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Report on
Geotechnical Investigation

Glenwood High School Upgrade
85 Forman Avenue, Glenwood

Prepared for
NSW Department of Education

Project 94626.00
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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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Table of Contents

Report on Geotechnical Investigation
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1. Introduction

This geotechnical report accompanies an Environmental Impact Statement (EIS) pursuant to Part 4 of the Environmental Planning and Assessment Act 1979 (EP&A Act) in support of a State Significant Development Application (SSD - 23512960).

The development is for upgrading works comprising alterations and additions to Glenwood High School at 85 Forman Avenue, Glenwood. The site is legally described as Lot 5227 DP 868693.

The site is roughly rectangular in shape, with a total area of 60,790m^2 and street frontages to Forman Avenue to the south and Glenwood Drive to the east. Glenwood Reserve adjoins the northern and western boundaries of the school.

This report addresses the relevant Secretary's Environmental Assessment Requirements (SEARs), specifically the assessment of salinity and a salinity management plan.

The investigation included the drilling of boreholes, installation of groundwater wells, insitu testing followed by laboratory testing of selected samples, engineering analysis and reporting. The details of the field work and laboratory testing are presented in this report, together with comments and recommendations for design and construction.

DP carried out a detailed site investigation (DSI) for contamination in conjunction with this geotechnical investigation, the results of which are presented in a separate report (DP Report Reference 94626.02.R.002.Rev1).

2. Site Description

The proposed new three-storey building, extensions to existing buildings and new carpark are to be located over the northern and eastern portions of Glenwood High School ("the site") located at 85 Forman Avenue, Glenwood. The new three-storey building comprises an irregular shaped area of approximately 0.5 hectare.

At the time of the field work the site of the new building was occupied by nineteen portable classroom buildings, concrete pavements and landscaped and grassed areas.

The site is bounded by undeveloped land to the north, Glenwood Park Drive to the east, Forman Avenue to the south and Glenwood Reserve and playing fields to the west.

The site topography generally slopes down to the north-east at gradients estimated to be less than 3° with the maximum elevation at about RL 70 (m AHD) in the south-west corner and the minimum

elevation at about RL 59 (m AHD) in the north-east corner. Caddies Creek is located about 240 m north-west of the site and Glenwood Lake is located about 320 m north of the site. An open drainage reserve associated with Caddies Creek lies about 40 m to the north-east of the site.

Table 1 presents site identification details and a location plan showing the approximate site area is presented in Figure 1.

Table 1: Site Identification

Item	Details
Allotment Identification	Lot 5227 DP 868693
Street Address	85 Forman Avenue
Locality	Glenwood, NSW
Site Area	Full school site 6.1 hectares (approximately) Development area 0.5 hectare (approximately)
Local Government Area	Blacktown City Council (BCC)
Zoning	SP2 Educational Establishment
Planning Instrument(s)	BCC DCP (2015); LEP (2015)
Current Land Use	High School
Current Owner	Minister for Education and Training

Figure 1: Site of New Three Storey Building (Source: Nearmap)

3. Published Data

3.1 Geology

Reference to the Penrith 1:100 000 scale Geological Series Sheet indicates that the site is underlain by Ashfield Shale of Triassic Age. Ashfield Shale typically comprises dark grey to black shale, siltstone and laminite which weathers to a residual clay profile of medium to high plasticity.

3.2 Hydrogeology

The closest surface water receptor to the site is Caddies Creek located about 240 m north-west of the site.

Based on the local topography, groundwater is anticipated to flow to the north-east towards the open stormwater channel associated with Caddies Creek.

A search of the NSW Department of Primary Industries Water (DPI Water) online map of registered groundwater works was undertaken as part of the investigation. The search carried out on 19 August 2020 identified no registered groundwater boreholes within 500 m of the site.

3.3 Soil Landscape

Reference to the Penrith 1: 100 000 scale Soil Landscape Series Sheet indicates that the site is located within the Blacktown soil landscape group. The Blacktown Group is characterised by moderately reactive, highly plastic subsoil with poor drainage characteristics.

3.4 Acid Sulfate Soils

Review of published mapping indicates that the site is in an area of 'no known occurrence of acid sulfate soils'. The NSW Acid Sulfate Soils Manual 1998 published by the Acid Sulfate Soils Management Advisory Committee (ASSMAC) indicates that ASS (and Potential Acid Sulfate Soils – PASS) normally occur in alluvial or estuarine soils below RL 5 m AHD although occasionally are encountered up to RL 12 m AHD. Considering the ASS mapping and given that the site soils are at site elevations above RL 50 m AHD, it is considered unlikely that ASS is present on-site.

3.5 Salinity Potential

The Department of Infrastructure, Planning and Natural Resources (DIPNR) "Map of Salinity Potential in Western Sydney 2002" suggests that the site is in an area of "moderate to high salinity potential" with a higher potential in the lower elevations areas in close proximity to the Caddies Creek system.

4. Field Work

4.1 Field Work Methods

The field work was undertaken on 8 August 2020, 27 August 2020 and 31 August 2020 and included the following:

- Drilling of thirteen boreholes (Bores 101 to 103, 105, 110 to 117 and 121) using a track mounted rig with 150 mm diameter spiral flight augers. The boreholes were drilled to depths ranging between

1.5 m and 4.7 m. Standard penetration tests (SPTs) were completed at regular depths within the overburden.

- Extension of three boreholes (Bores 102, 103 and 105) into the underlying bedrock using NMLC-coring techniques to obtain continuous 50 mm diameter core samples of the rock for identification and strength testing purposes. The boreholes were drilled to depths ranging between 6.7 m and 8.0 m.
- Drilling of eight boreholes (Bores 106 to 109, 118 to 120 and 122) using a 110 mm diameter portable hand auger due to limited access for a drilling rig. The boreholes were drilled to depths ranging between 0.1 m and 1.5 m.
- Dynamic Cone Penetrometer (DCP) tests adjacent to selected hand augered boreholes. DCPs were carried out to 1.2 m depth or prior refusal in accordance with AS1289.6.3.2.

Undisturbed and disturbed samples were collected from the boreholes to assist with logging and for laboratory testing.

Three of the boreholes (Bore 102, Bore 103 and Bore 105) were converted to groundwater wells at the completion of drilling. The wells involved inserting Class 18 uPVC screen and casing to the required depths, backfilling the screened length with clean gravel, sealing the top of the gravel with bentonite pellets and backfilling the casing with drilling spoil. The top of the wells were finished with a gatic cover installed flush with the surface. Following installation, the wells were purged of groundwater and measurement of the groundwater levels occurred on two subsequent occasions (27 August 2020 and 31 August 2020)?.

The ground surface levels (measured in 'metres above Australian Height Datum AHD') together with the Eastings and Northings at the borehole locations were determined by using a high precision Differential GPS which is accurate to approximately 0.1 m. The locations of the boreholes are shown on Drawing 1 in Appendix B.

4.2 Field Work Results

The borehole logs from the investigation are provided in Appendix C. Notes defining classification methods and terms used to describe the soils and rocks are included in Appendix A. The subsurface conditions encountered underlying the site of the can be summarised as follows:

- Topsoil: - silty clay topsoil fill to depths of between 0.1 m and 0.2 m in all boreholes except Bore 122. Inclusions of gravel, rootlets and surficial vegetation were encountered within the topsoil;
- Fill: - silty clay or sandy silt fill in all boreholes except Bore 104 to depths ranging between 0.1 m and 0.9 m. Inclusions of sand, gravel, brick, PVC pipe and plastic were encountered within the fill;
- Natural Soil: - typically stiff silty clay with some firm layers in all boreholes except Bore 122 to depths ranging between 0.5 m and 4.6 m. Stiff or very stiff gravelly clay was encountered in Bore 101 below a depth of 3 m and

from 2 m to 3 m depth in Bore 102. Inclusions of ironstone and siltstone gravel were encountered within the clay;

- Very Low and Low Strength Siltstone: - very low strength, moderately weathered siltstone was encountered below a depth of 1.3 m in Bore 105 increasing to very low to low strength, below a depth of 1.8 m. Low strength, moderately weathered siltstone was encountered below a depth of 4.6 m in Bore 101 and low strength, slightly weathered siltstone with very low strength bands was encountered below a depth of 4.4 m in Bore 102;

- Low and Medium Strength Siltstone - low to medium strength, moderately to highly weathered siltstone with very low strength bands and clay seams was encountered below a depth of 3.0 m in Bore 103. Medium strength, moderately or slightly weathered siltstone was encountered below depths of 4.9 m and 3.0 m in Bore 102 and Bore 105, respectively. Very low strength bands and clay seams were encountered within the siltstone in Bore 105;

- High Strength Siltstone - high strength, fresh, unbroken siltstone with 10 % sandstone laminations were encountered below depths of between 4.9 m and 5.1 m in Bores 102, 103 and 105.

Free groundwater was observed at depths of 3.0 m and 2.0 m in Bore 101 and Bore 102, respectively on completion of auger drilling. Groundwater was not observed during the drilling of the remaining boreholes. Backfilling of all boreholes (except where wells were installed in Bores 102, 103 and 105) at the completion of drilling precluded long term monitoring of the groundwater levels.

Groundwater levels were measured in the monitoring wells on two subsequent occasions. A summary of the groundwater levels measured to date are provided in Table 2.

Table 2: Results of Groundwater Level Measurements

Borehole Location	Surface RL (m AHD)	Monitoring Well Measurements – Water Level			
		27 August 2020		2 September 2020	
		Depth (m)	RL (m AHD)	Depth (m)	RL (m AHD)
102	59.4	1.6	57.8	2.2	57.2
103	60.4	2.4	58.0	2.3	58.1
105	62.2	3.2	59.0	3..1	59.1

Note: RL = Reduced Levels relative to Australian Height Datum (AHD)

No signs of efflorescence or salt scalds were noted during the inspection. Thick vegetation, however, precluded detailed inspection across most of the site.

5. Laboratory Testing

5.1 Mechanical Testing

Selected samples from the boreholes were tested in the laboratory for measurement of plasticity, dispersion potential, shrink-swell, moisture content, compaction properties and CBR. The detailed results are given in Appendix D and summarised in Table 3.

Table 3: Results of Laboratory Testing - Geotechnical

Sample Location	Material	Depth (m)	FMC (%)	OMC (%)	MDD (t/m^3)	CBR (%)	W_L (%)	W_P (%)	PI (%)	I_{ss} (%/ Δpf)	ECN
Bore 101	Silty Clay	0.8 – 1.0	-	-	-	-	-	-	-	0.4	-
Bore 102	Silty Clay	0.6 – 0.7	14.9	-	-	-	35	16	19	-	-
Bore 103	Silty Clay	1.0 - 1.15	-	-	-	-	-	-	-	3.2	-
Bore 105	Silty Clay	0.3 – 0.4	25.8	-	-	-	72	26	46	-	6
Bore 110	Silty Clay	0.5 – 1.5	15.5	15.5	1.88	5	-	-	-	-	-
Bore 113	Silty Clay	0.5 – 1.5	15.5	15.5	1.91	6	-	-	-	-	-
Bore 115	Silty Clay	0.9 – 1.0	26.7	-	-	-	76	25	51	-	-

Notes: FMC = Field Moisture Content; OMC = Standard Optimum Moisture Content; MDD = Maximum Dry Density; CBR = California bearing ratio; W_L = Liquid Limit; W_P = Plastic Limit; PI = Plasticity Index; I_{SS} = Shrink Swell Index; ECN = Emerson Crumb number

The results of the laboratory testing indicate the following:

- The Atterberg Limit test results indicate that the silty clay samples were generally of medium to high plasticity.
- The shrink-swell results indicate the silty clays are typically highly reactive and therefore susceptible to shrink and swell movements due to changes in soil moisture content.
- The CBR values were 5% and 6%for the natural silty clay samples tested.
- The field moisture contents ranged from 14.9 % to 26.7% for the silty clay samples tested. The field moisture contents of the samples were typically within 1% dry and 2% wet of the plastic limit.
- The Emerson Crumb Number was 6 indicating the clay sample was moderately dispersive.

5.2 Chemical Testing

Selected samples collected from the boreholes were also tested in the laboratory for determination of aggressivity to concrete and steel, sodicity, textural classification and salinity.

A result summary table (Appendix D) presents the results of laboratory tests, assessments of aggressivity to concrete and steel, sodicity class, textural classification, calculated salinity electrical conductivity (ECe) and salinity class inferred from ECe values using the method of Richards (1954). The detailed laboratory test reports and chain of custody information are also provided in Appendix D.

The total test sample numbers and the range of test results obtained are summarised in Table 4.

Table 4: Results of Laboratory Testing - Chemical

Parameter		Units	Number of Tests	Range of Results
pH		pH units	9	4.6 – 8.3
Chlorides		(mg/kg)	8	<10 – 630
Sulphates		(mg/kg)	8	28 – 230
Aggressivity [AS 2159]	to Concrete	-	-	non-aggressive to mildly aggressive
	to Steel	-	-	non-aggressive
Exchangeable Sodium (Na)		(meq/100g)	11	<0.1 – 1.8
CEC (cation exchange capacity)		(meq/100g)	11	4.7 - 36
Sodicity [Na/CEC]		(ESP%)	11	<1 - 29
Sodicity Class		[after DLWC]	11	Non - Sodic to Highly Sodic
EC1:5 [Lab.]		(mS/cm)	15	52 - 760
ECe [M x EC1:5] [1]		(dS/m)	15	<2 – 6.8
Salinity Class [after Richards]		-	15	Non-Saline to Moderately Saline

Notes: 1 M is soil textural factor

5.2.1 Aggressivity

Test results showing the aggressivity assessed by pH, sulphate concentrations and chloride concentration criteria (of AS 2159) at the borehole locations, together with the aggressivity class ranges indicated in Australian Standard AS 2159 are given in Appendix D. The inferred very low permeability of the sampled clay-rich soils indicates that soils at all boreholes are in Condition “B” as defined by AS 2159.

The results show that the samples tested indicate the ground conditions are non-aggressive to mildly aggressive to concrete and non-aggressive to steel with reference to AS2159. The pH profiles with depth are shown in Figure 2 (following page).

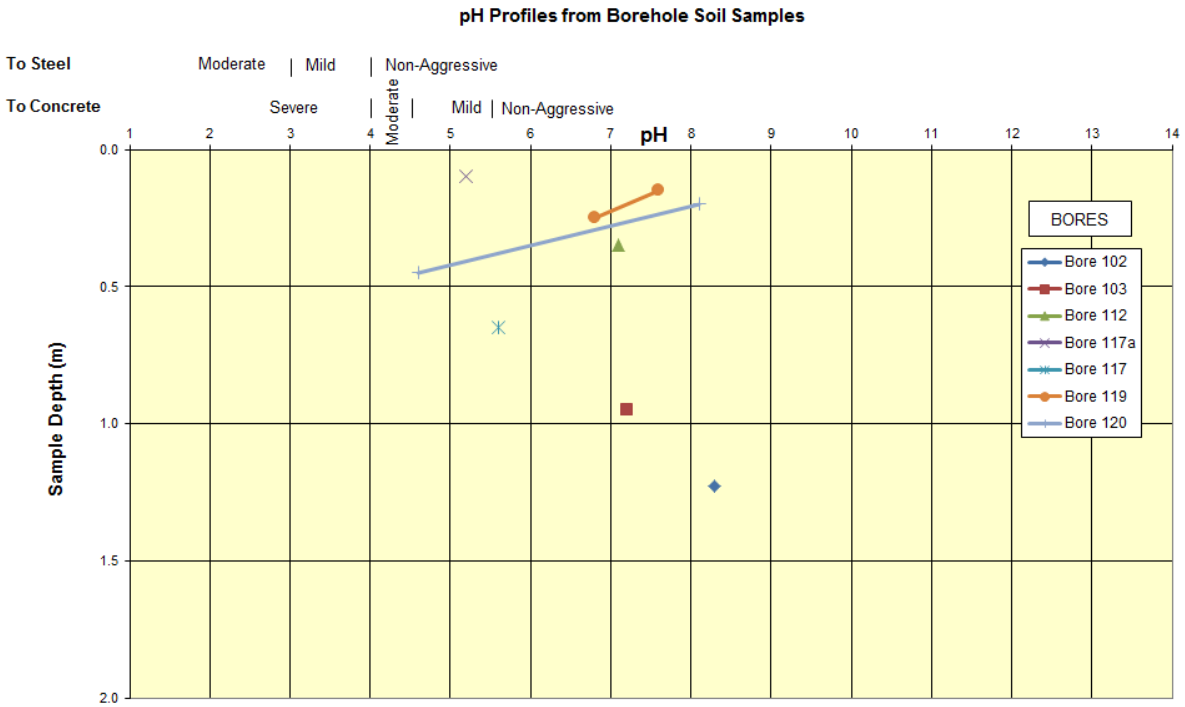


Figure 2: Vertical pH Profiles

5.2.2 Salinity

Figure 3 (following page) shows the salinity classifications based on the electrical conductivity (ECe) at borehole locations, together with the salinity classifications of Richards (1954). Test results are provided in Appendix D.

The results indicate that the samples tested were varied ranging from non-saline to moderately saline.

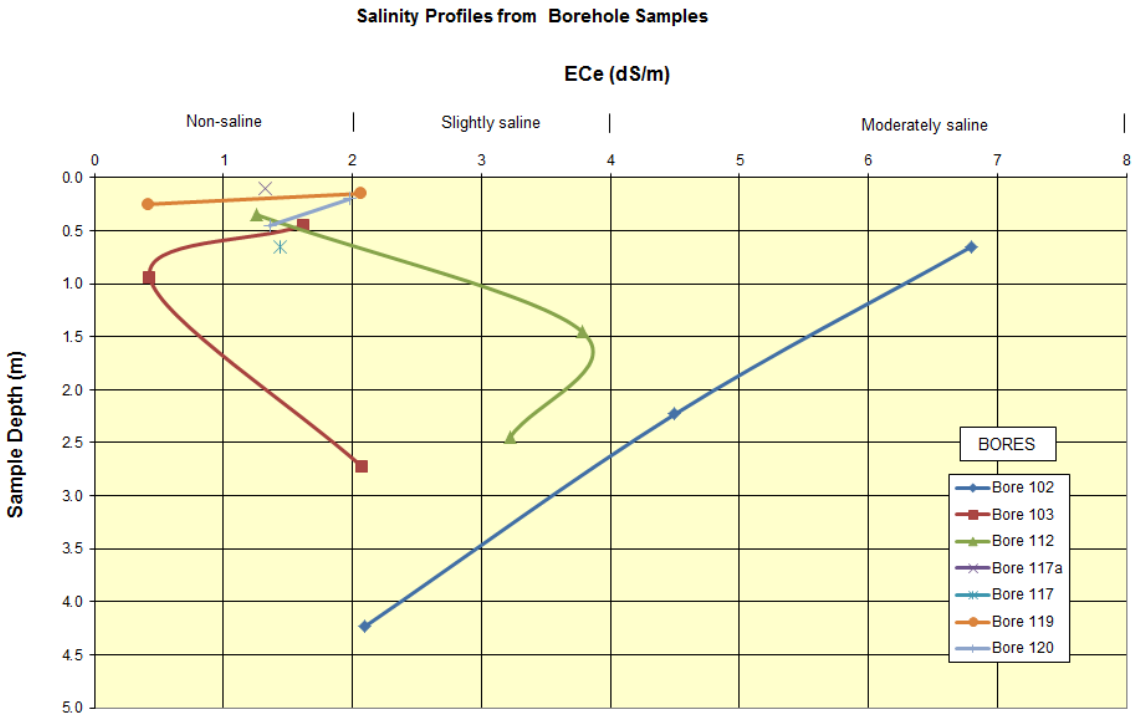


Figure 3: Vertical Salinity Profiles and Salinity Classes

5.2.3 Sodicity

The sodicity test results (refer Appendix D) indicates non-sodic to highly sodic soils, indicating a high potential for erosion of soils left exposed.

5.2.4 Rock Samples

Point Load Strength Index (Is_{50}) testing was carried out on selected rock core specimens. The results of the tests are shown on the borehole logs at the appropriate depths. Figure 4 (following page) shows the range of Is_{50} results at the various depths (shown as Reduced Levels relative to AHD).

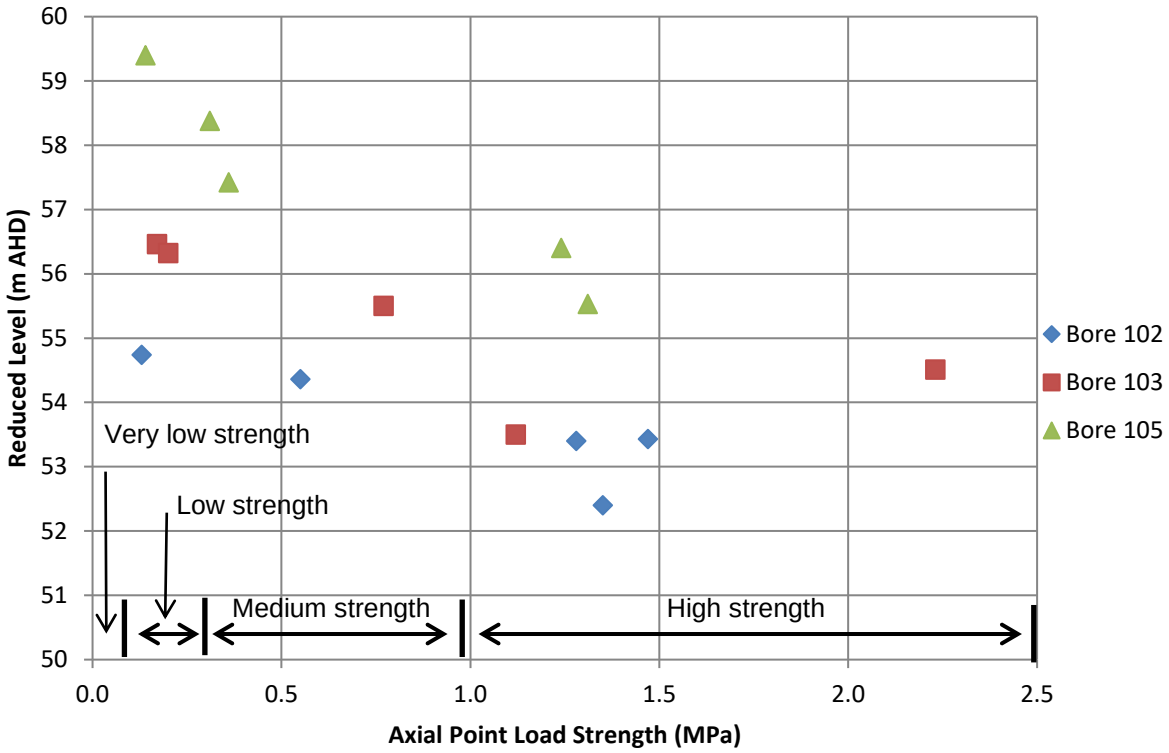


Figure 4: Results of Axial Point Load Tests

6. Proposed Development

The proposed development seeks to upgrade Glenwood High School. The upgrade consists of the following alterations and additions:

- Construction of a new three-storey building at the north-eastern portion of the site facing Glenwood Park Drive which will accommodate approximately 54 learning spaces.
- Construction of one storey performance pavilion;
- Refurbishment of existing Building Block A (ground floor only) to provide one new support unit within the space of an existing general learning space;
- Refurbishment of Building Block D (ground floor only) to provide an additional office space and storeroom;
- Refurbishment of Building Block E to re-purpose it on the ground floor for computer learning spaces, staff and administration as well as upgrades to the library on the first floor;
- Refurbishment of Building Block J to re-purpose it from visual arts and performing arts to learning spaces and workshops for food tech and woods/metal unit;
- Demolition of existing botany room and construction of a new single storey pavilion comprising of interview rooms and end-of trip facilities; and

- The proposed development will also involve ancillary works at the site associated with the proposed upgrades

This report relates only to the construction of the three storey building in the north-east corner of the site. Based on information provided, it is expected that column loads for the new building will be in the order of 2000 kN. For the purpose of this report, a maximum of 1.5 m of cut and fill has been assumed.

7. Comments

7.1 Geotechnical Model

The site is underlain generally by up to about 0.1 m of topsoil fill or up to about 0.9 m of fill, overlying stiff natural clays, with siltstone bedrock at depths of between 1.8 m and 4.6 m. The siltstone bedrock typically increased in strength from very low to high strength with increasing depth. The depths to rock were observed to decrease with an increase in distance from the Caddies Creek system. The fill material on-site appears uncontrolled. The clays on site are typically reactive and of high plasticity.

Groundwater was observed in two boreholes located at the northern end of the site at depths of 1.6 m and 3.3 m. Groundwater levels are expected to fluctuate with variations in climatic conditions.

7.2 Preliminary Site Classification

The results of field work indicate that the site is underlain by topsoil fill or fill (up to about 0.9 m depth) overlying alluvial and residual clay soils then weathered rock. Furthermore, the development areas across the site are located in close proximity to trees. Where mature trees are located near the proposed building and extension footprints, a “P” classification would be assigned to the site in accordance with the abnormal moisture provisions and uncontrolled fill greater than 0.4 m thick of AS2870 – 2011 “Residential Slabs and Footings”. Class P sites require design from engineering principles.

The laboratory testing indicates that the clays at the site are of high plasticity and therefore likely to be susceptible to shrink-swell movements in response to seasonal variations in soil moisture content. Based on the soil depth, and the results of laboratory testing, it is considered that the natural soil profile would generally be consistent with a Class “H2” site as per AS 2870. AS2870 indicates that characteristic surface movements (y_s) of up 75 mm are expected for a Class “H2” site.

For high-level footings, the effect of adjacent trees needs to be considered in the design. Using the methods of AS2870, an additional 10 mm to 15 mm of movement should be allowed for within the design of the footings where trees up to 15 m in height are within 5 m of the proposed structure.

7.3 Site Preparation and Earthworks

7.3.1 Excavation Conditions

Excavation to depths of up to 1.5 m is generally expected to encounter topsoil, fill, natural soils and possibly some very low strength bedrock in the vicinity of Bore 105. Excavation within the soils and any very low strength rock should be achievable using conventional earthmoving equipment such as hydraulic excavators.

Excavation works adjacent to existing buildings require further investigation to establish the existing footing depths and if there is potential to undermine these footings. If it is established that footings will undermine existing structures then underpinning works would need to be carried out.

Vibration generated during earthworks operations would generally be at a level that would not adversely affect the neighbouring structures.

All excavated materials disposed of off-site will need to be classified in accordance with the provisions of the current legislation and guidelines including the *Waste Classification Guidelines* (EPA, 2014). This includes topsoil, fill and natural materials that may be removed from the site. Reference should be made to Section 8.3 of DP's DSI report for further comments on preliminary waste classification.

7.3.2 Site Preparation

For planning purposes, the following site preparation measures are recommended for subgrade preparation and any site platform filling placement for the development:

- remove any deleterious, soft, wet or highly compressible material or material rich in organics or root matter (such as topsoils). Based on DP's investigation this will typically range from 0.1 m to 0.2 m depth. Topsoil materials should be separately stockpiled for use in landscaping or removed off site. Fill materials could potentially be reused on-site subject to geotechnical inspection and approval;
- roll the exposed surface with at least six passes of a minimum 12 tonne deadweight smooth drum roller, with a final test roll pass accompanied by careful visual inspection to ensure that any deleterious materials such as soft, wet or highly compressible soil and any organics are identified and removed;
- place approved filling, where required, in layers not exceeding 250 mm loose thickness, with each layer compacted to a minimum dry density ratio of 98% Standard within 2% of optimum moisture content (OMC) and to a minimum dry density ratio of 100% Standard within 0.5 m of subgrade or floor slab levels. New filling should be free of oversize particles (>75mm) and deleterious material;
- moisture conditioning of clay soils may be required if soils are saturated or dry. Moisture conditioning of saturated soils would involve drying in 'sunny and windy' weather, blending with other drier materials or lime stabilisation. Where the soil is dry, it is expected that this will involve either tyning or excavation with the addition of water to increase the moisture content;
- promptly cover any exposed clay at subgrade level with a minimum 150 mm of select granular fill (minimum CBR 15%) to reduce potential wetting and drying and trafficability problems; and
- new filling required to achieve design levels for support of any on-ground slabs and/or structural loads will need to be carried out under Level 1 testing conditions as defined in AS 3798–2007

"Guidelines on Earthworks for Commercial and Residential Developments". Level 2 testing is recommended for filling materials beneath pavements, recreational and landscaping areas.

The above procedures will require geotechnical inspection and testing services during construction.

7.4 Excavation Support

7.4.1 Batter Slopes

Excavation for the proposed building and pavement area is likely to be predominantly within fill and clays.

The soils exposed in cut will not be able to stand vertically without support in the longer term. Where space permits, it will be possible to batter the sides of the excavation and in these conditions, it is suggested to allow for temporary side slopes of 1H:1V in the stiff or stronger clays.

A maximum batter slope of 3H:1V is recommended for permanent slopes in the clays to allow for maintenance, provided that the slopes are protected against surface erosion and local slumping. The batter slopes recommended above are appropriate provided there are no surcharge loads from structures near the top of the batters.

All battered slopes will need to have appropriate drainage measures installed to limit the potential for slopes to be adversely affected by water runoff.

7.4.2 Retaining Walls

Where there is insufficient room to batter the sides of the excavations, the construction of retaining walls will be required for long term support. Cantilevered retaining walls will generally be suitable where some lateral movement can be tolerated at the crest of the wall.

Cantilevered retaining walls up to 1.5 m high, for which some deflection is acceptable, may be designed on the basis of a triangular earth pressure distribution using a bulk unit weight of 20 kN/m^3 for the retained material, and an active earth pressure coefficient (K_a) of 0.3 (level backfill conditions). In situations where the wall movements must be minimised or reduced, an 'at rest' earth pressure coefficient (K_0) of 0.6 should be used. Allowance should be made for surcharge pressures acting on the walls (e.g. sloping backfill, vehicle loads etc.).

Drainage should be included behind retaining walls to prevent the build-up of hydrostatic pressure.

7.5 Foundations

All structural loads will need to be supported on a uniform founding layer being either natural clays/controlled engineering fill, or siltstone bedrock.

Shallow footings (e.g. pad or strip footings) founded on controlled fill or stiff natural clays prepared in accordance with Section 7.3.2 could be designed for an allowable bearing pressure of 150 kPa. The

design of shallow footings should also take account of shrink-swell movements associated with the site classification outlined in Section 7.2.

If higher structural loads are proposed, or resultant settlements are beyond tolerable limits, then a deep-footing system, probably founding on weathered rock, would be required. Given the relatively high groundwater levels encountered on-site, bored piles with temporary or permanent liners (i.e. casing) may be required to manage issues associated with possible water seepage. Alternatively, piles may be constructed using continuous flight auger (CFA) piles.

Recommended design parameters for footings founding on rock are presented in Table 5.

Table 5: Maximum Foundation Design Parameters

Unit	Working Stress Design Values		Limit State Design Values		Elastic Modulus (MPa)
	Allowable End Bearing Pressure (kPa)	Shaft Adhesion (kPa)	Ultimate End Bearing Pressure (kPa)	Shaft Adhesion (kPa)	
Very Low to Low Strength Siltstone	1000	100	3000	300	100
Low to Medium Strength Siltstone	2000	200	18,000	450	800
High Strength Siltstone	3500	350	30,000	600	1200

A geotechnical strength reduction factor (ϕ_g) should be applied to the ultimate values provided in Table 5 if the limit-state design process is undertaken to design the piles. Australian Standard AS 2159:2009 "Piling – Design and Installation" (2009) provides information on how to determine an appropriate value of ϕ_g which is based on a risk assessment. The pile designer will need to confirm a ϕ_g value when the piling contractor is selected, however it is suggested that a preliminary value of 0.5 be adopted at this stage.

The total (long-term) settlement of a piled footing designed using the allowable parameters provided in this report should be less than about 1% of the pile diameter upon application of the design dead load. Serviceability analysis should be undertaken if the ultimate bearing pressures (incorporating a suitable reduction factor) are used to proportion the piles.

Over the designated 'socket length', the sidewalls of bored piles should be clean and free of clay 'smear'. Also, the sidewalls should meet the minimum roughness category of "R2" (defined as grooves of 1 to 4 mm depth and width greater than 2 mm, at a spacing of 50 mm to 200 mm) in Pells et.al (1998). A 'grooving' or 'roughening' tool may be required to achieve this criterion.

The foundation parameters provided in this report assume all footings are free of water and loose debris immediately prior to pouring concrete. All foundations should be constructed below the zone of influence of any existing or proposed service trenches. The zone of influence can be conservatively defined by a plane extending upwards at 45° from the base of the service trench.

All footings in one structure should be founded on the same strata to achieve uniform founding conditions and limit the potential for differential movement between different parts of the structure.

It is recommended that all footing excavations be inspected by an experienced geotechnical engineer or engineering geologist prior to the placement of concrete and steel to confirm the design bearing pressure.

7.6 Floor Slabs

Where buildings are to be designed with a suspended floor slab, site preparation measures will be minimal. If slabs are to be cast on ground (but designed as suspended slabs), then checks should be made to ensure that concrete is not poured onto softened or wet ground that could lead to deformation of the slab. Furthermore, in areas where clay is present, to reduce the potential for swelling of soils beneath the slab, the top 100 mm of the ground surface should be scarified and loosed prior to forming up for the slab. Alternatively, void formers could be used.

Where site preparation is undertaken in accordance with Section 7.3.2, on-grade slabs could be constructed in place of suspended slabs. Based on the results of the subsurface investigations, subgrade conditions are expected to be formed over natural clay and/or clay filling.

Floor slabs (slab-on-ground) should be cast independently of pads or pile and beam footings, and incorporate control joints to allow for differential movements. Edge protection, such as deepened stiffening edge beams in conjunction with surface paving should also be included to minimise the effects of reactivity movements due to the high reactivity of the site clays.

7.7 Seismic Design

In accordance with Part 4 of the Structural design actions Standard, AS1170.4 – 2007, the site is assessed to have a Site Sub-Soil Class of "C_e". This is in accordance with the definitions presented in Section 4.2 – Class Definitions of the Standard.

7.8 Pavements

Based on the highly reactive clays on-site, concrete pavements and ground slabs should be articulated to allow for differential movement together with a drainage system to limit the potential for shrink-swell movements that could potentially damage pavements.

Laboratory testing for CBR and compaction was carried out on two representative bulk samples of natural clay recovered from the estimated subgrade level of the proposed carpark. The CBR values obtained were 5% and 6%, however, experience in the area suggests CBR values in the range of 2-4%. Allowing for variability of results, it is suggested that the design of pavements be based on a design CBR value of 3%. If imported material is used to level the site and form subgrade levels, the design CBR value will depend on the type and depth of imported material. Pavements should be placed on a subgrade prepared in accordance with the recommendations provided in Section 7.3.2.

The design CBR value given above depends on the provision of adequate surface and subsoil drainage to maintain the subgrade as close to OMC as possible. Subsoil drainage should be installed to not less than 500 mm depth below subgrade level adjacent to the pavement. Preparation of subgrade surfaces should be such that adequate cross-falls for the surface drainage purposes are achievable across the final pavement.

7.9 Site Maintenance and Drainage

Surface and subsurface drainage for the building should be incorporated into the design.

Care should be taken to avoid external influences on the soil moisture-regime to prevent erosion and softening of the exposed soils. Detailing of surface and subsurface drainage should be aimed at avoiding substantial wetting of the soils beneath building and pavement areas. Surface water should be directed away from building or hardstand areas and the upper section of services trenches should be backfilled with compacted clay soil to avoid the trench acting as an inlet drain.

Site trafficability during dry weather should pose no problems, however inclement weather may cause clayey soils to soften and become unsuitable for construction traffic until the site conditions dry. In areas where high levels of construction traffic are expected, a temporary hardstand comprising crushed rock could be constructed to aid in trafficability during wet weather.

A copy of the CSIRO Building Technology File BTF 18 entitled, 'Foundation Maintenance and Footing Performance, A Homeowners Guide', which further describes appropriate site maintenance requirements set out within Appendix B of AS2870 is included in Appendix E.

7.10 Salinity

7.10.1 Impact of the Saline Soils on the Proposed Development

The mild aggressivity to concrete, the presence of slightly to moderately saline soils and the highly sodic soils are naturally occurring features of the local landscape and are not considered significant impediments for future development of the site, provided appropriate remediation or management techniques are employed.

Salinity and aggressivity affects the durability of concrete and steel by causing premature breakdown of concrete and corrosion of steel. This has impacts on the longevity of structures in contact with these materials. As a result management will be required.

Sodic soils have low permeability due to infilling of interstices with fine clay particles during the weathering process, restricting infiltration of surface water and potentially creating perched water tables, seepage in cut faces or ponding of water in flat open areas. In addition, sodic soils tend to erode when exposed. Management of sodic soils would therefore be required to prevent these adverse effects.

7.10.2 Salinity Management Plan

The current salinity investigation indicates that materials within the site range from non-saline to moderately saline with near-surface soils (within 0.5 m of the existing ground surface) generally non-saline. Testing of other parameters associated with salinity indicates that the materials are non – aggressive to mildly aggressive to concrete and non-aggressive to steel. In addition, shallow soils were highly sodic.

The amount of information regarding the distribution of salinity across the site is limited. Therefore, the management strategies assume the most conservative approach of moderately saline soils being present across the site.

The following management strategies are confined to the management of those factors with a potential to impact on the development:

A. Management should focus on capping of the upper surface of the sodic soils, both exposed by excavation and placed as filling, with a more permeable material to prevent ponding, to reduce capillary rise, to act as a drainage layer and to reduce the potential for erosion.

B. With respect to any required imported filling, which is expected to be only in small quantities, testing should be undertaken prior to importation, to determine the salinity characteristics of the material, which should not be greater than mildly-aggressive and, where possible, but should not be greater than “moderately saline” in classification.

C. Sodic soils can also be managed by maintaining vegetation where possible and planting new salt tolerant species. The addition of organic matter, gypsum and lime can also be considered where appropriate. After gypsum addition, reduction of sodicity levels may require some time for sufficient infiltration and leaching of sodium into the subsoils, however capping of exposed sodic material should remain the primary management method. Topsoil added at the completion of construction is, in effect, also adding organic matter which may help infiltration and leaching of sodium.

D. Avoiding water collecting in low lying areas, in depressions, or behind fill. This can lead to water logging of the soils, evaporative concentration of salts, and eventual breakdown in soil structure resulting in accelerated erosion.

E. Any pavements should be designed to be well drained of surface water. There should not be excessive concentrations of runoff or ponding that would lead to waterlogging of the pavement or additional recharge to the groundwater through any more permeable zones in the underlying filling material.

F. Surface drains should generally be provided along the top of batter slopes to reduce the potential for concentrated flows of water down slopes possibly causing scour.

G. Salt tolerant grasses and trees should be considered for landscaping in the drainage reserve, to reduce soil erosion and to maintain the existing evapo – transpiration and groundwater levels. Reference should be made to an experienced landscape planner or agronomist.

The following additional strategies are recommended for completion of service installation and for building construction. These strategies should be complementary to standard good building practices recommended within the Building Code of Australia, including cover to reinforcement within concrete and correct installation of a brick damp course, so that it cannot be bridged to allow moisture to move into brick work and up the wall.

H. Soils are classified as mildly aggressive to non-aggressive to concrete. Concrete piles, cast-in place, exposed to mildly aggressive soils should have a minimum strength of 32 MPa and a minimum cover to reinforcement of 60 mm (as per AS2159) to limit the corrosive effects of the surrounding soils (in accordance with AS2159).

I. With regard to concrete structures exposed to moderately saline soils with salinities in the range 4 dS/m to 8 dS/m that are classified as mildly aggressive to concrete (AS3600 – A2), slabs and foundations should have a minimum strength of 25 MPa, a minimum cover to reinforcement of 45 mm from unprotected ground and should be allowed to cure for a minimum of three days (as per AS3600) to limit the corrosive effects of the surrounding soils.

J. Wet cast concrete pipes and currently manufactured spun concrete pipes are understood to have estimated compressive strengths of 50 MPa and 60 – 70 MPa, respectively, in excess of the requirements for mass concrete in H to J above. Reference to the maximum and minimum test results of Table 4 (Section 6.2 of this report) and to Tables E1 and 3.1 of AS 4058 – 2007 "Precast concrete pipes" indicates that the site falls within the AS 4058 Clay/Stagnant (low sulphate) soil type (chlorides <=20,000 ppm, pH>=4.5 and sulphates <=1,000 ppm) and (in the absence of tidal water flow) falls within the AS 4058 Normal durability environment. Under these conditions, AS 4058-compliant reinforced concrete pipes of general purpose Portland cement, with a minimum cover to reinforcement of 10 mm, are expected to have a design life in excess of 100 years. Any concrete pipes installed within the site should employ AS 4058-compliant steel reinforced pipes of general purpose Portland cement, with minimum cover to reinforcement of 10 mm, or should be fibre reinforced.

8. References

- AS 1170 (2007) *Structural Design Actions, Part 4: Earthquake Actions in Australia*, Standards Australia
- AS 1726 (2017) *Geotechnical Site Investigations*, Standards Australia
- AS 2159 (2009) *Piling Design and Installation,* Standards Australia
- AS 2870 (2011) *Residential Slabs and Footings*, Standards Australia
- AS 3798 (2007) *Guidelines on Earthworks for Commercial and Residential Developments*, Standards Australia
- AS 4678 (2002) *Earth-retaining Structures*, Standards Australia
- Blacktown City Council (2005) *Engineering Guide to Development*
- Blacktown City Council (2005) Civil *Works Specification*
- Clark and Jones (1991) Penrith *1: 100 000 Geological Sheet* 9030 1st edition, Geological Survey of New South Wales, Sydney
- Department of Infrastructure, Planning and Natural Resources, *Salinity Potential in Western Sydney* (2002), NSW Government.
- NSW Department of Minerals and Energy, Penrith Geological Series Sheet No 9030 (1991), NSW Government.

- Pells, Mostyn and Walker (1998) *Foundations on Sandstone and Shale in the Sydney Region*, Australian Geomechanics Society
- Richards, L. A. (ed.) (1954), Diagnosis and Improvement of Saline and Alkaline Soils, USDA Handbook No. 60, Washington D.C.
- Walker and Pells (1998) *The Construction of Bored Piles Socketed into Shale and Sandstone*, Australian Geomechanics Society

9. Limitations

Douglas Partners (DP) has prepared this report for this project at 85 Forman Avenue, Glenwood in accordance with DP's proposal NWS200105 dated 15 July 2020. The work was carried out under DP's Conditions of Engagement. This report is provided for the exclusive use of the NSW Department of Education for this project only and for the purposes as described in the report. It should not be used by or relied upon for other projects or purposes on the same or other site or by a third party. Any party so relying upon this report beyond its exclusive use and purpose as stated above, and without the express written consent of DP, does so entirely at its own risk and without recourse to DP for any loss or damage. In preparing this report DP has necessarily relied upon information provided by the client and/or their agents.

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

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

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

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

The scope for work for this investigation/report did not include the assessment of surface or sub-surface materials or groundwater for contaminants, within or adjacent to the site. Should evidence of filling of unknown origin be noted in the report, and in particular the presence of building demolition materials, it should be recognised that there may be some risk that such filling may contain contaminants and hazardous building materials.

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

Douglas Partners Pty Ltd

Appendix A

About This Report

About this Report

Douglas Partners

Introduction

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

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

Copyright

Borehole and Test Pit Logs

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

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

Groundwater

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

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

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

Reports

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

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

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

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

About this Report

Site Anomalies

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

Information for Contractual Purposes

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

Site Inspection

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

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS – Page 1

Major Divisions				Description		Field Identification			
				Group Symbol*	Typical Name	Grading		Nature of Fines	Dry Strength
COARSE-GRAINED SOILS	More than 65% by dry mass, (excluding that larger than 63 mm) is greater than 0.075 mm	GRAVEL	More than 50% of coarse grains are greater than 2.36 mm	GW	Well graded gravels and gravel-sand mixtures, little or no fines.	Good	Wide range in grain size	'Clean' materials (not enough fines to bind grains)	None
				GP	Poorly graded gravels and gravel-sand mixtures, little or no fines.	Poor	Predominantly one size or gap graded		
		GRAVELLY SOILS		GM	Silty gravels, gravel-sand-silt mixtures.	Good to Fair	'Dirty' materials with excess of fines	Fines are non-plastic	None to medium
				GC	Clay gravels, gravel-sand-clay mixtures.			Fines are plastic	Medium to high
		SAND	More than 50% of coarse grains are less than 2.36 mm	SW	Well graded sands and gravelly sands, little or no fines.	Good	Wide range in grain size	'Clean' materials (not enough fines to bind grains)	None
				SP	Poorly graded sands and gravelly sands, little or no fines.	Poor	Predominantly one size or gap graded		
		SANDY SOILS		SM	Silty sand, sand-silt mixtures.	Good to Fair	'Dirty' materials with excess of fines	Fines are non-plastic	None to medium
				SC	Clayey sands, sand-clay mixtures.			Fines are plastic	Medium to high
* For coarse grained soils where the fines content is between 5% and 12%, the soil shall be given a dual classification eg GP-GM.						Dry Strength		Dilatancy	Toughness
FINE-GRAINED SOILS	More than 35% by dry mass, (excluding that larger than 63 mm) is less than 0.075 mm	Liquid Limit less than 35%		ML	Inorganic silts, very fine sands, rock flour, silty or clayey fine sands.	None to low		Slow to rapid	Low
				CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high		None to slow	Medium
				OL	Organic silts and organic silty clays of low plasticity	Low to medium		Slow	Low
		35% <LL< 50%		CI	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays.	Medium to high		None to slow	Medium
		Liquid Limit greater than 50%		MH	Inorganic silts, micaceous or diatomaceous fine sands or silts, elastic silts.	Low to medium		None to slow	Low to medium
				CH	Inorganic clays of high plasticity, fat clays.	High to very high		None	High
				OH	Organic clays of medium to high plasticity.	Medium to high		None to very slow	Low to medium
				Pt	Peat muck and other highly organic soils.	Readily identified by colour, odour, spongy feel and generally fibrous texture			

ORDER OF DESCRIPTION

In the soil description the terms should be given in the following order:

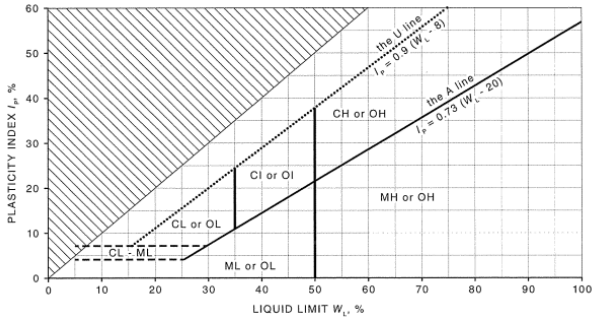
- SOIL NAME & UNIFIED CLASSIFICATION SYMBOL.
- Plasticity, behavioural or particle characteristics of the primary soil component
- Colour
- Secondary soil components' name(s), estimated proportion(s), plasticity, behavioural or particle characteristics, colour and where practical, its plasticity
- Moisture Condition (disturbed or undisturbed state)
- Consistency of fine-grained soils (undisturbed state only)
- Relative density of coarse-grained soils (determined by in situ tests)
- Structure of soil (in undisturbed state)
  - Zoning
  - Defects
  - Cementing
- Origin of soil
- Additional observations

EXAMPLES:

Silty SAND SM: fine to coarse grained, light brown, 15% non-plastic fines, with gravel, 20% angular particles, moist, apparently dense in place, alluvial.

SILT ML: low plasticity, brown, trace fine sand, w > PL, firm, estuarine.

PLASTICITY CHART (after AS 1726:2017)



The classification system excludes the boulder and cobble fractions of the soil and classifies only the materials less than 63 mm in size.

PARTICLE SIZES

Boulders	> 200 mm
Cobbles	63 mm to 200 mm
Gravel	2.36 mm to 63 mm
Sand	0.075 mm to 2.36 mm
Silt and Clay	< 0.075 mm

SAND			SILT
COARSE	MEDIUM	FINE	SILT
2.36-0.6 mm	0.6-0.2 mm	0.2-0.075 mm	0.075-0.002 mm
			

DATA FOR DESCRIPTION AND CLASSIFICATION OF SOILS – Page 2

GRAVEL

Density	Field Test
LOOSE	By inspection of voids and particle packing.
DENSE	

SAND

Density	Field Test	DPT Blows per 300 mm[1]		SPT N Blows	CPT q_c MPa	Relative Density %	Estimated Friction Angle
		Dry[2]	Wet[3]				
VERY LOOSE	Easily penetrated with 13 mm reinforcing rod pushed by hand.	< 1	0	0 – 4	0 – 2	0 – 15	25 - 30
LOOSE	Easily penetrated with 13 mm reinforcing rod pushed by hand. Can be excavated with a spade; 50 mm wooden peg can be easily driven.	1 - 3	< 1	4 – 10	2 – 5	15 – 35	27 - 32
MEDIUM DENSE	Penetrated 300 mm with 13 mm reinforcing rod driven by 2 kg hammer – hard shovelling.	3 - 8	1 - 6	10 – 30	5 – 15	35 – 65	30 - 35
DENSE	Penetrated 300 mm with 13 mm reinforcing rod driven with 2 kg hammer, requires pick for excavation; 50 mm wooden peg hard to drive	8 – 15	6 - 10	30 – 50	15 – 25	65 – 85	35 - 40
VERY DENSE	Penetrated only 25 – 50 mm with 13 mm reinforcing rod driven by 2 kg hammer.	> 15	> 10	> 50	> 25	85 – 100	38 - 43

[1]Valid for depths up to approx 1m bgl; [2]At a mc of approx. 3%-5%; [3]At a mc of approx. 15%.

SILT & CLAY

Consistency	Field Test		DCP Blows per 150 mm	SPT N Blows	Undrained Shear Strength C_u Shear Vane (kPa)	Unconfined Compressive Strength q_u PP* (kPa)	CPT q_c kPa
VERY SOFT	Easily penetrated > 40 mm by thumb. Exudes between thumb and fingers when squeezed in hand	Shear Vane Preferred	< 1	< 2	< 12	< 25	0 - 180
SOFT	Easily penetrated 10 mm by thumb. Moulded by light finger pressure.		1 – 1.5	2 – 4	12 – 25	25 – 50	180 - 375
FIRM	Impression by thumb with moderate effort. Moulded by strong finger pressure		1.5 – 3	4 – 8	25 – 50	50 – 100	375 - 750
STIFF	Slight impression by thumb cannot be moulded with finger		3 – 6	8 – 16	50 – 100	100 – 200	750 - 1500
VERY STIFF	Very tough. Readily indented by thumbnail.		6 – 12	16 – 32	100 – 200	200 – 400	1500 - 3000
HARD	Brittle. Indented with difficulty by thumbnail.		> 12	> 32	> 200	> 400	> 3000
FRIABLE	Easily crumbled or broken into small pieces by hand.						

* Pocket Penetrometer (**PP**) may overestimate q_u by a factor of 1.5 to 2.0.

Note: Visual-tactile assessment is indicative only. Use in-situ testing for logging

MOISTURE OF FINE GRAINED SOILS

Moist, dry of plastic limit	w < PL	Wet, near liquid limit	w ≈ LL
Moist, near plastic limit	w ≈ PL	Wet, wet of liquid limit	w > LL
Moist, wet of plastic limit	w > PL		

DEGREE OF SATURATION OF SANDS

Condition of Sand	Criteria	Degree of Saturation (%)
Dry	Non-cohesive and free-running	0 – 25%
Moist	Feels cool, darker colour, grains tend to adhere to one another	25 – 75%
Wet	Feels cold, makes hands wet, should be close to water table	75 – 99%

FIELD IDENTIFICATION PROCEDURE FOR FINE GRAINED SOILS OR FRACTIONS

These procedures are to be performed on the minus 0.4 mm sieve size particles. For field classification purposes, screening is not intended, simply remove by hand the coarse particles that interfere with the tests.

Dilatancy (Reaction to shaking):

After removing particles larger than 0.4 mm sieve size, prepare a pat of moist soil with a volume of about 8000 mm^3. Add enough water if necessary to make the soil soft but not sticky. Place the pat in the open palm of one hand and shake horizontally, striking vigorously against the other hand several times. A positive reaction consists of the appearance of water on the surface of the pat which changes to a livery consistency and becomes glossy. When the sample is squeezed between the fingers, the water and gloss disappear from the surface, the pat stiffens and finally it cracks or crumbles. The rapidity of appearance of water during shaking and of its disappearance during squeezing assist in identifying the character of the fines in a soil. Very fine clean sands give the quickest and most distinct reaction whereas a plastic clay has no reaction. Inorganic silts, such as a typical rock flour, show a moderately quick reaction.

Dry Strength (Crushing characteristics):

After removing particles larger than 0.4 mm sieve size, mould a pat of soil to the consistency of putty, adding water if necessary. Allow the pat to dry completely by oven sun or air drying, and then test its strength by breaking and crumbling between the fingers. This strength is a measure of the character and quantity of the colloidal fraction contained in the soil. The dry strength increases with increasing plasticity.

High dry strength is characteristic for clays of the CH group. A typical inorganic silt possesses only very slight dry strength. Silty fine sands and silts have about the same dry strength but can be distinguished by the feel when powdering the dried specimen. Fine sand feels gritty whereas a typical silt has the smooth feel of flour.

Toughness (Consistency near plastic limit):

After removing particles larger than the 0.4 mm sieve size, a specimen of soil about 12 mm cube in size, is moulded to the consistency of putty. If too dry, water must be added and if sticky, the specimen should be spread out in a thin layer and allowed to lose some moisture by evaporation. Then the specimen is rolled out by hand on a smooth surface or between the palms into a thread about 3 mm in diameter. The thread is then folded and re-rolled repeatedly. During this manipulation the moisture content is gradually reduced, and the specimen stiffens, finally loses its plasticity, and crumbles when the plastic limit is reached. After the thread crumbles, the pieces should be lumped together, and a slight kneading action continued until the lump crumbles.

The tougher the thread near the plastic limit and the stiffer the lump when it finally crumbles, the more potent is the colloidal clay fraction in the soil. Weakness of the thread at the plastic limit and quick loss of coherence of the lump below the plastic limit indicate either inorganic clay or low plasticity, or materials such as kaolin-type clays and organic clays which occur below the A-line.

Highly organic clays have a very weak and spongy feel at the plastic limit.

PROPORTION OF MINOR AND SECONDARY COMPONENTS

Term	Meaning	Approximate Proportion	
		Coarse Soils	Fine Soils
Trace	Just detectable by feel or eye. Soil properties of main component virtually unaffected.	< 5% fines < 15 % coarse fraction	< 15% sand / gravel
With	Easily detectable by feel or eye. Soil properties only slightly affected by minor components.	5% – 12% fines 15% – 30% coarse fraction	15% – 30% sand / gravel
Prefix	Easily detected by feel or eye. Soil properties significantly affected by secondary components.	> 12% fines > 30% coarse fraction	> 30% sand / gravel

PROPORTIONS OF SECONDARY COMPONENTS

5%	12%	35%
		

DATA FOR DESCRIPTION AND CLASSIFICATION OF ROCK

SEDIMENTARY ROCK TYPE DEFINITIONS

Rock Type	Definition
Conglomerate	More than 50% of the rock consists of gravel sized (greater than 2 mm) fragments.
Sandstone	More than 50% of the rock consists of sand sized (0.06 mm to 2 mm) grains.
Siltstone	More than 50% of the rock consists of silt-sized (less than 0.06 mm) granular particles and the rock is not laminated.
Claystone	More than 50% of the rock consists of clay or sericitic material and the rock is not laminated.
Shale	More than 50% of the rock consists of silt or clay sized particles and the rock is laminated.

Rocks possessing characteristics of two groups are described by their predominant particle size with reference also to the minor constituents, e.g. Clayey SANDSTONE, Sandy SHALE.

DEGREE OF WEATHERING

Term	Abbreviation	Definition
Residual soil	RS	Material is weathered to such an extent that it has soil properties. Mass structure, material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered	XW	Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	HW	The whole of the rock is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching or may be decreased due to deposition of weathering products in pores.
Moderately Weathered	MW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable but shows little or no change of strength from fresh rock.
Slightly Weathered	SW	Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh	FR	Rock shows no sign of decomposition of individual minerals or colour changes.

DW*

*If highly and moderately weathered rock cannot be differentiated use the term, 'Distinctly Weathered (DW)'.

ORDER OF DESCRIPTION

In the rock description the terms should be given in the following order:
ROCK NAME
Grain size and type
Colour
Fabric and texture
Inclusions and minor components
Moisture content
Durability
Strength
Weathering and/or alteration
Defects – type, orientation, spacing, roughness
Stratigraphic unit
Geological structure

STRATIFICATION

Term	Separation of Stratification Planes
Thinly laminated	< 6 mm
Laminated	6 mm to 20 mm
Very thinly bedded	20 mm to 60 mm
Thinly bedded	60 mm to 0.2 m
Medium bedded	0.2 m to 0.6 m
Thickly bedded	0.6 m to 2 m
Very thickly bedded	> 2 m

DEGREE OF FRACTURING

This classification applies to diamond drill cores and refers to the spacing of all types of natural fractures along which the core discontinuous. These include bedding plane partings, joints and other rock defects, **but exclude artificial fractures such as drilling breaks.**

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than the core diameter
Highly Fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections
Slightly Fractured	Core lengths are generally 300 mm or longer with occasional sections of 100 mm to 300 mm
Unbroken	The core contains very few fractures

ROCK STRENGTH

Rock strength is classified using the unconfined compressive strength (UCS). Where adequate UCS data are not available then the classification may be based on the Point Load Strength ($I_{S(50)}$) and refers to the strength of the rock substance in the direction normal to the bedding.

Strength Term	UCS MPa	Field Guide	Approx $I_{S(50)}$ MPa
Material less than very low strength is to be described using soil properties			
Very Low	2	Material crumbles under firm blows with sharp end of pick; can be peeled with knife. Pieces up to 30 mm thick can be broken by finger pressure.	0.1
Low	6	Easily scored with a knife; indentations 1 mm to 3 mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150 mm long by 50 mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.	0.3
Medium	20	Readily scored with a knife; a piece of core 150 mm long by 50 mm diameter can be broken by hand with difficulty.	1.0
High	60	A piece of core 150 mm long by 50 mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.	3.0
Very High	200	Hand specimen breaks with pick after more than one blow; rock rings under hammer.	10.0
Extremely High		Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.	

The approximate point load strength ($I_{S(50)}$) is based on an assumed ratio to UCS of 1:20. This ratio may vary widely and should be determined for each site and rock type.

DISCONTINUITIES / DEFECTS

The actual defect is described not the process which formed or may have formed it, e.g. 'sheared zone', not 'zone of shearing'; the latter suggests a currently active process.

Spacing*:

A measure of the spacing of discontinuities. Measure mean and range of spacings for each set where possible (do not use descriptive terms).

Thickness, openness:

Measured in millimetres normal to plane of the discontinuity.

Persistence*:

The areal extent of a discontinuity. Give trace lengths in metres.

Roughness and Shape*:

A measure of the inherent surface unevenness and waviness of the defect relative to its mean plane.

Coating or Infilling:

Clean: no visible coating or infilling.

Stained: no visible coating or infilling but surfaces are discoloured by mineral staining.

Veneer: a visible coating or infilling of soil or mineral substance but usually unable to be measured (less than 1 mm).

Patchy Veneer: if discontinuous over the plane.

Coating: a visible coating or infilling of soil or mineral substance, greater than 1 mm thick. Describe composition and thickness.

* Usually determined in field exposures

Roughness:

Very Rough
Rough
Smooth
Polished
Slickensided

Shape*:

Planar
Curved
Undulating
Stepped
Irregular

Discontinuity Spacing in Three Dimensions:

The spacing of discontinuities in exposures may be described with reference to the size and shape of rock bounded by the discontinuities.

Equidimensional	Same size in all directions
Tabular	Thickness much less than length or width
Columnar	Height much greater than cross section
Polyhedral	Irregular defects without obvious pattern

Sampling

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

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

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

Test Pits

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

Large Diameter Augers

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

Continuous Spiral Flight Augers

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

Non-core Rotary Drilling

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

Continuous Core Drilling

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

Standard Penetration Tests

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

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

The test results are reported in the following form.

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

  4,6,7
  N=13

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

  15, 30/40 mm

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

Dynamic Cone Penetrometer Tests / Perth Sand Penetrometer Tests

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

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

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

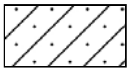
Soils


Topsoil

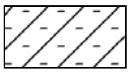

Peat


Clay

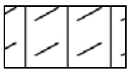

Silty clay

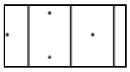

Sandy clay

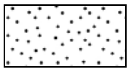

Gravelly clay

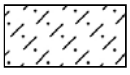

Shaly clay

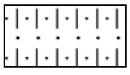

Silt


Clayey silt


Sandy silt

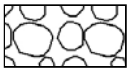

Sand

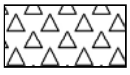

Clayey sand


Silty sand


Gravel


Sandy gravel


Cobbles, boulders

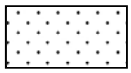

Talus

Sedimentary Rocks

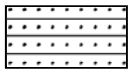

Boulder conglomerate

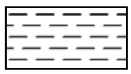

Conglomerate


Conglomeratic sandstone

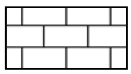

Sandstone


Siltstone


Laminite

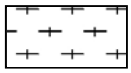

Mudstone, claystone, shale

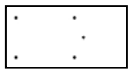

Coal


Limestone

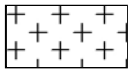
Metamorphic Rocks

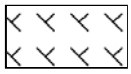

Slate, phyllite, schist

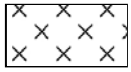

Gneiss

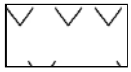

Quartzite

Igneous Rocks


Granite


Dolerite, basalt, andesite

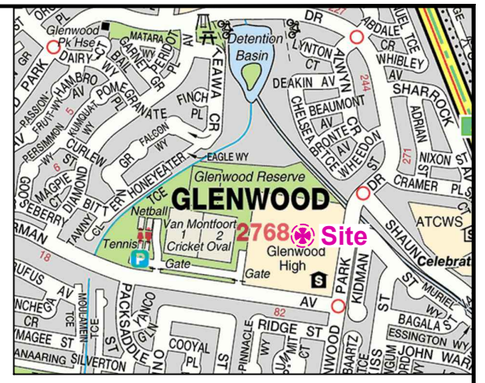

Dacite, epidote


Tuff, breccia

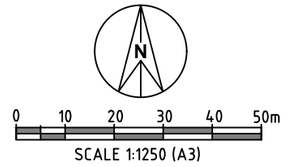

Porphyry

Appendix B

Drawing No 1



Location Plan



LEGEND

- NEW-ADMINISTRATION UNIT
- NEW-CIRCULATION
- NEW-FOOD TECH - MATERIALS LEARNING UNIT
- NEW-GENERAL LEARNING UNIT
- NEW-SHARED LEARNING SPACE
- NEW-LIBRARY UNIT
- NEW-OUTDOOR COVERED LEARNING
- NEW-PERFORMING ARTS UNIT
- NEW-PERFORM ARTS WORKSHOP
- NEW-PERFORM ARTS STORE
- NEW-SCIENCE LEARNING UNIT
- NEW-SCIENCE LABORATORY
- NEW-SCIENCE STORE
- NEW-STAFF UNIT
- NEW-STORAGE UNIT / COMMS
- NEW-STUDENT AMENITIES
- NEW-STAFF AMENITIES
- NEW-SUPPORT LEARNING UNIT
- NEW-WOOD/METAL - MATERIALS LEARNING UNIT
- EXIST-ADMINISTRATION
- EXIST-CANTEEN UNIT
- EXIST-CIRCULATION
- EXIST-FITNESS LEARNING UNI
- EXIST-GENERAL LEARNING UNIT
- EXIST-MOVEMENT COMPLEX
- EXIST-STORAGE UNIT / COMMS
- EXIST-STUDENT AMENITIES
- EXIST-SUPPORT LEARNING UNIT
- EXIST-WOOD/METAL - MATERIALS LEARNING UNIT

LEGEND:-

- Borehole location and number
- Approx. site boundary

NOTE:-

1. Test locations are approximate only and are shown with reference to existing site features.
2. Image obtained from Near Map. Date of imagery 14-07-2020.

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Geotechnics | Environment | Groundwater

CLIENT: NSW Department of Education		
OFFICE: North West Sydney	DRAWN BY: JST	
SCALE: As shown	DATE: 25 October 2021	

TITLE: **Site and Test Location Plan**
Glenwood High School Upgrade
Forman Avenue, Glenwood

PROJECT No:	94626.02
DRAWING No:	1
REVISION:	0

P:\NSW\94626.02\94626.00.D.002.Rev0.dwg

Appendix C

Results of Field Work

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.2 mAHD
EASTING: 308936
NORTHING: 6265740.1
DIP/AZIMUTH: 90°/--

BORE No: 101
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E*			
		FILL /Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL							D/E			
	0.6	Silty CLAY CH: medium to high plasticity, grey and orange-brown, w < PL, stiff, alluvial							U50			
58	1								S			5,6,8 N = 14
		1.5m: becoming pale grey mottled orange										
	2.0	Silty CLAY CL: low to medium plasticity, pale grey mottled orange, w > PL, firm to stiff, alluvial							S			2,4,4 N = 8
57	3											
	3.0	Gravelly CLAY CL: low to medium plasticity, pale grey mottled orange, with silt, ironstone and siltstone gravel, w > PL, very stiff, alluvial							S			10,11,14 N = 25
56	4											
55	4.6								S			17,10/20B refusal
	4.67	SILTSTONE: grey-brown, low strength, moderately weathered, Ashfield Shale										
		Bore discontinued at 4.67m										

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: Free groundwater observed at approximately 3.0m

REMARKS: *BD2/0200808 sampled at 0-0.1m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.4 mAHD
EASTING: 308982
NORTHING: 6265717.8
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 94626.00
DATE: 9/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.15	FILL / Topsoil: Silty Clay, brown, trace gravel, trace plastic, sand and rootlets, w > PL, surficial vegetation							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, brown, trace sand and gravel, w < PL							D/E			
	0.6	Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone gravel, w < PL, stiff, alluvial							D/E			
58	1								S			4,6,6 N = 12
	2.0	Gravelly CLAY CH: medium plasticity, pale grey mottled orange, gravel is ironstone, w > PL, stiff, alluvial							S			4,4,6 N = 10
57	2											
	3.0	Silty CLAY CH: medium plasticity, orange-brown and grey, trace ironstone gravel, w<PL, stiff, alluvial							S			4,6,7 N = 13
56	4							Note: Unless otherwise stated, defects are rough planar bedding dipping 0°- 10° some with fe stn				
		4.2m: becoming hard (extremely weathered siltstone)							S			7,15,30 N = 45
55	4.4	SILTSTONE: grey-brown, low strength, moderately weathered, Ashfield Shale						4.45 - 4.54: Cs(x3), 10 - 20 mm 4.48-4.87m: J(x3), 30-70°, he, pl, fe stn	C	100	20	PL(A) = 0.13
		4.94-5.07m: becoming medium strength, slightly weathered						4.78m: J80°, sm, pl, fe stn 4.84m: Fg, 20mm				

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY / YB **CASING:** HQ to 4.5m

TYPE OF BORING: Solid flight auger (TC) bit to 4.4m then NMLC coring to 8.0m

WATER OBSERVATIONS: Free groundwater observed at approximately 2.0m

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-7.0m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.4 mAHD
EASTING: 308982
NORTHING: 6265717.8
DIP/AZIMUTH: 90°/--

BORE No: 102
PROJECT No: 94626.00
DATE: 9/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
	5.07	SILTSTONE: dark grey and pale grey, with sandstone laminations, high strength, fresh, unbroken, Ashfield Shale						4.94m: Fg, 10mm				PL(A) = 0.55
54	6											PL(A) = 1.47 PL(A) = 1.28
53								6.29m: Ds, 20mm	C	100	99	
52	7											PL(A) = 1.35
	8											
	8.0	Bore discontinued at 8.0m										
51	9											
50												

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY / YB **CASING:** HQ to 4.5m

TYPE OF BORING: Solid flight auger (TC) bit to 4.4m then NMLC coring to 8.0m

WATER OBSERVATIONS: Free groundwater observed at approximately 2.0m

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-7.0m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BORE: BH102 PROJECT: 94626.00 August 2020

4.45m – 8.0m

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 60.4 mAHD
EASTING: 308962.4
NORTHING: 6265650.8
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Type	Core Rec. %	RQD %	Test Results & Comments
60	0.1	FILL / Topsoil: Sandy silt, low plasticity, grey-brown, fine sand, with clay, rootlets, grass and igneous gravel, w < PL							A/E			
		FILL / Silty CLAY: low plasticity, grey-brown and orange-brown, with fine sand, trace of gravel, moist							A/E			
	0.6	Silty CLAY CI-CH: medium to high plasticity, orange-brown and red-brown, trace of charcoal and ironstone gravel, w < PL, appears soft to firm, residual							A/E			
59	1.0	Silty CLAY CI -CH:medium to high plasticity, pale grey mottled red-brown and orange brown, trace ironstone gravel, w < PL, stiff, residual							A/E			
									U50			pp ~ 150 kPa
									S			2,5,9 N = 14
58	2.5	Silty CLAY CL - CH: medium to high plasticity, pale grey mottled red-brown and orange-brown, with ironstone bands, w < PL, very stiff to hard, residual (extremely weathered siltstone)						Note: Unless otherwise stated, rock is fractured along rough planar bedding dipping 0° - 10 °	S			5,13,13 N = 26
57	3.26	SILTSTONE: dark orange-brown, low strength , moderately then slightly weathered, with extremely weathered bands, highly fractured fractured, Ashfield Shale						3.26m: J45°, he, pl, fe stn 3.31 -3.75 m: Cs (x8), 20 - 50 mm 3.68-5.65m: J(x3), 45-80°, he, pl, fe stn	C	100	43	PL(A) = 0.17 PL(A) = 0.2
56	4.4	SILTSTONE: dark grey, medium strength with very low strength bands, slightly weathered, fractured, Ashfield Shale						4.18-4.26m: J(x3), 10-80°, he, pl, fe stn, cly vn 4.28 - 4.29 m: Cs (x2); 40 - 50 mm 4.56-4.83m: J(x3), 45°, ro, pl, fe stn 4.68m: Cs, 10mm 4.74 - 4.88, J 50-60°, pl, sm, fe, stn				PL(A) = 0.77
	4.9											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** IT / YB **CASING:** HQ to 2.5m

TYPE OF BORING: Solid flight auger (TC) bit to 3.0m then NMLC coring to 7.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-7.0m

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 60.4 mAHD
EASTING: 308962.4
NORTHING: 6265650.8
DIP/AZIMUTH: 90°/--

BORE No: 103
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
55		SILTSTONE: dark grey and pale grey, with 10% sandstone laminations, high strength, fresh, unbroken, Ashfield Shale *(continued)*							C	100	43	
54	6								C	100	100	PL(A) = 2.23
53	7 7.0	Bore discontinued at 7.0m										PL(A) = 1.12
52	8											
51	9											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** IT / YB **CASING:** HQ to 2.5m

TYPE OF BORING: Solid flight auger (TC) bit to 3.0m then NMLC coring to 7.0m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-7.0m

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH103 **PROJECT: 94626.00** **August 2020**

3.0m – 7.0m

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.2 mAHD
EASTING: 308912.5
NORTHING: 6265630.1
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 94626.00
DATE: 9/8/2020
SHEET 1 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering	Graphic Log	Rock Strength	Water	Fracture Spacing (m)	Discontinuities	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
			EW HW MW SW FS FR		Ex Low Very Low Low Medium High Very High Ex High		0.01 0.05 0.10 0.50 1.00	B - Bedding J - Joint S - Shear F - Fault				
62	0.05	FILL/Topsoil							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, brown, trace rootlets, w < PL										
	0.3	Silty CLAY CH: medium to high plasticity, orange-brown mottled grey, w < PL, very stiff to hard, residual							D/E			
									D			
61	1							Note: Unless otherwise stated, defects are rough planar bedding dipping 0°- 10° some with fe stn or cly vn	S			7,20,30 N = 50
	1.3	SILTSTONE: grey, very low strength, moderately weathered, Ashfield Shale										
								1.5m: CORE LOSS: 260mm				
	1.76	SILTSTONE: orange-brown and pale grey, very low and low strength, extremely weathered with moderately weathered bands, Ashfield Shale						1.76-2.08m: Cs, 320mm				
60	2							2.08m: Fg, 50mm	C	81	0	
								2.13-3.70m: J(x5), 45-60°, he, pl, fe stn				
								2.38 - 2.6, Cs(x4) 20 - 40 mm				
								2.42-2.48m: J80°, partially he, pl, cly vn				
								2.6m: Cs, 70mm				PL(A) = 0.14
								2.67m: J80°, ro, pl, cln				
								2.60 - 3.64 m; Cs (x5), 20 - 90 mm				
	3.0	SILTSTONE: dark orange-brown, medium strength with very low strength bands, moderately weathered with extremely weathered bands, highly fractured, Ashfield Shale						2.91m: CORE LOSS: 90mm	C	78	0	
59	3							3.15m: Ds, 30mm				
								3.18-3.5m: Cs (x 2) , 140-150mm				
								3.32m: Fg, 40mm				
								3.64m: Cs, 50mm				
								3.72m: J45°, ro, pl, fe stn				PL(A) = 0.31
	4							4.14m: Cs, 10mm	C	100	54	
58								4.54m: J50-80°, partially he, un, fe stn				
								4.54 - 4.6 m, J45-80° (x2), partially he, un, fe stn				PL(A) = 0.36
	4.88							4.74m: Cs, 20mm				

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY / YB **CASING:** HQ to 1.5m

TYPE OF BORING: 150mm diameter SFA to 1.5m then NMLC coring to 6.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-6.7m

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.2 mAHD
EASTING: 308912.5
NORTHING: 6265630.1
DIP/AZIMUTH: 90°/--

BORE No: 105
PROJECT No: 94626.00
DATE: 9/8/2020
SHEET 2 OF 2

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
57		SILTSTONE: dark grey and pale grey, with 10% sandstone laminations, high strength, fresh, unbroken, Ashfield Shale *(continued)*							C	100	54	
56	6							6.15m: J45°, ro, pl, cln	C	100	100	PL(A) = 1.24
	6.7	Bore discontinued at 6.7m										PL(A) = 1.31
55	7											
54	8											
53	9											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY / YB **CASING:** HQ to 1.5m

TYPE OF BORING: 150mm diameter SFA to 1.5m then NMLC coring to 6.7m

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: Blank 0-2.0m, Screen 2-5.0m. Backfill: 5mm gravel 0-1.0m, Bentonite 1-1.5m, 5mm gravel 1.5-6.7m

SAMPLING & IN SITU TESTING LEGEND

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

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BORE: BH105 PROJECT: 94626.00 August 2020

1.5m – 6.0m

BORE: BH105 PROJECT: 94626.00 August 2020

6.0m – 6.7m

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.1 mAHD
EASTING: 308946.7
NORTHING: 6265731.4
DIP/AZIMUTH: 90°/--

BORE No: 106
PROJECT No: 94626.00
DATE: 9/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E			
	0.3	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel							D/E			
	0.5	Silty CLAY CH:medium to high plasticity, grey mottled orange-brown, w < PL, firm										
		Bore discontinued at 0.5m										
58	1											
57	2											
56	3											
55	4											

RIG: Hand Tools **DRILLER:** JY **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.6 mAHD
EASTING: 308955.5
NORTHING: 6265686.7
DIP/AZIMUTH: 90°/--

BORE No: 107
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59.4	0.2	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, with sand, trace siltstone gravel, w > PL, surficial bark mulch layer							D/E			
59.1	0.5	Silty CLAY CH: medium to high plasticity, orange-brown, trace ironstone gravel, w < PL, stiff, residual							D/E			
		Bore discontinued at 0.5m										
59												
58	1											
57	2											
56	3											
55	4											

RIG: Hand Tools **DRILLER:** JY **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 61.3 mAHD
EASTING: 308927.9
NORTHING: 6265643.5
DIP/AZIMUTH: 90°/--

BORE No: 108
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
61	0.0	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace siltstone gravel, w<PL, surficial bark mulch layer							D/E*			
		0.2m: 10mm brick fragment										
	0.4	Silty CLAY CH: medium to high plasticity, orange-brown, with ironstone gravel, w <PL, stiff, residual							D/E			
	0.6	Bore discontinued at 0.5m							D/E			
60	1											
59	2											
58	3											
57	4											

RIG: Hand Tools **DRILLER:** JY **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.2 mAHD
EASTING: 308895.2
NORTHING: 6265641.4
DIP/AZIMUTH: 90°/--

BORE No: 109
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
62	0.0	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace siltstone gravel, w<PL, surficial bark mulch layer							D/E			
		0.2m: 10mm brick fragment										
	0.4	Silty CLAY CH: medium to high plasticity, orange-brown, with ironstone gravel, w <PL, stiff, residual							D/E			
	0.6	Bore discontinued at 0.6m										
61	1											
60	2											
59	3											
58	4											

RIG: Hand Tools **DRILLER:** JY **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS: *BD1/20200808 sampled at 0.0.1m

SAMPLING & IN SITU TESTING LEGEND

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

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Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.6 mAHD
EASTING: 308979.9
NORTHING: 6265709.5
DIP/AZIMUTH: 90°/--

BORE No: 110
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation										
		FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL										
	0.5	Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone and siltstone gravel, w < PL, stiff residual										
	1											
	1.5	Bore discontinued at 1.5m										
58	2											
57	3											
56	4											
55												

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased
TYPE OF BORING: Solid flight auger (TC) bit
WATER OBSERVATIONS: No free groundwater observed whilst augering
REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.5 mAHD
EASTING: 308982.1
NORTHING: 6265699.1
DIP/AZIMUTH: 90°/--

BORE No: 111
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL										
	0.5	Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone and siltstone gravel, w < PL, stiff residual							D/E			
58	1.0	Bore discontinued at 1.0m										
57	2											
56	3											
55	4											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

Douglas Partners
Geotechnics / Environment / Groundwater

BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.9 mAHD
EASTING: 308974
NORTHING: 6265661.3
DIP/AZIMUTH: 90°/--

BORE No: 112
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E			
	0.3	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL							D/E			
		Silty CLAY CH: medium to high plasticity, orange-brown, trace gravel, w < PL, stiff, residual							D/E			
	1											
									D			
58	2	2.0m: becoming grey							D			
									D			
57	3											
	3.7	Silty CLAY CH: medium to high plasticity, pale grey and orange-brown, trace siltstone gravel, w < PL, stiff, residual (extremely weathered siltstone)										
56	4	4.0 Bore discontinued at 4.0m							D			
55												

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.5 mAHD
EASTING: 308979.9
NORTHING: 6265687.6
DIP/AZIMUTH: 90°/--

BORE No: 113
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL							D/E			
	0.5	Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone and siltstone gravel, w < PL, stiff residual							D/E			
	1								B			
58	1.5	Bore discontinued at 1.5m										
	2											
57												
	3											
56												
	4											
55												

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 61.9 mAHD
EASTING: 308947.8
NORTHING: 6265620.4
DIP/AZIMUTH: 90°/--

BORE No: 114
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
61	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL							D/E			
	0.7	Silty CLAY CH: medium to high plasticity, orange-brown, w < PL, stiff, residual							D/E			
	1	1.0m: becoming pale grey mottled orange, with ironstone gravel										
	1.5	Bore discontinued at 1.5m										
60	2											
59	3											
58	4											
57												

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.2 mAHD
EASTING: 308945.1
NORTHING: 6265612.4
DIP/AZIMUTH: 90°/--

BORE No: 115
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding, J - Joint, S - Shear, F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
62	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace gravel, w < PL, surficial vegetation							D/E			
		FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel, w < PL							D/E			
									B			
	0.9											
61	1	Silty CLAY CH: medium to high plasticity, orange-brown mottled pale grey, trace ironstone gravel, w < PL, stiff, residual							D			
	1.5	Bore discontinued at 1.5m										
60	2											
59	3											
58	4											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.8 mAHD
EASTING: 308786.7
NORTHING: 6265678.8
DIP/AZIMUTH: 90°/--

BORE No: 116
PROJECT No: 94626.00
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
62.7	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation										
62.6	0.2	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel										
		Silty CLAY CH:medium to high plasticity, grey mottled orange-brown, w < PL, very stiff										
62	0.8	SILTSTONE: grey, very low strength, Ashfield Shale										
	1								S			10/50 refusal
61.7	1.1	Bore discontinued at 1.1m										
61	2											
60	3											
59	4											
58												

RIG: Multi-Drill **DRILLER:** GRB **LOGGED:** GRB **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 62.6 mAHD
EASTING: 308803.9
NORTHING: 6265676.3
DIP/AZIMUTH: 90°/--

BORE No: 117
PROJECT No: 94626.00
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
62	0.15	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets, w < PL, surficial vegetation										
		Silty CLAY CH: medium to high plasticity, grey mottled orange-brown, w < PL, very stiff, residual							S			10,20/50 refusal
	0.7	SILTSTONE: grey, very low strength to low, Ashfield Shale										
61	1.6	Bore discontinued at 1.6m										
60												
59												
58												

RIG: MultiDrill **DRILLER:** GRB **LOGGED:** GRB **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 63.5 mAHD
EASTING: 308836.9
NORTHING: 6265662.9
DIP/AZIMUTH: 90°/--

BORE No: 118
PROJECT No: 94626.00
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
63	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets and brick fragments (10mm), w < PL, surficial vegetation										
		Silty CLAY CH: medium to high plasticity, orange-brown, trace ironstone gravel, w<PL, stiff, residual										
62	1.0	Bore discontinued at 1.0m										
61												
60												
59												

RIG: Hand Tools **DRILLER:** GRB **LOGGED:** GRB **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 64.2 mAHD
EASTING: 308912.9
NORTHING: 6265536.2
DIP/AZIMUTH: 90°/--

BORE No: 119
PROJECT No: 94626.00
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
64	0.2	FILL / TOPSOIL: Silty CLAY: brown, with sand, trace gravel, trace rootlets, w < PL, surficial vegetation							D/E			
		Silty CLAY CH: medium to high plasticity, pale grey mottled orange, trace ironstone gravel, w < PL, stiff, residual							D/E			
	0.5	Bore discontinued at 0.5m							D/E			
63	1											
62	2											
61	3											
60	4											

RIG: Hand Tools **DRILLER:** GRB **LOGGED:** GRB **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 64.2 mAHD
EASTING: 308928.9
NORTHING: 6265515
DIP/AZIMUTH: 90°/--

BORE No: 120
PROJECT No: 94626.00
DATE: 31/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
64	0.2	FILL / TOPSOIL: Silty CLAY: brown, with sand, trace gravel, brick and plastic fragment observed, trace rootlets, w < PL							D/E			
	0.4	FILL / Silty CLAY CH: medium to high plasticity, grey and brown, trace gravel and rootlets, w < PL							D/E			
	0.5	Silty CLAY CH: medium to high plasticity, pale grey mottled orange, trace ironstone gravel, w < PL, stiff, residual							D/E			
		Bore discontinued at 0.5m										
63	1											
62	2											
61	3											
60	4											

RIG: Hand Tools **DRILLER:** GRB **LOGGED:** GRB **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 59.2 mAHD
EASTING: 308970.1
NORTHING: 6265735.3
DIP/AZIMUTH: 90°/--

BORE No: 121
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low / Very Low / Low / Medium / High / Very High / Ex High)	Water	Fracture Spacing (m) (0.01 / 0.05 / 0.10 / 0.50 / 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
59	0.1	FILL / TOPSOIL: Silty CLAY: grey-brown, trace rootlets and brick fragments (10mm), w < PL, surficial vegetation							D/E			
	0.5	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, trace gravel 0.45m: PVC pipe fragment							D/E			
58	1	Silty CLAY CH: medium to high plasticity, orange-brown, trace ironstone gravel, w ~= PL, stiff, residual							D/E			
	1.5	Bore discontinued at 1.5m										
57	2											
56	3											
55	4											

RIG: Hanjin D&B 8-D **DRILLER:** Rockwell **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: Solid flight auger (TC) bit

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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BOREHOLE LOG

CLIENT: Woolacotts Consulting Engineers Pty Ltd
PROJECT: Glenwood High School Upgrade
LOCATION: 85 Forman Avenue, Glenwood

SURFACE LEVEL: 60.1 mAHD
EASTING: 308958.8
NORTHING: 6265662.7
DIP/AZIMUTH: 90°/--

BORE No: 122
PROJECT No: 94626.00
DATE: 8/8/2020
SHEET 1 OF 1

RL	Depth (m)	Description of Strata	Degree of Weathering (EW HW MW SW FS FR)	Graphic Log	Rock Strength (Ex Low, Very Low, Low, Medium, High, Very High, Ex High)	Water	Fracture Spacing (m) (0.01, 0.05, 0.10, 0.50, 1.00)	Discontinuities (B - Bedding J - Joint S - Shear F - Fault)	Sampling & In Situ Testing: Type	Core Rec. %	RQD %	Test Results & Comments
60	0.1	FILL / Silty CLAY CH: medium to high plasticity, grey-brown, with sand, trace siltstone gravel, w > PL, surficial bark mulch layer							D/E			
		Bore discontinued at 0.1m										
59	1											
58	2											
57	3											
56	4											

RIG: Hand Tools **DRILLER:** JY **LOGGED:** JY **CASING:** Uncased

TYPE OF BORING: 110mm diameter hand auger

WATER OBSERVATIONS: No free groundwater observed whilst augering

REMARKS:

SAMPLING & IN SITU TESTING LEGEND

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

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Appendix D

Laboratory Test Results

Table D1: Summary of Borehole Data, Laboratory Tests and Assessments

Bore	Top of soil unit	Base of soil unit	Sample Depth	pH	Chlorides (mg/kg)	Sulphates (mg/kg)	Aggressivity		Exchangeable Sodium (Na)	CEC Cation exchange capacity	Sodicity [Na/CEC]	Sodicity Class 5-15 Sodic >15 Highly Sodic	Soil Texture Group	Textural Factor [M]	$EC_{1:5}$ [Lab.]	EC_e [M x $EC_{1:5}$]	Salinity Class
							Soil Condition "B" used for natural soils and engineered filling										
102	0.60	0.70	0.65		630	230			1.60	8.2	20	Highly Sodic	Clay loam	9	760	6.8	Moderately Saline
102	1.00	1.45	1.23	8.3			Non-Aggressive	Non-Aggressive	1.40	4.7	29	Highly Sodic					
102	2.00	2.45	2.23										Clay loam	9	500	4.5	Moderately Saline
102	4.00	4.45	4.23										Medium clay	7	300	2.1	Slightly Saline
103	0.40	0.50	0.45										Clay loam	9	180	1.6	Non Saline
103	0.90	1.00	0.95	7.2			Non-Aggressive	Non-Aggressive	0.15	6.8	2	Non-sodic	Light medium clay	8	54	0.4	Non Saline
103	2.50	2.95	2.73										Light medium clay	8	260	2.1	Slightly Saline
109	0.40	0.50	0.45		<10	40			0.12	10.0	1	Non-sodic					
112	0.30	0.40	0.35	7.1			Non-Aggressive	Non-Aggressive	1.80	9.8	18	Highly Sodic	Medium clay	7	180	1.3	Non Saline
112	1.40	1.50	1.45										Medium clay	7	540	3.8	Slightly Saline
112	2.40	2.50	2.45										Medium clay	7	460	3.2	Slightly Saline
117a	0.00	0.20	0.10	5.2	95	150	Mild	Non-Aggressive	0.43	7.2	6	Sodic	Medium clay	7	190	1.3	Non Saline
117	0.50	0.80	0.65	5.6	<10	68	Non-Aggressive	Non-Aggressive	<0.1	7.9	NT		Clay loam	9	160	1.4	Non Saline
119	0.00	0.10	0.15	7.6	<10	47	Non-Aggressive	Non-Aggressive	<0.1	36.0	<1	Non-sodic	Clay loam	9	230	2.1	Slightly Saline
119	0.20	0.30	0.25	6.8	<10	28	Non-Aggressive	Non-Aggressive	0.25	16.0	2	Non-sodic	Light medium clay	8	52	0.4	Non Saline
120	0.10	0.30	0.20	8.1	26	54	Non-Aggressive	Non-Aggressive	0.17	36.0	<1	Non-sodic	Clay loam	9	220	2.0	Non Saline
120	0.40	0.50	0.45	4.6	140	85	Mild	Non-Aggressive	1.10	8.3	13	Sodic	Light medium clay	8	170	1.4	Non Saline

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CERTIFICATE OF ANALYSIS 249157

Client Details

Client	Douglas Partners Pty Ltd (Riverstone)
Attention	Gavin Boyd
Address	43 Hobart St, Riverstone, NSW, 2765

Sample Details

Your Reference	**94626.00, Glenwood High School**
Number of Samples	40 soil
Date samples received	17/08/2020
Date completed instructions received	17/08/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	24/08/2020
Date of Issue	24/08/2020

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vTRH(C6-C10)/BTEXN in Soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	108	110	108	113

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	121	114	110	108	112

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-15
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH102
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.6-0.7m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	118	126	115	111	112

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		249157-16	249157-17	249157-18	249157-19	249157-20
Your Reference	UNITS	BH107	BH109	BH113	BH114	BH121
Depth		0.2-0.3m	0.4-0.5m	0.5-0.6m	0.7-0.8m	0.5-0.6m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	101	93	110	84	98

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		249157-27	249157-28	249157-29	249157-30
Your Reference	UNITS	BD1/20200808	BD2/20200808	Trip Spike	Trip Blank
Depth		-	-	-	-
Date Sampled		8/08/2020	8/08/2020	5/08/2020	5/08/2020
Type of sample		soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	[NA]
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	[NA]
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	[NA]
Benzene	mg/kg	<0.2	<0.2	108%	<0.2
Toluene	mg/kg	<0.5	<0.5	102%	<0.5
Ethylbenzene	mg/kg	<1	<1	104%	<1
m+p-xylene	mg/kg	<2	<2	103%	<2
o-Xylene	mg/kg	<1	<1	102%	<1
naphthalene	mg/kg	<1	<1	[NA]	[NA]
Total +ve Xylenes	mg/kg	<3	<3	[NA]	[NA]
Surrogate aaa-Trifluorotoluene	%	96	95	93	87

svTRH (C10-C40) in Soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	85	80	86	83	74

svTRH (C10-C40) in Soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	210	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	260	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	390	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	200	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	600	<50	<50	<50
Surrogate o-Terphenyl	%	72	87	78	75	73

svTRH (C10-C40) in Soil						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-15
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH102
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.6-0.7m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	120	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	120	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	120	<50	<50	<50	<50
Surrogate o-Terphenyl	%	80	77	74	73	78

svTRH (C10-C40) in Soil						
Our Reference		249157-16	249157-17	249157-18	249157-19	249157-20
Your Reference	UNITS	BH107	BH109	BH113	BH114	BH121
Depth		0.2-0.3m	0.4-0.5m	0.5-0.6m	0.7-0.8m	0.5-0.6m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	78	78	75	77	73

svTRH (C10-C40) in Soil			
Our Reference		249157-27	249157-28
Your Reference	UNITS	BD1/20200808	BD2/20200808
Depth		-	-
Date Sampled		8/08/2020	8/08/2020
Type of sample		soil	soil
Date extracted	-	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50
Surrogate o-Terphenyl	%	77	77

PAHs in Soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.1	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	1.2	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	123	135	123	121	128

PAHs in Soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	123	124	128	120	124

PAHs in Soil						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-15
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH102
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.6-0.7m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	123	123	125	125	119

PAHs in Soil						
Our Reference		249157-16	249157-17	249157-18	249157-19	249157-20
Your Reference	UNITS	BH107	BH109	BH113	BH114	BH121
Depth		0.2-0.3m	0.4-0.5m	0.5-0.6m	0.7-0.8m	0.5-0.6m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	124	126	126	130	124

PAHs in Soil			
Our Reference		249157-27	249157-28
Your Reference	UNITS	BD1/20200808	BD2/20200808
Depth		-	-
Date Sampled		8/08/2020	8/08/2020
Type of sample		soil	soil
Date extracted	-	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020
Naphthalene	mg/kg	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	127	127

Organochlorine Pesticides in soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	116	120	116	115	115

Organochlorine Pesticides in soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	127	121	115	109	111

Organochlorine Pesticides in soil					
Our Reference		249157-11	249157-12	249157-13	249157-14
Your Reference	UNITS	BH113	BH114	BH121	BH122
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	110	109	110	111

Organophosphorus Pesticides in Soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	116	120	116	115	115

Organophosphorus Pesticides in Soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	127	121	115	109	111

Organophosphorus Pesticides in Soil					
Our Reference		249157-11	249157-12	249157-13	249157-14
Your Reference	UNITS	BH113	BH114	BH121	BH122
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	110	109	110	111

PCBs in Soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	116	120	116	115	115

PCBs in Soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	127	121	115	109	111

PCBs in Soil					
Our Reference		249157-11	249157-12	249157-13	249157-14
Your Reference	UNITS	BH113	BH114	BH121	BH122
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil
Date extracted	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	110	109	110	111

Acid Extractable metals in soil						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Arsenic	mg/kg	8	6	7	7	5
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	20	21	18	18	10
Copper	mg/kg	9	14	11	10	10
Lead	mg/kg	18	19	17	15	14
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	12	6	5	5
Zinc	mg/kg	20	32	27	23	29

Acid Extractable metals in soil						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Arsenic	mg/kg	6	6	9	6	8
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	17	16	15	12	19
Copper	mg/kg	11	10	16	9	10
Lead	mg/kg	14	13	20	14	17
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	5	8	6	6
Zinc	mg/kg	29	30	35	22	23

Acid Extractable metals in soil						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-15
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH102
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.6-0.7m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Arsenic	mg/kg	7	6	8	6	9
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	17	16	15	13	13
Copper	mg/kg	10	10	14	10	14
Lead	mg/kg	18	16	18	12	16
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	4	6	7	8
Zinc	mg/kg	19	20	40	28	31

Acid Extractable metals in soil						
Our Reference		249157-16	249157-17	249157-18	249157-19	249157-20
Your Reference	UNITS	BH107	BH109	BH113	BH114	BH121
Depth		0.2-0.3m	0.4-0.5m	0.5-0.6m	0.7-0.8m	0.5-0.6m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Arsenic	mg/kg	4	7	6	7	8
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	10	17	11	20	13
Copper	mg/kg	9	13	11	19	14
Lead	mg/kg	13	9	13	13	17
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	5	6	5	7	7
Zinc	mg/kg	21	29	20	36	31

Acid Extractable metals in soil				
Our Reference		249157-27	249157-28	249157-41
Your Reference	UNITS	BD1/20200808	BD2/20200808	BH101 - [TRIPLICATE]
Depth		-	-	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020
Arsenic	mg/kg	6	8	9
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	16	20	18
Copper	mg/kg	10	10	11
Lead	mg/kg	14	17	17
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	6	5	5
Zinc	mg/kg	31	21	24

Misc Soil - Inorg						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg					
Our Reference		249157-11	249157-12	249157-13	249157-14
Your Reference	UNITS	BH113	BH114	BH121	BH122
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5

Moisture						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Moisture	%	21	17	21	18	16

Moisture						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Moisture	%	17	19	17	16	14

Moisture						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-15
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH102
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.6-0.7m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	9/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Moisture	%	18	19	19	19	12

Moisture						
Our Reference		249157-16	249157-17	249157-18	249157-19	249157-20
Your Reference	UNITS	BH107	BH109	BH113	BH114	BH121
Depth		0.2-0.3m	0.4-0.5m	0.5-0.6m	0.7-0.8m	0.5-0.6m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Moisture	%	18	18	12	18	15

Asbestos ID - soils						
Our Reference		249157-1	249157-2	249157-3	249157-4	249157-5
Your Reference	UNITS	BH101	BH102	BH103	BH105	BH107
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	9/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Sample mass tested	g	Approx. 55g	Approx. 45g	Approx. 35g	Approx. 45g	Approx. 35g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		249157-6	249157-7	249157-8	249157-9	249157-10
Your Reference	UNITS	BH108	BH109	BH110	BH111	BH112
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0-0.1m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Sample mass tested	g	Approx. 40g	Approx. 40g	Approx. 50g	Approx. 60g	Approx. 75g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		249157-11	249157-12	249157-13	249157-14	249157-21
Your Reference	UNITS	BH113	BH114	BH121	BH122	BH101
Depth		0-0.1m	0-0.1m	0-0.1m	0-0.1m	0.2-0.3m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	9/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Sample mass tested	g	Approx. 50g	Approx. 50g	Approx. 55g	Approx. 70g	Approx. 50g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		249157-22	249157-23	249157-24	249157-25	249157-26
Your Reference	UNITS	BH102	BH103	BH109	BH112	BH115
Depth		0.2-0.3m	0.2-0.3m	0.2-0.3m	0.2-0.3m	0.2-0.3m
Date Sampled		9/08/2020	8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	20/08/2020	20/08/2020	20/08/2020	20/08/2020	20/08/2020
Sample mass tested	g	Approx. 55g	Approx. 40g	Approx. 55g	Approx. 60g	Approx. 40g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Misc Inorg - Soil						
Our Reference		249157-15	249157-31	249157-32	249157-36	249157-38
Your Reference	UNITS	BH102	BH109	BH102	BH103	BH112
Depth		0.6-0.7m	0.4-0.5m	1-1.45m	0.9-1.0m	0.3-0.4m
Date Sampled		9/08/2020	8/08/2020	9/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
Date analysed	-	19/08/2020	19/08/2020	19/08/2020	19/08/2020	19/08/2020
pH 1:5 soil:water	pH Units	[NA]	[NA]	8.3	7.2	7.1
Chloride, Cl 1:5 soil:water	mg/kg	630	<10	[NA]	[NA]	[NA]
Sulphate, SO4 1:5 soil:water	mg/kg	230	40	[NA]	[NA]	[NA]

Texture and Salinity*						
Our Reference		249157-15	249157-33	249157-34	249157-35	249157-36
Your Reference	UNITS	BH102	BH102	BH102	BH103	BH103
Depth		0.6-0.7m	2-2.45m	4-4.45m	0.4-0.5m	0.9-1.0m
Date Sampled		9/08/2020	9/08/2020	9/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	19/08/2020	21/08/2020	21/08/2020	21/08/2020	19/08/2020
Date analysed	-	19/08/2020	21/08/2020	21/08/2020	21/08/2020	19/08/2020
Electrical Conductivity 1:5 soil:water	µS/cm	760	500	300	180	54
Texture Value	-	9.0	9.0	7.0	9.0	8.0
Texture	-	CLAY LOAM	CLAY LOAM	MEDIUM CLAY	CLAY LOAM	LIGHT MEDIUM CLAY
ECe	dS/m	6.8	4.5	2.1	<2	<2
Class	-	MODERATELY SALINE	MODERATELY SALINE	SLIGHTLY SALINE	NON SALINE	NON SALINE

Texture and Salinity*					
Our Reference		249157-37	249157-38	249157-39	249157-40
Your Reference	UNITS	BH103	BH112	BH112	BH112
Depth		2.5-2.95m	0.3-0.4m	1.4-1.5m	2.4-2.5m
Date Sampled		8/08/2020	8/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil
Date prepared	-	21/08/2020	19/08/2020	21/08/2020	21/08/2020
Date analysed	-	21/08/2020	19/08/2020	21/08/2020	21/08/2020
Electrical Conductivity 1:5 soil:water	µS/cm	260	180	540	460
Texture Value	-	8.0	7.0	7.0	7.0
Texture	-	LIGHT MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY	MEDIUM CLAY
ECe	dS/m	2.1	<2	3.8	3.2
Class	-	SLIGHTLY SALINE	NON SALINE	SLIGHTLY SALINE	SLIGHTLY SALINE

ESP/CEC						
Our Reference		249157-15	249157-31	249157-32	249157-36	249157-38
Your Reference	UNITS	BH102	BH109	BH102	BH103	BH112
Depth		0.6-0.7m	0.4-0.5m	1-1.45m	0.9-1.0m	0.3-0.4m
Date Sampled		9/08/2020	8/08/2020	9/08/2020	8/08/2020	8/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Date analysed	-	21/08/2020	21/08/2020	21/08/2020	21/08/2020	21/08/2020
Exchangeable Ca	meq/100g	1.5	4.5	0.6	3.5	2.6
Exchangeable K	meq/100g	0.1	0.5	<0.1	<0.1	0.1
Exchangeable Mg	meq/100g	4.9	5.2	2.6	3.1	5.3
Exchangeable Na	meq/100g	1.6	0.12	1.4	0.15	1.8
Cation Exchange Capacity	meq/100g	8.2	10	4.7	6.8	9.8
ESP	%	20	1	29	2	18

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-123	Determined using a "Texture by Feel" method.
Metals-020	Determination of various metals by ICP-AES.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.

Method ID	Methodology Summary
Org-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			20/08/2020	1	20/08/2020	20/08/2020		20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	82	85
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	82	85
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	72	73
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	84	90
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	88	91
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	84	86
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	84	86
naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	106	1	95	102	7	105	102

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	249157-20
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			[NT]	14	20/08/2020	20/08/2020		20/08/2020	20/08/2020
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	14	<25	<25	0	81	82
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	14	<25	<25	0	81	82
Benzene	mg/kg	0.2	Org-023	[NT]	14	<0.2	<0.2	0	72	70
Toluene	mg/kg	0.5	Org-023	[NT]	14	<0.5	<0.5	0	82	89
Ethylbenzene	mg/kg	1	Org-023	[NT]	14	<1	<1	0	87	88
m+p-xylene	mg/kg	2	Org-023	[NT]	14	<2	<2	0	82	82
o-Xylene	mg/kg	1	Org-023	[NT]	14	<1	<1	0	81	81
naphthalene	mg/kg	1	Org-023	[NT]	14	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	14	111	105	6	93	96

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	19	19/08/2020	19/08/2020		[NT]	[NT]
Date analysed	-			[NT]	19	20/08/2020	20/08/2020		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	19	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	19	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-023	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-023	[NT]	19	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-023	[NT]	19	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-023	[NT]	19	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-023	[NT]	19	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-023	[NT]	19	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	19	84	93	10	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	124	122
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	101	97
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	108	78
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	124	122
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	101	97
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	108	78
Surrogate o-Terphenyl	%		Org-020	80	1	85	84	1	130	80

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	249157-20
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	20/08/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	14	<50	<50	0	106	110
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	14	<100	<100	0	86	88
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	14	<100	<100	0	88	89
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	14	<50	<50	0	106	110
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	14	<100	<100	0	86	88
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	14	<100	<100	0	88	89
Surrogate o-Terphenyl	%		Org-020	[NT]	14	73	77	5	120	120

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	19	19/08/2020	19/08/2020		[NT]	[NT]
Date analysed	-			[NT]	19	20/08/2020	20/08/2020		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	19	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	19	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	19	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	19	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	19	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	19	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-020	[NT]	19	77	79	3	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			21/08/2020	1	21/08/2020	21/08/2020		21/08/2020	21/08/2020
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	112	114
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	113	118
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	105	121
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	115	125
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	116	112
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	113	113
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	127	133
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	<0.05	<0.05	0	110	131
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	127	1	123	120	2	135	120

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	249157-20
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			[NT]	14	21/08/2020	21/08/2020		21/08/2020	21/08/2020
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	112	126
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	113	124
Fluorene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	118	110
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	123	110
Anthracene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	121	124
Pyrene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	118	124
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	129	112
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	14	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	14	<0.05	<0.05	0	127	138
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	14	125	122	2	125	117

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	19	19/08/2020	19/08/2020		[NT]	[NT]
Date analysed	-			[NT]	19	21/08/2020	21/08/2020		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	19	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	19	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	19	130	123	6	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			21/08/2020	1	21/08/2020	21/08/2020		21/08/2020	21/08/2020
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	97	125
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	111
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	87	113
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	114	123
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	110	116
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	111	116
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	109	107
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	114
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	103	114
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	78	124
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	114	1	116	113	3	133	124

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	[NT]
Date analysed	-			[NT]	14	21/08/2020	21/08/2020		21/08/2020	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	113	[NT]
HCB	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	109	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	103	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	121	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	118	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	116	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	121	[NT]
Endrin	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	118	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	117	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	88	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	14	111	110	1	113	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			21/08/2020	1	21/08/2020	21/08/2020		21/08/2020	21/08/2020
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	114
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	98	116
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	72	85
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	82	135
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	101	107
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	71	84
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	115
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	114	1	116	113	3	133	124

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	[NT]
Date analysed	-			[NT]	14	21/08/2020	21/08/2020		21/08/2020	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	114	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	114	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	85	[NT]
Malathion	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	120	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	117	[NT]
Parathion	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	84	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	115	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	14	111	110	1	113	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date extracted	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			21/08/2020	1	21/08/2020	21/08/2020		21/08/2020	21/08/2020
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	120	124
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	114	1	116	113	3	133	124

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date extracted	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	[NT]
Date analysed	-			[NT]	14	21/08/2020	21/08/2020		21/08/2020	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	126	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	[NT]	14	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	[NT]	14	111	110	1	113	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-2	249157-2
Date prepared	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Arsenic	mg/kg	4	Metals-020	<4	1	8	10	22	96	75
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	96	75
Chromium	mg/kg	1	Metals-020	<1	1	20	21	5	95	77
Copper	mg/kg	1	Metals-020	<1	1	9	13	36	93	90
Lead	mg/kg	1	Metals-020	<1	1	18	17	6	93	#
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	103	86
Nickel	mg/kg	1	Metals-020	<1	1	5	8	46	96	81
Zinc	mg/kg	1	Metals-020	<1	1	20	34	52	97	#

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	249157-20
Date prepared	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			[NT]	14	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Arsenic	mg/kg	4	Metals-020	[NT]	14	6	8	29	94	77
Cadmium	mg/kg	0.4	Metals-020	[NT]	14	<0.4	<0.4	0	93	77
Chromium	mg/kg	1	Metals-020	[NT]	14	13	14	7	93	80
Copper	mg/kg	1	Metals-020	[NT]	14	10	12	18	92	88
Lead	mg/kg	1	Metals-020	[NT]	14	12	15	22	92	73
Mercury	mg/kg	0.1	Metals-021	[NT]	14	<0.1	<0.1	0	93	84
Nickel	mg/kg	1	Metals-020	[NT]	14	7	6	15	95	76
Zinc	mg/kg	1	Metals-020	[NT]	14	28	37	28	94	82

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	19	19/08/2020	19/08/2020		[NT]	[NT]
Date analysed	-			[NT]	19	19/08/2020	19/08/2020		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	19	7	9	25	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	19	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	19	20	19	5	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	19	19	18	5	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	19	13	13	0	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	19	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	19	7	6	15	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	19	36	32	12	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	249157-2
Date prepared	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Date analysed	-			19/08/2020	1	19/08/2020	19/08/2020		19/08/2020	19/08/2020
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	1	<5	<5	0	101	99

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	14	19/08/2020	19/08/2020		[NT]	[NT]
Date analysed	-			[NT]	14	19/08/2020	19/08/2020		[NT]	[NT]
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	[NT]	14	<5	<5	0	[NT]	[NT]

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			19/08/2020	38	19/08/2020	19/08/2020		19/08/2020	[NT]
Date analysed	-			19/08/2020	38	19/08/2020	19/08/2020		19/08/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	38	7.1	7.0	1	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	90	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			19/08/2020	38	19/08/2020	19/08/2020		19/08/2020	[NT]
Date analysed	-			19/08/2020	38	19/08/2020	19/08/2020		19/08/2020	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	38	180	170	6	101	[NT]
Texture Value	-		INORG-123	[NT]	38	7.0	7.0	0	[NT]	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			21/08/2020	[NT]	[NT]	[NT]	[NT]	21/08/2020	[NT]
Date analysed	-			21/08/2020	[NT]	[NT]	[NT]	[NT]	21/08/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

pH / EC
Samples were out of the recommended holding time for this analysis.

Asbestos: Excessive sample volumes were provided for asbestos analysis.
A portion of the supplied samples were sub-sampled according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples requested for asbestos testing were sub-sampled from bags provided by the client.

Acid Extractable Metals in Soil:
-The laboratory RPD acceptance criteria has been exceeded for 249157-1 for Zn. Therefore a triplicate result has been issued as laboratory sample number 249157-41.
-# Percent recovery is not possible to report due to the inhomogeneous nature of the element/s in the sample/s. However an acceptable recovery was obtained for the LCS.

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CHAIN OF CUSTODY DESPATCH SHEET

Project No:	94626.00	**Suburb:**	Glenwood	**To:**	Envirolab Services
Project Name:	Glenwood High School	**Order Number**			12 Ashley St Chatswood 2067
Project Manager:	Gavin Boyd	**Sampler:**	Jeremie Young		
Emails:	gavin.boyd@douglaspartners.com.au	petrina.fielding@douglaspartners.com.au			kristine.nicodemus@douglaspartners.com.au
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑				
Prior Storage:	☑ Esky ☑ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☑	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8a	Combo 3	Asbestos	Textural Classification / ECE	CEC	pH	Chloride/ Sulphate/ Sodicity	HM, TRH, BTEX, PAH	TRH / BTEX	Notes/preservation
BH101/0-0.1m	1	8.8.20	S	G/P	●									
BH102/0-0.1m	2	9.8.20	S	G/P	●									
BH103/0-0.1m	3	8.8.20	S	G/P	●									
BH105/0-0.1m	4	9.8.20	S	G/P	●									
BH107/0-0.1m	5	8.8.20	S	G/P	●									
BH108/0-0.1m	6	8.8.20	S	G/P	●									
BH109/0-0.1m	7	8.8.20	S	G/P	●									
BH110/0-0.1m	8	8.8.20	S	G/P	●									
BH111/0-0.1m	9	8.8.20	S	G/P	●									
BH112/0-0.1m	10	8.8.20	S	G/P	●									
BH113/0-0.1m	11	8.8.20	S	G/P	●									
BH114/0-0.1m	12	8.8.20	S	G/P	●									
BH121/0-0.1m	13	8.8.20	S	G/P	●									
BH122/0-0.1m	14	9.8.20	S	G/P	●									
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

ENVIROLAB

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

Job No: 249157
Date Received: 17/8/20
Time Received: 15:43
Received By: Helen
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container:	**Relinquished by:** JY	**Transported to laboratory by:**
Send Results to: Douglas Partners Pty Ltd	**Address:** 43 Hobart St Riverstone NSW 2765	**Phone:** **Fax:**
Signed:	**Received by:** Helen	**Date & Time:** 15:43 17/8/20

249157

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	94626.00	**Suburb:**	Glenwood	**To:**	Envirolab Services
Project Name:	Glenwood High School	**Order Number**			12 Ashley St Chatswood 2067
Project Manager:	Gavin Boyd	**Sampler:**	Jeremie Young		
Emails:	gavin.boyd@douglaspartners.com.au	petrina.fielding@douglaspartners.com.au		kristine.nicodemus@douglaspartners.com.au	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑				
Prior Storage:	☑ Esky ☑ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☑ (If YES, then handle, transport and store in accordance with FPM HAZID)			

Sample ID	Lab ID	Sampling Date	Sample Type: S - soil, W - water	Container Type: G - glass, P - plastic	Analytes: Combo 8a	Combo 3	Asbestos	Textural Classification / ECE	CEC	pH	Chloride/ Sulphate/ Sodicity	HM, TRH, BTEX, PAH	TRH / BTEX	Notes/preservation
BH102/0.6-0.7m	15	9.8.20	S	G/P		●		●			●			
BH107/0.2-0.3m	16	8.8.20	S	G		●								
BH109/0.4-0.5m	17	8.8.20	S	G		●								
BH113/0.5-0.6m	18	8.8.20	S	G		●								
BH114/0.7-0.8m	19	8.8.20	S	G		●								
BH121/0.5-0.6m	20	8.8.20	S	G		●								
BH101/0.2-0.3m	21	8.8.20	S	G/P			●							
BH102/0.2-0.3m	22	9.8.20	S	G/P			●							
BH103/0.2-0.3m	23	8.8.20	S	G/P			●							
BH109/0.2-0.3m	24	8.8.20	S	G/P			●							
BH112/0.2-0.3m	25	8.8.20	S	G/P			●							
BH115/0.2-0.3m	26	8.8.20	S	G/P			●							
BD1/20200808	27	8.8.20	S	G								●		
BH2/20200808	28	8.8.20	S	G								●		
Trip spike/blank	29 30	5.8.20	S	G									●	
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:

Lab Report/Reference No:

Total number of samples in container: **Relinquished by:** JY **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** 43 Hobart St Riverstone NSW 2765 **Phone:** **Fax:**

Signed: **Received by:** **Date & Time:** 15 43 17/8/20

249157

Douglas Partners
Geotechnics | Environment | Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	94626.00	**Suburb:**	Glenwood	**To:**	Envirolab Services
Project Name:	Glenwood High School	**Order Number**			12 Ashley St Chatswood 2067
Project Manager:	Gavin Boyd	**Sampler:**	Jeremie Young		
Emails:	gavin.boyd@douglaspartners.com.au	petrina.fielding@douglaspartners.com.au		kristine.nicodemus@douglaspartners.com.au	
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☑				
Prior Storage:	☑ Esky ☑ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐	No ☑	(If YES, then handle, transport and store in accordance with FPM HAZID)

Sample ID	Lab ID	Sampling Date	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8a	Combo 3	Asbestos	Textural Classification / ECE	CEC	pH	Chloride/ Sulphate/ Sodicity	HM, TRH, BTEX, PAH	TRH / BTEX	Notes/preservation
BH109/0.4-0.5m	31										●			
BH102/1-1.45m	32								●	●				
BH102/2-2.45m	33							●						
BH102/4-4.45m	34							●						
BH103/0.4-0.5m	35							●						
BH103/0.9-1.0m	36							●	●	●				
BH103/2.5-2.95m	37							●						
BH112/0.3-0.4m	38							●	●	●				
BH112/1/4-1.5m	39							●						
BH112/2.4-2.5m	40							●						
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:

Lab Report/Reference No:

Total number of samples in container: **Relinquished by:** JY **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address** 43 Hobart St Riverstone NSW 2765 **Phone:** **Fax:**

Signed: **Received by:** **Date & Time:** 1543 17/8/20

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

CERTIFICATE OF ANALYSIS 251036

Client Details

Client	Douglas Partners Pty Ltd (Riverstone)
Attention	Gavin Boyd
Address	43 Hobart St, Riverstone, NSW, 2765

Sample Details

Your Reference	**94626.00, Glenwood**
Number of Samples	4 WATER, 2 SOIL
Date samples received	11/09/2020
Date completed instructions received	11/09/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	14/09/2020
Date of Issue	14/09/2020

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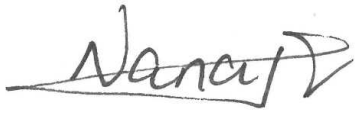
Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Loren Bardwell, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Water					
Our Reference		251036-1	251036-2	251036-3	251036-4
Your Reference	UNITS	BH012	BH103	BH105	BD1/20200902
Date Sampled		02/09/2020	02/09/2020	02/09/2020	02/09/2020
Type of sample		WATER	WATER	WATER	WATER
Date extracted	-	11/09/2020	11/09/2020	11/09/2020	11/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
TRH C_6 - C_9	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10	<10
Benzene	µg/L	<1	<1	<1	<1
Toluene	µg/L	<1	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2	<2
o-xylene	µg/L	<1	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1	<1
Surrogate Dibromofluoromethane	%	96	100	77	102
Surrogate toluene-d8	%	100	100	100	99
Surrogate 4-BFB	%	104	100	102	102

svTRH (C10-C40) in Water					
Our Reference		251036-1	251036-2	251036-3	251036-4
Your Reference	UNITS	BH012	BH103	BH105	BD1/20200902
Date Sampled		02/09/2020	02/09/2020	02/09/2020	02/09/2020
Type of sample		WATER	WATER	WATER	WATER
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
TRH C_{10} - C_{14}	µg/L	<50	<50	200	300
TRH C_{15} - C_{28}	µg/L	<100	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50	230	320
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	230	320
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100	<100
Surrogate o-Terphenyl	%	117	80	102	92

PAHs in Water					
Our Reference		251036-1	251036-2	251036-3	251036-4
Your Reference	UNITS	BH012	BH103	BH105	BD1/20200902
Date Sampled		02/09/2020	02/09/2020	02/09/2020	02/09/2020
Type of sample		WATER	WATER	WATER	WATER
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Naphthalene	µg/L	<1	<1	<1	<1
Acenaphthylene	µg/L	<1	<1	<1	<1
Acenaphthene	µg/L	<1	<1	<1	<1
Fluorene	µg/L	<1	<1	<1	<1
Phenanthrene	µg/L	<1	<1	<1	<1
Anthracene	µg/L	<1	<1	<1	<1
Fluoranthene	µg/L	<1	<1	<1	<1
Pyrene	µg/L	<1	<1	<1	<1
Benzo(a)anthracene	µg/L	<1	<1	<1	<1
Chrysene	µg/L	<1	<1	<1	<1
Benzo(b,j+k)fluoranthene	µg/L	<2	<2	<2	<2
Benzo(a)pyrene	µg/L	<1	<1	<1	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1	<1	<1	<1
Dibenzo(a,h)anthracene	µg/L	<1	<1	<1	<1
Benzo(g,h,i)perylene	µg/L	<1	<1	<1	<1
Benzo(a)pyrene TEQ	µg/L	<5	<5	<5	<5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	93	83	91	85

Organochlorine Pesticides in Water		
Our Reference		251036-2
Your Reference	UNITS	BH103
Date Sampled		02/09/2020
Type of sample		WATER
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
alpha-BHC	µg/L	<0.2
HCB	µg/L	<0.2
beta-BHC	µg/L	<0.2
gamma-BHC	µg/L	<0.2
Heptachlor	µg/L	<0.2
delta-BHC	µg/L	<0.2
Aldrin	µg/L	<0.2
Heptachlor Epoxide	µg/L	<0.2
gamma-Chlordane	µg/L	<0.2
alpha-Chlordane	µg/L	<0.2
Endosulfan I	µg/L	<0.2
pp-DDE	µg/L	<0.2
Dieldrin	µg/L	<0.2
Endrin	µg/L	<0.2
Endosulfan II	µg/L	<0.2
pp-DDD	µg/L	<0.2
Endrin Aldehyde	µg/L	<0.2
pp-DDT	µg/L	<0.2
Endosulfan Sulphate	µg/L	<0.2
Methoxychlor	µg/L	<0.2
Surrogate TCMX	%	79

OP Pesticides in Water		
Our Reference	UNITS	251036-2
Your Reference		BH103
Date Sampled		02/09/2020
Type of sample		WATER
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
Dichlorvos	µg/L	<0.2
Dimethoate	µg/L	<0.2
Diazinon	µg/L	<0.2
Chlorpyriphos-methyl	µg/L	<0.2
Ronnel	µg/L	<0.2
Fenitrothion	µg/L	<0.2
Malathion	µg/L	<0.2
Chlorpyriphos	µg/L	<0.2
Parathion	µg/L	<0.2
Bromophos ethyl	µg/L	<0.2
Ethion	µg/L	<0.2
Azinphos-methyl (Guthion)	µg/L	<0.2
Surrogate TCMX	%	79

PCBs in Water		
Our Reference		251036-2
Your Reference	UNITS	BH103
Date Sampled		02/09/2020
Type of sample		WATER
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
Aroclor 1016	µg/L	<2
Aroclor 1221	µg/L	<2
Aroclor 1232	µg/L	<2
Aroclor 1242	µg/L	<2
Aroclor 1248	µg/L	<2
Aroclor 1254	µg/L	<2
Aroclor 1260	µg/L	<2
Surrogate TCMX	%	79

Total Phenolics in Water		
Our Reference		251036-2
Your Reference	UNITS	BH103
Date Sampled		02/09/2020
Type of sample		WATER
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
Total Phenolics (as Phenol)	mg/L	<0.05

HM in water - dissolved					
Our Reference	UNITS	251036-1	251036-2	251036-3	251036-4
Your Reference		BH012	BH103	BH105	BD1/20200902
Date Sampled		02/09/2020	02/09/2020	02/09/2020	02/09/2020
Type of sample		WATER	WATER	WATER	WATER
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Arsenic-Dissolved	µg/L	<1	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1	0.2	0.2
Chromium-Dissolved	µg/L	<1	<1	<1	<1
Copper-Dissolved	µg/L	2	1	1	<1
Lead-Dissolved	µg/L	<1	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	10	5	100	95
Zinc-Dissolved	µg/L	19	8	150	140

Cations in water Dissolved				
Our Reference		251036-1	251036-2	251036-3
Your Reference	UNITS	BH012	BH103	BH105
Date Sampled		02/09/2020	02/09/2020	02/09/2020
Type of sample		WATER	WATER	WATER
Date digested	-	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020
Calcium - Dissolved	mg/L	71	34	26
Magnesium - Dissolved	mg/L	290	110	150
Hardness	mgCaCO 3 /L	1,400	540	680

Method ID	Methodology Summary
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			11/09/2020	[NT]	[NT]	[NT]	[NT]	11/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	94	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	96	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	93	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	102	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate toluene-d8	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	100	[NT]
Surrogate 4-BFB	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	119	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	119	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate o-Terphenyl	%		Org-020	93	[NT]	[NT]	[NT]	[NT]	69	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Naphthalene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	78	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	104	[NT]	[NT]	[NT]	[NT]	83	[NT]

QUALITY CONTROL: Organochlorine Pesticides in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
alpha-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	83	[NT]
HCB	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	78	[NT]
gamma-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	100	[NT]
delta-BHC	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	77	[NT]
Heptachlor Epoxide	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	81	[NT]
gamma-Chlordane	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-Chlordane	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	78	[NT]
Dieldrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	80	[NT]
Endrin	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	89	[NT]
Endosulfan II	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	73	[NT]
Endrin Aldehyde	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	110	[NT]
Methoxychlor	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	97	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: OP Pesticides in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Dichlorvos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	122	[NT]
Dimethoate	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	88	[NT]
Fenitrothion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	98	[NT]
Malathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	95	[NT]
Chlorpyriphos	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	117	[NT]
Parathion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	94	[NT]
Bromophos ethyl	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	126	[NT]
Azinphos-methyl (Guthion)	µg/L	0.2	Org-022/025	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	97	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: PCBs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Aroclor 1016	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	90	[NT]
Aroclor 1260	µg/L	2	Org-021	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-021	97	[NT]	[NT]	[NT]	[NT]	82	[NT]

QUALITY CONTROL: Total Phenolics in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Total Phenolics (as Phenol)	mg/L	0.05	Inorg-031	<0.05	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Arsenic-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	[NT]	[NT]	[NT]	[NT]	99	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	[NT]	[NT]	[NT]	[NT]	113	[NT]
Nickel-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: Cations in water Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Date analysed	-			14/09/2020	[NT]	[NT]	[NT]	[NT]	14/09/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	117	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	115	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Samples received in good order: Holding time exceedance

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	94626.00	**Suburb:**	Glenwood	**To:**	Envirolab Services
Project Name:	Glenwood High School	**Order Number**			12 Ashley St Chatswood 2067
Project Manager:	Gavin Boyd	**Sampler:**	Jeremie Young		
Emails:	gavin.boyd@douglaspartners.com.au	petrina.fielding@douglaspartners.com.au			kristine.nicodemus@douglaspartners.com.au
Date Required:	Same day ☐ 24 hours ☑ 48 hours ☐ 72 hours ☐ Standard ☐				
Prior Storage:	☐ Esky ☑ Fridge ☐ Shelved	Do samples contain 'potential' HBM? Yes ☐ No ☐ (If YES, then handle, transport and store in accordance with FPM HAZID)			

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil, W - water)	Container Type (G - glass, P - plastic)	Analytes: Combo 8	Combo 3	Hardness	Combo 1M						Notes/preservation
BH102	1	2.9.2020	W	G/P		●	●							
BH103	2	2.9.2020	W	G/P	●		●							
BH105	3	2.9.2020	W	G/P		●	●							
BD1/20200902	4	2.9.2020	W	G/P		●								
TS/TB	5-6		S	G										
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

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

Job No: 251036
Date Received: 11/09/2020.
Time Received: 15.27
Received By: RL
Temp: ~~Cool/Ambient~~ 14.°C
Cooling: ~~Ice/Icepack~~
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Metals to Analyse: 8HM unless specified here:

Lab Report/Reference No:

Total number of samples in container: **Relinquished by:** JY **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address:** 43 Hobart St Riverstone NSW 2765 **Phone:** **Fax:**

Signed: **Received by:** RLhazeen ELS Sydney **Date & Time:** 11/09/2020 15.27

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

CERTIFICATE OF ANALYSIS 251040

Client Details

Client	Douglas Partners Pty Ltd (Riverstone)
Attention	Gavin Boyd
Address	43 Hobart St, Riverstone, NSW, 2765

Sample Details

Your Reference	**94626.00, Glenwood High School**
Number of Samples	10 soil
Date samples received	11/09/2020
Date completed instructions received	11/09/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	15/09/2020
Date of Issue	15/09/2020

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Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Dragana Tomas, Senior Chemist
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Manju Dewendrage, Chemist

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		251040-1	251040-3	251040-4	251040-5	251040-6
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.4-0.5	120/0.2-0.3	119/0.0-0.1
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	87	91	91	72	75

vTRH(C6-C10)/BTEXN in Soil				
Our Reference		251040-7	251040-8	251040-9
Your Reference	UNITS	121a/0.2-0.3	119/0.2-0.3	120/0.1-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	97	77	103

svTRH (C10-C40) in Soil						
Our Reference		251040-1	251040-3	251040-4	251040-5	251040-6
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.4-0.5	120/0.2-0.3	119/0.0-0.1
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	15/09/2020	15/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	88	82	90	78	83

svTRH (C10-C40) in Soil				
Our Reference		251040-7	251040-8	251040-9
Your Reference	UNITS	121a/0.2-0.3	119/0.2-0.3	120/0.1-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50
Surrogate o-Terphenyl	%	88	77	80

PAHs in Soil						
Our Reference		251040-1	251040-3	251040-4	251040-5	251040-6
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.4-0.5	120/0.2-0.3	119/0.0-0.1
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	100	104	104	103	106

PAHs in Soil				
Our Reference		251040-7	251040-8	251040-9
Your Reference	UNITS	121a/0.2-0.3	119/0.2-0.3	120/0.1-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	100	100	103

Organochlorine Pesticides in soil						
Our Reference		251040-1	251040-3	251040-5	251040-6	251040-7
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.2-0.3	119/0.0-0.1	121a/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	107	112	109	111	105

Organochlorine Pesticides in soil		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
alpha-BHC	mg/kg	<0.1
HCB	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	107

Organophosphorus Pesticides in Soil						
Our Reference		251040-1	251040-3	251040-5	251040-6	251040-7
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.2-0.3	119/0.0-0.1	121a/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	107	112	109	111	105

Organophosphorus Pesticides in Soil		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Parathion	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Ethion	mg/kg	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1
Surrogate TCMX	%	107

PCBs in Soil						
Our Reference		251040-1	251040-3	251040-5	251040-6	251040-7
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.2-0.3	119/0.0-0.1	121a/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	107	112	109	111	105

PCBs in Soil		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date extracted	-	14/09/2020
Date analysed	-	14/09/2020
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCMX	%	107

Acid Extractable metals in soil						
Our Reference		251040-1	251040-3	251040-4	251040-5	251040-6
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.4-0.5	120/0.2-0.3	119/0.0-0.1
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Arsenic	mg/kg	6	8	6	6	4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	17	22	9	16	12
Copper	mg/kg	12	12	13	21	36
Lead	mg/kg	11	20	12	15	14
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	3	6	2	4	9
Zinc	mg/kg	15	44	14	41	84

Acid Extractable metals in soil				
Our Reference		251040-7	251040-8	251040-9
Your Reference	UNITS	121a/0.2-0.3	119/0.2-0.3	120/0.1-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020
Arsenic	mg/kg	6	7	7
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	11	12	17
Copper	mg/kg	14	17	23
Lead	mg/kg	14	13	18
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	7	4	6
Zinc	mg/kg	34	21	41

Misc Soil - Inorg						
Our Reference		251040-1	251040-3	251040-5	251040-6	251040-7
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.2-0.3	119/0.0-0.1	121a/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Total Phenolics (as Phenol)	mg/kg	<5	<5	<5	<5	<5

Misc Soil - Inorg		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date prepared	-	15/09/2020
Date analysed	-	15/09/2020
Total Phenolics (as Phenol)	mg/kg	<5

Moisture						
Our Reference		251040-1	251040-3	251040-4	251040-5	251040-6
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.4-0.5	120/0.2-0.3	119/0.0-0.1
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	14/09/2020	14/09/2020	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Moisture	%	15	8.4	18	17	29

Moisture				
Our Reference		251040-7	251040-8	251040-9
Your Reference	UNITS	121a/0.2-0.3	119/0.2-0.3	120/0.1-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil
Date prepared	-	14/09/2020	14/09/2020	14/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020
Moisture	%	15	19	14

Asbestos ID - soils						
Our Reference		251040-1	251040-3	251040-5	251040-6	251040-7
Your Reference	UNITS	117a/0.0-0.2	116/0.0-0.4	120/0.2-0.3	119/0.0-0.1	121a/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Sample mass tested	g	Approx. 50g	Approx. 45g	Approx. 35g	Approx. 30g	Approx. 25g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Red coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date analysed	-	15/09/2020
Sample mass tested	g	Approx. 30g
Sample Description	-	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected

Misc Inorg - Soil						
Our Reference		251040-1	251040-2	251040-4	251040-6	251040-8
Your Reference	UNITS	117a/0.0-0.2	117/0.5-0.8	120/0.4-0.5	119/0.0-0.1	119/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
pH 1:5 soil:water	pH Units	5.2	5.6	4.6	7.6	6.8
Chloride, Cl 1:5 soil:water	mg/kg	95	<10	140	<10	<10
Sulphate, SO4 1:5 soil:water	mg/kg	150	68	85	47	28

Misc Inorg - Soil		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date prepared	-	15/09/2020
Date analysed	-	15/09/2020
pH 1:5 soil:water	pH Units	8.1
Chloride, Cl 1:5 soil:water	mg/kg	26
Sulphate, SO4 1:5 soil:water	mg/kg	54

Texture and Salinity*						
Our Reference		251040-1	251040-2	251040-4	251040-6	251040-8
Your Reference	UNITS	117a/0.0-0.2	117/0.5-0.8	120/0.4-0.5	119/0.0-0.1	119/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Electrical Conductivity 1:5 soil:water	µS/cm	190	160	170	230	52
Texture Value	-	7.0	9.0	8.0	9.0	8.0
Texture	-	MEDIUM CLAY	CLAY LOAM	LIGHT MEDIUM CLAY	CLAY LOAM	LIGHT MEDIUM CLAY
ECe	dS/m	<2	<2	<2	2.1	<2
Class	-	NON SALINE	NON SALINE	NON SALINE	SLIGHTLY SALINE	NON SALINE

Texture and Salinity*		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date prepared	-	15/09/2020
Date analysed	-	15/09/2020
Electrical Conductivity 1:5 soil:water	µS/cm	220
Texture Value	-	9.0
Texture	-	CLAY LOAM
ECe	dS/m	<2
Class	-	NON SALINE

ESP/CEC						
Our Reference		251040-1	251040-2	251040-4	251040-6	251040-8
Your Reference	UNITS	117a/0.0-0.2	117/0.5-0.8	120/0.4-0.5	119/0.0-0.1	119/0.2-0.3
Date Sampled		31/08/2020	31/08/2020	31/08/2020	31/08/2020	31/08/2020
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Date analysed	-	15/09/2020	15/09/2020	15/09/2020	15/09/2020	15/09/2020
Exchangeable Ca	meq/100g	3.6	5.1	1.6	34	12
Exchangeable K	meq/100g	0.4	0.6	0.3	0.3	0.2
Exchangeable Mg	meq/100g	2.8	2.2	5.3	1.2	3.6
Exchangeable Na	meq/100g	0.43	<0.1	1.1	<0.1	0.25
Cation Exchange Capacity	meq/100g	7.2	7.9	8.3	36	16
ESP	%	6	[NT]	13	<1	2

ESP/CEC		
Our Reference		251040-9
Your Reference	UNITS	120/0.1-0.3
Date Sampled		31/08/2020
Type of sample		soil
Date prepared	-	15/09/2020
Date analysed	-	15/09/2020
Exchangeable Ca	meq/100g	34
Exchangeable K	meq/100g	0.6
Exchangeable Mg	meq/100g	1.8
Exchangeable Na	meq/100g	0.17
Cation Exchange Capacity	meq/100g	36
ESP	%	<1

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-031	Total Phenolics by segmented flow analyser (in line distillation with colourimetric finish). Solids are extracted in a caustic media prior to analysis.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Waters samples are filtered on receipt prior to analysis. Alternatively determined by colourimetry/turbidity using Discrete Analyser.
INORG-123	Determined using a "Texture by Feel" method.
Metals-020	Determination of various metals by ICP-AES.
Metals-020	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.

Method ID	Methodology Summary
Org-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	114	101
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	114	101
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	115	103
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	114	102
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	110	97
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	115	102
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	119	105
naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	96	1	87	92	6	103	94

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	[NT]	9	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	[NT]	9	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-023	[NT]	9	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-023	[NT]	9	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-023	[NT]	9	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-023	[NT]	9	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-023	[NT]	9	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-023	[NT]	9	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	[NT]	9	103	91	12	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	120	104
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	104	91
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	81	98
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	120	104
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	104	91
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	81	98
Surrogate o-Terphenyl	%		Org-020	88	1	88	115	27	104	82

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	15/09/2020	15/09/2020		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	[NT]	9	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	[NT]	9	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	[NT]	9	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	[NT]	9	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	[NT]	9	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	[NT]	9	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-020	[NT]	9	80	78	3	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	99	92
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	106	94
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	100	91
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	109	99
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	107	96
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	109	98
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	106	94
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	<0.05	<0.05	0	105	97
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	105	1	100	101	1	104	102

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	[NT]	9	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	[NT]	9	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	[NT]	9	103	104	1	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	92
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	89
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	97
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	108	101
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	107	99
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	108	101
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	105	99
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	100	102
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	94
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	69	91
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	107	1	107	106	1	107	109

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
HCB	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endrin	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	9	107	109	2	[NT]	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	78	80
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	102	96
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	97
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	112
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	107	103
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	98	102
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	119	113
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	107	1	107	106	1	107	109

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Malathion	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Parathion	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	[NT]	9	107	109	2	[NT]	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date extracted	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Date analysed	-			14/09/2020	1	14/09/2020	14/09/2020		14/09/2020	14/09/2020
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	80	80
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	107	1	107	106	1	107	109

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	14/09/2020	14/09/2020		[NT]	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	[NT]	9	107	109	2	[NT]	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date prepared	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Date analysed	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Arsenic	mg/kg	4	Metals-020	<4	1	6	6	0	104	87
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	101	80
Chromium	mg/kg	1	Metals-020	<1	1	17	15	12	90	85
Copper	mg/kg	1	Metals-020	<1	1	12	11	9	90	91
Lead	mg/kg	1	Metals-020	<1	1	11	15	31	88	79
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	96	100
Nickel	mg/kg	1	Metals-020	<1	1	3	3	0	93	84
Zinc	mg/kg	1	Metals-020	<1	1	15	16	6	93	85

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	9	15/09/2020	15/09/2020		[NT]	[NT]
Date analysed	-			[NT]	9	15/09/2020	15/09/2020		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	9	7	8	13	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	9	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	9	17	19	11	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	9	23	29	23	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	9	18	18	0	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	9	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	9	6	6	0	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	9	41	40	2	[NT]	[NT]

QUALITY CONTROL: Misc Soil - Inorg						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	251040-3
Date prepared	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Date analysed	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	15/09/2020
Total Phenolics (as Phenol)	mg/kg	5	Inorg-031	<5	1	<5	<5	0	99	114

QUALITY CONTROL: Misc Inorg - Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date prepared	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
Date analysed	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chloride, Cl 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	101	[NT]
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: Texture and Salinity*					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date prepared	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
Date analysed	-			15/09/2020	[NT]	[NT]	[NT]	[NT]	15/09/2020	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: ESP/CEC						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date prepared	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	[NT]
Date analysed	-			15/09/2020	1	15/09/2020	15/09/2020		15/09/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-020	<0.1	1	3.6	3.2	12	105	[NT]
Exchangeable K	meq/100g	0.1	Metals-020	<0.1	1	0.4	0.3	29	105	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-020	<0.1	1	2.8	2.7	4	102	[NT]
Exchangeable Na	meq/100g	0.1	Metals-020	<0.1	1	0.43	0.42	2	105	[NT]
ESP	%	1	Metals-020	[NT]	1	6	6	0	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Asbestos: Excessive sample volumes were provided for asbestos analysis.
A portion of the supplied samples were sub-sampled according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Samples 251040-1,3 were sub-sampled from bags provided by the client.

Asbestos: A portion of the supplied samples were sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that these sub-samples are indicative of the entire sample.
Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 251040-5,6,7,9 were sub-sampled from jars provided by the client.

ESP: Where the exchangeable Sodium is less than the PQL and CEC is less than 10meq/100g, the ESP cannot be calculated.

Douglas Partners
Geotechnics / Environment / Groundwater

CHAIN OF CUSTODY DESPATCH SHEET

Project No:	94626.00	**Suburb:**	Glenwood	**To:**	Envirolab Services
Project Name:	Glenwood High School	**Order Number**			12 Ashley St Chatswood 2067
Project Manager:	Gavin Boyd	**Sampler:**	Jeremie Young		
Emails:	gavin.boyd@douglaspartners.com.au	petrina.fielding@douglaspartners.com.au			kristine.nicodemus@douglaspartners.com.au
Date Required:	Same day ☐ 24 hours ☐ 48 hours ☐ 72 hours ☐ Standard ☐				
Prior Storage:	☐ Esky ☐ Fridge ☐ Shelved	Do samples contain 'potential' HBM?	Yes ☐ No ☐	(If YES, then handle, transport and store in accordance with FPM HAZID)	

Sample ID	Lab ID	Date Sampled	Sample Type (S - soil W - water)	Container Type (G - glass P - plastic)	Analytes: Combo 8a	Combo 3	Asbestos	Textural Classification / ECE	CEC	pH	Chloride/ Sulphate/ Sodicity	HM, TRH, BTEX, PAH	TRH / BTEX	Notes/preservation
117a/0.0-0.2	1	31/08/20	Soil	G	•			•		•	•			
117/0.5-0.8	2	31/08/20	Soil	G				•		•	•			
116/0.0-0.4	3	31/08/20	Soil	G	•									
120/0.4-0.5	4	31/08/20	Soil	G		•		•		•	•			
120/0.2-0.3	5	31/08/20	Soil	G	•									
119/0.0-0.1	6	31/08/20	Soil	G	•			•		•	•			
121a/0.2-0.3	7	31/08/20	Soil	G	•									
119/0.2-0.3	8	31/08/20	Soil	G		•		•		•	•			
120/0.1-0.3	9	31/08/20	Soil	G	•			•		•	•			
extra TP114(0.0-0.3)	10													
PQL (S) mg/kg														**ANZECC PQLs req'd for all water analytes** ☐

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

Job No: 258104O
Date Received: 11/09/2020
Time Received: 15.27
Received By: RL
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

PQL = practical quantitation limit. If none given, default to Laboratory Method Detection Limit

Lab Report/Reference No:

Metals to Analyse: 8HM unless specified here:

Total number of samples in container: **Relinquished by:** JY **Transported to laboratory by:**

Send Results to: Douglas Partners Pty Ltd **Address:** 43 Hobart St Riverstone NSW 2765 **Phone:** **Fax:**

Signed: **Received by:** R. Chazeen **Date & Time:** 11/09/2020 15.27

		Date	Sample Type	Container Type	Analytes

Material Test Report

Douglas Partners
Geotechnics / Environment / Groundwater
Douglas Partners Pty Ltd
Sydney Laboratory
96 Hermitage Road West Ryde NSW 2114
Phone: (02) 9809 0666
Fax: (02) 9809 0666
Email: andrew.hutchings@douglaspartners.com.au

Accredited for compliance with ISO/IEC 17025 - Testing

NATA
WORLD RECOGNISED ACCREDITATION

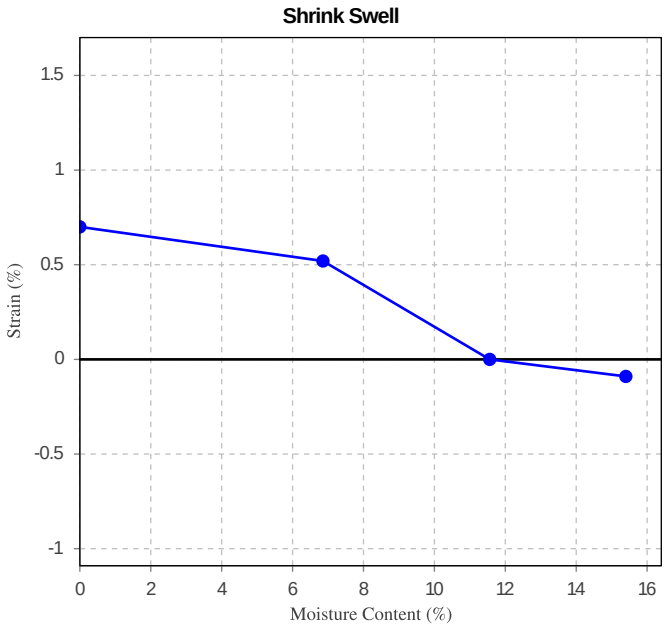
Approved Signatory: Andrew Hutchings
Laboratory Manager
NATA Accredited Laboratory Number: 828

Report Number:	**94626.00-1**
Issue Number:	2 - *This version supersedes all previous issues*
Reissue Reason:	*Amended ISS measurement*
Date Issued:	09/09/2020
Client:	Woolacotts Consulting Engineers Pty Ltd
	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571A
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 20/08/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH101 (0.8 - 1.0m)**
Material:	Silty CLAY CH: medium to high plasticity, grey and orange-brown

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**0.4**
Visual Description	Silty CLAY CH: medium to high plasticity, grey and orange-brown
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**0.7**
Estimated % by volume of significant inert inclusions	20
Cracking	Slightly Cracked
Crumbling	No
Moisture Content (%)	11.6

Swell Test	
Initial Pocket Penetrometer (kPa)	>400
Final Pocket Penetrometer (kPa)	250
Initial Moisture Content (%)	13.0
Final Moisture Content (%)	15.4
Swell (%)	**0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



Material Test Report

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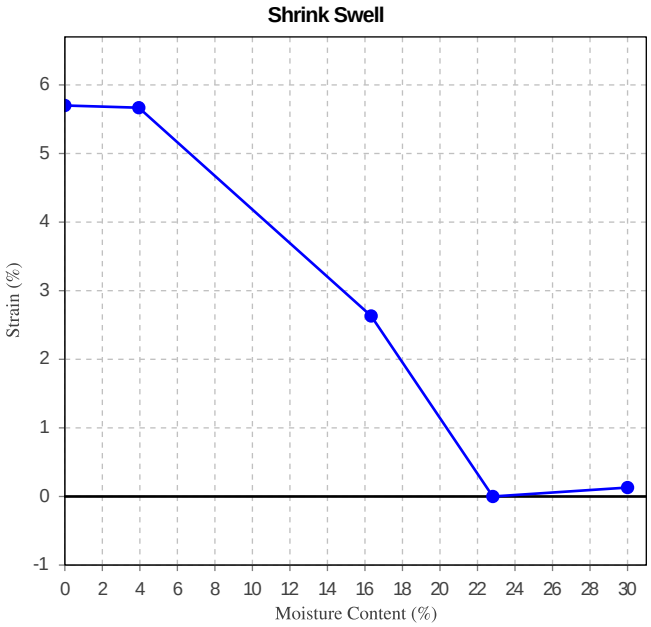
	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571B
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 20/08/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH103 (1.0 - 1.15m)**
Material:	Silty CLAY CI-CH: medium to high plasticity, orange-brown and red-brown, trace of charcoal, ripped sandstone gravel and ironstone gravel

Shrink Swell Index (AS 1289 7.1.1 & 2.1.1)	
Iss (%)	**3.2**
Visual Description	Silty CLAY CI-CH: medium to high plasticity, orange-brown and red-brown, trace of charcoal, ripped sandstone gravel and ironstone gravel
* Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.	
Accurate final length measurement not obtainable due to substantial cracking	

Core Shrinkage Test	
Shrinkage Strain - Oven Dried (%)	**5.7**
Estimated % by volume of significant inert inclusions	10
Cracking	Moderately Cracked
Crumbling	No
Moisture Content (%)	22.8

Swell Test	
Initial Pocket Penetrometer (kPa)	85
Final Pocket Penetrometer (kPa)	70
Initial Moisture Content (%)	26.7
Final Moisture Content (%)	30.0
Swell (%)	**-0.1**
* NATA Accreditation does not cover the performance of pocket penetrometer readings.	



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	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571C
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 26/08/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH102 (0.6 - 0.7m)**
Material:	Silty CLAY: medium to high plasticity, orange-brown and grey, trace ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	35		
Plastic Limit (%)	16		
Plasticity Index (%)	**19**		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	14.9

Material Test Report

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	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571D
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 26/08/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH105 (0.3 - 0.4m)**
Material:	Silty CLAY CH: medium to high plasticity, orange-brown mottled grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	72		
Plastic Limit (%)	26		
Plasticity Index (%)	**46**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Silty CLAY CH: medium to high plasticity, orange-brown mottled grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	25.8

Material Test Report

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Date Issued:	09/09/2020
Client:	Woolacotts Consulting Engineers Pty Ltd
	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571E
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 26/08/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH115 (0.9 - 1.0m)**
Material:	Silty CLAY CH: medium to high plasticity, orange-brown mottled pale grey, trace ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	76		
Plastic Limit (%)	25		
Plasticity Index (%)	**51**		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	26.7

Material Test Report

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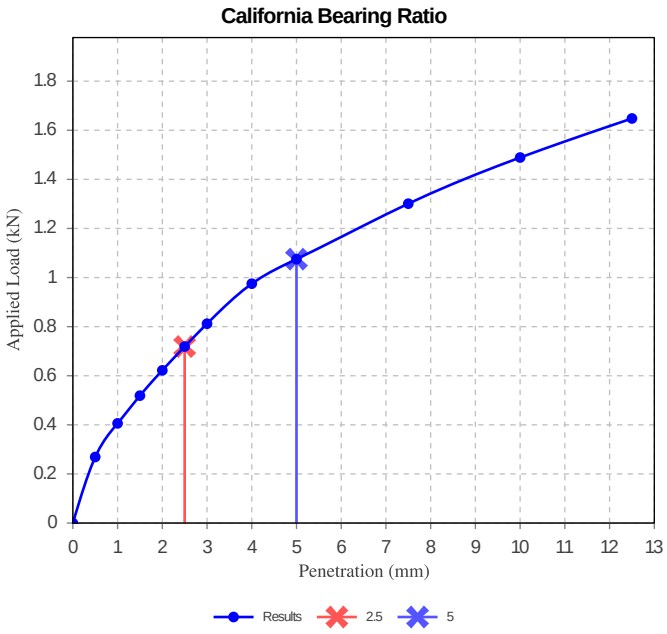
Client:	Woolacotts Consulting Engineers Pty Ltd
	PO Box 5612, Chatswood NSW 1515
Contact:	Kevin Christesen
Project Number:	94626.00
Project Name:	Glenwood High School Upgrade
Project Location:	Forman Avenue, Glenwood
Work Request:	6571
Sample Number:	SY-6571F
Date Sampled:	08/08/2020
Dates Tested:	18/08/2020 - 04/09/2020
Sampling Method:	Sampled by Engineering Department
	The results apply to the sample as received
Sample Location:	**BH110 (0.5 - 1.5m)**
Material:	Silty CLAY CH: medium to high plasticity, orange-brown and grey

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	2.5 mm		
CBR %	**5**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.88		
Optimum Moisture Content (%)	15.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	100.0		
Dry Density after Soaking (t/m^3)	1.88		
Field Moisture Content (%)	15.5		
Moisture Content at Placement (%)	15.5		
Moisture Content Top 30mm (%)	17.9		
Moisture Content Rest of Sample (%)	15.7		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	96.1		
Swell (%)	0.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	15.5



Material Test Report

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Report Number: **94626.00-1**
Issue Number: 2 - *This version supersedes all previous issues*
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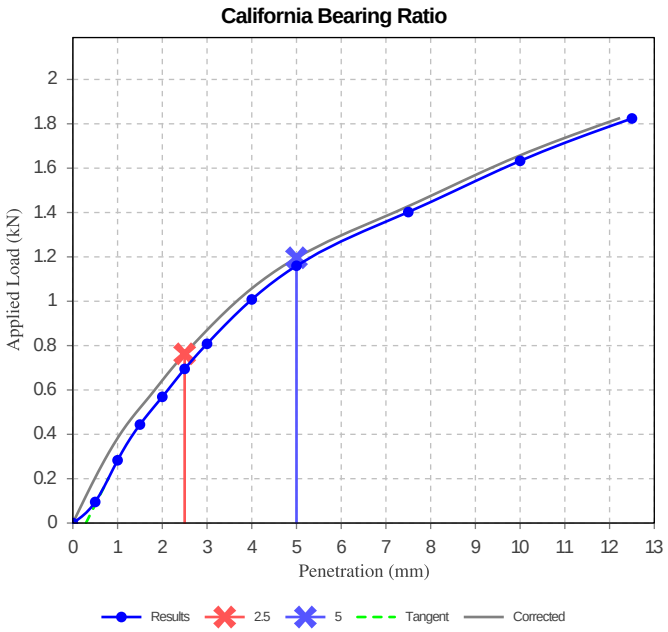
Date Issued: 09/09/2020
Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Sample Number: SY-6571G
Date Sampled: 08/08/2020
Dates Tested: 18/08/2020 - 04/09/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH113 (0.5 - 1.5m)**
Material: Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone and siltstone gravel

California Bearing Ratio (AS 1289 6.1.1 & 2.1.1)		Min	Max
CBR taken at	5 mm		
CBR %	**6**		
Method of Compactive Effort	Standard		
Method used to Determine MDD	AS 1289 5.1.1 & 2.1.1		
Method used to Determine Plasticity	Visual Assessment		
Maximum Dry Density (t/m^3)	1.91		
Optimum Moisture Content (%)	15.5		
Laboratory Density Ratio (%)	100.0		
Laboratory Moisture Ratio (%)	99.5		
Dry Density after Soaking (t/m^3)	1.89		
Field Moisture Content (%)	15.5		
Moisture Content at Placement (%)	15.3		
Moisture Content Top 30mm (%)	17.2		
Moisture Content Rest of Sample (%)	15.6		
Mass Surcharge (kg)	4.5		
Soaking Period (days)	4		
Curing Hours	163.7		
Swell (%)	1.0		
Oversize Material (mm)	19		
Oversize Material Included	Excluded		
Oversize Material (%)	0		

Moisture Content (AS 1289 2.1.1)	
Moisture Content (%)	15.5



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Report Number: **94626.00-1**
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Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Sample Number: SY-6571C
Date Sampled: 08/08/2020
Dates Tested: 18/08/2020 - 26/08/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH102 (0.6 - 0.7m)**
Material: Silty CLAY: medium to high plasticity, orange-brown and grey, trace ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	35		
Plastic Limit (%)	16		
Plasticity Index (%)	**19**		

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Report Number: **94626.00-1**
Issue Number: 1
Date Issued: 02/09/2020
Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Sample Number: SY-6571D
Date Sampled: 08/08/2020
Dates Tested: 18/08/2020 - 26/08/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH105 (0.3 - 0.4m)**
Material: Silty CLAY CH: medium to high plasticity, orange-brown mottled grey

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	72		
Plastic Limit (%)	26		
Plasticity Index (%)	**46**		

Emerson Class Number of a Soil (AS 1289 3.8.1)		Min	Max
Emerson Class	**6**		
Soil Description	Silty CLAY CH: medium to high plasticity, orange-brown mottled grey		
Nature of Water	Distilled		
Temperature of Water (^{o}C)	22		

Material Test Report

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Report Number: **94626.00-1**
Issue Number: 1
Date Issued: 02/09/2020
Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Sample Number: SY-6571E
Date Sampled: 08/08/2020
Dates Tested: 18/08/2020 - 26/08/2020
Sampling Method: Sampled by Engineering Department
The results apply to the sample as received
Sample Location: **BH115 (0.9 - 1.0m)**
Material: Silty CLAY CH: medium to high plasticity, orange-brown mottled pale grey, trace ironstone gravel

Atterberg Limit (AS1289 3.1.2 & 3.2.1 & 3.3.1)		Min	Max
Sample History	Oven Dried		
Preparation Method	Dry Sieve		
Liquid Limit (%)	76		
Plastic Limit (%)	25		
Plasticity Index (%)	**51**		

Material Test Report

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Date Issued: 02/09/2020
Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Dates Tested: 18/08/2020 - 25/08/2020

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Moisture Content AS 1289 2.1.1			
Sample Number	Sample Location	Moisture Content (%)	Material
SY-6571C	BH102 (0.6 - 0.7m)	14.9 %	Silty CLAY: medium to high plasticity, orange-brown and grey, trace ironstone gravel
SY-6571D	BH105 (0.3 - 0.4m)	25.8 %	Silty CLAY CH: medium to high plasticity, orange-brown mottled grey
SY-6571E	BH115 (0.9 - 1.0m)	26.7 %	Silty CLAY CH: medium to high plasticity, orange-brown mottled pale grey, trace ironstone gravel
SY-6571F	BH110 (0.5 - 1.5m)	15.5 %	Silty CLAY CH: medium to high plasticity, orange-brown and grey
SY-6571G	BH113 (0.5 - 1.5m)	15.5 %	Silty CLAY CH: medium to high plasticity, orange-brown and grey, trace ironstone and siltstone gravel

Material Test Report

Report Number: **94626.00-1**
Issue Number: 1
Date Issued: 02/09/2020
Client: Woolacotts Consulting Engineers Pty Ltd
PO Box 5612, Chatswood NSW 1515
Contact: Kevin Christesen
Project Number: 94626.00
Project Name: Glenwood High School Upgrade
Project Location: Forman Avenue, Glenwood
Work Request: 6571
Dates Tested: 18/08/2020 - 20/08/2020

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Shrink Swell Index AS 1289 7.1.1 & 2.1.1					
Sample Number	SY-6571A	SY-6571B			
Date Sampled	08/08/2020	08/08/2020			
Date Tested	20/08/2020	20/08/2020			
Material Source	**	**			
Sample Location	BH101 (0.8 - 1.0m)	BH103 (1.0 - 1.15m)			
Inert Material Estimate (%)	20	10			
Pocket Penetrometer before (kPa)	>400	85			
Pocket Penetrometer after (kPa)	250	70			
Shrinkage Moisture Content (%)	11.6	22.8			
Shrinkage (%)	**0.7**	**4.6**			
Swell Moisture Content Before (%)	13.0	26.7			
Swell Moisture Content After (%)	15.4	30.0			
Swell (%)	**0.1**	**-0.2**			
Shrink Swell Index Iss (%)	**0.4**	**2.6**			
Visual Description	Silty CLAY CH: medium to high plasticity, grey and orange-brown	Silty CLAY CI-CH: medium to high plasticity, orange-brown and red-brown, trace of charcoal, ripped sandstone gravel and ironstone gravel			
Cracking	SC	HC			
Crumbling	No	No			
Remarks	**	**			

Shrink Swell Index (Iss) reported as the percentage vertical strain per pF change in suction.
Cracking Terminology: UC Uncracked, SC Slightly Cracked, MC Moderately Cracked, HC Highly Cracked, FR Fragmented.
NATA Accreditation does not cover the performance of pocket penetrometer readings.

Appendix E

CSIRO Notes

Foundation Maintenance and Footing Performance:
A Homeowner's Guide

CSIRO

BTF 18 replaces Information Sheet 10/91

Buildings can and often do move. This movement can be up, down, lateral or rotational. The fundamental cause of movement in buildings can usually be related to one or more problems in the foundation soil. It is important for the homeowner to identify the soil type in order to ascertain the measures that should be put in place in order to ensure that problems in the foundation soil can be prevented, thus protecting against building movement.

This Building Technology File is designed to identify causes of soil-related building movement, and to suggest methods of prevention of resultant cracking in buildings.

Soil Types

The types of soils usually present under the topsoil in land zoned for residential buildings can be split into two approximate groups – granular and clay. Quite often, foundation soil is a mixture of both types. The general problems associated with soils having granular content are usually caused by erosion. Clay soils are subject to saturation and swell/shrink problems.

Classifications for a given area can generally be obtained by application to the local authority, but these are sometimes unreliable and if there is doubt, a geotechnical report should be commissioned. As most buildings suffering movement problems are founded on clay soils, there is an emphasis on classification of soils according to the amount of swell and shrinkage they experience with variations of water content. The table below is Table 2.1 from AS 2870, the Residential Slab and Footing Code.

Causes of Movement

Settlement due to construction
There are two types of settlement that occur as a result of construction:

- Immediate settlement occurs when a building is first placed on its foundation soil, as a result of compaction of the soil under the weight of the structure. The cohesive quality of clay soil mitigates against this, but granular (particularly sandy) soil is susceptible.
- Consolidation settlement is a feature of clay soil and may take place because of the expulsion of moisture from the soil or because of the soil's lack of resistance to local compressive or shear stresses. This will usually take place during the first few months after construction, but has been known to take many years in exceptional cases.

These problems are the province of the builder and should be taken into consideration as part of the preparation of the site for construction. Building Technology File 19 (BTF 19) deals with these problems.

Erosion
All soils are prone to erosion, but sandy soil is particularly susceptible to being washed away. Even clay with a sand component of say 10% or more can suffer from erosion.

Saturation
This is particularly a problem in clay soils. Saturation creates a bog-like suspension of the soil that causes it to lose virtually all of its bearing capacity. To a lesser degree, sand is affected by saturation because saturated sand may undergo a reduction in volume – particularly imported sand fill for bedding and blinding layers. However, this usually occurs as immediate settlement and should normally be the province of the builder.

Seasonal swelling and shrinkage of soil
All clays react to the presence of water by slowly absorbing it, making the soil increase in volume (see table below). The degree of increase varies considerably between different clays, as does the degree of decrease during the subsequent drying out caused by fair weather periods. Because of the low absorption and expulsion rate, this phenomenon will not usually be noticeable unless there are prolonged rainy or dry periods, usually of weeks or months, depending on the land and soil characteristics.

The swelling of soil creates an upward force on the footings of the building, and shrinkage creates subsidence that takes away the support needed by the footing to retain equilibrium.

Shear failure
This phenomenon occurs when the foundation soil does not have sufficient strength to support the weight of the footing. There are two major post-construction causes:

- Significant load increase.
- Reduction of lateral support of the soil under the footing due to erosion or excavation.
- In clay soil, shear failure can be caused by saturation of the soil adjacent to or under the footing.

GENERAL DEFINITIONS OF SITE CLASSES

Class	Foundation
A	Most sand and rock sites with little or no ground movement from moisture changes
S	Slightly reactive clay sites with only slight ground movement from moisture changes
M	Moderately reactive clay or silt sites, which can experience moderate ground movement from moisture changes
H	Highly reactive clay sites, which can experience high ground movement from moisture changes
E	Extremely reactive sites, which can experience extreme ground movement from moisture changes
A to P	Filled sites
P	Sites which include soft soils, such as soft clay or silt or loose sands; landslip; mine subsidence; collapsing soils; soils subject to erosion; reactive sites subject to abnormal moisture conditions or sites which cannot be classified otherwise

Tree root growth
Trees and shrubs that are allowed to grow in the vicinity of footings can cause foundation soil movement in two ways:

- **Roots that grow under footings may increase in cross-sectional size, exerting upward pressure on footings.**
- **Roots in the vicinity of footings will absorb much of the moisture in the foundation soil, causing shrinkage or subsidence.**

Unevenness of Movement

The types of ground movement described above usually occur unevenly throughout the building's foundation soil. Settlement due to construction tends to be uneven because of:

- Differing compaction of foundation soil prior to construction.
- Differing moisture content of foundation soil prior to construction.

Movement due to non-construction causes is usually more uneven still. Erosion can undermine a footing that traverses the flow or can create the conditions for shear failure by eroding soil adjacent to a footing that runs in the same direction as the flow.

Saturation of clay foundation soil may occur where subfloor walls create a dam that makes water pond. It can also occur wherever there is a source of water near footings in clay soil. This leads to a severe reduction in the strength of the soil which may create local shear failure.

Seasonal swelling and shrinkage of clay soil affects the perimeter of the building first, then gradually spreads to the interior. The swelling process will usually begin at the uphill extreme of the building, or on the weather side where the land is flat. Swelling gradually reaches the interior soil as absorption continues. Shrinkage usually begins where the sun's heat is greatest.

Effects of Uneven Soil Movement on Structures

Erosion and saturation
Erosion removes the support from under footings, tending to create subsidence of the part of the structure under which it occurs. Brickwork walls will resist the stress created by this removal of support by bridging the gap or cantilevering until the bricks or the mortar bedding fail. Older masonry has little resistance. Evidence of failure varies according to circumstances and symptoms may include:

- Step cracking in the mortar beds in the body of the wall or above/below openings such as doors or windows.
- Vertical cracking in the bricks (usually but not necessarily in line with the vertical beds or perpends).

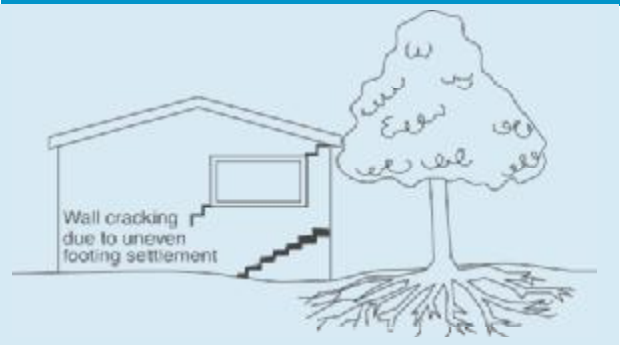
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

Seasonal swelling/shrinkage in clay
Swelling foundation soil due to rainy periods first lifts the most exposed extremities of the footing system, then the remainder of the perimeter footings while gradually permeating inside the building footprint to lift internal footings. This swelling first tends to create a dish effect, because the external footings are pushed higher than the internal ones.

The first noticeable symptom may be that the floor appears slightly dished. This is often accompanied by some doors binding on the floor or the door head, together with some cracking of cornice mitres. In buildings with timber flooring supported by bearers and joists, the floor can be bouncy. Externally there may be visible dishing of the hip or ridge lines.

As the moisture absorption process completes its journey to the innermost areas of the building, the internal footings will rise. If the spread of moisture is roughly even, it may be that the symptoms will temporarily disappear, but it is more likely that swelling will be uneven, creating a difference rather than a disappearance in symptoms. In buildings with timber flooring supported by bearers and joists, the isolated piers will rise more easily than the strip footings or piers under walls, creating noticeable doming of flooring.

Trees can cause shrinkage and damage



As the weather pattern changes and the soil begins to dry out, the external footings will be first affected, beginning with the locations where the sun's effect is strongest. This has the effect of lowering the external footings. The doming is accentuated and cracking reduces or disappears where it occurred because of dishing, but other cracks open up. The roof lines may become convex.

Doming and dishing are also affected by weather in other ways. In areas where warm, wet summers and cooler dry winters prevail, water migration tends to be toward the interior and doming will be accentuated, whereas where summers are dry and winters are cold and wet, migration tends to be toward the exterior and the underlying propensity is toward dishing.

Movement caused by tree roots
In general, growing roots will exert an upward pressure on footings, whereas soil subject to drying because of tree or shrub roots will tend to remove support from under footings by inducing shrinkage.

Complications caused by the structure itself
Most forces that the soil causes to be exerted on structures are vertical – i.e. either up or down. However, because these forces are seldom spread evenly around the footings, and because the building resists uneven movement because of its rigidity, forces are exerted from one part of the building to another. The net result of all these forces is usually rotational. This resultant force often complicates the diagnosis because the visible symptoms do not simply reflect the original cause. A common symptom is binding of doors on the vertical member of the frame.

Effects on full masonry structures
Brickwork will resist cracking where it can. It will attempt to span areas that lose support because of subsided foundations or raised points. It is therefore usual to see cracking at weak points, such as openings for windows or doors.

In the event of construction settlement, cracking will usually remain unchanged after the process of settlement has ceased.

With local shear or erosion, cracking will usually continue to develop until the original cause has been remedied, or until the subsidence has completely neutralised the affected portion of footing and the structure has stabilised on other footings that remain effective.

In the case of swell/shrink effects, the brickwork will in some cases return to its original position after completion of a cycle, however it is more likely that the rotational effect will not be exactly reversed, and it is also usual that brickwork will settle in its new position and will resist the forces trying to return it to its original position. This means that in a case where swelling takes place after construction and cracking occurs, the cracking is likely to at least partly remain after the shrink segment of the cycle is complete. Thus, each time the cycle is repeated, the likelihood is that the cracking will become wider until the sections of brickwork become virtually independent.

With repeated cycles, once the cracking is established, if there is no other complication, it is normal for the incidence of cracking to stabilise, as the building has the articulation it needs to cope with the problem. This is by no means always the case, however, and monitoring of cracks in walls and floors should always be treated seriously.

Upheaval caused by growth of tree roots under footings is not a simple vertical shear stress. There is a tendency for the root to also exert lateral forces that attempt to separate sections of brickwork after initial cracking has occurred.

The normal structural arrangement is that the inner leaf of brickwork in the external walls and at least some of the internal walls (depending on the roof type) comprise the load-bearing structure on which any upper floors, ceilings and the roof are supported. In these cases, it is internally visible cracking that should be the main focus of attention, however there are a few examples of dwellings whose external leaf of masonry plays some supporting role, so this should be checked if there is any doubt. In any case, externally visible cracking is important as a guide to stresses on the structure generally, and it should also be remembered that the external walls must be capable of supporting themselves.

Effects on framed structures
Timber or steel framed buildings are less likely to exhibit cracking due to swell/shrink than masonry buildings because of their flexibility. Also, the doming/dishing effects tend to be lower because of the lighter weight of walls. The main risks to framed buildings are encountered because of the isolated pier footings used under walls. Where erosion or saturation cause a footing to fall away, this can double the span which a wall must bridge. This additional stress can create cracking in wall linings, particularly where there is a weak point in the structure caused by a door or window opening. It is, however, unlikely that framed structures will be so stressed as to suffer serious damage without first exhibiting some or all of the above symptoms for a considerable period. The same warning period should apply in the case of upheaval. It should be noted, however, that where framed buildings are supported by strip footings there is only one leaf of brickwork and therefore the externally visible walls are the supporting structure for the building. In this case, the subfloor masonry walls can be expected to behave as full brickwork walls.

Effects on brick veneer structures
Because the load-bearing structure of a brick veneer building is the frame that makes up the interior leaf of the external walls plus perhaps the internal walls, depending on the type of roof, the building can be expected to behave as a framed structure, except that the external masonry will behave in a similar way to the external leaf of a full masonry structure.

Water Service and Drainage

Where a water service pipe, a sewer or stormwater drainage pipe is in the vicinity of a building, a water leak can cause erosion, swelling or saturation of susceptible soil. Even a minuscule leak can be enough to saturate a clay foundation. A leaking tap near a building can have the same effect. In addition, trenches containing pipes can become watercourses even though backfilled, particularly where broken rubble is used as fill. Water that runs along these trenches can be responsible for serious erosion, interstrata seepage into subfloor areas and saturation.

Pipe leakage and trench water flows also encourage tree and shrub roots to the source of water, complicating and exacerbating the problem.
Poor roof plumbing can result in large volumes of rainwater being concentrated in a small area of soil:

- Incorrect falls in roof guttering may result in overflows, as may gutters blocked with leaves etc.
- Corroded guttering or downpipes can spill water to ground.
- Downpipes not positively connected to a proper stormwater collection system will direct a concentration of water to soil that is directly adjacent to footings, sometimes causing large-scale problems such as erosion, saturation and migration of water under the building.

Seriousness of Cracking

In general, most cracking found in masonry walls is a cosmetic nuisance only and can be kept in repair or even ignored. The table below is a reproduction of Table C1 of AS 2870.

AS 2870 also publishes figures relating to cracking in concrete floors, however because wall cracking will usually reach the critical point significantly earlier than cracking in slabs, this table is not reproduced here.

Prevention/Cure

Plumbing
Where building movement is caused by water service, roof plumbing, sewer or stormwater failure, the remedy is to repair the problem. It is prudent, however, to consider also rerouting pipes away from the building where possible, and relocating taps to positions where any leakage will not direct water to the building vicinity. Even where gully traps are present, there is sometimes sufficient spill to create erosion or saturation, particularly in modern installations using smaller diameter PVC fixtures. Indeed, some gully traps are not situated directly under the taps that are installed to charge them, with the result that water from the tap may enter the backfilled trench that houses the sewer piping. If the trench has been poorly backfilled, the water will either pond or flow along the bottom of the trench. As these trenches usually run alongside the footings and can be at a similar depth, it is not hard to see how any water that is thus directed into a trench can easily affect the foundation's ability to support footings or even gain entry to the subfloor area.

Ground drainage
In all soils there is the capacity for water to travel on the surface and below it. Surface water flows can be established by inspection during and after heavy or prolonged rain. If necessary, a grated drain system connected to the stormwater collection system is usually an easy solution.

It is, however, sometimes necessary when attempting to prevent water migration that testing be carried out to establish watertable height and subsoil water flows. This subject is referred to in BTF 19 and may properly be regarded as an area for an expert consultant.

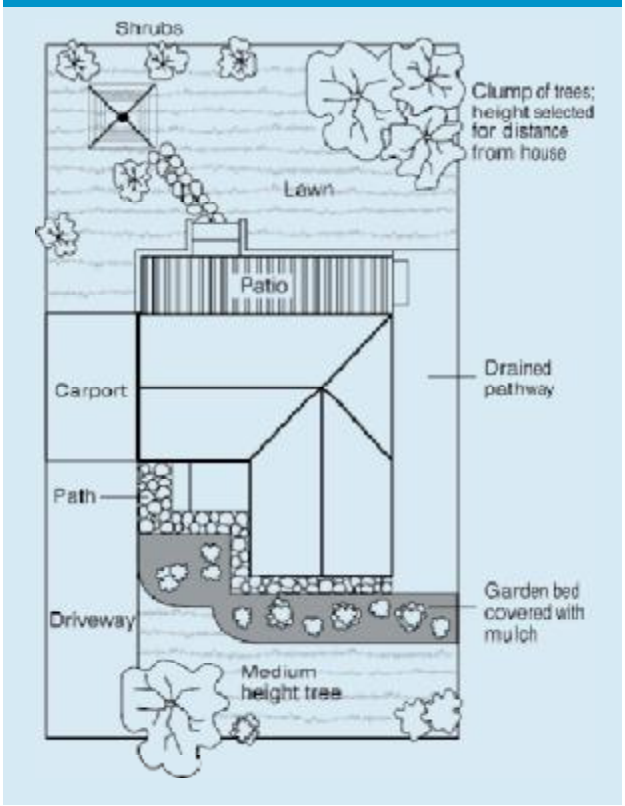
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

For this reason, particularly where problems exist or are likely to occur, it is recommended that an apron of paving be installed around as much of the building perimeter as necessary. This paving

CLASSIFICATION OF DAMAGE WITH REFERENCE TO WALLS

Description of typical damage and required repair	Approximate crack width limit (see Note 3)	Damage category
Hairline cracks	<0.1 mm	0
Fine cracks which do not need repair	<1 mm	1
Cracks noticeable but easily filled. Doors and windows stick slightly	<5 mm	2
Cracks can be repaired and possibly a small amount of wall will need to be replaced. Doors and windows stick. Service pipes can fracture. Weathertightness often impaired	5–15 mm (or a number of cracks 3 mm or more in one group)	3
Extensive repair work involving breaking-out and replacing sections of walls, especially over doors and windows. Window and door frames distort. Walls lean or bulge noticeably, some loss of bearing in beams. Service pipes disrupted	15–25 mm but also depend on number of cracks	4

Gardens for a reactive site



should extend outwards a minimum of 900 mm (more in highly reactive soil) and should have a minimum fall away from the building of 1:60. The finished paving should be no less than 100 mm below brick vent bases.

It is prudent to relocate drainage pipes away from this paving, if possible, to avoid complications from future leakage. If this is not practical, earthenware pipes should be replaced by PVC and backfilling should be of the same soil type as the surrounding soil and compacted to the same density.

Except in areas where freezing of water is an issue, it is wise to remove taps in the building area and relocate them well away from the building – preferably not uphill from it (see BTF 19).

It may be desirable to install a grated drain at the outside edge of the paving on the uphill side of the building. If subsoil drainage is needed this can be installed under the surface drain.

Condensation

In buildings with a subfloor void such as where bearers and joists support flooring, insufficient ventilation creates ideal conditions for condensation, particularly where there is little clearance between the floor and the ground. Condensation adds to the moisture already present in the subfloor and significantly slows the process of drying out. Installation of an adequate subfloor ventilation system, either natural or mechanical, is desirable.

Warning: Although this Building Technology File deals with cracking in buildings, it should be said that subfloor moisture can result in the development of other problems, notably:

- Water that is transmitted into masonry, metal or timber building elements causes damage and/or decay to those elements.
- High subfloor humidity and moisture content create an ideal environment for various pests, including termites and spiders.
- Where high moisture levels are transmitted to the flooring and walls, an increase in the dust mite count can ensue within the living areas. Dust mites, as well as dampness in general, can be a health hazard to inhabitants, particularly those who are abnormally susceptible to respiratory ailments.

The garden

The ideal vegetation layout is to have lawn or plants that require only light watering immediately adjacent to the drainage or paving edge, then more demanding plants, shrubs and trees spread out in that order.

Overwatering due to misuse of automatic watering systems is a common cause of saturation and water migration under footings. If it is necessary to use these systems, it is important to remove garden beds to a completely safe distance from buildings.

Existing trees

Where a tree is causing a problem of soil drying or there is the existence or threat of upheaval of footings, if the offending roots are subsidiary and their removal will not significantly damage the tree, they should be severed and a concrete or metal barrier placed vertically in the soil to prevent future root growth in the direction of the building. If it is not possible to remove the relevant roots without damage to the tree, an application to remove the tree should be made to the local authority. A prudent plan is to transplant likely offenders before they become a problem.

Information on trees, plants and shrubs

State departments overseeing agriculture can give information regarding root patterns, volume of water needed and safe distance from buildings of most species. Botanic gardens are also sources of information. For information on plant roots and drains, see Building Technology File 17.

Excavation

Excavation around footings must be properly engineered. Soil supporting footings can only be safely excavated at an angle that allows the soil under the footing to remain stable. This angle is called the angle of repose (or friction) and varies significantly between soil types and conditions. Removal of soil within the angle of repose will cause subsidence.

Remediation

Where erosion has occurred that has washed away soil adjacent to footings, soil of the same classification should be introduced and compacted to the same density. Where footings have been undermined, augmentation or other specialist work may be required. Remediation of footings and foundations is generally the realm of a specialist consultant.

Where isolated footings rise and fall because of swell/shrink effect, the homeowner may be tempted to alleviate floor bounce by filling the gap that has appeared between the bearer and the pier with blocking. The danger here is that when the next swell segment of the cycle occurs, the extra blocking will push the floor up into an accentuated dome and may also cause local shear failure in the soil. If it is necessary to use blocking, it should be by a pair of fine wedges and monitoring should be carried out fortnightly.

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