Assyrian Schools Limited
C/- PMDL

Detailed Site Investigation
Lots 2320 and 2321 DP 1223137, 17 and 19 Kosovich Place, Cecil Park, NSW

P1705798JR01V03
July 2018

martens consulting engineers

ENVIRONMENTAL

WATER

WASTEWATER

GEOTECHNICAL

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PROJECT MANAGEMENT

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All enquiries regarding this project are to be directed to the Project Manager.

Contents

1 Introduction

1.1 Overview

This report prepared by Martens and Associates (MA), on behalf of Assyrian Schools Limited C/- PMDL documents the findings of a detailed site investigation (DSI) to support a State Significant development application for 17 and 19 Kosovich Place, Cecil Park, NSW. The investigation area is Lots 2320 and 2321 DP 1223137 ('the site').

This report updates a detailed site investigation (DSI) which was previously completed by SESL Australia (2015), and which should be read in conjunction with this report. This report supplements past DSI's testing scope to include fill areas, review asbestos onsite, and assess former market garden areas in accordance with DEC (1995).

1.2 Objectives

The objective of this report is to assess identified potential site contamination, target areas of environmental concern (AECs) not previously assessed (SESL, 2015), and determine site suitability for the proposed site school development.

1.3 Scope of Works

The scope of works includes:

- Review of past DSI (SESL, 2015).
- Intrusive soil investigation and soil sampling program, targeting AECs not adequately assessed in SESL (2015).
- Laboratory analyses of selected samples for identified contaminants of potential concern (COPC) and assessment against site acceptance criteria (SAC).
- Preparation of a report in general accordance with the relevant sections of ASC NEPM (1999, amended 2013), NSW OEH (2011), DEC (1995), and DEC (2006).

1.4 Reference Guidelines

This assessment is prepared in general accordance with the following guidelines:

- ASC NEPM (1999, amended 2013) *National Environmental Protection Measure, 1999 (site contamination measure)*.
- NSW DEC (1995) *Contaminated Sites – Guidelines for Assessing Former Orchards and Market Gardens*.
- NSW DEC (2006) *2nd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.
- NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

1.5 Abbreviations

ABC – Ambient background concentration

ACM – Asbestos containing material

AEC – Area of environmental concern

AF – Asbestos fines

ASC NEPM – *Assessment of site contamination (National Environmental Protection Measure*)

BTEX – Benzene, toluene, ethyl benzene, xylene

COPC – Contaminants of potential concern

DEC – NSW Department of Environment and Conservation

DP – Deposited Plan

DQI – Data quality indicators

DQO – Data quality objective

DSI – Detailed site investigation

EIL – Ecological investigation levels

EPA – NSW Environmental Protection Authority

EQL – Estimated quantitation limit

ESL – Ecological screening levels

FCC – Fairfield City Council

HM – Heavy metals

LGA – Local government area

MA – Martens and Associates Pty Ltd

mbgl – Metres below ground level

NATA – National Association of Testing Authorities

OCP – Organochloride pesticides

OEH – NSW Office of Environment and Heritage

OPP – Organophosphate pesticides

PACM – Potential asbestos containing material

PAH – Polycyclic aromatic hydrocarbons

PSI – Preliminary site investigation

RPD – Relative percentage difference – difference between two values divided by the average

SAC – Site acceptance criteria

SAQP – Sampling analytical and quality plan

SOP – Standard operating procedure

TCLP – Toxicity characteristic leaching procedure

TRH – Total recoverable hydrocarbons

VHC – Volatile halogenated compounds

VOC – Volatile organic compounds

2 Site Background Information

2.1 Site Location and Existing Land Use

General site information is summarised in Table 1 and detail survey is provided in Attachment A.

Table 1: General site information.

Item	Description / Detail
Lot/DP and site address	17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)
Investigation Area	Approximately 3 ha
Local Government Area (LGA)	Fairfield City Council (FCC)
Current land use	The site is currently used for rural purposes, and is predominantly open grasslands and paddocks. The site is zoned RU4 – Primary Production Small Lots. The extreme north west corner of the site, presently covered by the site dam, is zoned as E2-Environmental Conservation. Site elevation is approximately 89 m near the site's north western boundary, to 102 m near the eastern boundary.
Proposed land use	Primary school
Surrounding land uses	Primarily rural, and church located to the north. Westlink M7 motorway located approximately 350 m east.
Expected geology and soil landscape	The Penrith 1:100,000 Geological Sheet 9030 (NSW Dept. of Mineral Resources, 1991) identifies the site is underlain by Bringelly Shale which comprises shale, carbonaceous claystone, claystone, laminite, fine to medium grained lithic sandstone and rare coal/tuff. The NSW Environment and Heritage eSPADE website identifies the site as having soils of the Luddenham soil landscapes consisting of undulating to rolling low hills on Wianamatta Group shales, often associated with Minchinbury Sandstone. Soils are generally shallow to deep podzolic soils or earthy clays.
Drainage	Site drainage generally occurs via overland flow to an onsite dam and unnamed tributary of Ropes Creek near the western boundary.
Environmental receptors	Site drainage path. Unnamed mapped tributary and dam located adjacent to western boundary. Current and future site flora and fauna.
Human receptors	Future students, staff, and visitors. Site workers during future construction works. Surrounding residents, and visitors to nearby church.

2.2 Hydrogeology

Review of NSW Department of Primary Industries Water's database indicated one groundwater bore within 500 m of the site (Table 2).

Table 2: Available hydrogeological information.

The	Direction and Distance	Depth To Groundwater (mbgl)	Intended Use	Water Bearing Zone Substrate
GW108121	North east (260m)	34.0	Test bore	Shale

Notes

[1] ND – No data available.

From review of the information in Table 2, the groundwater well in the vicinity is used as a test bore and groundwater is typically greater than 34.0 m below ground level (mbgl). SESL (2015) report is unclear with regards to groundwater, it notes in one place "Groundwater was encountered when observing a deep soil profile immediately adjacent to the creek" (page 2), and at another place that "Groundwater was not encountered during the sampling process" (page 33). MA onsite investigations to 4.0 mbgl did not encounter water, and it is not considered likely that a significant groundwater system underlies the site. Further investigations would be required to fully characterise site hydrogeology.

3 Summary of Previous Investigation

3.1 Detailed Site Investigation (DSI) (SESL, 2015)

3.1.1 Historical Site and Walkover Findings Summary

A DSI (SESL, 2015) has been completed for 153 -189 Wallgrove Road (a larger property which includes the site), which provided an account of potential onsite contamination. A summary of key historical site and walkover findings is outlined in Table 3.

Table 3: Summary of previous site investigations (SESL, 2015).

Investigation Details	Investigation Task and Finding
Scope of works	o Research and review of available site information. o Site walkover inspection. o Intrusive soil sampling based on site inspection and history; groundwater was not sampled as part of investigations. o Laboratory analysis, and review of field and analytical results. o Preparation of a DSI in general accordance with ASC NEPM (1999, amended 2013).
Current and historical site records key findings	o Available Council records show no development applications applicable to the investigation area. A dwelling and sheds are located on the eastern portion of 153-189 Wallgrove Road site (13 and 15 Kosovich Place). o A review of historic aerial photography showed rural land use, with the site historically used for agricultural and pastoral purposes. The site was used for crop production from at least the 1970's until recently, when the site has returned to pastoral use. o A title search revealed the land has been predominantly owned by farmers since at least 1904. o The site soils are identified as Class 4 acid sulfate soils (ASS), although due to elevation and geological land unit of the area, ASS are not expected to be present onsite. o Section 149 certificates did not identify the land as a heritage item, conservation area, or critical habitat by Council, nor is the site considered contaminated land. o No records were identified on the list of NSW contaminated sites notified to the EPA, or listed under the Contaminated Land Management Act (1997) and the Environmentally Hazardous Chemicals Act (1985) within 500 m of the site. o A Dangerous Goods License search reported no chemicals being stored at the site.
Site walkover key findings	A site walkover inspection (28 April 2015) provided the following observations: o At the time of inspection, the site was used for rural residential purposes and agricultural grazing. o Possible lead-based paints used on dwelling and sheds (not located within investigation area). o No electrical transformers (PCBs) were observed onsite. o No hazardous materials were observed to be stored onsite.

Investigation Details	Investigation Task and Finding
	o Fill material was observed near the western site boundary, up to a depth of 1 m. o Asbestos containing materials (ACM) were observed on the soil surface in some sections of the site. ACM was observed in the current investigation area.

3.1.2 Selected Areas of Environmental Concern

DSI (SESL, 2015) assessment of site AECs and COPCs (Table 4) is made on the basis of available site history, aerial photograph interpretation and site walkovers.

Table 4: Areas of environmental concern and contaminants of potential concern (SESL, 2015).

AEC [1]	Potential for Contamination	COPC
AEC 1 – General agricultural land	Use of the site for general agricultural purposes	HM, OCP/OPP
AEC 2 – Modified soil profiles (including fill materials from on- and off-site)	Presence of fill materials at the site	HM, TRH, BTEX, PAH, OCP and asbestos
AEC 3[1] – Existing dwellings – degraded and demolished	Degrading structures	HM and asbestos

Notes

[1] Not located within the investigation area.

3.1.3 Sampling Regime

Where access was available, intrusive subsurface investigations and sampling of identified AECs was undertaken. Within the investigation area, surface and depth samples were taken at 16 locations, to provide samples for pesticide and heavy metal (contaminants commonly used on agricultural land) analysis, and to identify contamination within fill material.

3.1.4 Summary of Key Laboratory Findings

3.1.4.1 Adopted Site Acceptance Criteria (SAC)

Selected samples were analysed for identified COPC by a NATA accredited laboratory and results assessed against site acceptance criteria (SAC) in accordance with ASC NEPM (1999, amended 2013).

Table 5 summarises the applicability of the SAC adopted for the SESL (2015) investigation.

Table 5: Summary of SAC adopted for SESL (2015) DSI investigations.

Media	Adopted Guidelines	Applicability
Soil	ASC NEPM (1999, amended 2013) Soil HILs, HSLs, EILs, ESLs, TPH Management Limits, and asbestos	Health Investigation Levels (HILs) Based on proposed development, HIL A – Residential with garden/accessible soil land use were adopted. Health Screening Levels (HSLs) Soil HSLs for Vapour Intrusion were adopted. Ecological Screening ESL and EIL guidelines were applied as site assessment criteria, as garden/open space is proposed as part of intended primary school development land use. Management Limits TPH management levels were not assessed as part of SESL (2015) DSI investigations. Asbestos HSLs for Asbestos Contamination in Soil, Residential A with garden/accessible soil, including primary schools, were adopted as SAC.
	CRC Care (2011): Soil Direct Contact HSLs	Direct Contact Health Screening Levels (HSLs) Direct contact HSLs were not assessed as part of SESL (2015) DSI investigations.

3.1.4.2 Asbestos Findings

ACM was observed within brown loamy fill (borehole B10) (to a depth of 0 – 0.2 m) adjacent to the creek near the western boundary. ACM was not recorded on any other borelogs within the investigation area. An area of inferred potential ACM impacted filling, was mapped by SESL (2015) in the western portion of the site, and shown in Appendix A of the SESL (2015) DSI.

No material samples within the investigation area were tested for asbestos.

3.1.4.3 Laboratory Analysis Results

Selected soil samples within the investigation area were tested for pesticides and heavy metals. All laboratory results for samples taken within the investigation area were below adopted SAC.

3.2 SESL Data Gaps

Following review of DSI report findings (SESL, 2015), a number of data gaps were identified by Martens, as follows:

- Inadequate number of testing locations within the investigation area, based on previous agricultural land use (review of historical aerials indicate former market gardens within the investigation

area). In accordance with NSW EPA (1995), 30 sampling locations are required for a 3 ha site, but only 16 locations were assessed in SESL (2015). Additional sampling locations are to be identified in accordance with NSW EPA (1995), and further testing of soil samples to be completed for heavy metals and pesticides.

- Although PACM material was observed in one borehole during DSI (SESL, 2015) investigations, and a fill area extent, including ACM, was noted in the western portion of the site, no material samples were tested for asbestos.

4 Sampling, Analytical and Quality Plan (SAQP)

A SAQP has been developed to ensure that data collected for this DSI to address remaining data gaps is representative and provides a robust basis for site assessment decisions. Preparation of the SAQP has been completed in general accordance with ASC NEPM (1999, amended 2013) methodology and includes:

- Data quality objectives.
- Sampling methodologies and procedures.
- Field screening methods.
- Sample handling, preservation and storage procedures.
- Analytical QA/QC.

4.1 Data Quality Objectives (DQO)

Data quality objectives (DQO) have been prepared as statements specifying qualitative and quantitative data required to support project decisions. DQO have been prepared in general accordance with NSW DEC (2006) guidelines and are presented in Table 6.

Table 6: Data quality objectives for the assessment of soil investigations.

Step 1 **Stating the Problem**	Data gaps from SESL (2015) detailed in Section 3.2 require assessment.
Step 2 **Identifying the Decision(s)**	Historical investigation review indicates former market garden areas, and fill material, including observed PACM, may be a source of contamination within the investigation area. To assess the suitability of the site for future primary school use, decisions are to be made based on the following questions: o Is site soil quality suitable for the intended primary school land use? o Has previous or current site use impacted the quality of site soils posing a human health risk during intended future land use including construction phase? o Do site soils require remediation or management prior to onsite primary school land use?
Step 3 **Identification of Inputs to the Decision**	The inputs to the assessment of site soil quality will include: o Soil sampling at nominated locations (where access is available) across the site. o Laboratory analytical results for relevant COPC. o Assessment of analytical results against site suitable human health and ecological risk criteria.

Step 4 **Study Boundary Definitions**	Study boundaries are as follows: o Lateral – Lateral boundary of the assessment is defined by the site boundary as indicated in Attachment A. o Vertical – Vertical boundary will be governed by the maximum depth reached during subsurface investigations. o Temporal – At this stage of investigation, only one round of sampling has been undertaken.
Step 5 **Development of Decision Rules**	The decision rule for this investigation area as follows: If the concentration of contaminants in the soil data exceeds the adopted site assessment criteria; an assessment of the need to further investigate, remediate and or manage the onsite impacts in relation to the proposed development will be undertaken.
Step 6 **Specification of Limits on Decision Errors**	Guidance found in ASC NEPM (1999 amended 2013) Schedule B2 regarding 95% upper confidence limit (UCL) states that the 95% UCL of the arithmetic mean provides a 95% confidence level that the true population mean will be less than or equal to this value. Therefore a decision can be made based on a probability that 95% of the data collected will satisfy the site acceptance criteria. A limit on decision error will be 5% that a conclusive statement may be incorrect.
Step 7 **Optimisation of Sampling Design**	Proposed sampling locations shall provide even coverage across identified areas of the site (with consideration to the existing site constraints). Sampling shall attempt to ensure that critical locations are assessed, sampled, and analysed for appropriate contaminants of concern. Soil sampling locations were set using a combined judgemental and grid pattern across the site (access permitting).

4.2 Data Quality Indicators (DQI)

In accordance with NSW DEC (2006), the investigation data set has been compared with Data Quality Indicators (DQI) outlined in Table 7 to ensure that collected data meets the project needs and that DQOs have been meet.

Table 7: Data Quality Indicators.

Assessment Measure (DQI)	Comment
Precision – A measure of the variability (or reproducibility) of data.	Precision is assessed by reviewing blind field duplicated sample set through the calculation of relative percent difference (RPD). Data precision is deemed acceptable where RPDs are less than 30%. Exceedance of this range is still considered acceptable where: o Results are less than 10 times the laboratory EQL. o Heterogeneous materials are sampled.
Accuracy – A measure of the closeness of reported data to the "true value".	Data accuracy is assessed by: o Method blanks. o Field spikes and blanks. o Laboratory control samples. o Matrix spikes.

Assessment Measure (DQI)	Comment
Representativeness – The confidence that data are representative of each media present on the site.	To ensure data representativeness the following field and laboratory procedures are followed: o Ensure that the design and implementation of the sampling program has been completed in accordance with MA standard operating procedures (SOP). o Blank samples shall be utilised during field sampling to ensure no cross contamination or laboratory artefacts. o Ensure that all laboratory hold times are met and that sample handling and transport is completed in accordance with MA SOP.
Completeness – A measure of the amount of usable data from a data collection activity.	To ensure data set completeness, the following is required: o Confirmation that all sampling methodology was completed in general accordance with MA SOP. o COC and receipt forms. o Results from all Laboratory QA/QC samples (Lab blanks, matrix spikes, lab duplicates). o NATA accreditation stamp on all laboratory reports.
Comparability - The confidence that data may be considered to be equivalent for each sampling and analytical event.	Data comparability is maintained by ensuring that: o All site sampling events are undertaken following methodologies outlined in MA SOP and published guidelines. o NATA accredited laboratory methodologies shall be followed on all laboratory testing.

4.3 Investigation and Sampling Methodology and Quality Assurance / Quality Control

Site investigation and soil sampling methodology (Table 8) was completed to meet the project DQOs.

Table 8: Investigation and sampling methodology.

Activity	Detail / Comments
Site History	A review of site history was completed.
Fieldworks	Subsurface investigations were completed within the investigation area on 10 February, 2017, and involved walkover inspection and the excavation of boreholes and the collection of surface samples. Boreholes (BH101 – BH114) were excavated using a 4WD truck-mounted drill rig with solid flight augers, and surface samples (S1 – S11) were excavated using a hand spade.
Soil sampling	Soil sampling was completed by the supervising MA environmental engineer. Each sample was placed into a laboratory-supplied, acid-rinsed 250mL glass jar, labelled with a unique identification number and no headspace to limit volatile loss. A clean pair of disposable gloves was used when handling each sample.

Activity	Detail / Comments
Sample compositing	Selected surface and borehole samples were triple composited for laboratory analysis as part of this investigation.
QA / QC sampling	Duplicate samples were collected at a rate of approximately 1 in 10 samples for intra-laboratory analysis. 4 soil duplicate samples were collected during investigations. Blank and trip spike samples were utilised during sampling.
Sample handling and transportation	Sample collection, storage and transport were conducted according to MA SOP. Collected samples were placed immediately into an ice chilled cooler-box. Samples were dispatched to NATA-accredited laboratories under chain of custody documentation within holding times.

A review of QA/QC procedure has been completed and is presented in the data validation report (Attachment E). The report concludes that data is suitable for the purposes of the assessment.

4.4 Laboratory Analytical Suite

Laboratory analysis was carried out by Envirolab Pty Ltd, a NATA accredited laboratory. Laboratory analytical documentation is presented in Attachment D. Soil laboratory analysis is summarised in Table 9.

Table 9: Summary of primary soil laboratory analyses.

COC	Number of Primary Samples Analysed
BTEX	4
TRH	4
PAH	4
Heavy metals[1]	22[2]
OCP/OPP	22[2]

Notes:
[1] Heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc.
[2] Four discrete samples and six triple composite samples.

5 Site Assessment Criteria

5.1 Overview

The site assessment criteria (SAC) adopted for this DSI have been derived from the following source:

- ASC NEPM (1999, amended 2013) National Environmental Protection (Assessment of Site Contamination) Measure (NEPM).
- CRC CARE (2011) Friebel, E. and Nadebaum, P. *Health screening levels for petroleum hydrocarbons in soil and groundwater: summary, Technical Report No. 10, CRC for Contamination Assessment and Remediation of the Environment.*

Guideline values for individual contaminants analysed for this assessment are presented in laboratory tables in Attachment C.

Table 10 summarises the applicability of the SAC adopted for this investigation.

Table 10: Summary of SAC.

Media	Adopted Guidelines	Applicability
Soil	ASC NEPM (1999, amended 2013) Soil HILs, EILs, HSLs, ESLs and TPH Management Limits	Health Investigation Levels (HILs) HIL A – residential land use with access to soil have been adopted due to intended primary school land use. Ecological Investigation Levels (EIL) Site EILs have been calculated using methodology outlined in ASC NEPM (1999, amended 2013). Typical conservative physiochemical properties of site soils have been used in EIL calculations. Ambient background concentrations (ABC) have been taken from Olszowy et al. (1995) for aged contamination in low traffic areas in NSW. Ecological Screening Levels (ESLs) ESLs for coarse grained soils in urban residential and open spaces (ASC NEPM 1999, amended 2013) have been adopted based on site lithology, and as a conservative measure. Health Screening Levels (HSL) HSLs A – residential land use for sand (ASC NEPM 1999, amended 2013) have been adopted based on site lithology, and as a conservative measure. Management Limits TPH management levels for coarse grained material have been selected based on site lithology, and as a conservative measure. Asbestos Due to the preliminary nature of this assessment, the presence / absence of asbestos has been adopted as SAC.
	CRC Care (2011): Soil Direct Contact HSLs	Direct Contact Health Screening Levels (HSLs) HSL-A for Residential (Low Density) land use has been adopted.

6 Results

6.1 MA Walkover and Historical Aerial Photograph Review

6.1.1 Walkover Findings

MA site inspection of the investigation area on 12 February, 2017, observed the following:

- Investigation area is currently open grassland and paddocks.
- An unnamed mapped tributary of Ropes Creek drains north through an online dam, forming the western boundary of the site.
- Fill material was observed in the western portion of the investigation area in the vicinity of erosion gullies identified in historic photos. Potential ACM (PACM) and builder's material inclusions were observed in fill material.
- Significant vegetation (i.e. typha and water hyacinth) within the dam.
- Large tree trunks on the ground in south eastern portion of investigation area.
- No structures were located within the investigation area.

6.1.2 Historical Aerial Photograph Review

Review of historical aerials indicate that:

- Much of the investigation area appears to have been used for market gardens from some time prior to 1965, until at least 2007.
- An eroded open channel is visible in 1955 extending south into the northern portion of Lot 2321 from Ropes Creek, which is located to the north of the site. The extent of the eroded channel increases across the north western portion of Lot 2321 from 1965 until at least 1994. The eroded channel is no longer visible in the 2007 and 2017 images, and the land is used for agricultural purposes, we infer the eroded channel was filled.

6.2 Field Observations

6.2.1 Natural Lithology

A summary of typical natural lithology observations is presented in Table 11. Detailed borehole logs are presented in Attachment F.

Table 11: Summary of natural soils.

Lithology [1]	Depth Range (mbgl) [2]
Clayey SILT – low plasticity, dark brown; Silty CLAY – low plasticity, brown/red; or Sandy CLAY – low plasticity, brown.	0.0 – 0.5 (variable)
CLAY – low plasticity, orange, brown, yellow, or grey, stiff to hard	0.15 – 2.2 (variable)
Weathered SHALE – grey, very low to low strength	1.4 – 3.0 (variable)

Notes:
[1] See borehole logs for detailed material description.
[2] Indicative depth range. Material depth may vary across the site depending on site and local geological conditions.

6.2.2 Fill and Stockpile Observations

Subsurface investigations and sampling was undertaken for fill material in the western portion of the investigation site. All collected samples were examined for signs of contamination (odours, fibrous material, inclusions, staining etc.).

Fill material was observed in Boreholes 113 and 114, consisting of:

BH113: - CLAY – red/grey, sandstone gravels, brick inclusions (0.0 to 0.30 mbgl).

BH114: - Clayey SILT – low plasticity, brown (0.0 to 0.15 mbgl) and
- Ripped/crushed SANDSTONE – yellow brown (0.7 to 1.5 mbgl); and
- Clayey SAND – grey/dark grained sand, with plastic and metal inclusions (1.5 to 4.0 mbgl).

No soil staining or malodourous materials were observed during investigations. ACM fragments were observed within fill material in the western portion of the site. Detailed borehole logs are presented in Attachment F.

6.3 Laboratory Analytical Results

The following sections summarise the results of soil laboratory analysis for samples taken. Detailed tabulated results showing individual sample concentrations compared to adopted SAC values are available in Attachment C. Laboratory analytical documentation is available in Attachment D.

Table 12: Summary of soil laboratory results for Lots 2320 and 2321 DP 1223137.

Analyte	Results Compared to SAC
Heavy Metals[1]	HILs All results below SAC. EIL All results below SAC.
OCP/OPP	HILs All results below SAC. EIL All results below SAC.
BTEX/TRH	HSLs All results below SAC. ESLs All results below SAC. Management limits All results below SAC.
PAH	HSLs All results below SAC. HILs All results below SAC. ESL All results below SAC.
Asbestos material	**Asbestos (chrysotile and amosite) detected in ASB101**.

Notes:
[1] Heavy metals – arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc.

7 Discussion

7.1 Overview

All results for tested analytes in soil samples were less than the adopted SAC for HILs, HSLs, EILs and Management Limits.

Asbestos (chrysotile and amosite) was detected in material sample ASB101 in the form of fibre cement sheeting fragments.

7.2 Asbestos Material Contamination

Material sample ASB101 was collected from the soil surface from areas associated with observed fill material to the south east of the dam. Additional potential asbestos material fragments were observed in the vicinity during site walkover inspection.

8 Conclusions and Recommendations

All soil samples tested were below the adopted SAC.

The positive identification of ACM cement fibre sheeting identifies risks to human receptors identified in the preliminary DSI. A remediation action plan (RAP) will be required to address this contamination risk and site remediation be completed prior to primary school development and use.

We consider that the site can be made suitable for proposed primary school development provided that a RAP is developed and implemented accordingly. A likely remediation strategy may involve the removal and offsite disposal of identified contaminated soil and ACM material. The RAP is to outline waste management requirements in light of any additional investigations or unexpected finds.

Following remediation works, a validation report is required to be prepared to confirm site suitability for the proposed development.

Prior to any soil or ACM material being removed from site, a formal waste classification assessment in accordance with NSW DECCW Waste Classification Guidelines (2014) is required.

9 Limitations

This DSI was undertaken in accordance with current industry standards.

It is important to note that no land contamination study can be considered to be a complete and exhaustive characterisation of a site nor can it be guaranteed that any assessment shall identify and characterise all areas of potential contamination or all past potentially contaminating land-uses. Therefore, this report should not be read as a guarantee that only contamination identified shall be found on the site. Should material be exposed in future which appears to be contaminated, additional testing may be required to determine the implications for the site.

Martens & Associates Pty Ltd has undertaken this assessment for the purposes of assessing potential site contamination. No reliance on this report should be made for any other investigation or proposal. Martens & Associates accepts no responsibility, and provides no guarantee regarding the characteristics of areas of the site not specifically studied in this investigation.

10 References

ASC NEPM (1999, amended 2013) *National Environmental Protection Measure, 1999 (site contamination measure).*

CRC CARE (2011) Friebel, E. and Nadebaum, P. *Health screening levels for petroleum hydrocarbons in soil and groundwater: summary, Technical Report No. 10, CRC for Contamination Assessment and Remediation of the Environment.*

Fairfield City Council (2013*) Fairfield Local Environmental Plan.*

GeoStrata (2017) *Plan of Detail over Lots 2320 and 2321 in DP 1223137 Being Nos 17 and 19 Kosovich Place, Cecil Park* (ref 1266 Detail 06).

Google Maps (2009).

Nearmap – Aerial photographs (2017).

NSW Department of Mineral Resources, (1991) *Penrith 1:100,000 Geological Sheet 9030*.

NSW DEC (1995) *Contaminated Sites – Guidelines for Assessing Former Orchards and Market Gardens*.

NSW DEC (2006) *2nd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.

NSW DEC (2006) *2nd Ed. Contaminated Sites: Guidelines for the NSW Site Auditor Scheme*.

NSW EPA (1995) *Sampling Design Guidelines.*

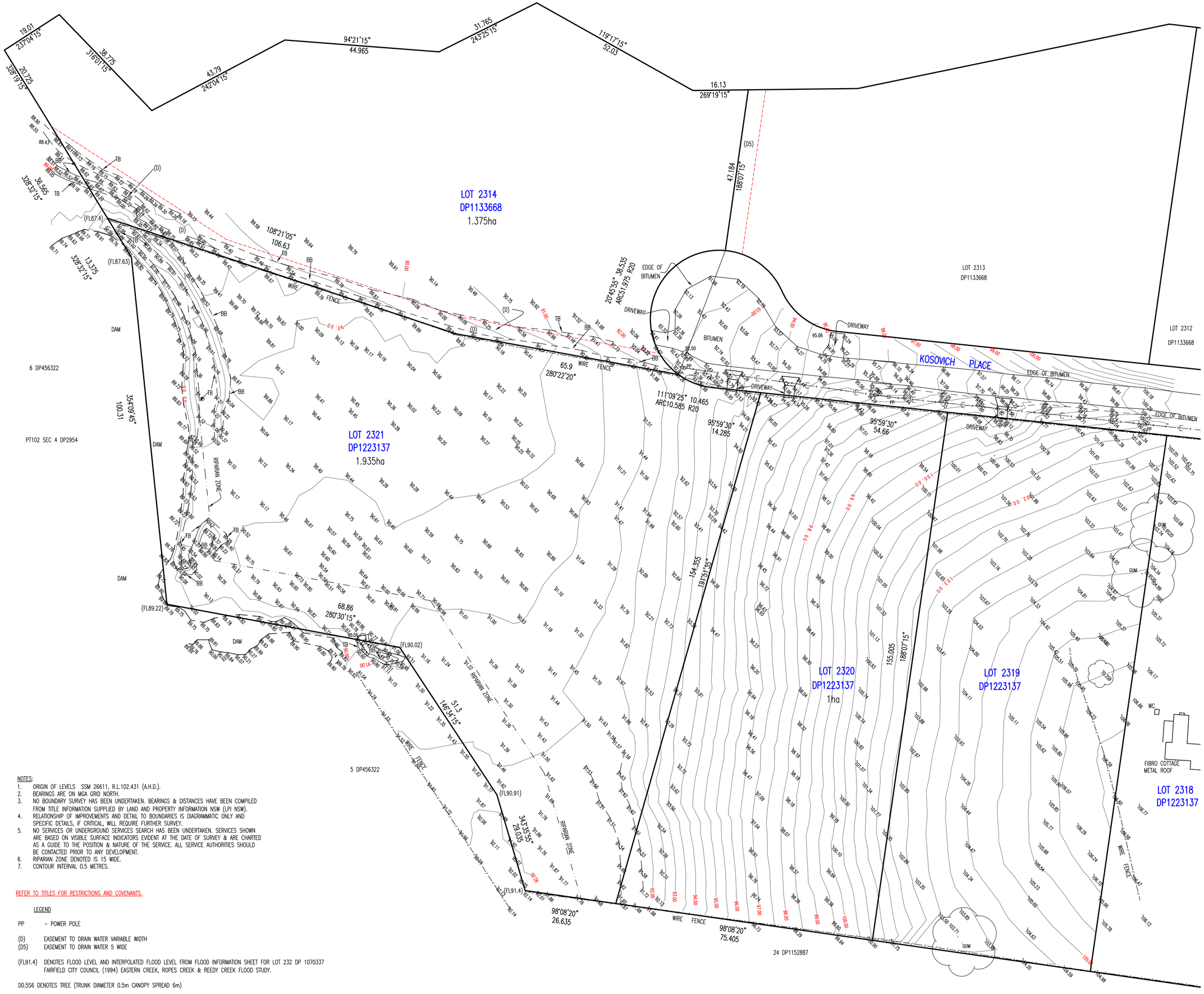
NSW Land and Property Information (LPI) - Aerial photographs (1955, 1970, 1994).

NSW OEH (2011) *Contaminated Sites: Guidelines for Consultants Reporting on Contaminated Sites*.

SEPP *55 Remediation of Land.*

SESL Australia (2015) *Detailed Site Investigation – 153-189 Wallgrove Road, Cecil Park, NSW (Lot 2315 DP 1133688).*

11 Attachment A – Detail Survey (GeoStrata, 2017), and Site Sampling Plan



NOTES:

1. ORIGIN OF LEVELS SSM 26611, R.L.102.431 (A.H.D.).
2. BEARINGS ARE ON MGA GRID NORTH.
3. NO BOUNDARY SURVEY HAS BEEN UNDERTAKEN. BEARINGS & DISTANCES HAVE BEEN COMPILED FROM TITLE INFORMATION SUPPLIED BY LAND AND PROPERTY INFORMATION NSW (LPI NSW).
4. RELATIONSHIP OF IMPROVEMENTS AND DETAIL TO BOUNDARIES IS DIAGRAMMATIC ONLY AND SPECIFIC DETAILS, IF CRITICAL, WILL REQUIRE FURTHER SURVEY.
5. NO SERVICES OR UNDERGROUND SERVICES SEARCH HAS BEEN UNDERTAKEN. SERVICES SHOWN ARE BASED ON VISIBLE SURFACE INDICATORS EVIDENT AT THE DATE OF SURVEY & ARE CHARTED AS A GUIDE TO THE POSITION & NATURE OF THE SERVICE. ALL SERVICE AUTHORITIES SHOULD BE CONTACTED PRIOR TO ANY DEVELOPMENT.
6. RIPARIAN ZONE DENOTED IS 15 WIDE.
7. CONTOUR INTERVAL 0.5 METRES.

REFER TO TITLES FOR RESTRICTIONS AND COVENANTS.

LEGEND

PP – POWER POLE

(D) EASEMENT TO DRAIN WATER VARIABLE WIDTH
(D5) EASEMENT TO DRAIN WATER 5 WIDE

(FL91.4) DENOTES FLOOD LEVEL AND INTERPOLATED FLOOD LEVEL FROM FLOOD INFORMATION SHEET FOR LOT 232 DP 1070337 FAIRFIELD CITY COUNCIL (1994) EASTERN CREEK, ROPES CREEK & REEDY CREEK FLOOD STUDY.

D0.5S6 DENOTES TREE (TRUNK DIAMETER 0.5m CANOPY SPREAD 6m)

PLAN OF DETAIL OVER LOTS 2320 & 2321 IN DP1223137 BEING Nos. 17 & 19 KOSOVICH PLACE CECIL PARK

GeoStrata
Project Surveying
Land Development and Title Consulting
PO Box 5195
Greenwich NSW 2065
t: 02 9405 2242
f: 02 9405 2216
e: info@geostrata.com.au
www.geostrata.com.au

SCALE: 1:500		DATE: 1/3/2017	
DATUM: AHD		CLIENT: PMDL	
PROJECT No. 1266		SHEET SIZE: A1	
DRAWN	CHECKED	COORDINATED	APPROVED
DD	PW	PW	PW
DRAWING No. 1266 DETAIL 06			REVISION 00

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
C	**AMENDED TEXT LEADER**	**31/07/2018**	**LZ**	**CS**	**TH**	**TH**
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 7.5 15.0 22.5 30.0 37.5 45.0 52.5 60.0 67.5 75.0 METRES
A1 (A3) 1:750 (1:1,500)

GRID	DATUM	PROJECT MANAGER
---	---	TH

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martens & Associates Pty Ltd
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Geotechnical
Civil
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DRAWING TITLE
BOREHOLES AND SURFACE SAMPLE LOCATIONS SOURCE NEARMAP 2017

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ09	C

DRAWING ID: P1705798-PS02-R03-AZ09

PRINTED: --- --- (USER: LZW)
A1 / A3 LANDSCAPE (A1LC_v02.0.01)

12 Attachment B – Historical Aerial Photos

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID	DATUM	PROJECT MANAGER
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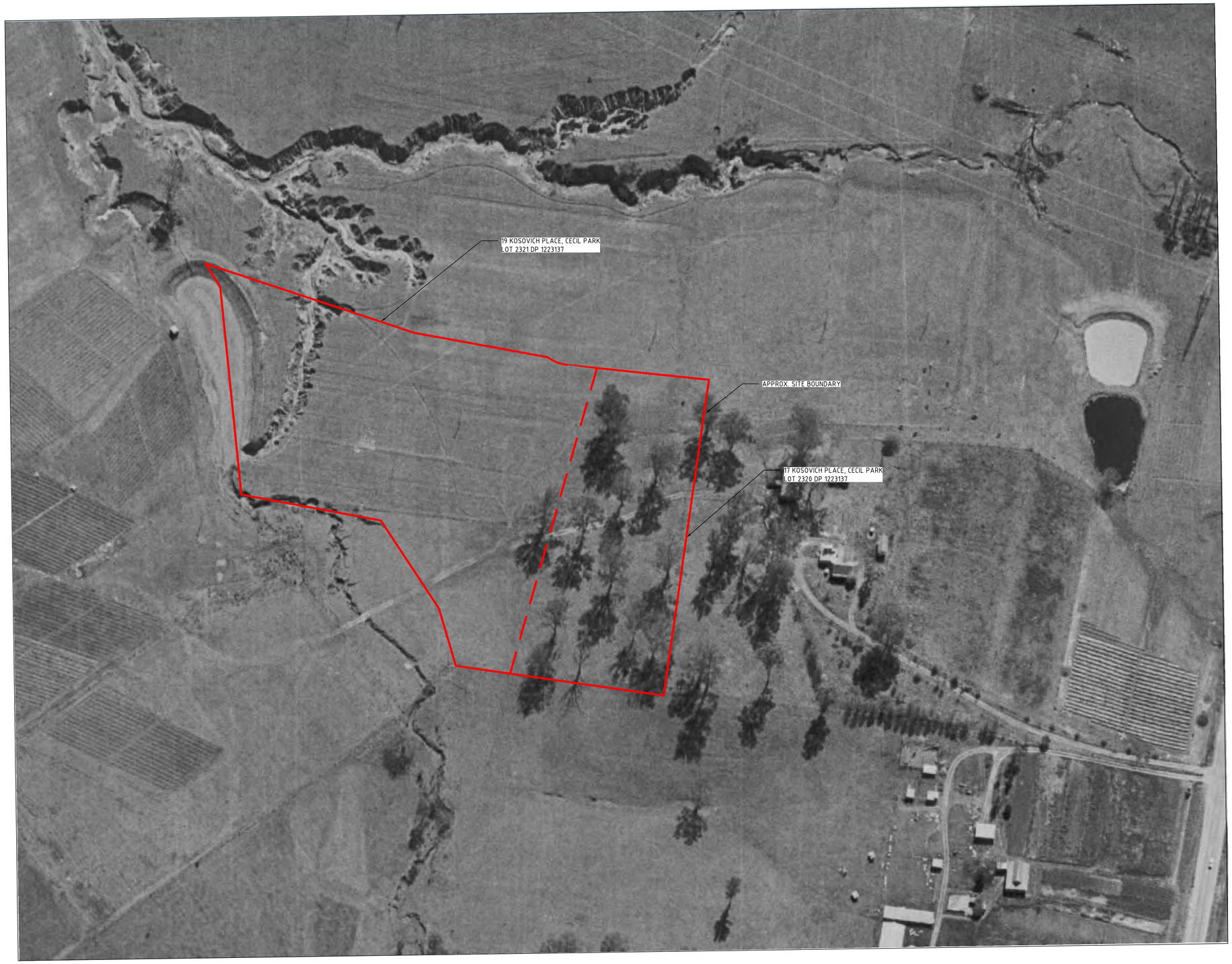
DRAWING TITLE
AERIAL PHOTOGRAPHY
1955
SOURCE NSW LPI

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ01	B

PRINTED: ---- USER: LZHOU
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1705798-PS02-R03-AZ01



REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID: ---
DATUM: ---
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DRAWING TITLE
AERIAL PHOTOGRAPHY
1965
SOURCE GOOGLE EARTH MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ02	B

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A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1705798-PS02-R03-AZ02

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
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A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID: ---
DATUM: ---
PROJECT MANAGER: TH

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DRAWING TITLE
AERIAL PHOTOGRAPHY
1978
SOURCE GOOGLE EARTH MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ03	B

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REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
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A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID	DATUM	PROJECT MANAGER
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DRAWING TITLE
AERIAL PHOTOGRAPHY
1986
SOURCE GOOGLE EARTH MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ04	B

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A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1705798-PS02-R03-AZ04

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID: ---
DATUM: ---
PROJECT MANAGER: TH

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DRAWING TITLE
AERIAL PHOTOGRAPHY
1994
SOURCE GOOGLE EARTH MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ05	B

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID	DATUM	PROJECT MANAGER
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DRAWING TITLE
AERIAL PHOTOGRAPHY
2007
SOURCE GOOGLE EARTH MAP

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ06	B

DRAWING ID: P1705798-PS02-R03-AZ06

PRINTED: --- - USER: LZHOU

A1 / A3 LANDSCAPE (A1LC_v02.0.01)

REV	DESCRIPTION	DATE	DRAWN	DESIGNED	CHECKED	APPRVD
B	CHECKED AND APPROVED	25/07/2018	LZ	CS	TH	TH
A	INITIAL RELEASE	08/03/2018	KH	CS		

SCALE
0 10 20 30 40 50 60 70 80 90 100 METRES
A1 (A3) 1:1,000 (1:2,000)

GRID	DATUM	PROJECT MANAGER
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DRAWING TITLE
AERIAL PHOTOGRAPHY
2017
SOURCE NEARMAP 2017

PROJECT NO.	PLANSET NO.	RELEASE NO.	DRAWING NO.	REVISION
P1705798	PS02	R03	PS02-AZ07	B

PRINTED: --- USER: LZHOU
A1 / A3 LANDSCAPE (A1LC_v02.0.01)
DRAWING ID: P1705798-PS02-R03-AZ07

13 Attachment C – Laboratory Result Summary Tables

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	BTEX							PAH/Phenols															TPH									
	Benzene	Ethylbenzene	Toluene	Xylene (m & p)	Xylene (o)	Xylene Total	C6-C10 less BTEX (F1)	Acenaphthene	Acenaphthylene	Anthracene	Benz(a)anthracene	Benzo(a) pyrene	Benzo(g,h,i)perylene	Chrysene	Dibenz(a,h)anthracene	Carcinogenic PAHs (as B(a)P TPE)	Fluoranthene	Fluorene	Indeno(1,2,3-c,d)pyrene	Naphthalene	Phenanthrene	Pyrene	C10-C16	C16-C34	C34-C40	F2-NAPHTHALENE	C6 - C9	C10 - C14	C15 - C28	C29-C36	C10 - C40 (Sum of total)	C6-C10
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.2	1	0.5	2	1	1	25	0.1	0.1	0.1	0.1	0.05	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	50	100	100	50	25	50	100	100	50	25
Direct Contact HSL-A	100	4500	14000			12000														1400			3300	4500	6300							4400
NEPM 2013 Table 1A(1) HILs Res A Soil																3																
NEPM 2013 Table 1A(3) Res A/B Soil HSL for Vapour Intrusion, Sand																																
0-1m	0.5	55	160			40	45													3						110						
1-2m	0.5	NL	220			60	70													NL						240						
2-4m	0.5	NL	310			95	110													NL						440						
>4m	0.5	NL	540			170	200													NL						NL						
NEPM 2013 Table 1B(6) ESLs for Urban Res, Coarse Soil																																
0-2m	50	70	85			105	180					0.7												300	2800	120						
NEPM 2013 Table 1B(7) Management Limits Comm / Ind, Coarse Soil																							1000	5000	10000							800
Field_ID																																
5798/BH111/0.1/S/1	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
5798/BH113/0.2/S/1	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
5798/BH114/0.1/S/1	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
5798/SS01	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Statistical Summary																																
Number of Results	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4	4
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	<0.2	<1	<0.5	<2	<1	<1	<25	<0.1	<0.1	<0.1	<0.1	<0.05	<0.1	<0.1	<0.1	<0.172	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<50	<100	<100	<50	<25	<50	<100	<100	<50	<25
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.1	0.5	0.25	1	0.5	0.5	13	0.05	0.05	0.05	0.05	0.025	0.05	0.05	0.05	0.086	0.05	0.05	0.05	0.05	0.05	0.05	25	50	50	25	13	25	50	50	25	13
Median Concentration	0.1	0.5	0.25	1	0.5	0.5	12.5	0.05	0.05	0.05	0.05	0.025	0.05	0.05	0.05	0.086	0.05	0.05	0.05	0.05	0.05	0.05	25	50	50	25	12.5	25	50	50	25	12.5
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Halogenated Benzenes	Organochlorine Pesticides																					Organophosphorous Pesticides											Pesticides
	Hexachlorobenzene	4,4-DDE	a-BHC	Aldrin	Aldrin + Dieldrin	b-BHC	Chlordane (cis)	Chlordane (trans)	d-BHC	DDD	DDT	DDT+DDE+DDD	Dieldrin	Endosulfan I	Endosulfan II	Endosulfan sulphate	Endrin	Endrin aldehyde	g-BHC (Lindane)	Heptachlor	Heptachlor epoxide	Methoxychlor	Azinophos methyl	Bromophos-ethyl	Chlorpyrifos	Chlorpyrifos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Ronnel	Parathion
	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	0.1	0.1	0.1		0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
NEPM 2013 Table 1A(1) HILs Res A Soil	10				6							240					10			6		300			160									
Site Specific EIL											180																							
Field_ID																																		
5798/BH111/0.1/S/1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/BH113/0.2/S/1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/BH114/0.1/S/1	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C01	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C02	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C03	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C04	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C05	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/C06	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/SS01	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/SS04	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
5798/SS10	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Statistical Summary																																		
Number of Results	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12	12
Number of Detects	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Minimum Concentration	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Minimum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Maximum Concentration	<0.1	<0.1	<0.1	<0.1	<0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Maximum Detect	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Average Concentration	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Median Concentration	0.05	0.05	0.05	0.05	0.1	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
Standard Deviation	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0

	Inorganics		Lead	Metals						
	Moisture	Sulphate	Lead	Arsenic	Cadmium	Chromium (III+VI)	Copper	Mercury	Nickel	Zinc
	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
EQL	0.1	10	1	4	0.4	1	1	0.1	1	1
NEPM 2013 Table 1A(1) HILs Res A Soil			300	100	20		6000	40	400	7400
Site Specific EIL			1100	100			220		230	640
Field_ID										
5798/BH102/0.25/S/1	-	41	-	-	-	-	-	-	-	-
5798/BH102/0.5/S/1	-	60	-	-	-	-	-	-	-	-
5798/BH102/1.0/S/1	-	29	-	-	-	-	-	-	-	-
5798/BH102/2.0/S/1	-	39	-	-	-	-	-	-	-	-
5798/BH103/0.25/S/1	-	91	-	-	-	-	-	-	-	-
5798/BH103/0.5/S/1	-	140	-	-	-	-	-	-	-	-
5798/BH103/1.5/S/1	-	20	-	-	-	-	-	-	-	-
5798/BH103/2.5/S/1	-	<10	-	-	-	-	-	-	-	-
5798/BH111/0.1/S/1	24	-	71	7	<0.4	19	29	0.1	9	100
5798/BH111/0.3/S/1	-	<10	-	-	-	-	-	-	-	-
5798/BH111/0.6/S/1	-	54	-	-	-	-	-	-	-	-
5798/BH113/0.2/S/1	17	-	26	11	<0.4	20	14	0.1	3	17
5798/BH114/0.1/S/1	14	-	35	6	<0.4	20	20	<0.1	8	54
5798/C01	15	-	34	9	<0.4	18	31	0.1	9	110
5798/C02	17	-	24	8	<0.4	19	27	<0.1	12	110
5798/C03	21	-	16	8	<0.4	19	29	<0.1	15	52
5798/C04	20	-	16	8	<0.4	20	33	<0.1	13	52
5798/C05	19	-	13	9	<0.4	22	27	<0.1	16	44
5798/C06	19	-	16	9	<0.4	21	25	<0.1	13	37
5798/SS01	24	-	42	6	<0.4	24	26	0.1	21	76
5798/SS04	15	-	22	8	<0.4	21	21	<0.1	11	290
5798/SS10	34	-	21	9	<0.4	20	34	<0.1	12	55
Statistical Summary										
Number of Results	12	10	12	12	12	12	12	12	12	12
Number of Detects	12	8	12	12	0	12	12	4	12	12
Minimum Concentration	14	<10	13	6	<0.4	18	14	<0.1	3	17
Minimum Detect	14	20	13	6	ND	18	14	0.1	3	17
Maximum Concentration	34	140	71	11	<0.4	24	34	0.1	21	290
Maximum Detect	34	140	71	11	ND	24	34	0.1	21	290
Average Concentration	20	48	28	8.2	0.2	20	26	0.067	12	83
Median Concentration	19	40	23	8	0.2	20	27	0.05	12	54.5
Standard Deviation	5.5	41	16	1.4	0	1.6	5.7	0.025	4.5	71
Number of Guideline Exceedances	0	0	0	0	0	0	0	0	0	0
Number of Guideline Exceedances(Detects Only)	0	0	0	0	0	0	0	0	0	0

14 Attachment D – Laboratory Certificates

COC received 21/2

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consulting engineers since 1989

SOIL ANALYSIS CHAIN OF CUSTODY FORM

Additional Testing												
Name	P1705798JCOC01V01											
Martens Contact Officer	Robert Mehaffey					**Contact Email**	rmehaffey@martens.com.au					
Sampling and Shipping	**Sample Date**	10.02.2017		**Dispatch Date**	15.02.2017		**Turnaround Time**		standard			
	Our Reference	P1705798JCOC01V01				**Shipping Method (X)**	**Hand**		**Post**		**Courier**	X
	On Ice (X)	X	**No Ice (X)**		**Other (X)**							
Laboratory												
Name	EnviroLab											
Sample Delivery Address	12 Ashley Street, Chatswood											
Delivery Contact	**Name**	Aileen		**Phone**	9910 6200	**Fax**		**Email**	ahie@envirolabservices.com.au			
Please Send Report By (X)	**Post**		**Fax**		**Email**	X	**Reporting Email Address**	rmehaffey@martens.com.au anorris@martens.com.au				

	Sample ID	Composite
1	5798/SS02	C01
2	5798/SS03	
3	5798/SS05	
4	5798/SS06	C02
5	5798/SS07	
6	5798/SS08	
7	5798/SS09	C03
8	5798/SS10	
9	5798/BH103/0.25/S/1	
10	5798/SS11	C04
11	5798/BH104/0.4/S/1	
12	5798/BH105/0.1/S/1	

	Sample ID	Composite
13	5798/BH101/0.4/S/1	C05
14	5798/BH102/0.25/S/1	
15	5798/BH106/0.2/S/1	
16	5798/BH107/0.2/S/1	C06
17	5798/BH108/0.2/S/1	
18	5798/BH109/0.1/S/1	

ENVIROLAB

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

Job No: 162213
Date Received: ~~21/2~~ 15/2
Time Received: 15:30
Received by: JAG
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Head Office
Suite 201 Level 2, 20 George Street
Hornsby NSW 2077, Australia
Ph 02 9476 9999 **Fax** 02 9476 8767

> mail@martens.com.au
> www.martens.com.au
MARTENS & ASSOCIATES P/L
ABN 85 070 240 890 ACN 070 240 890

SOIL ANALYSIS CHAIN OF CUSTODY

162213

	Sample ID	OCP/OPP	8 HM	pH	EC	S04	Combo 5b	BTEX	TRH		Asbestos (Material)		Hold
62	5798/C01	X	X										
63	5798/C02	X	X										
64	5798/C03	X	X										
65	5798/C04	X	X										
66	5798/C05	X	X										
67	5798/C06	X	X										
13	5798/BH101/0.4/S/1												X
19	5798/BH101/0.6/S/1												X
20	5798/BH101/0.9/S/1												X
14	5798/BH102/0.25/S/1			X	X	X							
21	5798/BH102/0.5/S/1			X	X	X							
22	5798/BH102/1.0/S/1			X	X	X							
23	5798/BH102/2.0/S/1			X	X	X							
9	5798/BH103/0.25/S/1			X	X	X							
24	5798/BH103/0.5/S/1			X	X	X							
25	5798/BH103/1.5/S/1			X	X	X							
26	5798/BH103/2.5/S/1			X	X	X							
11	5798/BH104/0.4/S/1												X
27	5798/BH104/0.8/S/1												X
12	5798/BH105/0.1/S/1												X
28	5798/BH105/0.4/S/1												X
29	5798/BH105/0.9/S/1												X
30	5798/BH105/1.3/S/1												X
15	5798/BH106/0.2/S/1												X
31	5798/BH106/0.9/S/1												X
16	5798/BH107/0.2/S/1												X
32	5798/BH107/0.5/S/1												X
33	5798/BH107/0.8/S/1												X
17	5798/BH108/0.2/S/1												X
34	5798/BH108/0.6/S/1												X
35	5798/BH108/1.1/S/1												X
18	5798/BH109/0.1/S/1												X
36	5798/BH109/0.4/S/1												X
37	5798/BH109/0.9/S/1												X
38	5798/BH109/2.1/S/1												X
39	5798/BH110/0.1/S/1												X
40 35	5798/BH110/1.0/S/1												X
41	5798/BH111/0.1/S/1						X						
42	5798/BH111/0.3/S/1			X	X	X							
43	5798/BH111/0.6/S/1			X	X	X							
44	5798/BH112/0.4/S/1												X
45	5798/BH112/0.8/S/1												X
46	5798/BH113/0.2/S/1						X						

SOIL ANALYSIS CHAIN OF CUSTODY

Page of

162213

	Sample ID	OCP/OPP	8 HM	pH	EC	S04	Combo 5b	BTEX	TRH		Asbestos (Material)		Hold
47	5798/BH113/0.8/S/1												X
48	5798/BH114/0.1/S/1						X						
49	5798/BH114/0.4/S/1												X
50	5798/BH114/0.8/S/1												X
51	5798/BH114/2.0/S/1												X
52	5798/BH114/2.4/S/1												X
53	5798/SS01						X						
1	5798/SS02												X
2	5798/SS03												X
54	5798/SS04	X	X										
3	5798/SS05												X
4	5798/SS06												X
5	5798/SS07												X
6	5798/SS08												X
7	5798/SS09												X
8	5798/SS10	X	X										
10	5798/SS11												X
55	5798/Dup101	X	X										
56	5798/Dup102	X	X										
57	5798/Dup103	X	X										
58	5798/Dup104	X	X										
59	5798/ASB101										X		
60	Trip Spike							X					
61	Trip Blank								X				

12 Ashley Street, Chatswood, NSW 2067
tel: +61 2 9910 6200

email: sydney@envirolab.com.au
envirolab.com.au

Envirolab Services Pty Ltd - Sydney | ABN 37 112 535 645

CERTIFICATE OF ANALYSIS 162213

Client:

Martens & Associates Pty Ltd
Suite 201, 20 George St
Hornsby
NSW 2077

Attention: Robert Mehaffey, A Norris

Sample log in details:

Your Reference:	**P1705798JCOC01V01**
No. of samples:	1 Material, 60 Soils, 6 Composites
Date samples received / completed instructions received	15/02/17 / 21/02/17

Analysis Details:

Please refer to the following pages for results, methodology summary and quality control data.
Samples were analysed as received from the client. Results relate specifically to the samples as received.
Results are reported on a dry weight basis for solids and on an as received basis for other matrices.
Please refer to the last page of this report for any comments relating to the results.

Report Details:

Date results requested by: / Issue Date:	28/02/17 / 27/02/17
Date of Preliminary Report:	Not Issued

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

Results Approved By:

David Springer
General Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference:	UNITS	162213-41	162213-46	162213-48	162213-53	162213-60
Your Reference	---------- -	5798/BH111/0.1/ S/1	5798/BH113/0.2/ S/1	5798/BH114/0.1/ S/1	5798/SS01	Trip Spike
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
TRHC$_6$ - C$_9$	mg/kg	<25	<25	<25	<25	[NA]
TRHC$_6$ - C$_{10}$	mg/kg	<25	<25	<25	<25	[NA]
vTPHC$_6$ - C$_{10}$ less BTEX (F1)	mg/kg	<25	<25	<25	<25	[NA]
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	78%
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	84%
Ethylbenzene	mg/kg	<1	<1	<1	<1	89%
m+p-xylene	mg/kg	<2	<2	<2	<2	89%
o-Xylene	mg/kg	<1	<1	<1	<1	89%
Total +ve Xylenes	mg/kg	<1	<1	<1	<1	[NA]
naphthalene	mg/kg	<1	<1	<1	<1	[NA]
Surrogate aaa-Trifluorotoluene	%	86	93	93	82	78

vTRH(C6-C10)/BTEXN in Soil		
Our Reference:	UNITS	162213-61
Your Reference	---------- -	Trip Blank
Composite Reference	----------	-
Date Sampled		10/02/2017
Type of sample		Soil
Date extracted	-	22/02/2017
Date analysed	-	23/02/2017
TRHC$_6$ - C$_9$	mg/kg	<25
TRHC$_6$ - C$_{10}$	mg/kg	<25
Surrogate aaa-Trifluorotoluene	%	95

svTRH (C10-C40) in Soil						
Our Reference:	UNITS	162213-41	162213-46	162213-48	162213-53	162213-61
Your Reference	----------	5798/BH111/0.1/ S/1	5798/BH113/0.2/ S/1	5798/BH114/0.1/ S/1	5798/SS01	Trip Blank
Composite Reference	- ----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
$TRHC_{10}$ - C_{14}	mg/kg	<50	<50	<50	<50	<50
$TRHC_{15}$ - C_{28}	mg/kg	<100	<100	<100	<100	<100
$TRHC_{29}$ - C_{36}	mg/kg	<100	<100	<100	<100	<100
$TRH>C_{10}$-C_{16}	mg/kg	<50	<50	<50	<50	<50
$TRH>C_{10}$ - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
$TRH>C_{16}$-C_{34}	mg/kg	<100	<100	<100	<100	<100
$TRH>C_{34}$-C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	89	86	86	88	89

PAHs in Soil Our Reference: Your Reference Composite Reference Date Sampled Type of sample	UNITS ---------- - ---------- 	162213-41 5798/BH111/0.1/ S/1 - 10/02/2017 Soil	162213-46 5798/BH113/0.2/ S/1 - 10/02/2017 Soil	162213-48 5798/BH114/0.1/ S/1 - 10/02/2017 Soil	162213-53 5798/SS01 - 10/02/2017 Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017
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
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
Total +ve PAH's	mg/kg	<0.05	<0.05	<0.05	<0.05
Surrogate p-Terphenyl-d14	%	103	107	97	94

Organochlorine Pesticides in soil						
Our Reference:	UNITS	162213-8	162213-41	162213-46	162213-48	162213-53
Your Reference	---------- -	5798/SS10	5798/BH111/0.1/ S/1	5798/BH113/0.2/ S/1	5798/BH114/0.1/ S/1	5798/SS01
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-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
beta-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
pp-DDD	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-DDT	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
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	%	99	101	98	94	99

Organochlorine Pesticides in soil						
Our Reference:	UNITS	162213-54	162213-55	162213-56	162213-57	162213-58
Your Reference	----------	5798/SS04	5798/Dup101	5798/Dup102	5798/Dup103	5798/Dup104
Composite Reference	- ----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-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
beta-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
pp-DDD	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-DDT	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
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	%	96	98	95	94	94

Organochlorine Pesticides in soil						
Our Reference:	UNITS	162213-62	162213-63	162213-64	162213-65	162213-66
Your Reference	----------	5798/C01	5798/C02	5798/C03	5798/C04	5798/C05
Composite Reference	- ----------	1+2+3	4+5+6	7+8+9	10+11+12	13+14+15
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-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
beta-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
pp-DDD	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-DDT	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
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	%	92	96	99	96	96

Organochlorine Pesticides in soil		
Our Reference:	UNITS	162213-67
Your Reference	----------	5798/C06
	-	
Composite Reference	----------	16+17+18
Date Sampled		10/02/2017
Type of sample		Soil
Date extracted	-	22/02/2017
Date analysed	-	23/02/2017
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	96

Organophosphorus Pesticides Our Reference: Your Reference Composite Reference Date Sampled Type of sample	UNITS ---------- - ---------- -	162213-8 5798/SS10 - 10/02/2017 Soil	162213-41 5798/BH111/0.1/ S/1 - 10/02/2017 Soil	162213-46 5798/BH113/0.2/ S/1 - 10/02/2017 Soil	162213-48 5798/BH114/0.1/ S/1 - 10/02/2017 Soil	162213-53 5798/SS01 - 10/02/2017 Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Azinphos-methyl (Guthion)	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
Chlorpyriphos	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
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
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
Ethion	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
Parathion	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
Surrogate TCMX	%	99	101	98	94	99

Organophosphorus Pesticides Our Reference: Your Reference Composite Reference Date Sampled Type of sample	UNITS ---------- - ---------- -	162213-54 5798/SS04 - 10/02/2017 Soil	162213-55 5798/Dup101 - 10/02/2017 Soil	162213-56 5798/Dup102 - 10/02/2017 Soil	162213-57 5798/Dup103 - 10/02/2017 Soil	162213-58 5798/Dup104 - 10/02/2017 Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Azinphos-methyl (Guthion)	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
Chlorpyriphos	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
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
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
Ethion	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
Parathion	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
Surrogate TCMX	%	96	98	95	94	94

Organophosphorus Pesticides						
Our Reference:	UNITS	162213-62	162213-63	162213-64	162213-65	162213-66
Your Reference	----------	5798/C01	5798/C02	5798/C03	5798/C04	5798/C05
	-					
Composite Reference	----------	1+2+3	4+5+6	7+8+9	10+11+12	13+14+15
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Azinphos-methyl (Guthion)	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
Chlorpyriphos	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
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
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
Ethion	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
Parathion	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
Surrogate TCMX	%	92	96	99	96	96

Organophosphorus Pesticides		
Our Reference:	UNITS	162213-67
Your Reference	----------	5798/C06
	-	
Composite Reference	----------	16+17+18
Date Sampled		10/02/2017
Type of sample		Soil
Date extracted	-	22/02/2017
Date analysed	-	23/02/2017
Azinphos-methyl (Guthion)	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Ethion	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Parathion	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Surrogate TCMX	%	96

Acid Extractable metals in soil						
Our Reference:	UNITS	162213-8	162213-41	162213-46	162213-48	162213-53
Your Reference	---------- -	5798/SS10	5798/BH111/0.1/ S/1	5798/BH113/0.2/ S/1	5798/BH114/0.1/ S/1	5798/SS01
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Arsenic	mg/kg	9	7	11	6	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	20	19	20	20	24
Copper	mg/kg	34	29	14	20	26
Lead	mg/kg	21	71	26	35	42
Mercury	mg/kg	<0.1	0.1	0.1	<0.1	0.1
Nickel	mg/kg	12	9	3	8	21
Zinc	mg/kg	55	100	17	54	76

Acid Extractable metals in soil						
Our Reference:	UNITS	162213-54	162213-55	162213-56	162213-57	162213-58
Your Reference	---------- -	5798/SS04	5798/Dup101	5798/Dup102	5798/Dup103	5798/Dup104
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Arsenic	mg/kg	8	6	8	7	8
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	21	34	18	20	18
Copper	mg/kg	21	26	21	18	28
Lead	mg/kg	22	38	40	20	18
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	11	27	8	11	11
Zinc	mg/kg	290	82	70	290	49

Acid Extractable metals in soil						
Our Reference:	UNITS	162213-62	162213-63	162213-64	162213-65	162213-66
Your Reference	---------- -	5798/C01	5798/C02	5798/C03	5798/C04	5798/C05
Composite Reference	----------	1+2+3	4+5+6	7+8+9	10+11+12	13+14+15
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Arsenic	mg/kg	9	8	8	8	9
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	18	19	19	20	22
Copper	mg/kg	31	27	29	33	27
Lead	mg/kg	34	24	16	16	13
Mercury	mg/kg	0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	9	12	15	13	16
Zinc	mg/kg	110	110	52	52	44

Acid Extractable metals in soil		
Our Reference:	UNITS	162213-67
Your Reference	---------- -	5798/C06
Composite Reference	----------	16+17+18
Date Sampled		10/02/2017
Type of sample		Soil
Date prepared	-	22/02/2017
Date analysed	-	23/02/2017
Arsenic	mg/kg	9
Cadmium	mg/kg	<0.4
Chromium	mg/kg	21
Copper	mg/kg	25
Lead	mg/kg	16
Mercury	mg/kg	<0.1
Nickel	mg/kg	13
Zinc	mg/kg	37

Moisture						
Our Reference:	UNITS	162213-8	162213-41	162213-46	162213-48	162213-53
Your Reference	---------- -	5798/SS10	5798/BH111/0.1/ S/1	5798/BH113/0.2/ S/1	5798/BH114/0.1/ S/1	5798/SS01
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Moisture	%	34	24	17	14	24

Moisture						
Our Reference:	UNITS	162213-54	162213-55	162213-56	162213-57	162213-58
Your Reference	---------- -	5798/SS04	5798/Dup101	5798/Dup102	5798/Dup103	5798/Dup104
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Moisture	%	15	21	17	16	17

Moisture						
Our Reference:	UNITS	162213-62	162213-63	162213-64	162213-65	162213-66
Your Reference	---------- -	5798/C01	5798/C02	5798/C03	5798/C04	5798/C05
Composite Reference	----------	1+2+3	4+5+6	7+8+9	10+11+12	13+14+15
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
Moisture	%	15	17	21	20	19

Moisture		
Our Reference:	UNITS	162213-67
Your Reference	---------- -	5798/C06
Composite Reference	----------	16+17+18
Date Sampled		10/02/2017
Type of sample		Soil
Date prepared	-	22/02/2017
Date analysed	-	23/02/2017
Moisture	%	19

Misc Inorg - Soil						
Our Reference:	UNITS	162213-9	162213-14	162213-21	162213-22	162213-23
Your Reference	----------	5798/BH103/0.25/S/1	5798/BH102/0.25/S/1	5798/BH102/0.5/S/1	5798/BH102/1.0/S/1	5798/BH102/2.0/S/1
	-					
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
pH 1:5 soil:water	pH Units	5.9	7.1	6.9	8.3	8.4
Electrical Conductivity 1:5 soil:water	µS/cm	110	71	85	56	65
Sulphate, SO4 1:5 soil:water	mg/kg	91	41	60	29	39

Misc Inorg - Soil						
Our Reference:	UNITS	162213-24	162213-25	162213-26	162213-42	162213-43
Your Reference	----------	5798/BH103/0.5/S/1	5798/BH103/1.5/S/1	5798/BH103/2.5/S/1	5798/BH111/0.3/S/1	5798/BH111/0.6/S/1
	-					
Composite Reference	----------	-	-	-	-	-
Date Sampled		10/02/2017	10/02/2017	10/02/2017	10/02/2017	10/02/2017
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	22/02/2017	22/02/2017	22/02/2017	22/02/2017	22/02/2017
Date analysed	-	23/02/2017	23/02/2017	23/02/2017	23/02/2017	23/02/2017
pH 1:5 soil:water	pH Units	5.8	8.8	8.9	6.8	6.8
Electrical Conductivity 1:5 soil:water	µS/cm	170	240	180	47	54
Sulphate, SO4 1:5 soil:water	mg/kg	140	20	<10	<10	54

Asbestos ID - materials		
Our Reference:	UNITS	162213-59
Your Reference	----------	5798/ASB101
	-	
Composite Reference	----------	-
Date Sampled		10/02/2017
Type of sample		Material
Date analysed	-	27/02/2017
Mass / Dimension of Sample	-	33x30x5mm
Sample Description	-	Grey compressed fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected

Method ID	Methodology Summary
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-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.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-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-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'TEQ 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. 'TEQ 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. 'TEQ 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-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
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.

Method ID	Methodology Summary
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Inorg-081	Anions - a range of Anions are determined by Ion Chromatography, in accordance with APHA latest edition, 4110-B. Alternatively determined by colourimetry/turbidity using Discrete Analyer.
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.

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/02/2017	[NT]	[NT]	LCS-3	22/02/2017
Date analysed	-			23/02/2017	[NT]	[NT]	LCS-3	23/02/2017
TRHC$_{6}$ - C$_{9}$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-3	97%
TRHC$_{6}$ - C$_{10}$	mg/kg	25	Org-016	<25	[NT]	[NT]	LCS-3	97%
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	LCS-3	83%
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	LCS-3	91%
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-3	102%
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	LCS-3	105%
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	LCS-3	108%
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NR]	[NR]
Surrogate aaa-Trifluorotoluene	%		Org-016	95	[NT]	[NT]	LCS-3	101%

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/02/2017	[NT]	[NT]	LCS-3	22/02/2017
Date analysed	-			22/02/2017	[NT]	[NT]	LCS-3	22/02/2017
TRHC$_{10}$ - C$_{14}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-3	94%
TRHC$_{15}$ - C$_{28}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-3	94%
TRHC$_{29}$ - C$_{36}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-3	91%
TRH>C$_{10}$-C$_{16}$	mg/kg	50	Org-003	<50	[NT]	[NT]	LCS-3	94%
TRH>C$_{16}$-C$_{34}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-3	94%
TRH>C$_{34}$-C$_{40}$	mg/kg	100	Org-003	<100	[NT]	[NT]	LCS-3	91%
Surrogate o-Terphenyl	%		Org-003	86	[NT]	[NT]	LCS-3	85%

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/02/2017	[NT]	[NT]	LCS-3	22/02/2017
Date analysed	-			23/02/2017	[NT]	[NT]	LCS-3	23/02/2017
Naphthalene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	99%
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluorene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	104%
Phenanthrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	109%
Anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	114%
Pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	117%
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Chrysene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	LCS-3	105%
Benzo(b,j +k)fluoranthene	mg/kg	0.2	Org-012	<0.2	[NT]	[NT]	[NR]	[NR]

QUALITY CONTROL PAHs in Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	[NT]	[NT]	LCS-3	88%
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	[NT]	[NT]	[NR]	[NR]
Surrogate p-Terphenyl-d14	%		Org-012	118	[NT]	[NT]	LCS-3	128%

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/02/2017	162213-8	22/02/2017 || 22/02/2017	LCS-3	22/02/2017
Date analysed	-			23/02/2017	162213-8	23/02/2017 || 23/02/2017	LCS-3	23/02/2017
HCB	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	93%
gamma-BHC	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
beta-BHC	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	99%
Heptachlor	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	96%
delta-BHC	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Aldrin	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	93%
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	96%
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
pp-DDE	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	95%
Dieldrin	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	103%
Endrin	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	124%
pp-DDD	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	97%
Endosulfan II	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
pp-DDT	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	LCS-3	121%
Methoxychlor	mg/kg	0.1	Org-005	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Surrogate TCMX	%		Org-005	95	162213-8	99 || 100 || RPD: 1	LCS-3	96%

QUALITY CONTROL Organophosphorus Pesticides	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date extracted	-			22/02/2017	162213-8	22/02/2017 || 22/02/2017	LCS-3	22/02/2017
Date analysed	-			23/02/2017	162213-8	23/02/2017 || 23/02/2017	LCS-3	23/02/2017
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	93%
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Diazinon	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	89%
Dimethoate	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	[NR]	[NR]
Ethion	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	99%
Fenitrothion	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	101%
Malathion	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	100%
Parathion	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	90%
Ronnel	mg/kg	0.1	Org-008	<0.1	162213-8	<0.1 || <0.1	LCS-3	88%
Surrogate TCMX	%		Org-008	95	162213-8	99 || 100 || RPD: 1	LCS-3	94%

QUALITY CONTROL Acid Extractable metals in soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			22/02/2017	162213-8	22/02/2017 || 22/02/2017	LCS-3	22/02/2017
Date analysed	-			23/02/2017	162213-8	23/02/2017 || 23/02/2017	LCS-3	23/02/2017
Arsenic	mg/kg	4	Metals-020	<4	162213-8	9 || 9 || RPD: 0	LCS-3	110%
Cadmium	mg/kg	0.4	Metals-020	<0.4	162213-8	<0.4 || <0.4	LCS-3	100%
Chromium	mg/kg	1	Metals-020	<1	162213-8	20 || 20 || RPD: 0	LCS-3	106%
Copper	mg/kg	1	Metals-020	<1	162213-8	34 || 33 || RPD: 3	LCS-3	106%
Lead	mg/kg	1	Metals-020	<1	162213-8	21 || 21 || RPD: 0	LCS-3	97%
Mercury	mg/kg	0.1	Metals-021	<0.1	162213-8	<0.1 || <0.1	LCS-3	92%
Nickel	mg/kg	1	Metals-020	<1	162213-8	12 || 12 || RPD: 0	LCS-3	95%
Zinc	mg/kg	1	Metals-020	<1	162213-8	55 || 54 || RPD: 2	LCS-3	98%

QUALITY CONTROL Misc Inorg - Soil	UNITS	PQL	METHOD	Blank	Duplicate Sm#	Duplicate results Base II Duplicate II %RPD	Spike Sm#	Spike % Recovery
Date prepared	-			22/02/2017	[NT]	[NT]	LCS-1	22/02/2017
Date analysed	-			22/02/2017	[NT]	[NT]	LCS-1	22/02/2017
pH 1:5 soil:water	pH Units		Inorg-001	[NT]	[NT]	[NT]	LCS-1	102%
Electrical Conductivity 1:5 soil:water	µS/cm	1	Inorg-002	<1	[NT]	[NT]	LCS-1	105%
Sulphate, SO4 1:5 soil:water	mg/kg	10	Inorg-081	<10	[NT]	[NT]	LCS-1	104%

QUALITY CONTROL vTRH(C6-C10)/BTEXN in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	23/02/2017 || 23/02/2017
TRH C_6 - C_9	mg/kg	162213-53	<25 || <25
TRH C_6 - C_{10}	mg/kg	162213-53	<25 || <25
Benzene	mg/kg	162213-53	<0.2 || <0.2
Toluene	mg/kg	162213-53	<0.5 || <0.5
Ethylbenzene	mg/kg	162213-53	<1 || <1
m+p-xylene	mg/kg	162213-53	<2 || <2
o-Xylene	mg/kg	162213-53	<1 || <1
naphthalene	mg/kg	162213-53	<1 || <1
Surrogate aaa-Trifluorotoluene	%	162213-53	82 || 94 || RPD: 14

QUALITY CONTROL svTRH (C10-C40) in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	22/02/2017 || 22/02/2017
TRH C_{10} - C_{14}	mg/kg	162213-53	<50 || <50
TRH C_{15} - C_{28}	mg/kg	162213-53	<100 || <100
TRH C_{29} - C_{36}	mg/kg	162213-53	<100 || <100
TRH >C_{10}-C_{16}	mg/kg	162213-53	<50 || <50
TRH >C_{16}-C_{34}	mg/kg	162213-53	<100 || <100
TRH >C_{34}-C_{40}	mg/kg	162213-53	<100 || <100
Surrogate o-Terphenyl	%	162213-53	88 || 88 || RPD: 0

QUALITY CONTROL PAHs in Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	23/02/2017 || 23/02/2017
Naphthalene	mg/kg	162213-53	<0.1 || <0.1
Acenaphthylene	mg/kg	162213-53	<0.1 || <0.1
Acenaphthene	mg/kg	162213-53	<0.1 || <0.1
Fluorene	mg/kg	162213-53	<0.1 || <0.1
Phenanthrene	mg/kg	162213-53	<0.1 || <0.1
Anthracene	mg/kg	162213-53	<0.1 || <0.1
Fluoranthene	mg/kg	162213-53	<0.1 || <0.1
Pyrene	mg/kg	162213-53	<0.1 || <0.1
Benzo(a)anthracene	mg/kg	162213-53	<0.1 || <0.1
Chrysene	mg/kg	162213-53	<0.1 || <0.1
Benzo(b,j+k)fluoranthene	mg/kg	162213-53	<0.2 || <0.2
Benzo(a)pyrene	mg/kg	162213-53	<0.05 || <0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	162213-53	<0.1 || <0.1
Dibenzo(a,h)anthracene	mg/kg	162213-53	<0.1 || <0.1
Benzo(g,h,i)perylene	mg/kg	162213-53	<0.1 || <0.1
Surrogate p-Terphenyl-d14	%	162213-53	94 || 101 || RPD: 7

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	23/02/2017 || 23/02/2017
HCB	mg/kg	162213-53	<0.1 || <0.1
alpha-BHC	mg/kg	162213-53	<0.1 || <0.1
gamma-BHC	mg/kg	162213-53	<0.1 || <0.1
beta-BHC	mg/kg	162213-53	<0.1 || <0.1
Heptachlor	mg/kg	162213-53	<0.1 || <0.1
delta-BHC	mg/kg	162213-53	<0.1 || <0.1
Aldrin	mg/kg	162213-53	<0.1 || <0.1
Heptachlor Epoxide	mg/kg	162213-53	<0.1 || <0.1
gamma-Chlordane	mg/kg	162213-53	<0.1 || <0.1
alpha-chlordane	mg/kg	162213-53	<0.1 || <0.1
Endosulfan I	mg/kg	162213-53	<0.1 || <0.1
pp-DDE	mg/kg	162213-53	<0.1 || <0.1
Dieldrin	mg/kg	162213-53	<0.1 || <0.1
Endrin	mg/kg	162213-53	<0.1 || <0.1
pp-DDD	mg/kg	162213-53	<0.1 || <0.1
Endosulfan II	mg/kg	162213-53	<0.1 || <0.1
pp-DDT	mg/kg	162213-53	<0.1 || <0.1
Endrin Aldehyde	mg/kg	162213-53	<0.1 || <0.1
Endosulfan Sulphate	mg/kg	162213-53	<0.1 || <0.1

QUALITY CONTROL Organochlorine Pesticides in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Methoxychlor	mg/kg	162213-53	<0.1 || <0.1
Surrogate TCMX	%	162213-53	99 || 98 || RPD: 1
QUALITY CONTROL Organophosphorus Pesticides	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date extracted	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	23/02/2017 || 23/02/2017
Azinphos-methyl (Guthion)	mg/kg	162213-53	<0.1 || <0.1
Bromophos-ethyl	mg/kg	162213-53	<0.1 || <0.1
Chlorpyriphos	mg/kg	162213-53	<0.1 || <0.1
Chlorpyriphos-methyl	mg/kg	162213-53	<0.1 || <0.1
Diazinon	mg/kg	162213-53	<0.1 || <0.1
Dichlorvos	mg/kg	162213-53	<0.1 || <0.1
Dimethoate	mg/kg	162213-53	<0.1 || <0.1
Ethion	mg/kg	162213-53	<0.1 || <0.1
Fenitrothion	mg/kg	162213-53	<0.1 || <0.1
Malathion	mg/kg	162213-53	<0.1 || <0.1
Parathion	mg/kg	162213-53	<0.1 || <0.1
Ronnel	mg/kg	162213-53	<0.1 || <0.1
Surrogate TCMX	%	162213-53	99 || 98 || RPD: 1
QUALITY CONTROL Acid Extractable metals in soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	162213-53	22/02/2017 || 22/02/2017
Date analysed	-	162213-53	23/02/2017 || 23/02/2017
Arsenic	mg/kg	162213-53	6 || 8 || RPD: 29
Cadmium	mg/kg	162213-53	<0.4 || <0.4
Chromium	mg/kg	162213-53	24 || 23 || RPD: 4
Copper	mg/kg	162213-53	26 || 27 || RPD: 4
Lead	mg/kg	162213-53	42 || 40 || RPD: 5
Mercury	mg/kg	162213-53	0.1 || 0.1 || RPD: 0
Nickel	mg/kg	162213-53	21 || 19 || RPD: 10
Zinc	mg/kg	162213-53	76 || 76 || RPD: 0

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD	Spike Sm#	Spike % Recovery
Date prepared	-	[NT]	[NT]	162213-14	22/02/2017
Date analysed	-	[NT]	[NT]	162213-14	22/02/2017
pH 1:5 soil:water	pH Units	[NT]	[NT]	[NR]	[NR]
Electrical Conductivity 1:5 soil:water	µS/cm	[NT]	[NT]	[NR]	[NR]
Sulphate, SO4 1:5 soil:water	mg/kg	[NT]	[NT]	162213-14	94%

QUALITY CONTROL Misc Inorg - Soil	UNITS	Dup. Sm#	Duplicate Base + Duplicate + %RPD
Date prepared	-	162213-9	22/02/2017 || 22/02/2017
Date analysed	-	162213-9	23/02/2017 || 23/02/2017
pH 1:5 soil:water	pH Units	162213-9	5.9 || 6.0 || RPD: 2
Electrical Conductivity 1:5 soil:water	µS/cm	162213-9	110 || 100 || RPD: 10
Sulphate, SO4 1:5 soil:water	mg/kg	162213-9	91 || 70 || RPD: 26

Report Comments:

Asbestos ID was analysed by Approved Identifier: Lucy Zhu
Asbestos ID was authorised by Approved Signatory: Paul Ching

INS: Insufficient sample for this test
NR: Test not required
<: Less than

PQL: Practical Quantitation Limit
RPD: Relative Percent Difference
>: Greater than

NT: Not tested
NA: Test not required
LCS: Laboratory Control Sample

Quality Control Definitions

Blank: This is the component of the analytical signal which is not derived from the sample but from reagents, glassware etc, can be determined by processing solvents and reagents in exactly the same manner as for samples.

Duplicate: This is the complete duplicate analysis of a sample from the process batch. If possible, the sample selected should be one where the analyte concentration is easily measurable.

Matrix Spike : A portion of the sample is spiked with a known concentration of target analyte. The purpose of the matrix spike is to monitor the performance of the analytical method used and to determine whether matrix interferences exist.

LCS (Laboratory Control Sample) : This comprises either a standard reference material or a control matrix (such as a blank sand or water) fortified with analytes representative of the analyte class. It is simply a check sample.

Surrogate Spike: Surrogates are known additions to each sample, blank, matrix spike and LCS in a batch, of compounds which are similar to the analyte of interest, however are not expected to be found in real samples.

Laboratory Acceptance Criteria

Duplicate sample and matrix spike recoveries may not be reported on smaller jobs, however, were analysed at a frequency to meet or exceed NEPM requirements. All samples are tested in batches of 20. The duplicate sample RPD and matrix spike recoveries for the batch were within the laboratory acceptance criteria.
Filters, swabs, wipes, tubes and badges will not have duplicate data as the whole sample is generally extracted during sample extraction.
Spikes for Physical and Aggregate Tests are not applicable.
For VOCs in water samples, three vials are required for duplicate or spike analysis.

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.
Matrix Spikes, LCS and Surrogate recoveries: Generally 70-130% for inorganics/metals; 60-140% for organics (+/-50% surrogates) and 10-140% for labile SVOCs (including labile surrogates), ultra trace organics and speciated phenols is acceptable.

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

15 Attachment E – Data Validation Report

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

1. Sample Handling

	Yes	No (Comments below)
a. Were sample holding times met?	✓	
b. Were samples in proper custody between the field and reaching the laboratory?	✓	
c. Were the samples properly and adequately preserved?	✓	
d. Were the samples received by the laboratory in good condition?	✓	

COMMENTS

Sample handling is:

- ✓ **Satisfactory**
- **Partially Satisfactory**
- **Unsatisfactory**

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

2. Precision / Accuracy Statement

	Yes	No (Comments below)
a. Was a NATA registered laboratory used?	✓	
b. Did the laboratory perform the requested tests?	✓	
c. Were laboratory methods adopted NATA endorsed?	✓	
d. Were appropriate test procedures followed?	✓	
e. Were reporting limits satisfactory?	✓	
f. Was the NATA seal on the reports?	✓	
g. Were reports signed by an authorised person?	✓	

COMMENTS

Precision / Accuracy of the Laboratory Report:	✓	**Satisfactory**
		Partially Satisfactory
		Unsatisfactory

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

3. Field Quality Assurance / Quality Control (QA/QC)

	Media	Number
a. Number of Primary Samples analysed *(does not include duplicates)*	Soil:	6
	Material:	1
b. Number of days of sampling		1
c. Number and Type of QA/QC Samples analysed		
Intra-Laboratory Field Duplicates	4	
Inter-Laboratory Field triplicates	-	
Trip Blanks	1	
Wash Blanks	-	
Other (Field Blanks, Spikes, Trip Blanks, etc.)	1	

Field Duplicates

	Yes	No (Comments below)
Adequate Numbers of intra-laboratory field duplicates analysed?	✓	
Adequate Numbers of inter-laboratory field duplicates analysed?		-
Were RPDs within Control Limits?		
i. Organics (+ 50%)	✓	
ii. Metals / Inorganics (+ 50%)		✓
iii. Nutrients (+ 50%)	N/A	

COMMENTS

Not all RPDs for metals are within control limits, however all samples are well below SAC and data is considered usable.

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

Trip Blank / Wash Blanks

	Yes	No (Comments below)
Were Adequate Numbers of trip blanks analysed?	✓	
Were Adequate Numbers of wash blanks analysed?		✓
Were the Trip Blanks free of contaminants?	✓	
Were the Wash Blanks free of contaminants?	-	

COMMENTS

Wash blanks were not collected for the investigation. Sampling was completed in accordance with MA SOP, with sampling equipment decontaminated between sampling locations. In light of the above we consider the results are directly usable.

Trip Spikes

	Yes	No (Comments below)
Were adequate numbers of Trip Spikes analysed?	✓	
Were the Trip Spike results within control limits?	✓	

COMMENTS

Field QA/QC:

✓ **Satisfactory**

Partially Satisfactory

Unsatisfactory

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

4. Laboratory Internal Quality Assurance / Quality Control (QA/QC) Procedures

a. Type and Number of QA/QC Samples

QA/QC Type	Yes	No
Laboratory Blanks/Reagent Blanks (at least 1 per batch)	✓	
Matrix Spikes/Matrix Spike Duplicates (1 for each soil type)	✓	
Laboratory Control Samples	✓	
Laboratory Duplicates (at least one per batch or 1 per 10 samples, whichever is smaller)	✓	
Surrogates (where appropriate)[1]	✓	

[1] Number of surrogate spikes carried out on each sample

	Yes	No (Comments below)
b. Were the laboratory blanks/reagents blanks free of contamination?	✓	
c. Were the spike recoveries within control limits?	✓	
d. Were the RPDs of the laboratory duplicates within control limits?		
i. Organics (0-50%)	✓	
ii. Metals / Inorganics (0-50%)	✓	
e. Were the surrogate recoveries within control limits?	✓	

COMMENTS

Laboratory internal QA / QC is:

✓ **Satisfactory**

Partially Satisfactory

Unsatisfactory

DATA VALIDATION REPORT – PRELIMINARY SITE CONTAMINATION ASSESSMENT, 17 and 19 Kosovich Place, Cecil Park, NSW (Lots 2320 and 2321 DP 1223137)

5. Summary of Quality Assurance / Quality Control (QA/QC)

QA/QC Type	Satisfactory	Partially Satisfactory	Unsatisfactory
Sample handling	✓		
Precision / Accuracy of the Laboratory Report	✓		
Field QA / QC	✓		
Laboratory Internal QA / QC	✓		

6. Data Usability

1. Data directly usable ✓
2. Data usable with the following corrections/modifications *(see comment below)*
3. Data not usable.

COMMENTS

16 Attachment F – Detailed Borehole Logs

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH101**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	99 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.80 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	99.00	SPT 0.00-0.45 m 1,3,4 N=7			SiCL	Silty Clay Loam, low plasticity, brown/red.		F	RESIDUAL SOIL
				0.50 98.50	5798/101/0.40/S/1 D 0.40 m			LMC	Light Medium Clay, medium plasticity, orange-brown.			
				0.70 98.30	5798/101/0.60/S/1 D 0.60 m			LC	Light Clay, medium plasticity, brown.	M	St	
	H		1.0		5798/101/0.90/S/1 D 0.90 m SPT 1.00-1.45 m 21,15,8 HB N=23						VSt	
AD/T			1.5	***1.50*** 97.50					SANDSTONE/SHALE LAMINITE, inferred distinctly weathered, inferred very low to low strength.	D		1.45: V-bit refusal. WEATHERED ROCK
				1.80					Hole Terminated at 1.80 m			1.80: TC-bit refusal on inferred medium strength laminite.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL	COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH102**
PROJECT	Geotechnical Investigation	LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT	4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	96 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 2.10 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	96.00	SPT 0.00-0.45 m 3,5,5 N=10			SiCL	Silty Clay Loam, low plasticity, dark brown.	M	St	RESIDUAL SOIL
				0.15 95.85	5798/102/0.25/S/1 D 0.25 m			SiC	Silty Clay, low plasticity, red/brown, sandstone gravels.			
					5798/102/0.50/S/1 D 0.50 m						VSt	
AD/T	H		1.0		SPT 1.00-1.45 m 12,18,18 HB N=36 5798/102/1.0/S/1 D 1.00 m						H	1.20: V-bit refusal.
			1.5	*1.70* 94.30				LMC	Light Medium Clay, low plasticity, brown.			
			2.0	*2.10*	5798/102/2.0/S/1 D 2.00 m				Hole Terminated at 2.10 m			2.10: TC-bit refusal on inferred medium strength sandstone.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH103**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	92 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered	0	92.00	SPT 0.00-0.45 m 1,6,8 N=14			CL	Clay Loam, low plasticity, dark brown.			RESIDUAL SOIL
				0.20 91.80	5798/103/0.25/S/1 D 0.25 m			SiC	Silty Clay, medium plasticity, orange/brown, trace shale gravels.		St	
	M		0.5		5798/103/0.5/S/1 D 0.50 m				@0.60m - grading to orange/grey.			
			1.0	*1.10* 90.90	SPT 1.00-1.45 m 9,9,12 N=21			MC	Medium Clay, medium-high plasticity, grey, shale gravel inclusions.		VSt	
			1.5		5798/103/1.5/S/1 D 1.50 m					M		
AD/T	H		2.0									2.00: V-bit refusal.
			2.5		5798/103/2.5/S/1 D 2.50 m						H	
			3.0	*2.90* 89.10					Weathered SHALE, grey, inferred distinctly weathered, inferred very low to low strength.			WEATHERED ROCK
			3.5							D		
			4.0	*4.00*					Hole Terminated at 4.00 m (Investigation Limit)			
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH104**
PROJECT	Geotechnical Investigation		LOGGED	RM	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	103 m	DATUM AHD
EXCAVATION DIMENSIONS		2.20 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
		Not Encountered	0.5	103.00				SiCL	Silty Clay Loam, low plasticity, brown.		S	RESIDUAL SOIL
				0.15								
				102.85				LMC	Light Medium Clay, medium plastcity, red/orange.			
					5798/104/0.40/S/1 D 0.40 m							
				0.70								
				102.30				MC	Medium Clay, medium plastcity, yellow/brown, trace sandstone gravels.			0.70: V-bit refusal.
			1.0		5798/104/0.85/S/1 D 0.85 m					M	St	
			1.5						@1.8m-grading to grey.			
			2.0								H	
				2.20					Hole Terminated at 2.20 m			2.20: TC-bit refusal on inferred medium strength shale.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL	COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH105**
PROJECT	Geotechnical Investigation	LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW	GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT	4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	99 m	DATUM AHD
EXCAVATION DIMENSIONS	Ø100 mm x 3.00 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	99.00	5798/105/0.10/S/1 D 0.10 m			SCL	Sandy Clay Loam, low plasticity, brown.	M	St	RESIDUAL SOIL
				0.20 98.80				LMC	Light Medium Clay, medium plasticity, yellow/brown.		St - H	
					5798/105/0.40/S/1 D 0.40 m							
				0.60 98.40				MC	Medium Clay, medium to high plasticity, grey, shale gravels.			
AD/T	H		1.0		5798/105/0.90/S/1 D 0.90 m						H	1.00: V-bit refusal.
				1.40 97.60	5798/105/1.3/S/1 D 1.30 m				Weathered SHALE, grey, inferred very low strength.	D		WEATHERED ROCK
			2.5	*3.00*					Hole Terminated at 3.00 m			3.00: TC-bit refusal on inferred low strength shale.
			3.5									
			4.0									
			4.5									

EXCAVATION LOG TO BE READ IN CONJUCTION WITH ACCOMPANYING REPORT NOTES AND ABBREVIATIONS

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH106**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	102 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.70 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	102.00 *0.40* 101.60 *0.60* 101.40	5798/106/0.20/S/1 D 0.20 m			SCL	Sandy Clay Loam, low plasticity, brown, fine sands.		St	RESIDUAL SOIL
								LMC	Light Medium Clay, medium plasticity, red/orange.	M	VSt	
								MC	Medium Clay, medium to high plasticity, orange/grey, shale gravels.		St - H	0.80: V-bit refusal.
AD/T	H		1.0	*1.00* 101.00	5798/106/0.20/S/1 D 0.90 m				Weathered SHALE, yellow, inferred low strength.	D		WEATHERED ROCK
			1.5	*1.70*					Hole Terminated at 1.70 m			1.70: TC-bit refusal on inferred low to medium strength sandstone.
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH107**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	97 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	97.00	5798/107/0.20/S/1 D 0.20 m			SCL	Sandy Clay Loam, low plasticity, brown.	M	St	RESIDUAL SOIL
				0.40 96.60				LMC	Light Medium Clay, medium plasticity, orange.			
					5798/107/0.50/S/1 D 0.50 m							
				0.60 96.40				MC	Medium Clay, medium to high plasticity, brown/grey.		VSt	
			1.0									
			1.5						@1.5m - grading to grey.		H	1.50: V-bit refusal
AD/T	H		2.0	*2.00* 95.00					Weathered SHALE, grey, inferred distinctly weathered, inferred low strength.	D		WEATHERED ROCK
			2.5									
			3.0	*3.00*					Hole Terminated at 3.00 m			
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH108**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	93 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.80 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V		Not Encountered	0	93.00				SiCL	Silty Clay Loam, low plasticity, brown.			RESIDUAL SOIL
					5798/108/0.20/S/1 D 0.20 m						St	
	M			*0.50*								
			0.5	92.50				LMC	Light Medium Clay, low to medium plasticity, brown, with shale gravels.			
					5798/108/0.60/S/1 D 0.60 m							
			1.0						@1.0m - grading to grey.	M		
					5798/108/1.1/S/1 D 1.10 m						H	
				1.50								
			1.5	91.50				MC	Medium Clay, medium plasticity, orange/grey.			1.50: V-bit refusal.
	H			*2.00*								
AD/T			2.0	91.00					Weathered SHALE, grey, inferred distinctly weathered, inferred very low to low strength.			WEATHERED ROCK
										D		
			2.5									
				2.80					Hole Terminated at 2.80 m			2.80: TC-bit refusal on inferred medium strength shale.
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH109**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	94 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 3.00 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	94.00 *0.15* 93.85	5798/109/0.40/S/1 D 0.40 m 5798/109/0.50/S/1 D 0.50 m			SiCL	Silty Clay Loam, low plasticity, brown.	M	S	RESIDUAL SOIL
								LMC	Light Medium Clay, medium plasticity, red/orange/brown.		St - VSt	
			1.0						@1.2m - grading to grey.			
AD/T	H		1.5	*1.50* 92.50					Weathered SHALE, grey, inferred distinctly weathered, inferred very low strength.	D	H	1.20: V-bit refusal. WEATHERED ROCK
			2.0		5798/109/2.1/S/1 D 2.10 m							
			2.5									
			3.0	*3.00*					Hole Terminated at 3.00 m			
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH110**
PROJECT	Geotechnical Investigation		LOGGED	RM/HD	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	94 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 2.00 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.0	94.00	5798/110/0.10/S/1 D 0.10 m			SiCL	Silty Clay Loam, low plasticity, brown.	M	S	RESIDUAL SOIL
				0.25 93.75				LMC	Light Medium Clay, medium plasticity, orange.			
			0.5		5798/110/0.50/S/1 D 0.50 m						F	
			1.0		5798/110/1.0/S/1 D 1.00 m							
	H			*1.20* 92.80				MC	Medium Clay, medium to high plastictity, grey.		H	1.30: V-bit refusal.
AD/T			1.5	*1.50* 92.50					Weathered SHALE, grey, inferred distinctly weathered, inferred low strength.	D		WEATHERED ROCK
			2.0	*2.00*					Hole Terminated at 2.00 m			2.00: TC-bit refusal on inferred medium strength shale.
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH111**
PROJECT	Geotechnical Investigation		LOGGED	RM	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	91 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.50 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/T	M	Not Encountered	0	91.00				SiCL	Silty Clay Loam, low plasticity, brown.			RESIDUAL SOIL
				0.15 90.85	5798/111/0.10/S/1 D 0.10 m							
					5798/111/0.30/S/1 D 0.30 m			LMC	Light Medium Clay, low to medium plasticity.		S	
			0.5	*0.50* 90.50				MC	Medium Clay, medium plasticity, orange.	M		
					5798/111/0.60/S/1 D 0.60 m						F	
			1.0									
			1.5	*1.50*					Hole Terminated at 1.50 m (Investigation Limit)			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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Engineering Log - BOREHOLE

CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH112**
PROJECT	Geotechnical Investigation		LOGGED	RM	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	90 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.50 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	90.00 *0.15* 89.85 *0.60* 89.40	5798/112/0.40/S/1 D 0.40 m 5798/112/0.80/S/1 D 0.80 m			SiCL	Silty Clay Loam, low plasticity, brown.	M	S	RESIDUAL SOIL
								LMC	Light Medium Clay, low plasticity, grey.			
			1.0					MC	Medium Clay, medium plasticity, orange/yellow/brown.		St	
			1.5	*1.50*					Hole Terminated at 1.50 m (Investigation Limit)			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH113**
PROJECT	Geotechnical Investigation		LOGGED	RM	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	90 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 1.50 m depth	NORTHING		ASPECT	West	SLOPE 15-20%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	DEPTH RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
AD/V	M	Not Encountered	0.5	90.00	5798/113/0.20/S/1 D 0.20 m			LMC	FILL: Light Medium Clay, red/grey, sandstone gravels, brick inclusions.		S	FILL
				0.30 89.70	5798/113/0.20/S/2 D 0.20 m			LMC	Light Medium Clay, low plasticity, grey.			RESIDUAL SOIL
					5798/113/0.40/S/1 D 0.40 m							
				0.70 89.30				MC	Medium Clay, medium plasticity, orange/yellow/brown.	M	St	
			1.0		5798/113/0.80/S/1 D 0.80 m							
			1.5	*1.50*					Hole Terminated at 1.50 m (Investigation Limit)			
			2.0									
			2.5									
			3.0									
			3.5									
			4.0									
			4.5									

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CLIENT	Assyrian Schools Limited C/- PMDL		COMMENCED	10/02/2017	COMPLETED	10/02/2017	**REF BH114**
PROJECT	Geotechnical Investigation		LOGGED	RM	CHECKED	RE	Sheet 1 OF 1
SITE	153-189 Wallgrove Rd, Cecil Park, NSW		GEOLOGY	Bringelly Shale	VEGETATION	Grass	PROJECT NO. P1705798
EQUIPMENT		4WD truck-mounted hydraulic drill rig	EASTING		RL SURFACE	90 m	DATUM AHD
EXCAVATION DIMENSIONS		Ø100 mm x 4.00 m depth	NORTHING		ASPECT	West	SLOPE 5-10%

Drilling					Sampling		Field Material Description					
METHOD	PENETRATION RESISTANCE	WATER	DEPTH (metres)	*DEPTH* RL	SAMPLE OR FIELD TEST	RECOVERED	GRAPHIC LOG	USCS / ASCS CLASSIFICATION	SOIL/ROCK MATERIAL DESCRIPTION	MOISTURE CONDITION	CONSISTENCY DENSITY	STRUCTURE AND ADDITIONAL OBSERVATIONS
				90.00				SiCL	FILL: Silty Clay Loam, low plasticity, brown.			FILL
				0.15 89.85	5798/114/0.10/S/1 D 0.10 m			SiC	FILL: Silty Clay, dark grey, shale gravels.			
			0.5		5798/114/0.40/S/1 D 0.40 m							
				0.70 89.30					FILL: Ripped/Crushed SANDSTONE, yellow brown.			
			1.0		5798/114/0.80/S/1 D 0.80 m							
			1.5	*1.50* 88.50				CLS	FILL: Clayey SAND, grey/dark grey, coarse grained sand, with plastic and metal inclusions.			
AD/V	M	Not Encountered	2.0		5798/114/2.0/S/1 D 2.00 m					M		
			2.5		5798/114/2.40/S/1 D 2.40 m							
			3.0									
			3.5									
			4.0	*4.00*					Hole Terminated at 4.00 m (Investigation Limit)			
			4.5									

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Engineering Log - BOREHOLE

17 Attachment G – Relative Percentage Difference Table

P1705798: 17 and 19 Kosovich Place, Cecil Park (Lots 2320 and 2321 DP 1223137); Preliminary Site Contamination Assessment - Relative Percentage Difference (RPD)

Heavy Metals	LOR [1]	Primary 5798/SS01 Soil	Intra-laboratory 5798/DUP1 Soil	RPD [2] (%)	Primary 5798/BH114/0.1 Soil	Intra-laboratory 5798/DUP2 Soil	RPD [2] (%)	Primary 5798/SS04 Soil	Intra-laboratory 5798/DUP3 Soil	RPD [2] (%)	Primary 5798/SS10 Soil	Intra-laboratory 5798/DUP4 Soil	RPD [2] (%)
Arsenic	<4	6	6	0%	6	8	-29%	8	7	13%	9	8	12%
Cadmium	<0.4	<0.4	<0.4	0%	<0.4	<0.4	0%	<0.4	<0.4	0%	<0.4	<0.4	0%
Chromium (III)	<1	24	34	-34%	20	18	11%	21	20	5%	20	18	11%
Copper	<1	26	26	0%	20	21	-5%	21	18	15%	34	28	19%
Lead	<1	42	38	10%	35	40	-13%	22	20	10%	21	18	15%
Mercury	<0.1	0.1	<0.1	0%	<0.1	<0.1	0%	<0.1	<0.1	0%	<0.1	<0.1	0%
Nickel	<1	21	27	-25%	8	8	0%	11	11	0%	12	11	9%
Zinc	<1	76	82	-8%	54	70	-26%	290	290	0%	55	49	12%
Notes: [1] Limit of Reporting (LOR). All results in mg/kg unless otherwise noted.													
Notes: [2] Where sample concentration is >5 x LOR acceptable RPD is 30%, where <5 x LOR any RPD is acceptable.													

18 Attachment H – Notes About this Report

Information

Important Information About Your Report (1 of 2)

These notes have been prepared by Martens to help you interpret and understand the limitations of your report. Not all are necessarily relevant to all reports but are included as general reference.

Engineering Reports - Limitations

Engineering reports are based on information that may be gained from limited subsurface site testing and sampling, supplemented by knowledge of local geology and experience. For this reason, they must be regarded as interpretative rather than factual documents, limited to some extent by the scope of information on which they rely.

Engineering Reports – Project Specific Criteria

Engineering reports are prepared by qualified personnel. They are based on information obtained, on current engineering standards of interpretation and analysis, and on the basis of your unique project specific requirements as understood by Martens. Project criteria typically include the general nature of the project; its size and configuration; the location of any structures on the site; other site improvements; the presence of underground utilities; and the additional risk imposed by scope-of-service limitations imposed by the Client.

Where the report has been prepared for a specific design proposal (e.g. a three storey building), the information and interpretation may not be relevant if the design proposal is changed (e.g. to a twenty storey building). Your report should not be relied upon, if there are changes to the project, without first asking Martens to assess how factors, which changed subsequent to the date of the report, affect the report's recommendations. Martens will not accept responsibility for problems that may occur due to design changes, if not consulted.

Engineering Reports – Recommendations

Your report is based on the assumption that site conditions, as may be revealed through selective point sampling, are indicative of actual conditions throughout an area. This assumption often cannot be substantiated until project implementation has commenced. Therefore your site investigation report recommendations should only be regarded as preliminary.

Only Martens, who prepared the report, are fully familiar with the background information needed to assess whether or not the report's recommendations are valid and whether or not changes should be considered as the project develops. If another party undertakes the implementation of the recommendations of this report, there is a risk that the report will be misinterpreted and Martens cannot be held responsible for such misinterpretation.

Engineering Reports – Use for Tendering Purposes

Where information obtained from investigations is provided for tendering purposes, Martens recommend that all information, including the written report and discussion, be made available. In circumstances where the discussion or comments section is not relevant to the contractual situation, it may be appropriate to prepare a specially edited document.

Martens would be pleased to assist in this regard and/or to make additional report copies available for contract purposes at a nominal charge.

Engineering Reports – Data

The report as a whole presents the findings of a site assessment and should not be copied in part or altered in any way.

Logs, figures, drawings *etc* are customarily included in a Martens report and are developed by scientists, engineers or geologists based on their interpretation of field logs (assembled by field personnel), desktop studies and laboratory evaluation of field samples. These data should not under any circumstances be redrawn for inclusion in other documents or separated from the report in any way.

Engineering Reports – Other Projects

To avoid misuse of the information contained in your report it is recommended that you confer with Martens before passing your report on to another party who may not be familiar with the background and purpose of the report. Your report should not be applied to any project other than that originally specified at the time the report was issued.

Subsurface Conditions - General

Every care is taken with the report in relation to interpretation of subsurface conditions, discussion of geotechnical aspects, relevant standards and recommendations or suggestions for design and construction. However, the Company cannot always anticipate or assume responsibility for:

- Unexpected variations in ground conditions - the potential will depend partly on test point (eg. excavation or borehole) spacing and sampling frequency, which are often limited by project imposed budgetary constraints.

- Changes in guidelines, standards and policy or interpretation of guidelines, standards and policy by statutory authorities.

- The actions of contractors responding to commercial pressures.

- Actual conditions differing somewhat from those inferred to exist, because no professional, no matter how qualified, can reveal precisely what is hidden by earth, rock and time.

  The actual interface between logged materials may be far more gradual or abrupt than assumed based on the facts obtained. Nothing can be done to change the actual site conditions which exist, but steps can be taken to reduce the impact of unexpected conditions.

If these conditions occur, Martens will be pleased to assist with investigation or providing advice to resolve the matter.

Subsurface Conditions - Changes

Natural processes and the activity of man create subsurface conditions. For example, water levels can vary with time, fill may be placed on a site and pollutants may migrate with time. Reports are based on conditions which existed at the time of the subsurface exploration / assessment.

Decisions should not be based on a report whose adequacy may have been affected by time. If an extended period of time has elapsed since the report was prepared, consult Martens to be advised how time may have impacted on the project.

Subsurface Conditions - Site Anomalies

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

Report Use by Other Design Professionals

To avoid potentially costly misinterpretations when other design professionals develop their plans based on a Martens report, retain Martens to work with other project professionals affected by the report. This may involve Martens explaining the report design implications and then reviewing plans and specifications produced to see how they have incorporated the report findings.

Subsurface Conditions – Geo-environmental Issues

Your report generally does not relate to any findings, conclusions, or recommendations about the potential for hazardous or contaminated materials existing at the site unless specifically required to do so as part of Martens' proposal for works.

Specific sampling guidelines and specialist equipment, techniques and personnel are typically used to perform geo-environmental or site contamination assessments. Contamination can create major health, safety and environmental risks. If you have no information about the potential for your site to be contaminated or create an environmental hazard, you are advised to contact Martens for information relating to such matters.

Responsibility

Geo-environmental reporting relies on interpretation of factual information based on professional judgment and opinion and has an inherent level of uncertainty attached to it and is typically far less exact than the design disciplines. This has often resulted in claims being lodged against consultants, which are unfounded.

To help prevent this problem, a number of clauses have been developed for use in contracts, reports and other documents. Responsibility clauses do not transfer appropriate liabilities from Martens to other parties but are included to identify where Martens' responsibilities begin and end. Their use is intended to help all parties involved to recognise their individual responsibilities. Read all documents from Martens closely and do not hesitate to ask any questions you may have.

Site Inspections

Martens will always be pleased to provide engineering inspection services for aspects of work to which this report relates. This could range from a site visit to confirm that conditions exposed are as expected, to full time engineering presence on site. Martens is familiar with a variety of techniques and approaches that can be used to help reduce risks for all parties to a project, from design to construction.

Soil Data

Explanation of Terms (1 of 3)

Definitions

In engineering terms, soil includes every type of uncemented or partially cemented inorganic or organic material found in the ground. In practice, if the material does not exhibit any visible rock properties and can be remoulded or disintegrated by hand in its field condition or in water it is described as a soil. Other materials are described using rock description terms.

The methods of description and classification of soils and rocks used in this report are typically based on Australian Standard 1726 and the Unified Soil Classification System (USCS) – refer Soil Data Explanation of Terms (2 of 3). In general, descriptions cover the following properties - strength or density, colour, structure, soil or rock type and inclusions.

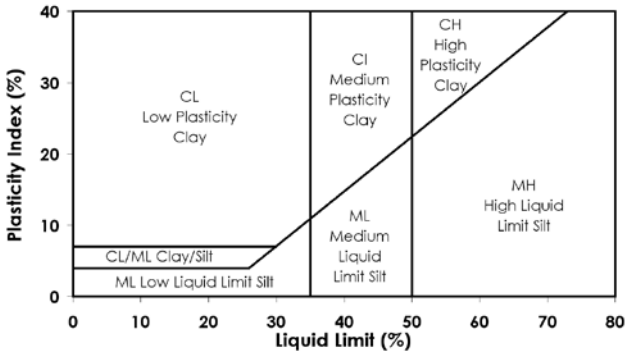
Particle Size

Soil types are described according to the predominating particle size, qualified by the grading of other particles present (e.g. sandy CLAY). Unless otherwise stated, particle size is described in accordance with the following table.

Division	Subdivision	Size (mm)
BOULDERS		>200
COBBLES		63 to 200
GRAVEL	Coarse	20 to 63
	Medium	6 to 20
	Fine	2.36 to 6
SAND	Coarse	0.6 to 2.36
	Medium	0.2 to 0.6
	Fine	0.075 to 0.2
SILT		0.002 to 0.075
CLAY		< 0.002

Plasticity Properties

Plasticity properties of cohesive soils can be assessed in the field by tactile properties or by laboratory procedures.



Moisture Condition

Dry	Looks and feels dry. Cohesive and cemented soils are hard, friable or powdery. Uncemented granular soils run freely through hands.
Moist	Soil feels cool and damp and is 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.

Consistency of Cohesive Soils

Cohesive soils refer to predominantly clay materials.

Term	C_u (kPa)	Approx. SPT "N"	Field Guide
Very Soft	<12	2	A finger can be pushed well into the soil with little effort. Sample extrudes between fingers when squeezed in fist.
Soft	12 - 25	2 – 4	A finger can be pushed into the soil to about 25mm depth. Easily moulded in fingers.
Firm	25 - 50	4 – 8	The soil can be indented about 5mm with the thumb, but not penetrated. Can be moulded by strong pressure in the figures.
Stiff	50 - 100	8 – 15	The surface of the soil can be indented with the thumb, but not penetrated. Cannot be moulded by fingers.
Very Stiff	100 - 200	15 – 30	The surface of the soil can be marked, but not indented with thumb pressure. Difficult to cut with a knife. Thumbnail can readily indent.
Hard	> 200	> 30	The surface of the soil can be marked only with the thumbnail. Brittle. Tends to break into fragments.
Friable	-	-	Crumbles or powders when scraped by thumbnail.

Density of Granular Soils

Non-cohesive soils are classified on the basis of relative density, generally from standard penetration test (SPT) or Dutch cone penetrometer test (CPT) results as below:

Relative Density	%	SPT 'N' Value* (blows/300mm)	CPT Cone Value (q_c MPa)
Very loose	< 15	< 5	< 2
Loose	15 - 35	5 - 10	2 - 5
Medium dense	35 - 65	10 - 30	5 - 15
Dense	65 - 85	30 - 50	15 - 25
Very dense	> 85	> 50	> 25

* Values may be subject to corrections for overburden pressures and equipment type.

Minor Components

Minor components in soils may be present and readily detectable, but have little bearing on general geotechnical classification. Terms include:

Term	Assessment	Proportion of Minor component In:
Trace of	Presence just detectable by feel or eye. Soil properties little or no different to general properties of primary component.	Coarse grained soils: < 5 % Fine grained soils: < 15 %
With some	Presence easily detectable by feel or eye. Soil properties little different to general properties of primary component.	Coarse grained soils: 5 – 12 % Fine grained soils: 15 – 30 %

Soil Data

Explanation of Terms (2 of 3)

martens consulting engineers

Symbols for Soils and Other

SOILS


COBBLES/BOULDERS


GRAVEL (GP OR GW)


SILTY GRAVEL (GM)


CLAYEY GRAVEL (GC)


SAND (SP OR SW)


SILTY SAND (SM)


CLAYEY SAND (SC)


SILT (ML OR MH)


ORGANIC SILT (OH)


CLAY (CL, CI OR CH)


SILTY CLAY


SANDY CLAY


PEAT


TOPSOIL

OTHER


FILL


TALUS


ASPHALT


CONCRETE

Unified Soil Classification Scheme (USCS)

FIELD IDENTIFICATION PROCEDURES (Excluding particles larger than 63 mm and basing fractions on estimated mass)					USCS	Primary Name
COARSE GRAINED SOILS More than 50 % of material less than 63 mm is larger than 0.075 mm	(A 0.075 mm particle is about the smallest particle visible to the naked eye)	GRAVELS More than half of coarse fraction is larger than 2.0 mm.	CLEAN GRAVELS (Little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes.	GW	Gravel
				Predominantly one size or a range of sizes with more intermediate sizes missing	GP	Gravel
			GRAVELS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	GM	Silty Gravel
				Plastic fines (for identification procedures see CL below)	GC	Clayey Gravel
		SANDS More than half of coarse fraction is smaller than 2.0 mm	CLEAN SANDS (Little or no fines)	Wide range in grain sizes and substantial amounts of intermediate sizes missing.	SW	Sand
				Predominantly one size or a range of sizes with some intermediate sizes missing	SP	Sand
			SANDS WITH FINES (Appreciable amount of fines)	Non-plastic fines (for identification procedures see ML below)	SM	Silty Sand
				Plastic fines (for identification procedures see CL below)	SC	Clayey Sand

FINE GRAINED SOILS More than 50 % of material less than 63 mm is smaller than 0.075 mm	IDENTIFICATION PROCEDURES ON FRACTIONS < 0.2 MM					
	DRY STRENGTH (Crushing Characteristics)	DILATANCY	TOUGHNESS	DESCRIPTION	USCS	Primary Name
	None to Low	Quick to Slow	None	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	ML	Silt
	Medium to High	None	Medium	Inorganic clays of low to medium plasticity [1], gravely clays, sandy clays, silty clays, lean clays	CL [2]	Clay
	Low to Medium	Slow to Very Slow	Low	Organic slits and organic silty clays of low plasticity	OL	Organic Silt
	Low to Medium	Slow to Very Slow	Low to Medium	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts	MH	Silt
	High	None	High	Inorganic clays of high plasticity, fat clays	CH	Clay
	Medium to High	None	Low to Medium	Organic clays of medium to high plasticity	OH	Organic Silt
HIGHLY ORGANIC SOILS	Readily identified by colour, odour, spongy feel and frequently by fibrous texture				Pt	Peat

Notes:

1. Low Plasticity – Liquid Limit W_L < 35 % Medium Plasticity – Liquid limit W_L 35 to 60 % High Plasticity - Liquid limit W_L > 60 %.
2. CI may be adopted for clay of medium plasticity to distinguish from clay of low plasticity.

Soil Data

Explanation of Terms (3 of 3)

Soil Agricultural Classification Scheme

In some situations, such as where soils are to be used for effluent disposal purposes, soils are often more appropriately classified in terms of traditional agricultural classification schemes. Where a Martens report provides agricultural classifications, these are undertaken in accordance with descriptions by Northcote, K.H. (1979) *The factual key for the recognition of Australian Soils*, Rellim Technical Publications, NSW, p 26 - 28.

Symbol	Field Texture Grade	Behaviour of moist bolus	Ribbon length	Clay content (%)
S	Sand	Coherence nil to very slight; cannot be moulded; single grains adhere to fingers	0 mm	< 5
LS	Loamy sand	Slight coherence; discolours fingers with dark organic stain	6.35 mm	5
CLS	Clayey sand	Slight coherence; sticky when wet; many sand grains stick to fingers; discolours fingers with clay stain	6.35mm - 1.3cm	5 - 10
SL	Sandy loam	Bolus just coherent but very sandy to touch; dominant sand grains are of medium size and are readily visible	1.3 - 2.5	10 - 15
FSL	Fine sandy loam	Bolus coherent; fine sand can be felt and heard	1.3 - 2.5	10 - 20
SCL$^-$	Light sandy clay loam	Bolus strongly coherent but sandy to touch, sand grains dominantly medium size and easily visible	2.0	15 - 20
L	Loam	Bolus coherent and rather spongy; smooth feel when manipulated but no obvious sandiness or silkiness; may be somewhat greasy to the touch if much organic matter present	2.5	25
Lfsy	Loam, fine sandy	Bolus coherent and slightly spongy; fine sand can be felt and heard when manipulated	2.5	25
SiL	Silt loam	Coherent bolus, very smooth to silky when manipulated	2.5	25 + > 25 silt
SCL	Sandy clay loam	Strongly coherent bolus sandy to touch; medium size sand grains visible in a finer matrix	2.5 - 3.8	20 - 30
CL	Clay loam	Coherent plastic bolus; smooth to manipulate	3.8 - 5.0	30 - 35
SiCL	Silty clay loam	Coherent smooth bolus; plastic and silky to touch	3.8 - 5.0	30- 35 + > 25 silt
FSCL	Fine sandy clay loam	Coherent bolus; fine sand can be felt and heard	3.8 - 5.0	30 - 35
SC	Sandy clay	Plastic bolus; fine to medium sized sands can be seen, felt or heard in a clayey matrix	5.0 - 7.5	35 - 40
SiC	Silty clay	Plastic bolus; smooth and silky	5.0 - 7.5	35 - 40 + > 25 silt
LC	Light clay	Plastic bolus; smooth to touch; slight resistance to shearing	5.0 - 7.5	35 - 40
LMC	Light medium clay	Plastic bolus; smooth to touch, slightly greater resistance to shearing than LC	7.5	40 - 45
MC	Medium clay	Smooth plastic bolus, handles like plasticine and can be moulded into rods without fracture, some resistance to shearing	> 7.5	45 - 55
HC	Heavy clay	Smooth plastic bolus; handles like stiff plasticine; can be moulded into rods without fracture; firm resistance to shearing	> 7.5	> 50

Rock Data

Explanation of Terms (1 of 2)

Symbols for Rock

SEDIMENTARY ROCK


BRECCIA


CONGLOMERATE


CONGLOMERATIC SANDSTONE


SANDSTONE/QUARTZITE


SILTSTONE


MUDSTONE/CLAYSTONE


SHALE


COAL


LIMESTONE


LITHIC TUFF

IGNEOUS ROCK


GRANITE


DOLERITE/BASALT

METAMORPHIC ROCK


SLATE, PHYLLITE, SCHIST


GNEISS


METASANDSTONE


METASILTSTONE


METAMUDSTONE

Definitions

Descriptive terms used for Rock by Martens are based on AS1726 and encompass rock substance, defects and mass.

Rock Substance In geotechnical engineering terms, rock substance is any naturally occurring aggregate of minerals and organic matter which cannot be disintegrated or remoulded by hand in air or water. Other material is described using soil descriptive terms. Rock substance is effectively homogeneous and may be isotropic or anisotropic.

Rock Defect Discontinuity or break in the continuity of a substance or substances.

Rock Mass Any body of material which is not effectively homogeneous. It can consist of two or more substances without defects, or one or more substances with one or more defects.

Degree of Weathering

Rock weathering is defined as the degree of decline in rock structure and grain property and can be determined in the field.

Term	Symbol	Definition
Residual soil[1]	Rs	Soil derived from the weathering of rock. The mass structure and substance fabric are no longer evident. There is a large change in volume but the soil has not been significantly transported.
Extremely weathered[1]	EW	Rock substance affected by weathering to the extent that the rock exhibits soil properties - i.e. it can be remoulded and can be classified according to the Unified Classification System, but the texture of the original rock is still evident.
Highly weathered[2]	HW	Rock substance affected by weathering to the extent that limonite staining or bleaching affects the whole of the rock substance and other signs of chemical or physical decomposition are evident. Porosity and strength may be increased or decrease compared to the fresh rock usually as a result of iron leaching or deposition. The colour and strength of the original rock substance is no longer recognisable.
Moderately weathered[2]	MW	Rock substance affected by weathering to the extent that staining extends throughout the whole of the rock substance and the original colour of the fresh rock is no longer recognisable.
Slightly weathered	SW	Rock substance affected by weathering to the extent that partial staining or discolouration of the rock substance usually by limonite has taken place. The colour and texture of the fresh rock is recognisable.
Fresh	FR	Rock substance unaffected by weathering

Notes:
1 The term "Distinctly Weathered" (DW) may be used to cover the range of substance weathering between EW and SW.
2 Rs and EW material is described using soil descriptive terms.

Rock Strength

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the direction normal to the loading. The test procedure is described by the International Society of Rock Mechanics.

Term	Is (50) MPa	Field Guide	Symbol
Very low	>0.03 ≤0.1	May be crumbled in the hand. Sandstone is 'sugary' and friable.	VL
Low	>0.1 ≤0.3	A piece of core 150mm long x 50mm diameter may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.	L
Medium	>0.3 ≤1.0	A piece of core 150mm long x 50mm diameter can be broken by hand with considerable difficulty. Readily scored with a knife.	M
High	>1 ≤3	A piece of core 150mm long x 50mm diameter cannot be broken by unaided hands, can be slightly scratched or scored with a knife.	H
Very high	>3 ≤10	A piece of core 150mm long x 50mm diameter may be broken readily with hand held hammer. Cannot be scratched with pen knife.	VH
Extremely high	>10	A piece of core 150mm long x 50mm diameter is difficult to break with hand held hammer. Rings when struck with a hammer.	EH

Rock Data

Explanation of Terms (2 of 2)

Degree of Fracturing

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

Term	Description
Fragmented	The core is comprised primarily of fragments of length less than 20 mm, and mostly of width less than core diameter.
Highly fractured	Core lengths are generally less than 20 mm to 40 mm with occasional fragments.
Fractured	Core lengths are mainly 30 mm to 100 mm with occasional shorter and longer sections.
Slightly fractured	Core lengths are generally 300 mm to 1000 mm, with occasional longer sections and sections of 100 mm to 300 mm.
Unbroken	The core does not contain any fractures.

Rock Core Recovery

TCR = Total Core Recovery

$$= \frac{\text{Length of core recovered}}{\text{Length of core run}} \times 100\%$$

SCR = Solid Core Recovery

$$= \frac{\sum \text{Length of cylindrical core recovered}}{\text{Length of core run}} \times 100\%$$

RQD = Rock Quality Designation

$$= \frac{\sum \text{Axial lengths of core} > 100\,\text{mm long}}{\text{Length of core run}} \times 100\%$$

Rock Strength Tests

- ▼ Point load strength Index (Is50) - axial test (MPa)
- ▶ Point load strength Index (Is50) - diametral test (MPa)
- ● Unconfined compressive strength (UCS) (MPa)

Defect Type Abbreviations and Descriptions

Defect Type (with inclination given)

BP	Bedding plane parting
FL	Foliation
CL	Cleavage
JT	Joint
FC	Fracture
SZ/SS	Sheared zone/ seam (Fault)
CZ/CS	Crushed zone/ seam
DZ/DS	Decomposed zone/ seam
FZ	Fractured Zone
IS	Infilled seam
VN	Vein
CO	Contact
HB	Handling break
DB	Drilling break

Planarity

Pl	Planar
Cu	Curved
Un	Undulating
St	Stepped
Ir	Irregular
Dis	Discontinuous

Roughness

Pol	Polished
Sl	Slickensided
Sm	Smooth
Ro	Rough
VR	Very rough

Thickness

Zone	> 100 mm
Seam	> 2 mm < 100 mm
Plane	< 2 mm

Coating or Filling

Cn	Clean
Sn	Stain
Ct	Coating
Vnr	Veneer
Fe	Iron Oxide
X	Carbonaceous
Qz	Quartzite
MU	Unidentified mineral

Inclination

Inclination of defect is measured from perpendicular to and down the core axis.
Direction of defect is measured clockwise (looking down core) from magnetic north.

Test, Drill and Excavation Methods

Explanation of Terms (1 of 3)

Sampling

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

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

Undisturbed samples may be taken by pushing a thin-walled sampling tube, e.g. U_{50} (50 mm internal diameter thin walled tube), into soils and withdrawing a soil sample in a relatively undisturbed state. Such samples yield information on structure and strength and are necessary for laboratory determination of shear strength and compressibility. Undisturbed sampling is generally effective only in cohesive soils. Other sampling methods may be used. Details of the type and method of sampling are given in the report.

Drilling / Excavation Methods

The following is a brief summary of drilling and excavation methods currently adopted by the Company and some comments on their use and application.

Hand Excavation - in some situations, excavation using hand tools, such as mattock and spade, may be required due to limited site access or shallow soil profiles.

Hand Auger - the hole is advanced by pushing and rotating either a sand or clay auger, generally 75-100 mm in diameter, into the ground. The penetration depth is usually limited to the length of the auger pole; however extender pieces can be added to lengthen this.

Test Pits - these are excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils and, if it is safe to descend into the pit, collection of bulk disturbed samples. The depth of penetration is limited to about 3 m for a backhoe and up to 6 m for an excavator. A potential disadvantage is the disturbance caused by the excavation.

Large Diameter Auger (e.g. Pengo) - the hole is advanced by a rotating plate or short spiral auger, generally 300 mm or larger in diameter. The cuttings are returned to the surface at intervals (generally of not more than 0.5 m) and are disturbed but usually unchanged in moisture content. Identification of soil strata is generally much more reliable than with continuous spiral flight augers, and is usually supplemented by occasional undisturbed tube sampling.

Continuous Sample Drilling (Push Tube) - the hole is advanced by pushing a 50 - 100 mm diameter socket into the ground and withdrawing it at intervals to extrude the sample. This is the most reliable method of drilling in soils, since moisture content is unchanged and soil structure, strength *etc.* is only marginally affected.

Continuous Spiral Flight Augers - the hole is advanced using 90 - 115 mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling or in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface or, or may be collected after withdrawal of the auger flights, but they are very disturbed and may be contaminated. Information from the drilling (as distinct from specific sampling by SPTs or undisturbed samples) is of relatively lower reliability, due to remoulding, contamination or softening of samples by ground water.

Non-core Rotary Drilling - the hole is advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be determined from the cuttings, together with some information from 'feel' and rate of penetration.

Rotary Mud Drilling - similar to rotary drilling, but using drilling mud as a circulating fluid. The mud tends to mask the cuttings and reliable identification is again only possible from separate intact sampling (eg. from SPT).

Continuous Core Drilling - a continuous core sample is obtained using a diamond tipped core barrel of usually 50 mm internal diameter. Provided full core recovery is achieved (not always possible in very weak or fractured rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation.

In-situ Testing and Interpretation

Cone Penetrometer Testing (CPT)

Cone penetrometer testing (sometimes referred to as Dutch Cone) described in this report has been carried out using an electrical friction cone penetrometer.

The test is described in AS 1289.6.5.1-1999 (R2013). In the test, a 35 mm diameter rod with a cone tipped end is pushed continuously into the soil, the reaction being provided by a specially designed truck or rig which is fitted with an hydraulic ram system.

Measurements are made of the end bearing resistance on the cone and the friction resistance on a separate 130 mm long sleeve, immediately behind the cone. Transducers in the tip of the assembly are connected by electrical wires passing through the push rod centre to an amplifier and recorder unit mounted on the control truck. As penetration occurs (at a rate of approximately 20 mm per second) the information is output on continuous chart recorders. The plotted results given in this report have been traced from the original records. The information provided on the charts comprises:

(i) Cone resistance (q_c) - the actual end bearing force divided by the cross sectional area of the cone, expressed in MPa.

(ii) Sleeve friction (q_f) - the frictional force of the sleeve divided by the surface area, expressed in kPa.

(iii) Friction ratio - the ratio of sleeve friction to cone resistance, expressed in percent.

There are two scales available for measurement of cone resistance. The lower (A) scale (0 - 5 MPa) is used in very soft soils where increased sensitivity is required and is shown in the graphs as a dotted line. The main (B) scale (0 - 50 MPa) is less sensitive and is shown as a full line.

The ratios of the sleeve resistance to cone resistance will vary with the type of soil encountered, with higher relative friction in clays than in sands. Friction ratios of 1 % - 2 % are commonly encountered in sands and very soft clays rising to 4 % - 10 % in stiff clays.

In sands, the relationship between cone resistance and SPT value is commonly in the range:

q_c (MPa) = (0.4 to 0.6) N (blows/300 mm)

In clays, the relationship between undrained shear strength and cone resistance is commonly in the range:

q_c = (12 to 18) C_u

Interpretation of CPT values can also be made to allow estimation of modulus or compressibility values to allow calculation of foundation settlements.

Inferred stratification as shown on the attached reports is assessed from the cone and friction traces and from experience and information from nearby boreholes *etc.* This information is presented for general guidance, but must be regarded as being to some extent interpretive. The test method provides a continuous profile of engineering properties, and where precise information on soil classification is required, direct drilling and sampling may be preferable.

Standard Penetration Testing (SPT)

Standard penetration tests are used mainly in non-cohesive soils, but occasionally also in cohesive soils as a means of determining density or strength and also of obtaining a relatively undisturbed sample.

The test procedure is described in AS 1289.6.3.1-2004. The test is carried out in a borehole by driving a 50 mm diameter split sample tube under the impact of a 63 kg hammer with a free fall of 760 mm. It is normal for the tube to be driven in three successive 150 mm penetration depth increments and the 'N' value is taken as the number of blows for the last two 150 mm depth increments (300 mm total penetration). In dense sands, very hard clays or weak rock, the full 450 mm penetration may not be practicable and the test is discontinued. The test results are reported in the following form:

(i) Where full 450 mm penetration is obtained with successive blow counts for each 150 mm of say 4, 6 and 7 blows:

as 4, 6, 7
N = 13

(ii) Where the test is discontinued, short of full penetration, say after 15 blows for the first 150mm and 30 blows for the next 40mm

as 15, 30/40 mm.

The results of the tests can be related empirically to the engineering properties of the soil. Occasionally, the test method is used to obtain samples in 50 mm diameter thin walled sample tubes in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

Dynamic Cone (Hand) Penetrometers

Hand penetrometer tests are carried out by driving a rod into the ground with a falling weight hammer and measuring the blows for successive 150mm increments of penetration. Normally, there is a depth limitation of 1.2m but this may be extended in certain conditions by the use of extension rods. Two relatively similar tests are used.

Perth sand penetrometer (PSP) - a 16 mm diameter flat ended rod is driven with a 9 kg hammer, dropping 600 mm. The test, described in AS 1289.6.3.3-1997 (R2013), was developed for testing the density of sands (originating in Perth) and is mainly used in granular soils and filling.

Cone penetrometer (DCP) - sometimes known as the Scala Penetrometer, a 16 mm rod with a 20 mm diameter cone end is driven with a 9 kg hammer dropping 510 mm. The test, described in AS 1289.6.3.2-1997 (R2013), was developed initially for pavement sub-grade investigations, with correlations of the test results with California Bearing Ratio published by various Road Authorities.

Pocket Penetrometers

The pocket (hand) penetrometer (PP) is typically a light weight spring hand operated device with a stainless steel loading piston, used to estimate unconfined compressive strength, q_u, (UCS in kPa) of a fine grained soil in field conditions. In use, the free end of the piston is pressed into the soil at a uniform penetration rate until a line, engraved near the piston tip, reaches the soil surface level. The reading is taken from a gradation scale, which is attached to the piston via a built-in spring mechanism and calibrated to kilograms per square centimetre (kPa) UCS. The UCS measurements are used to evaluate consistency of the soil in the field moisture condition. The results may be used to assess the undrained shear strength, C_u, of fine grained soil using the approximate relationship:

$$q_u = 2 \times C_u.$$

It should be noted that accuracy of the results may be influenced by condition variations at selected test surfaces. Also, the readings obtained from the PP test are based on a small area of penetration and could give misleading results. They should not replace laboratory test results. The use of the results from this test is typically limited to an assessment of consistency of the soil in the field and not used directly for design of foundations.

Test Pit / Borehole Logs

Test pit / borehole log(s) presented herein are an engineering and / or geological interpretation of the subsurface conditions. Their reliability will depend to some extent on frequency of sampling and methods of excavation / drilling. Ideally, continuous undisturbed sampling or excavation / core drilling will provide the most reliable assessment but this is not always practicable, or possible to justify on economic grounds. In any case, the test pit / borehole logs represent only a very small sample of the total subsurface profile.

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

Laboratory Testing

Laboratory testing is carried out in accordance with AS 1289 Methods of Testing Soil for Engineering Purposes. Details of the test procedure used are given on the individual report forms.

Ground Water

Where ground water levels are measured in boreholes, there are several potential problems:

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

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

Test, Drill and Excavation Methods

Explanation of Terms (3 of 3)

DRILLING / EXCAVATION METHOD

HA	Hand Auger	RD	Rotary Blade or Drag Bit	NQ	Diamond Core - 47 mm
AD/V	Auger Drilling with V-bit	RT	Rotary Tricone bit	NMLC	Diamond Core – 51.9 mm
AD/T	Auger Drilling with TC-Bit	RAB	Rotary Air Blast	HQ	Diamond Core – 63.5 mm
AS	Auger Screwing	RC	Reverse Circulation	HMLC	Diamond Core – 63.5 mm
HSA	Hollow Stem Auger	CT	Cable Tool Rig	DT	Diatube Coring
S	Excavated by Hand Spade	PT	Push Tube	NDD	Non-destructive digging
BH	Tractor Mounted Backhoe	PC	Percussion	PQ	Diamond Core - 83 mm
JET	Jetting	E	Tracked Hydraulic Excavator	X	Existing Excavation

SUPPORT

Nil	No support	S	Shotcrete	RB	Rock Bolt
C	Casing	Sh	Shoring	SN	Soil Nail
WB	Wash bore with Blade or Bailer	WR	Wash bore with Roller	T	Timbering

WATER

▽ Water level at date shown

▷ Water inflow

◁ Partial water loss

◀ Complete water loss

GROUNDWATER NOT OBSERVED (NO) — The observation of groundwater, whether present or not, was not possible due to drilling water, surface seepage or cave in of the borehole/test pit.

GROUNDWATER NOT ENCOUNTERED (NX) — The borehole/test pit was dry soon after excavation. However, groundwater could be present in less permeable strata. Inflow may have been observed had the borehole/test pit been left open for a longer period.

PENETRATION / EXCAVATION RESISTANCE

L Low resistance: Rapid penetration possible with little effort from the equipment used.

M Medium resistance: Excavation possible at an acceptable rate with moderate effort from the equipment used.

H High resistance: Further penetration possible at slow rate & requires significant effort equipment.

R Refusal/ Practical Refusal. No further progress possible without risk of damage/ unacceptable wear to digging implement / machine.

These assessments are subjective and dependent on many factors, including equipment power, weight, condition of excavation or drilling tools, and operator experience.

SAMPLING

D	Small disturbed sample	W	Water Sample	C	Core sample
B	Bulk disturbed sample	G	Gas Sample	CONC	Concrete Core

U63 Thin walled tube sample - number indicates nominal undisturbed sample diameter in millimetres

TESTING

SPT 4,7,11 N=18	Standard Penetration Test to AS1289.6.3.1-2004 4,7,11 = Blows per 150mm. 'N' = Recorded blows per 300mm penetration following 150mm seating
DCP	Dynamic Cone Penetration test to AS1289.6.3.2-1997. 'n' = Recorded blows per 150mm penetration

Notes:

RW	Penetration occurred under the rod weight only
HW	Penetration occurred under the hammer and rod weight only
HB 30/80mm	Hammer double bouncing on anvil after 80 mm penetration
N=18	Where practical refusal occurs, report blows and penetration for that interval

CPT	Static cone penetration test
CPTu	CPT with pore pressure (u) measurement
PP	Pocket penetrometer test expressed as instrument reading (kPa)
FP	Field permeability test over section noted
VS	Field vane shear test expressed as uncorrected shear strength (sv = peak value, sr = residual value)
PM	Pressuremeter test over section noted
PID	Photoionisation Detector reading in ppm
WPT	Water pressure tests

SOIL DESCRIPTION

Density		Consistency		Moisture	
VL	Very loose	VS	Very soft	D	Dry
L	Loose	S	Soft	M	Moist
MD	Medium dense	F	Firm	W	Wet
D	Dense	St	Stiff	Wp	Plastic limit
VD	Very dense	VSt	Very stiff	Wl	Liquid limit
		H	Hard		

ROCK DESCRIPTION

Strength		Weathering	
VL	Very low	EW	Extremely weathered
L	Low	HW	Highly weathered
M	Medium	MW	Moderately weathered
H	High	SW	Slightly weathered
VH	Very high	FR	Fresh
EH	Extremely high		