ² , TRH and PAH

1. EPA Screen consists of an IWRG 621 Table 2 Screen which comprises metals/metalloids (arsenic, cadmium, chromium (VI), copper, iron lead, mercury, molybdenum, nickel, tin, selenium, silver and zinc), total cyanide, total fluoride, speciated phenols (halogenated and non-halogenated), monocyclic aromatic hydrocarbons (including benzene, toluene, ethyl benzene and xylenes known as BTEX), Polycyclic Aromatic Hydrocarbons (PAH), Total Recoverable Hydrocarbons (TRH), polychlorinated biphenyls (PCB), chlorinated hydrocarbons (volatile and semi-volatile) and organochlorine pesticides (OCP).
2. Metals/metalloids analysis comprised arsenic, cadmium, total chromium, copper, iron lead, mercury, molybdenum, nickel, tin, selenium, silver and zinc.

Results are summarised in Table E1, Appendix E. The NATA accredited laboratory reports and chain of custody are also provided in Appendix E.

5. Results of Investigation

Details of the drilling, sampling and description of the conditions encountered in the boreholes are presented on the borehole logs in Appendix C along with photographs of the recovered rock core. The borehole logs should be read in conjunction with the notes 'About this Report' and accompanying explanatory notes contained in Appendix A.

5.1 Subsurface Conditions

The subsurface conditions encountered in the boreholes were generally consistent with those expected from published geological and the nearby boreholes with Brighton Group soils overlying the Melbourne Formation, although the Brighton Group soils were only encountered in BH02.

The inferred stratigraphic sequence, general description and classification of the main units encountered in the site investigation are discussed below in increasing depth order.

- **Filling** – (0.6 m to 1.5 m thick) – Asphalt (up to 50 mm), crushed rock (0.35 m to 0.45 m thick), overlying silty sand (SM), and reworked silty clay (CH);
- **Silty Clay (CH), Sandy Clay (CI) and Clayey Sand (SC)** – Firm to very stiff, or dense, pale brown mottled orange, (inferred Brighton Group soil). This unit was only observed in BH02 between the depths of 0.6 m and 4.5 m;
- **Silty Clay (CH), Clayey Gravel (GC) / Extremely to Highly Weathered (XW-HW) Sandstone** – hard or very dense soils with rock fabric observed to very low strength rock, with HW rock fragments present, orange brown, yellow brown, extending to depths of between 1.8 m and 7.0 m;
- **Moderately Weathered Sandstone (MW)** – Typically medium strength, sometimes moderately to slightly weathered, orange brown, grey brown.

The rock bedding in the core generally dips from 10° to around 30° from the horizontal. The joint sets observed either typically dip between sub-horizontal and 35° from the horizontal or between 60° to around 80° from horizontal with occasional sub-vertical joints.

The boreholes were terminated within the moderately to slightly weathered siltstone at depths of between 8.0 m and 11.5 m below the existing surface.

A generalised subsurface profile is presented in Table 2.

Table 2: Generalised Subsurface Profile

Borehole No.	Depth Interval (Thickness) (m)				
	Filling	Inferred Brighton Group Soils	Residual Clay / XW Sandstone	Sandstone Predominantly XW-HW	Sandstone Predominantly MW or MW-SW
BH01	0.0 – 1.2 (1.2)	Not Encountered	1.2 – 2.7 (1.5)	Not Encountered	2.7 – 8.25* (> 5.55)
BH02	0.0 – 0.6 (0.6)	0.6 – 4.5 (3.9)	4.5 – 7.0 (2.5)	Not Encountered	7.0 – 11.5* (> 4.5)
BH03	0.0 – 1.5 (1.5)	Not Encountered	1.5 – 1.8 (0.3)	1.8 – 3.6 (1.8)	3.6 – 8.0* (> 4.4)

*Denotes Borehole Termination Depth.

XW : Extremely Weathered HW : Highly Weathered MW : Moderately Weathered SW : Slightly Weathered

The borehole logs show that the top of the residual clay layer is shallower (1.2 m in BH01 and 1.5 m in BH03) in the south and south east part of the site than the northern part (4.5 m in BH02). This is consistent with the north western dipping bedding indicated by the published literature.

While igneous intrusions or dykes are often encountered within the siltstone and sandstone of the Melbourne area, none were intersected in the boreholes drilled. However, such intrusions are often sub-vertically orientated and can be relatively thin (i.e. several metres wide) and as such may still be present between the boreholes. Dykes typically have soil properties and where encountered within the rock profile can present difficulties with regard to the stability of excavations and foundations, possibly requiring modifications to the retention and foundation system design during construction.

5.2 Groundwater Conditions

Maps included as part of Visualising Victoria’s Groundwater (copies available on vvg.org.au website) indicated that the depth to groundwater may be less than about 5 m below surface level.

Groundwater was observed in BH02 at approximately 6.2 m whilst drilling. No groundwater observations were made in BH01 and BH03 due to water being used as part of the drilling process which may have masked the presence of groundwater below a depth of 2.0 m.

Standpipes were installed to allow the measurement of groundwater levels in boreholes BH02 and BH03. Details regarding the installation of the standpipes are presented in Appendix C. The standpipes were purged of drilling fluids on 18 August 2019.

Water level measurements recorded in the standpipes are summarised in Table 3.

Table 3: Groundwater Measurements in Standpipe

Borehole No.	Collar RL	Date of Measurement	Depth to Groundwater (m)	Groundwater Level (m AHD)
BH02	5.9	25 January 2019	3.3	2.6
BH03	6.2	25 January 2019	3.2	3.0

Based on the measurements of the standpipes, groundwater should be expected from depths of about 3.2 m below the existing surface (i.e. approximately RL 2.6 m to RL 3.0 m AHD). Groundwater levels can vary seasonally, following periods of rainfall and due to local factors, such as permeability of the soil or rock, changes to drainage conditions and nearby underground services or basements. It is recommended that ongoing measurement of groundwater levels be undertaken. Perched water may be present in some areas.

5.3 Preliminary Environmental Investigation

No obvious evidence of soil contamination, such as the presence of non-soil materials, and malodorous or stained soils, was encountered during the investigation.

6. Laboratory Results

6.1 Geotechnical Testing Results

A selected soil and rock samples recovered from the boreholes were submitted to DP’s Melbourne NATA accredited laboratory for determination of relevant engineering properties. One soil sample was taken and tested for the particle size distribution. A total of 10 rock core samples were selected for laboratory testing which comprised saturated moisture content tests on each sample and point load index testing on 7 of the samples. Laboratory test certificates are presented in Appendix D. A summary of the soil and rock results are separately provided in Tables 4 and 5, respectively.

Table 4: Laboratory Test Results - Soil

Location	Sample Interval (m)	Sample Description	Grading % Passing 0.075 mm Sieve
BH02	3.0 - 3.45	Clayey SAND	37

Table 5: Results of Point Load Index and Saturated Moisture Content Tests

Borehole	Sample Depth (m)	Rock Type, Weathering Grade and Strength	Is ₍₅₀₎ (MPa)	Saturated Moisture Content (%)
BH01	2.75 – 2.95	Sandstone (MW) medium strength	0.91	3.5
	4.42 - 4.61	Sandstone (MW-SW) medium strength	2.24	2.4
	8.0 - 8.25	Sandstone (MW) medium strength	2.23	4.0
BH02	4.5-4.6	Clayey Gravel / Sandstone (HW) very low strength	-	4.4
	6.0-6.27	Clayey Gravel / Sandstone (HW) very low to low strength	-	13.8
	7.61-7.72	Sandstone (MW) low to medium strength	0.18*	5.4
	10.08-10.28	Sandstone (MW-SW) medium to high strength	3.35	2.0
BH03	2.9 – 3.0	Sandstone (EW-HW) very low to low strength	-	11.6
	3.9-4.0	Sandstone (MW) medium strength	1.47	4.0
	6.55-6.78	Sandstone (MW-SW) medium to high strength	4.03	3.9

Is₍₅₀₎ = Point load index strength * = test failed through defect as opposed to through the rock mass.
 EW = Extremely Weathered HW = Highly Weathered MW = Moderately Weathered SW = Slightly Weathered

Saturated moisture content tests ranged between 2.0% and 13.8% for samples collected from the weathered sandstone, but were generally between about 2% and 6%, which is within the typical range for predominantly moderately to slightly weathered sandstone.

The point load test results (Is₍₅₀₎) ranged between 0.18 MPa and 4.03 MPa, but were typically within the range of 0.9 MPa and 2.3 MPa, which is generally consistent with medium strength rock.

6.2 Groundwater Aggressivity

The results of the groundwater aggressivity testing on the water samples collected from boreholes BH 2 and BH 3 are presented in Appendix D and summarised in Table 6.

Table 6: Result of Groundwater Analysis

Borehole	pH	Sulphate Concentration SO ₄ (mg/l)	Chloride Concentration (mg/l)	Electrical Conductivity (µS/cm)
BH 2	7.9	210	270	2300
BH 3	7.8	180	210	2200

Comments on these laboratory results are given in Section 7.4.1.

6.3 Preliminary Environmental Investigation Results

It is anticipated that the proposed development would include a basement across the majority of the site footprint, therefore DP compared the soil laboratory results to upper limits presented in EPA Publication IWRG621 June 2009, *Soil Hazard Categorisation and Management*, which is the current guideline used to assess soil intended for off-site disposal. Under EPA Publication IWRG621 soil can be classified into one of four categories based upon its relative hazard. From least to most contaminated, the categories are:

- Fill Material;
- Category C contaminated soil;
- Category B contaminated soil; and
- Category A contaminated soil.

Further information on each category can be found in the IWRG621 guideline.

A comparison of laboratory results to EPA criteria is provided in Table E1, Appendix E, along with statistical analysis of results, and the NATA endorsed laboratory test certificates and chain of custody documentation are also included in Appendix E. The following summary of results is provided:

- Results from one crushed rock sample (BH01-0.1) reported a pH value of 10.1, and a fluoride concentration 680 mg/kg, consistent with Category C contaminated soil. Results from the remaining two crushed rock samples were consistent with 'clean' Fill Material;
- Results from filling samples BH1-0.5 and BH3-0.5 reported concentrations of one or more of arsenic, benzo(a)pyrene (B(a)P), and Total PAH consistent with Category C contaminated soil. Results from the remaining filling sample was consistent with 'clean' Fill Material; and
- Results from one natural soil sample (BH02-1.5) reported an arsenic concentration consistent with Category C contaminated soil. Results from the remaining four natural soil samples were consistent with 'clean' Fill Material.

Statistical analysis of the arsenic, B(a)P and total PAH results (presented in Appendix E) indicates that, if all soils are treated as a single domain, arsenic results would be consistent with Fill Material, but B(a)P and total PAH would remain consistent with Category C contaminated soils. In any case, the single pH and fluoride results from sample BH01-01 remains consistent with Category C contaminated soils, and although leachability results were consistent with Fill Material, results for tested site soils remain consistent with Category C contaminated soil.

7. Geotechnical Comments

7.1 Appreciation of Site

The results of the investigation have indicated that the site is underlain by a subsurface profile comprising filling up to 1.5 m thick, overlying residual hard silty clays or very dense clayey gravel / extremely weathered sandstone over typically moderately to slightly weathered sandstone. The soil profile includes a layer of Brighton Group Silty Clay grading to Clayey Sand between 0.6 m to 4.5 m in BH02.

Details of the basement configuration or finished floor levels have not been provided, but it is assumed that the bulk excavation of the basement carpark level will occupy the majority of the site footprint and will extend to around 3.0 m below the existing ground level (approximately RL 3.0 m AHD). At this depth it is expected that founding materials at the basement floor level may include:

- Stiff to very stiff or dense Brighton Group soils;
- Very stiff to Hard residual soils;
- Weathered sandstone rock; and
- A combination of the above.

It is anticipated that the proposed building could be supported on spread footings founded in the natural soil/rock.

Groundwater was encountered at depths of 3.2 m (RL 3.0 m AHD) and 3.3 m (RL 2.6 m) in boreholes BH02 and BH03 respectively, which may be similar to the bulk excavation level of the basement. Variations in groundwater levels may occur over time, although it should be expected that the groundwater levels are likely to be close to, or even above, the basement floor at times.

For the assumed basement bulk excavation level of 3 m below ground level, consideration will need to be given to the control and management of groundwater both during construction and in the long term. While it is considered that a drained basement system should be suitable, provision for the management of groundwater will need to be incorporated and a suitable legal point of discharge identified, should the basement be located below groundwater. However based on DP's recent experiences, the local water authority and local government may not permit the long term disposal of groundwater into the sewer or stormwater systems. In this instance an undrained basement (i.e. tanked) will need to be adopted. It may be preferable to limit the basement depth to above the groundwater table.

7.2 Excavation Conditions

Bulk excavation would be expected to be undertaken to approximately 3.0 m below existing ground levels for the majority of the basement, with local deepening for footings. Such excavations are expected to encounter:

- Filling;
- Stiff to very stiff silty clays, sandy clays and dense clayey sands of the Brighton Group;
- Very stiff to hard residual clays or extremely weathered sandstone; and,
- Weathered siltstone rock.



Assuming that all existing pavements and the like are removed as part of the site demolition process, the majority of excavation should be readily achievable using conventional earthmoving plant such as medium to large hydraulic excavators, dozers, pile boring machines or similar. Medium strength, fractured to slightly fractured sandstone may require the use of hydraulic breakers or a ripper to loosen the rock and facilitate removal.

Groundwater was measured in the standpipes at depths of between 3.2 m and 3.3 m below existing ground level (*i.e.* approximate RL 2.6 m AHD to RL 3.0 m AHD), although these levels may not be representative of long term equilibrium ground water levels.

Personnel should not enter excavations greater than the depth specified by relevant site OH&S guidelines (typically 1.5 m), unless the excavations are appropriately shored or battered back to a safe angle. It is recommended that all trenches be examined for signs of potential failure prior to entering them.

7.2.1 Temporary Batter Slopes

It is understood that bulk excavation will extend for the most part across the site. Existing buildings on and adjoining the site may constrain excavations, especially in the north and east of the site. As such, there may not be sufficient space for temporary batters along the site boundaries. This will require assessment prior to commencing construction and regardless, temporary batter slopes could be formed within the bulk excavation to create benches, localised excavations and trenches, access ramps and working platforms as the basement excavation proceeds.

The batter slopes presented in Table 7 may be adopted for short term conditions.

Table 7: Maximum Batter Angles for Short Term Condition

Strata	Height of Excavation (m)	Temporary Batter Angle (H:V)
Filling	< 2	2 : 1
Silty Clay / Extremely Weathered sandstone (XW)	2 – 3	1.5 : 1
Sandstone (MW)	2 - 3	1 : 1

Flatter batter slopes may be required should deeper uncontrolled fill, wet or weak zones be encountered. Steeper or higher slopes may be possible in the weathered rock, depending on the orientation of joints, defects and discontinuities, but can only be assessed by geological mapping during excavation.

The above batter slopes assume that there is no surcharge load on the slope crests or structures / assets within 3 m of the slope crest. It is recommended that all batter slopes be inspected by a suitably experienced engineering geologist or geotechnical engineer during construction. Such inspections are of particular importance in areas where works are to be undertaken close to the toe or crest of the batter. For slope heights > 3 m, it is recommended that DP be contacted for further advice regarding appropriate batter angles.

Should any seepage or indications of instability be observed during excavation *i.e.* cracking or unfavourably orientated jointing specific geotechnical advice should be sought. If necessary, side walls should be battered with the appropriate batter angle assessed on-site at the time of construction.

Drainage should be provided at the top of batter slopes to divert runoff away from the slope face. Some loss of material should be expected from the batter faces. Face deterioration would be exacerbated if surface water is allowed to flow over unprotected batters or pond behind the excavations.

Where existing underground service trenches are located near to batter slopes, water may be retained in the trench, which may impact on batter stability. Therefore, it is recommended that any nearby trenches be drained of water prior to, and during, excavation for batter slopes.

7.2.2 Groundwater Management

Groundwater management may need to be considered for the basement excavation as groundwater was encountered in the 2 standpipes at or near the anticipated bulk excavation level of 3 m below existing ground level. Groundwater can vary over time and in the absence of long term groundwater monitoring data, a design groundwater level equivalent to 1 m above the highest level recorded in this investigation should be adopted for basement design. Based on DP's recent experiences the local water authority (City West Water) and local government may not accept long term disposal of groundwater into the sewer or stormwater systems. The prohibition of long term groundwater disposal effectively requires the basement to be undrained/tanked. Further advice on water management can be provided once the basement configuration is confirmed.

7.3 Basement Design and Construction

7.3.1 General

Selection of a suitable ground retention system will depend on basement depth, drainage requirements, space constraints, control of ground movements outside of the excavation and a construction method that provides suitable protection to site personnel and surrounds. The proximity of adjacent structures and any movement sensitive assets must be taken into consideration, and it is recommended that the depth and founding level of the footings of adjacent structures be established prior to commencement of excavations or installation of temporary support systems on the site.

Various basement retention systems can be considered, including a conventional soldier pile wall (drained system) or secant piles (tanked system). A diaphragm wall may also be considered for a tanked system however it is not likely to be economical compared to secant piles for the proposed single level basement. At this stage, it is recommended that excavations near adjacent structures be fully supported to reduce the risk of ground movement and instability. Depending on the depth of excavation and/or wall movement tolerance, ground anchors may be required to limit wall movement.

For basement excavations up to 3 m deep and where the basement wall is not located close to existing buildings or critical services, a battered excavation and propped precast concrete panel wall may be considered. For this approach it is critical that the groundwater level is below the toe of the temporary batters.

The different wall systems are discussed further in the following sections.

7.3.2 Soldier Pile Wall

Typically this wall system comprises piles (the soldiers) bored in advance of the excavation and shotcrete infill panels (and anchors where required) formed progressively as the excavation is lowered. Typically centre-to-centre pile spacings of $3D$, where D is the pile diameter, can be adopted in stable ground conditions although this would depend on loading conditions behind the wall. Note closer spacings are required where buildings are to be retained and specific analyses should be undertaken, but for preliminary purposes a maximum spacing of $2D$ is recommended. Cantilevered pile walls should not be used adjacent structures or where movement sensitive assets are located behind the wall.

Both conventional bored piles and continuous flight auger piles (CFA) are considered appropriate for the soldier pile wall, although consideration would need to be given to shaft stability if bored piles are adopted, especially in wet soils and below the water table where the use of casing or drilling fluid may be required. CFA piles can be installed through saturated soils without the need for temporary casing or support since the flight augers provide the required shaft stability. For bored piles, on-site geotechnical inspection should be undertaken to log the ground conditions encountered. For CFA piles, such inspection is not possible and additional instrumentation may be warranted to confirm actual founding conditions if axial capacity is required.

Shotcrete infill will be needed for the full excavation depth between the soldier piles for lateral support. The shotcrete panels should be constructed in lifts progressively and expeditiously and as soon as practicable following excavation. Initially, it is recommended that the excavation and shotcreting be undertaken in lifts not exceeding 1.5 m, although this may need to be reduced to avoid loss of ground from behind the piles over the interval where leaking services or saturated backfilled trenches may exist behind the wall. Continuous vertical strip drains should be installed behind the infill panels and connected to the basement floor drainage system.

Temporary ground anchors using prestressed strands or props may be utilised to support soldier pile retaining walls until the lateral loads can be resisted by the building itself. The anchors/props should be installed progressively and without delay as the excavation proceeds.

For anchored soldier pile walls, pile embedment below the excavation level for the purpose of passive restraint should have a minimum length of two pile diameters below the lowest level of any nearby excavation, but subject to checking the required embedment. A low level anchor can be used to supplement the lateral toe support.

7.3.3 Secant Pile Wall

Secant piles would form a low permeability vertical barrier for the basement excavation and would extend below basement slab level. This system would be used as an undrained (tanked) structure. Secant pile walls with hard-hard piles provide greater watertightness relative to a hard-soft pile combination. However, hard-hard piles can be more difficult to construct and the risk of piles deflecting off vertical needs to be carefully addressed. The long term durability of the soft piles also needs to be carefully assessed if that approach is adopted. Allowance should be made for progressive grouting to seal any gaps during excavation in order to reduce the risk of sediment loss and water seepage through gaps between the piles, although, for a well-constructed secant pile wall where the piles are sufficiently overlapped, this risk is generally low. Similar to a soldier pile wall, piles may need to be supported laterally by ground anchors or props. Hydrostatic pressure will need to be considered in assessing lateral pressures behind a secant pile wall, and uplift pressures on the floor slab for a tanked basement unless under floor drainage is provided.

7.3.4 Battered Excavation and Propped Precast Panels

For the construction of a single basement level (up to 3 m deep), and where the basement wall is not located close to existing buildings or critical services, a battered excavation and propped precast concrete panel wall may be considered. For this type of approach sufficient space will be required between the basement wall and site boundary to allow the formation of temporary batters and backfilling operations. In these instances the temporary batter angles in Section 7.2.1 may be adopted and it is important that groundwater level is below the batter toe.

Where there is insufficient space to allow a full length stable batter to be formed, the installation of precast panel walls may be considered by implementing a sequential 'hit one and miss two' drive-slot method of excavation. This involves leaving in-situ sloped earth buttresses to provide temporary ground support and cutting near vertical slots to enable construction of strip footings to support the precast panels. The use of full height sturdy shields is required within the cut slots, for face heights greater than 1.5 m, for the safety and protection of personnel working inside the slots. The precast panels will need to be temporarily supported using inclined props fixed to footings within the excavation.

In DP's experience, this method of construction is susceptible to ground instability related to water pressures acting on the walls stemming from: (i) leaking services or saturated backfilled trenches behind the walls (ii) poor external surface drainage (iii) periods of prolonged rainfall leading to saturation and weakening of the subsoil. These risks need to be carefully considered and suitably managed during construction.

Where backfilling is to take place against precast walls, backfilling methods and materials should be selected with consideration of batter slope stability and avoid the need for personnel to enter the confined space between the panels and batter slopes.

7.3.5 Lateral Earth Pressures

The lateral earth pressures acting on retaining walls will depend on several factors including the method of construction, type of wall, the materials to be retained and whether or not the wall is free to rotate at the top.

For a retaining wall that is free to rotate at the top (i.e. cantilevered wall), a triangular earth pressure distribution is applicable, plus the addition of any surcharge. For this situation, the following parameters for the soils at the site may be considered to calculate the lateral earth pressures:

- Coefficient of Active Earth Pressure (k_a): 0.4
- Coefficient of Passive Earth Pressure (k_p): 2.5
- Coefficient of 'At Rest' Earth Pressure (k_0): 0.6
- Bulk Density: 20 kN/m³

The above earth pressure coefficients apply where there is level ground behind the retaining wall. Hydrostatic pressures do not need to be considered provided there is effective and permanent drainage over the full height of the wall.

For basement walls that are propped or restrained against rotation by the ground floor slab in the long term and where there are no movement sensitive underground structures / assets behind the wall, lateral earth pressures can be calculated using the following uniform lateral earth pressure distribution:

$$p = 4H + 0.4q \text{ (kPa)}$$

Where: p = horizontal lateral earth pressure (kPa)

H = maximum height of retained ground (m)

q = uniform surcharge behind the wall (kPa)

Where sensitive underground structures or assets are located within the zone of influence of the excavation and / or require a stiffer wall to limit movement, the uniform pressure distribution should be increased to $6H + 0.6q$ (kPa). Further advice could be provided once details of the nearby underground structures or assets are available.

The lateral support provided by soldier piles should be designed to carry the full lateral earth pressure. Whereas the infill panels between soldier piles can generally be designed to resist lower earth pressures due to arching effects between piles, a nominal reduction of 50% can be applied. Regardless, the minimum lateral pressure should not be less than 12 kPa for a single level basement.

Unless positive drainage measures are incorporated to prevent water pressure build up behind the walls, full hydrostatic head should be allowed for in design over the depth of the retained ground in addition to the above lateral earth pressure distributions.

If flowable backfill is used to backfill behind precast panels, the temporary pressures acting on the walls will need to be considered. Such pressures should be based upon a triangular distribution assuming a unit weight of 24 kN/m^3 . To minimise fluid pressures on the panels no-fines concrete or flowable backfill may be placed in stages and allowed to hardened prior to subsequent lifts.

Basement excavation will inevitably cause lateral and vertical ground displacements outside of the excavation. The amount of movement will be a function of the construction practice, earth pressure loads, and rigidity of the walls. As a preliminary indication for tied back walls, the maximum surface settlement is anticipated to be approximately 0.3% H , where H is the height of excavation, reducing to 0.2% H at a distance equal to H behind the excavation. Greater movements would be expected for less rigid wall systems, and where the propped precast wall system is used.

7.3.6 Ground Anchor Design

Where anchors are adopted, they are required to be only of a temporary nature since the building itself will provide the permanent lateral propping. As a preliminary guide, prestressed cable anchors are considered a suitable method to anchor the soldier piles.

Installation of ground anchors is usually performed on a design and construct basis as anchor capacity is predominately size and methodology based, amongst other factors. Specialist installation contractors normally submit their own anchor design to achieve the nominated load capacities.

Anchor load capacity should be wholly based on either soil or rock resistance. Anchor holes should have a minimum inclination from the horizontal of 15° to facilitate grouting but can be steepened to avoid behind wall obstructions. Installation angles exceeding 30° should be avoided due to undesirable vertical load increases on the soldier piles. Regardless, the vertical load component should be taken into account.

The fixed anchor length should start no nearer the excavation face than 1 m outside of a line taken up at 45° from the base of the excavation (including any perimeter deepening *i.e.* drains). Anchor free lengths should be designed equal to their height above the excavation base and be a minimum of 3 m and a maximum of 10 m.

As a preliminary guide for assessing anchor capacity, allowable grout-to-ground bond stress of 50 kPa is suggested for straight shafted air flushed drilled holes in the natural silty and sandy clays of the Brighton Group. Lower bond stress values would apply for anchors in clay if the holes are drilled using water flush. An allowable grout-to-ground bond stress of 100 kPa suggested for straight air flush drilled holes in the extremely to highly weathered siltstone (Unit 4a).

Grouting and other installation procedures should be carried out in accordance with good anchoring practice.

After installation, proof testing to 125% the design working load prior to 100 % lock-off should be carried out. Periodic checks should be carried out during the construction phase to ensure that the lock-off load is maintained and not lost due to creep effects or other causes.

It will be necessary to obtain permission from neighbouring landowners prior to installing anchors that extend beyond the perimeter of the site. In addition, care should be taken to avoid damaging buried services, pipes and other subsurface structures during anchor installation.

7.4 Basement Floor Slabs

The subgrade materials at the anticipated 3 m depth of bulk excavation will predominantly comprise natural very stiff silty and sandy clays of the Brighton Group, residual silty clays and clayey gravels and weathered siltstone. Where the floor slab is to be used by vehicles, a design CBR value of 3 %, or a modulus of subgrade reaction of 25 kPa/mm is suggested for the natural very stiff clays. A design CBR value of 5% or a modulus of subgrade reaction of 40kPa/mm is suggested for the EW-HW Sandstone. These values should not be adopted for other than wheel loading without first confirming their suitability with DP.

Depending on the final proposed basement depth, hydrostatic pressures acting as uplift on the basement floor may need to be considered in the design for a fully tanked basement system. Should a drained system be acceptable then a more substantial drainage system would be required.

7.5 Foundations

7.5.1 Spread Footings

The uncontrolled fill is considered unsuitable as a founding material.

The appropriateness of spread footings to support the proposed building will depend on the applied loading and whether the resulting footings are of a reasonable size to be feasibly constructed. At the anticipated basement level, the founding soils are expected to comprise:

- Very stiff silty clays, sandy clays and dense clayey sands of the Brighton Group;
- Very stiff to hard residual clays or extremely weathered sandstone; and,
- Weathered siltstone rock.

Based on these subsurface conditions, it is considered that spread footings founded near the basement level on very stiff to hard silty/sandy clay may be proportioned based on a maximum allowable bearing pressure of 300 kPa for pad footings and 250 kPa for strip footings.

Spread footings founded within the extremely to highly weathered siltstone/sandstone may be proportioned based on an allowable bearing pressure of 600 kPa for pad footings and 450 kPa for strip footings.

The estimated total settlement of an individual footing proportioned on the basis of the above suggested bearing pressures is expected to be in the order of 0.5% to 1.0% of the footing width. The majority of the settlement is expected to occur upon load application during construction. Any time dependent settlement would be minor. Differential settlement between adjacent footings is expected to be about 50% of the total settlement. Should settlements be critical, it is suggested that a review of settlements be undertaken once the footing loads and layout are confirmed.

Footing excavations should be inspected by a suitably experienced geotechnical engineer to confirm that the founding conditions are consistent with those on which these recommendations are based. Footing excavations should be cleaned of all loose or water softened materials and the base covered with a protective layer of blinding concrete after cleaning.

7.6 Subgrade Preparation

The following subgrade preparation procedures are recommended for basement level slabs:

- Proof roll the exposed subgrade using a 6 t/m width static weight roller and a minimum of 6 passes to observe the subgrade deflection and check for soft spots. Zones that undergo excessive deflection or are unstable would require additional treatment, the extent of which is best assessed at the time of construction. The treatment may involve further compaction or removal and replacement with select filling.
- The select filling will depend on the particular circumstances and may include ripped sedimentary rock, site won natural low reactivity silty clay, or crushed rock. A maximum particle size after compaction not exceeding 40 mm is recommended to enable routine compaction control testing to be carried out. Representative samples of the select fill should be submitted to DP for examination, possible testing and approval.

All engineered filling placed beneath slabs and pavements should be placed in horizontal layers no greater than 250 mm loose thickness and uniformly compacted to achieve a minimum dry density ratio of 98% standard in accordance with relevant sections in AS 1289. Materials should be compacted at a placement moisture ratio between 85% and 115% of standard optimum moisture content.

To ensure that the desired construction standards are achieved it is suggested that engineered filling be tested at the appropriate minimum frequency given in Section 8, Table 8.1 of Australian Standard AS 3798-2007 "Guidelines on Earthworks and Residential Developments".

7.7 Working Platform

A suitable working platform will be needed to support construction equipment such as pile boring rigs, ancillary service cranes and the like where located on the clays. It is recommended allowance be made to use a granular platform as this will improve traffickability across the site particularly for tracked plant and reduce deterioration from spillages of drilling fluids. Comments on the design, construction and maintenance of the platform can be addressed once the type of equipment and loads are known.

7.8 Earthquake Classification

Based on Table 3.2 in Australian Standard AS 1170.4 – 2007, the hazard factor (Z) for the Melbourne region is 0.08. The site sub-soil class is considered to correlate to Class C_e - shallow soil site.

7.9 Groundwater Aggressivity

Based on the results from the chemical laboratory testing of the water sample collected from boreholes BH02 and BH03, and with reference to Table 4.8.1 in AS 3600 – 2009, the Exposure Classification for concrete footings for the site would be "A2". With reference to Tables 6.4.2C and 6.5.2C in AS 2159 – 2009, the Exposure Classification for concrete piles and steel piles for the site is "Non-aggressive".

7.10 Construction Inspections

It is recommended that the site preparation procedures, prepared subgrades, temporary batters, piling excavations and footing excavations be inspected by DP to confirm that the conditions are consistent with those anticipated and the design assumptions.

8. Preliminary Environmental Investigation Comments

The Preliminary Environmental Investigation results indicate that tested soils are consistent with Category C contaminated soils, due to elevated concentrations of fluoride, arsenic, B(a)P and total PAH, and a high pH result.

If soils are to be removed from site, as has been suggested that a basement may form part of the site development, disposal costs may be reduced if separate domains can be separated. If asphalt can be removed separately it can be sent for recycling at an asphalt recycling plant. Between 0.4 and 0.5 metres of crushed rock was identified within the three boreholes, therefore if this material can effectively be separated from other site filling, it can be reused on-site or removed as inert waste, reducing the volume and associated costs of disposal of Category C soils.

As per current EPA waste guidelines, remaining site soils should be treated as separate domains, namely site filling and natural soils. Based on the preliminary results, it is likely that deeper natural soils would be consistent with the Fill Material waste category, but this would have to be confirmed via additional sampling and testing. To confirm the contamination status of filling and natural soils it is recommended that additional in-situ testing is undertaken. Additional soil sampling may also be undertaken ex-situ, via sampling of stockpiled soils prior to disposal from the site, although it should be noted that this second approach would require space and time on-site for the storage of stockpiled material from when it is excavated and sampled, to when it is categorised and removed from site.

It should be noted that, from an environmental perspective, soils tested during this investigation are suitable to remain on-site, therefore it may be possible to over-excavate and bury Category C soils on-site, therefore only deeper natural soils, likely to be categorised as Fill Material, would be removed from site. As previously stated, the contamination status of filling and natural soils would need to be confirmed, via additional environmental soil sampling and testing. Additionally the geotechnical suitability of reused filling would also need to be considered.

9. References

1. Australia Standard AS 1170.4-2007, 'Structural Design Actions - Earthquake Actions in Australia', May 2007, Standards Australia.
2. Australian Standard AS2159-2009, 'Piling – Design and Installation', November 2009, Standards Australia.
3. Australian Standard AS3600 – 2009, 'Concrete Structures', December 2009, Standards Australia.
4. Australian Standard AS4482.1-2005, 'Guide to the sampling and investigation of sites with potentially contaminated soil. Part 1: Non-volatile and semi-volatile compounds', November 2005, Standards Australia
5. Douglas Partners Pty Ltd: "*Field Procedures Manual*" and "*Project Management Manual*", which form part of the Company Quality System (accredited to AS/NZS ISO 9001:2000);
6. EPA Victoria (2009), *Soil Hazard Categorisation and Management*, Publication IWRG621, June 2009, Environment Protection Authority Victoria, Melbourne, Australia.
7. EPA Victoria (2009), *Sampling and Analysis of Waters, Wastewaters, Soils and Sludges*, Publication IWRG701, June 2009, Environment Protection Authority Victoria, Melbourne, Australia.

10. Limitations

Douglas Partners (DP) has prepared this report for this project at in accordance with DP's proposal dated 12 December 2018 and acceptance received from Anthony Savenkov of COPP dated 17 December 2018. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use 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.

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 sections 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 (geotechnical / environmental / groundwater) components set out in this report and to their application by the project designers to project design, construction, maintenance and demolition.

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Appendix A

About This Report
Notes on Soil Descriptions
Notes on Sampling Methods
Notes on Symbols & Abbreviations

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

This report is the property of Douglas Partners Pty Ltd. The report may only be used for the purpose for which it was commissioned and in accordance with the Conditions of Engagement for the commission supplied at the time of proposal. Unauthorised use of this report in any form whatsoever is prohibited.

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.

Soil Descriptions

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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, 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.

Sampling Methods

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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

Sampling Methods

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.

Symbols & Abbreviations

Douglas Partners



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


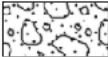
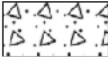

Other

fg	fragmented
bnd	band
qtz	quartz


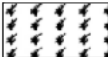

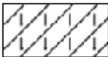
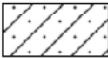







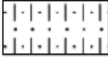




Symbols & Abbreviations

Graphic Symbols for Soil and Rock




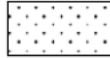




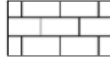
General

	Asphalt
	Road base
	Concrete
	Filling


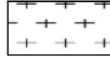

Soils

	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

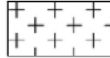
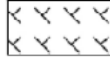



Sedimentary Rocks

	Boulder conglomerate
	Conglomerate
	Conglomeratic sandstone
	Sandstone
	Siltstone
	Laminite
	Mudstone, claystone, shale
	Coal
	Limestone

Metamorphic Rocks

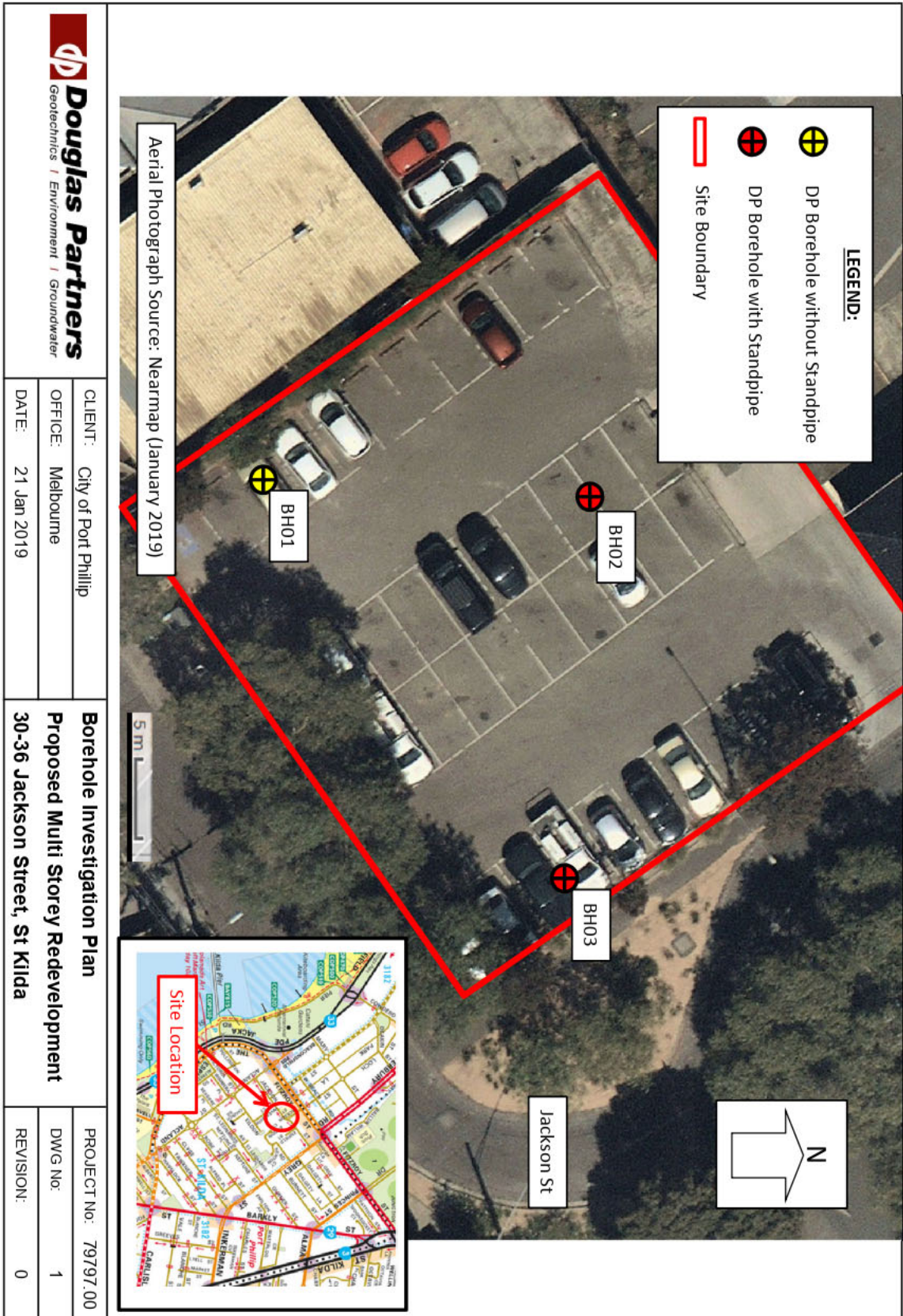
	Slate, phyllite, schist
	Gneiss
	Quartzite

Igneous Rocks

	Granite
	Dolerite, basalt, andesite
	Dacite, epidote
	Tuff, breccia
	Porphyry

Appendix B

Borehole Investigation Plan
Site Photographs





Photograph 1 : Drilling rig setup at borehole location BH01 (facing south)



Photograph 2 : Drilling rig setup at borehole location BH03 (facing south east)

	Site Photographs	Project No. :	79797.00
	Proposed Multi Storey Redevelopment	Plate No :	1 of 1
	Client : City of Port Phillip	Date:	Feb 2019

Appendix C

Borehole Logs
Core Photographs
Standpipe Construction Drawings

BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 6.6 m AHD
EASTING: 321966
NORTHING: 5807626
DIP/AZIMUTH: 90°/-

BORE No: BH01
PROJECT NO: 79797.00
DATE: 17/1 - 18/1/2019
SHEET: 1 of 2

DRILLING						MATERIAL						
PROGRESS	DRILLING & CASING	WATER	SAMPLING			DEPTH (m)	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY	TEST RESULTS & COMMENTS		
			GEO	ENV	IDs and REMARKS						RELATIVE DENSITY	
SFA HWT No free groundwater observed			D	IR	BH01-0.1	0.04m	ASPHALT: dark grey; 40 mm	moist	MD	0.10m: SMC = Saturated Moisture Content		
						0.40m	FILL/SANDY GRAVEL (GP): fine to coarse; sub-angular; dark grey; sand is fine to coarse grained; (Crushed Rock)					
								0.70m	FILL/SILTY SAND (SM): fine to coarse; grey, dark grey; with fine to medium gravel	ST to VST		
								1.20m	FILL/SILTY CLAY (CH): mottled dark grey, brown and red; trace fine to coarse grained sand; trace fine to coarse, subrounded to subangular gravel			
						D	IR	BH01-1.5		moist, w<PL	H	Melbourne Formation 1.50m: U83 forced in using SPT hammer 1.80m SPT: 7.25.26 N = 51
						SPT		2				
			D	E	BH01-2.5	2.70m	SILTY CLAY (CL): mottled pale brown, orange; with fine to medium sand; with fine sandstone fragments, evidence of rock structure; extremely weathered sandstone					
CONTINUED ON SHEET 2												

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

A	Auger sample	P	Piston sample	PL(A)	Point load axial test Is(50) (MPa)
B	Bulk sample	U _s	Tube sample (x mm dia.)	PL(D)	Point load diametral test Is(50) (MPa)
C	Core drilling	W	Water seep	pp	Pocket penetrometer (kPa)
D	Disturbed sample	WL	Water level	SPT	Standard penetration test
E	Environmental Sample	PID	Photo ionisation detector (ppm)	V	Shear vane (kPa)



CORED BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 6.6 m AHD
EASTING: 321966
NORTHING: 5807626
DIP/AZIMUTH: 90°/-

BORE No: BH01
PROJECT NO: 79797.00
DATE: 17/1 - 18/1/2019
SHEET: 2 of 2

DRILLING					MATERIAL	ROCK MASS					
PROGRESS		SAMPLING				DESCRIPTION OF STRATA	Weathering	Rock Strength	Fracture Spacing (m)	Core Rec %	ROD %
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS	Very Low						
					2.70m CONTINUED FROM SHEET 1						
		PLT			SANDSTONE: yellow brown; bedding at 10°-20°; fine to coarse grained	MW			100	53	2.70m: B 10-20° 2.75m: PL(D) = 0.91 MPa SMC = 3.5% Melbourne Formation
					From 4m: becoming brown						3.18-6.50m: unless others stated defects comprise J, 0-30° pl-cu, ro, clin or fe stn 3.15-3.28m: J 60-70° pl, ro, clin 3.40-3.50m: J 60° cu, ro, clay inf 3.50-3.65m: J 70° pl, ro, clay inf 3.65-3.75m: Ds 4.04-4.29m: J 10-30° pl, ro, clay inf
		PLT				MW to SW			100	48	4.35-4.44m: Ds 4.42m: PL(D) = 2.24 MPa SMC = 2.4%
											5.20m: J 30-35° pl, ro, clay inf 5.35m: J 80° pl, ro, clay inf 5.53-5.55m: Ds
									100	53	5.95-6.00m: Ds 6.14m: J 20° pl, ro, clay inf
											6.50-8.25m: unless others stated defects comprise J, 0-45° cu-ir, ro, fe, fe, occasionally fe stn
						MW			100	0	7.14-7.18m: Ds 7.25-7.93m: J 70-90° ir, ro, fe stn, cu
		PLT			8.25m						8.00m: PL(D) = 2.23 MPa SMC = 4.0%
					Bore discontinued at 8.25m depth						

DRDCO 1.04.18 REV 0/8.8 Log pp. 30.00.00 CORE: WGS84E 79797.00 BOREHOLE BH01 - BH40.GPJ -> Drawing Use -> 14/02/2019 11:44 10.0000 Dgngr Lab and In Situ Tool - DSD | Lib: 99999.104.02.P1.0099.1.00.04

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	P Piston sample	PL(A) Point load axial test (50) (MPa)
B Bulk sample	U ₁ Tube sample (x mm dia.)	PL(D) Point load diametral test (50) (MPa)
C Core drilling	W Water seep	pp Pocket penetrometer (kPa)
D Disturbed sample	W _l Water level	SPT Standard penetration test
E Environmental Sample	PID Photo ionisation detector (ppm)	V Shear vane (kPa)



BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 5.9 m AHD
EASTING: 321986
NORTHING: 5807643
DIP/AZIMUTH: 90°/-

BORE No: BH02
PROJECT NO: 79797.00
DATE: 17/1/2019
SHEET: 1 of 3

DRILLING				MATERIAL								
PROGRESS	DRILLING & CASING	WATER	GROUND WATER LEVELS	SAMPLING		DEPTH (m)	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY	RELATIVE DENSITY	TEST RESULTS & COMMENTS	
				GEO	ENV							IDS and REMARKS
				D	E	BH02-0.1	0.05m ASPHALT: dark grey; 50 mm				0.10m: SMC = Saturated Moisture Content	Fill
				D	E	BH02-0.5	0.45m 0.80m FILL/SANDY GRAVEL (GP): fine to medium; sub-angular; brown; sand is medium to coarse grained; density inferred, (Crushed Rock)	moist	D			
							FILL/SILTY CLAY (CH): mottled dark brown, orange; trace fine grained sand	M<Wp	ST			Brighton Group
				SPT			SILTY CLAY (CH): mottled brown, orange, pale brown; trace fine grained sand; alluvial	moist	F to ST		1.00m SPT: 2.4,4 N= 8	
				D	E	BH02-1.0	1.80m From 1.5m: trace fine to coarse subangular gravel					
				SPT			SANDY CLAY (CI): fine to medium; pale brown, mottled orange; trace fine to medium, subangular sandstone gravel; with silty clay seams; alluvial	moist, w<PL	VST		2.00m SPT: 20,14,11 N= 25	
				D	E	BH02-2.5	3.00m CLAYEY SAND (SC): fine to medium; pale brown; trace fine subangular sandstone gravel; alluvial				3.00m SPT: 7,15,20 N= 35	
				SPT	E	BH02-3.0			D			
				D			4.50m CLAYEY GRAVEL (GC): fine to coarse; sub-angular to angular; orange brown; with fine to coarse grained sand; with silty clay bands, EW/HW Sandstone fragments; extremely weathered sandstone	moist	VD		4.50m: SMC = 4.0% 4.50m SPT: 30/100 mm double bouncing	Melbourne Formation
				SPT			From 6m: becoming EW-HW Sandstone				6.00m: SMC = 13.8% 6.00m SPT: 30,30/120 mm double bouncing	
							7.00m					
							CONTINUED ON SHEET 2					

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	P Piston sample	PL(A) Point load axial test Is(50) (MPa)
B Bulk sample	U ₁ Tube sample (x mm dia.)	PL(D) Point load diametral test Is(50) (MPa)
C Core drilling	W ₁ Water seep	pp Pocket penetrometer (kPa)
D Disturbed sample	W ₂ Water level	SPT Standard penetration test
E Environmental Sample	PID Photo ionisation detector (ppm)	V Shear vane (kPa)



CORED BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 5.9 m AHD
EASTING: 321986
NORTHING: 5807643
DIP/AZIMUTH: 90°/-

BORE No: BH02
PROJECT NO: 79797.00
DATE: 17/1/2019
SHEET: 2 of 3

DRILLING					DEPTH (m)	GRAPHIC LOG	DESCRIPTION OF STRATA	ROCK MASS					TEST RESULTS DISCONTINUITIES & COMMENTS
PROGRESS	SAMPLING			RL				Weathering	Rock Strength	Fracture Spacing (m)	Core Rec %	RQD %	
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS			Very Low Low Medium High Very High Ex. High	0.005 0.01 0.02 0.03 0.04 0.05					
					0								
					1								
					2								
					3								
					4								
					5								
					6								
					7								
					7.00m		CONTINUED FROM SHEET 1						
					7.00m		SANDSTONE: mottled pale brown, grey, orange; faintly identified bedding at 10°; fine grained						7.00m SPT: 30/50 mm double bouncing 7.05m: J unless otherwise stated defects comprise J, 0-45°, cu-ir, ro, fe, he, occasionally fe stn 7.28-7.72m: J 80-90° pl, ro, fe, he 7.81m: PL(D) = 0.18 MPa SMC = 5.4% 7.77-7.82m: fg zone 8.07-8.21m: fg zone 8.33-8.44m: J 45° pl, ro, cly inf, <10mm 8.75-8.90m: Ds 9.57-9.82m: J 45° pl, ro, cly inf, <10mm
					8								
					9		From 9m: becoming grey brown, bedding at 30°						
					10								

RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	P Piston sample	PL(A) Point load axial test (50) (MPa)
B Bulk sample	U Tube sample (x mm dia.)	PL(D) Point load diametral test (50) (MPa)
C Core drilling	W Water temp	pp Pocket penetrometer (kPa)
D Disturbed sample	W Water level	SPT Standard penetration test
E Environmental Sample	PID Photo ionisation detector (ppm)	V Shear vane (kPa)



CORED BOREHOLE LOG

CLIENT: City of Port Phillip **SURFACE LEVEL:** 5.9 m AHD **BORE No:** BH02
PROJECT: Multi Storey Redevelopment **EASTING:** 321986 **PROJECT NO:** 79797.00
LOCATION: 30-36 Jackson Street, St Kilda **NORTHING:** 5807643 **DATE:** 17/1/2019
DIP/AZIMUTH: 90°/- **SHEET:** 3 of 3

DRILLING					DEPTH (m)	GRAPHIC LOG	MATERIAL	ROCK MASS				
PROGRESS	SAMPLING			RL				DESCRIPTION OF STRATA	Weathering	Rock Strength	Fracture Spacing (m)	Core Rec %
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS								
NMMLC		PLT			10							9.90-10.00m: J 70' un. re. cly str 10.08m: PL(D) = 3.35 MPa SMC = 2.0% Melbourne Formation
					11		MW to SW			100	0	
					11.50		SANDSTONE: grey, brown; bedding at 30°; fine grained					
					12		Bore discontinued at 11.50m depth					
					13							
					14							
					15							
					16							
					17							
					18							
					19							
					20							

PDCDD 1.04.18 REV 0.8.8 Log pp. 302.00.00 CORE: WGS84E 79797.00 BOREHOLE BH01 - BH02.GPJ -> Drawing of use -> 14/02/2019 11:44 10.0000 Degree Lat and in Stu Tool - DDD | Use: 99999.104.02.P1.9999.1.03.04

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS

RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

A Auger sample	P Piston sample	PL(A) Point load axial test (s(50)) (MPa)
B Bulk sample	U ₁ Tube sample (x mm dia.)	PL(D) Point load diametral test (s(50)) (MPa)
C Core drilling	W Water seep	pp Pocket penetrometer (kPa)
D Disturbed sample	W Water level	SPT Standard penetration test
E Environmental Sample	PID Photo ionisation detector (ppm)	V Shear vane (kPa)



BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 6.2 m AHD
EASTING: 321989
NORTHING: 5808741
DIP/AZIMUTH: 90°/-

BORE No: BH03
PROJECT NO: 79797.00
DATE: 18/1/2019
SHEET: 1 of 2

DRILLING						MATERIAL				
PROGRESS	DRILLING & CASING WATER	GROUND WATER LEVELS	SAMPLING			DEPTH (m)	DESCRIPTION OF STRATA	MOISTURE CONDITION	CONSISTENCY	TEST RESULTS & COMMENTS
			GEO	ENV	IDs and REMARKS					
SFA HWT	No free groundwater observed					0	0.04m ASPHALT: dark grey; 40 mm	moist	MD	0.10m: SMC = Saturated Moisture Content
						0.50m	SANDY GRAVEL: fine to coarse; sub-angular; grey; fine to coarse grained sand			
						0.70m	SILTY SAND: fine to medium; sub-angular; grey	moist, w<PL	ST	1.00m SPT: 5.7.8 N=15
						1.50m	SILTY CLAY: mottled brown, orange, red; trace fine to coarse grained sand; (reworked residual clays)			
								1.80m	CLAYEY GRAVEL: fine to coarse; yellow brown, grey; with fine to coarse grained sand; extremely weathered sandstone	
CONTINUED ON SHEET 2										

REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

SAMPLING & IN SITU TESTING LEGEND

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



CORED BOREHOLE LOG

CLIENT: City of Port Phillip
PROJECT: Multi Storey Redevelopment
LOCATION: 30-36 Jackson Street, St Kilda

SURFACE LEVEL: 6.2 m AHD
EASTING: 321989
NORTHING: 5808741
DIP/AZIMUTH: 90°/-

BORE No: BH03
PROJECT NO: 79797.00
DATE: 18/1/2019
SHEET: 2 of 2

DRILLING					MATERIAL		ROCK MASS					
PROGRESS	SAMPLING				DEPTH (m)	DESCRIPTION OF STRATA	Weathering	Rock Strength	Fracture Spacing (m)	Core Rec %	RCD %	TEST RESULTS DISCONTINUITIES & COMMENTS
DRILLING & CASING	WATER	GEO	ENV	IDs and REMARKS								
					0							
					1							
					1.80m	CONTINUED FROM SHEET 1						
					1.90m	CORE LOSS 0.10m						
					2	SANDSTONE: orange; fine grained, HW-MW corestones in a XW matrix, corestones up to 150 mm.				94	0	1.90-3.70m: Unless otherwise stated defects comprise J, 45-90°, cu-ir, ro, cly, inf, <20mm 1.95-2.10m: Ds
					3		XW to HW					2.60-3.00m: Ds 2.90m: SMC = 11.6% 3.00-3.15m: Ds
					4	From 3.6m: becoming orange brown						3.70-8.0m: Unless otherwise stated defects comprise J, 10-90° pl, ro, fe, stn or fe he 3.90m: PL(D) = 1.47 MPa SMC = 4.0% 4.10-4.28m: J 80° un, ro, cin 4.28-4.35m: J 10° ir, ro, cly co 4.38-4.38m: fg zone 4.44m: J 10° un, ro, cly inf, 10mm
					5	From 4.5m: becoming orange brown, bedding 20° - 30°.	MW			100	0	5.20-5.33m: J 30-50° cu, ro, cly co 6.35-5.45m: Cs with frg
					6							
					7		MW to SW			100	64	7.61m: PL(D) = 4.03 MPa SMC = 3.9% 7.60-8.00m: J 45-80° un, ro, fe stn
					8	Bore discontinued at 8.00m depth						
					9							
					10							

DRPDD 1.04.18 REV 0.8.8 Log pp. 32.00.00 CORE: VEGATE, 79797.00 BOREHOLE BH03 - BH03.GPJ ->Drawing<= 14/02/2019 11:44 10.0000 Dwg: Lab and in Situ Tool - DSD | Lib: 9999 | 04.02.19 | 9999 | 1.03.04


REFER TO EXPLANATORY NOTES FOR DESCRIPTION OF SYMBOLS AND ABBREVIATIONS
RIG: Hydrapower Scout **DRILLER:** Rockwell Drilling **LOGGED:** MD **CHECKED:** WB 31/01/2019
REMARKS: **GRID DATUM:** WGS 84 UTM Zone 55

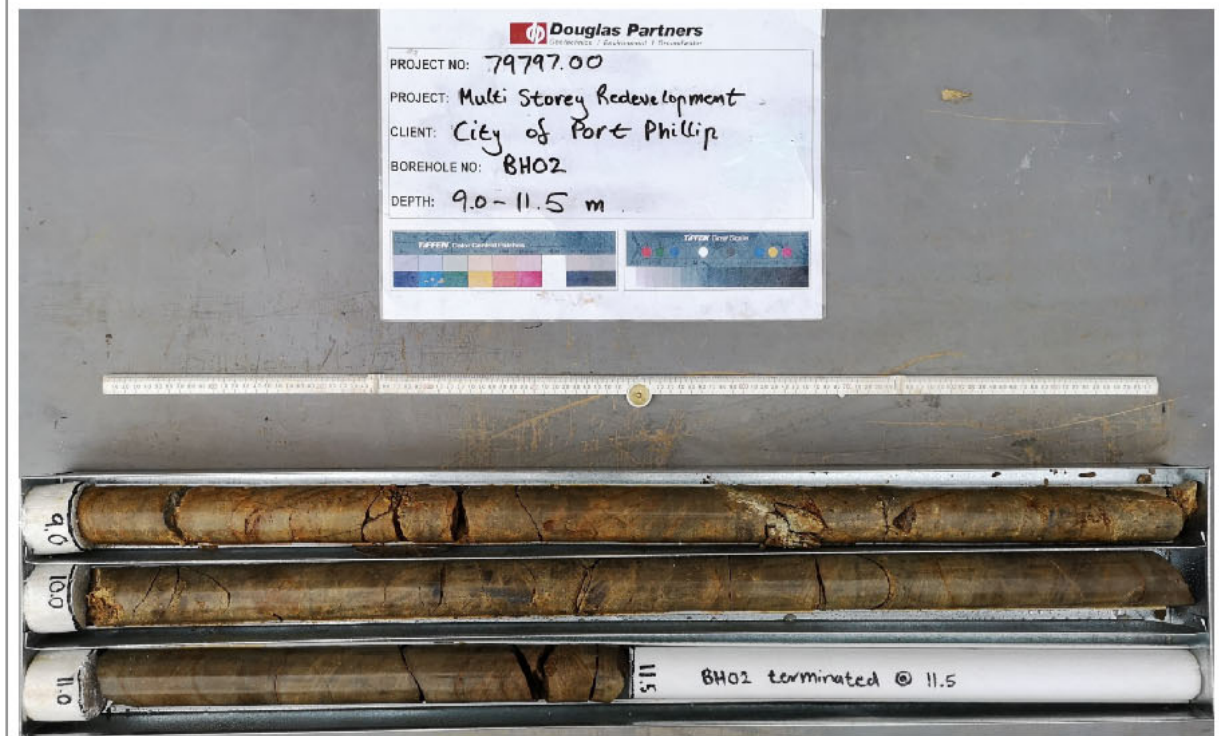
SAMPLING & IN SITU TESTING LEGEND

A Auger sample	P Piston sample	PL(A) Point load axial test (s(50)) (MPa)
B Bulk sample	U ₁ Tube sample (x mm dia.)	PL(D) Point load diametral test (s(50)) (MPa)
C Core drilling	W Water seep	pp Pocket penetrometer (kPa)
D Disturbed sample	W _l Water level	SPT Standard penetration test
E Environmental Sample	PID Photo ionisation detector (ppm)	V Shear vane (kPa)






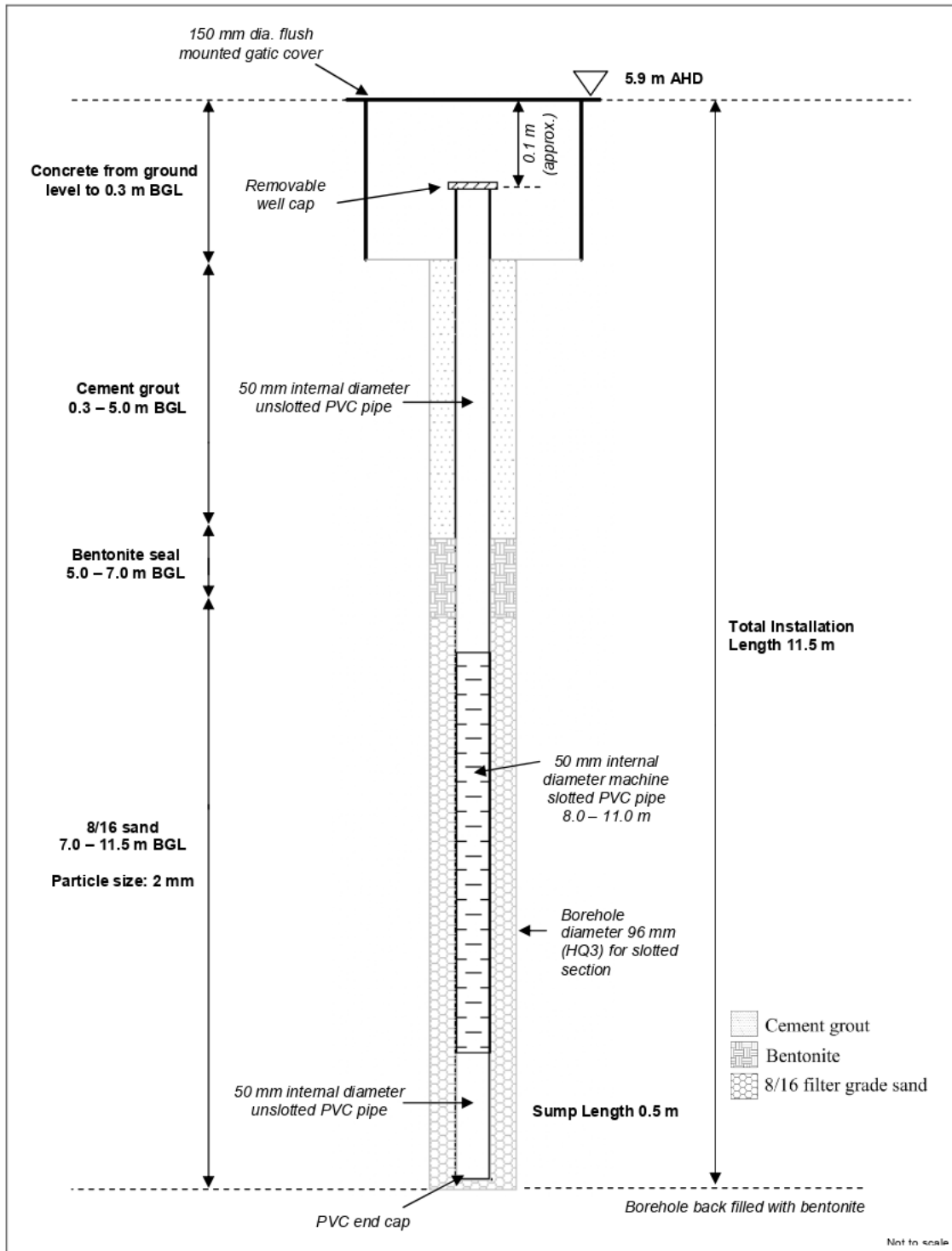
 <p>Douglas Partners Geotechnics Environment Groundwater</p>	BH01 : 2.7 m to 8.25 m	Project No. :	79797.00
	Proposed Multi Storey Redevelopment	Plate No :	1 of 3
	Client : City of Port Phillip	Date:	Feb 2019



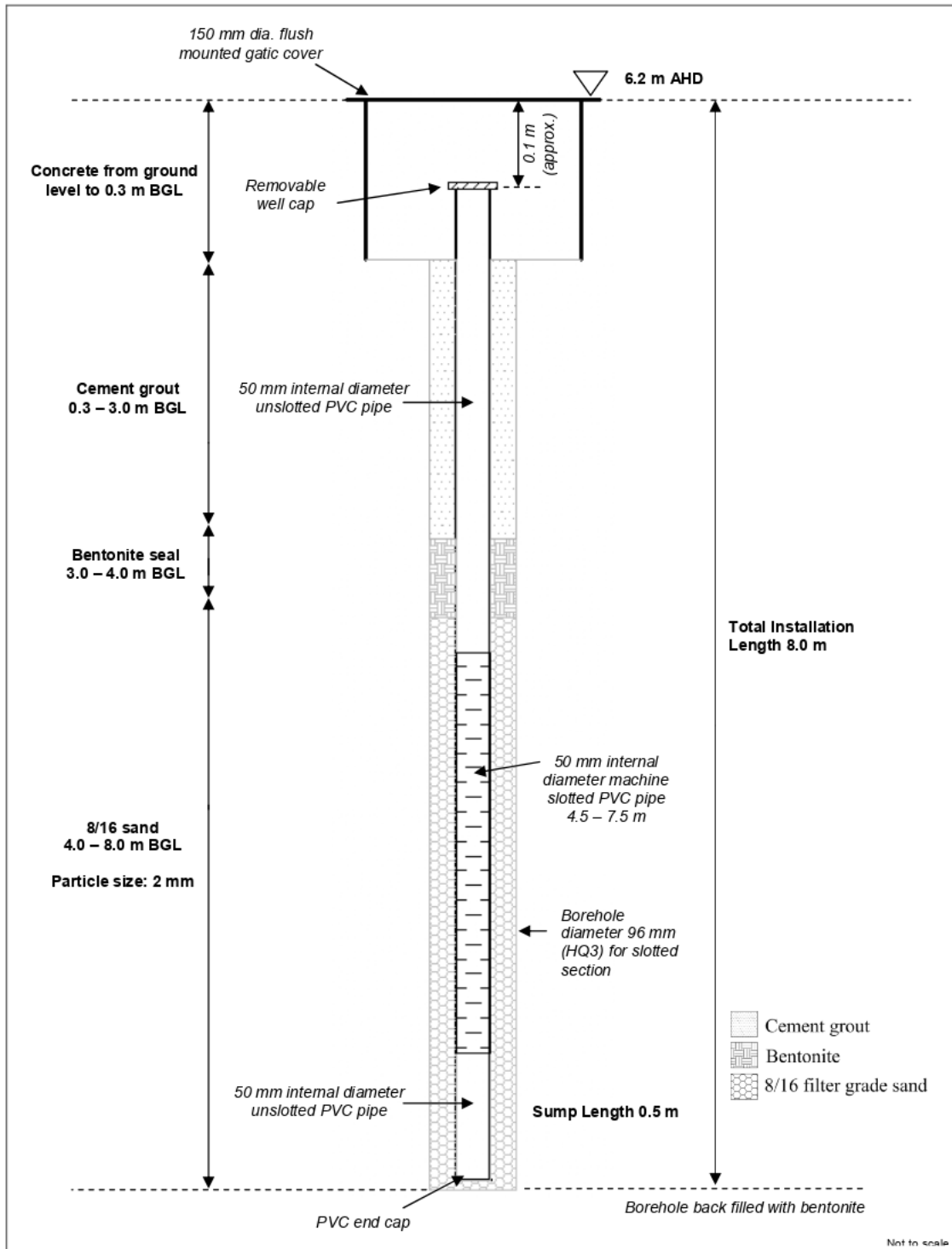
	BH02 : 7.0 m to 11.5 m	Project No. :	79797.00
	Proposed Multi Storey Redevelopment	Plate No :	2 of 3
	Client : City of Port Phillip	Date:	Feb 2019



 Douglas Partners Geotechnics Environment Groundwater	BH03 : 1.8 m to 8.0 m	Project No. :	79797.00
	Proposed Multi Storey Redevelopment	Plate No :	3 of 3
	Client : City of Port Phillip	Date:	Feb 2019



PROJECT:	Proposed Multi Storey Redevelopment	Standpipe Sketch BH-02	
CLIENT:	City of Port Phillip	30-36 Jackson Street, St Kilda	
 Douglas Partners Geotechnics Environment Groundwater	Installation Date :	17/01/2019	
	Borehole Termination Depth	11.5 m	



PROJECT:	Proposed Multi Storey Redevelopment	Standpipe Sketch BH-03	
CLIENT:	City of Port Phillip	30-36 Jackson Street, St Kilda	
 Douglas Partners Geotechnics Environment Groundwater	Installation Date :	18/01/2019	
	Borehole Termination Depth	8.0 m	

Appendix D

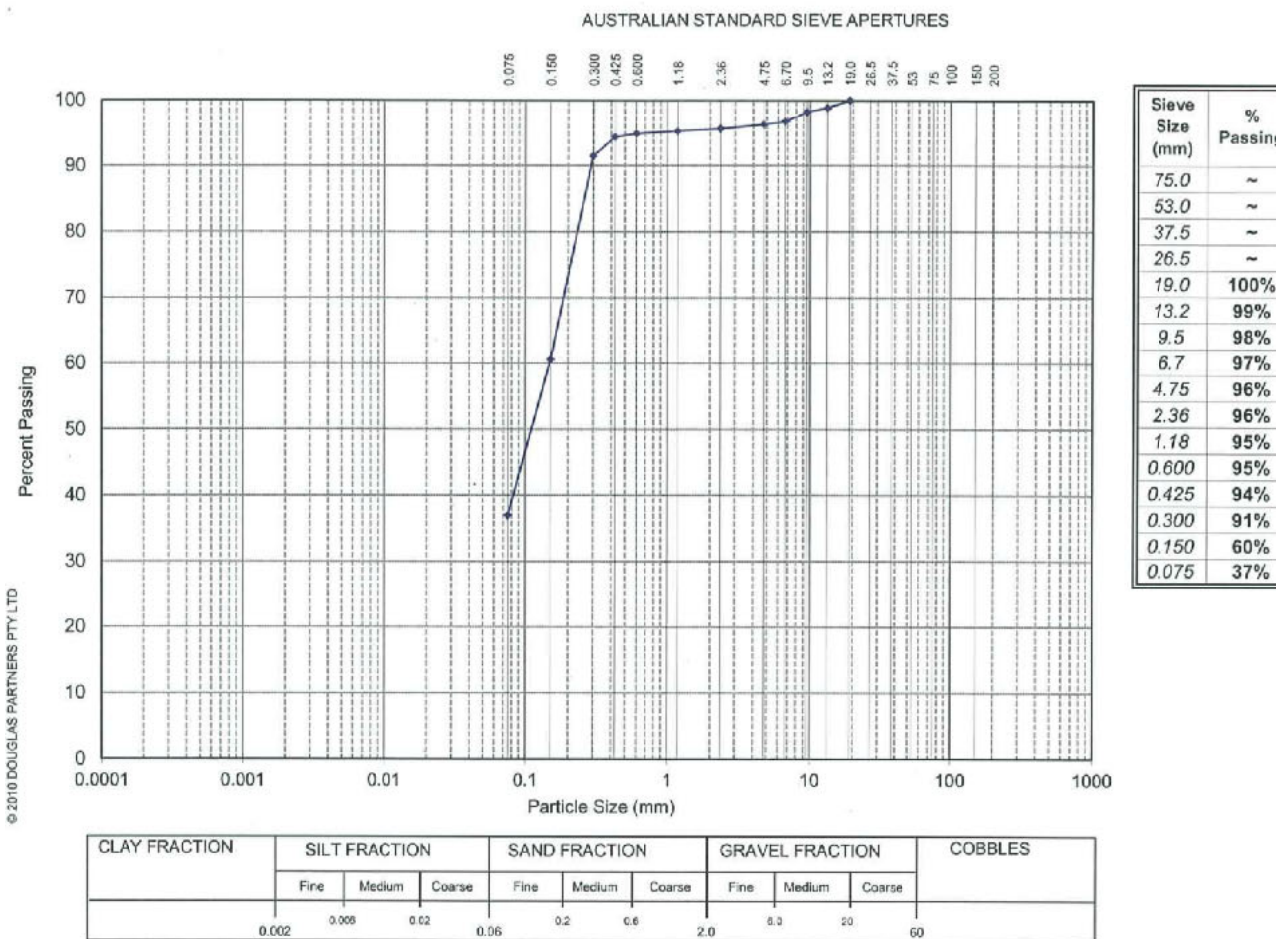
Geotechnical Laboratory Certificates
Groundwater Aggressivity Laboratory Certificates



Douglas Partners Pty
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 231 Normanby Rd
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 Fax (03) 9673 35

Results of Particle Size Distribution

Client :	City of Port Phillip	Project No. :	79797.00
Project :	Multi Storey Redevelopment	Report No. :	M19021001
Location :	30-36 Jackson Street, St Kilda	Report Date :	05.02.2019
Test Location:	BH02	Date Sampled:	-
Depth / Layer:	3.0-3.45(m)	Date of Test:	30/01/2019
		Page:	1 of 1



Description: CLAY and SAND, trace gravel
Test Method(s): AS 1289.3.61
Sampling Method(s): Sampled by Engineering Department
Remarks:

FORM R004C REV 5 JULY 2010



NATA Accredited Laboratory Number: 828
 The results of the tests, calibrations and/or measurements included
 in this document are traceable to Australian national standards.
 Accredited for compliance with ISO/IEC 17025

Tested: SP
 Checked: AG

Arveendra Gounde
 Arveendra Gounde
 Laboratory Manager



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Results of Point Load Strength Index Test

Client:	City of Port Phillip	Project No:	79797.00
Project:	Multi Storey Redevelopment	Report No:	M19021002
Location:	30-36 Jackson Street, St Kilda	Report Date:	05-Feb-2019
		Date Sampled:	-
		Date of Test:	31-Jan-2019
		Page:	1 of 1

Bore / Pit	Depth (m)	Description Of Rock	Test Type	Failure Load (N)	Failure Mode	I _s (MPa)	I _{s(50)} (MPa)	Saturated Moisture Content (%)
BH01	2.75-2.95	SANDSTONE	D	2200	M	0.92	0.91	3.5
BH01	4.42-4.61	SANDSTONE	D	5430	M	2.26	2.24	2.4
BH01	8.0-8.25	SANDSTONE	D	5230	M	2.27	2.23	4.0
BH02	7.61-7.72	SANDSTONE	D	430	P	0.18	0.18	5.4
BH02	10.08-10.28	SANDSTONE	D	7360	M	3.48	3.35	2
BH03	3.9-4.0	SANDSTONE	D	3440	M	1.49	1.47	4.0
BH03	6.55-6.78	SANDSTONE	D	8270	M	4.27	4.03	3.9

Test Method(s): AS 4133.4.1, AS 1289.2.1.1

Sampling Technique: Sampled By Engineering Department

Remarks: Failure Mode:
 P = Plane of weakness
 B = Bedding
 M = Matrix
 C = Combination

Type of Test
 A - Axial
 D - Diametral
 L - Lump

Sample Stored in Sealed Plastic Bag



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards. Accredited for compliance with ISO/IEC 17025

Tested: SP
 Checked: AG

Arveendra Gounder
 Arveendra Gounder
 Laboratory Manager



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Results of Moisture Content Test

Client:	City of Port Phillip	Project No:	79797.00
Project:	Multi Storey Redevelopment	Report No:	M19021003
		Report Date:	05-Feb-2019
Location:	30-36 Jackson Street, St Kilda	Date Sampled:	-
		Date of Test:	31-Jan-2019
		Page:	1 of 1

TEST LOCATION	DEPTH (m)	DESCRIPTION	MOISTURE CONTENT (%)
BH01	2.75-2.95	SANDSTONE	3.5
BH01	4.42-4.61	SANDSTONE	2.4
BH01	8.0-8.25	SANDSTONE	4.0
BH02	4.5-4.6	Clayey GRAVEL / SANDSTONE	4.4
BH02	6.0-6.27	Clayey GRAVEL / SANDSTONE	13.8
BH02	7.61-7.72	SANDSTONE	5.4
BH02	10.08-10.28	SANDSTONE	2.0
BH03	2.9-3.0	SANDSTONE	11.6
BH03	3.9-4.0	SANDSTONE	4.0
BH03	6.55-6.78	SANDSTONE	3.9

Test Method(s): AS1289.2.1.1
Sampling Method(s): Sampled by Engineering Department
Remarks: Saturated Moisture content



NATA Accredited Laboratory Number: 828

The results of the tests, calibrations and/or measurements included in this document are traceable to Australian national standards. Accredited for compliance with ISO/IEC 17025

Tested: SP
Checked: AG


 Arveendra Gounder
 Laboratory Manager



CERTIFICATE OF ANALYSIS

Batch No:	19-06163	<i>Page</i>	Page 1 of 3
<i>Final Report</i>	736533	<i>Laboratory</i>	Scoresby Laboratory
<i>Client:</i>	Douglas Partners Pty Ltd	<i>Address</i>	Caribbean Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
<i>Contact:</i>	Winston Brackley	<i>Phone</i>	[REDACTED]
<i>Address:</i>	231 Normanby Road SOUTH MELBOURNE VIC 3205	<i>Fax</i>	[REDACTED]
		<i>Contact:</i>	Tuyen Nguyen Client Manager
<i>Client Program Ref:</i>	79797-00 - St Kilda	<i>Date Sampled:</i>	25-Jan-2019
<i>ALS Program Ref:</i>	DOUGLAS	<i>Date Samples Received:</i>	29-Jan-2019
<i>PO No:</i>	144059	<i>Date Issued:</i>	01-Feb-2019

The hash (#) below indicates methods not covered by NATA accreditation in the performance of this service.

Analysis	Method	Laboratory	Analysis	Method	Laboratory	Analysis	Method	Laboratory
Chloride	WD045G	Scoresby	EC	WA010	Scoresby	pH	WA005	Scoresby
SO4 DA	WD041G	Scoresby						

Result for pH in water tested in the laboratory may be indicative only as holding time is generally not achievable.



Signatories
Legionella species refers to Legionella species other than Legionella pneumophila

Name	Title	Name	Title
Joseph De Alwis	Analyst	Melani Wijayasiri	Analyst

Page: **Page 2 of 3**
 Batch No: **19-06163**
 Report Number: **736533**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
 CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5973830	5973831
				Client Sample ID	BH02	BH03
				Sample Date	25/01/19	25/01/19
				Sample Type	WATER	WATER
Analysis	Analyte	CAS #	LOR			
pH	pH, units	pH_Lab	Units	7.9	7.8	
EC	Electrical Conductivity @ 25C	EC_Lab	<2	uS/cm	2300	2200
Chloride	Chloride, as Cl	16887-00-6	<1	mg/L	270	210
SO4 DA	Sulphate, as SO4	14808-79-8	<1	mg/L	210	180

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil microbiological testing was commenced within 4 days from the day collected unless otherwise stated.
 MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate.
 MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.
 Calculated results are based on raw data.

Page: **Page 3 of 3**
 Batch No: **19-06163**
 Report Number: **736533**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



QUALITY CONTROL - BLANKS

QC Blanks are an 'analyte free' matrix in which all applicable reagents have been added in the same proportion as in standard samples and are an internal monitor for laboratory contamination.

Lab Sample ID	Client Sample ID	Analysis	Analyte	Units	Value
5978683	QC - Blank	Chloride	Chloride, as Cl	mg/L	<1
5978683	QC - Blank	SO4 DA	Sulphate, as SO4	mg/L	<1
5979072	QC - Blank	pH	pH, units	Units	5.7
5979072	QC - Blank	EC	Electrical Conductivity @ 25C	uS/cm	<2

QUALITY CONTROL - DUPLICATES

QC Data for duplicates is calculated on raw 'unrounded' values. Laboratory duplicates are randomly selected samples tested by the laboratory to maintain method precision and provide information on sample homogeneity.

RPD = Relative Percentage Difference for duplicate determinations. RPD's that fall outside the general acceptance criteria will be attributed to non-homogeneity of samples or results of low magnitudes.

Lab Sample ID	Client Sample ID	Analysis	Analyte	Units	Sample Value	Duplicate Value	% RPD
5979096	NCP	pH	pH, units	Units	9.0	9.0	0.1
5979096	NCP	EC	Electrical Conductivity @ 25C	uS/cm	2900	2900	1.0

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil microbiological testing was commenced within 4 days from the day collected unless otherwise stated.

MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate.

MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.

Calculated results are based on raw data.

Appendix E

Tabulated Environmental Laboratory Results
Environmental Laboratory Documents

User Selected Options			
Date/Time of Computation	ProUCL 5.17/02/2019 12:28:50 PM		
From File	WorkSheet.xls		
Full Precision	OFF		
Confidence Coefficient	95%		
Number of Bootstrap Operations	2000		
Arsenic			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	7
Number of Detects	6	Number of Non-Detects	4
Number of Distinct Detects	6	Number of Distinct Non-Detects	1
Minimum Detect	6	Minimum Non-Detect	5
Maximum Detect	25	Maximum Non-Detect	5
Variance Detects	50.27	Percent Non-Detects	40%
Mean Detects	14.67	SD Detects	7.09
Median Detects	13	CV Detects	0.483
Skewness Detects	0.493	Kurtosis Detects	-0.937
Mean of Logged Detects	2.58	SD of Logged Detects	0.517
Normal GOF Test on Detects Only			
Shapiro Wilk Test Statistic	0.953	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Normal at 5% Significance Level	
Lilliefors Test Statistic	0.204	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.325	Detected Data appear Normal at 5% Significance Level	
Detected Data appear Normal at 5% Significance Level			
Kaplan-Meier (KM) Statistics using Normal Critical Values and other Nonparametric UCLs			
KM Mean	10.8	KM Standard Error of Mean	2.389
KM SD	6.896	95% KM (BCA) UCL	14.9
95% KM (t) UCL	15.18	95% KM (Percentile Bootstrap) UCL	14.6
95% KM (z) UCL	14.73	95% KM Bootstrap t UCL	15.67
90% KM Chebyshev UCL	17.97	95% KM Chebyshev UCL	21.21
97.5% KM Chebyshev UCL	25.72	99% KM Chebyshev UCL	34.57
Gamma GOF Tests on Detected Observations Only			
A-D Test Statistic	0.196	Anderson-Darling GOF Test	
5% A-D Critical Value	0.698	Detected data appear Gamma Distributed at 5% Significance Level	
K-S Test Statistic	0.173	Kolmogorov-Smirnov GOF	
5% K-S Critical Value	0.333	Detected data appear Gamma Distributed at 5% Significance Level	
Detected data appear Gamma Distributed at 5% Significance Level			
Gamma Statistics on Detected Data Only			
k hat (MLE)	4.909	k star (bias corrected MLE)	2.566
Theta hat (MLE)	2.988	Theta star (bias corrected MLE)	5.716
nu hat (MLE)	58.91	nu star (bias corrected)	30.79
Mean (detects)	14.67		
Gamma ROS Statistics using Imputed Non-Detects			
GROS may not be used when data set has > 50% NDs with many tied observations at multiple DLs			
GROS may not be used when kstar of detects is small such as <1.0, especially when the sample size is small (e.g., <15-20)			
For such situations, GROS method may yield incorrect values of UCLs and BTVs			
This is especially true when the sample size is small.			

Attachment 3: 30-34 Jackson Street, St Kilda - geotechnical & preliminary environmental investigation

Maximum	25	Median	8
SD	9.006	CV	0.996
k hat (MLE)	0.383	k star (bias corrected MLE)	0.335
Theta hat (MLE)	23.58	Theta star (bias corrected MLE)	26.98
nu hat (MLE)	7.669	nu star (bias corrected)	6.701
Adjusted Level of Significance (β)	0.0267		
Approximate Chi Square Value (6.70, α)	2.008	Adjusted Chi Square Value (6.70, β)	1.593
95% Gamma Approximate UCL (use when $n \geq 50$)	30.17	95% Gamma Adjusted UCL (use when $n < 50$)	38.02
Estimates of Gamma Parameters using KM Estimates			
Mean (KM)	10.8	SD (KM)	6.896
Variance (KM)	47.56	SE of Mean (KM)	2.389
k hat (KM)	2.452	k star (KM)	1.783
nu hat (KM)	49.05	nu star (KM)	35.67
theta hat (KM)	4.404	theta star (KM)	6.056
80% gamma percentile (KM)	16.39	90% gamma percentile (KM)	21.58
95% gamma percentile (KM)	26.57	99% gamma percentile (KM)	37.72
Gamma Kaplan-Meier (KM) Statistics			
Approximate Chi Square Value (35.67, α)	23	Adjusted Chi Square Value (35.67, β)	21.25
95% Gamma Approximate KM-UCL (use when $n \geq 50$)	16.75	95% Gamma Adjusted KM-UCL (use when $n < 50$)	18.13
Lognormal GOF Test on Detected Observations Only			
Shapiro Wilk Test Statistic	0.973	Shapiro Wilk GOF Test	
5% Shapiro Wilk Critical Value	0.788	Detected Data appear Lognormal at 5% Significance Level	
Lilliefors Test Statistic	0.149	Lilliefors GOF Test	
5% Lilliefors Critical Value	0.325	Detected Data appear Lognormal at 5% Significance Level	
Detected Data appear Lognormal at 5% Significance Level			
Lognormal ROS Statistics Using Imputed Non-Detects			
Mean in Original Scale	10.13	Mean in Log Scale	2.006
SD in Original Scale	7.922	SD in Log Scale	0.866
95% t UCL (assumes normality of ROS data)	14.72	95% Percentile Bootstrap UCL	14.14
95% BCA Bootstrap UCL	14.77	95% Bootstrap t UCL	15.75
95% H-UCL (Log ROS)	24.49		
Statistics using KM estimates on Logged Data and Assuming Lognormal Distribution			
KM Mean (logged)	2.192	KM Geo Mean	8.953
KM SD (logged)	0.6	95% Critical H Value (KM-Log)	2.368
KM Standard Error of Mean (logged)	0.208	95% H-UCL (KM -Log)	17.2
KM SD (logged)	0.6	95% Critical H Value (KM-Log)	2.368
KM Standard Error of Mean (logged)	0.208		
DL/2 Statistics			
DL/2 Normal		DL/2 Log-Transformed	
Mean in Original Scale	9.8	Mean in Log Scale	1.915
SD in Original Scale	8.21	SD in Log Scale	0.942
95% t UCL (Assumes normality)	14.56	95% H-Stat UCL	26.97
DL/2 is not a recommended method, provided for comparisons and historical reasons			
Nonparametric Distribution Free UCL Statistics			
Detected Data appear Normal Distributed at 5% Significance Level			
Suggested UCL to Use			
95% KM (t) UCL	15.18		

Attachment 3: 30-34 Jackson Street, St Kilda - geotechnical & preliminary environmental investigation

Recommendations are based upon data size, data distribution, and skewness.			
These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).			
However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.			
Benzo(a)Pyrene			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	4
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	3
Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set! s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT			
The data set for variable Benzo(a)Pyrene was not processed!			
Total PAH			
General Statistics			
Total Number of Observations	10	Number of Distinct Observations	4
Number of Detects	1	Number of Non-Detects	9
Number of Distinct Detects	1	Number of Distinct Non-Detects	3
Warning: Only one distinct data value was detected! ProUCL (or any other software) should not be used on such a data set! s suggested to use alternative site specific values determined by the Project Team to estimate environmental parameters (e.g., EPC, BT			
The data set for variable Total PAH was not processed!			



CERTIFICATE OF ANALYSIS

Batch No: 19-05426	Page	Page 1 of 30
<i>Replacement Report</i> 737740	<i>Laboratory</i>	Scoresby Laboratory
<i>This report replaces Report Number:</i> 735562	<i>Address</i>	Caribbean Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
<i>Client:</i> Douglas Partners Pty Ltd	<i>Phone</i>	[REDACTED]
<i>Contact:</i> Michael Davidson	<i>Fax</i>	[REDACTED]
<i>Address:</i> 231 Normanby Road SOUTH MELBOURNE VIC 3205	<i>Contact:</i>	Tuyen Nguyen Client Manager
<i>Client Program Ref:</i> 79797-00 - St Kilda	<i>Date Sampled:</i>	17-Jan-2019 - 18-Jan-2019
<i>ALS Program Ref:</i> DOUGLAS	<i>Date Samples Received:</i>	22-Jan-2019
<i>PO No:</i> 144047	<i>Date Issued:</i>	08-Feb-2019

The hash (#) below indicates methods not covered by NATA accreditation in the performance of this service.

Analysis	Method	Laboratory	Analysis	Method	Laboratory	Analysis	Method	Laboratory
BTEXN	WP074	Scoresby	CHC	WP084	Scoresby	Cyanide	WK026SF	Scoresby
Total Fluoride	QWI-EN.WK040T	Scoresby	HVOL	WP074	Scoresby	MAH	WP125 & WP074	Scoresby
Moisture	WA055	Scoresby	MS Total Metals	WG020B	Scoresby	OCP	WP068A	Scoresby
PAH	WP075B	Scoresby	PCB	WP066	Scoresby	pH	EA002	Scoresby
Phenols(Halo)	WP075A	Scoresby	Phenols(NonHalo)	WP075A	Scoresby	Total Cr 6+ DA	EG048G	Scoresby
TRH F2	# WP071	Scoresby	TRH & TPH (>C10)	WP071	Scoresby	TRH (C6-C10) & F1	WP071 (F1 not NATA)	Scoresby

Please note that this is an amended report replacing the one originally sent on 29/01/2019. The amendment involves reporting total chromium for all samples as per client's request. The amendments were made by Tuyen Nguyen on 08/02/2019.



Legionella species refers to Legionella species other than Legionella pneumophila

[Redacted]			
<i>Name</i>	<i>Title</i>	<i>Name</i>	<i>Title</i>
Chatura Perera	Team Leader Nutrients	Hao Zhang	Team Leader Organics
Joseph De Alwis	Analyst	John Earl	Team Leader Metals
Kosta Christopoulos	Chemist/Analyst	Melani Wijayasiri	Analyst

Page: **Page 3 of 30**
 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
 CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5967877	5967878	5967879	5967882	5967883	5967885
				Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
				Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Analysis	Analyte	CAS #	LOR							
BTEXN	Benzene	71-43-2	<0.5 mg/kg	<0.5						
BTEXN	Toluene	108-88-3	<0.5 mg/kg	<0.5						
BTEXN	Ethyl Benzene	100-41-4	<0.5 mg/kg	<0.5						
BTEXN	Xylene - m&p	108-38-3 /	<1 mg/kg	<1						
BTEXN	Xylene - O	95-47-6	<0.5 mg/kg	<0.5						
BTEXN	Naphthalene	91-20-3	<0.5 mg/kg	<0.5						
BTEXN	Total Xylenes	1330-20-7	<1 mg/kg	<1						
BTEXN	BTEX (Sum)	BTEX	<1 mg/kg	<1						
Analysis	Analyte	CAS #	LOR							
CHC	1,2,3,4-Tetrachlorobenzene	634-66-2	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,2,3,5-Tetrachlorobenzene	634-90-2	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,2,3-Trichlorobenzene	87-61-6	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,2,4,5-Tetrachlorobenzene	95-94-3	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,2,4-Trichlorobenzene	120-82-1	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,2-Dichlorobenzene	95-50-1	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,3,5-Trichlorobenzene	108-70-3	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,3-Dichlorobenzene	541-73-1	<0.1 mg/kg	<0.3 _{LORR}						
CHC	1,4-Dichlorobenzene	106-46-7	<0.1 mg/kg	<0.3 _{LORR}						
CHC	2-Chloronaphthalene	91-58-7	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Benzal Chloride	98-87-3	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Benzotrichloride	98-07-7	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Benzylchloride	100-44-7	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Hexachloroethane	67-72-1	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Hexachlorobutadiene	87-68-3	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Hexachlorocyclopentadiene	77-47-4	<0.1 mg/kg	<0.3 _{LORR}						
CHC	Pentachlorobenzene	608-93-5	<0.1 mg/kg	<0.3 _{LORR}						
Analysis	Analyte	CAS #	LOR							

Samples not collected by ALS and are tested as received.

blank space indicates no test performed. Soil microbiological testing was commenced within 4 days from the day collected unless otherwise stated.
 M524: Plate count results <10 per mL and >300 per mL are deemed as approximate.
 M526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.
 calculated results are based on raw data.

Page: **Page 4 of 10**
 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



				Sample No.	5967877	5967878	5967879	5967882	5967883	5967885
				Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
				Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
HVOL	1,1,1,2-Tetrachloroethane	630-20-6	<0.5	mg/kg	<0.5					
HVOL	1,1,2,2-Tetrachloroethane	79-34-5	<0.5	mg/kg	<0.5					
HVOL	1,1-Dichloroethane	75-34-3	<0.5	mg/kg	<0.5					
HVOL	1,1-Dichloroethene	75-35-4	<0.5	mg/kg	<0.5					
HVOL	1,1-Dichloropropene	563-58-6	<0.5	mg/kg	<0.5					
HVOL	1,2,3-Trichloropropane	96-18-4	<0.5	mg/kg	<0.5					
HVOL	1,2-Dibromo-3-Chloropropane	96-12-8	<0.5	mg/kg	<0.5					
HVOL	1,2-Dichloroethene [cis]	540-59-0(cis)	<0.5	mg/kg	<0.5					
HVOL	1,2-Dichloroethene [trans]	540-59-0(trans)	<0.5	mg/kg	<0.5					
HVOL	1,2-Dichloroethane	107-06-2	<0.5	mg/kg	<0.5					
HVOL	1,2-Dichloropropane	78-87-5	<0.5	mg/kg	<0.5					
HVOL	1,3-Dichloropropane	142-28-9	<0.5	mg/kg	<0.5					
HVOL	1,3-Dichloropropene [cis]	10061-01-5	<0.5	mg/kg	<0.5					
HVOL	1,3-Dichloropropene [trans]	10061-02-6	<0.5	mg/kg	<0.5					
HVOL	2,2-Dichloropropane	594-20-7	<0.5	mg/kg	<0.5					
HVOL	2-Chlorotoluene	95-49-8	<0.5	mg/kg	<0.5					
HVOL	4-Chlorotoluene	106-43-4	<0.5	mg/kg	<0.5					
HVOL	Bromochloromethane	74-97-5	<0.5	mg/kg	<0.5					
HVOL	Bromodichloromethane	75-27-4	<0.5	mg/kg	<0.5					
HVOL	Bromobenzene	108-86-1	<0.5	mg/kg	<0.5					
HVOL	Bromoform (Tribromomethane)	75-25-2	<0.5	mg/kg	<0.5					
HVOL	Carbon Tetrachloride	56-23-5	<0.5	mg/kg	<0.5					
HVOL	Chloroform (Trichloromethane)	67-66-3	<0.5	mg/kg	<0.5					
HVOL	Chlorobenzene	108-90-7	<0.5	mg/kg	<0.5					
HVOL	Dibromochloromethane	124-48-1	<0.5	mg/kg	<0.5					
HVOL	Dibromomethane	74-95-3	<0.5	mg/kg	<0.5					
HVOL	1,2-Dibromoethane	106-93-4	<0.5	mg/kg	<0.5					
HVOL	Dichloromethane	75-09-2	<1	mg/kg	<1					
HVOL	Trichlorofluoromethane (CFC11)	75-69-4	<2	mg/kg	<2					
HVOL	Tetrachloroethene	127-18-4	<0.5	mg/kg	<0.5					
HVOL	Vinyl Chloride (Monomer)	75-01-4	<1	mg/kg	<1					

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 calculated results are based on raw data.

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



				Sample No.	5967877	5967878	5967879	5967882	5967883	5967885
				Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
				Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
HVOL	1,1,1-Trichloroethane	71-55-6	<0.5	mg/kg	<0.5					
HVOL	1,1,2-Trichloroethane	79-00-5	<0.5	mg/kg	<0.5					
HVOL	Trichloroethene	79-01-6	<0.5	mg/kg	<0.5					
Analysis	Analyte	CAS #	LOR							
MAH	Styrene	100-42-5	<0.5	mg/kg	<0.5					
Analysis	Analyte	CAS #	LOR							
OCP	BHC (alpha isomer)	319-84-6	<0.05	mg/kg	<0.1 LORR					
OCP	a-Endosulphan	959-98-8	<0.05	mg/kg	<0.1 LORR					
OCP	Aldrin	309-00-2	<0.05	mg/kg	<0.1 LORR					
OCP	BHC (beta isomer)	319-85-7	<0.05	mg/kg	<0.1 LORR					
OCP	b-Endosulphan	33213-65-9	<0.05	mg/kg	<0.1 LORR					
OCP	Chlordane	57-74-9	<0.05	mg/kg	<0.1 LORR					
OCP	cis-Chlordane	5103-71-9	<0.05	mg/kg	<0.1 LORR					
OCP	trans-Chlordane	5103-74-2	<0.05	mg/kg	<0.1 LORR					
OCP	BHC (delta isomer)	319-86-8	<0.05	mg/kg	<0.1 LORR					
OCP	DDD	72-54-8	<0.05	mg/kg	<0.1 LORR					
OCP	DDE	72-55-9	<0.05	mg/kg	<0.1 LORR					
OCP	DDT	50-29-3	<0.05	mg/kg	<0.1 LORR					
OCP	Dieldrin	60-57-1	<0.05	mg/kg	<0.1 LORR					
OCP	Sum of alpha-, beta- and Endosulphan	115-29-7	<0.05	mg/kg	<0.1 LORR					
OCP	Endosulfan Sulfate	1031-07-8	<0.05	mg/kg	<0.1 LORR					
OCP	Endrin	72-20-8	<0.05	mg/kg	<0.1 LORR					
OCP	Endrin Aldehyde	7421-93-4	<0.05	mg/kg	<0.1 LORR					
OCP	Endrin Ketone	53494-70-5	<0.05	mg/kg	<0.1 LORR					
OCP	Hexachlorobenzene	118-74-1	<0.05	mg/kg	<0.1 LORR					
OCP	Heptachlor Epoxide	1024-57-3	<0.05	mg/kg	<0.1 LORR					
OCP	Heptachlor	76-44-8	<0.05	mg/kg	<0.1 LORR					
OCP	BHC (gamma isomer) [Lindane]	58-89-9	<0.05	mg/kg	<0.1 LORR					
OCP	Methoxychlor	72-43-5	<0.05	mg/kg	<0.1 LORR					
OCP	Oxychlordane	27304-13-8	<0.05	mg/kg	<0.1 LORR					
OCP	Sum of DDD, DDE and DDT	DDT+DDE+DD	<0.05	mg/kg	<0.1 LORR					

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



				Sample No.	5967877	5967878	5967879	5967882	5967883	5967885
				Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
				Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
OCP	Sum of Aldrin and Dieldrin	309-00-2 +	<0.05	mg/kg	<0.1 LORR					
Analysis	Analyte	CAS #	LOR							
PAH	Acenaphthene	83-32-9	<0.1	mg/kg	<0.3 LORR	<0.2 LORR	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Acenaphthylene	208-96-8	<0.1	mg/kg	<0.3 LORR	0.5	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Anthracene	120-12-7	<0.1	mg/kg	<0.3 LORR	0.7	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Benzo(a)anthracene	56-55-3	<0.1	mg/kg	<0.3 LORR	1.7	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Benzo(a)pyrene	50-32-8	<0.1	mg/kg	<0.3 LORR	1.7	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Benzo(b)fluoranthene	205-99-2	<0.1	mg/kg	<0.3 LORR	1.5	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Benzo(g,h,i)perylene	191-24-2	<0.1	mg/kg	<0.3 LORR	1.0	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Benzo(k)fluoranthene	207-08-9	<0.1	mg/kg	<0.3 LORR	1.3	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Chrysene	218-01-9	<0.1	mg/kg	<0.3 LORR	1.6	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Dibenz(a,h)anthracene	53-70-3	<0.1	mg/kg	<0.3 LORR	0.2	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Fluoranthene	206-44-0	<0.1	mg/kg	<0.3 LORR	3.7	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Fluorene	86-73-7	<0.1	mg/kg	<0.3 LORR	0.3	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Indeno(1,2,3-cd)pyrene	193-39-5	<0.1	mg/kg	<0.3 LORR	1.1	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Naphthalene	91-20-3	<0.1	mg/kg	<0.3 LORR	<0.2 LORR	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Phenanthrene	85-01-8	<0.1	mg/kg	<0.3 LORR	3.0	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Pyrene	129-00-0	<0.1	mg/kg	<0.3 LORR	3.3	<0.1	<0.2 LORR	<0.1	<0.1
PAH	Total PAH	TOTALPAH	<0.1	mg/kg	<0.3 LORR	22	<0.1	<0.2 LORR	<0.1	<0.1
PAH	BaP TEQ (zero)	BaP_TEQ_0xE	<0.1	mg/kg	<0.1	2.5	<0.1	<0.1	<0.1	<0.1
PAH	BaP TEQ (half LOR)	BaP_TEQ_0.5x	<0.1	mg/kg	0.4	2.5	0.1	0.2	0.1	0.1
PAH	BaP TEQ (LOR)	BaP_TEQ_1.0x	0.2	mg/kg	0.7	2.5	0.2	0.5	0.2	0.2
Analysis	Analyte	CAS #	LOR							
PCB	Aroclor 1016	12674-11-2	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1221	11104-28-2	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1232	11141-16-5	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1242	53469-21-9	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1248	12672-29-6	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1254	11097-69-1	<0.1	mg/kg	<0.3 LORR					
PCB	Aroclor 1260	11096-82-5	<0.1	mg/kg	<0.3 LORR					
PCB	Total PCBs	1336-36-3	<0.1	mg/kg	<0.3 LORR					

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



				Sample No.	5967877	5967878	5967879	5967882	5967883	5967885
				Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
				Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
Analysis	Analyte	CAS #	LOR							
Phenols(Halo)	4-Chloro-3-Methylphenol	59-50-7	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2-Chlorophenol	95-57-8	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,4-Dichlorophenol	120-83-2	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,6-Dichlorophenol	87-65-0	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	Pentachlorophenol	87-86-5	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,3,4,5-Tetrachlorophenol	4901-51-3	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,3,4,6-Tetrachlorophenol	58-90-2	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,3,5,6-Tetrachlorophenol	935-95-5	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,4,5-Trichlorophenol	95-95-4	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	2,4,6-Trichlorophenol	88-06-2	<0.5 mg/kg	<2 LORR						
Phenols(Halo)	Total Phenols (Halogenated)	64743-03-9(Hal)	<0.5 mg/kg	<2 LORR						
Analysis	Analyte	CAS #	LOR							
Phenols(NonHalo)	Phenol	108-95-2	<0.5 mg/kg	<2 LORR						
Phenols(NonHalo)	Total Cresols	1319-77-3	<1 mg/kg	<5 LORR						
Phenols(NonHalo)	2,4-Dimethylphenol	105-67-9	<0.5 mg/kg	<2 LORR						
Phenols(NonHalo)	2,4-Dinitrophenol	51-28-5	<30 mg/kg	<150 LORR						
Phenols(NonHalo)	2-Methyl-4,6-Dinitrophenol	534-52-1	<10 mg/kg	<50 LORR						
Phenols(NonHalo)	2-Nitrophenol	88-75-5	<0.5 mg/kg	<2 LORR						
Phenols(NonHalo)	4-Nitrophenol	100-02-7	<0.5 mg/kg	<2 LORR						
Phenols(NonHalo)	2-Cyclohexyl-4,6-Dinitrophenol	131-89-5	<30 mg/kg	<150 LORR						
Phenols(NonHalo)	Dinoseb	88-85-7	<10 mg/kg	<50 LORR						
Phenols(NonHalo)	Total Phenols (non Halogenated)	64743-03-9(Non)	<30 mg/kg	<150 LORR						
Analysis	Analyte	CAS #	LOR							
Moisture	Moisture %	MOISTCONTE	<2 % w/wet w	3						
pH	pH, units	pH_Lab	<0.1 Units	10.1						
Total Fluoride	Total Fluoride, as F	16984-48-8	<100 mg/kg	680						
Cyanide	Cyanide, as CN	57-12-5	<5 mg/kg	<5						
Total Cr 6+ DA	Hexavalent Chromium (Total) Soil DA	18540-29-9	<1 mg/kg	<1						
Analysis	Analyte	CAS #	LOR							
MS Total Metals	Arsenic	7440-38-2	<5 mg/kg	<5	6	10	<5	14	21	

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



					5967877	5967878	5967879	5967882	5967883	5967885	
					Client Sample ID	BH01-0.1	BH01-0.5	BH01-1.0	BH02-0.1	BH02-0.5	BH02-1.5
					Sample Date	18/01/19	18/01/19	18/01/19	17/01/19	17/01/19	17/01/19
					Sample Type	SOIL	SOIL	SOIL	SOIL	SOIL	SOIL
MS Total Metals	Cadmium	7440-43-9	<0.2	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
MS Total Metals	Chromium	7440-47-3	<5	mg/kg	28	20	44	21	61	42	
MS Total Metals	Copper	7440-50-8	<5	mg/kg	21	37	9	21	9	10	
MS Total Metals	Lead	7439-92-1	<5	mg/kg	<5	220	32	<5	20	14	
MS Total Metals	Manganese	7439-96-5	<5	mg/kg					71		
MS Total Metals	Mercury	7439-97-6	<0.05	mg/kg	<0.05	0.91	0.12	<0.05	0.10	<0.05	
MS Total Metals	Molybdenum	7439-98-7	<5	mg/kg	<5	<5	<5	<5	<5	<5	
MS Total Metals	Nickel	7440-02-0	<5	mg/kg	45	52	19	34	28	18	
MS Total Metals	Selenium	7782-49-2	<3	mg/kg	<3	<3	<3	<3	<3	<3	
MS Total Metals	Silver	7440-22-4	<5	mg/kg	<5	<5	<5	<5	<5	<5	
MS Total Metals	Tin	7440-31-5	<5	mg/kg	<5	18	<5	<5	<5	<5	
MS Total Metals	Zinc	7440-66-6	<5	mg/kg	59	97	23	67	21	22	
Analysis	Analyte	CAS #	LOR								
TRH (C6-C10) &	TPHC6-C9	C6-C9	<20	mg/kg	<20	<20	<20	<20	<20	<20	
TRH (C6-C10) &	TRHC6-C10	C6-C10	<20	mg/kg	<20	<20	<20	<20	<20	<20	
TRH (C6-C10) &	TRHC6-C10 minus BTEX	F1-BTEX	<20	mg/kg	<20	<20	<20	<20	<20	<20	
Analysis	Analyte	CAS #	LOR								
TRH F2	TRH>C10-C16 minus Naphthalene	F2-NAPHTHAL	<20	mg/kg	<60	<20	<20	<20	<20	<20	
TRH & TPH	TPH C10-C14	C10-C14	<20	mg/kg	<60 LORR	<20	<20	<20	<20	<20	
TRH & TPH	TPH C15-C28	C15-C28	<50	mg/kg	<150 LORR	60	<50	<50	<50	<50	
TRH & TPH	TPH C29-C36	C29-C36	<50	mg/kg	180	51	<50	<50	<50	<50	
TRH & TPH	TRH>C10-C16	C10-C16	<20	mg/kg	<60 LORR	<20	<20	<20	<20	<20	
TRH & TPH	TRH>C16-C34	C16-C34	<50	mg/kg	<150 LORR	94	<50	<50	<50	<50	
TRH & TPH	TRH>C34-C40	C34-C40	<50	mg/kg	260	<50	<50	<50	<50	<50	
TRH & TPH	Sum of TRH>C10-C40	C10-C40	<50	mg/kg	260	94	<50	<50	<50	<50	

LORR Limit of Reporting has been raised due to high moisture content, insufficient sample or matrix interference.

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
 CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5967888	5967889	5967890	5967891
				Client Sample ID	BH02-3.0	BH03-0.1	BH03-0.5	BH03-1.5
				Sample Date	17/01/19	18/01/19	18/01/19	18/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL
Analysis	Analyte	CAS #	LOR					
PAH	Acenaphthene	83-32-9	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Acenaphthylene	208-96-8	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Anthracene	120-12-7	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Benz(a)anthracene	56-55-3	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Benzo(a)pyrene	50-32-8	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Benzo(b)fluoranthene	205-99-2	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Benzo(g,h,i)perylene	191-24-2	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Benzo(k)fluoranthene	207-08-9	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Chrysene	218-01-9	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Dibenz(a,h)anthracene	53-70-3	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Fluoranthene	206-44-0	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Fluorene	86-73-7	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Indeno(1,2,3-cd)pyrene	193-39-5	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Naphthalene	91-20-3	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Phenanthrene	85-01-8	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Pyrene	129-00-0	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	Total PAH	TOTALPAH	<0.1 mg/kg	<0.1	<0.2 LORR	<0.3 LORR	<0.2 LORR	<0.2 LORR
PAH	BaP TEQ (zero)	BaP_TEQ_0xE	<0.1 mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
PAH	BaP TEQ (half LOR)	BaP_TEQ_0.5x	<0.1 mg/kg	0.1	0.2	0.4	0.2	0.2
PAH	BaP TEQ (LOR)	BaP_TEQ_1.0x	0.2 mg/kg	0.2	0.5	0.7	0.5	0.5
Analysis	Analyte	CAS #	LOR					
MS Total Metals	Arsenic	7440-38-2	<5 mg/kg	<5	<5	25	12	12
MS Total Metals	Cadmium	7440-43-9	<0.2 mg/kg	<0.2	0.2	<0.2	<0.2	<0.2
MS Total Metals	Chromium	7440-47-3	<5 mg/kg	34	24	35	57	57
MS Total Metals	Copper	7440-50-8	<5 mg/kg	<5	23	12	14	14
MS Total Metals	Lead	7439-92-1	<5 mg/kg	<5	14	31	15	15
MS Total Metals	Mercury	7439-97-6	<0.05 mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05

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				Sample No.	5967888	5967889	5967890	5967891
				Client Sample ID	BH02-3.0	BH03-0.1	BH03-0.5	BH03-1.5
				Sample Date	17/01/19	18/01/19	18/01/19	18/01/19
				Sample Type	SOIL	SOIL	SOIL	SOIL
MS Total Metals	Molybdenum	7439-98-7	<5	mg/kg	<5	<5	<5	<5
MS Total Metals	Nickel	7440-02-0	<5	mg/kg	<5	44	28	24
MS Total Metals	Selenium	7782-49-2	<3	mg/kg	<3	<3	<3	<3
MS Total Metals	Silver	7440-22-4	<5	mg/kg	<5	<5	<5	<5
MS Total Metals	Tin	7440-31-5	<5	mg/kg	<5	<5	<5	<5
MS Total Metals	Zinc	7440-66-6	<5	mg/kg	11	69	29	31
Analysis	Analyte	CAS #	LOR					
TRH (C6-C10) &	TPHC6-C9	C6-C9	<20	mg/kg	<20	<20	<20	<20
TRH (C6-C10) &	TRHC6-C10	C6-C10	<20	mg/kg	<20	<20	<20	<20
TRH (C6-C10) &	TRHC6-C10 minus BTEX	F1-BTEX	<20	mg/kg	<20	<20	<20	<20
Analysis	Analyte	CAS #	LOR					
TRH F2	TRH>C10-C16 minus Naphthalene	F2-NAPHTHAL	<20	mg/kg	<20	<20	<60	<20
TRH & TPH	TPH C10-C14	C10-C14	<20	mg/kg	<20	<20	<60 _{LORR}	<20
TRH & TPH	TPH C15-C28	C15-C28	<50	mg/kg	<50	<50	<150 _{LORR}	<50
TRH & TPH	TPH C29-C36	C29-C36	<50	mg/kg	<50	54	200	<50
TRH & TPH	TRH>C10-C16	C10-C16	<20	mg/kg	<20	<20	<60 _{LORR}	<20
TRH & TPH	TRH>C16-C34	C16-C34	<50	mg/kg	<50	53	160	<50
TRH & TPH	TRH>C34-C40	C34-C40	<50	mg/kg	<50	64	200	<50
TRH & TPH	Sum of TRH>C10-C40	C10-C40	<50	mg/kg	<50	120	360	<50

LORR Limit of Reporting has been raised due to high moisture content, insufficient sample or matrix interference.

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QUALITY CONTROL - BLANKS

QC Blanks are an 'analyte free' matrix in which all applicable reagents have been added in the same proportion as in standard samples and are an internal monitor for laboratory contamination.

Lab Sample ID	Client Sample ID	Analysis	Analyte		Value
5972644	QC - Blank	Moisture	Moisture %	% w/wet w	100
Lab Sample ID	Client Sample ID	Analysis	Analyte		
5972553	QC - Blank	MS Total Metals	Arsenic	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Cadmium	mg/kg	<0.2
5972553	QC - Blank	MS Total Metals	Chromium	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Copper	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Lead	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Manganese	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Mercury	mg/kg	<0.05
5972553	QC - Blank	MS Total Metals	Molybdenum	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Nickel	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Selenium	mg/kg	<3
5972553	QC - Blank	MS Total Metals	Silver	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Tin	mg/kg	<5
5972553	QC - Blank	MS Total Metals	Zinc	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Arsenic	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Cadmium	mg/kg	<0.2
5988366	QC - Blank	MS Total Metals	Chromium	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Copper	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Lead	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Manganese	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Mercury	mg/kg	<0.05
5988366	QC - Blank	MS Total Metals	Molybdenum	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Nickel	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Selenium	mg/kg	<3
5988366	QC - Blank	MS Total Metals	Silver	mg/kg	<5
5988366	QC - Blank	MS Total Metals	Tin	mg/kg	<5

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Lab Sample ID	Client Sample ID	Analysis	Analyte	mg/kg	Value
5988366	QC - Blank	MS Total Metals	Zinc	mg/kg	<5
5972812	QC - Blank	MAH	Styrene	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Benzene	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Toluene	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Ethyl Benzene	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Xylene - m&p	mg/kg	<1
5972804	QC - Blank	BTEXN	Xylene - O	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Naphthalene	mg/kg	<0.5
5972804	QC - Blank	BTEXN	Total Xylenes	mg/kg	<1
5972804	QC - Blank	BTEXN	BTEX (Sum)	mg/kg	<1
5972795	QC - Blank	TRH (C6-C10) & F1	TPHC6-C9	mg/kg	<20
5972795	QC - Blank	TRH (C6-C10) & F1	TRHC6-C10	mg/kg	<20
5972795	QC - Blank	TRH (C6-C10) & F1	TRHC6-C10 minus BTEX	mg/kg	<20
5971086	QC - Blank	TRH & TPH (>C10)	TPH C10-C14	mg/kg	<20
5971086	QC - Blank	TRH & TPH (>C10)	TPH C15-C28	mg/kg	<50
5971086	QC - Blank	TRH & TPH (>C10)	TPH C29-C36	mg/kg	<50
5971086	QC - Blank	TRH & TPH (>C10)	TRH>C10-C16	mg/kg	<20
5971086	QC - Blank	TRH & TPH (>C10)	TRH>C16-C34	mg/kg	<50
5971086	QC - Blank	TRH & TPH (>C10)	TRH>C34-C40	mg/kg	<50
5971086	QC - Blank	TRH & TPH (>C10)	Sum of TRH>C10-C40	mg/kg	<50
5971378	QC - Blank	PAH	Acenaphthene	mg/kg	<0.1
5971378	QC - Blank	PAH	Acenaphthylene	mg/kg	<0.1
5971378	QC - Blank	PAH	Anthracene	mg/kg	<0.1
5971378	QC - Blank	PAH	Benz(a)anthracene	mg/kg	<0.1
5971378	QC - Blank	PAH	Benzo(a)pyrene	mg/kg	<0.1
5971378	QC - Blank	PAH	Benzo(b)fluoranthene	mg/kg	<0.1
5971378	QC - Blank	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1
5971378	QC - Blank	PAH	Benzo(k)fluoranthene	mg/kg	<0.1
5971378	QC - Blank	PAH	Chrysene	mg/kg	<0.1

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					Value
5971378	QC - Blank	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1
5971378	QC - Blank	PAH	Fluoranthene	mg/kg	<0.1
5971378	QC - Blank	PAH	Fluorene	mg/kg	<0.1
5971378	QC - Blank	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1
5971378	QC - Blank	PAH	Naphthalene	mg/kg	<0.1
5971378	QC - Blank	PAH	Phenanthrene	mg/kg	<0.1
5971378	QC - Blank	PAH	Pyrene	mg/kg	<0.1
5971378	QC - Blank	PAH	Total PAH	mg/kg	<0.1
5971378	QC - Blank	PAH	BaP TEQ (zero)	mg/kg	<0.1
5971378	QC - Blank	PAH	BaP TEQ (half LOR)	mg/kg	0.1
5971378	QC - Blank	PAH	BaP TEQ (LOR)	mg/kg	0.2
5971387	QC - Blank	PAH	Acenaphthene	mg/kg	<0.1
5971387	QC - Blank	PAH	Acenaphthylene	mg/kg	<0.1
5971387	QC - Blank	PAH	Anthracene	mg/kg	<0.1
5971387	QC - Blank	PAH	Benz(a)anthracene	mg/kg	<0.1
5971387	QC - Blank	PAH	Benzo(a)pyrene	mg/kg	<0.1
5971387	QC - Blank	PAH	Benzo(b)fluoranthene	mg/kg	<0.1
5971387	QC - Blank	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1
5971387	QC - Blank	PAH	Benzo(k)fluoranthene	mg/kg	<0.1
5971387	QC - Blank	PAH	Chrysene	mg/kg	<0.1
5971387	QC - Blank	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1
5971387	QC - Blank	PAH	Fluoranthene	mg/kg	<0.1
5971387	QC - Blank	PAH	Fluorene	mg/kg	<0.1
5971387	QC - Blank	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1
5971387	QC - Blank	PAH	Naphthalene	mg/kg	<0.1
5971387	QC - Blank	PAH	Phenanthrene	mg/kg	<0.1
5971387	QC - Blank	PAH	Pyrene	mg/kg	<0.1
5971387	QC - Blank	PAH	Total PAH	mg/kg	<0.1
5971387	QC - Blank	PAH	BaP TEQ (zero)	mg/kg	<0.1
5971387	QC - Blank	PAH	BaP TEQ (half LOR)	mg/kg	0.1
5971387	QC - Blank	PAH	BaP TEQ (LOR)	mg/kg	0.2
Lab Sample ID	Client Sample ID	Analysis	Analyte		
5971394	QC - Blank	OCP	BHC (alpha isomer)	mg/kg	<0.05
5971394	QC - Blank	OCP	a-Endosulphan	mg/kg	<0.05

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					Value
5971394	QC - Blank	OCP	Aldrin	mg/kg	<0.05
5971394	QC - Blank	OCP	BHC (beta isomer)	mg/kg	<0.05
5971394	QC - Blank	OCP	b-Endosulphan	mg/kg	<0.05
5971394	QC - Blank	OCP	Chlordane	mg/kg	<0.05
5971394	QC - Blank	OCP	cis-Chlordane	mg/kg	<0.05
5971394	QC - Blank	OCP	trans-Chlordane	mg/kg	<0.05
5971394	QC - Blank	OCP	BHC (delta isomer)	mg/kg	<0.05
5971394	QC - Blank	OCP	DDD	mg/kg	<0.05
5971394	QC - Blank	OCP	DDE	mg/kg	<0.05
5971394	QC - Blank	OCP	DDT	mg/kg	<0.05
5971394	QC - Blank	OCP	Dieldrin	mg/kg	<0.05
5971394	QC - Blank	OCP	Sum of alpha-, beta- and Endosulphan	mg/kg	<0.05
5971394	QC - Blank	OCP	Endosulfan Sulfate	mg/kg	<0.05
5971394	QC - Blank	OCP	Endrin	mg/kg	<0.05
5971394	QC - Blank	OCP	Endrin Aldehyde	mg/kg	<0.05
5971394	QC - Blank	OCP	Endrin Ketone	mg/kg	<0.05
5971394	QC - Blank	OCP	Hexachlorobenzene	mg/kg	<0.05
5971394	QC - Blank	OCP	Heptachlor Epoxide	mg/kg	<0.05
5971394	QC - Blank	OCP	Heptachlor	mg/kg	<0.05
5971394	QC - Blank	OCP	BHC (gamma isomer) [Lindane]	mg/kg	<0.05
5971394	QC - Blank	OCP	Methoxychlor	mg/kg	<0.05
5971394	QC - Blank	OCP	Oxychlordane	mg/kg	<0.05
5971394	QC - Blank	OCP	Sum of DDD, DDE and DDT	mg/kg	<0.05
5971394	QC - Blank	OCP	Sum of Aldrin and Dieldrin	mg/kg	<0.05
Lab Sample ID	Client Sample ID	Analysis	Analyte		
5971400	QC - Blank	PCB	Aroclor 1016	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1221	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1232	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1242	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1248	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1254	mg/kg	<0.1
5971400	QC - Blank	PCB	Aroclor 1260	mg/kg	<0.1
5971400	QC - Blank	PCB	Total PCBs	mg/kg	<0.1
Lab Sample ID	Client Sample ID	Analysis	Analyte		

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					Value
5971371	QC - Blank	CHC	1,2,3,4-Tetrachlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,2,3,5-Tetrachlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,2,3-Trichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,2,4,5-Tetrachlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,2,4-Trichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,2-Dichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,3,5-Trichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,3-Dichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	1,4-Dichlorobenzene	mg/kg	<0.1
5971371	QC - Blank	CHC	2-Chloronaphthalene	mg/kg	<0.1
5971371	QC - Blank	CHC	Benzal Chloride	mg/kg	<0.1
5971371	QC - Blank	CHC	Benzotrichloride	mg/kg	<0.1
5971371	QC - Blank	CHC	Benzylchloride	mg/kg	<0.1
5971371	QC - Blank	CHC	Hexachloroethane	mg/kg	<0.1
5971371	QC - Blank	CHC	Hexachlorobutadiene	mg/kg	<0.1
5971371	QC - Blank	CHC	Hexachlorocyclopentadiene	mg/kg	<0.1
5971371	QC - Blank	CHC	Pentachlorobenzene	mg/kg	<0.1
Lab Sample ID	Client Sample ID	Analysis	Analyte		
5971424	QC - Blank	Phenols(Halo)	4-Chloro-3-Methylphenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2-Chlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,4-Dichlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,6-Dichlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	Pentachlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,3,4,5-Tetrachlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,3,4,6-Tetrachlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,3,5,6-Tetrachlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,4,5-Trichlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	2,4,6-Trichlorophenol	mg/kg	<0.5
5971424	QC - Blank	Phenols(Halo)	Total Phenols (Halogenated)	mg/kg	<0.5
Lab Sample ID	Client Sample ID	Analysis	Analyte		
5971411	QC - Blank	Phenols(NonHalo)	Phenol	mg/kg	<0.5
5971411	QC - Blank	Phenols(NonHalo)	Total Cresols	mg/kg	<1
5971411	QC - Blank	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<0.5
5971411	QC - Blank	Phenols(NonHalo)	2,4-Dinitrophenol	mg/kg	<30

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Lab Sample ID	Client Sample ID	Analysis	Analyte	mg/kg	Value
5971411	QC - Blank	Phenols(NonHalo)	2-Methyl-4,6-Dinitrophenol	mg/kg	<10
5971411	QC - Blank	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<0.5
5971411	QC - Blank	Phenols(NonHalo)	4-Nitrophenol	mg/kg	<0.5
5971411	QC - Blank	Phenols(NonHalo)	2-Cyclohexyl-4,6-Dinitrophenol	mg/kg	<30
5971411	QC - Blank	Phenols(NonHalo)	Dinoseb	mg/kg	<10
5971411	QC - Blank	Phenols(NonHalo)	Total Phenols (non Halogenated)	mg/kg	<30
5972808	QC - Blank	HVOL	1,1,1,2-Tetrachloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,1,2,2-Tetrachloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,1-Dichloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,1-Dichloroethene	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,1-Dichloropropene	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2,3-Trichloropropane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dibromo-3-Chloropropane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dichloroethene [cis]	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dichloroethene [trans]	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dichloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dichloropropane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,3-Dichloropropane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,3-Dichloropropene [cis]	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,3-Dichloropropene [trans]	mg/kg	<0.5
5972808	QC - Blank	HVOL	2,2-Dichloropropane	mg/kg	<0.5
5972808	QC - Blank	HVOL	2-Chlorotoluene	mg/kg	<0.5
5972808	QC - Blank	HVOL	4-Chlorotoluene	mg/kg	<0.5
5972808	QC - Blank	HVOL	Bromochloromethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	Bromodichloromethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	Bromobenzene	mg/kg	<0.5
5972808	QC - Blank	HVOL	Bromoform (Tribromomethane)	mg/kg	<0.5
5972808	QC - Blank	HVOL	Carbon Tetrachloride	mg/kg	<0.5
5972808	QC - Blank	HVOL	Chloroform (Trichloromethane)	mg/kg	<0.5
5972808	QC - Blank	HVOL	Chlorobenzene	mg/kg	<0.5
5972808	QC - Blank	HVOL	Dibromochloromethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	Dibromomethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,2-Dibromoethane	mg/kg	<0.5

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 calculated results are based on raw data.

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					Value
5972808	QC - Blank	HVOL	Dichloromethane	mg/kg	<1
5972808	QC - Blank	HVOL	Trichlorofluoromethane (CFC11)	mg/kg	<2
5972808	QC - Blank	HVOL	Tetrachloroethene	mg/kg	<0.5
5972808	QC - Blank	HVOL	Vinyl Chloride (Monomer)	mg/kg	<1
5972808	QC - Blank	HVOL	1,1,1-Trichloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	1,1,2-Trichloroethane	mg/kg	<0.5
5972808	QC - Blank	HVOL	Trichloroethene	mg/kg	<0.5

QUALITY CONTROL - DUPLICATES

QC Data for duplicates is calculated on raw 'unrounded' values. Laboratory duplicates are randomly selected samples tested by the laboratory to maintain method precision and provide information on sample homogeneity.

RPD = Relative Percentage Difference for duplicate determinations. RPD's that fall outside the general acceptance criteria will be attributed to non-homogeneity of samples or results of low magnitudes.

Lab Sample ID	Client Sample ID	Analysis	Analyte	Units	Sample Value	Duplicate Value	% RPD
5971125	NCP	pH	pH, units	Units	8.3	8.3	0.1
5972362	BH01-0.1	Cyanide	Cyanide, as CN	mg/kg	<5	<5	0
5972622	NCP	Moisture	Moisture %	% w/wet w	8	6	34.1
5972986	NCP	Total Fluoride	Total Fluoride, as F	mg/kg	280	300	4.9
Lab Sample ID	Client Sample ID	Analysis	Analyte	Units	Sample Value	Duplicate Value	% RPD
5972558	NCP	MS Total Metals	Arsenic	mg/kg	10	9	4.3
5972558	NCP	MS Total Metals	Cadmium	mg/kg	5.5	5.5	0.0
5972558	NCP	MS Total Metals	Chromium	mg/kg	250	240	3.6
5972558	NCP	MS Total Metals	Copper	mg/kg	660	650	2.3
5972558	NCP	MS Total Metals	Lead	mg/kg	110	110	0.2
5972558	NCP	MS Total Metals	Manganese	mg/kg	210	240	11.9
5972558	NCP	MS Total Metals	Mercury	mg/kg	1.6	1.7	4.7
5972558	NCP	MS Total Metals	Molybdenum	mg/kg	19	18	2.4
5972558	NCP	MS Total Metals	Nickel	mg/kg	80	82	2.4
5972558	NCP	MS Total Metals	Selenium	mg/kg	5	5	4.0
5972558	NCP	MS Total Metals	Tin	mg/kg	53	52	1.1
5972558	NCP	MS Total Metals	Zinc	mg/kg	1000	1000	0.8
5988367	BH03-1.5	MS Total Metals	Arsenic	mg/kg	12	10	16.6

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					Sample Value	Duplicate Value	% RPD
5988367	BH03-1.5	MS Total Metals	Cadmium	mg/kg	<0.2	<0.2	0
5988367	BH03-1.5	MS Total Metals	Chromium	mg/kg	57	52	7.9
5988367	BH03-1.5	MS Total Metals	Copper	mg/kg	14	12	17.5
5988367	BH03-1.5	MS Total Metals	Lead	mg/kg	15	13	11.5
5988367	BH03-1.5	MS Total Metals	Manganese	mg/kg	93	83	11.4
5988367	BH03-1.5	MS Total Metals	Mercury	mg/kg	<0.05	<0.05	0
5988367	BH03-1.5	MS Total Metals	Molybdenum	mg/kg	<5	<5	0
5988367	BH03-1.5	MS Total Metals	Nickel	mg/kg	24	22	11.6
5988367	BH03-1.5	MS Total Metals	Selenium	mg/kg	<3	<3	0
5988367	BH03-1.5	MS Total Metals	Silver	mg/kg	<5	<5	0
5988367	BH03-1.5	MS Total Metals	Tin	mg/kg	<5	<5	0
5988367	BH03-1.5	MS Total Metals	Zinc	mg/kg	31	27	10.9
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972810	NCP	MAH	Styrene	mg/kg	<0.5	<0.5	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972801	BH01-0.1	BTEXN	Benzene	mg/kg	<0.5	<0.5	0
5972801	BH01-0.1	BTEXN	Toluene	mg/kg	<0.5	<0.5	0
5972801	BH01-0.1	BTEXN	Ethyl Benzene	mg/kg	<0.5	<0.5	0
5972801	BH01-0.1	BTEXN	Xylene - m&p	mg/kg	<1	<1	0
5972801	BH01-0.1	BTEXN	Xylene - O	mg/kg	<0.5	<0.5	0
5972801	BH01-0.1	BTEXN	Naphthalene	mg/kg	<0.5	<0.5	0
5972801	BH01-0.1	BTEXN	Total Xylenes	mg/kg	<1	<1	0
5972801	BH01-0.1	BTEXN	BTEX (Sum)	mg/kg	<1	<1	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972792	NCP	TRH (C6-C10) & F1	TPHC6-C9	mg/kg	<20	<20	0
5972792	NCP	TRH (C6-C10) & F1	TRHC6-C10	mg/kg	<20	<20	0
5972792	NCP	TRH (C6-C10) & F1	TRHC6-C10 minus BTEX	mg/kg	<20	<20	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971080	NCP	TRH & TPH (>C10)	TPH C10-C14	mg/kg	<20	<20	0
5971080	NCP	TRH & TPH (>C10)	TPH C15-C28	mg/kg	<50	<50	0
5971080	NCP	TRH & TPH (>C10)	TPH C29-C36	mg/kg	<50	<50	0
5971080	NCP	TRH & TPH (>C10)	TRH>C10-C16	mg/kg	<20	<20	0
5971080	NCP	TRH & TPH (>C10)	TRH>C16-C34	mg/kg	<50	<50	0
5971080	NCP	TRH & TPH (>C10)	TRH>C34-C40	mg/kg	<50	<50	0

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					Sample Value	Duplicate Value	% RPD
5971080	NCP	TRH & TPH (>C10)	Sum of TRH>C10-C40	mg/kg	<50	<50	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971375	NCP	PAH	Acenaphthene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Acenaphthylene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Anthracene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Benzo(a)anthracene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Benzo(a)pyrene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Benzo(b)fluoranthene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Benzo(k)fluoranthene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Chrysene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Fluoranthene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Fluorene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Naphthalene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Phenanthrene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Pyrene	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	Total PAH	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	BaP TEQ (zero)	mg/kg	<0.1	<0.1	0
5971375	NCP	PAH	BaP TEQ (half LOR)	mg/kg	0.1	0.1	0.0
5971375	NCP	PAH	BaP TEQ (LOR)	mg/kg	0.2	0.2	0.0
5971382	NCP	PAH	Acenaphthene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Acenaphthylene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Anthracene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Benzo(a)anthracene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Benzo(a)pyrene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Benzo(b)fluoranthene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Benzo(k)fluoranthene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Chrysene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Fluoranthene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Fluorene	mg/kg	<0.1	<0.1	0

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					Sample Value	Duplicate Value	% RPD
5971382	NCP	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Naphthalene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Phenanthrene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Pyrene	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	Total PAH	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	BaP TEQ (zero)	mg/kg	<0.1	<0.1	0
5971382	NCP	PAH	BaP TEQ (half LOR)	mg/kg	0.1	0.1	0.0
5971382	NCP	PAH	BaP TEQ (LOR)	mg/kg	0.2	0.2	0.0
5971384	NCP	PAH	Acenaphthene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Acenaphthylene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Anthracene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Benz(a)anthracene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Benzo(a)pyrene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Benzo(b)fluoranthene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Benzo(k)fluoranthene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Chrysene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Fluoranthene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Fluorene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Naphthalene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Phenanthrene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Pyrene	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	Total PAH	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	BaP TEQ (zero)	mg/kg	<0.1	<0.1	0
5971384	NCP	PAH	BaP TEQ (half LOR)	mg/kg	0.1	0.1	0.0
5971384	NCP	PAH	BaP TEQ (LOR)	mg/kg	0.2	0.2	0.0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971388	NCP	OCP	BHC (alpha isomer)	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	a-Endosulphan	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Aldrin	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	BHC (beta isomer)	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	b-Endosulphan	mg/kg	<0.05	<0.05	0

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					Sample Value	Duplicate Value	% RPD
5971388	NCP	OCP	Chlordane	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	cis-Chlordane	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	trans-Chlordane	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	BHC (delta isomer)	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	DDD	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	DDE	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	DDT	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Dieldrin	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Sum of alpha-, beta- and Endosulphan	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Endosulfan Sulfate	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Endrin	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Endrin Aldehyde	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Endrin Ketone	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Hexachlorobenzene	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Heptachlor Epoxide	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Heptachlor	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	BHC (gamma isomer) [Lindane]	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Methoxychlor	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Oxychlordane	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Sum of DDD, DDE and DDT	mg/kg	<0.05	<0.05	0
5971388	NCP	OCP	Sum of Aldrin and Dieldrin	mg/kg	<0.05	<0.05	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971395	NCP	PCB	Aroclor 1016	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1221	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1232	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1242	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1248	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1254	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Aroclor 1260	mg/kg	<0.1	<0.1	0
5971395	NCP	PCB	Total PCBs	mg/kg	<0.1	<0.1	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971366	NCP	CHC	1,2,3,4-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,2,3,5-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,2,3-Trichlorobenzene	mg/kg	<0.1	<0.1	0

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					Sample Value	Duplicate Value	% RPD
5971366	NCP	CHC	1,2,4,5-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,2,4-Trichlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,2-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,3,5-Trichlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,3-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	1,4-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	2-Chloronaphthalene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Benzal Chloride	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Benzotrichloride	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Benzylchloride	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Hexachloroethane	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Hexachlorobutadiene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Hexachlorocyclopentadiene	mg/kg	<0.1	<0.1	0
5971366	NCP	CHC	Pentachlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2,3,4-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2,3,5-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2,3-Trichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2,4,5-Tetrachlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2,4-Trichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,2-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,3,5-Trichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,3-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	1,4-Dichlorobenzene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	2-Chloronaphthalene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Benzal Chloride	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Benzotrichloride	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Benzylchloride	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Hexachloroethane	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Hexachlorobutadiene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Hexachlorocyclopentadiene	mg/kg	<0.1	<0.1	0
5971368	NCP	CHC	Pentachlorobenzene	mg/kg	<0.1	<0.1	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971412	NCP	Phenols(Halo)	4-Chloro-3-Methylphenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2-Chlorophenol	mg/kg	<0.5	<0.5	0

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					Sample Value	Duplicate Value	% RPD
5971412	NCP	Phenols(Halo)	2,4-Dichlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,6-Dichlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	Pentachlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,3,4,5-Tetrachlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,3,4,6-Tetrachlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,3,5,6-Tetrachlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,4,5-Trichlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	2,4,6-Trichlorophenol	mg/kg	<0.5	<0.5	0
5971412	NCP	Phenols(Halo)	Total Phenols (Halogenated)	mg/kg	<0.5	<0.5	0
5971427	NCP	Phenols(Halo)	4-Chloro-3-Methylphenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2-Chlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,4-Dichlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,6-Dichlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	Pentachlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,3,4,5-Tetrachlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,3,4,6-Tetrachlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,3,5,6-Tetrachlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,4,5-Trichlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	2,4,6-Trichlorophenol	mg/kg	<2 LORR	<2 LORR	0
5971427	NCP	Phenols(Halo)	Total Phenols (Halogenated)	mg/kg	<2 LORR	<2 LORR	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971404	NCP	Phenols(NonHalo)	Phenol	mg/kg	<0.5	<0.5	0
5971404	NCP	Phenols(NonHalo)	Total Cresols	mg/kg	<1	<1	0
5971404	NCP	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<0.5	<0.5	0
5971404	NCP	Phenols(NonHalo)	2,4-Dinitrophenol	mg/kg	<30	<30	0
5971404	NCP	Phenols(NonHalo)	2-Methyl-4,6-Dinitrophenol	mg/kg	<10	<10	0
5971404	NCP	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<0.5	<0.5	0
5971404	NCP	Phenols(NonHalo)	4-Nitrophenol	mg/kg	<0.5	<0.5	0
5971404	NCP	Phenols(NonHalo)	2-Cyclohexyl-4,6-Dinitrophenol	mg/kg	<30	<30	0
5971404	NCP	Phenols(NonHalo)	Dinoseb	mg/kg	<10	<10	0
5971404	NCP	Phenols(NonHalo)	Total Phenols (non Halogenated)	mg/kg	<30	<30	0
5971407	NCP	Phenols(NonHalo)	Phenol	mg/kg	<0.5	<0.5	0
5971407	NCP	Phenols(NonHalo)	Total Cresols	mg/kg	<1	<1	0
5971407	NCP	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<0.5	<0.5	0

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 calculated results are based on raw data.

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					Sample Value	Duplicate Value	% RPD
5971407	NCP	Phenols(NonHalo)	2,4-Dinitrophenol	mg/kg	<30	<30	0
5971407	NCP	Phenols(NonHalo)	2-Methyl-4,6-Dinitrophenol	mg/kg	<10	<10	0
5971407	NCP	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<0.5	<0.5	0
5971407	NCP	Phenols(NonHalo)	4-Nitrophenol	mg/kg	<0.5	<0.5	0
5971407	NCP	Phenols(NonHalo)	2-Cyclohexyl-4,6-Dinitrophenol	mg/kg	<30	<30	0
5971407	NCP	Phenols(NonHalo)	Dinoseb	mg/kg	<10	<10	0
5971407	NCP	Phenols(NonHalo)	Total Phenols (non Halogenated)	mg/kg	<30	<30	0
5971425	NCP	Phenols(NonHalo)	Phenol	mg/kg	<2 LORR	<2 LORR	0
5971425	NCP	Phenols(NonHalo)	Total Cresols	mg/kg	<5 LORR	<5 LORR	0
5971425	NCP	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<2 LORR	<2 LORR	0
5971425	NCP	Phenols(NonHalo)	2,4-Dinitrophenol	mg/kg	<150 LORR	<150 LORR	0
5971425	NCP	Phenols(NonHalo)	2-Methyl-4,6-Dinitrophenol	mg/kg	<50 LORR	<50 LORR	0
5971425	NCP	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<2 LORR	<2 LORR	0
5971425	NCP	Phenols(NonHalo)	4-Nitrophenol	mg/kg	<2 LORR	<2 LORR	0
5971425	NCP	Phenols(NonHalo)	2-Cyclohexyl-4,6-Dinitrophenol	mg/kg	<150 LORR	<150 LORR	0
5971425	NCP	Phenols(NonHalo)	Dinoseb	mg/kg	<50 LORR	<50 LORR	0
5971425	NCP	Phenols(NonHalo)	Total Phenols (non Halogenated)	mg/kg	<150 LORR	<150 LORR	0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972806	NCP	HVOL	1,1,1,2-Tetrachloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,1,2,2-Tetrachloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,1-Dichloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,1-Dichloroethene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,1-Dichloropropene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2,3-Trichloropropane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dibromo-3-Chloropropane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dichloroethene [cis]	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dichloroethene [trans]	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dichloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dichloropropane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,3-Dichloropropane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,3-Dichloropropene [cis]	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,3-Dichloropropene [trans]	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	2,2-Dichloropropane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	2-Chlorotoluene	mg/kg	<0.5	<0.5	0

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					Sample Value	Duplicate Value	% RPD
5972806	NCP	HVOL	4-Chlorotoluene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Bromochloromethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Bromodichloromethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Bromobenzene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Bromoform (Tribromomethane)	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Carbon Tetrachloride	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Chloroform (Trichloromethane)	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Chlorobenzene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Dibromochloromethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Dibromomethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,2-Dibromoethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Dichloromethane	mg/kg	<1	<1	0
5972806	NCP	HVOL	Trichlorofluoromethane (CFC11)	mg/kg	<2	<2	0
5972806	NCP	HVOL	Tetrachloroethene	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Vinyl Chloride (Monomer)	mg/kg	<1	<1	0
5972806	NCP	HVOL	1,1,1-Trichloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	1,1,2-Trichloroethane	mg/kg	<0.5	<0.5	0
5972806	NCP	HVOL	Trichloroethene	mg/kg	<0.5	<0.5	0

QUALITY CONTROL - SPIKES

QC Data for spikes is calculated on raw 'unrounded' values. Laboratory spikes are randomly selected samples in which the analytes in question have been artificially introduced and recovered via standard analysis and are used to provide information on potential matrix effects on analyte recoveries.

Spike recoveries that fall outside the general acceptance criteria will be attributed to sample matrix interference or results of high magnitudes.

NCP: Non-Customer Parent (sample quality is representative of the analytical batch but the sample that was QC tested belongs to a customer not pertaining to the report.)

Lab Sample ID	Client Sample ID	Analysis	Analyte		Sample Value	Expected Value	% Recovery
5972359	BH01-0.1	Cyanide	Cyanide, as CN	mg/kg	<5	20	104
5972983	NCP	Total Fluoride	Total Fluoride, as F	mg/kg	250	650	108
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972559	NCP	MS Total Metals	Arsenic	mg/kg	10	110	97.0
5972559	NCP	MS Total Metals	Cadmium	mg/kg	5.5	100	102
5972559	NCP	MS Total Metals	Chromium	mg/kg	250	280	85.9
5972559	NCP	MS Total Metals	Copper	mg/kg	660	570	82.4

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					Sample Value	Expected Value	% Recovery
5972559	NCP	MS Total Metals	Lead	mg/kg	110	180	96.1
5972559	NCP	MS Total Metals	Manganese	mg/kg	210	250	92.7
5972559	NCP	MS Total Metals	Mercury	mg/kg	1.6	2.2	98.0
5972559	NCP	MS Total Metals	Molybdenum	mg/kg	19	110	101
5972559	NCP	MS Total Metals	Nickel	mg/kg	80	160	87.2
5972559	NCP	MS Total Metals	Selenium	mg/kg	5	100	96.0
5972559	NCP	MS Total Metals	Tin	mg/kg	53	140	94.5
5972559	NCP	MS Total Metals	Zinc	mg/kg	1000	830	96.1
5988368	BH03-1.5	MS Total Metals	Arsenic	mg/kg	12	110	92.4
5988368	BH03-1.5	MS Total Metals	Cadmium	mg/kg	<0.2	100	104
5988368	BH03-1.5	MS Total Metals	Chromium	mg/kg	57	150	83.6
5988368	BH03-1.5	MS Total Metals	Lead	mg/kg	15	110	98.9
5988368	BH03-1.5	MS Total Metals	Mercury	mg/kg	<0.05	1.0	97.0
5988368	BH03-1.5	MS Total Metals	Molybdenum	mg/kg	<5	100	105
5988368	BH03-1.5	MS Total Metals	Nickel	mg/kg	24	120	83.8
5988368	BH03-1.5	MS Total Metals	Selenium	mg/kg	<3	100	92.8
5988368	BH03-1.5	MS Total Metals	Tin	mg/kg	<5	100	101
5988368	BH03-1.5	MS Total Metals	Zinc	mg/kg	31	130	82.7
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972811	NCP	MAH	Styrene	mg/kg	<0.5	5.0	72.4
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972803	NCP	BTEXN	Benzene	mg/kg	<0.5	5.0	77.1
5972803	NCP	BTEXN	Toluene	mg/kg	<0.5	5.0	76.4
5972803	NCP	BTEXN	Ethyl Benzene	mg/kg	<0.5	5.0	71.8
5972803	NCP	BTEXN	Xylene - m&p	mg/kg	<1	10	79.7
5972803	NCP	BTEXN	Xylene - O	mg/kg	<0.5	5.0	77.1
5972803	NCP	BTEXN	Naphthalene	mg/kg	<0.5	5.0	70.1
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972793	NCP	TRH (C6-C10) & F1	TPHC6-C9	mg/kg	<20	120	96.2
5972793	NCP	TRH (C6-C10) & F1	TRHC6-C10	mg/kg	<20	120	103
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971081	NCP	TRH & TPH (>C10)	TPH C15-C28	mg/kg	<50	1000	112
5971081	NCP	TRH & TPH (>C10)	TRH>C16-C34	mg/kg	<50	1100	108
Lab Sample ID	Client Sample ID	Analysis	Analyte				

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					Sample Value	Expected Value	% Recovery
5971372	NCP	PAH	Acenaphthene	mg/kg	<0.1	1.6	86.6
5971372	NCP	PAH	Acenaphthylene	mg/kg	<0.1	1.6	91.2
5971372	NCP	PAH	Anthracene	mg/kg	<0.1	1.6	89.0
5971372	NCP	PAH	Benz(a)anthracene	mg/kg	<0.1	1.6	79.8
5971372	NCP	PAH	Benzo(a)pyrene	mg/kg	<0.1	1.6	97.4
5971372	NCP	PAH	Benzo(b)fluoranthene	mg/kg	<0.1	1.6	96.2
5971372	NCP	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1	1.6	89.4
5971372	NCP	PAH	Benzo(k)fluoranthene	mg/kg	<0.1	1.6	97.6
5971372	NCP	PAH	Chrysene	mg/kg	<0.1	1.6	100
5971372	NCP	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1	1.6	75.8
5971372	NCP	PAH	Fluoranthene	mg/kg	<0.1	1.6	82.6
5971372	NCP	PAH	Fluorene	mg/kg	<0.1	1.6	87.4
5971372	NCP	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	1.6	83.2
5971372	NCP	PAH	Naphthalene	mg/kg	<0.1	1.6	92.8
5971372	NCP	PAH	Phenanthrene	mg/kg	<0.1	1.6	82.6
5971372	NCP	PAH	Pyrene	mg/kg	<0.1	1.6	80.0
5971383	NCP	PAH	Acenaphthene	mg/kg	<0.1	1.4	89.2
5971383	NCP	PAH	Acenaphthylene	mg/kg	<0.1	1.4	93.6
5971383	NCP	PAH	Anthracene	mg/kg	<0.1	1.4	103
5971383	NCP	PAH	Benz(a)anthracene	mg/kg	<0.1	1.4	84.6
5971383	NCP	PAH	Benzo(a)pyrene	mg/kg	<0.1	1.4	105
5971383	NCP	PAH	Benzo(b)fluoranthene	mg/kg	<0.1	1.4	87.0
5971383	NCP	PAH	Benzo(g,h,i)perylene	mg/kg	<0.1	1.4	99.2
5971383	NCP	PAH	Benzo(k)fluoranthene	mg/kg	<0.1	1.4	97.4
5971383	NCP	PAH	Chrysene	mg/kg	<0.1	1.4	107
5971383	NCP	PAH	Dibenz(a,h)anthracene	mg/kg	<0.1	1.4	98.4
5971383	NCP	PAH	Fluoranthene	mg/kg	<0.1	1.4	89.0
5971383	NCP	PAH	Fluorene	mg/kg	<0.1	1.4	96.0
5971383	NCP	PAH	Indeno(1,2,3-cd)pyrene	mg/kg	<0.1	1.4	88.4
5971383	NCP	PAH	Naphthalene	mg/kg	<0.1	1.4	102
5971383	NCP	PAH	Phenanthrene	mg/kg	<0.1	1.4	99.0
5971383	NCP	PAH	Pyrene	mg/kg	<0.1	1.4	89.4
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971389	NCP	OCP	BHC (alpha isomer)	mg/kg	<0.05	2.8	83.7

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					Sample Value	Expected Value	% Recovery
5971389	NCP	OCP	a-Endosulphan	mg/kg	<0.05	1.4	90.8
5971389	NCP	OCP	Aldrin	mg/kg	<0.05	1.4	85.2
5971389	NCP	OCP	BHC (beta isomer)	mg/kg	<0.05	2.3	83.9
5971389	NCP	OCP	b-Endosulphan	mg/kg	<0.05	1.4	85.0
5971389	NCP	OCP	Chlordane	mg/kg	<0.05	2.8	84.0
5971389	NCP	OCP	cis-Chlordane	mg/kg	<0.05	1.4	84.2
5971389	NCP	OCP	trans-Chlordane	mg/kg	<0.05	1.4	83.8
5971389	NCP	OCP	BHC (delta isomer)	mg/kg	<0.05	2.8	79.2
5971389	NCP	OCP	DDD	mg/kg	<0.05	1.4	110
5971389	NCP	OCP	DDE	mg/kg	<0.05	1.4	110
5971389	NCP	OCP	DDT	mg/kg	<0.05	1.4	71.0
5971389	NCP	OCP	Dieldrin	mg/kg	<0.05	1.4	86.0
5971389	NCP	OCP	Endosulfan Sulfate	mg/kg	<0.05	1.4	87.2
5971389	NCP	OCP	Endrin	mg/kg	<0.05	1.4	77.4
5971389	NCP	OCP	Endrin Aldehyde	mg/kg	<0.05	1.4	96.0
5971389	NCP	OCP	Endrin Ketone	mg/kg	<0.05	1.4	105
5971389	NCP	OCP	Hexachlorobenzene	mg/kg	<0.05	2.5	98.2
5971389	NCP	OCP	Heptachlor Epoxide	mg/kg	<0.05	1.4	85.0
5971389	NCP	OCP	Heptachlor	mg/kg	<0.05	1.4	76.8
5971389	NCP	OCP	BHC (gamma isomer) [Lindane]	mg/kg	<0.05	2.8	84.1
5971389	NCP	OCP	Methoxychlor	mg/kg	<0.05	1.4	70.6
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971396	NCP	PCB	Aroclor 1016	mg/kg	<0.1	2.4	97.1
5971396	NCP	PCB	Aroclor 1260	mg/kg	<0.1	2.7	106
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971367	NCP	CHC	1,2,3,4-Tetrachlorobenzene	mg/kg	<0.1	1.4	88.6
5971367	NCP	CHC	1,2,3-Trichlorobenzene	mg/kg	<0.1	1.4	91.2
5971367	NCP	CHC	1,2,4,5-Tetrachlorobenzene	mg/kg	<0.1	2.8	89.0
5971367	NCP	CHC	1,2,4-Trichlorobenzene	mg/kg	<0.1	1.4	92.2
5971367	NCP	CHC	1,2-Dichlorobenzene	mg/kg	<0.1	1.4	89.8
5971367	NCP	CHC	1,3,5-Trichlorobenzene	mg/kg	<0.1	1.4	92.0
5971367	NCP	CHC	1,3-Dichlorobenzene	mg/kg	<0.1	1.4	89.0
5971367	NCP	CHC	1,4-Dichlorobenzene	mg/kg	<0.1	1.4	89.8
5971367	NCP	CHC	2-Chloronaphthalene	mg/kg	<0.1	1.4	101

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					Sample Value	Expected Value	% Recovery
5971367	NCP	CHC	Benzal Chloride	mg/kg	<0.1	1.4	93.0
5971367	NCP	CHC	Benzotrifluoride	mg/kg	<0.1	1.4	79.4
5971367	NCP	CHC	Benzylchloride	mg/kg	<0.1	1.4	106
5971367	NCP	CHC	Hexachloroethane	mg/kg	<0.1	1.4	85.6
5971367	NCP	CHC	Hexachlorobutadiene	mg/kg	<0.1	1.4	80.8
5971367	NCP	CHC	Pentachlorobenzene	mg/kg	<0.1	1.4	87.6
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971413	NCP	Phenols(Halo)	4-Chloro-3-Methylphenol	mg/kg	<0.5	1.4	69.6
5971413	NCP	Phenols(Halo)	2-Chlorophenol	mg/kg	<0.5	1.4	83.6
5971413	NCP	Phenols(Halo)	2,4-Dichlorophenol	mg/kg	<0.5	1.4	75.0
5971413	NCP	Phenols(Halo)	2,6-Dichlorophenol	mg/kg	<0.5	1.4	76.6
5971413	NCP	Phenols(Halo)	2,3,4,6-Tetrachlorophenol	mg/kg	<0.5	2.8	73.3
5971413	NCP	Phenols(Halo)	2,3,5,6-Tetrachlorophenol	mg/kg	<0.5	1.4	79.2
5971413	NCP	Phenols(Halo)	2,4,5-Trichlorophenol	mg/kg	<0.5	1.4	79.2
5971428	NCP	Phenols(Halo)	4-Chloro-3-Methylphenol	mg/kg	<2 LORR	1.6	84.0
5971428	NCP	Phenols(Halo)	2-Chlorophenol	mg/kg	<2 LORR	1.6	94.0
5971428	NCP	Phenols(Halo)	2,4-Dichlorophenol	mg/kg	<2 LORR	1.6	84.0
5971428	NCP	Phenols(Halo)	2,6-Dichlorophenol	mg/kg	<2 LORR	1.6	86.0
5971428	NCP	Phenols(Halo)	2,3,4,6-Tetrachlorophenol	mg/kg	<2 LORR	3.2	71.0
5971428	NCP	Phenols(Halo)	2,3,5,6-Tetrachlorophenol	mg/kg	<2 LORR	1.6	72.0
5971428	NCP	Phenols(Halo)	2,4,5-Trichlorophenol	mg/kg	<2 LORR	1.6	78.0
5971428	NCP	Phenols(Halo)	2,4,6-Trichlorophenol	mg/kg	<2 LORR	1.6	76.0
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5971406	NCP	Phenols(NonHalo)	Phenol	mg/kg	<0.5	1.4	102
5971406	NCP	Phenols(NonHalo)	Total Cresols	mg/kg	<1	4.2	94.7
5971406	NCP	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<0.5	1.4	84.0
5971406	NCP	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<0.5	1.4	74.6
5971406	NCP	Phenols(NonHalo)	4-Nitrophenol	mg/kg	<0.5	1.4	60.4
5971426	NCP	Phenols(NonHalo)	Phenol	mg/kg	<2 LORR	1.6	98.0
5971426	NCP	Phenols(NonHalo)	Total Cresols	mg/kg	<5 LORR	4.8	107
5971426	NCP	Phenols(NonHalo)	2,4-Dimethylphenol	mg/kg	<2 LORR	1.6	104
5971426	NCP	Phenols(NonHalo)	2-Nitrophenol	mg/kg	<2 LORR	1.6	102
Lab Sample ID	Client Sample ID	Analysis	Analyte				
5972807	NCP	HVOL	1,1,2,2-Tetrachloroethane	mg/kg	<0.5	5.0	76.8

Samples not collected by ALS and are tested as received.

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 M526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.
 calculated results are based on raw data.

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 Batch No: **19-05426**
 Report Number: **737740**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



					Sample Value	Expected Value	% Recovery
5972807	NCP	HVOL	1,1-Dichloroethane	mg/kg	<0.5	5.0	78.1
5972807	NCP	HVOL	1,1-Dichloroethene	mg/kg	<0.5	5.0	80.8
5972807	NCP	HVOL	1,1-Dichloropropene	mg/kg	<0.5	5.0	81.7
5972807	NCP	HVOL	1,2,3-Trichloropropane	mg/kg	<0.5	5.0	75.0
5972807	NCP	HVOL	1,2-Dichloroethene [cis]	mg/kg	<0.5	5.0	78.4
5972807	NCP	HVOL	1,2-Dichloroethene [trans]	mg/kg	<0.5	5.0	76.6
5972807	NCP	HVOL	1,2-Dichloroethane	mg/kg	<0.5	5.0	86.4
5972807	NCP	HVOL	1,2-Dichloropropane	mg/kg	<0.5	5.0	80.5
5972807	NCP	HVOL	1,3-Dichloropropane	mg/kg	<0.5	5.0	82.3
5972807	NCP	HVOL	2-Chlorotoluene	mg/kg	<0.5	5.0	80.9
5972807	NCP	HVOL	4-Chlorotoluene	mg/kg	<0.5	5.0	76.8
5972807	NCP	HVOL	Bromochloromethane	mg/kg	<0.5	5.0	77.4
5972807	NCP	HVOL	Bromobenzene	mg/kg	<0.5	5.0	77.6
5972807	NCP	HVOL	Chloroform (Trichloromethane)	mg/kg	<0.5	5.0	83.2
5972807	NCP	HVOL	Chlorobenzene	mg/kg	<0.5	5.0	80.6
5972807	NCP	HVOL	Dibromomethane	mg/kg	<0.5	5.0	79.3
5972807	NCP	HVOL	1,2-Dibromoethane	mg/kg	<0.5	5.0	70.7
5972807	NCP	HVOL	Dichloromethane	mg/kg	<1	5.0	77.3
5972807	NCP	HVOL	Trichlorofluoromethane (CFC11)	mg/kg	<2	5.0	83.7
5972807	NCP	HVOL	Tetrachloroethene	mg/kg	<0.5	5.0	79.1
5972807	NCP	HVOL	Vinyl Chloride (Monomer)	mg/kg	<1	5.0	82.9
5972807	NCP	HVOL	1,1,1-Trichloroethane	mg/kg	<0.5	5.0	73.5
5972807	NCP	HVOL	1,1,2-Trichloroethane	mg/kg	<0.5	5.0	74.3
5972807	NCP	HVOL	Trichloroethene	mg/kg	<0.5	5.0	85.7

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 M526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.
 alculated results are based on raw data.

LS Water

Trading name of:
ALS Water Australia Pty Ltd ABN: 94 105 060 320
100 Dandenong Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
Tel: 1800 251 251 / 03 9490 2511
www.alswater.com.au www.alsglobal.com



Sample Receipt Advice (SRA)

Client: Douglas Partners Pty Ltd 231 Normanby Road SOUTH MELBOURNE VIC 3205	Client Contact: Michael Davidson Phone : Mobile : Fax : Email : <input type="text"/>
--	--

Batch Summary: ALS Water Batch No : 19-05426

Date Received : 22/01/2019 1:08:06PM
Scheduled Reporting Date : 30-Jan-2019
Client Job Ref : 79797-00 - St Kilda
No. of Sample(s) : 16
Program : Misc.
Purchase Order : 144047
ATA report : Reqd.
Lab Contact : **Tuyen Nguyen**

Phone: (03) 8756 8116

Please direct any enquiries you have regarding this project to the above ALS Water contact.

Delivery Details:

COC Received :

Sample Temperature on Receipt. C °
 Samples preserved where applicable #

Comments:

Disclaimer : This document contains privileged and confidential information intended only for the use of the addressee. If you are not the addressee, you are hereby notified that you must not disseminate, copy or take action of its contents. If you have received this document in error, please notify the ALS Water immediately.
Comparisons are made against pretreatment/preservation as per AS, VICEPA, APHA, USEPA standards
Sample disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order

Attachment 3: 30-34 Jackson Street, St Kilda - geotechnical & preliminary environmental investigation

<p>Client:</p> <p>Douglas Partners Pty Ltd</p> <p>231 Normanby Road SOUTH MELBOURNE VIC 3205</p>	<p>Client Contact: Michael Davidson</p> <p>Phone : Mobile : Fax : Email : </p>
--	--

Summary of Sample and Received Analysis:			
ALS Sample	Sample Name	Date	Test Count
5967877	BH01-0.1	18/01/2019	20
5967878	BH01-0.5	18/01/2019	7
5967879	BH01-1.0	18/01/2019	7
5967882	BH02-0.1	17/01/2019	7
5967883	BH02-0.5	17/01/2019	7
5967885	BH02-1.5	17/01/2019	7
5967888	BH02-3.0	17/01/2019	7
5967889	BH03-0.1	18/01/2019	7
5967890	BH03-0.5	18/01/2019	7
5967891	BH03-1.5	18/01/2019	7

Disclaimer : This document contains privileged and confidential information intended only for the use of the addressee. If you are not the addressee, you are hereby notified that you must not disseminate, copy or take action of its contents. If you have received this document in error, please notify the ALS Water immediately.

Comparisons are made against pretreatment/ preservation as per AS, VICEPA, APHA, USEPA standards

Sample disposal - Aqueous (14 days), Solid (60 days) from date of completion of work order



14-05424
CHAIN OF CUSTODY DESPATCH SHEET

Project No: 79797.00		Suburb: St Kilda		To: ALS WRG	
Project Name: St Kilda, 30-36 Jackson Street		Order Number		22 Dalmore Drive, Scoresby	
Project Manager: Evan Denton		Sampler: Michael Davidson		Attn: Tuyen Nguyen	
Emails:				Phone: 03 8756 8000	
Date Required: Same day <input type="checkbox"/> 24 hours <input type="checkbox"/> 48 hours <input type="checkbox"/> 72 hours <input type="checkbox"/> Standard <input checked="" type="checkbox"/>				Email:	
Prior Storage: <input type="checkbox"/> Esky <input checked="" type="checkbox"/> Fridge <input type="checkbox"/> Shelved		Do samples contain 'potential' HBM? Yes <input type="checkbox"/> No <input checked="" type="checkbox"/> (If YES, then handle, transport and store in accordance with F			

Sample ID	Lab ID	Date Sampled	Sample Type	Container Type	Analytes						Notes/preservation		
			S - soil W - water	G - glass P - plastic	EPA Screen	Metals TRH + PAH							
BH01-0.1		18/01/19	S	G	X								
BH01-0.5		18/01/19	S	G		X							
BH01-1.0		18/01/19	S	G		X							
BH01-1.5		18/01/19	S	G									
BH01-2.5		18/01/19	S	G									
BH02-0.1		17/01/19	S	G		X							
BH02-0.5		17/01/19	S	G		X							
BH02-1.0		17/01/19	S	G									
BH02-1.5		17/01/19	S	G		X							
BH02-2.0		17/01/19	S	G									
BH02-2.5		17/01/19	S	G									
BH02-3.0		17/01/19	S	G		X							
BH03-0.1		18/01/19	S	G		X							
BH03-0.5		18/01/19	S	G		X							
BH03-1.5		18/01/19	S	G		X							
BH03-3.0		18/01/19	S	G									

ALS

DOUGLAS

DOUGLAS 19-05426

MEL-C-04 Due Date: 30/01/2019

lab#

5967897

598

PQL (S) mg/kg		ANZECC PQLs req'd for all water analytes			
PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit					
Metals to Analyse: 8HM unless specified here:		As per EPA Screen			
Total number of samples in container:		6		Relinquished by: MD	
		Transferred to laboratory b:		Melbourne Office	
Send Results to:		Douglas Partners Pty Ltd		Address 231 Normanby Road South Melbourne VIC 3205	
Signed:		Received by: Solomon		Date & Time: 21/1/19 12:30	



CERTIFICATE OF ANALYSIS

Batch No:	19-07839	<i>Page</i>	Page 1 of 6
<i>Final Report</i>	738434	<i>Laboratory</i>	Scoresby Laboratory
<i>Client:</i>	Douglas Partners Pty Ltd	<i>Address</i>	Caribbean Business Park, 22 Dalmore Drive, Scoresby, VIC 3179
<i>Contact:</i>	Alex Patterson	<i>Phone</i>	
<i>Address:</i>	231 Normanby Road SOUTH MELBOURNE VIC 3205	<i>Fax</i>	
		<i>Contact:</i>	
<i>Client Program Ref:</i>	79797-00 - St Kilda	<i>Date Sampled:</i>	18-Jan-2019
<i>ALS Program Ref:</i>	DOUGLAS	<i>Date Samples Received:</i>	08-Feb-2019
<i>PO No:</i>	144074	<i>Date Issued:</i>	13-Feb-2019

The hash (#) below indicates methods not covered by NATA accreditation in the performance of this service.

<i>Analysis</i>	<i>Method</i>	<i>Laboratory</i>	<i>Analysis</i>	<i>Method</i>	<i>Laboratory</i>	<i>Analysis</i>	<i>Method</i>	<i>Laboratory</i>
ASLP(Acetate) Prep	EN33SC	Scoresby	ASLP(Acet.) PAH	WP075B, EN33SC	Scoresby	MS ASLP(Acet) Metals	WG020A; EN33SC	Scoresby

*Analysis conducted outside holding time due to late arrival or delayed extraction/analysis. Based on APHA, VICEPA, AS & NEPM
Late Sample Arrival - ASLP(Acet.) PAH[5988543]*

100 grams of sample was taken for ASLP determinations unless a lesser amount was submitted to this laboratory.



Signatories
Legionella species refers to Legionella species other than Legionella pneumophila

<i>Name</i>	<i>Title</i>	<i>Name</i>	<i>Title</i>
Hao Zhang	Team Leader Organics	John Levvey	Principal Trace Metals Chemist

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 Batch No: **19-07839**
 Report Number: **738434**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



LOR = Limit of reporting. When a reported LOR is higher than the standard LOR, this may be due to high moisture content, insufficient sample or matrix interference.
 CAS Number = Chemistry Abstract Services Number. The analytical procedures in this report (including in house methods) are developed from internationally recognised procedures such as those published by USEPA, APHA and NEPM.

				Sample No.	5988543	5988544
				Client Sample ID	BH01-0.5	BH03-0.5
				Sample Date	18/01/19	18/01/19
				Sample Type	SOIL	SOIL
Analysis	Analyte	CAS #	LOR			
ASLP(Acet.) PAH	Naphthalene	91-20-3	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Acenaphthylene	208-96-8	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Acenaphthene	83-32-9	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Fluorene	86-73-7	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Phenanthrene	85-01-8	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Anthracene	120-12-7	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Fluoranthene	206-44-0	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Pyrene	129-00-0	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Benz(a)anthracene	56-55-3	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Chrysene	218-01-9	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Benzo(b)fluoranthene	205-99-2	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Benzo(k)fluoroanthene	207-08-9	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Benzo(a)pyrene	50-32-8	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Dibenz(a,h)anthracene	53-70-3	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Benzo(g,h,i)perylene	191-24-2	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Indeno(1,2,3-cd)pyrene	193-39-5	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	Total PAH	TOTALPAH	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	BAP TEQ (zero)	BaP_TEQ_0xE	<0.001 mg/L	<0.001		
ASLP(Acet.) PAH	BAP TEQ (LOR)	BaP_TEQ_1.0x	<0.001 mg/L	0.002		
Analysis	Analyte	CAS #	LOR			
ASLP(Acetate)	Leach Fluid pH	pH_aq_extract		pH units	5.0	5.0
ASLP(Acetate)	Solids Leachate pH (post rolling)	pH_post_rolling		pH units	5.4	5.1
Analysis	Analyte	CAS #	LOR			
MS ASLP(Acet)	ASLP-Arsenic	7440-38-2	<0.01 mg/L	<0.01	<0.01	<0.01
MS ASLP(Acet)	ASLP-Cadmium	7440-43-9	<0.002 mg/L	<0.002	<0.002	<0.002
MS ASLP(Acet)	ASLP-Chromium	7440-47-3	<0.01 mg/L	<0.01	<0.01	<0.01

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil microbiological testing was commenced within 4 days from the day collected unless otherwise stated.

MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate.

MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.

Calculated results are based on raw data.

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 Batch No: **19-07839**
 Report Number: **738434**
 Client: **Douglas Partners Pty Ltd**
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				Sample No.	5988543	5988544
				Client Sample ID	BH01-0.5	BH03-0.5
				Sample Date	18/01/19	18/01/19
				Sample Type	SOIL	SOIL
MS ASLP(Acet)	ASLP-Copper	7440-50-8	<0.01	mg/L	<0.01	<0.01
MS ASLP(Acet)	ASLP-Lead	7439-92-1	<0.01	mg/L	0.12	0.04
MS ASLP(Acet)	ASLP-Mercury	7439-97-6	<0.001	mg/L	<0.001	<0.001
MS ASLP(Acet)	ASLP-Molybdenum	7439-98-7	<0.01	mg/L	<0.01	<0.01
MS ASLP(Acet)	ASLP-Nickel	7440-02-0	<0.01	mg/L	0.03	0.01
MS ASLP(Acet)	ASLP-Selenium	7782-49-2	<0.01	mg/L	<0.01	<0.01
MS ASLP(Acet)	ASLP-Silver	7440-22-4	<0.01	mg/L	<0.01	<0.01
MS ASLP(Acet)	ASLP-Tin	7440-31-5	<0.01	mg/L	<0.01	<0.01
MS ASLP(Acet)	ASLP-Zinc	7440-66-6	<0.01	mg/L	0.35	0.01

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 Calculated results are based on raw data.

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 Batch No: **19-07839**
 Report Number: **738434**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



QUALITY CONTROL - BLANKS

QC Blanks are an 'analyte free' matrix in which all applicable reagents have been added in the same proportion as in standard samples and are an internal monitor for laboratory contamination.

Lab Sample ID	Client Sample ID	Analysis	Analyte	Value
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Arsenic	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Cadmium	mg/L <0.002
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Chromium	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Copper	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Lead	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Mercury	mg/L <0.001
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Molybdenum	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Nickel	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Selenium	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Silver	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Tin	mg/L <0.01
5991485	QC - Blank	MS ASLP(Acet) Metals	ASLP-Zinc	mg/L <0.01
Lab Sample ID	Client Sample ID	Analysis	Analyte	Value
5991582	QC - Blank	ASLP(Acet.) PAH	Naphthalene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Acenaphthylene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Acenaphthene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Fluorene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Phenanthrene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Anthracene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Fluoranthene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Pyrene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Benzo(a)anthracene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Chrysene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Benzo(b)fluoranthene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Benzo(k)fluoranthene	mg/L <0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Benzo(a)pyrene	mg/L <0.001

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Calculated results are based on raw data.

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 Batch No: **19-07839**
 Report Number: **738434**
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					Value
5991582	QC - Blank	ASLP(Acet.) PAH	Dibenz(a,h)anthracene	mg/L	<0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Benzo(g,h,i)perylene	mg/L	<0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Indeno(1,2,3-cd)pyrene	mg/L	<0.001
5991582	QC - Blank	ASLP(Acet.) PAH	Total PAH	mg/L	<0.001
5991582	QC - Blank	ASLP(Acet.) PAH	BAP TEQ (zero)	mg/L	<0.001
5991582	QC - Blank	ASLP(Acet.) PAH	BAP TEQ (LOR)	mg/L	0.002

QUALITY CONTROL - DUPLICATES

QC Data for duplicates is calculated on raw 'unrounded' values. Laboratory duplicates are randomly selected samples tested by the laboratory to maintain method precision and provide information on sample homogeneity.

RPD = Relative Percentage Difference for duplicate determinations. RPD's that fall outside the general acceptance criteria will be attributed to non-homogeneity of samples or results of low magnitudes.

Lab Sample ID	Client Sample ID	Analysis	Analyte	Sample Value	Duplicate Value	% RPD
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Arsenic	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Cadmium	mg/L	<0.002	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Chromium	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Copper	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Lead	mg/L	0.04	3.1
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Molybdenum	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Nickel	mg/L	0.01	4.0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Selenium	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Silver	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Tin	mg/L	<0.01	0
5991486	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Zinc	mg/L	0.01	0.6
Lab Sample ID	Client Sample ID	Analysis	Analyte			
5991581	BH01-0.5	ASLP(Acet.) PAH	Naphthalene	mg/L	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Acenaphthylene	mg/L	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Acenaphthene	mg/L	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Fluorene	mg/L	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Phenanthrene	mg/L	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Anthracene	mg/L	<0.001	0

Samples not collected by ALS and are tested as received.

A blank space indicates no test performed. Soil microbiological testing was commenced within 4 days from the day collected unless otherwise stated.

MM524: Plate count results <10 per mL and >300 per mL are deemed as approximate.

MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.

Calculated results are based on raw data.

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 Batch No: **19-07839**
 Report Number: **738434**
 Client: **Douglas Partners Pty Ltd**
 Client Program Ref: **79797-00 - St Kilda**



					Sample Value	Duplicate Value	% RPD
5991581	BH01-0.5	ASLP(Acet.) PAH	Fluoranthene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Pyrene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Benz(a)anthracene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Chrysene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Benzo(b)fluoranthene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Benzo(k)fluoranthene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Benzo(a)pyrene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Dibenz(a,h)anthracene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Benzo(g,h,i)perylene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Indeno(1,2,3-cd)pyrene	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	Total PAH	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	BAP TEQ (zero)	mg/L	<0.001	<0.001	0
5991581	BH01-0.5	ASLP(Acet.) PAH	BAP TEQ (LOR)	mg/L	0.002	0.002	0.0

QUALITY CONTROL - SPIKES

QC Data for spikes is calculated on raw 'unrounded' values. Laboratory spikes are randomly selected samples in which the analytes in question have been artificially introduced and recovered via standard analysis and are used to provide information on potential matrix effects on analyte recoveries.

Spike recoveries that fall outside the general acceptance criteria will be attributed to sample matrix interference or results of high magnitudes.

NCP: Non-Customer Parent (sample quality is representative of the analytical batch but the sample that was QC tested belongs to a customer not pertaining to the report.)

Lab Sample ID	Client Sample ID	Analysis	Analyte		Sample Value	Expected Value	% Recovery
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Arsenic	mg/L	<0.01	0.40	106
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Cadmium	mg/L	<0.002	0.40	102
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Chromium	mg/L	<0.01	0.40	95.2
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Copper	mg/L	<0.01	0.40	92.3
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Lead	mg/L	0.04	0.44	97.5
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Molybdenum	mg/L	<0.01	0.40	102
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Nickel	mg/L	0.01	0.41	92.8
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Selenium	mg/L	<0.01	0.40	108
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Tin	mg/L	<0.01	0.40	98.0
5991487	BH03-0.5	MS ASLP(Acet) Metals	ASLP-Zinc	mg/L	0.01	0.41	101

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MM526: Plate count results <2,500 per mL and >250,000 per mL are deemed as approximate.

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