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GEOTECHNICAL CONSULTING

Geotechnical Assessment Report

Project: Redevelopment of Aged Care Facility
St Columba's, Fig Tree Street, Lane Cove NSW.

Prepared for:
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GEOTECHNICAL INVESTIGATION REPORT

For **Redevelopment of Aged Care Facility** at

St Columba's, Fig Street, Lane Cove, NSW

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1.0 INTRODUCTION

At the request of UNITING NSW.ACT (Uniting), Ascent Geotechnical Consulting Pty Ltd (Ascent) has carried out geotechnical investigations at Uniting's St Columba's Fig Street aged care facility, and its neighbouring residential properties, hereafter referenced individually, or referred to collectively as the "Site".

The work was carried out in general accordance with our proposal dated 20th December, 2019, and Uniting's approval to proceed via consultancy agreement, and purchase order (130478), dated 3rd February, 2020.

Field work was carried out between 11th – 14th February, 2020. This report provides results of field investigations, laboratory analysis, interpreted subsurface characteristics and geological model for the Site, and geotechnical recommendations to enable design and construction of footings and ground support structures for the proposed development.

This geotechnical assessment was carried out in general accordance with the following standards:

- Australian Standard (AS1726) 2017: Geotechnical Site Investigation,
- Australian Standard (AS2870) 2011: Residential Slabs and Footings,
- Australian Standard 1289.6.3.2:1997 Methods of Testing Soils for Engineering Purposes,

A Targeted Contamination Assessment (PO34542 / C02260, Version B, 22nd April, 2020) has also been undertaken by Progressive Risk Management (PRM). This report can be found in Appendix F of this report. Ascent Engaged PRM to undertake field sampling of soils for contamination assessment concurrently with the geotechnical field work.

1.1 Available Information

Prior to commencement of the geotechnical site assessment, field work, and the preparation of this report, the following information was made available to Ascent by Uniting:

- Preliminary architectural design drawings have been prepared by Morrison Design Partnership, Project Number 3108.
- Detailed levels survey has been prepared by Project Surveyors, Job No. B03824, Drawing No. 1 - 13.

1.2 Proposed Development

It is understood that the proposed redevelopment of the Site includes the demolition of a number of residential properties to the east of the existing Uniting St Columba's aged care facility, extending eastward along Centennial Avenue, Fig Tree Street, and Charlish Lane. The redevelopment will involve a significant addition to the eastern side of the existing facility incorporating a large single level basement.

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It is anticipated that excavations for the proposed basement will be carried out to an approximate maximum depth of 6.0m below existing surface levels across the Site.

1.3 Scope of Work

In accordance with the project brief, geotechnical field work was carried out on 11th to 14th February 2020, in the full-time presence of an experienced geotechnical engineer or engineering geologist from Ascent, and comprising of the following:

- Collection and review of Dial-Before-You-Dig (DBYD) plans and documentation.
- A site walkover assessment and photographic record.
- Service location using electromagnetic detection equipment to ensure excavation and vertical borehole locations were clear of underground services.
- Drilling of six (6) rotary boreholes using a multi-purpose CD180 tight access track mounted drilling rig. The boreholes were initially advanced using solid flight auger techniques and continued using NMLC coring to the required target depths. Boreholes are identified as BH01 – BH06. Standard Penetration Tests (SPT were carried out at regular intervals during auger drilling.
- Collection of disturbed soil and rock samples and recovered rock core for detailed logging and selective laboratory analysis.
- Co-ordination with PRM during the field work to enable targeted environmental contamination assessment.
- Reinstatement of boreholes with augured soil cuttings.

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2.0 SITE DESCRIPTION

2.1 Site Summary

A summary of site conditions identified at the time of our site visit is provided in the table below (Table 1). The site location is shown in Image 1.

Table 1: Summary of Site Conditions.

Parameter	Description
Site Visit	Ben Morgan & Morgan Spreadbury-Key - Ascent Geotechnical, 11th – 14th February, 2020
Site Address(s)	Uniting St Columba's Fig Tree Street, Lot 2 in DP184731 (1938m^2) & Lot A in DP385033 (1517m^2) 112 Centennial Avenue, Lane Cove, Lot B in DP385033 (750m^2) 108 Centennial Avenue, Lane Cove, Lot 2 in DP339444 (696.8m^2) 106 Centennial Avenue, Lane Cove, Lot 3 in DP339444 (696.8m^2) 13 Fig Tree Street, Lane Cove, Lot C in DP385033 (557.4m^2) 11 Fig Tree Street, Lane Cove, Lot D in DP385033 (562.0m^2) 9 Fig Tree Street, Lane Cove, Lot B in DP346581 (822.0m^2) 7 Fig Tree Street, Lane Cove, Lot C in DP336859 (986.1m^2) & 1 Charlish Lane, Lane Cove, Lot 33 in DP555562 (1240.0m^2)
Existing development	Aged care facility, one and two storey brick residential dwellings (occupied).
Vegetation	Lawn areas, garden beds, scattered shrubs and trees.

Image 1: Approximate redevelopment area – Red polygon (© SIX Maps NSW Gov)

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2.2 Site Topography

The site is located on the south-eastern corner of Centennial Avenue and Fig Tree Street, Lane Cove. Topographically, the site slopes from the south east to west north west with an elevation change of approximately 7m.

The site has an approximate frontage of 155m to Centennial Avenue, and approximately 180m to Fig Tree Street. The site is otherwise bounded by residential development to the east. A small uncalculated frontage to Charlish Lane also exists to the east.

The client supplied survey plan (B03824-1) prepared by Project Surveyors indicates the site levels range from about RL 58.25 (AHD) at the south eastern corner of No. 7 Fig Tree Street to about RL 51.0 at the western corner of The St Columba's grounds (near the corner of Centennial Avenue and Fig Tree Street).

The rear yards of the residential properties forming the eastern portion of the site were generally level, to gently sloping. Surface Conditions comprised lawn and garden areas, low landscaped garden beds and concrete/paved areas, with sparse to moderately dense shrubs and trees. A concrete in-ground pool is situated toward the western boundary of the property at No. 1 Charlish lane.

Visual assessment of the existing brick structures identified no significant structural damage, settlement, tension cracks or any other damage pertaining to slope instability within the site.

2.3 Site Geology

With reference to the Sydney 1:100,000 Soil Landscapes Series – Sheet 9130 (4th Ed), the site lies within the Glenorie (Gn) Colluvial Landscape, comprising undulating to rolling low hills on Wianamatta Group shales. Soils typically comprise moderately deep (700-1500mm) to deep (>2000mm), brown/orange/red/grey podzolic soils.

The Sydney 1:100,000 Geological Series Sheets 9130 (1st ed) indicates that the site is underlain by both the Middle Triassic age Hawkesbury Sandstones (Rh), and the Ashfield Shale (Rwa), also of Middle Triassic age. Based on the geological mapping available, it would appear that the boundary between the younger and overlying Ashfield Shale, and the older underlying Hawkesbury Sandstones runs approximately north-south on the eastern side of the St Columba's facility, with the Ashfield Shale geology extending eastward from the boundary (Image 2). The boundary between these two units is often marked by a relatively thin (<8 m) sedimentary unit known as the Mittagong Formation (Rm).

The Ashfield Shale is typically comprised of dark grey to black siltstone, and fine sandstone-siltstone laminite, which weathers to a residual clay profile of medium to high plasticity. The Hawkesbury Sandstone comprises massive and cross-bedded medium to coarse grained quartz sandstone with very minor shale and laminate lenses. The Mittagong Formation boundary unit is typically comprised of fine-grained quartz sandstone interbedded with dark grey siltstone and laminite, which can be difficult to distinguish from the underlying Hawkesbury Sandstone.

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The geotechnical field work carried out confirmed the presence of Ashfield Shale overlying Mittagong Formation sandstone at depth. It is possible that a number of the boreholes terminated in the uppermost Hawkesbury Sandstone, however from an engineering perspective the differentiation between the Mittagong and Hawkesbury Sandstones is inconsequential.

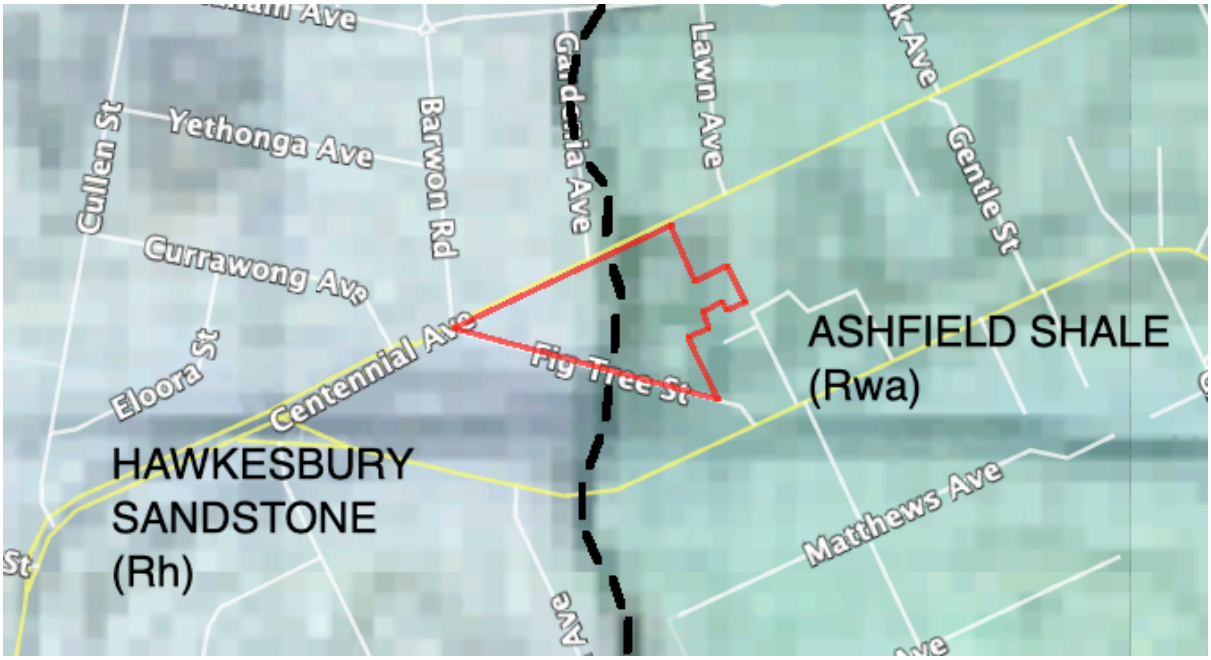

Image 2: Site location and approximate location of geological boundary – dashed line (© Google Earth w/ Sydney 1:100,000 Geological Series Sheets 9130 (Edition 1) overlay).

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3.0 FIELD & LABORATORY WORK

3.1 Geotechnical Field Work

Geotechnical field work for the current scope of work included the drilling of six (6) boreholes using a track mounted, SPT equipped, multi-purpose CE180 super tight access drilling rig, and a number of hand excavated shallow test pits for CBR testing. All six boreholes, identified as BH01 to BH06, were advanced through topsoil, clay and very low strength rock using spiral flight augers with a tungsten carbide bit. Standard Penetration tests (SPTs) were carried out at regular intervals though the residual soil and low strength rock to determine insitu strength characteristics. Boreholes were then cased, and continued to, or slightly beyond, target depth of 10.0m to collect a continuous core sample of the bedrock using NMLC diamond coring techniques. Samples of soil, and rock were retained for subsequent NATA laboratory analysis and detailed core logging. A site plan showing borehole locations is presented in appendix B. The depth to auger termination and commencement of NMLC coring, as well as final termination depth of each of the boreholes is summarised in Table 2. Borehole collar levels have been inferred from the site survey plan provided by Uniting.

A Targeted Contamination Assessment (TCA) was carried out by Progressive Risk Management (PRM), run in parallel with the geotechnical assessment. Full details on the results of this assessment are presented in Appendix F.

Table 2. Summary of Borehole Drilling Data

Borehole	Collar RL*	Auger Termination		Core Termination	
	(mAHD)	Depth (m)	RL (mAHD) approx.	Depth (m)	RL (mAHD) approx.
BH01	54.0	3.0	51.25	10.53	43.72
BH02	54.8	4.5	50.25	10.13	44.62
BH03	54.3	4.5	49.75	10.52	43.73
BH04	56.2	4.5	51.30	10.31	45.49
BH05	56.0	4.5	51.25	10.28	45.47
BH06	54.0	6.0	47.99	10.00	43.99

* Borehole collar RLs have been inferred from the site survey plan B03824, by Project Surveyors.

3.2 Geotechnical Laboratory Testing

Samples of soil and rock recovered from the drilling of the boreholes were returned to a NATA registered laboratory for laboratory testing. Laboratory testing included:

- Soil aggressivity analysis - pH, sulphate and chloride concentrations.
- Standard compaction properties - Using four-day soaked California Bearing Ratio (CBR) test.
- Point load analysis of rock strength
- Unconfined Compressive Strength (UCS) analysis of rock core with measurement of Youngs Modulus.

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4.0 GEOTECHNICAL INVESTIGATION RESULTS

Subsurface conditions encountered during borehole drilling are summarised in Table 3 below. Engineering Borehole Logs are presented in Appendix C, together with explanation sheets defining the terms and symbols used in their preparation (Appendix A). Core photographs and the results of point load index tests are presented in Appendix C and Appendix D, respectively. It should be noted that reference should be made to the engineering logs and/or specific test results for design purposes.

Table 3: Summary of Material Strata Levels and Rock Classifications

Bore-hole No.	Surface RL	Top of Natural Clays		Top of Extremely Low to Very Low Strength Bedrock (Class V Shale)		Top of Low - Medium strength Weathered Siltstone-Laminite (Class III Shale)		Top of High and Very High Strength, Fresh Siltstone-Laminite (Class II Shale)		Top of High Strength (fine to medium grained) Sandstone	
		D (m)	RL (m)	D (m)	RL (m)	D (m)	RL (m)	D (m)	RL (m)	D (m)	RL (m)
BH01	54.0	0.4	53.6	3.5	50.5	5.4	48.6	7.9	46.1	9.5	44.5
BH02	54.8	0.3	54.5	3.5	51.3	5.9	48.9	6.9	47.9	7.6	47.2
BH03	54.3	0.3	54	3.0	51.3	6.8	47.5	-	-	7.3	47
BH04	56.2	0.5	55.7	3.5	52.7	4.9	51.3	6.3	49.9	8.7	47.5
BH05	56.0	0.2	55.8	3.5	52.5	6.6	49.4	7.2	48.8	9.1	46.9
BH06	54.0	0.3	53.7	3.0	51.0	6.0	48.0	-	-	8.3	47.7

Note: D = Depth below ground surface level RL = Reduced Level

4.1 Geotechnical Model

With reference to the geological logging and strength conditions identified in our borehole tests, the site can be interpreted to comprise of several generalised 'Units' as follows.

Unit 1 – Organic topsoil, minor shallow uncontrolled fill

Unit 2 – Residual clays, generally stiff to hard.

Unit 3 – Extremely low to low strength siltstone (Class V Shale)

Unit 4 – Low to medium strength siltstone – laminite (Class III shale)

Unit 5 – High to very high strength laminite (Class II Shale)

Unit 6 – High Strength fine grained sandstone (Mittagong Formation)

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Two geological cross sections are provided in Appendix B, illustrating the inferred geological unit boundaries identified in boreholes BH01 – BH06.

Interpreted geological boundaries are based on borehole data only. Variation between our interpreted model and actual ground conditions away from borehole testing locations should be anticipated.

4.2 Groundwater

Significant groundwater was not identified during our subsurface testing, however the introduction of drilling water at the commencement of NMLC coring at depths of between 3m and 6m will mask the identification of groundwater inflow during drilling. It should be noted that the absence of groundwater during the investigation does not preclude the possibility of a standing or perched water table at the site.

Groundwater levels will be subject to seasonal and daily fluctuations, influenced by environmental factors such as short- and long-term rainfall patterns and development on adjacent properties. Soil moisture levels within the site may be influenced by events on site and in adjacent areas such as breakage of water mains, stormwater systems, and sewer pipes.

The installation of a groundwater monitoring standpipe piezometer was not part of the project brief.

5.0 LABORATORY TEST RESULTS

5.1 Soils – Aggressivity, and California Bearing Ratio (CBR)

Three samples of soil were submitted for chemical analyses (pH, sulphate and chloride concentrations) at a NATA accredited laboratory, for assessment of soil aggressivity to buried structural elements (e.g. concrete and steel). The results of the chemical analyses are summarised in Table 4, and the detailed laboratory analysis is presented in Appendix E.

Table 4: Soil Aggressivity Test Results

Borehole No.	Sample Depth (m)	Material Description	Sulphate (SO_4) (mg/kg)	Chloride (mg/kg)	pH (1:5 Aqueous extract)
BH01	1.0	SILTY CLAY	66	38	4.6
BH04	0.5	SILTY CLAY	14	<10	6.7
BH06	1.5	SILTY CLAY	90	20	4.6

One bulk sample of silty clay was collected from BH05 and was tested in a NATA accredited laboratory to determine standard compaction properties, and to establish the four-day soaked CBR value. The detailed results of the test are presented in Appendix E, and are summarised in Table 5.

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Table 5: Summary of CBR Test Results

Borehole No. (sample depth m)	Material Description	Dry Density (t/m³)	Field Moisture Content (%)	Optimum Moisture Content (%)	Percentage Swell (%)	CBR Value (%)
BH05 (0.3 – 0.5)	SILTY CLAY	1.50	20.4	23.2	1.00	9.0*

***** Presence of gravel in the sampled material may have resulted in an elevated CBR value. Design CBR values of ~5% are more typical of the residual clays derived from the Ashfield Shale.

5.2 Rock – Point Load Strength Tests.

Recovered rock cores were sent to a NATA accredited laboratory for rock strength testing. This testing involved diametral and axial Point Load Strength Index tests. The Point Load Strength results for the rock cores and the assessed rock strengths, in accordance with Australian Standards (AS4133.4.1-2007), are summarised in Table 6. Detailed laboratory testing report is presented in Appendix D.

Table 6. Point Load Index Strength Test Results

Borehole	Surface ~RL	Depth (m)	Reduced Level (mAHD)	Diametral $I_{s(50)}$ (MPa)	Assessed Strength
BH01	~54.25	6.04	48.21	1.1	High
		7.50	46.75	0.7	Medium
		9.07	45.18	1.8	High
		10.48	43.77	2.3	High
BH02	~54.75	7.85	46.90	0.7	Medium
		8.92	45.83	2.4	High
		10.1	44.65	2.1	High
BH03	~54.25	5.35	48.90	0.2	Low
		7.60	46.65	0.3	Low
		8.51	45.74	0.4	Medium
		9.50	44.75	1.5	High
		10.50	43.75	2.1	High
BH04	~55.80	6.40	49.40	0.7	Medium
		7.40	48.40	0.9	Medium
		9.04	46.76	1.1	High
		10.20	45.60	1.9	High
BH05	~55.75	7.80	47.95	0.2	Low
		9.60	46.15	0.7	Medium
		10.15	45.60	1.9	High
BH06	~53.99	8.45	45.54	0.1	Low
		9.90	44.09	1.4	High

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Laboratory compressive strength analysis of three samples from BH01, BH02, & BH05 is presented in Appendix E of this report. Uniaxial Compressive Strength (UCS) of the sampled rock core resulted in UCS values of 7.2 – 24.6 MPa corresponding to low to high strength rock.

Table 7. Summary of UCS Test Results

Borehole	Depth of sample	UCS Value (MPa)	Youngs Modulus (tangential, MPA)	Poissons Ratio	Point lOad Value (Is_{50})	Rock Strength
BH01	9.0 - 10.1	24.6	6800	0.25	1.8 – 2.3	High
BH05	7.5 – 7.75	7.2	1000	0.23	0.2	Low to Medium

6.0 Geotechnical Design and Recommendations

6.1 General

Based on geological mapping and the results of geotechnical field and laboratory testing carried out, the generalised subsurface profile is interpreted to comprise of minor fill/silty topsoil, and residual medium to high plasticity clays, overlying highly weathered siltstone and siltstone-laminite of the Ashfield Shale (Rwa), with Mittagong Formation (Rm)/Hawkesbury (Rh) sandstone encountered at a depth of between 7.3m and 9.5m from current surface levels in all six boreholes.

Detailed dilapidation surveys should be carried out for any adjacent properties, or adjoining structures to assess any possible impacts of construction work.

6.2 Earthworks and Site Preparation

All earthworks at the site should be carried out in accordance with AS3798 “Guidelines on Earthworks for Commercial and Residential Developments” (2007).

Site preparation across the area of the proposed works will require the demolition of existing structures, stripping of vegetation and loose topsoil, in preparation for excavation and the installation of supporting retention systems.

Appropriate design and construction methods shall be required during site works to minimise erosion and provide sediment control. In particular, any stockpiled soil will require erosion control measures, such as siltation fencing and barriers, to be designed by others.

It is expected that excavations required for the construction of the proposed basement level will extend to an approximate maximum depth of between 5 – 6m to ~RL 50.6, from existing ground levels. The excavation is expected to encounter predominantly residual soil and extremely low to low strength siltstone and laminite, with some medium to high strength laminite, sandstone-laminite & sandstone expected at the base of excavation.

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Excavation of soil materials and weathered, extremely low to low strength siltstone and laminite may be possible using conventional earthmoving equipment such as backhoes or tracked excavators.

It is likely heavy ripping and/or vibratory rock breaking techniques could be required within the stronger, less weathered siltstone-laminite and sandstones of medium to high strength, expected towards the base of the proposed excavation.

6.3 Vibration Management

It is expected that most of the proposed excavation will be carried out in a manner that should result in relatively low vibration levels.

Should vibratory rock breaking equipment be required for excavations in bedrock, it is recommended it be complemented with saw cutting, using an appropriate excavator mounted rock saw, or approved alternative measure, prior to excavation, so as to minimise transmission and amplification of vibrations to adjoining structures. Hammering should be carried out horizontally along bedding planes where possible, to minimise transmission of vibrations to adjoining structures.

Induced vibrations in structures adjacent to the excavation should not exceed a peak particle velocity (PPV) of 8mm/sec for structures in good condition, or 2mm/sec for heritage or structures in poor-condition. It may be necessary to confirm the specifications of equipment with the plant manufacturer to ensure normal operations can be carried out within these working tolerances.

Consideration of structural integrity, and human comfort may necessitate a possible reduction of the PPV value to 5mm/sec, where some existing commercial and residential structures are likely to be in close proximity to deep excavations. If vibrations in adjacent structures exceed these values or appear excessive, excavation should cease and Ascent should be contacted immediately for appropriate reviews.

6.4 Groundwater Management

Significant groundwater was not identified during our testing, though it should be noted that dedicated long-term groundwater monitoring wells were not part of the scope of this assessment and the introduction of drilling fluid below 3-6m depth will mask any field observation on groundwater seepage into boreholes.

Periodic or consistent seepage from either a perched water table or variable environmental, or man-made sources is likely to influence the excavation during construction, and should be considered for the long-term design life of the structures. Strip drains or drainage materials should be installed behind the shoring/retaining walls in conjunction with collection trenches, or pipes and pits connected to the buildings stormwater system. A temporary storage tank and pump system may be required. Depending on the groundwater inflow rate during excavation, groundwater seepage and surface water infiltration may be controlled by sump and pump methods during construction. Waterproofing of basement floor slab and walls should be provided unless appropriate drainage can be installed and maintained during the design life of the building. Surface water flows should be able to be readily intercepted by the construction of a suitable sub-surface cut-off drain on the high side of the Site.

Where bulk excavations are terminated within highly weathered bedrock layers, and particularly within weathered siltstones/shales, natural materials at the base of such excavations may require the

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incorporation of a granular surfacing so as to remain trafficable under unfavourable and adverse climatic conditions. If loose or soft rocks or clay seams are encountered within the basement floor areas, removal to competent rock and replacement with mass concrete may be considered.

Installation of groundwater wells and long-term water level monitoring may be required to confirm assumptions made in this report.

6.5 Temporary Batter Slopes

Temporary batter slopes may be considered where setbacks between basement excavation and existing structures, and property boundaries permit, or where adjacent structures are outside the zone of influence of the excavation. The zone of influence can be established by estimating a 45° plane from the toe of the proposed excavation.

Recommended maximum values for temporary batter slopes are provided in Table 8 below.

Table 8. Recommended Temporary Batter Slopes.

Material	Maximum Temporary Batter Slope (H:V)
Fill	2:1
Residual Soil	1.5:1
Class V Shale/Siltstone	1:1
Class IV Shale/Siltstone	1:1
Class III Shale/Sandstone	Sub-Vertical*

*Subject to geotechnical inspection to assess the possible requirement for stabilisation measures such as shotcrete, rock bolting etc.

As the basement construction may require maximum excavations of up to ~7.0m, and due to the relatively close proximity to adjacent property boundaries, and adjoining structures, the adoption of temporary or permanent batter slopes is likely to be unsuitable across most of the site.

6.6 Excavation Support

Based on the subsurface conditions encountered during borehole drilling, and our understanding of the proposed development, perimeter basement excavation retention system is likely to be required. This may comprise a secant, contiguous or soldier pile wall solution, socketed into the underlying bedrock below final basement level. Contiguous pile walls allow a small gap between piles which could allow groundwater ingress during excavation. Soldier pile walls have a larger gap between the piles. In both cases, strip drains and reinforced shotcrete infill between piles can limit the amount of groundwater ingress and support the soil between the piles. All vertical drains should be connected to a perimeter drain provided at the toe of the final excavation, which should discharge to the site stormwater system via a sump and pump, to provide long term drainage behind excavation walls.

Alternative supporting systems such as secant piles or diaphragm walls, may be suitable for the site, subject to detailed structural design, logistical considerations, and further discussion with Ascent regarding the chosen systems feasibility.

Sheet piles are unlikely to achieve sufficient embedment below basement floor depth and high driving energy would be required during installation.

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Considering the height of the retained excavation, it is likely that a temporary ground anchors or walers with bracing will be required to provide lateral support to the perimeter piles during construction. As at least two or more rows of anchors will likely be required to support the piles, and where significant lateral movements cannot be tolerated (e.g. due to adjacent infrastructure), the shoring/basement wall should be designed as a braced structure.

Ground anchor design should be based on allowing effective bonding into soil and rock behind the potential 'active zone' determined by drawing a line at 45° from the base of the internal excavation to intersect the ground surface behind the wall. Basement floor slabs may be designed to provide permanent restraint to the perimeter retaining walls. Ground anchors may be designed to temporary conditions. The design of permanent ground anchors may be necessary, however careful consideration of properties boundaries will be required.

Ground anchor installation beyond the property boundaries will be subject to approval by owners of adjoining properties, roads and infrastructure. Removable ground anchors may be considered if anchors encroach into adjacent properties. Where an anchorage system is shown to be impractical, consideration of other temporary support options would be necessary. These options include the following:

- Temporary solutions such as installation of waler beams, props and/or internal bracing associated with staged excavation;
- Staged excavations with temporary partial berms in front of walls.
- Top-down construction where floor slabs and beams are constructed at the top of shoring wall and at floor levels of the upper basement levels prior to excavation within the basement level underneath the floor slabs.

6.7 Retaining Wall Design Parameters

Design of retaining walls, including any temporary or permanent ground anchors, should comply with AS4678-2002 earth-Retaining Structures.

Detailed design of temporary or permanent anchored or propped pile walls should utilise computer software that can model the interaction between the structural support elements and retained soil or rock, with calculation of ground movement, wall deflection and structural forces within support elements. Stiffness of the retaining wall, embedment, spacing of anchors or waler beams with props (or any other chosen option to enable safe and stable excavation) may be incorporated into the soil-structure analysis to aid in design.

Retaining structures should be designed to account for lateral earth pressures, possibility of unstable wedges along joint planes, hydrostatic and seismic pressures, and any applied surcharge loads within the zone of influence of the excavation, including, but not limited to, existing structures and infrastructure, traffic and construction related activities. Suitably designed concrete pile retaining walls may form part of the final footing solution for the permanent structure.

Geotechnical design parameters for the design of the perimeter retention system, specific to the soil and rock strata identified on site, are summarised in Table 9. Magnitude of earth pressure will depend

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on wall stiffness and anchor/propping arrangement and will vary between at-rest, active and passive states depending on overall soil-structure behaviour.

Table 9. Preliminary Geotechnical Design Parameters for Perimeter Retention System Design.

Material	Bulk Unit Weight (kN/m^3)	Effective Cohesion c' (kPa)	Angle of Friction (°)	Elastic Modulus E_{sh} (MPa)
Fill/Topsoil	17	0	24	5
Residual Soil	20	5	24	15
Class V Siltstone /Shale (EL - VL)	22	15	24	50
Class IV Siltstone /Shale laminate (VL - L)	22	25	30	200
Class III Siltstone /Shale laminate (L-M)	24	50	30	500

Coefficients of lateral earth pressure can be calculated from the above soil parameters, taking into consideration behaviour of the chosen retention system. For undrained conditions, the at-rest earth pressure coefficient should be taken as 1.0.

Where temporary ground rock anchors are adopted, suitable embedment into Class V to Class III Shale/Siltstone will be required. Preliminary allowable grout-to-rock adhesion values temporary anchor design in the identified rock strata of the site is presented in Table 10.

Table 10. Preliminary Allowable Bond Adhesion Values for Temporary Ground Anchor Design.

Material	Allowable Bond Stress (kPa)
Class V Siltstone /Shale (EL - VL)	30
Class IV Siltstone /Shale (VL - L)	50
Class III Siltstone /Shale (L-M)	150

Anchors may be designed for the parameters recommended above provided they are proof tested to 1.5 times the design working load specified by the structural engineer; and the socket length in the bedrock be at least 3.0m. Anchors should be sufficiently embedded behind any potential slickenside joints within the Ashfield Shale.

6.8 Foundation Design Recommendations

Based on the results of subsurface investigations carried out, it is anticipated that foundation conditions at the site will comprise siltstone and siltstone-laminite of variable degrees of weathering and strength. Proposed basement excavation is planned to extend to RL 50.64, which is expected to terminate in extremely low to low strength Class V shale/siltstone, and low strength Class III Laminite. A suitable footings arrangement may comprise a stiffened raft slab with local pad or piled footings to support internal columns and walls.

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To reduce the potential for differential settlement, it is recommended that all footings be founded on similar strength rock throughout.

Geotechnical parameters for the design of shallow, piled and slab footings are provided in Table 11.

Table 11. Geotechnical parameters for foundation design.

Material	Allowable Bearing Capacity (kPa)
Residual Soil, stiff to hard clay	150
Class V Siltstone /Shale (EL - VL)	600
Class IV Siltstone /Shale (VL - L)*	800
Class III Siltstone /Shale (L - M)*	1500

*Assuming a minimum embedment depth of 0.5m

6.9 Site Classification

Site classification, as covered by AS2870 – 2011 "Residential Slabs and Footings" are not considered suitable for structures such as the one proposed due to significantly higher foundation loads compared to common residential houses, and the presence of a deep basement excavation and retention design. Hence the footings of the proposed development must be engineer-designed.

Architectural plans provided show that the floor of the proposed basement will be founded at approximately 6m below existing ground level. According to the information obtained from borehole drilling, founding material is anticipated to comprise mostly Class III Shale. Localised Class V or Class II Shale may be present at basement founding depth.

6.10 Preliminary Earthquake Design

The results of the geotechnical field and laboratory testing at the Site indicates the presence of shallow topsoil and residual soil extending to relatively shallow depth underlain by low strength siltstone or sandstone, increasing with strength with depth. In accordance with Australian Standard AS 1170.4-2007 the site may be classified as a "Shallow soil site" (Class C_e) for design of foundations and retaining walls embedded in the underlying soils and weathered bedrock. The Hazard Factor (Z) for Sydney, in accordance with AS 1170.4-2007 is considered to be 0.08.

6.11 Soil Aggressivity

With reference to Table 6.4.2 (c) in AS2159 – 2009 "Piling – Design and Installation", and the results of the pH, Chloride, and sulfate analyses of three soil samples collected from borehole BH01, BH04, and BH06 (as summarised in Table 4), indicate the soil samples collected are "non-aggressive" to "mild" to structures founded in low permeability soils.

6.12 Acid Sulfate Soils

With reference to eSPADE v2.0 Acid Sulfate Soils risk maps published by the NSW Government Office of Environment & Heritage, and Lane Cove Councils Local Environmental Plan (LEP) 2009, Acid Sulfate Soils Map – Sheet ASS_001, the Site is not classified under any specific Acid Sulfate Soils risk category.

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It is our opinion that the site lacks both the RL, and the reducing environment required for the formation of potential or actual Acid Sulfate Soils.

6.13 Pavement Design

Laboratory analysis of the upper residual soil profile of BH05 produced a four-day soaked CBR value of 9%. This value has likely been artificially elevated due to the presence of some gravel in the sample. A reduced pavement design CBR value of 5% is recommended for shallow soils at this site.

7.0 Limitations

This report has been prepared for Sally Bassett – Uniting, in accordance with Ascent Geotechnical Consulting's (Ascent) Fee Proposal dated 19th June, 2019.

The contents of this report are and remain the intellectual property of Ascent. This report has been provided for the exclusive use of Uniting, Morrison Design Partnership, and their nominated agents for the specific development and purpose as described in the report. This report must not be used for purposes other than those outlined in the report or applied to any other projects.

The information contained within this report is considered accurate at the time of issue with regard to the current surface and subsurface conditions onsite, as identified by Ascent and the documentation provided by others. Conditions between test locations may vary significantly from the interpreted model provided herein. Furthermore, subsurface conditions can change abruptly due to variable environmental, and geological processes, and also as a result of human influence, and infrastructure.

This report should be read in its entirety and should not be separated from its attachments or supporting notes. It should not have sections removed or included in other documents without the express approval of Ascent.

Should you have any queries regarding this report, please do not hesitate to contact the author of this report, undersigned.

For and on behalf of, **Ascent Geotechnical Consulting Pty Ltd,**

Ben Morgan BSc Geol.
Engineering Geologist

Karen Allan CPEng MIEAust
Senior Civil/Geotechnical Engineer

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8.0 References

Australian Standard AS 1726:2017 Geotechnical Site Investigations.

Australian Standard AS 2870:2011 Residential Slabs and Footings.

Australian Standard AS 2159:2009 Piling – Design and installation

Australian Standard AS 1289.6.3.2:1997 Methods of Testing Soils for Engineering Purposes.

Australian Standard AS 1170.4-2007 Structural Design Actions – Part 4: Earthquake actions in Australia.

Australian Standard AS 3798:2007 Guidelines for earthworks for commercial and residential developments.

Australian Standard AS 2670.2:1990 Evaluation of Human Exposure to Whole-Body Vibrations – Continuous and Shock Induced Vibrations in Buildings (1-80 Hz).

NSW Department of Mineral Resources (1983), Sydney Australia 1: 100,000 Geological Series Sheet 9130.

Australian Geomechanics Society (March 2007), *Landslide Risk Management*, Australian Geomechanics 42 (1).

Pells, P.J.N, Mostyn, G. & Walker B.F., "Foundations on Sandstone and Shale in the Sydney Region", Australian Geomechanics Journal, 1998

Excavation Work – *Code of Practice.* March, 2015 – Safe Work Australia.

"Acid Sulfate Soils Map – Sheet ASS_001" lane Cove Local Environmental Plan 2009, Lane Cove Council.

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Appendix A

Information Sheets

General Notes About This Report

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INTRODUCTION

These notes have been prepared by Ascent Geotechnical Consulting Pty Ltd (Ascent) to help our Clients interpret and understand the limitations of this report. Not all sections below are necessarily relevant to all reports.

SCOPE OF SERVICES

This report has been prepared in accordance with the scope of services set out in Ascent's proposal under Ascent's Terms and Conditions, or as otherwise agreed with the Client. The scope of work may have been limited by a range of factors including time, budget, access and/or site constraints.

RELIANCE ON INFORMATION PROVIDED

In preparing the report, Ascent has necessarily relied upon information provided by the Client and/or their Agents. Such data may include surveys, analyses, designs, maps and design plans. Ascent has not verified the accuracy or completeness of the data except as stated in this report.

GEOTECHNICAL AND ENVIRONMENTAL REPORTING

Geotechnical and environmental reporting relies on the interpretation of factual information, based on judgment and opinion, and is far less exact than other engineering or design disciplines.

Geotechnical and environmental reports are prepared for a specific purpose, development, and site, as described in the report, and may not contain sufficient information for other purposes, developments, or sites (including adjacent sites), other than that described in the report.

SUBSURFACE CONDITIONS

Subsurface conditions can change with time and can vary between test locations. For example, the actual interface between the materials may be far more gradual or abrupt than indicated.

Therefore, actual conditions in areas not sampled may differ from those predicted, since no subsurface investigation, no matter how comprehensive, can reveal all subsurface details and anomalies.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes or groundwater fluctuations can also affect subsurface conditions, and thus the continuing adequacy of a geotechnical report. Ascent should be kept informed of any such events, and should be retained to identify variances, conduct additional tests if required, and recommend solutions to problems encountered on site.

GROUNDWATER

Groundwater levels indicated on borehole and test pit logs are recorded at specific times. Depending on ground permeability, measured levels may or may not reflect actual levels if measured over a longer time period. Also, groundwater levels and seepage inflows may fluctuate with seasonal and environmental variations and construction activities.

INTERPRETATION OF DATA

Data obtained from nominated discrete locations, subsequent laboratory testing and empirical or external sources are interpreted by trained professionals in order to provide an opinion about overall site conditions, their likely impact with respect to the report purpose and recommended actions in accordance with any relevant industry standards, guidelines or procedures.

SOIL AND ROCK DESCRIPTIONS

Soil and rock descriptions are based on AS 1726 – 1993, using visual and tactile assessment, except at discrete locations where field and / or laboratory tests have been carried out. Refer to the accompanying soil and rock terms sheet for further information.

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FURTHER ADVICE

Ascent would be pleased to further discuss how any of the above issues could affect a specific project. We would also be pleased to provide further advice or assistance including:

- Assessment of suitability of designs and construction techniques;
- Contract documentation and specification;
- Construction advice (foundation assessments, excavation support).

Abbreviations, Notes & Symbols

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SUBSURFACE INVESTIGATION

METHOD

Borehole Logs		Excavation Logs	
AS#	Auger screwing (#-bit)	BH	Backhoe/excavator bucket
AD#	Auger drilling (#-bit)	NE	Natural exposure
B	Blank bit	HE	Hand excavation
V	V-bit	X	Existing excavation
T	TC-bit		
HA	Hand auger	**Cored Borehole Logs**	
R	Roller/tricone	NMLC	NMLC core drilling
W	Washbore	NQ/HQ	Wireline core drilling
AH	Air hammer		
AT	Air track		
LB	Light bore push tube		
MC	Macro core push tube		
DT	Dual core push tube		

SUPPORT

Borehole Logs		Excavation Logs	
C	Casing	S	Shoring
M	Mud	B	Benched

SAMPLING

B	Bulk sample
D	Disturbed sample
U#	Thin-walled tube sample (#mm diameter)
ES	Environmental sample
EW	Environmental water sample

FIELD TESTING

PP	Pocket penetrometer (kPa)
DCP	Dynamic cone penetrometer
PSP	Perth sand penetrometer
SPT	Standard penetration test
PBT	Plate bearing test
s_U	Vane shear strength peak/residual (kPa) and vane size (mm)
N*	SPT (blows per 300mm)
Nc	SPT with solid cone
R	Refusal

**denotes sample taken*

BOUNDARIES

———	Known
_ _ _ _ _	Probable
.....	Possible

SOIL

MOISTURE CONDITION

D	Dry
M	Moist
W	Wet
Wp	Plastic Limit
Wl	Liquid Limit
MC	Moisture Content

CONSISTENCY		DENSITY INDEX	
VS	Very Soft	VL	Very Loose
S	Soft	L	Loose
F	Firm	MD	Medium Dense
St	Stiff	D	Dense
VSt	Very Stiff	VD	Very Dense
H	Hard		
Fb	Friable		

USCS SYMBOLS

GW	Well graded gravels and gravel-sand mixtures, little or no fines
GP	Poorly graded gravels and gravel-sand mixtures, little or no fines
GM	Silty gravels, gravel-sand-silt mixtures
GC	Clayey gravels, gravel-sand-clay mixtures
SW	Well graded sands and gravelly sands, little or no fines
SP	Poorly graded sands and gravelly sands, little or no fines
SM	Silty sand, sand-silt mixtures
SC	Clayey sand, sand-clay mixtures
ML	Inorganic silts of low plasticity, very fine sands, rock flour, silty or clayey fine sands
CL	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays
OL	Organic silts and organic silty clays of low plasticity
MH	Inorganic silts of high plasticity
CH	Inorganic clays of high plasticity
OH	Organic clays of medium to high plasticity
PT	Peat muck and other highly organic soils

ROCK

WEATHERING		STRENGTH	
RS	Residual Soil	EL	Extremely Low
XW	Extremely Weathered	VL	Very Low
HW	Highly Weathered	L	Low
MW	Moderately Weathered	M	Medium
DW*	Distinctly Weathered	H	High
SW	Slightly Weathered	VH	Very High
FR	Fresh	EH	Extremely High

**covers both HW & MW*

ROCK QUALITY DESIGNATION (%)

$$= \frac{\text{sum of intact core pieces} > 100\text{mm}}{\text{total length of section being evaluated}} \times 100$$

CORE RECOVERY (%)

$$= \frac{\text{core recovered}}{\text{core lIft}} \times 100$$

NATURAL FRACTURES

Type

JT	Joint
BP	Bedding plane
SM	Seam
FZ	Fractured zone
SZ	Shear zone
VN	Vein

Infill or Coating

Cn	Clean
St	Stained
Vn	Veneer
Co	Coating
Cl	Clay
Ca	Calcite
Fe	Iron oxide
Mi	Micaceous
Qz	Quartz

Shape

pl	Planar
cu	Curved
un	Undulose
st	Stepped
ir	Irregular

Roughness

pol	Polished
slk	Slickensided
smo	Smooth
rou	Rough

Soil & Rock Terms

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SOIL

MOISTURE CONDITION

Term	Description
Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through the hand.
Moist	Feels cool and darkened in colour. Cohesive soils can be moulded. Granular soils tend to cohere.
Wet	As for moist, but with free water forming on hands when handled.

For cohesive soils, moisture content may also be described in relation to plastic limit (W_P) or liquid limit (W_L). [>> much greater than, > greater than, < less than, << much less than].

CONSISTENCY

Term	c_u (kPa)	Term	c_u (kPa)
Very Soft	< 12	Very Stiff	100 200
Soft	12 - 25	Hard	> 200
Firm	25 - 50	Friable	-
Stiff	50 - 100		

DENSITY INDEX

Term	I_D (%)	Term	I_D (%)
Very Loose	< 15	Dense	65 – 85
Loose	15 – 35	Very Dense	> 85
Medium Dense	35 – 65		

PARTICLE SIZE

Name	Subdivision	Size (mm)
Boulders		> 200
Cobbles		63 - 200
Gravel	coarse	20 - 63
	medium	6 - 20
	fine	2.36 - 6
Sand	coarse	0.6 -2.36
	medium	0.2 - 06
	fine	0.075 0.2
Silt & Clay		< 0.075

MINOR COMPONENTS

Term	Proportion by Mass coarse grained	fine grained
Trace	≤ 5%	≤ 15%
Some	5 - 2%	15 - 30%

SOIL ZONING

Layers	Continuous exposures
Lenses	Discontinuous layers of lenticular shape
Pockets	Irregular inclusions of different material

SOIL CEMENTING

Weakly	Easily broken up by hand
Moderately	Effort is required to break up the soil by hand

SOIL STRUCTURE

Massive	Coherent, with any partings both vertically and horizontally spaced at greater than 100mm
Weak	Peds indistinct and barely observable on pit face. When disturbed approx. 30% consist of peds smaller than 100mm
Strong	Peds are quite distinct in undisturbed soil. When disturbed >60% consists of peds smaller than 100mm

ROCK

SEDIMENTARY ROCK TYPE DEFINITIONS

Rock Type	Definition (more than 50% of rock consists of….)
Conglomerate	… gravel sized (> 2mm) fragments
Sandstone	… sand sized (0.06 to 2mm) grains
Siltstone	… silt sized (<0.06mm) particles, rock is not laminated
Claystone	… clay, rock is not laminated
Shale	… silt or clay sized particles, rock is laminated

STRENGTH

Term	Is50 (MPa)	Term	Is50 (MPa)
Extremely Low	< 0.03	High	1 – 3
Very Low	0.03 – 0.1	Very High	3 – 10
Low	0.1 – 0.3	Extremely High	> 10
Medium	0.3 – 1		

WEATHERING

Term	Description
Residual Soil	Soil developed on extremely weathered rock; the mass structure and substance fabric are no longer evident
Extremely Weathered	Rock is weathered to such an extent that it has 'soil' properties, i.e. it either disintegrates or can be remoulded, in water. Fabric of original rock is still visible
Highly Weathered	Rock strength usually highly changed by weathering; rock may be highly discoloured
Moderately Weathered	Rock strength usually moderately changed by weathering; rock may be moderately discoloured
Distinctly Weathered	See 'Highly Weathered' or 'Moderately Weathered'
Slightly Weathered	Rock is slightly discoloured but shows little or no change of strength from fresh rock
Fresh	Rock shows no signs of decomposition or staining

NATURAL FRACTURES

Type	Description
Joint	A discontinuity or crack across which the rock has little or no tensile strength. May be open or closed
Bedding plane	Arrangement in layers of mineral grains of similar sizes or composition
Seam	Seam with deposited soil (infill), extremely weathered insitu rock (XW), or disoriented usually angular fragments of the host rock (crushed)
Shear zone	Zone with roughly parallel planar boundaries, of rock material intersected by closely spaced (generally < 50mm) joints and /or microscopic fracture (cleavage) planes
Vein	Intrusion of any shape dissimilar to the adjoining rock mass. Usually igneous

Shape	Description
Planar	Consistent orientation
Curved	Gradual change in orientation
Undulose	Wavy surface
Stepped	One or more well defined steps
Irregular	Many sharp changes in orientation

Infill or Coating	Description
Clean	No visible coating or discolouring
Stained	No visible coating but surfaces are discoloured
Veneer	A visible coating of soil or mineral, too thin to measure; may be patchy
Coating	Visible coating ≤ 1mm thick. Ticker soil material described as seam

Roughness	Description
Polished	Shiny smooth surface
Slickensided	Grooved or striated surface, usually polished
Smooth	Smooth to touch. Few or no surface irregularities
Rough	Many small surface irregularities (amplitude generally < 1mm). Feels like fine to coarse sandpaper

Note: soil and rock descriptions are generally in accordance with AS1726-1993 Geotechnical Site Investigations

Graphic Symbols Index

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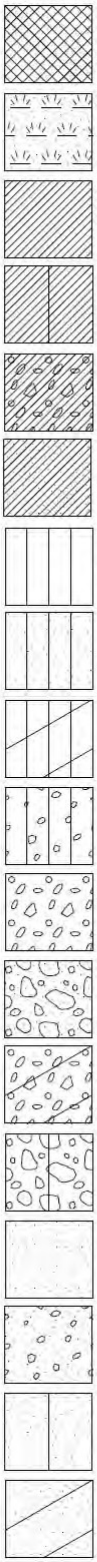
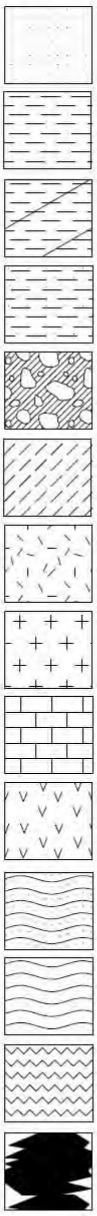
Soil



Rock



Other

Water Measurements

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).

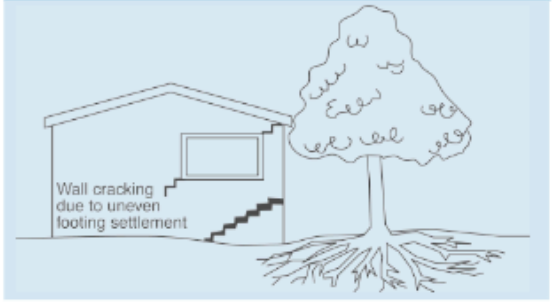
Isolated piers affected by erosion or saturation of foundations will eventually lose contact with the bearers they support and may tilt or fall over. The floors that have lost this support will become bouncy, sometimes rattling ornaments etc.

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.

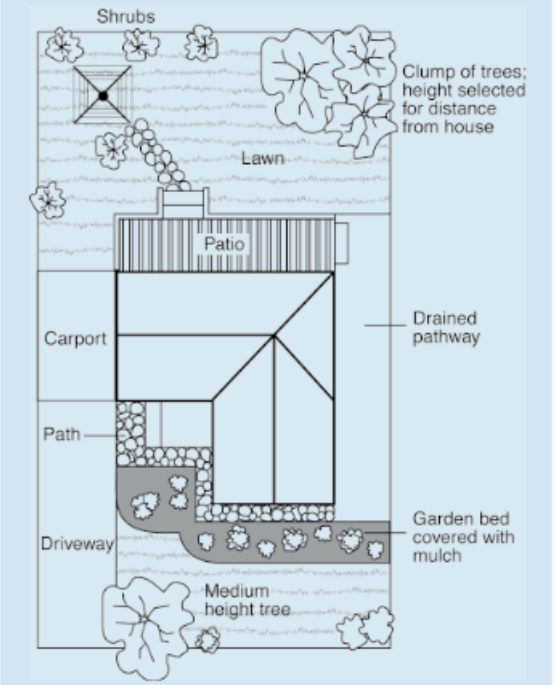
Protection of the building perimeter
It is essential to remember that the soil that affects footings extends well beyond the actual building line. Watering of garden plants, shrubs and trees causes some of the most serious water problems.

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.

This BTF was prepared by John Lewer FAIB, MIAMA, Partner, Construction Diagnosis.

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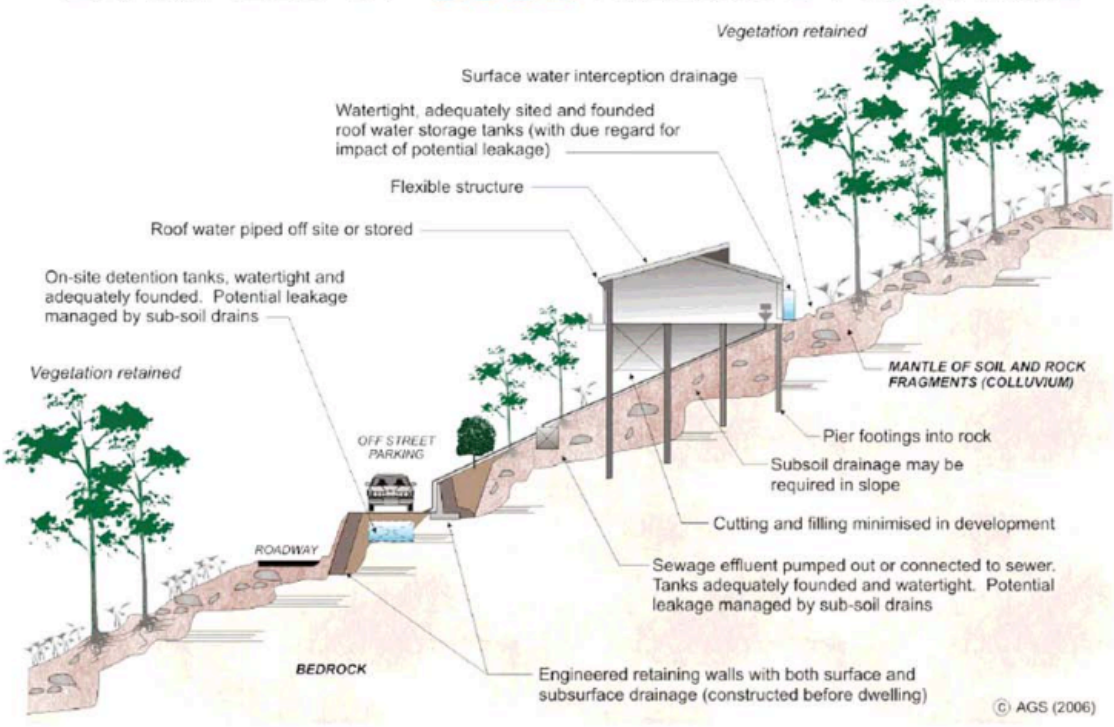
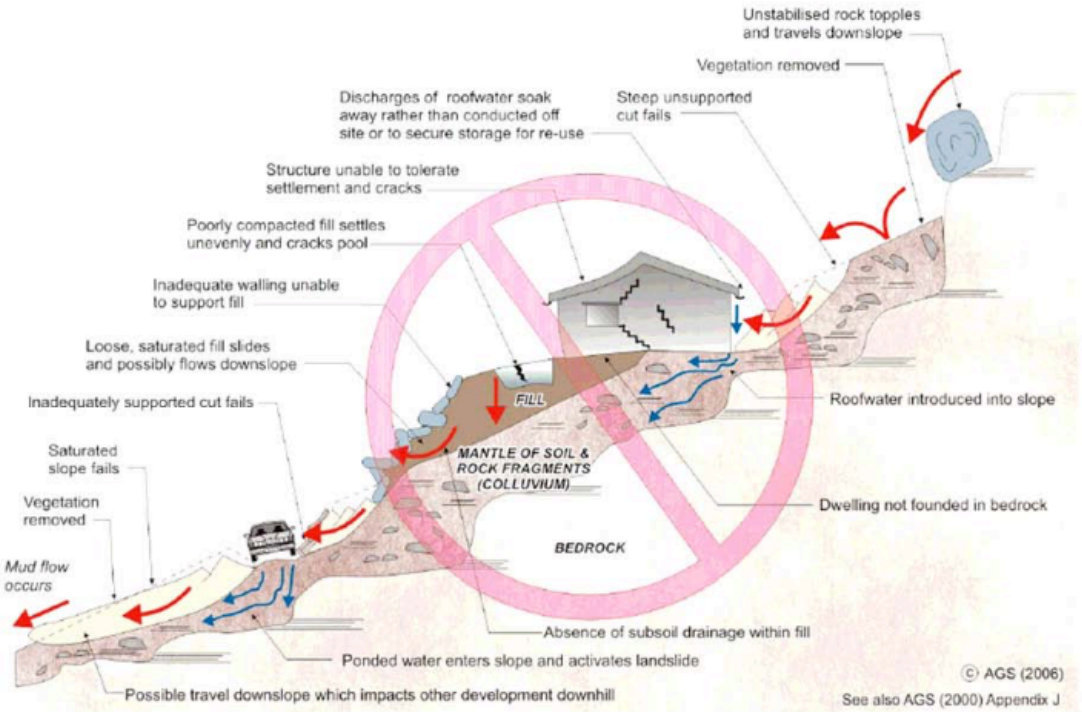
EXAMPLES OF **GOOD** HILLSIDE PRACTICE



EXAMPLES OF **POOR** HILLSIDE PRACTICE



PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: LANDSLIDE RISK ASSESSMENT

QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY

QUALITATIVE MEASURES OF LIKELIHOOD

Approximate Annual Probability		Implied Indicative Landslide Recurrence Interval		Description	Descriptor	Level
Indicative Value	Notional Boundary					
10^{-1}	$5x10^{-2}$	10 years	20 years	The event is expected to occur over the design life.	ALMOST CERTAIN	A
10^{-2}	$5x10^{-3}$	100 years	200 years	The event will probably occur under adverse conditions over the design life.	LIKELY	B
10^{-3}	$5x10^{-4}$	1000 years	2000 years	The event could occur under adverse conditions over the design life.	POSSIBLE	C
10^{-4}	$5x10^{-5}$	10,000 years	20,000 years	The event might occur under very adverse circumstances over the design life.	UNLIKELY	D
10^{-5}	$5x10^{-6}$	100,000 years	200,000 years	The event is conceivable but only under exceptional circumstances over the design life.	RARE	E
10^{-6}		1,000,000 years		The event is inconceivable or fanciful over the design life.	BARELY CREDIBLE	F

Note: (1) The table should be used from left to right; use Approximate Annual Probability or Description to assign Descriptor, not *vice versa*.

QUALITATIVE MEASURES OF CONSEQUENCES TO PROPERTY

Approximate Cost of Damage		Description	Descriptor	Level
Indicative Value	Notional Boundary			
200%	100%	Structure(s) completely destroyed and/or large scale damage requiring major engineering works for stabilisation. Could cause at least one adjacent property major consequence damage.	CATASTROPHIC	1
60%	40%	Extensive damage to most of structure, and/or extending beyond site boundaries requiring significant stabilisation works. Could cause at least one adjacent property medium consequence damage.	MAJOR	2
20%	10%	Moderate damage to some of structure, and/or significant part of site requiring large stabilisation works. Could cause at least one adjacent property minor consequence damage.	MEDIUM	3
5%	1%	Limited damage to part of structure, and/or part of site requiring some reinstatement stabilisation works.	MINOR	4
0.5%		Little damage. (Note for high probability event (Almost Certain), this category may be subdivided at a notional boundary of 0.1%. See Risk Matrix.)	INSIGNIFICANT	5

Notes: (2) The Approximate Cost of Damage is expressed as a percentage of market value, being the cost of the improved value of the unaffected property which includes the land plus the unaffected structures.

(3) The Approximate Cost is to be an estimate of the direct cost of the damage, such as the cost of reinstatement of the damaged portion of the property (land plus structures), stabilisation works required to render the site to tolerable risk level for the landslide which has occurred and professional design fees, and consequential costs such as legal fees, temporary accommodation. It does not include additional stabilisation works to address other landslides which may affect the property.

(4) The table should be used from left to right; use Approximate Cost of Damage or Description to assign Descriptor, not vice versa

PRACTICE NOTE GUIDELINES FOR LANDSLIDE RISK MANAGEMENT 2007

APPENDIX C: – QUALITATIVE TERMINOLOGY FOR USE IN ASSESSING RISK TO PROPERTY (CONTINUED)

QUALITATIVE RISK ANALYSIS MATRIX – LEVEL OF RISK TO PROPERTY

LIKELIHOOD		CONSEQUENCES TO PROPERTY (With Indicative Approximate Cost of Damage)				
	Indicative Value of Approximate Annual Probability	1: CATASTROPHIC 200%	2: MAJOR 60%	3: MEDIUM 20%	4: MINOR 5%	5: INSIGNIFICANT 0.5%
A – ALMOST CERTAIN	10^{-1}	VH	VH	VH	H	M or **L** (5)
B - LIKELY	10^{-2}	VH	VH	H	M	**L**
C - POSSIBLE	10^{-3}	VH	H	M	M	**VL**
D - UNLIKELY	10^{-4}	H	M	**L**	**L**	**VL**
E - RARE	10^{-5}	M	**L**	**L**	**VL**	**VL**
F - BARELY CREDIBLE	10^{-6}	**L**	**VL**	**VL**	**VL**	**VL**

Notes: (5) For Cell A5, may be subdivided such that a consequence of less than 0.1% is Low Risk.
(6) When considering a risk assessment it must be clearly stated whether it is for existing conditions or with risk control measures which may not be implemented at the current time.

RISK LEVEL IMPLICATIONS

Risk Level		Example Implications (7)
VH	VERY HIGH RISK	Unacceptable without treatment. Extensive detailed investigation and research, planning and implementation of treatment options essential to reduce risk to Low; may be too expensive and not practical. Work likely to cost more than value of the property.
H	HIGH RISK	Unacceptable without treatment. Detailed investigation, planning and implementation of treatment options required to reduce risk to Low. Work would cost a substantial sum in relation to the value of the property.
M	MODERATE RISK	May be tolerated in certain circumstances (subject to regulator's approval) but requires investigation, planning and implementation of treatment options to reduce the risk to Low. Treatment options to reduce to Low risk should be implemented as soon as practicable.
L	LOW RISK	Usually acceptable to regulators. Where treatment has been required to reduce the risk to this level, ongoing maintenance is required.
VL	VERY LOW RISK	Acceptable. Manage by normal slope maintenance procedures.

Note: (7) The implications for a particular situation are to be determined by all parties to the risk assessment and may depend on the nature of the property at risk; these are only given as a general guide.

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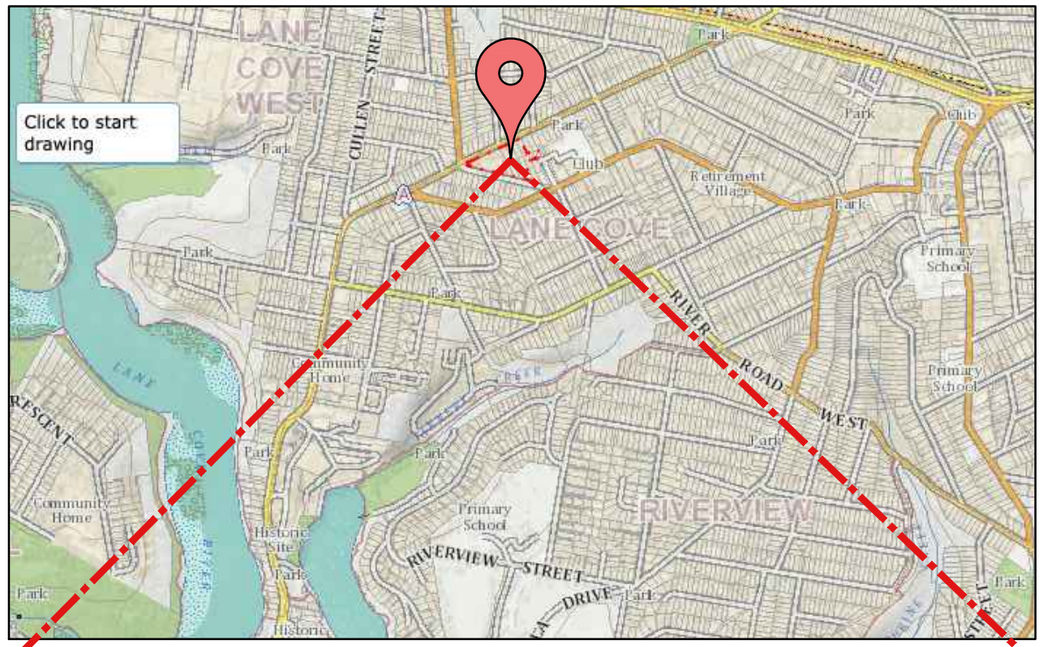
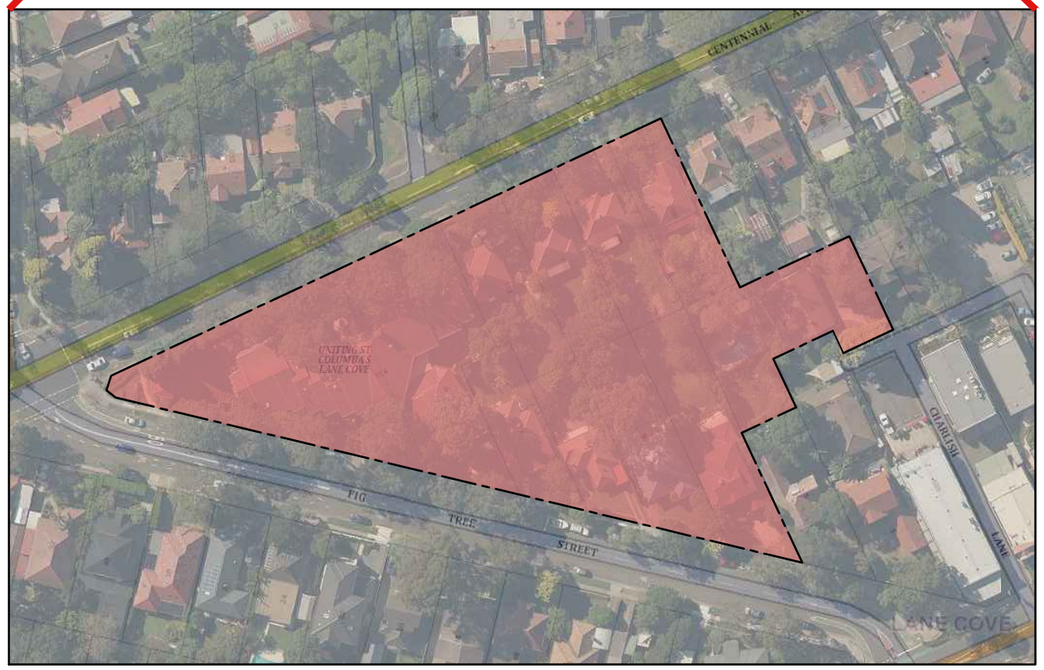
Appendix B

Site Plan | Testing Locations | Geotechnical Sections





SITE LOCALITY MAP FOR UNITING'S ST COLUMBA'S REDEVELOPMENT, FIG TREE STREET, LANE COVE NSW

SCALE NTS

REV	DATE	REVISION DESCRIPTION	REV BY	CHCKD
A	21.04.20	PRELIMINARY ISSUE	VT	BM

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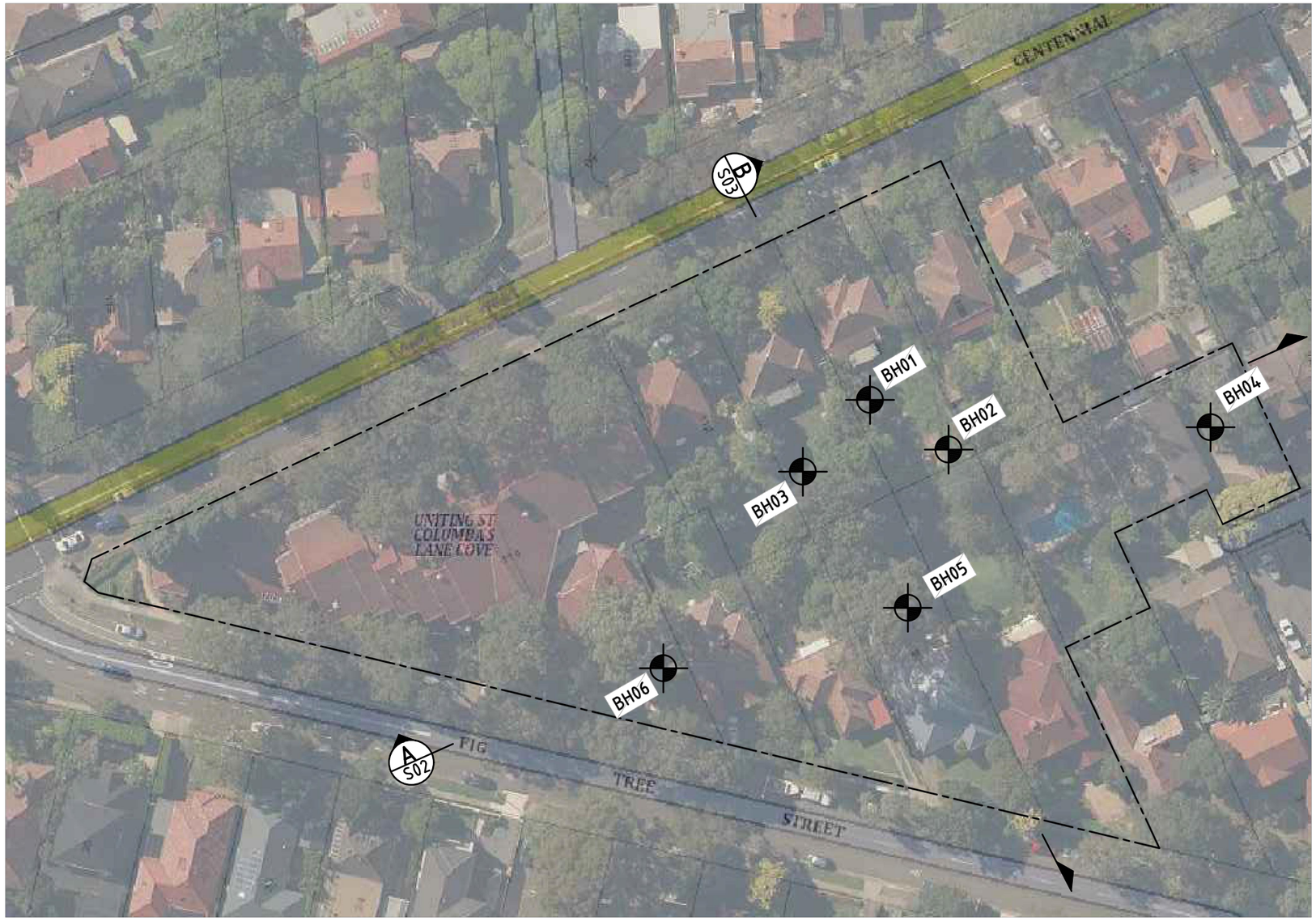
SITE LOCALITY MAP
FOR UNITING'S ST COLUMBA'S REDEVELOPMENT,
FIG TREE STREET, LANE COVE NSW

DATE: 21/04/2020
SCALE: AS SHOWN @ A3
DRAWING TITLE: SITE LOCALITY MAP
DRAWING NO: AG20004- S1

LEGEND

BOREHOLE LOCATIONS



GROUND TEST LOCATIONS

SCALE:NTS

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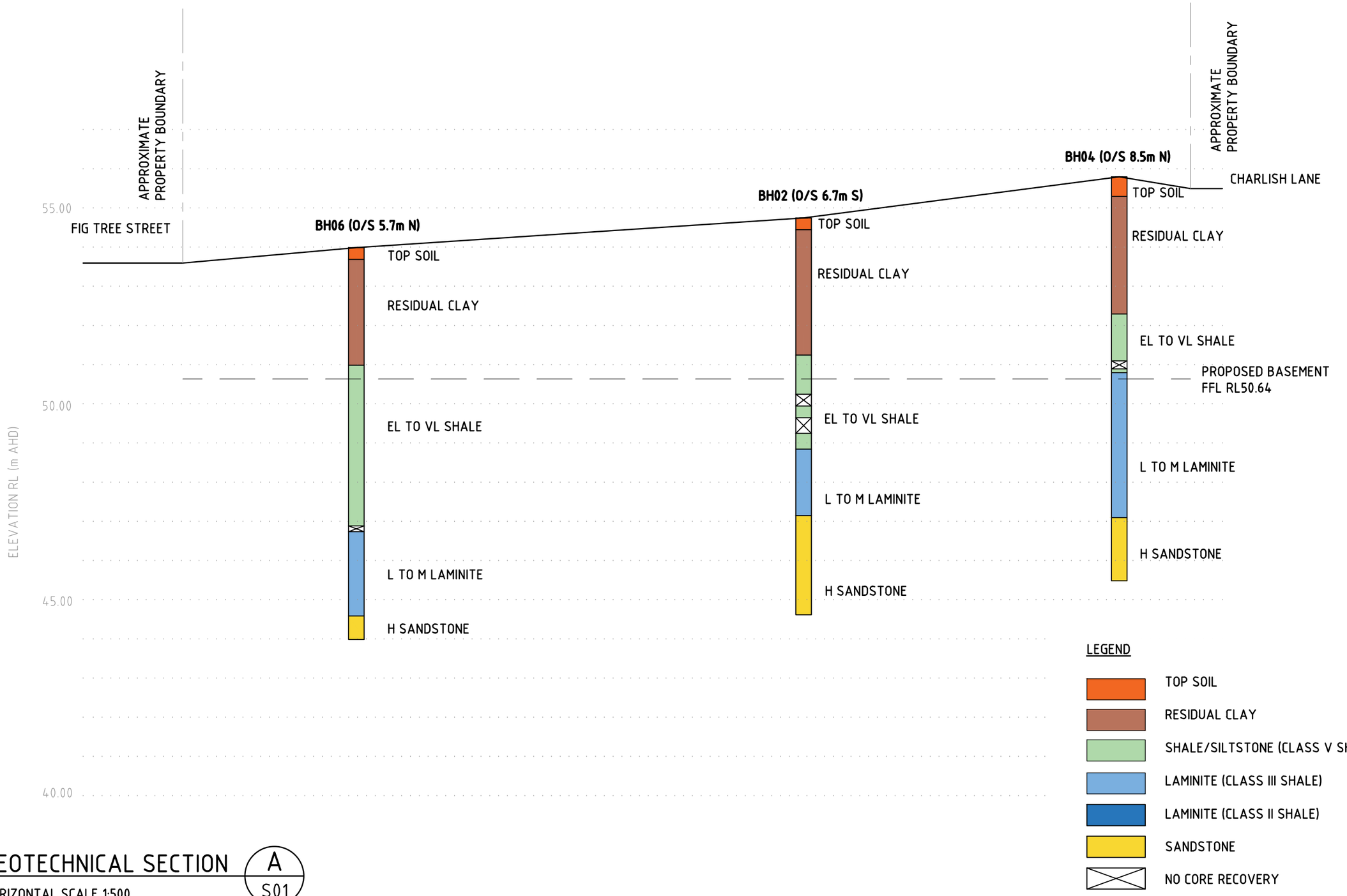
GROUND TEST LOCATIONS FOR
UNITING'S ST COLUMBA'S
REDEVELOPMENT
FIG TREE STREET
LANE COVE NSW

DATED: 21/04/2020
SCALE: AS SHOWN @ A3
DRAWING TITLE: GROUND TEST LOCATIONS
DRAWING NO: AG20004 - S01



GEOTECHNICAL SECTION A

S01

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

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A	21.04.20	PRELIMINARY ISSUE	AF	BM

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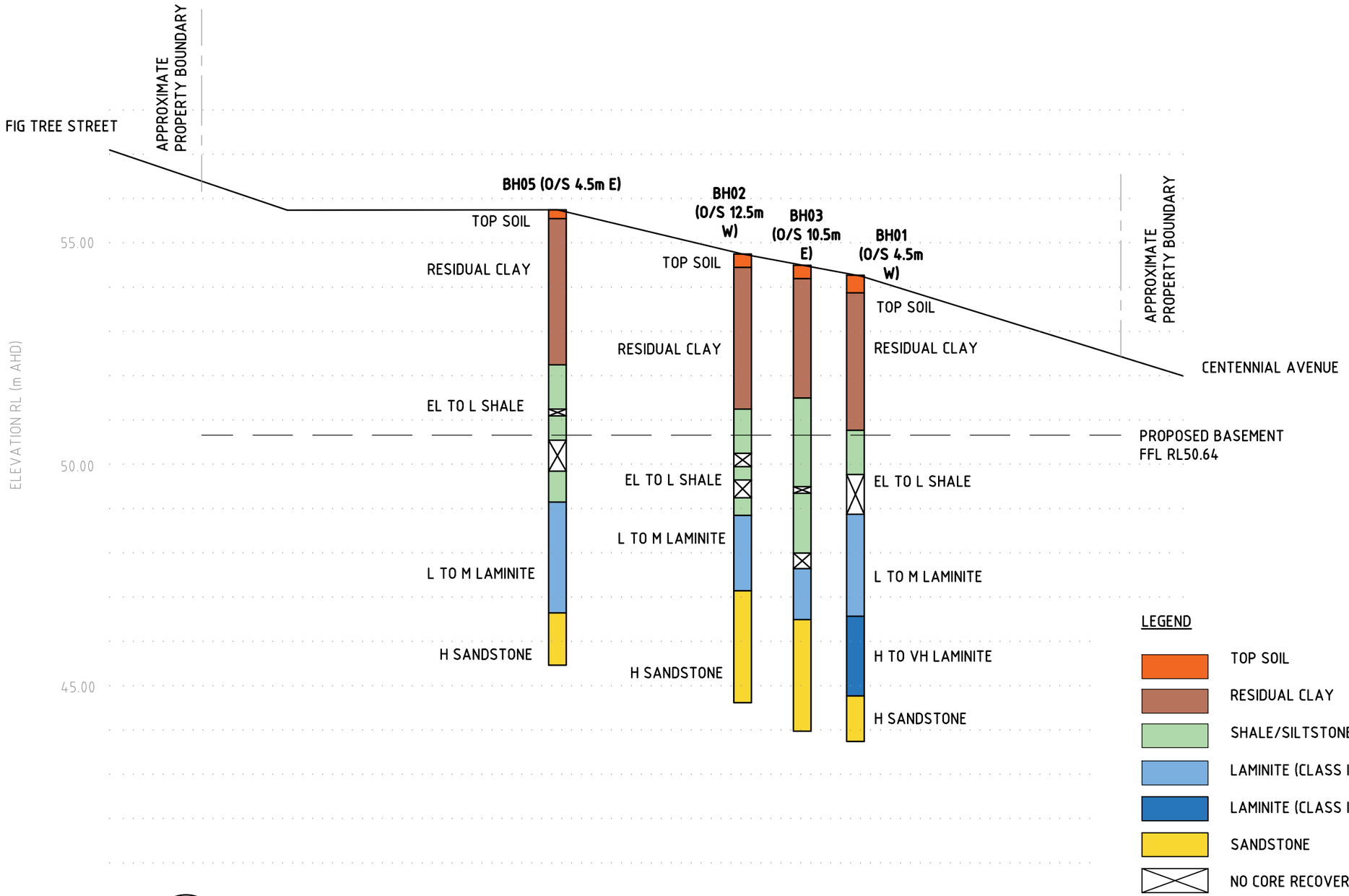
GROUND TEST LOCATIONS FOR
UNITING'S ST COLUMBA'S
REDEVELOPMENT
FIG TREE STREET
LANE COVE NSW

DATED: 21/04/2020
SCALE: AS SHOWN @ A3
DRAWING TITLE: GEOTECHNICAL SECTION
DRAWING NO: AG20004 - S02



GEOTECHNICAL SECTION B S01

HORIZONTAL SCALE 1:500
VERTICAL SCALE 1:100

REV	DATE	REVISION DESCRIPTION	REV BY	CHCKD
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LANE COVE NSW

DATED: 21/04/2020
SCALE: AS SHOWN @ A3
DRAWING TITLE: GEOTECHNICAL SECTION
DRAWING NO: AG20004 - S03

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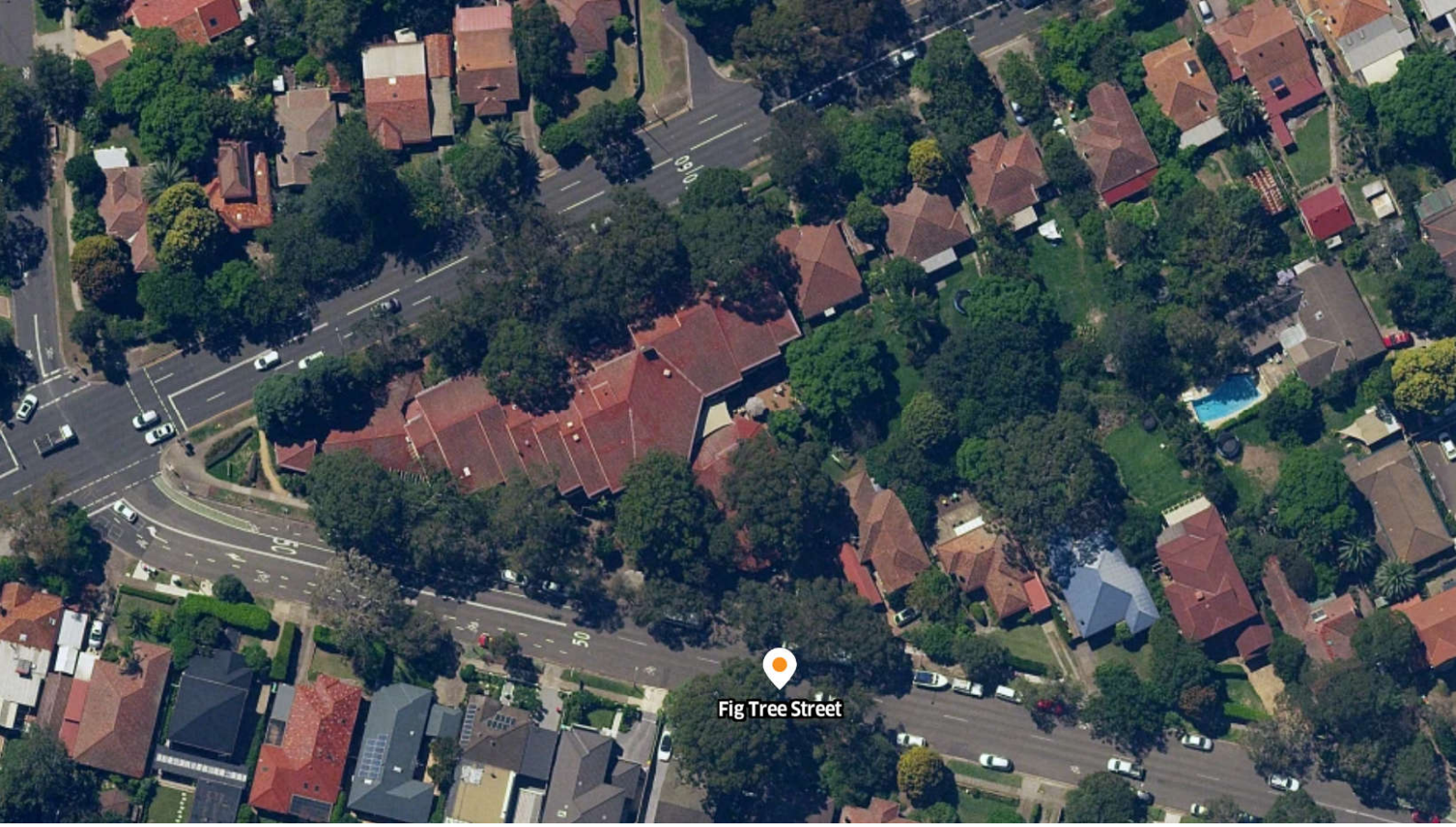
Appendix F

Targeted Contamination Assessment Report

By

Progressive Risk Management



PROGRESSIVE RISK MANAGEMENT

Targeted Contamination Assessment

15 Fig Tree Street, Lane Cove, NSW

Ascent Geotechnical

Version B| April 2020

Document Control

Project Details:	
Project Name:	Targeted Contamination Assessment
Site Details:	Aged Care Facility and surrounding properties
Client Name:	Ascent Geotechnical Consultants
Project Reference	P034542 / C0260

Report Version:					
Version Date:	Review Process:			Issued to:	Summary of changes from previous version:
	Prepared:	Reviewed:	Approved:		
Version A 12/03/2020	TAO	JPC	JAL	Ascent Geotechnical	Original
Version B 22/04/2020	TAO	JAL	JAL	Ascent Geotechnical	Minor changes to Section 2

Report Review:					
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		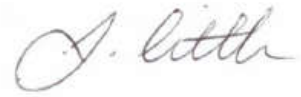		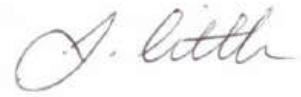	
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Date:	21/04/2020	Date:	22/04/2020	Date:	22/04/2020

Executive Summary:

Introduction

Progressive Risk Management (PRM) were engaged by Ascent Geotechnical (Ascent) to undertake a Targeted Contamination Assessment (TCA) within six selected properties in Lane Cove, NSW (hereafter referred to as 'the site').

The TCA was conducted in parallel with geotechnical works completed by Ascent on behalf of Uniting Care Australia to support potential future development works at the site.

Background

PRM understands that Uniting Care Australia are considering expanding the current aged care facility situated on Fig Tree Street in Lane Cove, NSW. As part of the proposed development, residential properties owned by the Uniting Care Australia and currently leased would need to be redeveloped to accommodate the installation of a basement, new foundations and retention systems.

Objectives and Scope of Works

The objectives of the TCA were to provide a preliminary assessment of underlying soils for land use suitability (i.e. low-density residential land use) and preliminary waste classification for offsite disposal of fill material and reuse/offsite disposal of natural underlying soils as Virgin Excavated Natural Material (VENM), following further investigation.

The scope works included the sampling and analysis of soil samples collected from selected Ascent geotechnical investigation locations and the provision of a TCA report with preliminary insitu waste classification.

Conclusions

The preliminary data indicates the following:

- Site soils generally meet the adopted SAC for residential land use with accessible gardens, with the exception of two locations (BH01 and BH05) where marginally elevated concentrations of heavy metals (lead, nickel and zinc) were identified, and one location (BH03) where detectable concentrations of benzene were identified above the adopted SAC.
- Surface soils at the site to contain various anthropogenic materials including bricks, timber, tile, sandstone blocks, ironstone gravels and trace glass in select locations. The presence of various anthropogenic materials in near surface soils across the site exceeded the adopted aesthetic SAC in a residential land use scenario.
- Fill material identified at the site may be suitable for offsite disposal during redevelopment works as General Solid Waste (non-putrescible).
- Natural soils observed underlying fill materials were considered to be consistent with the description of VENM as provided in the NSW EPA *Waste Classification Guidelines Part 1: Classifying Waste* (NSW EPA, 2014).

Further investigation works are required at the site to confirm these preliminary findings.

Recommendations

Should redevelopment works proceed, it is recommended that a suitably qualified environmental consultant is engaged to confirm the preliminary contamination and waste classification findings. Particular focus of the additional investigations should be made regarding:

- The identification of detectable concentrations of Benzene, Toluene and Ethylbenzene identified at BH03.
- Potential asbestos contamination in soils or structures across the site.

- Potential acidic conditions of natural soils at depth.
- Other properties part of the development works which were not able to be investigated as part of these works.

It is also recommended prior to demolition of any structures that Hazardous Material Building Surveys are undertaken and documented for each property (if not already done so).

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1. Introduction

Progressive Risk Management (PRM) were engaged by Ascent Geotechnical (Ascent) to undertake a Targeted Contamination Assessment (TCA) within six selected properties in Lane Cove, NSW (hereafter referred to as 'the site').

The TCA was conducted in parallel with geotechnical works completed by Ascent on behalf of Uniting Care Australia to support potential future development works at the site.

Figure 1 provides the regional site location; **Figure 2** provides the TCA investigation area and **Figure 3** includes an extract of the proposed development plan.

1.1. Background

PRM understands that Uniting Care Australia are considering expanding the current aged care facility situated on Fig Tree Street in Lane Cove, NSW. As part of the proposed development, residential properties owned by the Uniting Care Australia and currently leased would need to be redeveloped to accommodate the installation of a basement, new foundations and retention systems.

PRM worked concurrently with Ascent to provide preliminary data on soils at the site. Due to the proposed installation of a basement at the site, the TCA targeted overlying fill profiles and natural soil profiles at depth.

The TCA and geotechnical assessment involved the drilling of boreholes and hand-excavated test pits within six select properties, with selected soil samples collected by PRM for laboratory analysis for a broad range of contaminants of potential concern (CoPC).

The combined TCA and geotechnical investigation included the drilling of soil bores and excavation of test pits within the following property boundaries:

- 15 Fig Tree Street (Lot A/DP385033)
- 9 Fig Tree Street (Lot B/DP346581)
- 106-110 Centennial Ave (Lots 1-3/DP339444, respectively)
- 1 Charlish Lane. (Lot 33/DP555562)

No previous environmental investigations were provided to PRM for review.

1.2. Objectives

The objectives of the TCA were to provide a preliminary assessment of underlying soils for land use suitability (i.e. low-density residential land use) and preliminary waste classification for offsite disposal of fill material and reuse/offsite disposal of natural underlying soils as Virgin Excavated Natural Material (VENM).

1.3. Scope of works

The following scope of works was undertaken as part of the project:

- Preparation of relevant health and safety documentation and Safe Works Method Statement.
- Review of freely available historical aerial imagery and online NSW EPA Contaminated Land Database.
- Site walkover to determine areas of suspected contamination (e.g. distressed vegetation, filling, hazardous building materials etc).
- Soil sampling from five mechanically drilled boreholes as part of the concurrent geotechnical assessment and three supplementary hand-excavated test pits targeting surface soils.

- Laboratory analysis of soil samples using a National Association of Testing Authority (NATA) accredited laboratory.
- Provision of a TCA report detailing findings and recommendations.

The scope of works was limited to soil contamination only, and within the areas of the sites where access was permitted as part of the geotechnical investigation. The assessment did not include sampling of groundwater.

1.4. Regulatory Guidance

This TCA was undertaken in general accordance with specific environmental legislative requirements, guidelines and industry approved standards as follows:

- Australian Standards 4482.1 Guide to the Sampling and Investigation of Potentially Contaminated Soil Part 1: Non-Volatile and Semi-Volatile Substances 2005.
- CRC Care Technical Report No. 10, Health screening levels for petroleum hydrocarbons in soil and groundwater Summary, 2011 (CRC Care, 2011).
- CRC Care Technical Report No. 39, Risk-based management and remediation guidance for benzo(a)pyrene, 2017 (CRC Care, 2017).
- National Environmental Protection Council National Environmental Protection (Assessment of Contaminated Sites) Measure (Amendment No. 1), 2013 (NEPM, 2013).
- NSW Contaminated Land Management Act 1997 (CLM Act, 1997).
- NSW EPA Guidelines for the NSW Site Auditor Scheme (3rd Edition), (EPA, 2017).
- NSW EPA Guidelines for Consultants Reporting on Contaminated Sites, 2011 (EPA, 2011).
- NSW EPA Waste Classification Guidelines Part 1: Classifying Waste (EPA, 2014).
- NSW Protection of the Environment Operations (Waste) Regulation (POEO, 2014)

1.5. Project Specific Limitations

This report is preliminary in nature and does not constitute a detailed or compliant site assessment or waste classification as detailed in the Scope of Works.

2. Site Information

2.1. Site Identification Details

Table 1 provides a summary of site identification details

Table 1: Site Identification Details	
Site Address:	15 Fig Tree Street and select properties in Lane Cove 2066
Lot Parcels:	Part of: Lot A DP385033; Lots 1-3 DP339444; Lot 33 DP555562; and Lot B DP346581.
Local Council:	Lane Cove Council
Current Zoning:	Low Density Residential (R2) as per Lane Cove Local Environmental Plan (2009)
Potential Future Zoning:	Low Density Residential (R2)
Site Area:	The combined site area is approximately 1700m^2
Current Site Use:	Aged Care Facility and Low-Density Residential land use
Proposed future use:	Aged Care Facility
Surrounding Land Use:	The site is an aged care facility surrounded by low density residential housing. Surrounding land use consists of: • North: Centennial Ave and low-density residential land use beyond. • East: Low-density residential land use, recreational bowling greens and small industrial area. • South: Fig Tree Street and medium-density land use beyond. • West: Medium-density land use and Burns Bay Road beyond.

2.2. Site Environmental Setting

Table 2 provides a summary of site environmental setting

Table 2: Site Environmental Setting	
Geological Setting	The Sydney 1:100,000 Geological Sheet and Sydney 1:100,000 Soil Landscape Sheet indicates the site to be underlain by Ashfield Group Shales and Hawkesbury Sandstone formations. Soils typically found in this region of the Glenorie Soil Landscape are brown silty clay loam on the surface and brown, red brown or mottled grey sandy clays below.
Acid Sulfate Soil (ASS) Risk	A review of the ASS risk maps available on the NSW Government Office of Environment & Heritage eSPADE v2.0 online database and Lane Cove LEP (2009) acid Sulfate Risk Maps indicates that the site is not located within an area of risk for acid sulfate soils.
Topography and Drainage	The site generally slopes north. A site walkover saw evidence of minor cutting and filling as part of landscaping works observed within some residential properties and the aged care home, as well as stockpiling within some of the residential properties.
Hydrology (Receiving Water Body)	Within the site boundaries surface water is expected to infiltrate the exposed surface soils. Surface water has the potential to drain off the site surface and into local stormwater and into the down-gradient Stringybark Creek (approximately 600m north).

Hydrogeology	The Bureau of Meteorology's "Australian Groundwater Explorer" service (http://www.bom.gov.au/water/groundwater/explorer/map.shtml) was used to identify registered groundwater boreholes near the site. A total of nine groundwater monitoring wells are located <200m west of the site on Centennial Ave, ranging from 0.8 to 6.0mbgl in depth. These wells are most likely associated with the service station on the corner of Centennial Ave and Burns Bay Road. Based on the geological setting the subsurface conditions at the site is expected to consist of relatively low permeability (residual clay) soils overlying shale bedrock. The potential for viable groundwater abstraction and use of groundwater under these conditions is low.

3. Site History Review

A limited historical review of the investigation area was completed as part of the TCA and is summarised in the following sections.

3.1. Historical Aerial Photographs

Historical aerial imagery available on Google Earth were reviewed as part of this TCA.

Table 3 provides a summary of the aerial photos reviewed.

Table 3: Summary of Historical Aerial Photographs	
1943*	The site is primarily cleared land, with a residential property visible at 108 Centennial Ave and small structure at 1 Charlish Lane, with some surrounding properties outside the scope of this TCA. The aged care facility has not been developed; however, land clearing suggests construction is in progress.
2002:	The site has been developed as an aged care facility and residential properties. The residential properties are vegetated with grass cover and large trees, excluding property 108 Centennial Ave that has minimal tree coverage. 110 and 112 Centennial Ave have small structures along the south eastern boundary fences, assumed storage sheds. An excavation area is visible along the southern boundary of 108 Centennial Ave, within the property lines of 7 Fig Tree Street. The surrounding land use appears like current day, with the bowling greens and small business district established east of the site and residential properties surrounding.
2005:	The potential shed at 110 Centennial Ave has been removed. Surrounding land use appears like the 2002 image, with the excavation area at 7 Fig Tree street filled and vegetated.
2012:	The site appears like the 2005 image.
2015:	A shed has been constructed in the south-eastern corner of 108 Centennial Ave, along the western boundary of 106 Centennial Ave and along the eastern boundary of 110 Centennial Ave. Surrounding land use appears like the 2002 image, however significant landscaping has occurred at 7 Fig Tree Street, within the footprint of the excavation area.
2020:	The shed at 108 Centennial Ave has been removed, with a visible footprint of the structure visible amongst the grass coverage. Surrounding land use appears like the 2002 image.

*Image sourced from SixMaps (https://maps.six.nsw.gov.au/), visited 24 February 2020.

3.2. NSW EPA Records

The NSW EPA records available online were reviewed as part of this TCA and indicated the following:

- There were no records for the site or any properties within a 500 m radius in relation to contaminated land under Section 58 of the Contaminated Land Management Act 1997 (CLM Act 1997).
- The site has not been notified under Section 60 of the CLM Act 1997.
- There were no records of licenced activities at the site under the Protection of the Environment Operations Act (1997).

4. Identified Potential Contamination Issues

Following a review of historical information, and publicly available data for the site within a residential setting, the potential contamination sources and CoPC have been identified and summarised in **Table 4**.

No significant offsite sources of potential contamination have been identified for the site.

Table 4: Potential Contamination Sources and Contaminants of Potential Concern

Source	Description	CoPC	Likelihood
Construction of aged care home	The 1940's historical aerial imagery indicates works relating to the construction of the aged care home had begun with land clearing and minor earthworks visible.	• Heavy metals (Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Nickel, Zinc). • Total Recoverable Hydrocarbons (TRH). • Benzene, Toluene, Ethylbenzene, Xylene (BTEX). • Polycyclic Aromatic Hydrocarbons (PAH). • Organochlorine- and Organophosphorus Pesticides (OCP/OPP). • Polychlorinated biphenyl (PCB). • Asbestos.	Moderate
Historic residential land use and associated storage and landscaping	Houses built prior to the 1980s are present on the property, with risk of hazardous materials used in construction. The images from 2002 to 2020 show numerous small structures constructed and removed across the site, assumed to be storage sheds for residents. Site walkover revealed evidence of stockpiling within properties and imagery from 2002 indicated minor to moderate landscaping activity.		

5. Investigation Methodology

A track mounted drill rig operated by Ascent was used to drill six boreholes. Soil samples were collected from a total of five of the boreholes (BH01-BH05) at varying depths. Soil samples were also collected from three hand-excavated test pits (TP01-TP03) using a decontaminated shovel to obtain surface samples where the drill rig could not access.

Samples were generally collected from the boreholes within the surface soils (0.0-0.2mbgl) and natural clay soils, generally observed between 0.5mbgl to 1.0mbgl. During the collection of soil samples, features such as discolouration, staining, odours and other indicators of contamination were noted. Sample depths are provided in the test pit logs included in **Appendix A**.

All soil samples were collected by hand using fresh nitrile gloves and placed into the appropriate laboratory supplied containers including 250mL Teflon-lined jars with a unique sample ID. Collected samples were immediately stored within a chilled esky and sent to NATA-accredited analytical laboratories under chain of custody conditions for chemical analysis. Standard sampling procedures for contaminated site investigations were always adhered to, and standard documentation, such as chain of custody forms, were adopted.

5.1. Analytical Schedule

All samples collected during the investigation were transported under Chain of Custody to external NATA accredited laboratories (Envirolab Services Pty Ltd and ALS Environmental) for analysis. Samples were analysed for a combination of the following CoPC:

- Heavy metals.
- TRH/BTEX.
- PAH.
- OCP/OPP.
- PCBs.
- Asbestos (as per AS4964).

Samples at depth were analysed for the above suite, less asbestos, and:

- PH.
- Electrical Conductivity (EC).

6. Quality Assurance / Quality Control

6.1. Field QA/QC

6.1.1. Sample Collection

The following field quality assurance procedures were adopted during the investigation:

- All fieldwork was undertaken and supervised by suitably qualified and experienced environmental consultants from PRM.
- Logs and/or field notes for each sampling location were recorded in the field including sample number, depth, location, initials of sampler, duplicate locations, duplicate type and relevant site observations.
- Analysis to be performed was recorded on a chain-of-custody (COC) and all samples were analysed within designated holding times at NATA accredited laboratories.
- All samples were stored in an ice-cool esky and taken directly to the laboratory on the day of sampling.
- All equipment used for sampling was decontaminated (where required) prior to fieldwork and between each investigation location by scraping, scrubbing with brushes and Decon 90 solution, and rinsing with de-ionised water.
- Single use materials and equipment (e.g. nitrile gloves) were changed between each sample.
- All soil samples taken were discrete samples from one specific horizon and vertical interval to provide precision in spatial representation (both lateral and vertical) in sampling data.
- The QA/QC field samples were collected during sampling including intra- laboratory and inter-laboratory duplicate samples, trip spike and trip blank.

6.1.2. Field Duplicate Samples

Duplicates samples are prepared in the field by replicating the original sample and placing equivalent portions into separate containers. The purpose of this process is to assess the overall precision of the analytical data resulting from the laboratory process, as well as other secondary factors such as sampling methodology. Duplicate samples (intra/inter laboratory) are required to be collected and analysed at a rate of no less than 1 per 20 primary samples (i.e. 5%) across the project. Once results are received, relative percent difference (RPD) calculations should be undertaken on the data set, for comparison.

An assessment of field quality control samples was completed by calculating the RPD of duplicate samples. An RPD of +/- 50 % for all analytes (inorganic and organic) is generally considered acceptable by NSW EPA.

RPD was not reported in the following circumstances:

- Where the laboratory limit of reporting (LOR) are different and both samples are below the LOR.
- One sample is below the LOR and the other has a recorded detection below the other laboratory LOR.
- Both results are less than or equal to 5 times the LOR.

Table 5 summaries the duplicate samples obtained and analysed for this investigation.

Table 5: Field Duplicate Samples		
Duplicate ID	**Duplicate Type**	**Analysis Performed**
FD1 (Primary Sample BH04_0.9-1.1m)	Inter-laboratory duplicate (soil)	8 Heavy Metals, TRH/BTEX, PAHs, OPP/OCP and PCBs
FD2 (Primary Sample BH05_0.9-1.1m)	Intra-laboratory duplicate (soil)	

6.1.3. Field Trip Spike and Trip Blank

The purpose of a trip spike (TS) is to assess the potential loss of volatile analytes that may have occurred between the time of collection and transfer of the sample to the laboratory.

Laboratory prepared soil trip blanks (TB) are subjected to the same preservation methods as the field samples, then analysed for the purposes of determining whether transfer of contaminants into the blank sample had occurred prior to reaching the laboratory. If this is confirmed, then there is also a potential for other samples in the batch to have been impacted.

Trip spikes and trip blanks were taken into the field during soil sampling and dispatched with the batch sampling run. The storage and transport techniques were the same for primary samples and trip blanks/spikes, this is considered sufficient to give a representation of storage and transport quality.

One soil TB and soil TS were obtained for this TCA.

Analytical results from the field trip spikes/blanks are provided in NATA accredited laboratory reports in **Appendix B**.

6.2. Laboratory QA/QC

Laboratory analyses was conducted in accordance with the standard test methods outlined in NEPM 2013 Schedule B3. The LOR were established at levels that the laboratory can practicably analyse to and are NATA accredited to achieve. Laboratories selected for the assessment program were NATA accredited for the analyses required.

The laboratory reports attached in **Appendix B** outline the QA/QC procedures conducted by the laboratories.

6.2.1. Laboratory Duplicates

The laboratory collects duplicate sub-samples from a sample submitted for analysis. Analyses of these duplicate pairs are completed at a rate of 1 sample per 20 samples submitted for analysis, with a minimum of one sample per batch. The purpose of the laboratory duplicate is to assess the analytical precision (repeatability) of the test result.

The laboratory acceptance criteria for duplicate samples is:

- In cases where the level is < 5xLOR – any RPD is acceptable.
- In cases where the level is > 5xLOR – 0-50% RPD is acceptable.

6.2.2. Laboratory Control Sample (LCS)

This sample comprises spiking either a standard reference material or a control matrix (such as a blank of sand) with a known concentration of specific analytes. It is simply a check sample. LCSs are analysed at a frequency of 1 in 20, with a minimum of one analysed per batch.

The laboratory acceptance criteria for LCS samples is generally 70-130% for inorganic/ metals; and 60-140% for organics; and 10-140% for SVOC.

6.2.3. Matrix Spiked Samples

Samples submitted to the laboratory are spiked by adding an aliquot of known concentration of the target analyte prior to extraction and analysis. Matrix spikes are completed at a rate of 1 sample per 20 samples submitted for analysis, or one sample per batch. A spike documents the effect of the sample matrix on the extraction and analytical techniques.

The laboratory acceptance criteria for matrix spike samples is generally 70-130% for inorganic/metals; and 60-140% for organics; and 10-140% for semi-volatiles.

6.2.4. Laboratory Blank Results

The laboratory blank is the sample prepared and analysed at the beginning of every analytical run, following calibration of the analytical apparatus. This is the component of the analytical signal which is not derived from the sample but from reagents e.g. glassware. It can be determined by processing solvents and reagents in the same manner as for samples.

6.2.5. Surrogate Spikes

Samples submitted to the laboratory are spiked with a known amount of surrogate, which is like the analyte of interest in terms of chemical composition and extractability. The recovery of surrogates provides an assessment of analytical accuracy on a sample by sample basis.

The laboratory acceptance criteria for surrogate samples is generally 60-140% for organics.

7. Site Assessment Criteria

7.1. Soil

The site assessment criteria (SAC) for soil have been derived from NEPM (2013) guidelines and CRC Care (2011). The SAC adopted has been selected based on the proposed divestment of the site for low density residential land use/ aged care facility.

The various SAC adopted for the site are summarised in **Table 6**. Guideline values for individual contaminants analysed for this assessment are presented in the attached laboratory summary tables.

Table 6: Soil Assessment Criteria Summary

SAC	Applicability
Health Investigation Level (HIL) A – Residential	HIL A has been selected to assess risk to possible future site receptors. Is applicable to low density residential land use with accessible soils.
Health Screening Levels (HSL) A – Residential land use for fine soils.	In accordance with NEPM (2013) methodology, HSL A for vapour intrusion have been adopted for clay soils due to the predominantly sandy clay soil profiles encountered during the subsurface investigation. The depth the sample was collected from below ground level has been used to apply the required depth category for the adopted HSL. Total recoverable hydrocarbons (TRH) in the >C_{16}-C_{34} and >C_{34}-C_{40} fractions are not considered to pose a vapour risk and therefore not of concern for vapour intrusion, however, exposure can be via direct contact pathways (dermal contact and incidental ingestion and inhalation of soil particles). HSLs for the TRH C_{16} – C_{40} petroleum fractions have been adopted from CRC CARE Technical Report no. 10 (Friebel and Nadebaum 2011) for HSL A residential land use.
Ecological Investigation Levels (EILs) for Urban residential and public open space	EILs for selected analytes were taken from NEPM B1 Schedule. No CEC data was collected for comparison to the EILs so the most conservative values were adopted. Where applicable, pH values tested in select samples were used to inform adopted EIL criteria. The average of the seven pH results recorded in the laboratory reports was pH 6. The EIL criteria for zinc was calculated using an adopted pH 6 and the most conservative CEC value (5). The adopted copper criteria were based off a pH 6. Both the chromium and nickel criteria were based off the most conservative values, as the clay content and CEC were not determined during this preliminary investigation). The following conservative assumptions were also utilised: • Contamination is considered as "aged" (>2 years). • The site is in the state of NSW and from an area of "low" traffic volumes.
Ecological Screening Levels (ESLs) for Urban residential and public open space.	ESLs for selected hydrocarbon analytes have been adopted for fine grained material due to the predominantly clayey soil profiles encountered during subsurface investigation.
Asbestos in soil	In accordance with NEPM (2013) methodology, the following Residential A HSL criteria for asbestos in soil has been adopted: • 0.01% (w/w) bonded asbestos containing material (ACM). • 0.001% (w/w) asbestos fines/fibrous asbestos (AF/FA). • No visible asbestos for surface soils (designated as 0-0.1 mbgl).
Waste Classification Guidelines	Criteria from NSW EPA (2014) have been selected to assess the potential classification of topsoil at the site.

Table 6: Soil Assessment Criteria Summary	
SAC	**Applicability**
Virgin Excavated Natural Material / Excavated Natural Material Order	VENM is a waste that has been pre-classified as general solid waste (non-putrescible). The Waste Regulation (POEO, 2014) defines virgin excavated natural material (VENM) as: 'natural material (such as clay, gravel, sand, soil or rock fines): • that has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial, mining or agricultural activities and • that does not contain any sulfidic ores or soils or any other waste • and includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved for the time being pursuant to an EPA Gazettal notice.' As there are no prescribed assessment criteria for VENM, the Excavated Natural Material (ENM) Order criteria have been adopted for the chemical assessment of VENM soil at the site.

7.2. Aesthetic Impact

As per NSW EPA, 2017 and NEPM, 2013 the aesthetic condition of a site is required to be considered when assessing suitability for the proposed development. An assessment of the site aesthetics requires consideration of the natural state of soil on any given site, and a comparison between it and the soil encountered during investigation works. Soils on a site should not exhibit the following:

- Discolouration (staining).
- A malodorous nature (odours).
- Abnormal consistency (anthropogenic contaminants – e.g. rubble and asbestos).

Where any of these were observed the area was photographed and the extent of the objectionable materials was determined if possible.

8. Results

The following sections summarise the results of the TCA. Refer to **Figure 2** for site layout and investigation locations discussed herein.

8.1. Field Observations / Site Walkover

The following general observations were made during the assessment works:

- The site is generally well grassed, with some heavily vegetated areas. An area of minor grass dieback was observed at 1 Charlish Lane (targeted by sample taken at TP02).
- Stockpiled bricks and wood were observed at 9 Fig Tree Street, and bricks and tiles at 110 Centennial Ave.
- Evidence of landscaping was observed at some locations, particularly 9 Fig Tree Street where soil had been excavated at the rear of the property and a rock ledge installed creating an approximate 0.5m drop. Residence 108 Centennial Ave had dense vegetation at the rear of the property within the excavated footprint observed in historical images, and a brick footprint of a former structure.
- A small depression (targeted by sample taken at TP01) and possible above ground planter box were observed at 106 Centennial Ave.
- All properties had observed structures with potential asbestos-containing material observed in the main structure as well as potential lead containing paints. It is understood Uniting Care has sought building reports for Hazardous Materials for the properties.

Relevant images are shown in the attached **Photographic Log**.

8.2. Subsurface Conditions

The following observations were made during the intrusive works:

- Shallow fill material was identified at all borehole and test pit locations and generally consisted of a brown silty sand. Fill consisting of brown clayey silty sand was observed at BH01 and BH03, and clay nodules noted at TP03. Mulch was observed across the surface at TP01 and BH05.
- Anthropogenic inclusions such as bricks, tiles, wood cuttings were observed on and within surface soils (0-0.1mbgl) across the site. Sandstone blocks and trace glass were also observed within fill material. Fill material was generally encountered to a depth of 0.5mbgl across the site, excluding BH03 (0.8mbgl) and TP02 (0.2mbgl).
- Natural soils were encountered beneath the fill material in all boreholes, generally from 0.5mbgl, excluding BH03 (from 0.8mbgl) and TP02 (from 0.2mbgl). Natural material was observed to be a grey or red sandy clay with mottling present. A grey brown shale was observed at BH01 below the sandy clay profile (from 0.75mbgl).
- No malodorous odours or discoloured (stained) soils were noted during the investigation in the boreholes or test pits.

Subsurface details are summarised in the attached borehole and test pit logs included in **Appendix A**.

8.3. Aesthetic Considerations

From an environmental and human health risk perspective the relatively inert foreign (bricks, tiles, wood cuttings. sandstone blocks and trace glass) are not considered to pose a risk. The presence of foreign materials in near surface soils may present a concern to site users under a residential land use with accessible soils scenario and will require management during should the proposed development proceed, and the material remains onsite.

8.4. Laboratory Analytical Results

Soil analytical results are summarised in the following sections.

8.5. Fill Material

Concentration of TRH/BTEX, PAH, OCP, OPP and PCBs were below the SAC for residential land use with accessible soils. No suspected asbestos was observed in the fill soils and asbestos was not detected in soil laboratory analytical results.

Concentrations of some heavy metals were identified marginally above the adopted SAC, including:

- Concentrations of lead in sample BH01 (0.1-0.2mbgl) (570mg/kg) exceeded HIL A (NEPM, 2013) criteria for residential land use (300mg/kg).
- Concentrations of zinc in sample BH01 (0.1-0.2mbgl) (420mg/kg) exceeded the adopted EIL criteria (230mg/kg).
- Concentrations of nickel in sample BH05 (0.1-0.2mbgl) (65mg/kg) exceeded the adopted EIL criteria (30mg/kg).

A comparison of fill samples to NSW EPA (2014) returned concentrations below the CT1 criteria for General Solid Waste (GSW) with the following exceptions:

- Concentrations of lead in sample BH01 (0.1-0.2mbgl) (570mg/kg) which exceeded CT1 (NSW EPA, 2014) criteria for GSW (100mg/kg),
- Concentrations of nickel in sample BH05 (0.1-0.2mbgl) (65mg/kg) exceeded the CT1 criteria for GSW (40mg/kg).

Additional Toxicity Characteristic Leaching Procedure (TCLP) analysis to determining the potential leachability of heavy metals (lead and nickel) identified in the above fill samples returned concentrations below the relevant GSW criteria presented in Table 2 of NSW EPA (2014).

8.6. Natural Material

Concentration of TRH, PAH, OCP, OPP and PCBs were below the SAC for residential land use with accessible soils. No suspected asbestos was observed in the natural soils and asbestos was not detected in soil laboratory analytical results.

Concentrations of benzene in sample BH03 (0.9-1.1mbgl) (1mg/kg) exceeded the HSL A for clay soils between 0.0-1.0mbgl (NEPM, 2013) (0.7mg/kg) and the ENM Order (0.5mg/kg).

In addition, pH results in sample BH03 (0.9-1.1mbgl) marginally exceeded the pH criteria of the ENM with a pH of 4.4, just outside the 4.5-10 pH range.

It is noted that samples taken at depth had higher pH levels (average 4.8 pH from 5 samples tested) than those at the surface (average 8 pH from 2 samples tested).

Results are preliminary in nature and are limited by the area of investigation. Further investigation is needed for classification of material at the site.

Laboratory analytical results are included in **Appendix B**.

8.7. Quality Assurance / Quality Control

The results of the laboratory analysis for field QC samples are shown in the attached laboratory reports, **Appendix B**, and summarised as follows:

- One intra-laboratory and inter laboratory duplicate were obtained as part of the TCA. The duplicates were collected and analysed at a rate of 20% compared to primary data.
- The calculated RPD values were within the acceptable range of +/- 50 % for most analytes (inorganic and organic), excluding FD1 and parent sample which returned a marginal exceedance of chromium at 53%.

- Trip spike results indicated that the percentage loss for BTEX during the trip was minimal, indicating that appropriate preservation techniques were employed.
- Levels of analytes for trip blanks were mostly below detection limits, excluding benzene with a reported value of 0.2 mg/kg. This indicates there is potential for other samples in the batch to have been impacted, or that the laboratory blank was contaminated prior to PRM receiving it. Based on the site history and observations made during sampling, BTEX contamination is not a major contaminant of concern.

Detailed laboratory QA/QC results are presented on the laboratory testing certificates in **Appendix B**.

Based on the information referenced above, it was concluded that data generated during the TCA is of an acceptable quality to achieve the objectives of the TCA with the following comments:

- TRH Soil C10-C40 NEPM - Percent recovery for the surrogate/matrix spike was not possible to report as the high concentration of analytes in sample 236690-2.
- Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria was exceeded for 236592-1 for Zn. Therefore, a triplicate result was issued.

The laboratory data sets are considered reliable and useable for this assessment.

9. Discussion

9.1. Fill material

9.1.1. Offsite disposal

A comparison of soil analytical results to NSW EPA (2014) indicate the fill material across the site is likely to meet the classification of GSW (non-putrescible). However, further sampling should be undertaken to ensure consistency across the site and provide a robust sampling database for the volume of material to be moved offsite.

Given the presence of anthropogenic inclusions in the fill soils as well as the historical presence of small structures across areas of the sites, it is possible asbestos containing materials still present a risk during future excavation works at the site.

9.1.2. Onsite reuse

With the exception of marginally elevated heavy metals (lead, zinc and nickel) identified at two locations above the SAC for residential with accessible gardens land use, the site soils are considered generally suitable for re-use onsite. Should the client wish to reuse the fill material onsite during excavation works, further investigation will be required to determine the risk to future receivers from the marginally elevated heavy metal concentrations.

Some chemical parameters (pH and CEC) were not tested as part of this TCA for fill material. Should the proposed redevelopment works go ahead, it is recommended that these are included to better reflect the conditions at the site and better inform the adopted SAC (specifically the adopted EIL criteria).

Aesthetic considerations are discussed in **Section 8.3** and **Section 9.3** will require consideration and management during development should the proposed residential with accessible gardens land use eventuate.

9.2. Natural material

9.2.1. Offsite disposal

As noted in **Section 9.1**, the ENM Order was adopted for chemical assessment of natural soils at the site, as no chemical criteria exists for VENM. Based on site observations, the sandy clay at the site complies with the definition of VENM, however preliminary pH results at depth indicate potential acidic conditions. Further chemical analysis is recommended to ensure material at depth (generally >1mbgl) does not include potential acidic soils.

Supplementary sampling and analysis is also recommended to determine the extent of elevated concentrations of benzene at BH03 (0.9-1.1mbgl) to ensure the correct classification is applied for soils in the vicinity of the detection.

9.2.2. Reuse on site

Further testing is recommended to determine the extent of detectable concentrations of benzene at BH03, as it was reported above the adopted HSL (NEPM, 2013) in one sample at depth.

9.3. Aesthetic Considerations

The presence of various anthropogenic materials in near surface soils across the site exceeded the adopted aesthetic SAC in a residential land use scenario.

10. Conclusion and Recommendations

10.1. Conclusions

The preliminary data indicates the following:

- Site soils generally meet the adopted SAC for residential land use with accessible gardens, with the exception of two locations (BH01 and BH05) where marginally elevated concentrations of heavy metals (lead, nickel and zinc) were identified, and one location (BH03) where detectable concentrations of benzene were identified above the adopted SAC.
- Surface soils at the site to contain various anthropogenic materials including bricks, timber, tile, sandstone blocks, ironstone gravels and trace glass in select locations. The presence of various anthropogenic materials in near surface soils across the site exceeded the adopted aesthetic SAC in a residential land use scenario.
- Fill material identified at the site may be suitable for offsite disposal during redevelopment works as General Solid Waste (non-putrescible).
- Natural soils observed underlying fill materials were considered to be consistent with the description of VENM as provided in the NSW EPA *Waste Classification Guidelines Part 1: Classifying Waste* (NSW EPA, 2014).

Further investigation works are required at the site to confirm these preliminary findings.

10.2. Recommendations

Should redevelopment works proceed, it is recommended that a suitably qualified environmental consultant is engaged to confirm the preliminary contamination and waste classification findings. Particular focus of the additional investigations should be made regarding:

- The identification of detectable concentrations of Benzene, Toluene and Ethylbenzene identified at BH03.
- Potential asbestos contamination in soils or structures across the site.
- Potential acidic conditions of natural soils at depth.
- Other properties part of the development works which were not able to be investigated as part of these works.

It is also recommended prior to demolition of any structures that Hazardous Material Building Surveys are undertaken and documented for each property (if not already done so).

11. Limitations

This report is confidential and has been prepared by Progressive Risk Management Pty Ltd (PRM) for Ascent Geotechnical (the client). This report may only be used and relied upon by the client and must not be copied to, used by or relied upon by any person other than the client, and Uniting Care. If a third party (limited to only the first purchaser of the property from Uniting Care) wishes to rely on this report, they will need to enter into a Third-Party Reliance Deed with PRM.

This report is limited to the observations made by PRM during the Targeted Contamination Assessment and was limited to the assessment of contamination in soils only, as detailed in the Scope of Works.

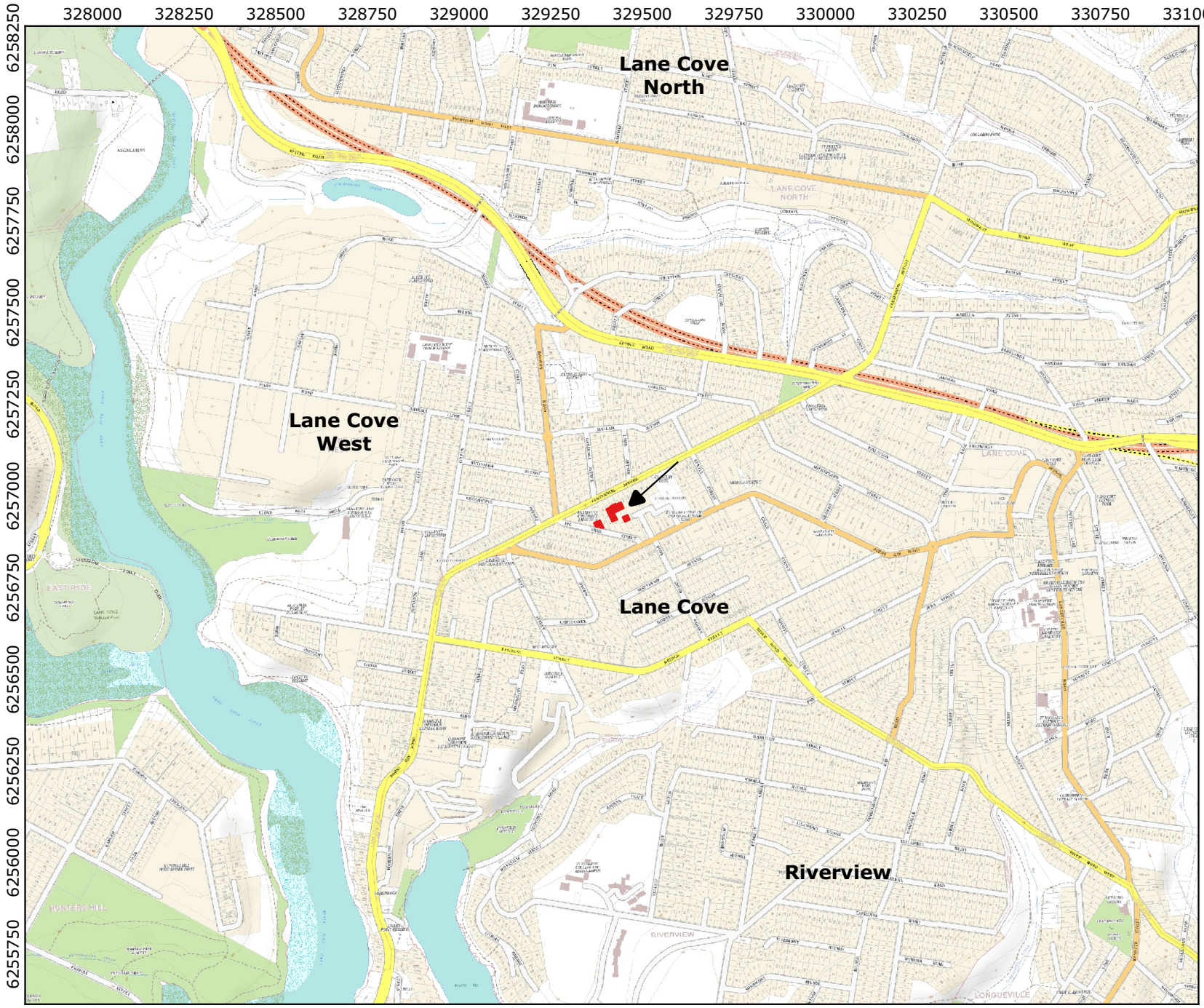
All results, conclusions and recommendations presented should be reviewed by a competent person before being used for any other purpose. PRM accepts no liability for use of, interpretation of or reliance upon this report by any person or body other than the client. Third parties must make their own independent inquiries.

This report should not be altered amended or abbreviated, issued in part or issued incomplete without prior checking and approval by PRM. PRM accepts no liability that may arise from the alteration, amendment, abbreviation or part-issue or incomplete issue of this report. To the maximum extent permitted by law, all implied warranties and conditions in relation to the services provided by PRM and this report are expressly excluded (save as agreed otherwise with the client).

PRM shall bear no liability in relation to any change to site conditions after the date of this report. This report does not provide a complete assessment of the environmental status of the site, and it is limited to the scope and limitations defined herein (Scope of Works). Should information become available regarding conditions at the site including previously unknown sources of contamination, PRM reserves the right to review the report in the context of the additional information.

Figures

Figure 1: Regional Site Location
Figure 2: Site Layout
Figure 3: Proposed Development Pl



Project Reference	P034542
Report Name	Targeted CA
Client	Ascent Geo

Various properties in Lane Cove, NSW

Site Locality Map
Figure 1

PROGRESSIVE RISK MANAGEMENT

Scale: 1:15,000

Coor. Sys: GDA 1994 MGA Zone56

Legend

Approximate Site Location

N

250 0 250 m

Image Source: Sixmaps (2020)

Project Reference	P034542
Report Name	Targeted CA
Client	Ascent Geo

Various properties in Lane Cove, NSW

Site Layout Diagram
Figure 2

PROGRESSIVE RISK MANAGEMENT

Fig Tree Street Scale: 1:700

Coor. Sys: GDA 1994 MGA Zone56

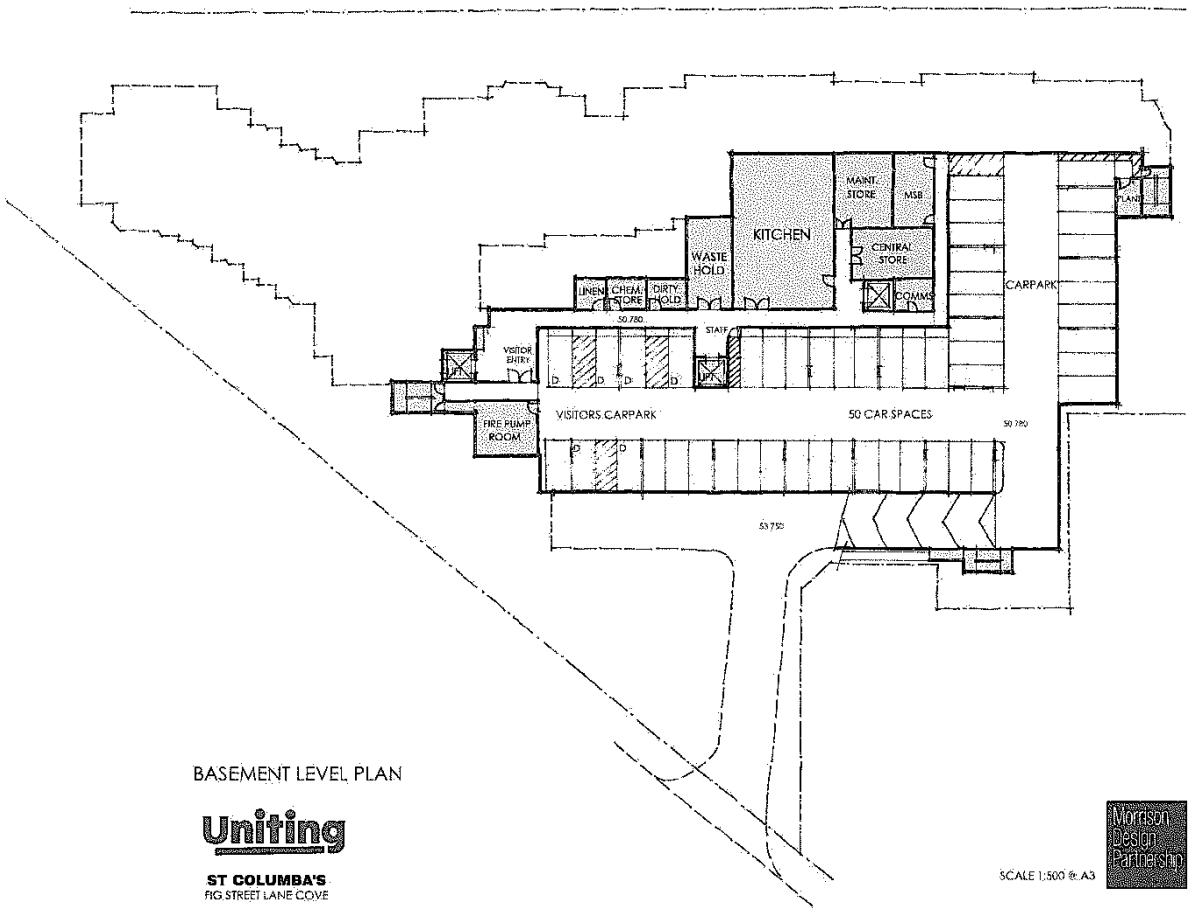
Legend

- Approximate Test Pit Location
- Approximate Borehole Location
- Approximate Site Boundary
- Lot Boundaries

N

10 0 10 m

Image Source: Spookfish (2019)



Project Reference	P034542
Report Name	Targeted CA
Client	Ascent Geo

Various Properties in Lane Cove, NSW

Proposed Development Plan Figure 3

PROGRESSIVE RISK MANAGEMENT

Image Source: Ascent Geo (2020)

Analytical Tables

Project Name:	Targeted Contamination Assessment
Client Name:	Ascent Geotechnical
Project Number:	P034542.001 / C0260
Table A:	**Summary of Site Assessment Results**

PROGRESSIVE RISK MANAGEMENT

Analyte	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Zinc	Nickel	Benzo(a)pyrene TEQ	Benzo(a)pyrene	Napthalene	Total PAH	Benzene	Toluene	Ethylbenzene	o-Xylene	C6-C10 less BTEX	C6-C10	>C10-C16	>C16-C34	>C34-C40	Total PCB	Pesticides	Asbestos in Soil	pH	EC
NEPM, 2013 HIL A	100	20	100	6000	300	40	7400	400	3	-	-	300	-	-	-	-	-	-	-	-	-	1	<240	-	-	-
NEPM, 2013 HSL A Clay 0-1 m	-	-	-	-	-	-	-	-	-	-	5	-	0.7	480	NL	110	50	-	280	-	-	-	-	-	-	-
NEPM, 2013 ML Residential and Open Public Space (Fine)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	800	1000	3500	10000	-	-	-	-	-
NEPM, 2013 EIL Urban Residential (Aged)	100	-	190	190	1100	-	230	30	-	-	170	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
NEPM, 2013 ESL Urban Residential (Fine)	-	-	-	-	-	-	-	-	-	1.4	-	-	65	105	125	45	-	180	120	1300	5600	-	-	-	-	-
Contamination Assessment Results																										
Sample ID	**Date**	**Depth**																								
BH01	11/02/2020	0.1-0.2	9	1	24	59	**570**	0.1	**420**	9	<0.5	0.05	<0.1	0.3	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	NAD	8.3	-
BH01	11/02/2020	0.6-0.8	15	<0.4	11	13	28	<0.1	18	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	-	5.2	0.054
BH02	11/02/2020	0.5-0.7	10	<0.4	9	9	18	<0.1	12	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	-	5.1	0.075
TP01	11/02/2020	0.2-0.3	16	<0.4	13	8	15	<0.1	3	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	NAD	-	-
BH03	12/02/2020	0.1-0.3	7	<0.4	13	9	27	<0.1	17*	1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	0.6	NAD	-	-
BH03	12/02/2020	0.9-1.1	7	<0.4	11	16	13	<0.1	9	<1	<0.5	<0.05	<0.1	<0.05	**1**	1	3	<1	<25	<25	<50	<100	<100	<0.1	0.1	-	4.4	0.014
TP02	12/02/2020	0.1-0.2	21	<0.4	12	21	46	<0.1	58	6	<0.5	0.2	<0.1	2.2	0.5	0.6	1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	NAD	-	-
BH04	13/02/3030	0.9-1.1	<4	<0.4	7	10	10	<0.1	5	1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	-	4.6	0.06
BH05	13/02/3030	0.1-0.2	11	<0.4	13	38	37	<0.1	67	**65**	<0.5	<0.05	<0.1	0.7	<0.2	<0.5	<1	<1	<25	<25	65	410	170	<0.1	<0.1	NAD	7.8	
BH05	13/02/3030	0.9-1.1	7	<0.4	14	2	14	<0.1	4	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<50	<100	<100	<0.1	<0.1	-	4.8	0.06
TP03	13/02/3030	0.0-0.2	6	<0.4	50	34	91	<0.1	98	27	<0.5	0.2	<0.1	2.8	<0.2	<0.5	<1	<1	<25	<25	<50	120	<100	<0.1	<0.1	NAD		

*Triplicate result following lab RPD exceedance

	Fill profiles
	Natural soil profiles

Project Name:	Targeted Contamination Assessment
Client Name:	Ascent Geotechnical
Project Number:	P034542.001 / C0260
Table B:	**Summary of Waste Classification Results**

PROGRESSIVE RISK MANAGEMENT

Analyte	Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Zinc	Nickel	Arsenic in TCLP	Cadmium in TCLP	Chromium in TCLP	Lead in TCLP	Mercury in TCLP	Nickel in TCLP	Benzo(a)pyrene in TCLP	Benzo(a)pyrene TEQ	Benzo(a)pyrene	Napthalene	Total PAH	Benzene	Toluene	Ethylbenzene	o-Xylene	C6-C10 less BTEX	C6-C9	C10-C36	Total PCB	Total Pesticides	Asbestos in Soil	pH	EC
NSW EPA, 2014 Waste Classification Guidelines (CT1)	**100**	**20**	**100**	**-**	**100**	**4**	**-**	**40**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**0.8**	**-**	**200**	**10**	**288**	**600**	**1000**	**-**	**650**	**10000**	**<50**	**<50**	**-**	**-**	**-**
NSW EPA, 2014 Waste Classification Guidelines (SCC1+TCLP1)	**500**	**100**	**1900**	**-**	**1500**	**50**	**-**	**1050**	**5**	**1**	**5**	**5**	**0.2**	**2**	**0.04**	**-**	**10**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**
EPA, 2014 ENM Order	**40**	**1**	**150**	**200**	**100**	**1**	**300**	**60**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**1**	**-**	**40**	**0.5**	**65**	**25**	**15**	**-**	**-**	**500**	**-**	**-**	**ASB**	**4.5-10**	**3**
Waste Results																															
Sample ID	**Date**	**Depth**																													
BH01	11/02/2020	0.1-0.2	9	1	24	59	**570**	0.1	420	9	<0.05	<0.01	<0.01	0.33	<0.0005	<0.02	-	<0.5	0.05	<0.1	0.3	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	NAD	8.3	-
BH01	11/02/2020	0.6-0.8	15	<0.4	11	13	28	<0.1	18	<1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	-	5.2	0.054
BH02	11/02/2020	0.5-0.7	10	<0.4	9	9	18	<0.1	12	<1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	-	5.1	0.075
TP01	11/02/2020	0.2-0.3	16	<0.4	13	8	15	<0.1	3	<1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	NAD	-	-
BH03	12/02/2020	0.1-0.3	7	<0.4	13	9	27	<0.1	17*	1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	NAD	-	-
BH03	12/02/2020	0.9-1.1	7	<0.4	11	16	13	<0.1	9	<1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	**1**	1	3	<1	<25	<25	<250	<0.1	<0.1	-	**4.4**	0.014
TP02	12/02/2020	0.1-0.2	21	<0.4	12	21	46	<0.1	58	6	-	-	-	-	-	-	-	<0.5	0.2	<0.1	2.2	0.5	0.6	1	<1	<25	<25	<250	<0.1	<0.1	NAD	-	-
BH04	13/02/3030	0.9-1.1	<4	<0.4	7	10	10	<0.1	5	1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	-	4.6	0.06
BH05	13/02/3030	0.1-0.2	11	<0.4	13	38	37	<0.1	67	**65**	<0.05	<0.01	<0.01	<0.03	<0.0005	<0.02	-	<0.5	<0.05	<0.1	0.7	<0.2	<0.5	<1	<1	<25	<25	<540	<0.1	<0.1	NAD	7.8	
BH05	13/02/3030	0.9-1.1	7	<0.4	14	2	14	<0.1	4	<1	-	-	-	-	-	-	-	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	-	4.8	0.06
TP03	13/02/3030	0.0-0.2	6	<0.4	50	34	91	<0.1	98	27	-	-	-	-	-	-	-	<0.5	0.2	<0.1	2.8	<0.2	<0.5	<1	<1	<25	<25	<250	<0.1	<0.1	NAD		

*Triplicate result following lab RPD exceedance

	Fill profiles
	Natural soil profiles

Project Name:	Targeted Contamination Assessment
Client Name:	Ascent Geotechnical
Project Number:	P034542.001 / C0260
Table C:	**Summary of QAQC**

PROGRESSIVE RISK MANAGEMENT

Analyte		Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Zinc	Nickel	Benzo(a)pyrene TEQ	Benzo(a)pyrene	Napthalene	Total PAH	Benzene	Toluene	Ethylbenzene	o-Xylene	C6-C10 less BTEX	C6-C9	C6-C10	>C10-C16	>C16-C34	>C34-C40	C10-C36	Total PCB	Total Pesticides
Quality Control Summary																										
Sample ID	**Sample Type**																									
BH04 (0.9-11)	Primary Sample	<4	<0.4	7	10	10	<0.1	5	1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<25	<50	<100	<100	<250	<0.1	<0.1
FD1	Inter-Laboratory Duplicate (ALS)	<5	<1	12	16	21	<0.1	10	<2	0.6	<0.5	<1	<0.05	<0.2	<0.5	<0.5	<0.5	<10	<10	<10	<50	<100	<100	<250	<0.1	<0.05
	RPD	-	-	53	46	71	-	67	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
BH05 (0.9-1.1)	Primary Sample	7	<0.4	14	2	14	<0.1	4	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<25	<50	<100	<100	<250	<0.1	<0.1
FD2	Intra-Laboratory Duplicate (EnviroLab)	11	<0.4	13	2	15	<0.1	3	<1	<0.5	<0.05	<0.1	<0.05	<0.2	<0.5	<1	<1	<25	<25	<25	<50	<100	<100	<250	<0.1	<0.1
	RPD	-	-	7	0	7	-	29	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

*Triplicate result following lab RPD exceedance

Photographic Log

Photolog			
Report Name:	Targeted Contamination Assessment	**Project Reference:**	P034542
Site Details:	Aged Care Facility and select properties - Various properties in Lane Cove, NSW		

Photo 1: Location of TP01.

Photo 2: Image of TP01 with brown silty sand observed above grey sandy clay with red and orange mottling. Representative of sample TP01_0.2-0.3.

Photo 3: Image of additional structure observed at 106 Centennial Ave, with possible lead paint on window frame and (insert) suspected ACM eaves.

Photo 4: Image of site area at 108 Centennial Ave facing north, with BH01 visible in north west corner and brick footprint of possible former structure in south west corner.

Photo 5: Image of brick footprint observed at 108 Centennial Ave and location of BH02.

Photo 6: Image of suspected ACM eaves at 108 Centennial Ave on house.

Photolog			
Report Name:	Targeted Contamination Assessment	**Project Reference:**	P034542
Site Details:	Aged Care Facility and select properties - Various properties in Lane Cove, NSW		

Photo 7: Image of brick footprint observed at 110 Centennial Ave behind shed.

Photo 8: Image of house at 110 Centennial Ave, with suspected ACM eaves.

Photo 9: Image of minor grass dieback at 1 Charlish Lane, with TP02 visible at top of image.

Photo 10: Image of BH04 at 9 Fig Tree Street.

Photo 11: Image of TP03 located at 9 Fig Tree Street, with (insert) sandstone blocks observed within brown silty sand fill layer.

Photo 12: Image of potential lead paint and suspected ACM eaves at 9 Fig Tree Street.

Photolog			
Report Name:	Targeted Contamination Assessment	**Project Reference:**	P034542
Site Details:	Aged Care Facility and select properties - Various properties in Lane Cove, NSW		

Photo 13: Image of stone ledge and approximate 0.5m drop at rear of property 9 Fig Tree Street. Brick and wood stockpiles are visible along fence line.

Photo 14: Image of landscaping observed at 15 Fig Tree Street, with mulch and leaf litter across surface, representative of BH05 location.

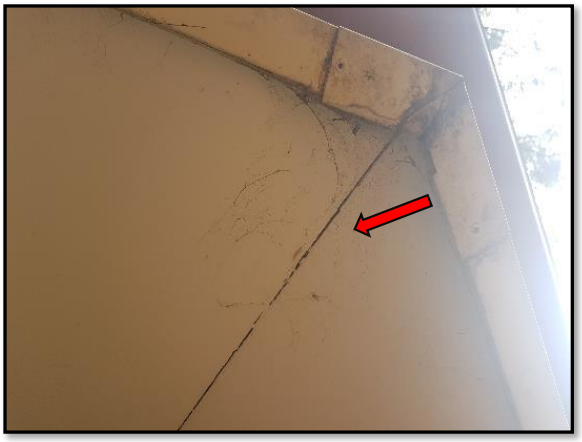


Photo 15: Image of suspected ACM eaves observed at 15 Fig Tree Street, near BH05.

Photo 16: Image of potential ACM eaves observed at 15 Fig Tree Street, near BH05.

End of Photolog

Appendix A: Borehole and Test Pit Logs

PROGRESSIVE RISK MANAGEMENT

BH01

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 108 Centennial Ave, Lane Cove

METHOD Auger
DEPTH OF INVESTIGATION 0.8mbgl
DATE 11/02/2020
LOGGED BY TAO

COORDINATES 151.15699395, -33.81373340
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.1	0.1-0.2	Jar		FILL: Clayey silty sand, brown, moist, with rootlets.	
0.2					
0.3					
0.4					
0.5				Sandy CLAY, red, dry.	
0.6	0.6-0.8	Jar			
0.7					
0.8				SHALE, grey brown.	
0.9				END OF BH INVESTIGATION @ 0.8mbgl - TDR	
1					
1.1					
1.2					
1.3					
1.4					

PROGRESSIVE RISK MANAGEMENT

BH02

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 108 Centennial Ave, Lane Cove

METHOD Auger
DEPTH OF INVESTIGATION 0.7mbgl
DATE 11/02/2020
LOGGED BY TAO

COORDINATES 151.15709390, -33.813774297
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS Brick footprint of possible former structure on surface of BH.

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.1	0.1-0.2	Jar		FILL: Silty sand, brown, with red brown clay nodules, rootlets, grass, trace ironstone gravels.	
0.5	0.5-0.7	Jar		Sandy CLAY, grey with red mottling, dry.	
0.7				END OF BH INVESTIGATION @ 0.7mbgl - TDR	

Disclaimer This bore log is intended for environmental not geotechnical purposes.

PROGRESSIVE RISK MANAGEMENT

BH03

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 110 Centennial Ave, Lane Cove

METHOD Auger
DEPTH OF INVESTIGATION 1.1mbgl
DATE 12/02/2020
LOGGED BY TAO

COORDINATES 151.15684432, -33.81380817
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.1	0.1-0.3	Jar		FILL: Clayey silty sand, brown, with rootlets, moist.	
0.3				Increasing clay content	
0.8				Sandy CLAY, red with grey mottling, dry.	
0.9	0.9-1.1	Jar			
1.1				END OF BH INVESTIGATION @ 1.1mbgl - TDR	

Disclaimer This bore log is intended for environmental not geotechnical purposes.

PROGRESSIVE RISK MANAGEMENT

BH04

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 9 Fig Tree Street, Lane Cove

METHOD Auger
DEPTH OF INVESTIGATION 1.1mbgl
DATE 13/02/2020
LOGGED BY TAO

COORDINATES 151.15706891, -33.814038945
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.1	0.1-0.3	Jar		FILL: Silty sand, brown, with rootlets.	
0.2					
0.3					
0.4					
0.5				Sandy CLAY, red with grey mottling, dry.	
0.6					
0.7					
0.8					
0.9	0.9-1.1	Jar DUP1			
1					
1.1				END OF BH INVESTIGATION @ 1.1mbgl - TDR	
1.2					
1.3					
1.4					

PROGRESSIVE RISK MANAGEMENT

BH05

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 15 Fig Tree Street, Lane Cove

METHOD Auger
DEPTH OF INVESTIGATION 1.1mbgl
DATE 13/02/2020
LOGGED BY TAO

COORDINATES 151.15654640, -33.81409559
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.1				Mulch, leaf litter	
	0.1 - 0.2	Jar		FILL: Silty sand, brown, with rootlets.	
0.5				Sandy CLAY, red with grey mottling, dry.	
0.9	0.9-1.1	Jar DUP2			
1.1				END OF BH INVESTIGATION @ 1.1mbgl - TDR	
1.4					

Disclaimer This bore log is intended for environmental not geotechnical purposes.

PROGRESSIVE RISK MANAGEMENT

TP01

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 106 Centennial Ave, Lane Cove

METHOD Shovel
TOTAL DEPTH 0.5mbgl
DATE 11/02/2020
LOGGED BY TAO

COORDINATES 151.15717559, -33.81366628
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS TP located within possible pit/well. Mulch and leaf litter across surface.

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.05				FILL: Silty sand, brown, moist, trace ironstone gravels.	
0.1					
0.15					
0.2	0.2-0.3	Jar		Grading to sandy clay, grey with red and orange mottling, trace ironstone gravels.	
0.25					
0.3					
0.35					
0.4					
0.45					
0.5				END OF TEST PIT @ 0.5mbgl - TDR	
0.55					
0.6					
0.65					
0.7					
0.75					
0.8					
0.85					
0.9					
0.95					

PROGRESSIVE RISK MANAGEMENT

TP02

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 1 Charlish Lane, Lane Cove

METHOD Shovel
TOTAL DEPTH 0.25mbgl
DATE 12/02/2020
LOGGED BY TAO

COORDINATES 151.15735928, -33.81400388
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS Grass die back across TP surface.

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.05				FILL: Silty sand, brown, moist, with rootlets, trace glass.	
0.1	0.1-0.2	Jar			
0.15					
0.2				Sandy CLAY, grey, with rootlets.	
0.25				END OF TEST PIT @ 0.25mbgl - TDR	
0.3					
0.35					
0.4					
0.45					
0.5					
0.55					
0.6					
0.65					
0.7					
0.75					
0.8					
0.85					
0.9					
0.95					

PROGRESSIVE RISK MANAGEMENT

TP03

PROJECT NUMBER P034542
PROJECT NAME Targeted Contam. Assessment
CLIENT Uniting Care
ADDRESS 9 Fig Tree Street, Lane Cove

METHOD Shovel
TOTAL DEPTH 0.3mbgl
DATE 13/02/2020
LOGGED BY TAO

COORDINATES 151.15697720, -33.81401429
COORD SYS GDA94 / MGA56
CHECKED BY

COMMENTS

Depth (m)	Samples	Sample Type	Graphic Log	Material Description	Additional Observations
0.05 0.1 0.15 0.2 0.25 0.3	0.0 - 0.2	Jar		FILL: Silty sand, brown, moist, with clay nodules, roots and rootlets, sandstone blocks.	Sandstone blocks were observed to have been cut to shape and size.
0.35 0.4 0.45 0.5 0.55 0.6 0.65 0.7 0.75 0.8 0.85 0.9 0.95				END OF TEST PIT @ 0.3mbgl - TDR	

Disclaimer This bore log is intended for environmental not geotechnical purposes.

Appendix B: NATA accredited Laboratory Analysis Certificates

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

CERTIFICATE OF ANALYSIS 236507

Client Details

Client	Progressive Risk Management Pty Ltd
Attention	Jessica Little
Address	14/76 Reserve Road, ARTARMON, NSW, 2064

Sample Details

Your Reference	**PO34542 - Lane Cove**
Number of Samples	5 SOIL
Date samples received	11/02/2020
Date completed instructions received	11/02/2020

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	18/02/2020
Date of Issue	18/02/2020

NATA Accreditation Number 2901. This document shall not be reproduced except in full.

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

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

Results Approved By
Josh Williams, Senior Chemist
Ken Nguyen, Reporting Supervisor
Lucy Zhu, Asbestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	98	108	88	110

svTRH (C10-C40) in Soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	118	105	113	103

PAHs in Soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	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
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	0.3	<0.05	<0.05	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	83	86	81	85

Organochlorine Pesticides in soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
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	%	79	80	79	84

Organophosphorus Pesticides in Soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
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	%	79	80	79	84

PCBs in Soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
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	%	79	80	79	84

Acid Extractable metals in soil					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Arsenic	mg/kg	9	15	10	16
Cadmium	mg/kg	1	<0.4	<0.4	<0.4
Chromium	mg/kg	24	11	9	13
Copper	mg/kg	59	13	9	8
Lead	mg/kg	570	28	18	15
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	<1	<1	1
Zinc	mg/kg	420	18	12	3

Misc Inorg - Soil			
Our Reference		236507-2	236507-4
Your Reference	UNITS	BH01	BH02
Depth		0.6-0.8	0.5-0.7
Date Sampled		11/02/2020	11/02/2020
Type of sample		SOIL	SOIL
Date prepared	-	14/02/2020	14/02/2020
Date analysed	-	14/02/2020	14/02/2020
pH 1:5 soil:water	pH Units	5.2	5.1
Electrical Conductivity 1:5 soil:water	µS/cm	54	75

Moisture					
Our Reference		236507-1	236507-2	236507-4	236507-5
Your Reference	UNITS	BH01	BH01	BH02	TP01
Depth		0.1-0.2	0.6-0.8	0.5-0.7	0.2-0.3
Date Sampled		11/02/2020	11/02/2020	11/02/2020	11/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Moisture	%	26	19	19	21

Asbestos ID - soils			
Our Reference		236507-1	236507-5
Your Reference	UNITS	BH01	TP01
Depth		0.1-0.2	0.2-0.3
Date Sampled		11/02/2020	11/02/2020
Type of sample		SOIL	SOIL
Date analysed	-	14/02/2020	14/02/2020
Sample mass tested	g	Approx. 25g	Approx. 25g
Sample Description	-	Brown clayey soil & rocks	Brown clayey 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
Trace Analysis	-	No asbestos detected	No asbestos detected

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.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
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.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. 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-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	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.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. 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.

Method ID	Methodology Summary
Org-012/017	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-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. 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-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	87	79
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	87	72
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	89	79
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	113	96
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	81	99
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	76	99
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	70	95
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	110	1	98	99	1	113	105

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			13/02/2020	1	14/02/2020	14/02/2020		13/02/2020	14/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	97	99
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	110	117
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	109
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	97	99
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	110	117
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	109
Surrogate o-Terphenyl	%		Org-003	100	1	118	118	0	113	105

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	80	82
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	80	80
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	86	86
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	0.1	0.2	67	82	82
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.1	0.2	67	76	78
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	0.1	0	78	62
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	0.05	0.07	33	100	80
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	90	1	83	87	5	83	86

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	106
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	104
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	104
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	111
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	106
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	104	107
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	117
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	104
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	92	96
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	101
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	85	1	79	85	7	77	82

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	92
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	106
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	112	120
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	103
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	106	111
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	70	67
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	107
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	85	1	79	85	7	77	82

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date extracted	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	80	120
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	85	1	79	85	7	77	82

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236507-2
Date prepared	-			13/02/2020	1	13/02/2020	13/02/2020		13/02/2020	13/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	9	5	57	101	91
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	1	0.8	22	101	86
Chromium	mg/kg	1	Metals-020	<1	1	24	24	0	104	89
Copper	mg/kg	1	Metals-020	<1	1	59	40	38	101	100
Lead	mg/kg	1	Metals-020	<1	1	570	400	35	106	86
Mercury	mg/kg	0.1	Metals-021	<0.1	1	0.1	<0.1	0	92	101
Nickel	mg/kg	1	Metals-020	<1	1	9	9	0	100	87
Zinc	mg/kg	1	Metals-020	<1	1	420	270	43	102	80

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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: 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 requested for asbestos testing were sub-sampled from jars provided by the client.

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CERTIFICATE OF ANALYSIS 236507-A

Client Details

Client	Progressive Risk Management Pty Ltd
Attention	Tara O'Brien
Address	14/76 Reserve Road, ARTARMON, NSW, 2064

Sample Details

Your Reference	**PO34542 - Lane Cove**
Number of Samples	5 SOIL
Date samples received	11/02/2020
Date completed instructions received	19/02/2020

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.

Report Details

Date results requested by	26/02/2020
Date of Issue	24/02/2020

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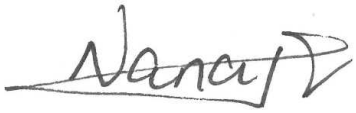
Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311		
Our Reference		236507-A-1
Your Reference	UNITS	BH01
Depth		0.1-0.2
Date Sampled		11/02/2020
Type of sample		SOIL
Date extracted	-	20/02/2020
Date analysed	-	20/02/2020
pH of soil for fluid# determ.	pH units	8.3
pH of soil TCLP (after HCl)	pH units	1.7
Extraction fluid used	-	1
pH of final Leachate	pH units	5.0
Arsenic in TCLP	mg/L	<0.05
Cadmium in TCLP	mg/L	<0.01
Chromium in TCLP	mg/L	<0.01
Copper in TCLP	mg/L	<0.01
Lead in TCLP	mg/L	0.33
Mercury in TCLP	mg/L	<0.0005
Nickel in TCLP	mg/L	<0.02
Zinc in TCLP	mg/L	1.1

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
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-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL: Metals in TCLP USEPA1311					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			20/02/2020	[NT]	[NT]	[NT]	[NT]	20/02/2020	[NT]
Date analysed	-			20/02/2020	[NT]	[NT]	[NT]	[NT]	20/02/2020	[NT]
Arsenic in TCLP	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	[NT]	[NT]	116	[NT]
Cadmium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	98	[NT]
Chromium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	103	[NT]
Copper in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	113	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	100	[NT]
Mercury in TCLP	mg/L	0.0005	Metals-021 CV-AAS	<0.0005	[NT]	[NT]	[NT]	[NT]	96	[NT]
Nickel in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	100	[NT]
Zinc in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	105	[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

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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.

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CERTIFICATE OF ANALYSIS 236592

Client Details

Client	Progressive Risk Management Pty Ltd
Attention	Jessica Little
Address	14/76 Reserve Road, ARTARMON, NSW, 2064

Sample Details

Your Reference	**PO34542 - Lane Cove**
Number of Samples	5 SOIL
Date samples received	12/02/2020
Date completed instructions received	12/02/2020

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	19/02/2020
Date of Issue	19/02/2020

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Diego Bigolin, Team Leader, Inorganics
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vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236592-1	236592-2	236592-3	236592-4	236592-5
Your Reference	UNITS	BH03	BH03	TP02	TRIP BLANK	TRIP SPIKE
Depth		0.1-0.3	0.9-1.1	0.1-0.2	-	-
Date Sampled		12/02/2020	12/02/2020	12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020	17/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	[NA]
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	[NA]
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	[NA]
Benzene	mg/kg	<0.2	1	0.5	0.2	100%
Toluene	mg/kg	<0.5	1	0.6	<0.5	101%
Ethylbenzene	mg/kg	<1	3	1	<1	98%
m+p-xylene	mg/kg	<2	<2	<2	<2	98%
o-Xylene	mg/kg	<1	<1	<1	<1	98%
naphthalene	mg/kg	<1	<1	<1	<1	[NA]
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	[NA]
Surrogate aaa-Trifluorotoluene	%	83	83	85	72	85

svTRH (C10-C40) in Soil				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020
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	%	120	79	93

PAHs in Soil				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
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	0.4
Pyrene	mg/kg	<0.1	<0.1	0.4
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.2
Chrysene	mg/kg	<0.1	<0.1	0.2
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	0.4
Benzo(a)pyrene	mg/kg	<0.05	<0.05	0.2
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	0.2
Total +ve PAH's	mg/kg	<0.05	<0.05	2.2
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	%	89	83	86

Organochlorine Pesticides in soil				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	0.3	<0.1	<0.1
alpha-chlordane	mg/kg	0.3	0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	106	96	104

Organophosphorus Pesticides in Soil				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	106	96	104

PCBs in Soil				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date extracted	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	106	96	104

Acid Extractable metals in soil					
Our Reference		236592-1	236592-2	236592-3	236592-6
Your Reference	UNITS	BH03	BH03	TP02	BH03 - [TRIPLICATE]
Depth		0.1-0.3	0.9-1.1	0.1-0.2	0.1-0.3
Date Sampled		12/02/2020	12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	14/02/2020	14/02/2020	14/02/2020	14/02/2020
Arsenic	mg/kg	7	7	21	10
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	13	11	12	14
Copper	mg/kg	9	16	21	12
Lead	mg/kg	27	13	46	26
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	1	<1	6	3
Zinc	mg/kg	15	9	58	17

Misc Inorg - Soil		
Our Reference		236592-2
Your Reference	UNITS	BH03
Depth		0.9-1.1
Date Sampled		12/02/2020
Type of sample		SOIL
Date prepared	-	18/02/2020
Date analysed	-	18/02/2020
pH 1:5 soil:water	pH Units	4.4
Electrical Conductivity 1:5 soil:water	µS/cm	140

Moisture				
Our Reference		236592-1	236592-2	236592-3
Your Reference	UNITS	BH03	BH03	TP02
Depth		0.1-0.3	0.9-1.1	0.1-0.2
Date Sampled		12/02/2020	12/02/2020	12/02/2020
Type of sample		SOIL	SOIL	SOIL
Date prepared	-	14/02/2020	14/02/2020	14/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
Moisture	%	17	11	18

Asbestos ID - soils			
Our Reference		236592-1	236592-3
Your Reference	UNITS	BH03	TP02
Depth		0.1-0.3	0.1-0.2
Date Sampled		12/02/2020	12/02/2020
Type of sample		SOIL	SOIL
Date analysed	-	18/02/2020	18/02/2020
Sample mass tested	g	Approx. 30g	Approx. 25g
Sample Description	-	Brown fine-grained soil & rocks	Brown fine-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
Trace Analysis	-	No asbestos detected	No asbestos detected

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.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
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.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. 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-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	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.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. 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.

Method ID	Methodology Summary
Org-012/017	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-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. 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-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	88	78
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	88	78
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	85	80
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	87	80
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	84	68
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	93	82
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	85	74
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	85	1	83	84	1	89	85

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	110	110
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	114	112
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	71
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	110	110
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	114	112
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	71
Surrogate o-Terphenyl	%		Org-003	88	1	120	82	38	108	79

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	84	82
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	82	86
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	83
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	86
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	88	82
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	70	71
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	<0.05	<0.05	0	100	95
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	91	1	89	86	3	91	82

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	111
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	111
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	89
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	124	111
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	122	110
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	0.3	0.2	40	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	0.3	0.3	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	118	107
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	106
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	128	113
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	118	107
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	72	73
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	116	1	106	108	2	106	99

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	108	120
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	104
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	124	126
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	60	70
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	120	107
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	72	120
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	130	110
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	116	1	106	108	2	106	99

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date extracted	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	122	94
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	116	1	106	108	2	106	99

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	236592-2
Date prepared	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Date analysed	-			14/02/2020	1	14/02/2020	14/02/2020		14/02/2020	14/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	7	9	25	115	86
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	109	84
Chromium	mg/kg	1	Metals-020	<1	1	13	15	14	121	91
Copper	mg/kg	1	Metals-020	<1	1	9	12	29	112	98
Lead	mg/kg	1	Metals-020	<1	1	27	32	17	120	90
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	96	99
Nickel	mg/kg	1	Metals-020	<1	1	1	2	67	111	88
Zinc	mg/kg	1	Metals-020	<1	1	15	27	57	115	88

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-3	[NT]
Date prepared	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Date analysed	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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

Acid Extractable Metals in Soil: The laboratory RPD acceptance criteria has been exceeded for 236592-1 for Zn. Therefore a triplicate result has been issued as laboratory sample number 236592-6.

Asbestos: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 236592-1 & 3 were sub-sampled from jars provided by the client.

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CERTIFICATE OF ANALYSIS 236690

Client Details

Client	Progressive Risk Management Pty Ltd
Attention	Jessica Little
Address	14/76 Reserve Road, ARTARMON, NSW, 2064

Sample Details

Your Reference	**PO34542 - Lane Cove**
Number of Samples	5 SOIL
Date samples received	13/02/2020
Date completed instructions received	13/02/2020

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	20/02/2020
Date of Issue	20/02/2020

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

Results Approved By
Giovanni Agosti, Group Technical Manager
Josh Williams, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
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	%	97	98	95	96	93

svTRH (C10-C40) in Soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	20/02/2020	20/02/2020	20/02/2020	20/02/2020	20/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	240	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	250	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	65	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	65	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	410	<100	120	<100
TRH >C_{34} -C_{40}	mg/kg	<100	170	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	640	<50	120	<50
Surrogate o-Terphenyl	%	90	#	94	94	93

PAHs in Soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
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	0.2	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.3	<0.1	0.7	<0.1
Pyrene	mg/kg	<0.1	0.2	<0.1	0.6	<0.1
Benzo(a)anthracene	mg/kg	<0.1	0.1	<0.1	0.3	<0.1
Chrysene	mg/kg	<0.1	0.1	<0.1	0.3	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	0.3	<0.2
Benzo(a)pyrene	mg/kg	<0.05	<0.05	<0.05	0.2	<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	0.70	<0.05	2.8	<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	%	118	114	117	109	108

Organochlorine Pesticides in soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
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	%	118	88	118	110	111

Organophosphorus Pesticides in Soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
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	%	118	88	118	110	111

PCBs in Soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
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	%	118	88	118	110	111

Acid Extractable metals in soil						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Arsenic	mg/kg	<4	11	7	6	11
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	7	13	14	50	13
Copper	mg/kg	10	38	2	34	2
Lead	mg/kg	10	37	14	91	15
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	1	65	<1	27	<1
Zinc	mg/kg	5	67	4	98	3

Misc Inorg - Soil			
Our Reference		236690-1	236690-3
Your Reference	UNITS	BH04	BH05
Depth		0.9-1.1	0.9-1.1
Date Sampled		13/02/2020	13/02/2020
Type of sample		SOIL	SOIL
Date prepared	-	18/02/2020	18/02/2020
Date analysed	-	18/02/2020	18/02/2020
pH 1:5 soil:water	pH Units	4.6	4.8
Electrical Conductivity 1:5 soil:water	µS/cm	60	60

Moisture						
Our Reference		236690-1	236690-2	236690-3	236690-4	236690-5
Your Reference	UNITS	BH04	BH05	BH05	TP03	DUP2
Depth		0.9-1.1	0.1-0.2	0.9-1.1	0.0-0.2	-
Date Sampled		13/02/2020	13/02/2020	13/02/2020	13/02/2020	13/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	18/02/2020	18/02/2020	18/02/2020	18/02/2020	18/02/2020
Moisture	%	13	15	14	23	21

Asbestos ID - soils			
Our Reference		236690-2	236690-4
Your Reference	UNITS	BH05	TP03
Depth		0.1-0.2	0.0-0.2
Date Sampled		13/02/2020	13/02/2020
Type of sample		SOIL	SOIL
Date analysed	-	20/02/2020	20/02/2020
Sample mass tested	g	Approx. 30g	Approx. 30g
Sample Description	-	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
Trace Analysis	-	No asbestos detected	No asbestos detected

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.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
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.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. 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-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	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.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. 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.

Method ID	Methodology Summary
Org-012/017	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-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. 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-5	236690-2
Date extracted	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			18/02/2020	1	18/02/2020	18/02/2020		18/02/2020	18/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	98	91
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	98	91
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	96	90
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	102	97
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	97	92
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	97	89
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	98	92
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	102	1	97	102	5	102	98

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date extracted	-			19/02/2020	1	17/02/2020	17/02/2020		19/02/2020	17/02/2020
Date analysed	-			19/02/2020	1	20/02/2020	20/02/2020		19/02/2020	20/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	109	85
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	124	86
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	109	85
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	124	86
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	#
Surrogate o-Terphenyl	%		Org-003	103	1	90	96	6	116	#

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date extracted	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			18/02/2020	1	18/02/2020	18/02/2020		18/02/2020	18/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	88	92
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	94
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	88	96
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	106	92
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	84	88
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	69
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	<0.05	<0.05	0	74	96
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	121	1	118	118	0	89	102

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date extracted	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			18/02/2020	1	18/02/2020	18/02/2020		18/02/2020	18/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	116
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	112	97
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	80	87
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	126	116
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	111
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	119
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	124
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	125
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	96	116
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	86	122
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	120	1	118	118	0	108	118

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date extracted	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			18/02/2020	1	18/02/2020	18/02/2020		18/02/2020	18/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	120	116
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	80	114
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	90	100
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	112	82
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	122
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	94	124
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	126	111
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	120	1	118	118	0	108	118

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date extracted	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			18/02/2020	1	18/02/2020	18/02/2020		18/02/2020	18/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	100	126
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	120	1	118	118	0	108	118

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	236690-2
Date prepared	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Date analysed	-			17/02/2020	1	17/02/2020	17/02/2020		17/02/2020	17/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	105	87
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	100	76
Chromium	mg/kg	1	Metals-020	<1	1	7	8	13	110	87
Copper	mg/kg	1	Metals-020	<1	1	10	11	10	106	102
Lead	mg/kg	1	Metals-020	<1	1	10	10	0	116	76
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	98	85
Nickel	mg/kg	1	Metals-020	<1	1	1	1	0	101	75
Zinc	mg/kg	1	Metals-020	<1	1	5	6	18	108	78

QUALITY CONTROL: Misc Inorg - Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-5	[NT]
Date prepared	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Date analysed	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

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: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying 40-50g of sample in its own container.
Note: Samples 236690-2 & 4 were sub-sampled from jars provided by the client.

TRH Soil C10-C40 NEPM - # Percent recovery for the surrogate/matrix spike is not possible to report as the high concentration of analytes in sample 236690-2,2ms have caused interference.

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 236690-A

Client Details

Client	Progressive Risk Management Pty Ltd
Attention	Jessica Little, Tara O'Brien
Address	14/76 Reserve Road, ARTARMON, NSW, 2064

Sample Details

Your Reference	**PO34542 - Lane Cove**
Number of Samples	5 SOIL
Date samples received	13/02/2020
Date completed instructions received	20/02/2020

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.

Report Details

Date results requested by	25/02/2020
Date of Issue	25/02/2020

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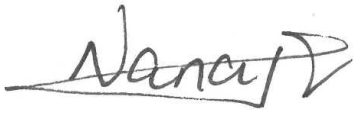
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311		
Our Reference		236690-A-2
Your Reference	UNITS	BH05
Depth		0.1-0.2
Date Sampled		13/02/2020
Type of sample		SOIL
Date extracted	-	24/02/2020
Date analysed	-	24/02/2020
pH of soil for fluid# determ.	pH units	7.8
pH of soil TCLP (after HCl)	pH units	1.8
Extraction fluid used	-	1
pH of final Leachate	pH units	5.0
Arsenic in TCLP	mg/L	<0.05
Cadmium in TCLP	mg/L	<0.01
Chromium in TCLP	mg/L	<0.01
Copper in TCLP	mg/L	<0.01
Lead in TCLP	mg/L	<0.03
Mercury in TCLP	mg/L	<0.0005
Nickel in TCLP	mg/L	<0.02
Zinc in TCLP	mg/L	0.06

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
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-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021 CV-AAS	Determination of Mercury by Cold Vapour AAS.

QUALITY CONTROL: Metals in TCLP USEPA1311					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			24/02/2020	[NT]	[NT]	[NT]	[NT]	24/02/2020	[NT]
Date analysed	-			24/02/2020	[NT]	[NT]	[NT]	[NT]	24/02/2020	[NT]
Arsenic in TCLP	mg/L	0.05	Metals-020 ICP-AES	<0.05	[NT]	[NT]	[NT]	[NT]	113	[NT]
Cadmium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	105	[NT]
Chromium in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
Copper in TCLP	mg/L	0.01	Metals-020 ICP-AES	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	101	[NT]
Mercury in TCLP	mg/L	0.0005	Metals-021 CV-AAS	<0.0005	[NT]	[NT]	[NT]	[NT]	101	[NT]
Nickel in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	102	[NT]
Zinc in TCLP	mg/L	0.02	Metals-020 ICP-AES	<0.02	[NT]	[NT]	[NT]	[NT]	108	[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
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ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES2005192**	Page	: 1 of 7
Client	: **PROGRESSIVE RISK MANAGEMENT**	Laboratory	: Environmental Division Sydney
Contact	: Jessica Little	Contact	: Customer Services ES
Address	: 14/76 Reserve Road Artarmon 2064	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: ----	Telephone	: +61-2-8784 8555
Project	: PO34542 - Lane Cove	Date Samples Received	: 14-Feb-2020 14:15
Order number	: ----	Date Analysis Commenced	: 17-Feb-2020
C-O-C number	: ----	Issue Date	: 21-Feb-2020 15:33
Sampler	: Tara O'Brien		
Site	: ----		
Quote number	: EN/333		
No. of samples received	: 1		
No. of samples analysed	: 1		

Accreditation No. 825
Accredited for compliance with
ISO/IEC 17025 - Testing

This report supersedes any previous report(s) with this reference. Results apply to the sample(s) as submitted. This document shall not be reproduced, except in full.

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

Additional information pertinent to this report will be found in the following separate attachments: Quality Control Report, QA/QC Compliance Assessment to assist with Quality Review and Sample Receipt Notification.

Signatories

This document has been electronically signed by the authorized signatories below. Electronic signing is carried out in compliance with procedures specified in 21 CFR Part 11.

Signatories	*Position*	*Accreditation Category*
Edwandy Fadjar	Organic Coordinator	Sydney Inorganics, Smithfield, NSW
Edwandy Fadjar	Organic Coordinator	Sydney Organics, Smithfield, NSW
Ivan Taylor	Analyst	Sydney Inorganics, Smithfield, NSW

General Comments

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the USEPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request.

Where moisture determination has been performed, results are reported on a dry weight basis.

Where a reported less than (<) result is higher than the LOR, this may be due to primary sample extract/digestate dilution and/or insufficient sample for analysis.

Where the LOR of a reported result differs from standard LOR, this may be due to high moisture content, insufficient sample (reduced weight employed) or matrix interference.

When sampling time information is not provided by the client, sampling dates are shown without a time component. In these instances, the time component has been assumed by the laboratory for processing purposes.

Where a result is required to meet compliance limits the associated uncertainty must be considered. Refer to the ALS Contact for details.

Key : CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
^ = This result is computed from individual analyte detections at or above the level of reporting
ø = ALS is not NATA accredited for these tests.
~ = Indicates an estimated value.

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	DUP1	----	----	----	----
			Client sampling date / time	13-Feb-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2005192-001	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**14.2**	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	<5	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**12**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**16**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**21**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	<2	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**10**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	----	----	----	----
EP068A: Organochlorine Pesticides (OC)								
alpha-BHC	319-84-6	0.05	mg/kg	<0.05	----	----	----	----
Hexachlorobenzene (HCB)	118-74-1	0.05	mg/kg	<0.05	----	----	----	----
beta-BHC	319-85-7	0.05	mg/kg	<0.05	----	----	----	----
gamma-BHC	58-89-9	0.05	mg/kg	<0.05	----	----	----	----
delta-BHC	319-86-8	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor	76-44-8	0.05	mg/kg	<0.05	----	----	----	----
Aldrin	309-00-2	0.05	mg/kg	<0.05	----	----	----	----
Heptachlor epoxide	1024-57-3	0.05	mg/kg	<0.05	----	----	----	----
^ Total Chlordane (sum)	----	0.05	mg/kg	<0.05	----	----	----	----
trans-Chlordane	5103-74-2	0.05	mg/kg	<0.05	----	----	----	----
alpha-Endosulfan	959-98-8	0.05	mg/kg	<0.05	----	----	----	----
cis-Chlordane	5103-71-9	0.05	mg/kg	<0.05	----	----	----	----
Dieldrin	60-57-1	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDE	72-55-9	0.05	mg/kg	<0.05	----	----	----	----
Endrin	72-20-8	0.05	mg/kg	<0.05	----	----	----	----
beta-Endosulfan	33213-65-9	0.05	mg/kg	<0.05	----	----	----	----
^ Endosulfan (sum)	115-29-7	0.05	mg/kg	<0.05	----	----	----	----
4.4`-DDD	72-54-8	0.05	mg/kg	<0.05	----	----	----	----
Endrin aldehyde	7421-93-4	0.05	mg/kg	<0.05	----	----	----	----
Endosulfan sulfate	1031-07-8	0.05	mg/kg	<0.05	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	DUP1	----	----	----	----
				Client sampling date / time	13-Feb-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES2005192-001	--------	--------	--------	--------
					Result	----	----	----	----
EP068A: Organochlorine Pesticides (OC) - Continued									
4.4`-DDT	50-29-3	0.2	mg/kg		<0.2	----	----	----	----
Endrin ketone	53494-70-5	0.05	mg/kg		<0.05	----	----	----	----
Methoxychlor	72-43-5	0.2	mg/kg		<0.2	----	----	----	----
^ **Sum of Aldrin + Dieldrin**	309-00-2/60-57-1	0.05	mg/kg		<0.05	----	----	----	----
^ **Sum of DDD + DDE + DDT**	72-54-8/72-55-9/50-2	0.05	mg/kg		<0.05	----	----	----	----
EP068B: Organophosphorus Pesticides (OP)									
Dichlorvos	62-73-7	0.05	mg/kg		<0.05	----	----	----	----
Demeton-S-methyl	919-86-8	0.05	mg/kg		<0.05	----	----	----	----
Monocrotophos	6923-22-4	0.2	mg/kg		<0.2	----	----	----	----
Dimethoate	60-51-5	0.05	mg/kg		<0.05	----	----	----	----
Diazinon	333-41-5	0.05	mg/kg		<0.05	----	----	----	----
Chlorpyrifos-methyl	5598-13-0	0.05	mg/kg		<0.05	----	----	----	----
Parathion-methyl	298-00-0	0.2	mg/kg		<0.2	----	----	----	----
Malathion	121-75-5	0.05	mg/kg		<0.05	----	----	----	----
Fenthion	55-38-9	0.05	mg/kg		<0.05	----	----	----	----
Chlorpyrifos	2921-88-2	0.05	mg/kg		<0.05	----	----	----	----
Parathion	56-38-2	0.2	mg/kg		<0.2	----	----	----	----
Pirimphos-ethyl	23505-41-1	0.05	mg/kg		<0.05	----	----	----	----
Chlorfenvinphos	470-90-6	0.05	mg/kg		<0.05	----	----	----	----
Bromophos-ethyl	4824-78-6	0.05	mg/kg		<0.05	----	----	----	----
Fenamiphos	22224-92-6	0.05	mg/kg		<0.05	----	----	----	----
Prothiofos	34643-46-4	0.05	mg/kg		<0.05	----	----	----	----
Ethion	563-12-2	0.05	mg/kg		<0.05	----	----	----	----
Carbophenothion	786-19-6	0.05	mg/kg		<0.05	----	----	----	----
Azinphos Methyl	86-50-0	0.05	mg/kg		<0.05	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg		<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg		<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg		<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg		<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg		<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg		<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg		<0.5	----	----	----	----

Analytical Results

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Compound	CAS Number	LOR	Unit		ES2005192-001	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benz(a)anthracene	56-55-3	0.5	mg/kg		<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg		<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----
^ **Sum of polycyclic aromatic hydrocarbons**	----	0.5	mg/kg		<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (zero)**	----	0.5	mg/kg		<0.5	----	----	----	----
^ **Benzo(a)pyrene TEQ (half LOR)**	----	0.5	mg/kg		**0.6**	----	----	----	----
^ **Benzo(a)pyrene TEQ (LOR)**	----	0.5	mg/kg		**1.2**	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	----	----	----	----
^ **C10 - C36 Fraction (sum)**	----	50	mg/kg		<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	----	----	----
^ **C6 - C10 Fraction minus BTEX (F1)**	C6_C10-BTEX	10	mg/kg		<10	----	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	----	----	----	----
^ **>C10 - C40 Fraction (sum)**	----	50	mg/kg		<50	----	----	----	----
^ **>C10 - C16 Fraction minus Naphthalene (F2)**	----	50	mg/kg		<50	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	DUP1	----	----	----	----
			Client sampling date / time	13-Feb-2020 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES2005192-001	--------	--------	--------	--------
				Result	----	----	----	----
EP080: BTEXN - Continued								
^ **Sum of BTEX**	----	0.2	mg/kg	<0.2	----	----	----	----
^ **Total Xylenes**	----	0.5	mg/kg	<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg	<1	----	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**98.8**	----	----	----	----
EP068S: Organochlorine Pesticide Surrogate								
Dibromo-DDE	21655-73-2	0.05	%	**102**	----	----	----	----
EP068T: Organophosphorus Pesticide Surrogate								
DEF	78-48-8	0.05	%	**81.4**	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	0.5	%	**75.6**	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%	**80.0**	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%	**51.2**	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	0.5	%	**89.2**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%	**78.8**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%	**93.8**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates								
1.2-Dichloroethane-D4	17060-07-0	0.2	%	**89.5**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%	**90.6**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%	**92.9**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: **SOIL**

Compound	CAS Number	Recovery Limits (%) Low	High
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	39	149
EP068S: Organochlorine Pesticide Surrogate			
Dibromo-DDE	21655-73-2	49	147
EP068T: Organophosphorus Pesticide Surrogate			
DEF	78-48-8	35	143
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

Jessica Hie

From: Ken Nguyen
Sent: Tuesday, 18 February 2020 6:50 PM
To: Jessica Hie
Subject: FW: Results for Registration 236507 PO34542 - Lane Cove

236507-A
Due: 26/2/20
Std TAT

Kind Regards,

Ken Nguyen | Customer Service / Chemist | Envirolab Services Pty Ltd
(Monday to Friday 10am to 6pm)
Great Science. Great Service.
12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E knguyen@envirolab.com.au | **W** www.envirolab.com.au

From: Tara O'Brien <tara.obrien@progressiverm.com>
Sent: Tuesday, 18 February 2020 3:30 PM
To: Ken Nguyen <KNguyen@envirolab.com.au>; Jessica Little <jessica.little@progressiverm.com>; Results PRM <results@progressiverm.com>; Leigh Rampley <leigh.rampley@progressiverm.com>
Subject: Re: Results for Registration 236507 PO34542 - Lane Cove

Hi Ken,

Could I get the TCLP for metals ran on sample BH01 0.1-0.2 (236507-1).
Standard TAT please.

Thanks!

Tara O'Brien
Consultant | Environmental Risk

Email: tara.obrien@progressiverm.com
Phone (AU): +61431415117
Web: www.progressiverm.com

From: Ken Nguyen <KNguyen@envirolab.com.au>
Sent: 18 February 2020 14:18
To: Jessica Little <jessica.little@progressiverm.com>; Tara O'Brien <tara.obrien@progressiverm.com>; Results PRM <results@progressiverm.com>; Leigh Rampley <leigh.rampley@progressiverm.com>
Subject: Results for Registration 236507 PO34542 - Lane Cove

10C 11/2 3:31pm

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067

Client:	Progressive Risk Management	**Project Details:**	P034542 - Lane Cove
Contact Person:		**Envirolab Quote:**	
Project Mgr:	Jessica Little	**Date results required:**	
Sampler:	Tara O'Brien	**or (circle)**	
Mobile:	0401918049	**Same day** / **1 day** / **2 day**	
Email:	results@progressiverm.com	**3 day** / **Standard**	
tara.obrien@progressiverm.com / jessica.little@progressiverm.com		**Lab Comments:**	

Sample information					Tests Required					Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Combo 6	Combo 6a	pH	EC		Provide as much information about the sample as you can
1	BH01	0.1-0.2	11-Feb	Soil		X				
2	BH01	0.6-0.8	11-Feb	Soil	X		X	X		
3	BH02	0.1-0.2	11-Feb	Soil	Hold					
4	BH02	0.5-0.7	11-Feb	Soil	X		X	X		
5	TP01	0.2-0.3	11-Feb	Soil		X				

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

Job No: 236507
Date Received: 11/02/2020
Time Received: 1531
Received by:
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (Company):	PRM	**Received by (Company):**	Envirolab
Print Name:	Tara O'Brien	**Print Name:**	Jacob Labota
Date & Time:	11/02/2020 15:30	**Date & Time:**	11/02/2020 1531
Signature:		**Signature:**	Received

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 11.5 (if applicable)
Transported by: Hand delivered / courier

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067

Client:	Progressive Risk Management	**Project Details:**	P034542 - Lane Cove
Contact Person:		**Envirolab Quote:**	
Project Mgr:	Jessica Little	**Date results required:**	
Sampler:	Tara O'Brien	**or (circle)**	
Mobile:	0401918049	**Same day** / **1 day** / **2 day**	
Email:	results@progressiverm.com	**3 day** / **Standard**	
tara.obrien@progressiverm.com / jessica.little@progressiverm.com		**Lab Comments:**	

Sample information					Tests Required														Comments
Envirolab Sample ID	**Client Sample ID or information**	**Depth**	**Date sampled**	**Type of sample**	Combo 6	Combo 6a	pH	EC	BTEX										**Provide as much information about the sample as you can**
1	BH03	0.1-0.3	12-Feb	Soil		X													
2	BH03	0.9-1.1	12-Feb	Soil	X		X	X											
3	TP02	0.1-0.2	12-Feb	Soil		X													
4/5	Trip blank/spike	-	-	-					X										

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

Job No: 236592
Date Received: 12-02-2020
Time Received: 12:50
Received by: TC.
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Relinquished by (Company):	PRM	**Received by (Company):**	ELS Sydney
Print Name:	Tara O'Brien	**Print Name:**	Thivaad Canales
Date & Time:	12/02/2020 12:30	**Date & Time:**	12.02.2020. 12:50
Signature:		**Signature:**	

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 20.1°C (if applicable)
Transported by: Hand delivered / courier

Jessica Hie

From: Nancy Zhang
Sent: Thursday, 20 February 2020 5:23 PM
To: Tara O'Brien; Results PRM; Jessica Little
Cc: Customer Service
Subject: RE: Results for Registration 236690 PO34542 - Lane Cove

236690-A
Due: 25/2/20
3 Day TAT.

Hi Tara,

No worries.

Kind Regards,

Nancy Zhang | Laboratory Manager, Sydney | Envirolab Services Pty Ltd

Great Science. Great Service.
12 Ashley Street Chatswood NSW 2067
T 612 9910 6200 **F** 612 9910 6201
E nzhang@envirolab.com.au | **W** www.envirolab.com.au

From: Tara O'Brien <tara.obrien@progressiverm.com>
Sent: Thursday, 20 February 2020 5:13 PM
To: Nancy Zhang <NZhang@envirolab.com.au>; Results PRM <results@progressiverm.com>; Jessica Little <jessica.little@progressiverm.com>
Subject: Re: Results for Registration 236690 PO34542 - Lane Cove

Hi Nancy,

Can I run TCLP for metals on sample BH05 0.1-0.2 (236690-2) please?

3 day TAT, thanks!

Tara O'Brien
Consultant | Environmental Risk

Email: tara.obrien@progressiverm.com
Phone (AU): +61431415117
Web: www.progressiverm.com

From: Nancy Zhang <NZhang@envirolab.com.au>
Sent: 20 February 2020 16:25
To: Results PRM <results@progressiverm.com>; Jessica Little <jessica.little@progressiverm.com>; Tara O'Brien <tara.obrien@progressiverm.com>
Subject: Results for Registration 236690 PO34542 - Lane Cove

COC 13/2 3:19pm.

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067

Client:	Progressive Risk Management	**Project Details:**	P034542 - Lane Cove
Contact Person:		**Envirolab Quote:**	
Project Mgr:	Jessica Little	**Date results required:**	
Sampler:	Tara O'Brien	**or (circle)**	
Mobile:	0401918049	**Same day** / **1 day** / **2 day**	
Email:	results@progressiverm.com	**3 day** / **Standard**	
tara.obrien@progressiverm.com / jessica.little@progressiverm.com		**Lab Comments:**	

Sample information					Tests Required														Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Combo 6	Combo 6a	pH	EC											Provide as much information about the sample as you can
1	BH04	0.9-1.1	13-Feb	Soil	X		X	X											
2	BH05	0.1-0.2	13-Feb	Soil		X													
3	BH05	0.9-1.1	13-Feb	Soil	X		X	X											
4	TP03	0.0-0.2	13-Feb	Soil		X													
-	DUP1	-	13-Feb	Soil	X														Send to ALS
5	DUP2	-	13-Feb	Soil	X														

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

Job No: 236690

Date Received: 13/2/20

Time Received: 1540

Received By: CM

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Relinquished by (Company):	PRM	**Received by (Company):**	ELS Sydney
Print Name:	Tara O'Brien	**Print Name:**	CHAINE MALEME
Date & Time:	13/02/2020 16:00	**Date & Time:**	13/2/20 1540
Signature:		**Signature:**	CM

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 16.4 (if applicable)
Transported by: Hand delivered / courier

14.02.20

CHAIN OF CUSTODY - Client

ENVIROLAB GROUP - National phone number 1300 42 43 44

Sydney Lab - Envirolab Services
12 Ashley St, Chatswood, NSW 2067
Ph 02 9910 6200 / sydney@envirolab.com.au

Perth Lab - MPL Laboratories
16-18 Hayden Crt Myaree, WA 6154
Ph 08 9317 2505 / lab@mpl.com.au

Melbourne Lab - Envirolab Services
1A Dalmore Drive Scoresby VIC 3179
Ph 03 9763 2500 / melbourne@envirolab.com.au

Brisbane Office - Envirolab Services
20a, 10-20 Depot St, Banyo, QLD 4014
Ph 07 3266 9532 / brisbane@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067

Client:	Progressive Risk Management	**Project Details:**	P034542 - Lane Cove
Contact Person:		**Envirolab Quote:**	
Project Mgr:	Jessica Little	**Date results required:**	
Sampler:	Tara O'Brien	**or (circle)**	
Mobile:	0401918049	**Same day** / **1 day** / **2 day**	
Email:	results@progressiverm.com	**3 day** / **Standard**	
tara.obrien@progressiverm.com / jessica.little@progressiverm.com		**Lab Comments:**	

Sample information					Tests Required					Comments
Envirolab Sample ID	Client Sample ID or information	Depth	Date sampled	Type of sample	Combo 6	Combo 6a	pH	EC		
1	BH04	0.9-1.1	13-Feb	Soil	X		X	X		
2	BH05	0.1-0.2	13-Feb	Soil		X				
3	BH05	0.9-1.1	13-Feb	Soil	X		X	X		
4	TP03	0.0-0.2	13-Feb	Soil		X				
(1) 6	DUP1	-	13-Feb	Soil	X					Send to ALS
5	DUP2	-	13-Feb	Soil	X					

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

Job No: 236690
Date Received: 13/2/20
Time Received: 1540
Received By: CM
Temp: Cool/Ambient
Cooling: Icepack
Security: Intact/Broken/None

Relinquished by (Company):	PRM	**Received by (Company):**	ES Sydney
Print Name:	Tara O'Brien	**Print Name:**	Charlene Mcleme
Date & Time:	13/02/2020 16:00		13/2/20 1540
Signature:			CM

ES Sydney Joan Day 14/2/20 0945

Lab use only:
Samples Received: Cool or Ambient (circle one)
Temperature Received at: 16.4 (if applicable)
Transported by: Hand delivered / courier

Environmental Division
Sydney
Work Order Reference
ES2005192

Telephone : +61-2-8784 8555

ES2005192
Charlene
13/2/20 1415

Appendix C: Assessment of QA/QC

Assessment of Laboratory QA/QC				
Data Quality Objectives	Frequency	Frequency Achieved?	DQI	DQI Met?
Precision				
Intra-laboratory field duplicates	1/20 samples	Yes	>5*LOR: 50% RPD	The results indicated that field precision was acceptable.
Inter-laboratory field duplicates	1/20 samples	Yes	>5*LOR: 50% RPD	The results indicated that field precision was acceptable. The RPDs for chromium were outside the acceptance limits and have been attributed to difficulties associated with obtaining homogenous duplicate samples.
Laboratory Duplicates	1/20 samples	Yes	>5*LOR: 50% RPD	Yes
Laboratory method blanks	1/10 samples	Yes	<LOR	Yes
Accuracy				
Laboratory Matrix Spikes	1/20 samples	Yes	Acceptable Recoveries: 70 – 130% for metals / inorganics. 60 – 140% for organics	Yes
Surrogate spikes	1/20 samples	Yes	Acceptable Recoveries: 70 – 130% for metals / inorganics. 60 – 140% for organics	
Representativeness				
Samples handling, storage and transport appropriate for media	All samples	Yes	Received by laboratory cooled with containers in good condition	Yes: Laboratory SRA advice indicates samples were received by the laboratory in good condition. See Appendix B for copies of laboratory documentation.
Trip Spike	1 per day	Yes	70-130% recovery	Yes
Trip blank	1 per day	Yes	<LOR	A benzene detection was reported in the trip blank and indicates there is potential for other samples in the batch to have been impacted, or that the laboratory blank was contaminated prior to PRM receiving it.
Samples extracted and analysed within holding times	All samples	Yes	Hold times: 7 days organics. 6 months inorganics.	Yes

Assessment of Laboratory QA/QC				
Data Quality Objectives	Frequency	Frequency Achieved?	DQI	DQI Met?
Comparability				
Standard operating procedures used for samples collection and handling	All Samples	Yes	Approved methodology to be used for all sample collection and handling.	Yes: All sample collection and handling were completed in accordance with PRM standard operating procedures.
Standard analytical methods used for all analyses	All Samples	Yes	Approved methodology to be used for all sample analysis.	All samples were analysed by a NATA accredited laboratory using approved methodology.
Consistent field conditions and laboratory analysis	All Samples	Yes	Consistent field sampling and laboratory analysis.	Yes: Samples were collected in the field by the same PRM staff member. All primary samples were analysed by Envirolab Services.
Limits of reporting appropriate and consistent	All Samples	Yes	-	Yes
Completeness				
Soil description and COCs completed and appropriate	All Samples	Yes	Appropriate documentation to be provided.	Yes: Material description presented in test pit logs in Appendix A and COC documentation is provided in Appendix B.
Summary				
In summary, the QA/QC undertaken as part of the TCA works are considered suitable.				

ASCENT
GEOTECHNICAL CONSULTING

Appendix C

Bore Logs | Core Photos

Project No:	AG 20004	Constractor:	BG DRILLING		
Client:	UNITING	Drill Rig:	14		
Date:	11/2/20	Location:	108 Centennial Avenue		
Logged:	BM & MSK				
Sheet 1 of 2					

BH01

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/Density	Moisture	Additional Observations
SFA	L	GWNO				SILTY CLAY. Medium to high plasticity, dark brown to black, grass roots.	F	M	TOPSOIL
	L		DS-1: 0.6m-0.8m	CL	0.5	SILTY CLAY. Medium to high plasticity, red/white, mottled orange.	F-St	M	RESIDUAL
	L-M		SPT 6, 9, 15 N* = 24	CH	1.0 1.5	SILTY CLAY. Medium to high plasticity, brown/orange/red.	F-St	M	
			DS-2: 1.5-1.7m		2.0				
			DS-3: 2.5-2.7m		2.5	Trace Sand & Gravel			
					3.0	Coring Start at 3.0m			
					3.5				
					4.0				
					4.5				
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling		
Client:	UNITING	Drill Rig:	14		
Date:	11/2/20	Location:	108 Centennial Avenue		
Logged:	BM & MSK				
Sheet 2 of 2			**BH01**		

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01, VL 0.03, L 0.1, M 0.3, H 1, VH 3, EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10, 30, 100, 300, 1000)	Defect Description
						3.0	Start Coring at 3.0m		
NMLC	NGWO	49.6	16 (43)		XW		SILTY CLAY. Stiff to hard, medium to high plasticity, mottled orange/brown/grey, minor ironstone gravel.		PP (break) at 3.43: 50kPa
					HW	4.0	LAMINITE. Laminated CLAY (60%), stiff, grey, and SILTSONE (40%), fine grained, dark grey, horizontal to sub-horizontal laminations.		3.54, Fz 3.61, JT. 3.65, JT. PP (break) 3.73, JT 3.76, JT 3.83, JT PP (break) 3.9: 300kPa. 3.91 DB 4.05 DB. 4.06 JT 4.11 JT
					XW	5.0	LAMINITE. Laminated CLAY (90%), stiff, pale grey, mottled orange, ironstone gravel, and SILTSTONE (10%), fine grained, dark grey, sub-horizontal jointing.		
		93	44 (86)		MW	6.0	LAMINITE. Laminated SILTSTONE (50%), fine grained, dark grey, red/orange staining, and CLAY (50%), pale grey. Point Load Test @ 6.04m		5.48 DB 5.51-5.58 Fz 0°. 7mm thick 5.66 JT. 20°. 5.69 JT. 5.73 JT. 5.74 JT. 5.78-5.9 Fz. 55°. 120mm thick 5.96 JT 6.00 JT 6.16 JT 6.22 JT. 6.28 JT 6.37 JT 6.49 JT
						7.0	LAMINITE. SANDSTONE (80%), fine to medium grained, pale grey/orange, red staining, and SILTSTONE (20%), fine grained, dark grey, horizontal to sub-horizontal laminations.		6.51-6.53 Fz. 20mm thick 6.54 JT. 6.56 JT. 6.6 JT 6.65 JT. 6.68-6.71 Fz. fe. 30mm thick 6.74-6.79. Fz. fe. 50mm thick 6.85 JT. 6.89-6.91. Fz. 20mm thick 7.0 DB. 6.93-6.95. Fz. fe. 20mm thick
					MW	8.0	LAMINITE. SANDSTONE (90%), fine to medium grained, pale grey, and SILTSTONE (10%), fine grained, dark grey, horizontal to sub-horizontal laminations. Point Load Test @ 7.50m		7.13 JT 7.22 JT 7.35 JT 7.43 JT 7.48 JT. 7.51 DB 7.57 DB 7.61 DB 7.70 JT. 7.71 JT 7.75 JT 7.86-7.93 Fz. 60mm thick
		100	76 (98)		FR	9.0	LAMINITE. SANDSTONE (95%), medium to coarse grained, pale grey, and SILTSTONE (5%), fine grained, dark grey, horizontal to sub-horizontal laminations. Point Load Test @ 9.07m		8.00 DB 8.23 JT 8.90 HB 9.00 DB. 9.15 JT. 20° 9.23 JT
						10.0	SANDSTONE, medium to coarse grained, pale grey. Laminations decreasing with depth. Point Load Test @ 10.48m Coring Discontinued at 10.53m		9.52 HB

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

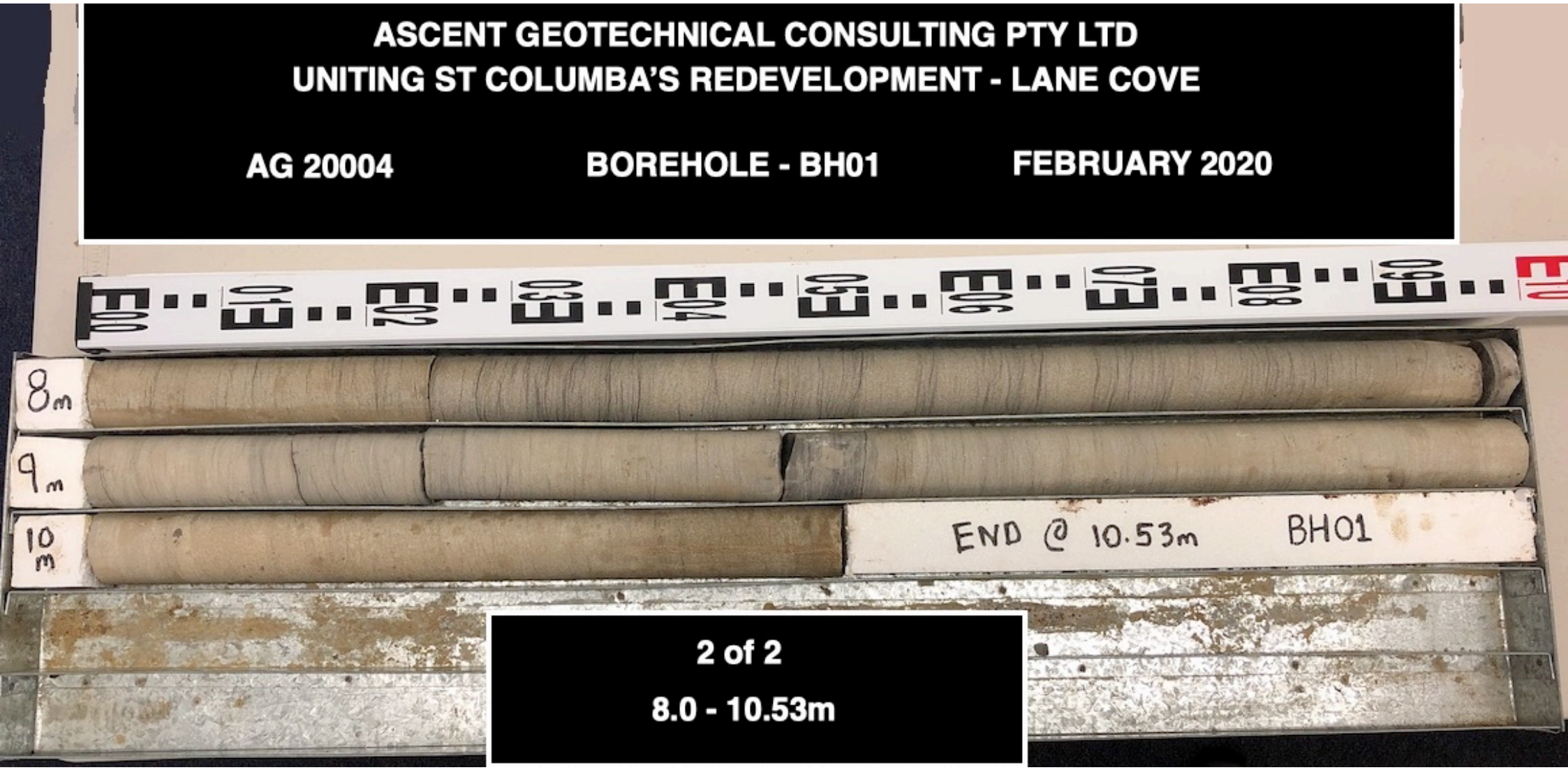
AG 20004 BOREHOLE - BH01 FEBRUARY 2020

1 of 2

3.0 - 8.0m

ASCENT GEOTECHNICAL CONSULTING PTY LTD
UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH01 FEBRUARY 2020



2 of 2

8.0 - 10.53m

Project No:	AG 20004	Constractor:	BG DRILLING
Client:	UNITING	Drill Rig:	14
Date:	11/2/20	Location:	108 Centennial Avenue
Logged:	BM & MSK		
Sheet 1 of 2			

BH02

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency Density	Moisture	Additional Observations
	L-M			CL		SILTY CLAY. Medium to high plasticity, dark brown to black, grass roots.	F	M	TOPSOIL
SFA	M	GWNO			0.5	SILTY CLAY. High plasticity, mottled orange/grey.			RESIDUAL
					1.0				
			SPT 6, 11, 15 N* 26						EW Shale in SPT Sample
					1.5		VSt		
					2.0				
			DS-1: 2.4-2.5m	CH	2.5			M	
			SPT 19, 23, 20 for 70mm						
					3.0				
					3.5		H		
	M-H				4.0				
					4.5	Coring Start at 4.5m			
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling
Client:	UNITING	Drill Rig:	14
Date:	11/2/20	Location:	108 Centennial Avenue
Logged:	BM & MSK		
Sheet 2 of 2			

BH02

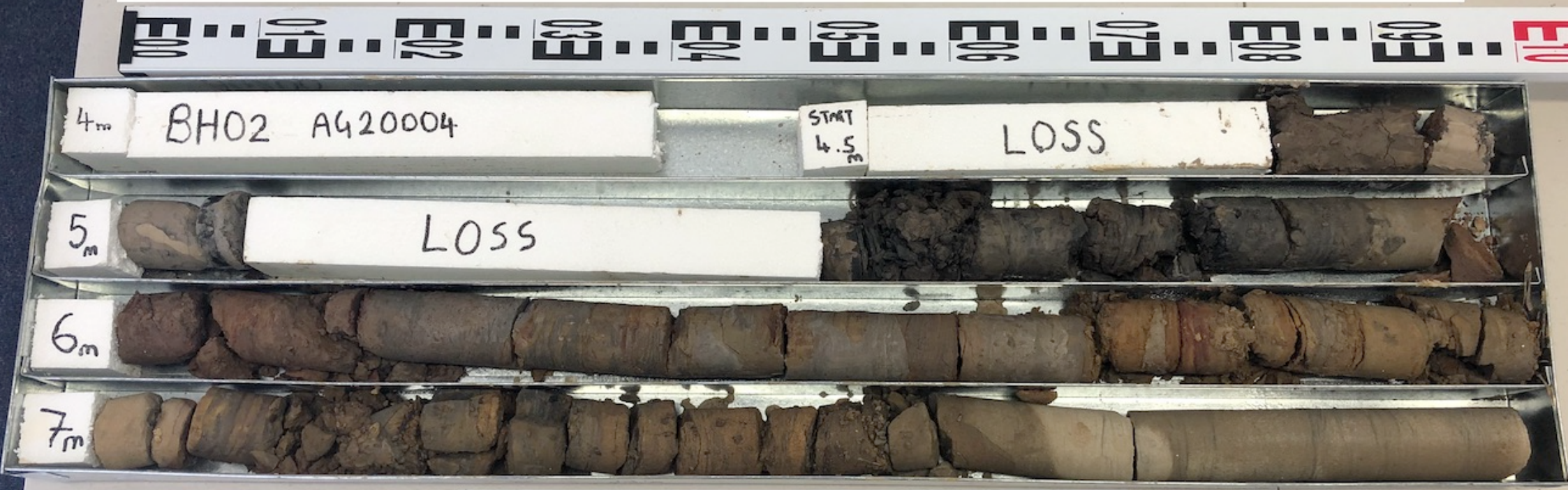
ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01 / VL 0.03 / L 0.1 / M 0.3 / H 1 / VH 3 / EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 / 30 / 100 / 300 / 1000)	Defect Description
						3.0			
						4.0	Start Coring at 4.5m		
NMLC	NGWO	24	0 (9)		XW	5.0	LAMINITE. Laminated CLAY (50%), hard, pale grey, mottled orange, medium to high plasticity, and SILTSTONE (50%), fine grained, dark grey, horizontal to sub-horizontal laminations.		PP (break) at 4.94: 400kPa 5.00 DB. 5.075 DB 5.04 BP
		100	37 (72)		SW	6.0	LAMINITE. SILTSTONE (70%) fine grained, grey, mottled yellow/red, horizontal to sub-horizontal laminations, and CLAY (30%), hard, pale grey, mottled orange, medium to high plasticity.		5.54-5.62 Fz, irregular 5.70 JT. 573 JT 5.76-5.79 Fz. 5.89 SM, Cl PP (break) at 5.95: 300 kPa 6.00 DB 6.07 JT. 6.13-6.18 Fz, 5mm thick 6.28 BP. 6.39 JT PP (break) at 6.35: 450 kPa 6.47 JT. 6.57 BP 6.6 JT 6.69-6.88 Fz, Fe, 19mm thick 6.92-6.95 Fz, 5mm thick
					MW	7.0	LAMINITE. SANDSTONE (80%), medium grained, greyish to pale orange, and SILTSTONE (20%) fine grained, grey with yellow staining, horizontal to sub-horizontal laminations.		7.0 DB 7.04 HB. 7.09 BP. 7.11-7.32 Fz, Cl, 21mm thick 7.36 BP 7.40 JT. 7.46 JT 7.49-7.58 Fz, 9mm thick
		100	75 (92)		FR	8.0	SANDSTONE. Medium to coarse grained, pale grey. Laminations decreasing with depth. Point Load Test @ 7.85m		7.71 HB 8.00 DB 8.11 HB 8.44 JT/BP 8.72 DB. 8.75 HB
						9.0	Point Load Test @ 8.92m		9.00 DB 9.04 JT. 9.09 BP. 9.10 BP 9.74 DB
						10.0	Point Load Test @ 10.10m Coring Discontinued at 10.13m		10.0 DB

ASCENT GEOTECHNICAL CONSULTING PTYLTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH02 FEBRUARY 2020

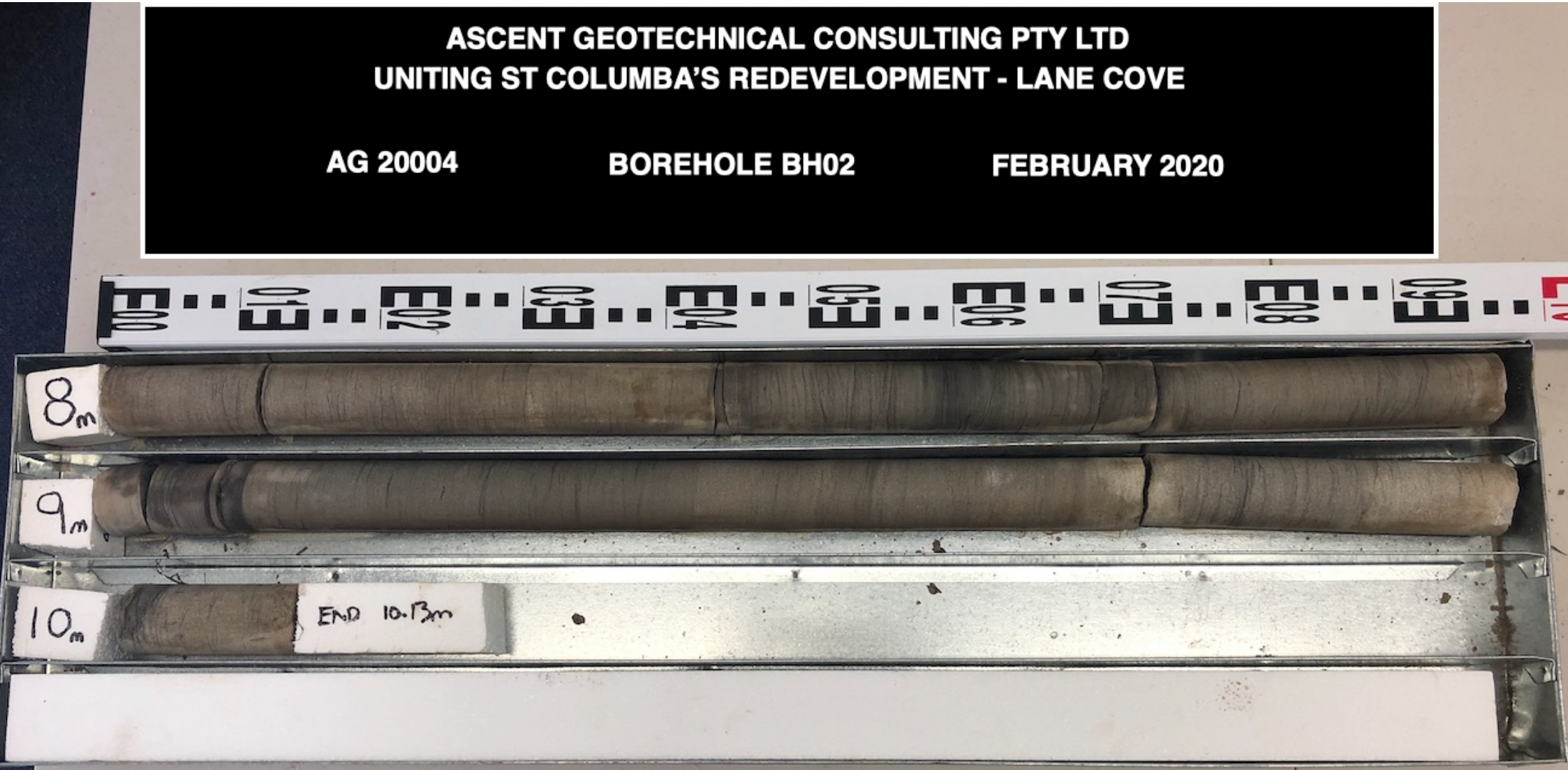


1 OF 2

4.5 - 8.0m

ASCENT GEOTECHNICAL CONSULTING PTY LTD
UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE BH02 FEBRUARY 2020



2 OF 2

8.0 - 10.13m

Project No:	AG 20004	Constractor:	BG DRILLING
Client:	UNITING	Drill Rig:	14
Date:	12/2/20	Location:	110 Centennial Avenue
Logged:	BM & MSK		
Sheet 1 of 2			

BH03

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency/Density	Moisture	Additional Observations
	L-M			CL		SILTY CLAY. Medium to high plasticity, dark brown to orange/red, grass roots.	F	M	TOPSOIL
SFA	M	GWNO	DS-1: 0.3-0.5m	CH	0.5	SILTY CLAY. High plasticity, mottled orange/grey.	VSt	M	RESIDUAL
			DS-2: 0.8-1.0m		1.0				
			SPT 14, 15, 20 N* 35		1.5				
					2.0				
			DS-3: 2.5-2.7m SPT 11, 25 R		2.5				
					3.0				
					3.5				
					4.0				
			DS-4: 4.3-4.5m		4.5	Coring Start at 4.5m			
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling		
Client:	UNITING	Drill Rig:	14		
Date:	12/2/20	Location:	110 Centennial Avenue		
Logged:	BM & MSK				
Sheet 2 of 2					

BH03

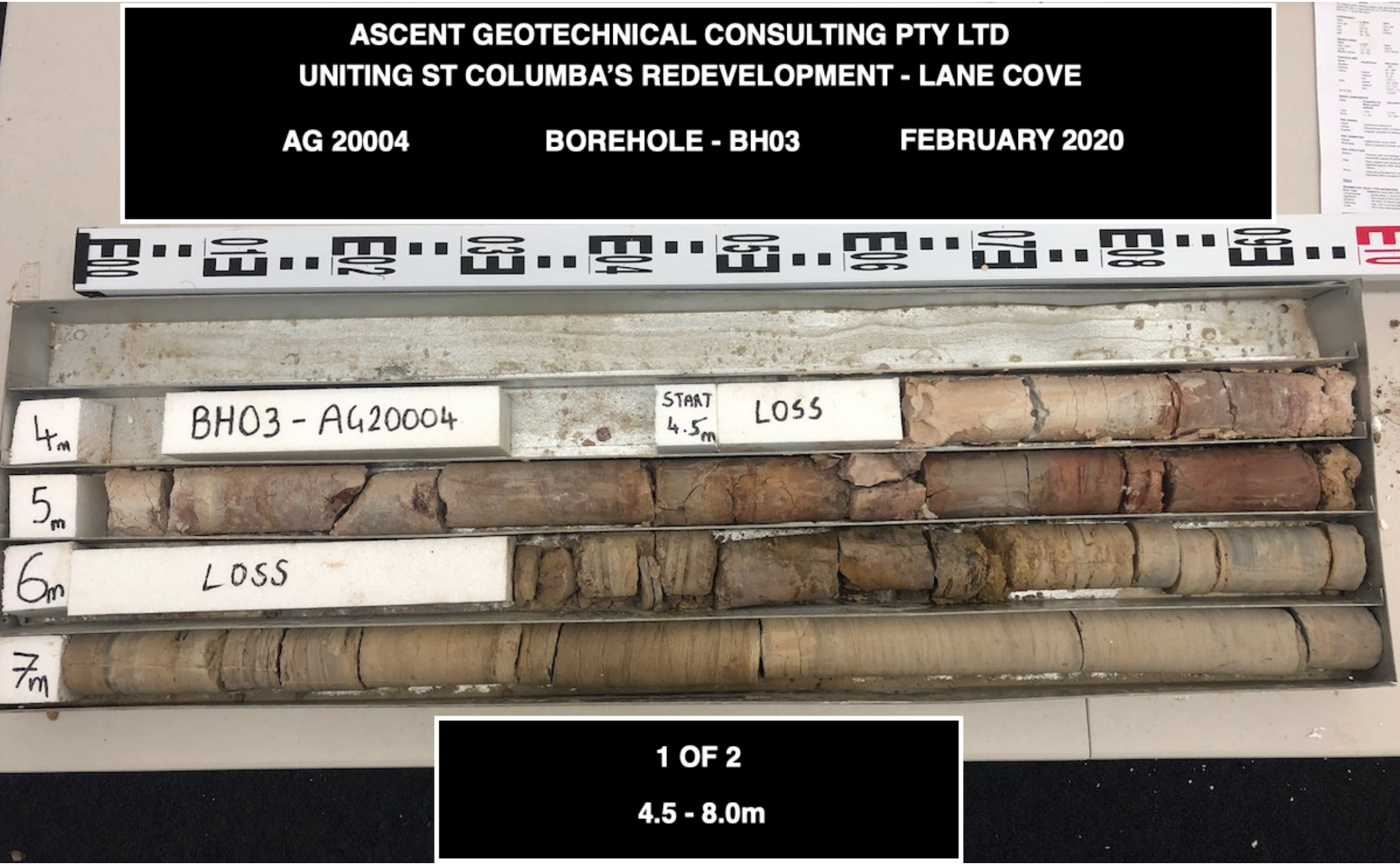
ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01, VL 0.03, L 0.1, M 0.3, H 1, VH 3, EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10, 30, 100, 300, 1000)	Defect Description
						3.0			
						4.0	Start Coring at 4.5m		
NMLC	NGWO	85	39 (73)		HW	5.0	LAMINITE. SILTSTONE (80%) fine grained, mottled white/pale grey/orange/red/brown, highly laminated horizontal to sub-horizontal, and CLAY (20%) white/grey/orange, fine grained, medium plasticity, hard.		PP (break) at 4.75: 250kPa
							Point Load Test @ 5.35m		4.86 JT 4.90 JT. 4.98 Sm, Cl, 100mm thick 5.22 JT, 30°. 5.28 JT 5.44 HB PP (break) at 5.46: 300 kPa 5.51 JT 5.60-5.66 Fz 5.67-5.75 Sm, Cl 5.81 JT. 5.84 JT. 5.96 HB 6.00 DB
					MW	6.0			6.33-6.50 Fz. 17mm thick
					SW	7.0			6.55 BP. 35° 6.58 JT 6.66 JT 6.70 Fz. 6.76 JT. 6.78 JT 6.80 JT. 6.82 JT. 6.85 JT. 6.88 JT 6.97 DB 7.11 JT. 7.16 JT 7.22 BP 7.34 BP. 7.37 BP
		89	53 (84)		FR		SANDSTONE. Medium grained, pale grey with dark grey horizontal to sub-horizontal laminations. Laminations decreasing with depth.		7.52 BP. 7.55 JT
						8.0	Point Load Test @ 7.6m		7.76 HB 7.86 HB. 7.93 BP 8.00 DB 8.08 DB. 8.11 JT 8.23 HB 8.37 BP 8.42 HB
						9.0	Point Load Test @ 8.51m		8.65 JT 8.75 JT 8.87 HB 9.00 DB 9.12 JT 9.20 DB
		100	94 (99)			10.0	Point Load Test @ 9.50m		9.93 HB. 10.0 DB 10.05 HB 10.52 DB
							Point Load Test @ 10.5m Coring Discontinued at 10.52m		

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH03 FEBRUARY 2020



1 OF 2

4.5 - 8.0m


ASCENT GEOTECHNICAL CONSULTING PTY LTD
UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE
AG 20004
BOREHOLE - BH03
FEBRUARY 2020
8m
9m
10m
EOB
10.52m
A PRODUCT OF BHUSHAN POWER & STEEL LTD.
2 OF 2
8.0 - 10.52m

Project No:	AG 20004	Constractor:	BG DRILLING		
Client:	UNITING	Drill Rig:	14		
Date:	12/2/20	Location:	1 Charlish Lane		
Logged:	BM & MSK				
Sheet 1 of 2					

BH04

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency Density	Moisture	Additional Observations
SFA	L-M	GWNO		CL		SILTY CLAY. Medium to high plasticity, dark brown to orange, grass roots.	F	M	TOPSOIL
			DS-1: 0.2-0.4m		0.5				
	M		DS-2: 0.5-0.7m			SILTY CLAY. Medium to high plasticity, dark brown, mottled orange.	F-St		RESIDUAL
					1.0				
			DS-3: 1.5-1.7m SPT 26 R		1.5				
					2.0				
			DS-4: 2.5-2.7m SPT 20, 25 R	CH	2.5			M	
					3.0				
					3.5		Vst		
					4.0				
			DS-5: 4.3-4.5m		4.5	Coring Start at 4.5m			
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling
Client:	UNITING	Drill Rig:	14
Date:	12/2/20	Location:	1 Charlish Lane
Logged:	BM & MSK		
Sheet 2 of 2			

BH04

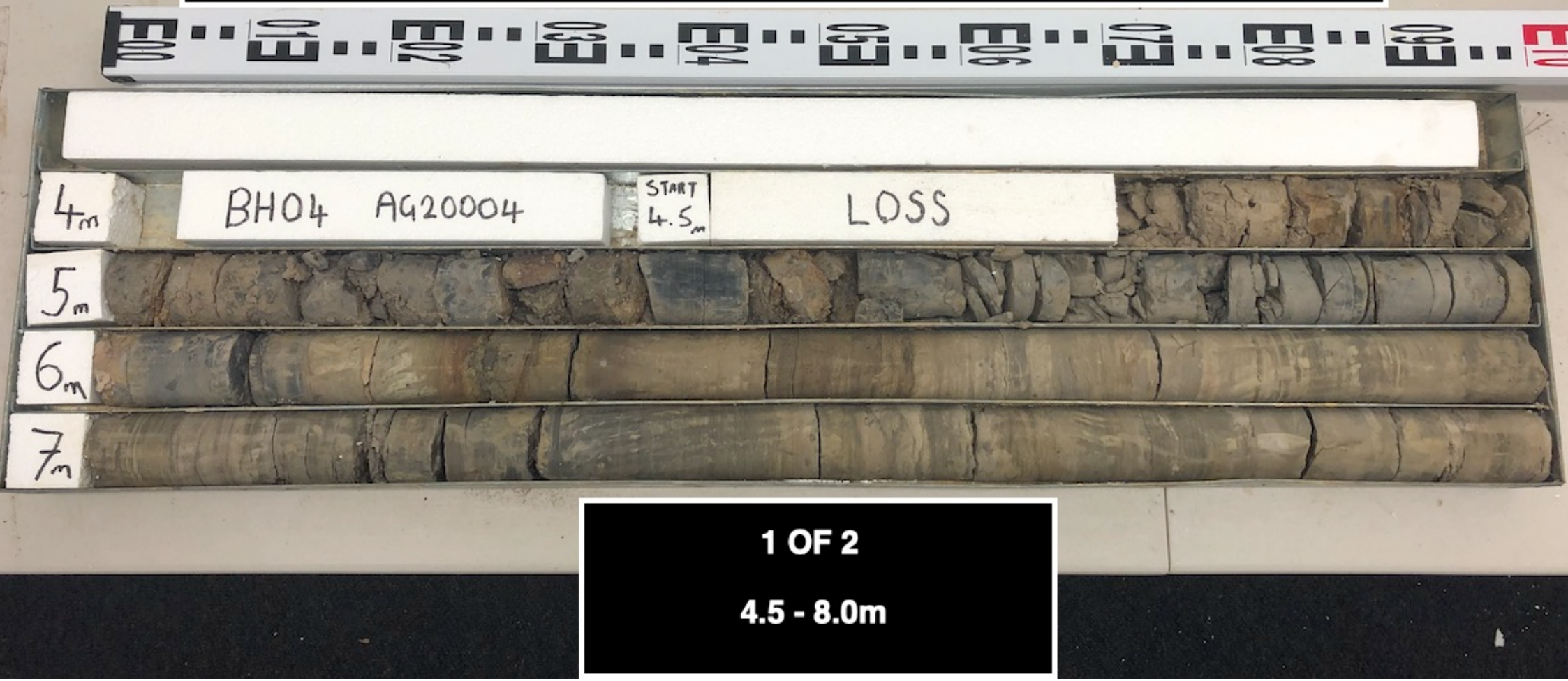
ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01, VL 0.03, L 0.1, M 0.3, H 1, VH 3, EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10, 30, 100, 300, 1000)	Defect Description
						3.0			
						4.0	Start Coring at 4.5m		
NMLC	NGWO	69	0 (30)		HW	5.0	LAMINITE. SILTSTONE (90%) fine grained, dark grey to black, highly laminated horizontal to sub-horizontal, and CLAY (10%) grey/orange, hard.		PP (break) at 4.80: 250kPa 4.70-5.81 Fz, Cl, Fe, 1110mm thick 5.66 DB 5.84 JT. 5.86 JT. 5.87 JT. 5.88 JT. 5.89 5.92 JT. 5.94 JT. 5.96 JT. 5.97 JT 6.0 DB 6.09 JT. 6.10 JT. 6.14JT. 6.18 JT.
					MW	6.0			
		100	47 (90)		SW	7.0	LAMINITE. SANDSTONE (60%), grey to brown, with orange/red staining, fine to medium grained, and SILTSTONE (40%) dark grey, fine grained laminations, horizontal to sub-horizontal. Point Load Test @ 6.40m		6.30 HB. 6.32 JT 6.47 HB. 6.48 JT. 6.62 JT 6.74 HB
					MW				
					SW	8.0	Point Load Test @ 7.40m		7.13 JT. 7.18-7.20 Fz. Cl. 20mm thick 7.24 JT. 7.25 JT 7.30 JT 7.50 JT 7.60 JT 7.71 JT 7.79 JT/ 7.83 JT 7.89 JT. 7.92 JT 8.00 DB
		100	85 (96)		FR	9.0	SANDSTONE. Medium grained, pale grey with dark grey horizontal to sub-horizontal laminations. Laminations decreasing with depth. Point Load Test @ 9.04m		8.38 JT. 8.40 JT. 8.46 JT 8.48 JT. 8.51 JT 8.63 JT 8.66 DB. 8.67 JT 8.71 JT. 8.72 JT. 8.76 HB 8.86 HB
						10.0	Point Load Test @ 10.20m Coring Discontinued at 10.31m		9.91 JT 10.00 DB 10.08 HB 10.27 DB. DB 10.31

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH04 FEBRUARY 2020



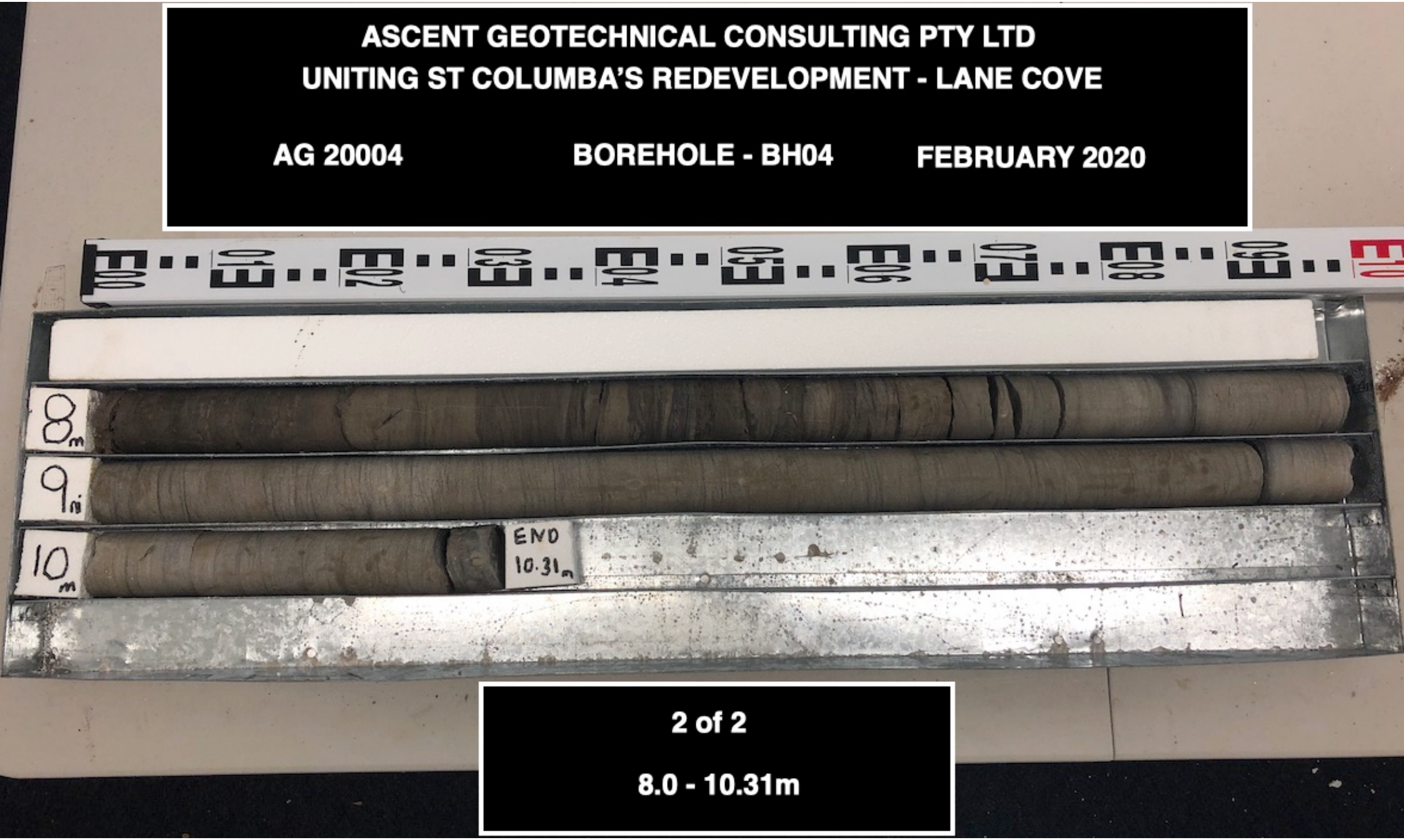
1 OF 2

4.5 - 8.0m

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH04 FEBRUARY 2020



2 of 2

8.0 - 10.31m

Project No:	AG 20004	Constractor:	BG DRILLING		
Client:	UNITING	Drill Rig:	14		
Date:	13/2/20	Location:	9 Fig Tree Street		
Logged:	BM & MSK				
Sheet 1 of 2					

BH05

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency / Density	Moisture	Additional Observations
				OL		SILTY CLAY. Low plasticity, dark brown.	F	M	TOPSOIL/FILL
SFA	L-M	GWNO	DS-1: 0.2-0.4m | BD-01:0.3-0.5m (CBR)	CL	0.5	SILTY CLAY. Medium plasticity, dark brown/orange.	F-St	M	RESIDUAL
					1.0				
			DS-2: 1.0-1.2m						
					1.5				
			DS-3: 1.5-1.7m SPT 8, 19, 26 N* 45						
					2.0				
					2.5				
			DS-4: 2.5-2.7m SPT 21, 20, 19 N* 39						
					3.0				
					3.5				
					4.0				
			DS-5: 4.3-4.5m		4.5	Coring Start at 4.5m			
					5.0				
					5.5				
					6.0				
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling
Client:	UNITING	Drill Rig:	14
Date:	13/2/20	Location:	9 Fig Tree Street
Logged:	BM & MSK		
Sheet 2 of 2			

BH05

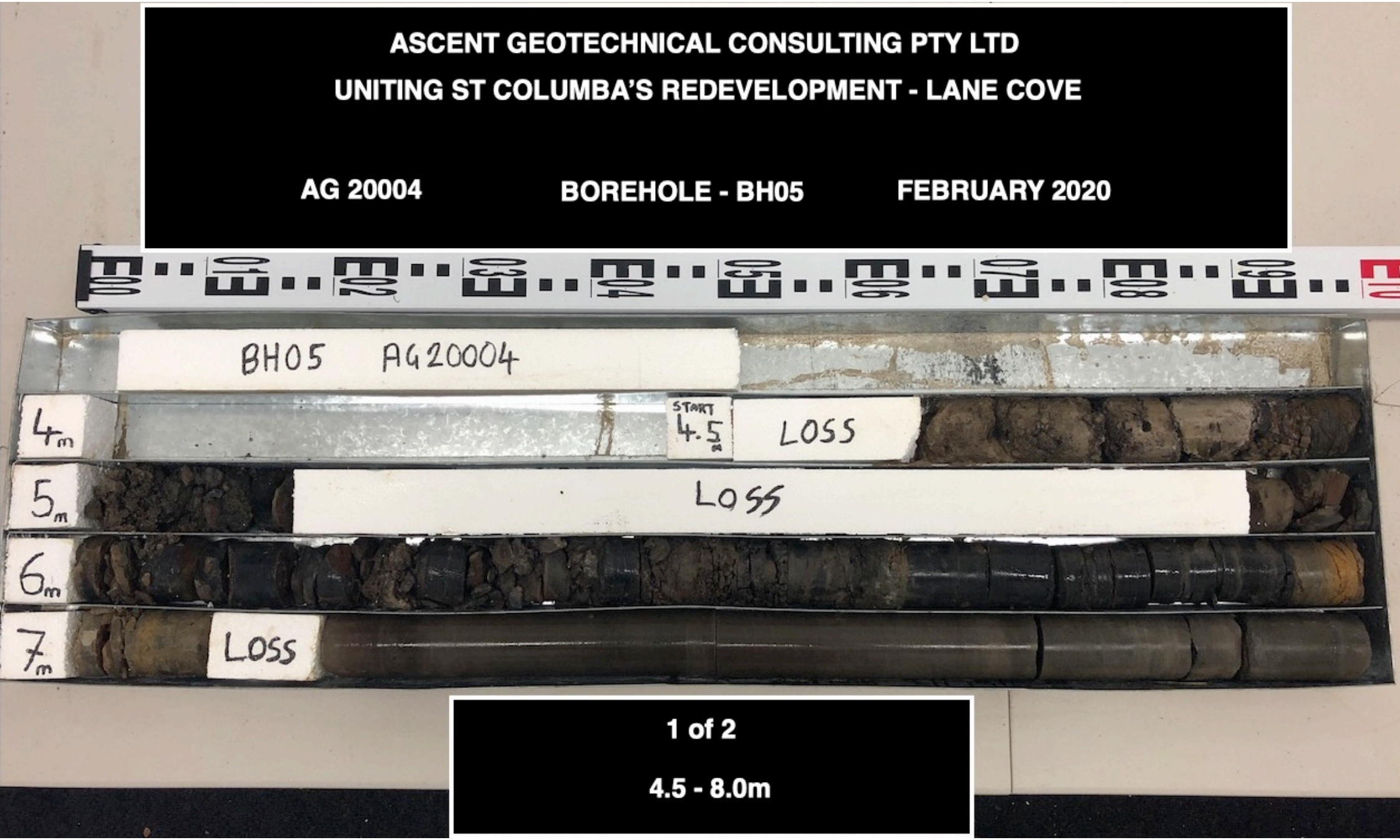
ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01, VL 0.03, L 0.1, M 0.3, H 1, VH 3, EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10, 30, 100, 300, 1000)	Defect Description
						3.0			
						4.0	Start Coring at 4.5m		
NMLC	NGWO	76	0 (34)		XW	5.0	LAMINITE. SILTSTONE (70%), dark grey to black, fine grained, highly laminated horizontal to sub-horizontal, and CLAYS (30%), pale grey, hard.		4.65-5.17 Fz, Cl, 52mm thick PP (break) at 4.82: 200 kPa 5.20 DB
		61	0 (34)		HW	6.0			5.9-6.64 Fz, Cl
					MW	7.0	SILTSTONE, dark grey to black, fine grained, horizontal to sub-horizontal lamintations, orange/yellow staining, colour grading into pale grey downhole.		6.68 JT 6.70 JT. 6.73 JT 6.77-6.80 Fz. Cl 6.82 JT. 6.85 JT. 6.87 JT 6.93 JT. 6.97 JT. 6.98 JT 7.04-7.06 Fz. 2mm thick. 7.10 DB
		100	62 (86)		SW	8.0	LAMINITE. SILTSTONE (50%) dark grey to black, fine grained, heavily laminated horizontal to sub-horizontal, and SANDSTONE (50%) pale grey, fine grained. Point Load Test @ 7.80m		7.49 JT 7.74 JT 7.85 JT 7.90 JT 8.04 JT. 8.08 JT 8.12 JT. 8.19 JT 8.23 JT 8.27-8.36 Fz. 9mm thick 8.43 JT 8.51 JT. 8.54 JT. 8.58 JT 8.61 JT. 8.68 JT 8.72 JT. 8.77 JT. 8.79 JT 8.80 JT 8.90 JT. 8.92 JT 9.08 JT. Cl. Fe
					FR	9.0	SANDSTONE. Fine grained, pale grey with dark grey horizontal to sub-horizontal laminations. Laminations decreasing with depth. Point Load Test @ 9.60m		9.23 JT. 9.25 JT 9.31 JT. 9.34 JT 9.43 JT 9.72 HB 9.87 JT 9.98 DB
						10.0	Point Load Test @ 10.15m Coring Discontinued at 10.28m		10.25 DB

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH05 FEBRUARY 2020



1 of 2

4.5 - 8.0m

ASCENT GEOTECHNICAL CONSULTING PTY LTD

UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG 20004 BOREHOLE - BH05 FEBRUARY 2020

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8.0 - 10.28m

Project No:	AG 20004	Constractor:	BG DRILLING		
Client:	UNITING	Drill Rig:	14		
Date:	13/2/20	Location:	UNITING		
Logged:	BM & MSK				
Sheet 1 of 2					

BH06

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Resistance	Water	Sampling	USCS	Depth	Stratigraphy	Consistency / Density	Moisture	Additional Observations
	L-M			CL		SILTY CLAY. Medium plasticity, dark brown, grass roots.	F	M	TOPSOIL
SFA	M	GWNO	DS-1: 0.3-0.5m	CH	0.5	SILTY CLAY. Medium to high plasticity, orange/red.	F-St	M	RESIDUAL
			DS-2: 0.8-1.0m		1.0				
			SPT 9, 14, 18 N* 32		1.5				
			SPT 25 R DS-3: 1.5-1.7m		2.0				
			DS-3: 2.5-2.7m SPT 11, 25 R		2.5		Vst		EW Shale in SPT Sample
					3.0				
					3.5				
					4.0				
					4.5				
					5.0				
			DS-4: 5.5-5.7m		5.5				
					6.0	Coring Start at 6.0m			
					6.5				
					7.0				
					7.5				

Project No:	AG 20004	Constractor:	BG Drilling		
Client:	UNITING	Drill Rig:	14		
Date:	13/2/20	Location:	UNITING		
Logged:	BM & MSK				
Sheet 2 of 2					

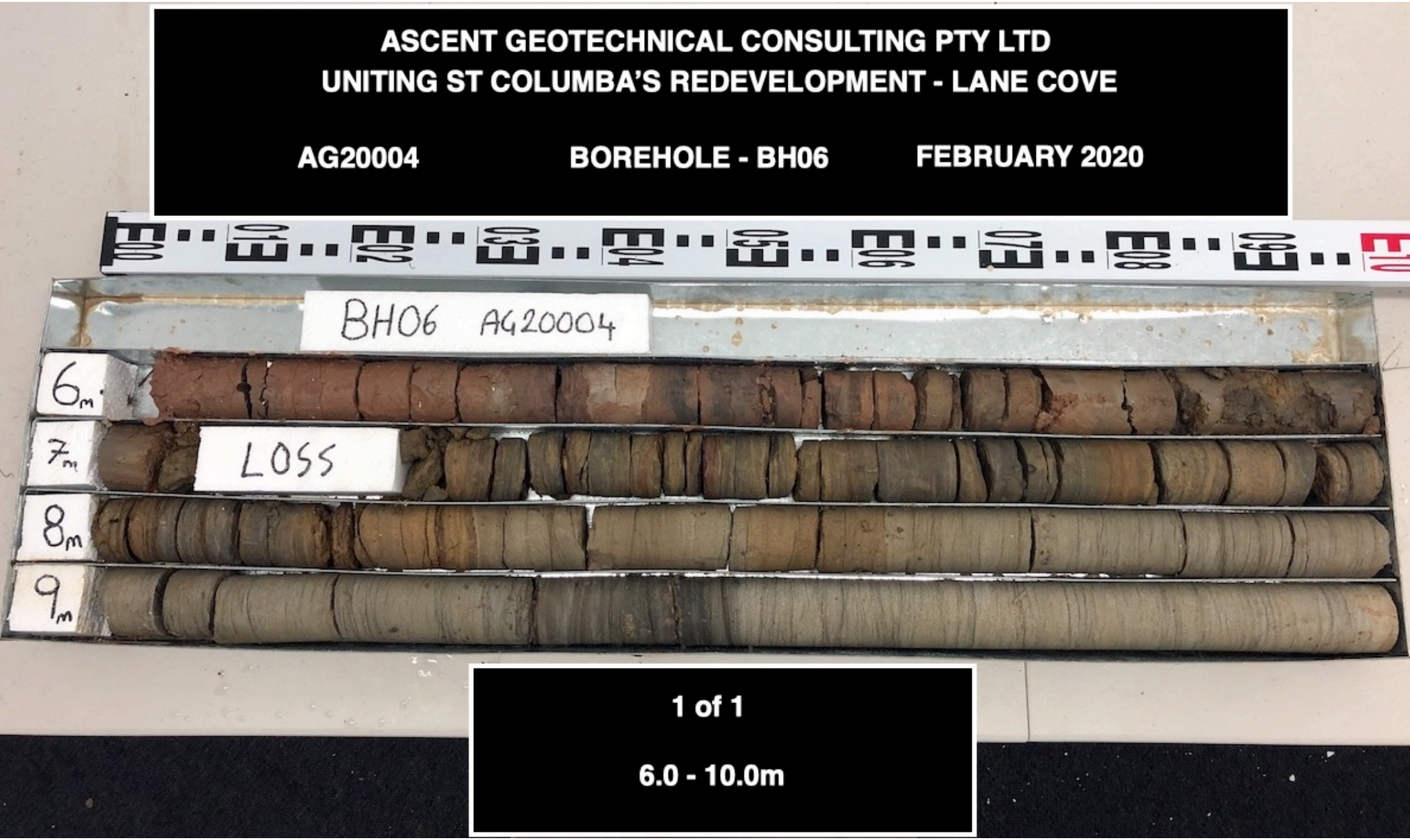
BH06

ASCENT GEOTECHNICAL CONSULTING

Drill Method	Water	TCR	RQD (SCR)	Rock Strength (EL 0.01 / VL 0.03 / L 0.1 / M 0.3 / H 1 / VH 3 / EH 10)	Weathering	Depth	Stratigraphy	Defect Spacing (10 / 30 / 100 / 300 / 1000)	Defect Description
						3.0			
						4.0			
						5.0			
						6.0	Start Coring at 6.0m		
NMLC	NGWO	100	0 (75)		HW	7.0	LAMINITE. SILTSTONE (60%) dark grey, fine grained, horiztontal to sub-horizontal laminations, and CLAY (40%) pale grey to grey/red, orange staining, hard.		PP (break) at 6.10: 300kPa 6.12 HB. 6.14 JT. 6.19 JT 6.23 JT. 6.27 JT 6.35 JT 6.38-6.42 Sm. Cl. 4m thick 6.46 JT. 6.51-6.52 Fz. 6.54 JT 6.56 JT. 6.60 JT. 6.63 JT. 6.66 JT 6.68 JT. 6.70 JT. PP (break) at 6.80: 250kPa 6.73-7.07 Sm. Cl 7.10 DB 7.23-7.27 Fz. 4mm thick 7.30 JT. 7.32 JT. 7.35 JT. 7.37 JT 7.40 JT. 7.43 JT. 7.45 JT. 7.46 JT 7.49 JT. 7.52 JT. 7.54 JT. 7.56 JT 7.60 JT. 7.66 JT. 7.68 JT 7.70 JT. 7.73 JT. 7.74 JT 7.81 JT. 7.87 JT. 7.91 JT 7.95 JT.7.97 JT 8.00 DB 8.03 JT. 8.07 JT 8.10 JT. 8.14 JT 8.17-8.20 Fz. Fe. 8.21 JT. 8.24 JT 8.25. JT 8.26 JT 8.32 JT. 8.38 JT 8.49 HB 8.56 JT 8.72 HB 8.84 JT. 8.92 JT. 8.93 JT 9.00 DB 9.05 HB. 9.10 HB 9.18 JT 9.33 JT. 9.37 JT. 9.39 JT 9.42 JT. 9.44 JT. 9.48 JT
		96	36 (86)		MW	8.0	LAMINITE. SILTSTONE (50%) dark grey, fine grained, horiztontal to sub-horizontal laminations, and SANDSTONE (50%) pale grey to yellow, fine grained, orange staining. Point Load Test @ 8.45m		
					SW				
					FR	9.0	SANDSTONE. Fine grained, pale grey with dark grey horizontal to sub-horizontal laminations. Laminations decreasing with depth. SILTSTONE Interbed, 9.33-4.48m, 150mm thick. Point Load Test @ 9.90m		
						10.0	Coring Discontinued at 10.00m		10.00 DB

ASCENT GEOTECHNICAL CONSULTING PTY LTD
UNITING ST COLUMBA'S REDEVELOPMENT - LANE COVE

AG20004 BOREHOLE - BH06 FEBRUARY 2020



1 of 1

6.0 - 10.0m

ASCENT
GEOTECHNICAL CONSULTING

Appendix D

Point Load Index Test Results

Compaction and Soil Testing Services Pty Ltd

Point Load Strength of Rock Specimens

Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
Project: Fig Street	Date Tested:	25/03/2020
Location: Lane Cove	Tested by:	JT
Lithological Description: Sandstone	Date Sampled:	6/03/2020
Method of Sampling: Rock Core	Sampled by:	Client

Testing Method o RMS 223 ✓ AS 4133.4.1 - 1993

		Diametral						Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
1	6.04	50	2.74	1.1	1.1	Dry	Valid							
1	7.5	50	1.7	0.7	0.7	Dry	Valid							
1	9.07	50	4.46	1.8	1.8	Dry	Valid							
1	10.48	50	5.72	2.3	2.3	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/03/2020

for Compaction and Soil Testing Services Pty Ltd.

Compaction and Soil Testing Services Pty Ltd

Point Load Strength of Rock Specimens

Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
Project: Fig Street	Date Tested:	25/03/2020
Location: Lane Cove	Tested by:	JT
Lithological Description: Sandstone	Date Sampled:	6/03/2020
Method of Sampling: Rock Core	Sampled by:	Client

Testing Method o RMS 223 ✓ AS 4133.4.1 - 1993

Diametral								Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
2	7.85	50	1.8	0.7	0.7	Dry	Valid							
2	8.92	50	6.08	2.4	2.4	Dry	Valid							
2	10.1	50	5.24	2.1	2.1	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/08/2020

for Compaction and Soil Testing Services Pty Ltd.

Compaction and Soil Testing Services Pty Ltd

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Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
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Diametral								Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
3	5.35	50	0.58	0.2	0.2	Dry	Valid							
3	7.6	50	0.7	0.3	0.3	Dry	Valid							
3	8.51	50	1.03	0.4	0.4	Dry	Invalid	50	50	5.16	398.9	0.03	0.1	Invalid
3	9.5	50	3.83	1.5	1.5	Dry	Valid							
3	10.5	50	5.19	2.1	2.1	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/03/2020

for Compaction and Soil Testing Services Pty Ltd.

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Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
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Testing Method o RMS 223 ✓ AS 4133.4.1 - 1993

Diametral								Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
4	6.4	50	1.77	0.7	0.7	Dry	Valid							
4	7.4	50	2.19	0.9	0.9	Dry	Valid							
4	9.04	50	2.83	1.1	1.1	Dry	Valid							
4	10.2	50	4.69	1.9	1.9	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/03/2020

for Compaction and Soil Testing Services Pty Ltd.

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Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
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Testing Method o RMS 223 ✓AS 4133.4.1 - 1993

Diametral								Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
5	7.8	50	0.47	0.2	0.2	Dry	Valid							
5	9.6	50	1.8	0.7	0.7	Dry	Valid							
5	10.15	50	4.66	1.9	1.9	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/03/2020

for Compaction and Soil Testing Services Pty Ltd.

Compaction and Soil Testing Services Pty Ltd

Point Load Strength of Rock Specimens

Client: Ascent Geotechnical Consulting	Job No:	ACT 3873
Project: Fig Street	Date Tested:	25/03/2020
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Testing Method o RMS 223 ✓ AS 4133.4.1 - 1993

Diametral								Axial						
BH No:	Depth:	D (mm)	P (kN)	I_s	$I_{s(50)}$	Moisture Content:	Failure Mode	W (mm)	D (mm)	P (kN)	D_e	I_s	$I_{s(50)}$	Failure Mode
6	8.45	50	0.35	0.1	0.1	Dry	Valid							
6	9.9	50	3.61	1.4	1.4	Dry	Valid							

Remarks: Results apply to sample as received

Signed: _____ **Date:** 26/03/2020

for Compaction and Soil Testing Services Pty Ltd.

ASCENT
GEOTECHNICAL CONSULTING

Appendix E

Laboratory Test Results

Compaction & Soil Testing
1/78 Owen St
Glendenning
NSW 2761

NATA Accredited
Accreditation Number 1261
Site Number 18217

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

Attention: **Manney Bandara**

Report **707388-S**
Project name LANE COVE ST COLUMBIA'S
Project ID ACT 3873
Received Date Mar 12, 2020

Client Sample ID			**BH1 1.0M**	**BH4 0.5M**	**BH06 1.5M**
Sample Matrix			**Soil**	**Soil**	**Soil**
Eurofins Sample No.			**S20-Ma17848**	**S20-Ma17849**	**S20-Ma17850**
Date Sampled			**Mar 06, 2020**	**Mar 06, 2020**	**Mar 06, 2020**
Test/Reference	LOR	Unit			
Chloride	10	mg/kg	38	< 10	20
Conductivity (1:5 aqueous extract at 25°C as rec.)	10	uS/cm	46	69	66
pH (1:5 Aqueous extract at 25°C as rec.)	0.1	pH Units	4.6	6.7	4.6
Resistivity*	0.5	ohm.m	1100	730	760
Sulphate (as SO4)	10	mg/kg	66	14	90
% Moisture	1	%	14	21	13

Sample History

Where samples are submitted/analysed over several days, the last date of extraction and analysis is reported.
A recent review of our LIMS has resulted in the correction or clarification of some method identifications. Due to this, some of the method reference information on reports has changed. However, no substantive change has been made to our laboratory methods, and as such there is no change in the validity of current or previous results.

If the date and time of sampling are not provided, the Laboratory will not be responsible for compromised results should testing be performed outside the recommended holding time.

Description	Testing Site	Extracted	Holding Time
Chloride	Sydney	Mar 17, 2020	28 Days
- Method: E045 /E047 Chloride			
Conductivity (1:5 aqueous extract at 25°C as rec.)	Sydney	Mar 17, 2020	7 Days
- Method: LTM-INO-4030 Conductivity			
pH (1:5 Aqueous extract at 25°C as rec.)	Sydney	Mar 17, 2020	7 Days
- Method: LTM-GEN-7090 pH in soil by ISE			
Sulphate (as SO4)	Sydney	Mar 17, 2020	28 Days
- Method: E045 Anions by Ion Chromatography			
% Moisture	Sydney	Mar 12, 2020	14 Days
- Method: LTM-GEN-7080 Moisture			

eurofins | Environment Testing

ABN – 50 005 085 521 web : www.eurofins.com.au e.mail : EnviroSales@eurofins.com

Australia

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Site # 1254 & 14271

Sydney
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NATA # 1261 Site # 18217

Brisbane
1/21 Smallwood Place
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Phone : +61 7 3902 4600
NATA # 1261 Site # 20794

Perth
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Kewdale WA 6105
Phone : +61 8 9251 9600
NATA # 1261
Site # 23736

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IANZ # 1327

Christchurch
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Rolleston, Christchurch 7675
Phone : 0800 856 450
IANZ # 1290

Company Name: Compaction & Soil Testing
Address: 1/78 Owen St
Glendenning
NSW 2761

Project Name: LANE COVE ST COLUMBIA'S
Project ID: ACT 3873

Order No.: ACT 3873
Report #: 707388
Phone: 02 9675 7522
Fax: 02 9675 7544

Received: Mar 12, 2020 12:05 PM
Due: Mar 19, 2020
Priority: 5 Day
Contact Name: Manney Bandara

Eurofins Analytical Services Manager : Alena Bounkeua

Sample Detail						Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH1 1.0M	Mar 06, 2020		Soil	S20-Ma17848	X	X
2	BH4 0.5M	Mar 06, 2020		Soil	S20-Ma17849	X	X
3	BH06 1.5M	Mar 06, 2020		Soil	S20-Ma17850	X	X
Test Counts						3	3

Internal Quality Control Review and Glossary

General

1. Laboratory QC results for Method Blanks, Duplicates, Matrix Spikes, and Laboratory Control Samples follows guidelines delineated in the National Environment Protection (Assessment of Site Contamination) Measure 1999, as amended May 2013 and are included in this QC report where applicable. Additional QC data may be available on request.
2. All soil/sediment/solid results are reported on a dry basis, unless otherwise stated.
3. All biota/food results are reported on a wet weight basis on the edible portion, unless otherwise stated.
4. Actual LORs are matrix dependant. Quoted LORs may be raised where sample extracts are diluted due to interferences.
5. Results are uncorrected for matrix spikes or surrogate recoveries except for PFAS compounds.
6. SVOC analysis on waters are performed on homogenised, unfiltered samples, unless noted otherwise.
7. Samples were analysed on an 'as received' basis.
8. Information identified on this report with blue colour, indicates data provided by customer, that may have an impact on the results.
9. This report replaces any interim results previously issued.

Holding Times

Please refer to 'Sample Preservation and Container Guide' for holding times (QS3001).

For samples received on the last day of holding time, notification of testing requirements should have been received at least 6 hours prior to sample receipt deadlines as stated on the SRA.

If the Laboratory did not receive the information in the required timeframe, and regardless of any other integrity issues, suitably qualified results may still be reported.

Holding times apply from the date of sampling, therefore compliance to these may be outside the laboratory's control.

For VOCs containing vinyl chloride, styrene and 2-chloroethyl vinyl ether the holding time is 7 days however for all other VOCs such as BTEX or C6-10 TRH then the holding time is 14 days.

****NOTE:** pH duplicates are reported as a range NOT as RPD

Units

mg/kg: milligrams per kilogram
mg/L: milligrams per litre
ug/L: micrograms per litre
ppm: Parts per million
ppb: Parts per billion
%: Percentage
org/100mL: Organisms per 100 millilitres
NTU: Nephelometric Turbidity Units
MPN/100mL: Most Probable Number of organisms per 100 millilitres

Terms

Dry	Where a moisture has been determined on a solid sample the result is expressed on a dry basis.
LOR	Limit of Reporting.
SPIKE	Addition of the analyte to the sample and reported as percentage recovery.
RPD	Relative Percent Difference between two Duplicate pieces of analysis.
LCS	Laboratory Control Sample - reported as percent recovery.
CRM	Certified Reference Material - reported as percent recovery.
Method Blank	In the case of solid samples these are performed on laboratory certified clean sands and in the case of water samples these are performed on de-ionised water.
Surr - Surrogate	The addition of a like compound to the analyte target and reported as percentage recovery.
Duplicate	A second piece of analysis from the same sample and reported in the same units as the result to show comparison.
USEPA	United States Environmental Protection Agency
APHA	American Public Health Association
TCLP	Toxicity Characteristic Leaching Procedure
COC	Chain of Custody
SRA	Sample Receipt Advice
QSM	US Department of Defense Quality Systems Manual Version 5.3
CP	Client Parent - QC was performed on samples pertaining to this report
NCP	Non-Client Parent - QC performed on samples not pertaining to this report, QC is representative of the sequence or batch that client samples were analysed within.
TEQ	Toxic Equivalency Quotient

QC - Acceptance Criteria

RPD Duplicates: Global RPD Duplicates Acceptance Criteria is 30% however the following acceptance guidelines are equally applicable:

Results <10 times the LOR : No Limit

Results between 10-20 times the LOR : RPD must lie between 0-50%

Results >20 times the LOR : RPD must lie between 0-30%

Surrogate Recoveries: Recoveries must lie between 20-130% Phenols & 50-150% PFASs

PFAS field samples that contain surrogate recoveries in excess of the QC limit designated in QSM 5.3 where no positive PFAS results have been reported have been reviewed and no data was affected.

WA DWER (n=10): PFBA, PFPeA, PFHxA, PFHpA, PFOA, PFBS, PFHxS, PFOS, 6:2 FTSA, 8:2 FTSA

QC Data General Comments

1. Where a result is reported as a less than (<), higher than the nominated LOR, this is due to either matrix interference, extract dilution required due to interferences or contaminant levels within the sample, high moisture content or insufficient sample provided.
2. Duplicate data shown within this report that states the word "BATCH" is a Batch Duplicate from outside of your sample batch, but within the laboratory sample batch at a 1:10 ratio. The Parent and Duplicate data shown is not data from your samples.
3. Organochlorine Pesticide analysis - where reporting LCS data, Toxaphene & Chlordane are not added to the LCS.
4. Organochlorine Pesticide analysis - where reporting Spike data, Toxaphene is not added to the Spike.
5. Total Recoverable Hydrocarbons - where reporting Spike & LCS data, a single spike of commercial Hydrocarbon products in the range of C12-C30 is added and it's Total Recovery is reported in the C10-C14 cell of the Report.
6. pH and Free Chlorine analysed in the laboratory - Analysis on this test must begin within 30 minutes of sampling.Therefore laboratory analysis is unlikely to be completed within holding time. Analysis will begin as soon as possible after sample receipt.
7. Recovery Data (Spikes & Surrogates) - where chromatographic interference does not allow the determination of Recovery the term "INT" appears against that analyte.
8. Polychlorinated Biphenyls are spiked only using Aroclor 1260 in Matrix Spikes and LCS.
9. For Matrix Spikes and LCS results a dash " -" in the report means that the specific analyte was not added to the QC sample.
10. Duplicate RPDs are calculated from raw analytical data thus it is possible to have two sets of data.

Quality Control Results

Test	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Method Blank							
Chloride	mg/kg	< 10			10	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	uS/cm	< 10			10	Pass	
Sulphate (as SO4)	mg/kg	< 10			10	Pass	
LCS - % Recovery							
Chloride	%	108			70-130	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	%	102			70-130	Pass	
Resistivity*	%	102			70-130	Pass	
Sulphate (as SO4)	%	108			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1			Acceptance Limits	Pass Limits	Qualifying Code
Spike - % Recovery									
				Result 1					
Chloride	S20-Ma17378	NCP	%	96			70-130	Pass	
Sulphate (as SO4)	S20-Ma17378	NCP	%	93			70-130	Pass	

Test	Lab Sample ID	QA Source	Units	Result 1	Result 2	RPD	Acceptance Limits	Pass Limits	Qualifying Code
Duplicate									
				Result 1	Result 2	RPD			
Chloride	S20-Ma17378	NCP	mg/kg	25	22	14	30%	Pass	
Conductivity (1:5 aqueous extract at 25°C as rec.)	S20-Ma18073	NCP	uS/cm	45	59	26	30%	Pass	
pH (1:5 Aqueous extract at 25°C as rec.)	S20-Ma18073	NCP	pH Units	5.3	5.1	Pass	30%	Pass	
Resistivity*	S20-Ma18073	NCP	ohm.m	1100	850	26	30%	Pass	
Sulphate (as SO4)	S20-Ma17378	NCP	mg/kg	350	330	5.0	30%	Pass	
% Moisture	S20-Ma17919	NCP	%	23	23	<1	30%	Pass	

Comments

Sample Integrity

Custody Seals Intact (if used)	N/A
Attempt to Chill was evident	Yes
Sample correctly preserved	Yes
Appropriate sample containers have been used	Yes
Sample containers for volatile analysis received with minimal headspace	Yes
Samples received within HoldingTime	Yes
Some samples have been subcontracted	No

Authorised By

Alena Bounkeua	Analytical Services Manager
Gabriele Cordero	Senior Analyst-Inorganic (NSW)

Glenn Jackson
General Manager

Final report - this Report replaces any previously issued Report

- Indicates Not Requested

* Indicates NATA accreditation does not cover the performance of this service

Measurement uncertainty of test data is available on request or please click here.

eurofins | Environment Testing

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43 Detroit Drive
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Phone : 0800 856 450
IANZ # 1290

Company Name: Compaction & Soil Testing
Address: 1/78 Owen St
Glendenning
NSW 2761

Project Name: LANE COVE ST COLUMBIA'S
Project ID: ACT 3873

Order No.: ACT 3873
Report #: 707388
Phone: 02 9675 7522
Fax: 02 9675 7544

Received: Mar 12, 2020 12:05 PM
Due: Mar 19, 2020
Priority: 5 Day
Contact Name: Manney Bandara

Eurofins Analytical Services Manager : Alena Bounkeua

Sample Detail						Aggressivity Soil Set	Moisture Set
Melbourne Laboratory - NATA Site # 1254 & 14271							
Sydney Laboratory - NATA Site # 18217						X	X
Brisbane Laboratory - NATA Site # 20794							
Perth Laboratory - NATA Site # 23736							
External Laboratory							
No	**Sample ID**	**Sample Date**	**Sampling Time**	**Matrix**	**LAB ID**		
1	BH1 1.0M	Mar 06, 2020		Soil	S20-Ma17848	X	X
2	BH4 0.5M	Mar 06, 2020		Soil	S20-Ma17849	X	X
3	BH06 1.5M	Mar 06, 2020		Soil	S20-Ma17850	X	X
Test Counts						3	3

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☑ **Sydney**
Unit F3 - 6 Building F, 16 Mars Road, Lane Cove
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Phone: +613 8564 5000 Fax: +613 8564 5090
Email: EnviroSampleVic@eurofins.com.au

CHAIN OF CUSTODY RECORD

CLIENT DETAILS

Company Name :	CSTS	Contact Name:	Manney Bandara	Purchase Order :	ACT 3873
Office Address :	1/78 Owen Street, Glendennin	Project Manager :	James Tricker	PROJECT Number :	ACT 3873
		Email for results :	manney@csts.net.au, james@csts.net	PROJECT Name :	Lane Cove St Columbia's

COC Number :

Eurofins | mgt quote ID :

Data output format:

Special Directions & Comments :

Eurofins | mgt DI water batch number:

Analytes

L2

	Sample ID	Date	Matrix	L2	Containers: 1LP	250P	125P	1LA	40mL vial	125mL A	Jar	Zip lock bag	Sample comments:
1	BH1 1.0m	6/03/2020	Soil	X							X		
2	BH4 0.5m	6/03/2020	Soil	X							X		
3	BH06 1.5m	6/03/2020	Soil	X							X		
4													
5													
6													
7													
8													
9													
10													
11													
12													
13													
14													
15													
16													

Some common holding times (with correct preservation).
For further information contact the lab

Waters		Soils	
BTEX, MAH, VOC	14 days	BTEX, MAH, VOC	14 days
TRH, PAH, Phenols, Pesticides	7 days	TRH, PAH, Phenols, Pesticides	14 days
Heavy Metals	6 months	Heavy Metals	6 months
Mercury, CrVI	28 days	Mercury, CrVI	28 days
Microbiological testing	24 hours	Microbiological testing	72 hours
BOD, Nitrate, Nitrite, Total N	2 days	Anions	28 days
Solids - TSS, TDS etc	7 days	SPOCAS, pH Field and FOX, CrS	24 hours
Ferrous iron	7 days	ASLP, TCLP	7 days

Relinquished By:	Manney Bandara	Laboratory Staff — Received By:	Suzanne Ford
Date & Time::	11/03/20	Date & Time:	12/3/2020 12:05PM
Signature:		Signature:	

Turn around time

1 DAY ☐ 2 DAY ☐ 3 DAY ☐
5 DAY ☑ 10 DAY ☐ Other:

Method Of Shipment

☑ Courier
☐ Hand Delivered
☐ Postal

Courier Consignment # :

Temperature on arrival: 11.9°C

Report number: 707388

C.S.T.S.

Compaction & Soil Testing Services Pty Limited

1/78 Owen Street, GLENDENNING NSW 2761 • ABN 44 106 976 738
Phone: (02) 9675 7522 Fax: (02) 9675 7544
Email: office@csts.net.au Web: www.comsoiltest.com.au

CALIFORNIA BEARING RATIO TEST RESULT

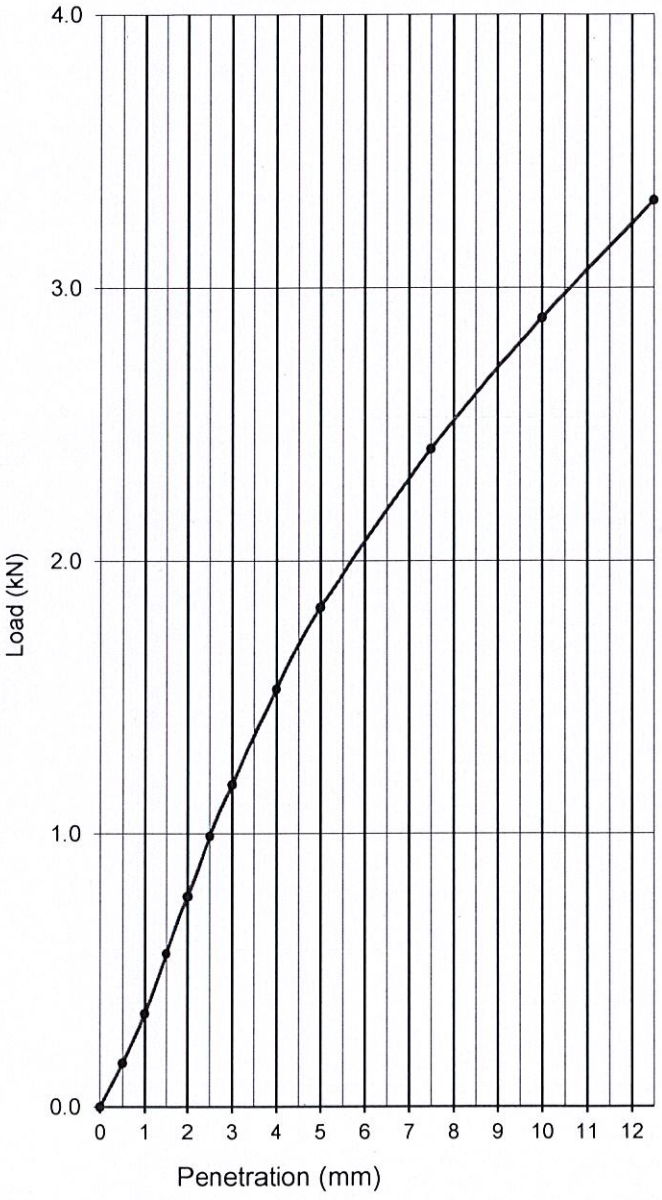
Client:	Ascent Geotechnical Consulting	Job No.:	ACT 3873
Project:	Fig Street	Report No.	ACT 3873 1748
Location:	Lane Cove	Start Date:	12/03/2020
Laboratory Test Procedures	AS1289.6.1.1 AS1289.5.1.1 AS1289.2.1.1 Pavement	End Date:	16/03/2020
		Tested By:	SH
		Checked By:	PC
Sampled By:	Client	Date Sampled:	6/03/2020

Laboratory No.:	1748
Sample Location:	BH05
Sample ID	BULK 1
Sample Description	SILTY GRAVELLY CLAY
Maximum Dry Density	1.50
Optimum Moisture Content	23.2
Field Moisture Content	20.4
% Retained on 19.0mm Sieve	0.0
Over Size Excluded (Yes / No)	Yes

CBR TEST RESULTS

Dry Density (t/m^3)	Before Soaking	1.48
	After Soaking	1.47
Moisture Content (%)	Before Soaking	24.5
	After Soaking	27.3
Moisture Content After Test (%)	Top 30mm	29.5
	Whole Sample	27.0
Density Ratio (%)	Before Soaking	99
Moisture Ratio (%)	Before Soaking	105

Number of Days Soaked	4
Mass of Surcharge Applied (kg)	4.5
Swell after Soaking (%)	1.00
Penetration (mm)	**5.0**
CBR Value (%)	***9.0***



NATA ACCREDITED FOR TECHNICAL COMPETENCE

Accredited for compliance with ISO/IEC 17025
The results of the tests, calibrations and/or measurements included in this document are traceable to Australian/national standards.
Results apply to sample as received
Accreditation No. 15121

Approved Signatory
Prakash Chandra

Date: 19/03/2020

UNIAXIAL COMPRESSION TEST REPORT

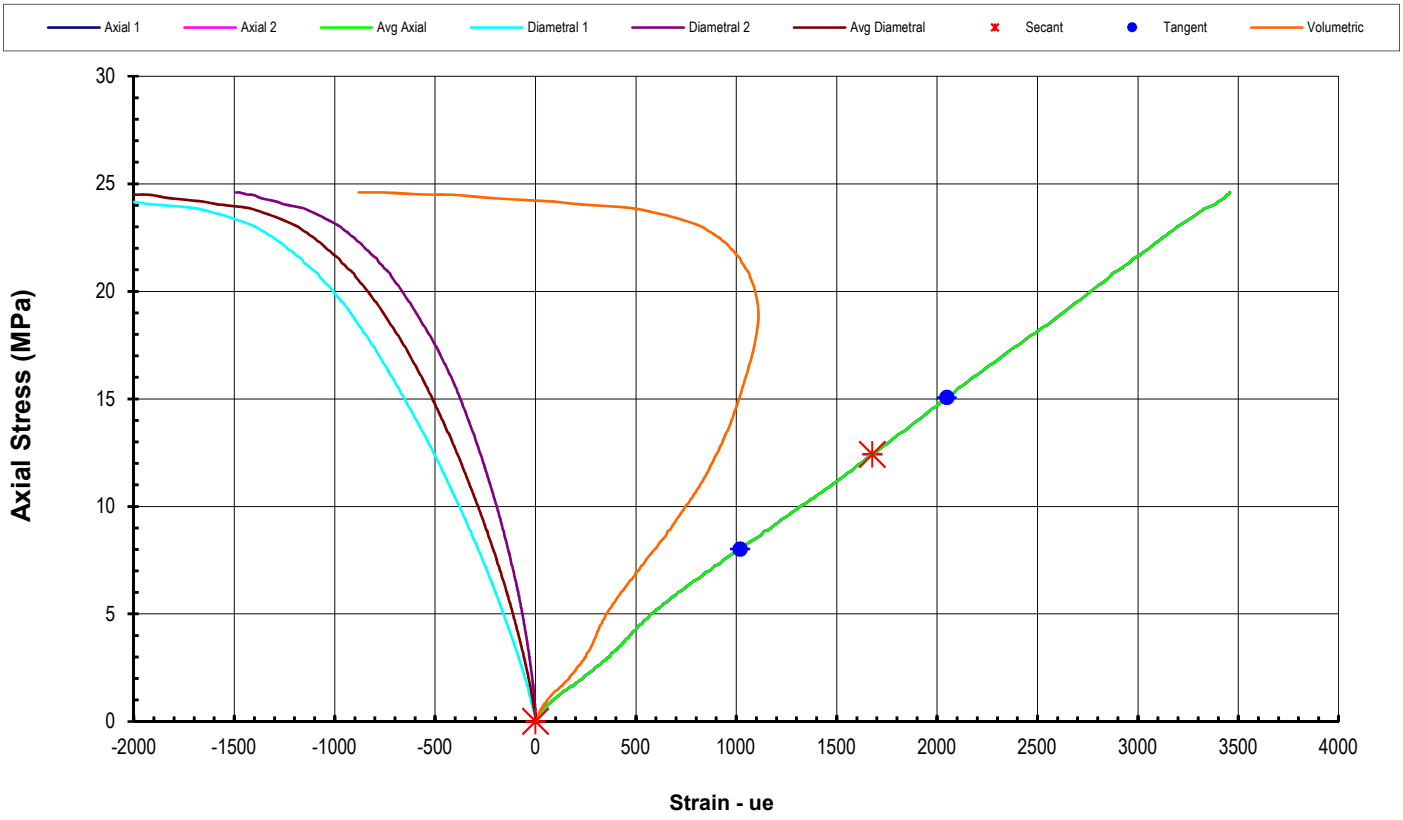
Test Method: AS 4133.4.3.1, AS4133.4.3.2 : Rock Strength Test

Client:	Compaction & Soil Testing Services	**Report No.:**	SYD2000787
		Sample No.:	SYD20-0139-01
Project:	Fig Street, Job #ACT3873	**Job No.:**	12523246
		Test Date:	1/04/2020
Bore Hole No:	BH01	**Depth (m):**	9.90 - 10.10
Rock Description:	Siltstone	**Sample Storage:**	Tested As Received
		Testing Machine:	Wykeham Farrance 2000 kN

Uniaxial Compressive Strength : ***24.6*** ***MPa***

	Young's Modulus	Poisson Ratio	
Tangent :	***6.8 GPa***	***0.246***	Calculated from 33 to 61 % of Max UCS
Secant :	***7.4 GPa***	***0.226***	Calculated from 0 to 50 % of Max UCS

Axial Stress v's Strain Plots



Remarks:

Sampled by: Client

Note: Graph not to scale

Tested By: AM
Date: 1/04/2020
Checked By: D B

Approved Signatory:

D. Brooke
Date: 3/04/2020

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UNIAXIAL COMPRESSION TEST REPORT

Test Method: AS 4133.4.3, AS4133.4.3.1 : Rock Strength Test

Client:	Compaction & Soil Testing Services	**Report No.:**	SYD2000787
		Sample No.:	SYD20-0139-01
Project:	Fig Street, Job #ACT3873	**Job No.:**	12523246
		Test Date:	1/04/2020
Bore Hole No:	BH01	**Depth (m):**	9.90 - 10.10
Rock Description:	Siltstone	**Sample Storage:**	Tested As Received
		Testing Machine:	Wykeham Farrance 2000 kN

Uniaxial Compressive Strength : ***24.6*** ***MPa***

Average Sample Diameter (mm):	51.0	Moisture Content (%):	0.7
Sample Height (mm):	100.9	Wet Density (t/m3):	2.270
Duration of Test (min):	4.80	Dry Density (t/m3):	2.253
Rate of Loading (MPa/min):	5.12	Orientation (deg):	-
Mode of Failure:	Tensile Dominated	Number of Specimens:	1
Length / Diameter ratio	2.0		

Before

After

Remarks: The length to diameter ratio falls outside the test method limits of 2.5:1 to 3.0:1.

Tested By: AM
Date: 1/04/2020
Checked By: D B

Approved Signatory:

D. Brooke
Date: 3/04/2020

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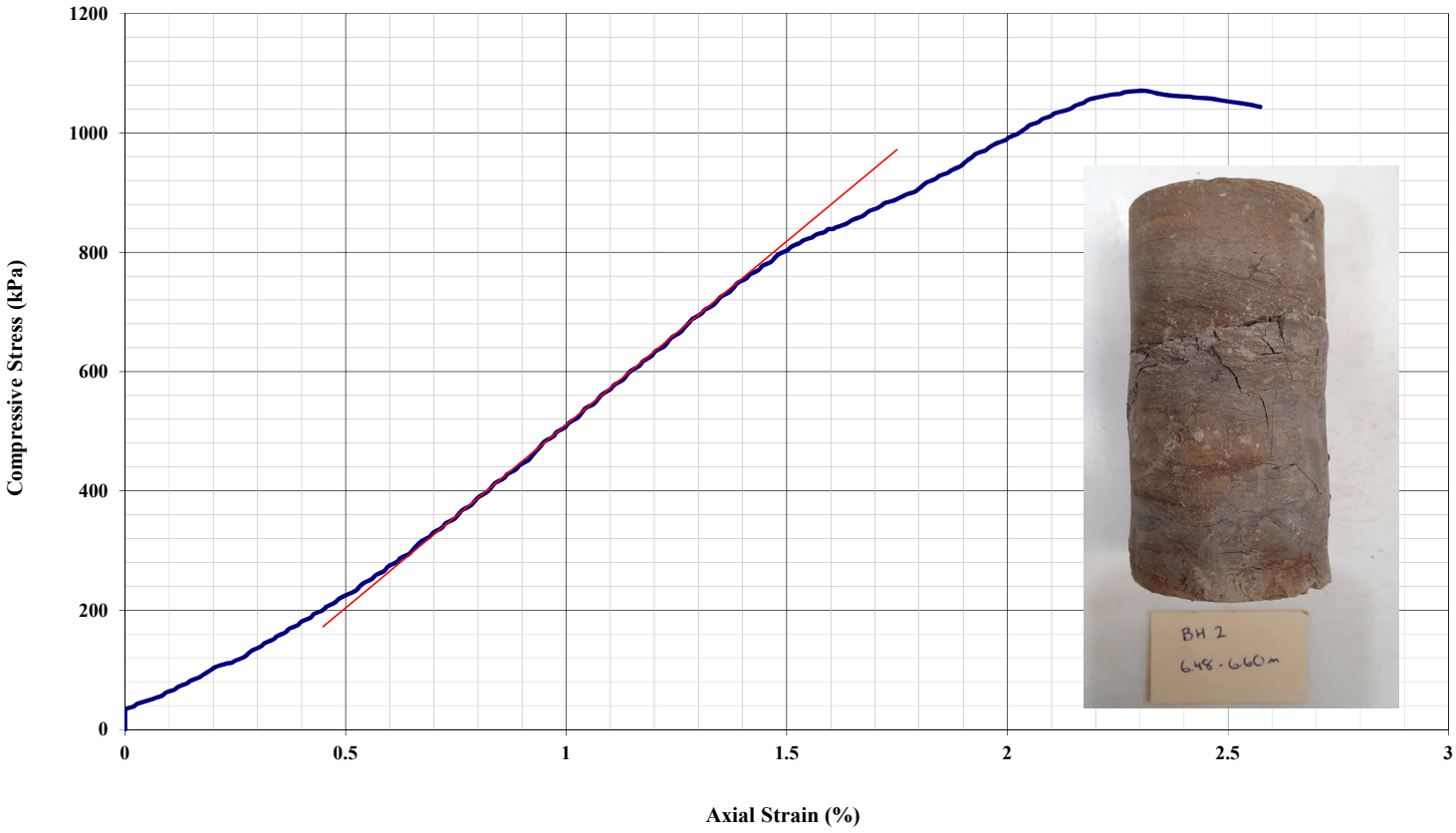
UCS TEST REPORT

Test Method : ASTM 2166

Client:	**Compaction & Soil Testing Services**	**Report No :**	**SYD2000788**
		Sample No.:	**SYD20-0139-02**
Project:	**Fig Street Job #3873**	**Job No.:**	**12523246**
		Test Date:	**2/04/2020**
Client ID	**-**	**Test Hole:**	**BH02** **Depth (m):** **6.48-6.60**

Description **Claystone grey @ orange brown**



Average Sample Diameter (mm)	51.1	Unconfined Compressive Strength (kPa)	1071
Average Sample Height (mm)	107.3	Strain at Failure (%)	2.3
Height to Diameter Ratio	2.1	Average rate of Strain (%/min)	1.6
Wet Density at moulding (t/m^3):	2.261	Moisture Content (%):	6.2
Dry Density at moulding (t/m^3):	2.129	Young's Modulus Sec 50 % (Mpa):	52
Remarks:	Sample tested as received. Significantly dried with shrinkage cracks	Young's Modulus tan (Mpa):	51

Tested By: AM

Checked By: DB

Approved Signatory : D.Brooke

Date: 3/04/2020

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UNIAXIAL COMPRESSION TEST REPORT

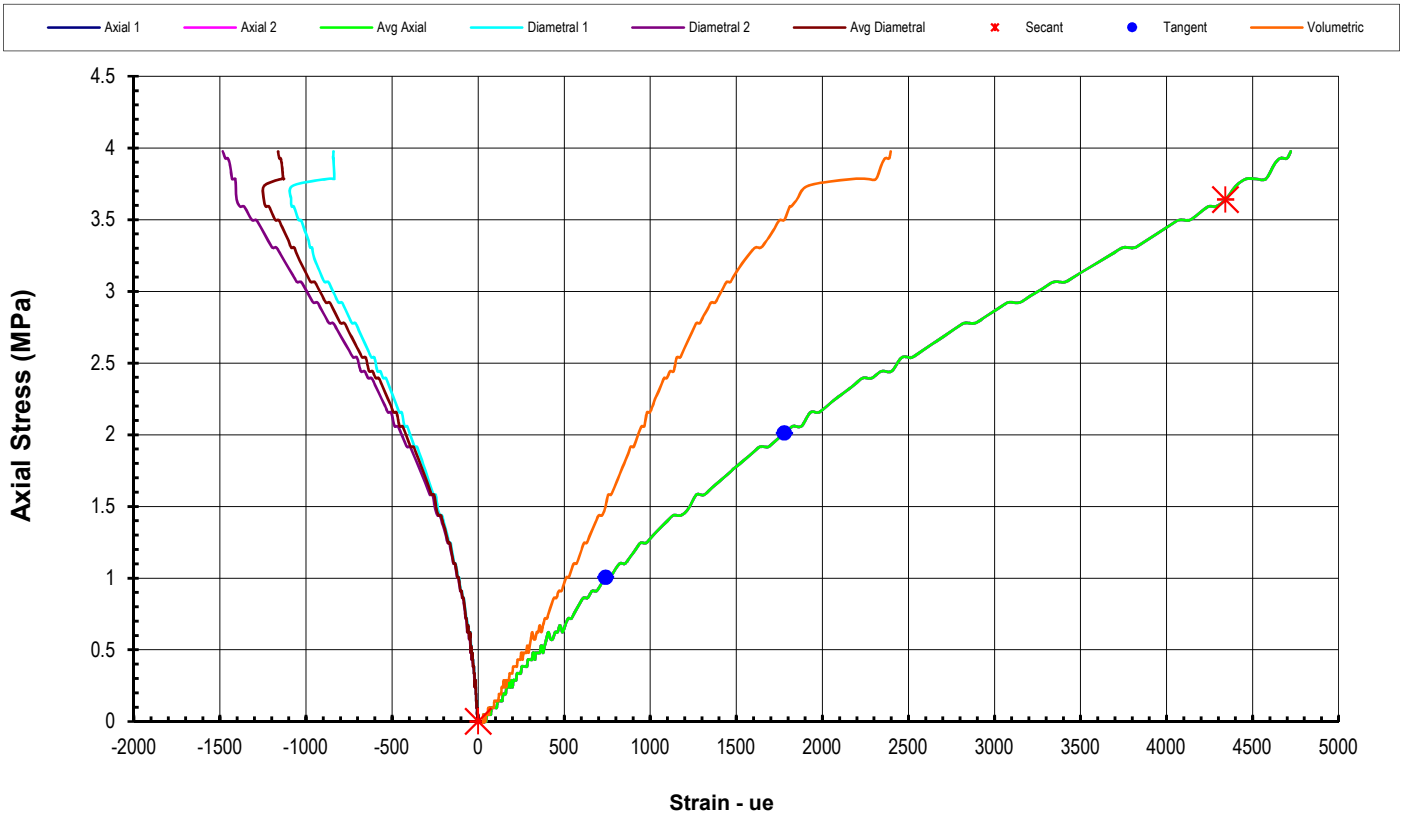
Test Method: AS 4133.4.3.1, AS4133.4.3.2 : Rock Strength Test

Client:	Compaction & Soil Testing Services	**Report No.:**	SYD2000789
		Sample No.:	SYD20-0139-03
Project:	Fig Street, Job # ACT3873	**Job No.:**	12523246
		Test Date:	1/04/2020
Bore Hole No:	BH05	**Depth (m):**	7.50 - 7.75
Rock Description:	Siltstone	**Sample Storage:**	Tested As Received
		Testing Machine:	Wykeham Farrance 2000 kN

Uniaxial Compressive Strength : ***7.2*** ***MPa***

	Young's Modulus	Poisson Ratio	
Tangent :	***1.0 GPa***	***0.234***	Calculated from 14 to 28 % of Max UCS
Secant :	***0.8 GPa***	***0.283***	Calculated from 0 to 50 % of Max UCS

Axial Stress v's Strain Plots



Remarks: Axial 2 strain data removed from analysis

Sampled by: Client | Note: Graph not to scale

Tested By: AM
Date: 1/04/2020
Checked By: D B

Approved Signatory:

D. Brooke
Date: 3/04/2020

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UNIAXIAL COMPRESSION TEST REPORT

Test Method: AS 4133.4.3, AS4133.4.3.1 : Rock Strength Test

Client:	Compaction & Soil Testing Services	**Report No.:**	SYD2000789
		Sample No.:	SYD20-0139-03
Project:	Fig Street, Job # ACT3873	**Job No.:**	12523246
		Test Date:	1/04/2020
Bore Hole No:	BH05	**Depth (m):**	7.50 - 7.75
Rock Description:	Siltstone	**Sample Storage:**	Tested As Received
		Testing Machine:	Wykeham Farrance 2000 kN

Uniaxial Compressive Strength : ***7.2*** ***MPa***

Average Sample Diameter (mm):	51.6	Moisture Content (%):	3.3
Sample Height (mm):	143.8	Wet Density (t/m3):	2.583
Duration of Test (min):	4.48	Dry Density (t/m3):	2.499
Rate of Loading (MPa/min):	1.60	Orientation (deg):	-
Mode of Failure:	Tensile Dominated	Number of Specimens:	1
Length / Diameter ratio	2.8		

Before

After

NOTE:
Strain data post 3.9 Mpa has been excluded due to detachment of strain gauges

Remarks:

Tested By: AM
Date: 1/04/2020
Checked By: D B

Approved Signatory:

D. Brooke
Date: 3/04/2020

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