REPORT TO

KINCOPPAL-ROSE BAY SCHOOL

ON

REMEDIATION ACTION PLAN

FOR

PROPOSED DEVELOPMENT AT KINCOPPAL-ROSE BAY SCHOOL

AT

CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW

Date: 29 October 2020
Ref: E32915BArpt-RAP

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Executive Summary

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW. The site location is shown on Figure 1 and the RAP applies to the two proposed development areas (i.e. proposed ELC Building and proposed bus parking) within the wider property boundary as shown on Figure 2 (Appendix A).

The RAP has been prepared to support the lodgement of a State Significant Development Application (SSDA).

A Preliminary Site Investigation (PSI) was previously undertaken at the site by JKE and the results are presented in a separate report with summary and key information included in this document.

The JKE PSI identified polycyclic aromatic hydrocarbons (PAHs), total recoverable hydrocarbons (TRHs) and heavy metals contamination in soil within areas of proposed development works (see Figure 3 in Appendix A). The source of contamination was identified as the fill material historically imported onto site. The contaminants requiring remediation include: lead contamination hotspot in the northern part of the site where the new ELC building is proposed, carcinogenic PAHs and also TRH F3 within the southern part of the site area where the new two-storey bus/carpark is proposed. It was noted that TRH F3 impact is co-located with carcinogenic PAHs contamination and can be remediated concurrently.

The goal of the remediation is to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to reduce the human health and environmental risks posed by the site contamination to an acceptable level. The RAP includes a methodology to remediate and validate the site. A contingency plan for remediation is included together with site management procedures and an unexpected finds protocol to be implemented during remediation.

The remediation objectives are to:

- Summarise previous investigations and historical contamination data;
- Provide a methodology to gather additional data from the areas where sampling did not occur during the JKE PSI and to ascertain the extent of the remediation required;
- Provide a methodology to remediate and validate the site;
- Provide a contingency plan and unexpected finds protocol for the remediation works; and
- Outline site management procedures to be implemented during remediation.

Identified data gaps, presented in this RAP, are to be addressed through pre-remediation validation program which is to be completed prior to site remediation taking place, with the additional data to be utilised to ascertain the specific details pertaining to remedial works via a Remedial Works Plan (RWP). Existing data gaps will also be addressed as part of the RAP protocols and waste classification assessment for off-site disposal of excavated material as part of the development.

The remediation is considered to be straight forward and includes the excavation and off-site disposal of contaminated fill associated with the impacted beneath the areas of proposed development works. If required, capping is to be provided for contaminated material to be left in-situ, which will require management via a long-term environmental management plan (EMP).

JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP is implemented accordingly. A site validation report and if required, a long term EMP should be prepared on completion of remediation activities and should be submitted to the consent authority.

The conclusions and recommendations should be read in conjunction with the limitations presented in the body of this report.

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Abbreviations

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Below Ground Level	**BGL**
Benzo(a)pyrene Toxicity Equivalent Factor	**BaP TEQ**
Bureau of Meteorology	**BOM**
Benzene, Toluene, Ethylbenzene, Xylene	**BTEX**
Cation Exchange Capacity	**CEC**
Contaminated Land Management	**CLM**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Ecological Investigation Level	**EIL**
Environmental Investigation Services	**EIS**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environment Protection Authority	**EPA**
Environment Protection Licence	**EPL**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Excavated Natural Material	**ENM**
Health Investigation Level	**HILs**
Health Screening Level	**HSL**
JK Environments	**JKE**
Long Term EMP	**LTEMP**
Map Grid of Australia	**MGA**
National Association of Testing Authorities	**NATA**
National Environmental Protection Measure	**NEPM**
Organochlorine Pesticides	**OCP**
Organophosphate Pesticides	**OPP**
Polycyclic Aromatic Hydrocarbons	**PAH**
Polychlorinated Biphenyls	**PCBs**
Per-and Polyfluoroalkyl Substances	**PFAS**
Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Review of Environmental Factors	**REF**
Relative Percentage Difference	**RPD**
Remedial Works Plan	**RWP**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Source, Pathway, Receptor	**SPR**
Standing Water Level	**SWL**

Total Recoverable Hydrocarbons	**TRH**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Validation Assessment Criteria	**VAC**
Virgin Excavated Natural Material	**VENM**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millilitres	**ml or mL**
Milligrams per Kilogram	**mg/kg**
Percentage	**%**
Percentage weight for weight	**%w/w**

1 INTRODUCTION

Mr. Terry Mahady of Mahady Management on behalf of Kincoppal-Rose Bay, School of the Sacred Heart (KRB) ('the client') commissioned JK Environments (JKE) to prepare a Remediation Action Plan (RAP) for the proposed development at KRB situated on the corner of New South Head Road and Vaucluse Road, Vaucluse, NSW. The site location is shown on Figure 1 and the RAP applies to the two proposed development areas (i.e. proposed ELC Building and proposed bus parking) within the wider property boundary as shown on Figure 2 (Appendix A).

JKE have previously undertaken a Preliminary Site Investigation (PSI) at the site (JKE Ref: E32915BDrpt, dated 2 March 2020)[1]. Information from the PSI is presented throughout this report (where relevant) and a summary of the findings is included in Section 2.

The RAP has been prepared to support the lodgement of a State Significant Development Application (SSDA).

The RAP includes a methodology to remediate and validate the site. A contingency plan for remediation is included together with site management procedures and an unexpected finds protocol to be implemented during remediation.

1.1 Proposed Development Details

The proposed development includes construction of a two-storey Early Learning Centre (ELC) building in Precinct A (northern part of the site), a two-storey bus/carpark in Precinct B (southern part of the site) and a road/elevated walkway in Precinct B (central part of the site). Required earthworks are anticipated to include excavations to a maximum depth of approximately 2m for the proposed ELC building and a new bus/carpark. Proposed new road is assumed to be at, or close to, existing surface levels.

1.2 Remediation Goal, Aims and Objectives

The goal of the remediation is to render the site suitable for the proposed development from a contamination viewpoint. The primary aim of the remediation at the site is to reduce the human health and environmental risks posed by site contamination to an acceptable level.

The primary objectives of the RAP are to:

- Summarise previous investigations and historical contamination data;
- Provide a methodology to provide additional data from the areas where sampling did not occur during the JKE PSI and to increase the general sample density to ascertain the extent of the remediation required;
- Provide a methodology to remediate and validate the site;
- Provide a contingency plan and unexpected finds protocol for the remediation works; and
- Outline site management procedures to be implemented during remediation.

[1] JKE, (2020). Report to Kincoppal-Rose Bay School on Preliminary Site Investigation with Limited Sampling for Proposed Development at Kincoppal-Rose Bay School at Corner New South Head Road and Vaucluse Road, Vaucluse, NSW (referred to as the 'PSI').

1.3 Scope of Work

The RAP was prepared generally in accordance with a JKE proposal (Ref: EP 52718BA-RAP) of 23 September 2020 and written acceptance from the client to proceed with the RAP of 23 September 2020. The scope of work included a review of previous reports and Conceptual Site Model (CSM), and preparation of the RAP.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[2], State Environmental Planning Policy No.55 – Remediation of Land (1998)[3] and other guidelines made under or with regards to the Contaminated Land Management Act (1997)[4], including the Consultants Reporting on Contaminated Land (2020)[5] guidelines.

A list of reference documents/guidelines is included in the appendices.

[2] National Environment Protection Council (NEPC), (2013). *National Environmental Protection (Assessment of Site Contamination) Measure 1999 (as amended 2013).* (referred to as NEPM 2013)

[3] *State Environmental Planning Policy No. 55 – Remediation of Land 1998* (NSW) (referred to as SEPP55)

[4] Contaminated Land Management Act 1997 (NSW) (referred to as CLM Act 1997)

[5] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)

2 SITE INFORMATION

2.1 Background / Summary of Site History

JKE have previously undertaken a Preliminary Site Investigation (PSI) with limited sampling. The PSI included a site inspection, desktop review of historical information and sampling from 10 boreholes and one groundwater monitoring well. Key information from this report is included in Appendix C. The site history is summarised in the following table:

Table 2-1: Summary of Historical Land Uses

Year(s)	Potential Land Use / Activities
Pre-1930 - Current	School grounds and accommodation as well as possibly for religious use.

The potential contamination sources and contaminants of potential concern (CoPC) identified in the PSI are presented in the following table:

Table 2-2: Potential (and/or known) Contamination Sources/AEC and Contaminants of Potential Concern

Source / AEC	CoPC
Fill material – The site appears to have been historically filled to achieve the existing levels. The fill may have been imported from various sources and could be contaminated.	Heavy metals (arsenic, cadmium, chromium, copper, lead, mercury, nickel and zinc), petroleum hydrocarbons (referred to as total recoverable hydrocarbons – TRHs), benzene, toluene, ethylbenzene and xylene (BTEX), polycyclic aromatic hydrocarbons (PAHs), organochlorine pesticides (OCPs), organophosphate pesticides (OPPs), polychlorinated biphenyls (PCBs) and asbestos.
Use of pesticides – Pesticides may have been used beneath the buildings and/or around the site.	Heavy metals and OCPs.
Hazardous Building Material – Hazardous building materials may be present as a result of former building and demolition activities. These materials may also be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs.

A summary of the subsurface conditions encountered during PSI is presented in the following table:

Table 2-3: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic Concrete (AC) pavement was encountered at the surface in BH1, BH2 and BH3, ranging in thickness between 50mm and 90mm.
Fill	Fill was encountered at the surface or beneath the AC pavement in all boreholes and extended to depths of approximately 0.2 to 6.2mBGL. BH10 was terminated in the fill at a depth of approximately 0.45m. Relatively deep fill greater than 2mBGL was encountered in boreholes BH2 and BH3 located near the proposed ELC building. The fill typically comprised gravelly silty sand, silty sand, fine to coarse grained, with inclusions comprising of varying sizes and fractions of igneous and sandstone gravel, clay, roots, brick fragments and occasional sandstone cobbles and boulders at depth (in some of the locations).

Profile	Description
Natural Residual Soil	Natural soil was encountered in BH2, BH6, BH7 and BH8 beneath the fill and extended down to at least between 0.4 and 9.20mBGL. Residual natural soil typically comprised Silty Sand, Clayey Sand and Gravelly Sand.
Bedrock	Sandstone bedrock was encountered in most of the boreholes at depths varying from approximately 0.4-6.2mBGL. Bedrock was not encountered in BH2 only. BH2 encountered deep sands.
Groundwater	All boreholes were dry on completion of drilling. A groundwater monitoring well was installed at BH2 to allow for further groundwater monitoring. In BH2, the groundwater was observed at depths ranging between 8.0-8.5mBGL after completion of drilling and upon return to the site at a later date. In BH8, groundwater was encountered on completion of hand auguring at 1.8m depth, just above the soil/bedrock interface.

Selected soil and groundwater samples were submitted for laboratory analysis to be assessed for any associated impacts by the CoPC.

Laboratory results identified lead and carcinogenic PAHs concentrations in fill above the adopted site assessment criteria (SAC) in northern and southern parts of the site within areas of proposed development. The source of contamination was identified as the fill material historically imported onto the site. The contaminants requiring remediation include: lead contamination (hotspot) in the northern part of the site where the new ELC building is proposed, carcinogenic PAHs within the southern part of the site area where the new two-storey bus/carpark is proposed, and TRH F3 identified within northern and southern parts of the site which poses a risk to ecological receptors. TRH exceedances where co-located with the identified exceedances of carcinogenic PAHs requiring remediation in BH8. The extent of soil impacted by the contaminants has not been confirmed and constitutes a data gap to be addressed as part of the remediation.

Significant contamination of groundwater was not identified. Elevated concentration of heavy metal zinc was detected in the groundwater sample, though were representative of groundwater conditions within an urban environment and considered to be a regional issue. A number of PAH compounds namely: phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were also detected above the ecological and human health SAC in groundwater. However, JKE are of the opinion that slow groundwater recharge and sediment present within one well sampled as part of the investigation may have cause interference with the PAH analysis.

Based on the preliminary waste classification assessment undertaken for the PSI, the fill material met the classification of General Solid Waste (non-putrescible). It was noted that low concentrations of PAHs were encountered within the sample of natural soil collected from BH8 (1.6-1.8m) and as such natural soils in this area were considered unlikely to meet the definition of VENM for off-site disposal or re-use purposes, and were assigned a preliminary classification of General Solid Waste (non-putrescible). It was recommended that additional testing be undertaken of the natural soil to confirm the final classification for off-site disposal.

Based on the findings of the PSI, the report recommended that the site can be made suitable for the proposed development, subject to the implementation of the following recommendations:

- Prepare a Remediation Action Plan (RAP) to address the contamination issues identified at the site. The RAP will include the requirements for addressing the data gaps identified in this assessment and for the preparation of an unexpected find protocol (UFP); and
- Undertake a validation assessment documenting the remediation works.

An assessment of data gaps was undertaken for the PSI and is provided in the following table:

Table 2-4: Data Gaps from the PSI

Data Gap	Assessment
Groundwater flow direction not confirmed / groundwater assessment limited in scope	The existence of only one groundwater monitoring well on site available for sampling presents limitations and creates data gaps associated with the limited scope of groundwater assessment at this stage. Groundwater flow direction could not be confirmed with great degree of accuracy and sensible assessment of groundwater quality between up-gradient and down-gradient locations at the site is also unable to be properly completed. Actual depth to groundwater table beneath the site was not ascertained. Groundwater conditions and quality could be further confirmed during the remediation/validation process.
Delineation of identified contamination hotspot.	This data gap relates to the lack of information associated with the lateral extent of the identified hotspot of lead impacted fill material in the vicinity of BH2. The Carcinogen PAHs detected in BH8 has not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during waste classification for off-site disposal of excavated material as part of the development.
Characterisation of soils for waste classification purposes	Based on the results of the intrusive investigation, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided within this report are preliminary in nature due to the limited samples and variation encountered, and will require confirmation prior to off-site disposal of soils and bedrock.

2.2 Site Identification

Table 2-5: Site Identification

Current Site Owner:	Kincoppal-Rose Bay School
Site Address:	Corner of New South Head Road and Vaucluse Road, Vaucluse, NSW
Lot & Deposited Plan:	Lot 104 in DP1092747
Current Land Use:	Educational Establishment
Proposed Land Use:	Educational Establishment
Local Government Authority:	Woollahra Municipal Council

Current Zoning:	SP2 – Educational Establishment
Site Area (m^2) (approx.):	Approximately 4,500m^2 - the site (i.e. targeted assessment areas as part of the PSI) 60,380 m^2 – the wider site
RL (AHD in m) (approx.):	10-60 mAHD
Geographical Location (decimal degrees) (approx.):	Latitude: -33.862451 Longitude: 151.270816
Site Location & Regional Setting:	The wider site is located in a predominantly residential area of Vaucluse. The wider site is bounded by mainly residential properties to the north, east and south, Hermitage Reserve to the west, Forsyth Park to the south/south-east and St. Michael's Anglican Church which is located on the property adjoining the site to the north/north-east. The wider site is located approximately 28m to the east of Rose Bay.
Topography:	The regional topography is characterised by a west facing hillside that falls towards Rose Bay. The site area is situated across the length of the hillside which has slope towards the west at an approximate average of 10.5°. Parts of the site appear to have been levelled to account for the slope and accommodate the existing buildings and infrastructure across the wider site area.
Geology & Hydrogeology:	Regional geological information presented in the JKE PSI indicated that the site is underlain by Hawkesbury Sandstone, which typically consists of medium to coarse grained quartz sandstone with minor shale and laminite lenses. The geological map also indicates an igneous dyke to pass through the site. The subsurface conditions within, and adjacent to a dyke can be extremely variable. The bedrock in contact with the dyke can vary considerably in terms of its depth below the surface. The information reviewed for the PSI indicated that the subsurface conditions at the site are expected to consist of moderate to high permeability residual sandy soils overlying sandstone bedrock which is typically encountered at moderate to shallow depths. Abstraction and use of groundwater at the site may be viable under these conditions, however the use of groundwater is not proposed as part of the development. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur. Considering the local topography and surrounding land features, JKE anticipate groundwater to flow east through the site towards Rose Bay.
Acid Sulfate Soil (ASS) Risk and Planning	The site is not located in an acid sulfate soil (ASS) risk area according to the risk maps prepared by the Department of Land and Water Conservation. ASS information reviewed for the PSI indicated that the site is located within a Class 5 risk area in accordance with the Woollahra Local Environmental Plan (LEP 2014). Works in Class 5 areas that could pose an environmental risk in terms of ASS include works within 500m of adjacent Class 1,2,3,4 land which are likely to lower the water table below 1m AHD on the adjacent Class 1,2,3,4 land. This is unlikely to be the case due to site's elevation above the sea level (i.e. 10-60 mAHD) and the anticipated depth of soil disturbance as part of the proposed development works.

Surrounding Land Use:	During our inspection, JKE observed the following land uses in the immediate surrounds: • North – residential and St. Michaels Anglican Church; • South – residential and Forsyth Park recreational area; • East – school playing fields and sporting grounds further across Vaucluse Road and residential further across New South Head Road; and • West – Hermitage Foreshore Reserve area and Rose Bay.
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2
Sample Contamination Plan:	Figure 3

2.2.1 Site Inspection

At the time of the inspection completed during PSI, the wider site was occupied by Kincoppal-Rose Bay School which was originally founded in 1882. Numerous single and multi-storey buildings and structures including accessing roads, footpaths and landscaping areas were identified across the wider property, including on or within close proximity to the proposed development areas. Based on the age of some of the buildings and structures on site, it was considered likely that hazardous building materials including asbestos may potentially be present at the site.

Fill soils were encountered within all boreholes drilled during fieldworks. Deeper fill was also identified in some parts of the site, and is indicative of cut/fill activities which historically took place across the site for levelling purposes. No information regarding potential source of identified fill material was provided.

Numerous mature native trees, landscaped areas and strips of vegetation were observed throughout the wider site. No obvious signs of vegetation stress or grass dieback were observed anywhere in the vicinity of the site.

3 SITE CHARACTERISATION AND CONCEPTUAL SITE MODEL

NEPM (2013) defines a CSM as a representation of site related information regarding contamination sources, receptors and exposure pathways between those sources and receptors. The CSM for the site is presented in the following sub-sections and is based on the previous investigation data, site history and site information presented in Section 2.

3.1 Summary of Contamination (Site Characterisation)

3.1.1 Soil

The PSI identified heavy metal lead concentration which exceeded the HIL SAC (300 mg/kg) in fill soil sample collected from BH2 [0.75-0.95m] (810 mg/kg). BH2 was located within the northern part of the site where new ELC building is being proposed (see Figure 3). The concentration was greater than 250% of the SAC and considered a hotspot. The source of the lead is considered to be associated with the fill material, with further testing of underlying natural material confirming lead concentration below the SAC. Analysis of groundwater at this location indicate low concentration of dissolved heavy metal lead. In addition, leachability analysis which was undertaken on fill samples from this location for waste classification purposes revealed low concentrations of dissolved lead. Based on this, it was considered unlikely for lead to migrate into the groundwater at this location.

Carcinogenic PAHs were detected at concentration which exceeded the HIL SAC (3 mg/kg) in fill soil sample collected from BH8 [0.6-0.7m] (6.9 mg/kg). BH8 was located within the southern part of the site where new two-storey bus/carpark is being proposed (see Figure 3). The source of Carcinogenic PAHs is considered to be associated with the fill material, with further testing of underlying natural material confirming concentration of Carcinogenic PAHs below the SAC. Leachability analysis was undertaken on samples from this location for waste classification purposes, with the TCLP results indicating the PAHs were generally immobile and unlikely to migrate into the groundwater beneath the site.

The concentration of TRH F3 in BH1 [0.05-0.15m] (350 mg/kg) and BH8 [0.6-0.7m] (340 mg/kg) marginally exceeded the EIL SAC (300 mg/kg). BH1 was located within the northern part of the site and was positioned outside the footprint of the new proposed ELC building within paved internal access road. BH8 was located in the southern part of the site within the areas where the new two-storey bus/carpark is proposed to be developed (see Figure 3). The sources of the TRHs are considered to be associated with the fill material, with further testing of underlying natural material confirming TRH concentrations below the SAC. It was noted that impact in BH8 [0.6-0.7m] is co-located with a Carcinogenic PAHs contamination posing human health risk and can be remediated concurrently.

3.1.2 Groundwater

Zinc concentration in excess of the ecological (GIL marine) SAC was reported for the sample from MW2. Zinc in groundwater is considered to be a regional issue which is common in urban environments due to runoff and leaking water infrastructure.

PAHs compounds phenanthrene, anthracene, fluoranthene and benzo(a)pyrene were detected above the ecological and human health SAC in sample from MW2. In addition, trace concentrations of other PAHs were also identified within the groundwater sample.

The source of PAHs in groundwater was not confirmed with certainty at this stage. Physio-chemical properties of PAHs, and in particular benzo(a)pyrene, indicate a very low water solubility factor. PAHs and especially benzo(a)pyrene tend to bind to particulate matter rather than leach/dissolve in order to be transported in groundwater. Field observations made during development and sampling of MW2 indicated a very low recharge rate into the well which also included some sediment loading. Sediment is believed to have caused interference with the PAH analysis. This was further substantiated by the analytical data for the duplicate sample which reported significantly difference in detected concentrations of PAHs as compared to the primary sample.

3.2 CSM

The table below includes a review of the CSM which has been used to design the remediation strategy. The CSM will require further review if additional site data becomes available.

Table 3-1: CSM

Contaminant source(s) and contaminants of concern	Potential contamination sources: fill soil. Contaminants of concern: heavy metal lead, carcinogenic PAHs and TRH F3 fraction.
Affected media	Soil/fill has been identified as the affected medium for remediation. Groundwater remediation is not deemed necessary and is not being captured under this RAP at this stage. Groundwater conditions and quality could be further confirmed during the remediation/validation process. Any seepage encountered during excavations will be captured and managed under dewatering requirements. Long-term use or exposure to groundwater is not anticipated.
Receptor identification	Human receptors include site occupants/users (including adults and children), construction workers and intrusive maintenance workers. Ecological receptors include terrestrial organisms and plants within unpaved areas (including any proposed landscaped areas).
Exposure pathways and mechanisms	Potential exposure pathways for contaminants of concern relevant to the human receptors include ingestion, dermal absorption and inhalation of dust. The potential for exposure would typically be associated with the construction and excavation works, and future use of the site. Potential exposure pathways for ecological receptors include primary contact and ingestion. Exposure to groundwater is unlikely in the context of the proposed development since the actual depth to groundwater was not ascertained. During PSI, groundwater seepage was observed at depths ranging from approximately 8.0-8.5mBGL which is below the anticipated depth of excavation for the proposed development.
Evaluation of data gaps	• **Delineation of identified contamination hotspot.** This data gap relates to the lack of information associated with the lateral extent of the identified hotspot of lead impacted fill material in the vicinity of BH2. Impact from carcinogen PAHs

	detected in BH8 also has not been adequately delineated. Given the limited scope of anticipated excavations as part of the construction works this data gap can be addressed as part of RAP protocols including during waste classification for off-site disposal of excavated material as part of the development. • **Groundwater flow direction not confirmed / groundwater assessment limited in scope.** Groundwater flow direction was not confirmed with great degree of accuracy and actual depth to groundwater table beneath the site was not ascertained. Sensible assessment of groundwater quality including between up-gradient and down-gradient locations at the site was also unable to be properly completed. Groundwater conditions and quality could be further confirmed during the remediation/validation process.; and • **Characterisation of soils for waste classification purposes.** Based on the results of the PSI, the characteristics of fill and natural soils across the site vary considerably. The waste classifications provided as part of the PSI was preliminary in nature and will require confirmation prior to off-site disposal of soils and bedrock. The procedure for this is addressed as part of RAP protocols.

3.3 Remediation Extent

Remediation is anticipated to be focussed at the areas of proposed development works constituting mainly footprint areas of the proposed ELC building in Precinct A (northern part of the site) and a two-storey bus/carpark in Precinct B (southern part of the site) as shown on Figure 2 (Appendix A). It is anticipated that the required earthworks include excavations to a maximum depth of approximately 2m for the proposed ELC building and a new bus/carpark. It should be noted that BH1 was located outside the footprint of the proposed ELC building within paved internal access road and remediation of associated ecological impact in this location is not considered to be necessary and is not captured under the RAP.

Extent of known soil remediation works includes fill across the areas listed above which is proposed to be disturbed/excavated as part of the earthworks. The extent of remediation (horizontal and vertical) associated with the fill material will be guided by the validation.

The exact extent of remediation is to be revised following completion of the final design. It is further acknowledged that the remediation extent may change depending on the outcome of the pre-remediation validation assessment as described in Section 4 below and it is possible that the extent of remediation may be reduced. A Remediation Work Plan (RWP) should be prepared on completion of the final design and the pre-remediation validation to address the extent of remedial works required for the proposed development.

4 PRE-REMEDIATION VALIDATION

Pre-remediation validation will occur in order to provide additional data from the areas beneath the current structures (i.e. pavements/access ways etc.) where no data was able to be obtained and excavations are proposed (i.e. where sampling did not occur during the PSI). This is to occur following the establishment of a construction site areas, removal of pavements/access ways, and prior to any excavation/off-site disposal of the fill.

4.1 Objectives

The objectives of the pre-remediation validation investigation are to:

- Further characterise the fill/soil contamination conditions in areas where no data was able to be obtained during PSI. This includes areas where new ELC building and a two-storey bus/carpark are proposed;
- Further confirm waste classification for the fill to be disposed off-site;
- Assess if any CoPC occur at concentrations that require further remediation and/or variation to the validation plan outlined in this RAP; and
- Facilitate the preparation of a Remedial Works Plan (RWP) in the event that additional or alternative remediation/validation strategies are required.

4.2 Additional Sampling

- The sampling density will depend on the areas to be disturbed during the development which is to be confirmed following completion of the final design. In general, a minimum density of one sampling location should be targeted within an area of disturbance less than 10m^2. Soil/fill samples are to be collected from excavated test pits targeting proposed soil disturbance areas as part of the development;
- Sampling is to occur using an excavator or hand tools where an excavator cannot be used. Samples are to be collected from each fill profile and from the top (~0.5m) of the natural soil/bedrock beneath the fill. One sample per fill profile at each location will be collected for analysis; and
- All soil samples will be screened using a photo-ionisation detector (PID).

4.3 Decontamination and Sample Preservation

Any re-usable equipment should be decontaminated using a scrubbing brush and potable water and Decon 90 solution (phosphate free detergent) followed by rinsing with potable water.

Samples will be preserved by immediate storage in an insulated sample container with ice. Any additional sample preservation requirements for specific analytes should also be adopted as required. On completion of the fieldwork, the samples should be delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

One sample per fill profile at each location will be submitted for analysis of the CoPC identified for fill (see Table 2-2). Leachate testing (TCLP) will also be undertaken for waste classification purposes. Additional

analysis should also be scheduled as required based on any observations of odours, staining and/or elevated PID results.

4.4 Quality Assurance/Quality Control (QA/QC)

Inter and intra-laboratory duplicates will be collected and analysed for the soil assessment at a rate of 5% for inter-laboratory and 5% for intra-laboratory analysis. A trip spike and trip blank will also be submitted and analysed with each batch of samples.

4.5 Data Assessment

The soil data for the site should be assessed using the validation assessment criteria (VAC) outlined in Section 7.2 which are based on a 'residential with accessible soils' exposure setting.

For waste classification purposes, the soil data should be assessed against the NSW Waste Classification Guidelines, Part 1: Classifying Waste (2014)[6].

4.6 Reporting

On completion of the pre-remediation validation assessment, an interim validation and waste classification assessment report should be completed presenting the results of the investigation. The report is to document/confirm the extent of remediation and the validation plan.

A Remedial Works Plan (RWP) should be prepared following completion of the pre-remediation validation outlining the extent of remedial works required for the proposed development. RWP should also document any additional contamination encountered that requires remedial measures to be implemented outside the scope of this RAP. The client and validation consultant are to discuss whether the RWP needs to be submitted to the consent authority (this will depend on how substantial the changes are to the scope of remediation) and the client is to take steps to notify council and other relevant authorities as required.

[6] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Waste Classification Guidelines 2014)

5 REMEDIATION OPTIONS

5.1 Soil Remediation

The NSW EPA follows the hierarchy set out in NEPM 2013 for the remediation of contaminated sites. The preferred order for soil remediation and management is as follows:

1. On-site treatment of soil so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level;
2. Off-site treatment of excavated material so that the contaminant is either destroyed or the associated hazard is reduced to an acceptable level, after which the soil is returned to the site;

Or if the above are not practicable:

3. Consolidation and isolation of the soil by on-site containment within a properly designed barrier; and
4. Removal of contaminated material to an approved site or facility, followed where necessary by replacement with clean material; or
5. Where the assessment indicates that remediation would have no net environmental benefit or would have a net adverse environmental effect, implementation of an appropriate management strategy.

For simplicity herein, the above hierarchy are respectively referred to as Option 1, Option 2, Option 3 etc.

The NEPM 2013 and Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia (2009)[7] prefer the following asbestos remediation hierarchy:

1. Minimisation of public risk;
2. Minimisation of contaminated soil disturbance; and
3. Minimisation of contaminated material/soil moved to landfill.

The NSW EPA Contaminated Land Management Guidelines for the NSW Site Auditor Scheme (3rd Edition) (2017)[8] provides the following additional requirements to be taken into consideration:

- Remediation should not proceed in the event that it is likely to cause a greater adverse effect than leaving the site undisturbed; and
- Where there are large quantities of soil with low levels of contamination, alternative strategies should be considered or developed.

[7] Western Australian (WA) Department of Health (DoH), (2009). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia. (referred to as WA DoH 2009)

[8] NSW EPA, (2017). *Contaminated land Management, Guidelines for the NSW Site Auditor Scheme (3rd ed.).* (referred to as Site Auditor Guidelines 2017)

5.2 Remediation Options Assessment

The table below discusses and assesses a range of remediation options:

Table 5-1: Consideration of Remediation Options

Option	Discussion	Assessment/Applicability
Option 1 **On-site treatment of contaminated soil**	On-site treatment can provide a mechanism to reuse the processed material, and in some instances, avoid the need for large scale earthworks. Treatment options are contaminant-specific and can include bio-remediation, soil washing, air sparging and soil vapour extraction, thermal desorption and physical removal of bonded ACM fragments. Depending on the treatment option, licences may be necessary for specific individual waste streams due to the potential for air pollution and the formation of harmful by-products during incineration processes. Licences for re-use of treated material/waste may also be required.	Not technically feasible or economically viable based on the combination of contaminants present in the fill.
Option 2 **Off-site treatment of contaminated soil**	Contaminated soils are excavated, transported to an approved/licensed treatment facility, treated to remove/stabilise the contaminants then returned to the subject site, transported to an alternative site or disposed to an approved landfill facility. This option is also contaminant-specific. The cost per tonne for transport to and from the site and for treatment is considered to be relatively high. The material would also have to be assessed in terms of suitability for reuse as part of the proposed development works under the waste and resource recovery regulatory framework.	As above.
Option 3 **Consolidation and isolation of impacted soil by cap and containment**	This would include the consolidation of impacted soil within an appropriately designed cell, followed by the placement of an appropriate barrier over the material to reduce the potential for future disturbance. The capping and/or containment must be appropriate for the specific contaminants of concern. Depending on the concentrations of contaminants being encapsulated, an ongoing environmental management plan (EMP) will be required and will need to be publicly notified and made to be legally enforceable (e.g. via listings in the Section 10.7 planning certificate and on the land title).	This option will be considered if soil contamination extends beyond the proposed excavation footprint and where contaminated material may retain in-situ (to be confirmed by validation sampling).

Option	Discussion	Assessment/Applicability
<u>Option 4</u> Removal of contaminated material to an appropriate facility and reinstatement with clean material	Contaminated soils would be classified in accordance with NSW EPA guidelines for waste disposal, excavated and disposed of off-site to a licensed landfill. The material would have to meet the requirements for landfill disposal. Landfill gate fees (which may be significant) would apply in addition to transport costs.	Most applicable option for this project considering the contaminants of concern and the extent of proposed development which will necessitate excavations to a maximum depth of approximately 2m for the proposed ELC building and a new bus/carpark and off-site material removal for the construction. This option is considered to be the most practical, technically achievable and economically viable for this project.
<u>Option 5</u> Implementation of management strategy	Contaminated soils would be managed in such a way to reduce risks to the receptors and monitor the conditions over time so that there is an on-going minimisation of risk. This may occur via the implementation of monitoring programs.	This will be applicable for the long-term management of contamination if Option 3 is triggered.

5.3 Rationale for the Preferred Option for Remediation

The preferred option for remediation is option 4 which includes excavation and off-site disposal of contaminated soil. In the unlikely event that soil contamination extends beyond the proposed excavation footprint (to be confirmed by validation sampling), the option for capping the contamination on site as outlined in option 3 may be required. A long-term Environmental Management Plan (EMP) will be required to manage the contamination remaining on site which would trigger option 5.

The preferred option for remediation is considered to be appropriate on the basis that:

- Treatment options are not technically achievable or economically viable on such a small site and based on the combination of contaminants of concern;
- Some excavation is expected to occur to create the desired site levels for the development;
- The strategy is technically achievable to implement concurrently with the proposed development works; and
- An alternative strategy such as 'cap and contain' and implementation of an EMP is undesirable on high sensitivity use site such as schools. However, we note that this option has been outlined as a precautionary measure at this stage and is also included as part of the contingency plan in this RAP.

6 REMEDIATION DETAILS

6.1 Roles and Responsibilities

Table 6-1: Roles and Responsibilities

Role	Responsibility
Developer	Mahady Management Contact: Terry Mahady The developer is required to appoint the project team for the remediation and must provide all investigation reports including this RAP to the project manager, remediation contractor, consent authority and any other relevant parties involved in the project.
Project Manager	Mahady Management Contact: Terry Mahady The project manager is required to review all documents prepared for the project and manage the implementation of the procedures outlined in this RAP. The project manager is to take reasonable steps so that the remediation contractor and others have understood the RAP and will implement it in its totality. The project manager will review the RAP and other documents and will update the parties involved of any changes to the development or remediation sequence (in consultation with the validation consultant).
Remediation Contractor	To be appointed. The remediation contractor is required to review all documents prepared for the project, apply for any relevant removal licences or permits and implement the remediation requirements outlined in this RAP. The remediation contractor may also be the construction contractor. The remediation contractor is required to collect all necessary documentation associated with the remediation activities and forward this documentation onto the client, project manager and validation consultant as they become available. The remediation contractor is required to advise the validation consultant at key points in the remediation and validation programme, and implement various aspects of the validation plan assigned to them.
Validation Consultant	JK Environments (at the time of preparation of this RAP) Contact: Anthony Barkway The validation consultant[9] provides consulting advice and validation services in relation to the remediation, and prepares the site validation report. The validation is required to review any deviation to this RAP or in the event of unexpected finds if and when encountered during the site work. The validation consultant is required to liaise with the client, project manager and remediation contractor on all matters pertaining to the site contamination, remediation and validation, carry out the required site inspections during excavation, and collect validation samples.

[9] It is recommended that the consultant be a certified practitioner (specialising in site contamination), under one of the NSW EPA endorsed certification schemes

6.2 Pre-commencement

The project team is to have a pre-commencement meeting to discuss the sequence of remediation, and the remediation and validation tasks. RWP will be required for the proposed remediation works when the concept designs and pre remediation validation have been finalised.

The site management plan for remediation works (see Section 8) should be reviewed by the project manager and remediation contractor, and appropriate steps are to be taken to ensure the adequate implementation of the plan.

The remediation contractor should be engaged to carry out the remediation tasks required under this RAP/RWP. The role of the contractor is to:

- Remediate the site in accordance with the remediation methods and the validation consultant's advice;
- Apply for any necessary permits/licenses required for remediation;
- Retain all necessary documentation for waste disposal, imported materials etc; and
- Keep the validation consultant informed regarding the progress of the site works and any unexpected finds.

6.3 Remediation and Associated Tasks

The following general sequence of works is anticipated:

- Site establishment, removal of pavements/access ways as required;
- Completion of the pre-remediation validation assessment outlined in Section 4;
- Remediation/excavation and validation of the fill contamination at the site;
- Remediation/capping of the site concurrently with the proposed development works (if required);
- Validation of capping areas (if required); and
- Validation of imported soil materials. This includes materials imported to reinstate the remedial excavations, together with engineering material such as sub-base, landscaping materials or any other materials imported onto site, to the point in time that the validation report is issued.

Validation of the works would occur progressively throughout the remediation program.

Details in relation to the above are outlined in the following subsections:

6.3.1 Site Establishment, Removal of Pavements/Access Ways

The remediation contractor is to establish on site as required to facilitate the remediation. Consideration must be given to the work sequence and extent of remediation so that the site establishment (e.g. site sheds, fencing, access points etc) does not inhibit the remediation works.

All pavements and access ways are to be removed from areas of proposed development works/remediation areas (i.e. areas where the new ELC building and a new bus/carpark are proposed with associated earthwork to be taking place).

6.3.2 Remediation Details – Excavation and Disposal of Contaminated Fill

The procedure for excavation of fill soil is outlined below:

Table 6-2: Remediation Details – Excavation and disposal of contaminated fill

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor	Address Stability Issues and Underground Services: Geotechnical advice must be sought regarding the stability of the adjacent structures and/or adjacent areas prior to commencing remediation (as required). Stability issues are to be addressed to the satisfaction of a suitably qualified geotechnical engineer. This may require the installation of temporary shoring, if specified by the engineer. All underground services are to be appropriately disconnected or rerouted to facilitate the works.
2.	Remediation contractor	Personal Protective Equipment (PPE) and Work Health and Safety (WHS): Check PPE and WHS requirements prior to commencement of remediation works. The minimum PPE required for the remediation at the site includes covered clothing, gloves, dust masks and steel cap boots. Other site/project specific PPE may be required including hard hat, eye protection, steel toed boots, masks, coveralls etc and will be dependent on the requirements of the contractor for the site.
3.	Project manager and Remediation Contractor	Removal of contaminated fill: Excavation of the remediation area will be undertaken as follows: • Classification of the fill material for waste disposal in areas of the proposed development is to be confirmed via additional testing and a waste classification advice must be prepared in accordance with relevant guidelines and provided to the remediation contractor prior to the fill material being taken off-site; • Submit an application to dispose the fill (in accordance with the assigned waste classification) to a landfill licensed by the NSW EPA to receive the waste and obtain authorisation to dispose; • A water system will need to be in place to spray the excavated soil during excavation/ remediation works and to decontaminate trucks entering the work area. The general site area should be kept damp during remediation works to minimise the generation of dust; • The remediation area should be excavated to the base of the fill and down to the surface of the underlying natural soil (or bedrock, whichever is encountered first). The details of the excavation works will need to be agreed with the remediation contractor. The works should be done in the most efficient manner that minimises cross contamination. We note that the natural soil/rock levels may vary across the site and provisions will need to be made for careful, detailed excavation and removal of all fill. Even minor amount of fill, if left present at the surface, will result in validation failure and the need for further excavation; • Load the fill onto trucks and dispose in accordance with the assigned waste classification. The receiving licenced landfill facility; and • All documents including landfill dockets should be retained and forwarded to the client and validation consultant for inclusion into the validation report.
4.	Validation Consultant	Validation of Excavation Base: • Once all fill is removed, the base of the excavation should be validated (by the validation consultant) in accordance with Section 6; • If the validation fails, the contaminated area should be chased out until the validation is successful; and

Step	Primary Role/ Responsibility	Procedure
		• If the validation is successful, the excavation can be continued to achieve the finished levels of the basement (additional waste classification documentation will be required to dispose or reuse the underlying natural soil/bedrock). Alternatively, the excavation can be re-instated using clean validated materials. Imported materials used to reinstate the site/remedial excavation must be validated in accordance with Section 6

The detailed validation plan relevant to the above items is provided in Section 6.

6.3.3 Capping of Contaminated Fill (if required)

The premise for remediating the site is based around capping the contaminated fill/soil beneath appropriate (clean) capping layers. The proposed capping system requires consideration during the design of the buildings, pavements and landscaping. A summary of the proposed capping strategy is provided in the following table. These requirements should be reviewed by the project team prior to finalising the design, and all relevant design drawings must include the capping specification details.

Table 6-3: Capping Specification

Area	Capping Specification^
New buildings / structures and paved areas	Installation of: • Geotextile marker layer (hi-vis) over the contaminated fill; • >50mm clean imported (validated) basecourse, as required for engineering specification; and • >150mm (minimum) of concrete.
Turfed areas / unpaved areas	Installation of: • Geotextile marker layer over the contaminated fill; • >200mm clean imported (validated) topsoil/growing medium; and • Surface finish to required development design.
Existing pavements being retained	No additional capping required. The horizontal extent of pavements being retained are to be surveyed.
Service trenches	Excavation of the service trench below the design level and greater than the required width of the conduit/service, then installation of: • Geotextile marker layer lining the trench and over the contaminated fill (this must be secured to the geotextile marker in the area adjoining the trench – a >0.2m overlap and use of soil 'U' nails to pin down the geotextile would be acceptable); • Backfill with clean imported (validated) material; and • Surface finish to required development design.

^ The capping specification relates to the remediation only and has not considered engineering design requirements for the site.

It is recommended that once the proposed development design is finalised and pre-remediation validation has been completed, a Remedial Works Plan (RWP) is prepared to identify the areas of the site where the various capping strategies should be implemented. If any amendments to the capping specification are

required as a result of consultation during the design process, or due to specific engineering requirements for the site, these changes must also be reflected in the RWP.

The RWP is to be prepared by the validation consultant (or by JKE) and approved by the client/Woollahra Municipal Council and the site auditor (if an auditor is engaged for the project).

The remediation steps for capping the site are provided below. The detailed validation plan relevant to this aspect of the remediation is provided in Section 7.

Table 6-4: Remediation – Areas to be Capped

Step	Primary Role/ Responsibility	Procedure
1.	Remediation contractor Validation Consultant	Earthworks/site preparations: The remediation contractor is to complete the earthworks required to facilitate the proposed capping of the remediation area. Where piling is required, it would also be preferable for this to occur prior to capping to minimise the potential for cross-contamination. Any imported materials used are to be validated by the validation consultant in accordance with Section 7. This may include but is not limited to coarse gravels (e.g. 40/70) for driveways, DGB, material used to create a piling platform etc.
2.	Remediation contractor (or the nominated construction contractor)	Survey of site levels: A pre-capping levels survey is to be completed by the relevant contractor. This should occur after the installation of the geotextile marker layer, but before the installation of any overlying capping layers. The purpose of the survey is to provide a record of the site levels across the top of the geotextile marker layer. It is recommended that the survey points are recorded with a spacing of not more than 5m between adjacent points. Additional survey points will be required in the vicinity of changes in surface slope and for specific features such as service trenches.
3.	Remediation contractor (or the nominated construction contractor) Validation consultant	Capping: The cap is to be constructed in accordance with the capping specification. Any imported materials used are to be validated by the validation consultant in accordance with Section 7. The validation consultant is required to inspect the capping works and imported materials in accordance with the validation plan.

The detailed validation plan relevant to the above items is provided in Section **Error! Reference source not found.**.

6.4 Remediation Documentation

The remediation contractor must retain all documentation associated with the remediation, including but not limited to:

- Waste register (see below);
- Photographs of remediation works;
- Waste tracking documentation (where applicable); and
- Imported materials documentation from suppliers, including any routine analysis reports, product specifications and dockets for imported materials.

Copies of these documents must be forwarded to the project manager and the validation consultant on completion of the remediation for inclusion in the validation report.

6.4.1 Waste Register

All excavated fill/natural soil/bedrock must be disposed of to a waste facility licensed by the NSW EPA to receive the waste stream. The final waste classification advice must be used to facilitate the lawful disposal of the waste. A separate waste classification assessment will be required for the material resulting from the proposed excavation works as part of the development as outlined in Table 5.2 above.

Based on the preliminary waste classification assessment undertaken for the PSI, the fill material met the classification of General Solid Waste (non-putrescible). It was noted that low concentrations of PAHs were encountered within the sample of natural soil collected from BH8 (1.6-1.8m) and as such natural soils in this area were considered unlikely to meet the definition of VENM for off-site disposal or re-use purposes, and were assigned a preliminary classification of General Solid Waste (non-putrescible). It was recommended that additional testing be undertaken of the natural soil to confirm the final classification for off-site disposal.

Natural bedrock at the site was considered likely to meet the definition of VENM for off-site disposal or re-use purposes.

All waste removed from the site is to be appropriately tracked and managed in accordance with the relevant regulations. The remediation contractor (and/or their nominated construction contractor) is to maintain adequate records and retain all documentation for waste disposal activities including:

- A summary register including details such as waste disposal dates, waste materials descriptions, disposal locations (i.e. facility details) and reconciliation of this information with waste disposal docket numbers; and
- Waste tracking records and transport certificates (where waste is required to be tracked/transported in accordance with the regulations); and
- Disposal dockets for the waste. Legible dockets are to be provided for all waste materials so they can be reconciled with the register.

Any soil waste classification documentation is to be prepared in accordance with the reporting requirements specified by the NSW EPA. Reports are to include:

- The full name, address, Australian Company Number (ACN) or Australian Business Number (ABN) of the organisation and person(s) providing the waste classification;
- Location of the site where the waste was generated, including the source site address;
- History of the material and the processes and activities that have taken place to produce the waste;

- Potential contaminating activities that may have occurred at the site where the waste was generated;
- Description of the waste, including photographs, visible signs of contamination, such as discolouration, staining, odours, etc;
- Quantity of the waste;
- Number of samples collected and analysed;
- Sampling method including pattern, depth, locations, sampling devices, procedures, and photos of the sample locations and samples;
- Contaminants tested;
- Laboratory documentation – chain-of-custody (COC), sample receipt, laboratory report;
- All results regardless of whether they are not used in the classification process;
- Results of sample mean, sample standard deviation and the 95% upper confidence limit (UCL) where relevant;
- Brief summary of findings including discussion of results; and
- A clear statement of the classification of the waste as at the time of the report.

A soil volume analysis should be undertaken on completion of remediation and reconciled with the quantities shown on the soil disposal dockets. This information is to be reviewed by the validation consultant on completion of the works and an assessment of the quantities of soil disposed off-site (e.g. comparison with the estimated and actual volumes) is to be included in the validation report. A review of the disposal facility's licence issued under the Protection of the Environment Operations (POEO) Act (1997)[10] should also be undertaken to assess whether the facility is appropriately licensed to receive the waste.

6.4.2 Imported Materials Register

The remediation contractor (and/or their nominated construction contractor) is to maintain for the duration of the project an imported material register. This must include a register (preferably in Microsoft Excel format) with details of each imported material type, supplier details, summary record of where the imported materials were placed on site, and importation docket numbers and a tally of quantities (separated for each import stream). Legible dockets for imported materials are to be provided electronically so these can be reconciled with the register.

The above information is to be provided to the validation consultant for inclusion in the validation report. It is recommended that the register be set up at the beginning of the project and provided to the validation consultant regularly (say on a monthly or two-monthly basis) so the details can be checked and any rectification of the record keeping process can occur in a timely manner.

[10]NSW Government, (1997)). *Protection of Environment Operations Act.*(referred to as POEO Act 1997)

7 VALIDATION PLAN

Validation is necessary to demonstrate that remedial measures described in the RAP have been successful and that the site is suitable for the intended land use. The sampling program for the validation is outlined in Section 7.1. This is the minimum requirement based on the remedial strategies provided. Additional validation sampling may be required based on observations made during remediation or in the event of an unexpected find.

7.1 Validation Sampling and Documentation

The table below outlines the validation requirements for the site:

Table 7-1: Validation Requirements

Aspect	Sampling	Analysis	Observations and Documentation
Remediation/excavation of Contaminated Fill (Section 6.3.2)			
Excavation walls	One sample per 5m lineal, from each observed soil stratum. Additional sampling is also to target obvious indicators of contamination and changes in soil/bedrock profile.	TRHs, PAHs and lead	The **validation consultant** is to: - Samples to be screened using PID; - Observations of staining and odour to be recorded. - Photographs to be taken and documented; and - Document the occurrence (or otherwise) of any unexpected finds. The **remediation contractor** is to keep records in relation to waste disposal (i.e. disposal dockets).
Excavation surface (base) following removal of fill	5m grid (one sample per 25m^2), with additional samples targeting any potentially impacted areas identified during the visual/olfactory assessment.		The **validation consultant** is to: - Samples to be screened using PID; - Observations of staining and odour to be recorded. - Photographs to be taken and documented; - Visual observations to confirm natural material at base (i.e. no fill); and - Document the occurrence (or otherwise) of any unexpected finds. The **remediation contractor** is to keep records in relation to waste disposal (i.e. disposal dockets).
Capping (if required)			
Survey of site levels.	NA	NA	**Remediation contractor** to obtain the survey as required in Section **Error! Reference source not found.**. It is also expected that the remediation contractor or their nominated construction contractor will provide as-built drawings for the

Aspect	Sampling	Analysis	Observations and Documentation
			project which document the capping layers.
Inspections.	NA	NA	**Validation consultant** to carry out inspections to document the installation of the cap. Key hold points for inspections include: - Geotextile/geogrid installation; - During importation of materials used to construct the cap; and - Finished surface levels. A photographic record is to be maintained by the **remediation contractor** and **validation consultant**.
Imported Materials – validation of imported materials is required for any materials imported onto the site during the remediation and to the point in time that the site validation report is prepared (e.g. general fill to raise the site levels or reinstate remedial excavations, imported materials to create piling platform, gravels for site preparation, material used for capping layers etc).			
Imported VENM backfill (if required) Imported garden mix/topsoil and mulches	Minimum of three samples per source	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos (500ml). Additional analysis may be required depending on the site history of the source property. Analysis of mulch can be limited to visual observations to confirm there is limited anthropogenic material and no visible asbestos materials.	**Remediation contractor** to supply existing VENM documentation/report (report to be prepared in accordance with the NSW EPA waste classification reporting requirements). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Material is to be inspected upon importation by the **validation consultant** to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Photographic documentation and an inspection log are to be maintained. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing VENM documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the Validation Assessment Criteria (VAC).
Imported engineering materials such as recycled	Minimum of three samples per source/material type.	Heavy metals (as above), TRHs, BTEX, PAHs, OCPs, PCBs and asbestos	**Remediation contractor** to provide product specification and documentation to confirm the material has been classified with reference to a relevant Resource

Aspect	Sampling	Analysis	Observations and Documentation
aggregate, road base etc or ENM	Additional testing may be required for ENM to meet the specification within the ENM Order.	(500ml quantification). Additional testing may be required for ENM (e.g. foreign materials, pH and electrical conductivity) depending on available documentation.	Recovery Order/Exemption. A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the facility's Environment Protection Licence (EPL). Material is to be inspected by the **validation consultant** upon importation to confirm it is free of visible/olfactory indicators of contamination and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.
Imported engineering materials comprising only natural quarried products.	At the validation consultant's discretion based on robustness of supplier documentation.	At the validation consultant's discretion based on robustness of supplier documentation.	**Remediation contractor** to provide documentation from the supplier confirming the material is a product comprising only VENM (i.e. natural quarried product). A hold point remains until the **validation consultant** approves the material for importation or advises on the next steps. Review of the quarry's EPL. Material is to be inspected by the **validation consultant** upon importation to confirm it is free of anthropogenic materials, visible and olfactory indicators of contamination, and is consistent with documentation. Where check sampling occurs by the **validation consultant** due to deficiencies or irregularities in existing documentation, the following is required: - Date of sampling and description of material sampled; - An estimate of the volume of material imported at the time of sampling; - Sample location plan; and - Analytical reports and tabulated results with comparison to the VAC.

7.2 Validation Assessment Criteria and Data Assessment

The VAC to be adopted for the validation assessment are outlined in the table below:

Table 7-2: VAC

Validation Aspect	VAC
Waste classification (Sections 5.3.2)	In accordance with the procedures and criteria outlined in Part 1 of the Waste Classification Guidelines 2014 and any other exemptions/approvals as required.
Fill removal and remaining material validation	The soil validation criteria to be adopted will be the health-based criteria for contaminants in soil and land use type A (residential with accessible soils including preschools and primary schools and low-high density residential HSL-A & HSL-B) and ESL for Urban Residential and Public Open Space (where applicable). It is noted that additional criteria will also need to be considered in the context of waste depending on the waste classification assessment process for the site.
Validation of capping (if required)	Validation of capping will occur via a review of survey information, as-built drawings and via the inspection process. The validation report is to include cross-sections documenting the completed capping details for the various areas of the site.
Imported materials	Material imported as general fill must only be VENM or ENM. VENM is defined in the Protection of the Environment Operations Act (1997)[11] as material: • That has been excavated or quarried from areas that are not contaminated with manufactured chemicals, or with process residues, as a result of industrial, commercial mining or agricultural activities; • That does not contain sulfidic ores or other waste; and • Includes excavated natural material that meets such criteria for virgin excavated natural material as may be approved from time to time by a notice published in the NSW Government Gazette. ENM and recycled materials are to meet the criteria of the relevant exemption/order under which they are produced. Analytical results for VENM and other imported materials will need to be consistent with expectations for those materials. For VENM, it is expected that: - Heavy metal concentrations are to be less than the most conservative Added Contaminant Limit (ACL) concentrations for an URPOS exposure setting presented in Schedule B1 of the NEPM 2013; and - Organic compounds are to be less than the laboratory PQLs and asbestos to be absent. All materials imported onto the site must also be adequately assessed as being appropriate for the final use of the site. A risk-based assessment approach is to be adopted with regards to the tier 1 screening criteria presented in Schedule B1 of NEPM 2013. Aesthetics: all imported materials are to be free of staining and odours.

Data should initially be assessed as above or below the VAC. Statistical analysis may be applied if deemed appropriate by the consultant and undertaken in accordance with the NEPM 2013.

[11] Protection of Environment Operations Act 1997 (NSW) (POEO Act 1997)

7.3 Validation Sampling, Analysis and Quality Plan (SAQP)

Appropriate QA/QC samples should be obtained during the validation (where applicable) and analysed for the same suite of contaminants as the primary samples. As a minimum, QA/QC sampling should include duplicates (5% inter-laboratory and 5% intra-laboratory), trip spikes and trip blanks. Rinsate samples should be obtained if re-usable sampling equipment is utilised.

Data Quality Objectives (DQOs) and Data Quality Indicators (DQIs) should be clearly outlined and assessed as part of the validation process. A framework for the DQO and DQI process is outlined below and should be reflected in the validation report.

DQOs have been broadly established for the validation with regards to the seven-step process outlined NEPM (2013). The seven steps include the following which are detailed further in the following subsections:

- State the problem;
- Identify the decisions/goal of the study;
- Identify information inputs;
- Define the study boundary;
- Develop the analytical approach/decision rule;
- Specify the performance/acceptance criteria; and
- Optimise the design for obtaining the data.

DQIs are to be assessed based on field and laboratory considerations for precision, accuracy, representativeness, completeness and comparability.

7.3.1 Step 1 - State the Problem

Validation data is required to demonstrate that the remediation is successful and that the site is suitable for the proposed land use described in Section 1.1.

7.3.2 Step 2 - Identify the Decisions of the Study

The remediation goal, aims and objectives are defined in Section 1.2. The decisions to be made reflect these objectives and are as follows:

- Was the remediation undertaken in accordance with the RAP?
- If there were any deviations, what were these and how do they impact the outcome of the validation?
- Are any of the validation results above the VAC?
- Is the site suitable for the proposed development from a contamination viewpoint?
- Will a long-term EMP be required for the site?

7.3.3 Step 3 - Identify Information Inputs

The primary information inputs required to address the decisions outlined in Step 2 include the following:

- Existing relevant data from previous reports;
- Site information, including site observations, inspections, survey information, as-built drawings, waste and imported materials registers;
- Validation sampling of imported materials; and
- Field and laboratory QA/QC data.

7.3.4 Step 4 - Define the Study Boundary

The remediation and validation will be confined to the footprint areas of new proposed ELC building and bus/carpark as shown in Figure 2 in Appendix A and will be limited vertically to the approximate depth of fill.

7.3.5 Step 5 - Develop an Analytical Approach (or Decision Rule)

7.3.5.1 VAC

The validation data will be assessed in accordance with the requirements outlined in Section 7.2.

7.3.5.2 Field and Laboratory QA/QC

Field QA/QC is to include analysis of inter-laboratory duplicates (5% frequency), intra-laboratory duplicates (5% frequency), trip spike, trip blank and rinsate samples (one each for the assessment to demonstrate adequacy of standard sampling/handling procedures). Field QA/QC samples are to be analysed for the contaminants of concern, except asbestos. The trip spike will only be analysed for BTEX as BTEX will be considered a surrogate to assess potential loss of volatiles from TRH fractions if present.

DQIs for field and laboratory QA/QC samples are defined below:

Field Duplicates

Acceptable targets for precision of field duplicates will be 30% or less, consistent with NEPM (2013). RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the concentrations used to calculate the RPD (i.e. RPD exceedance where concentrations are close to the PQL are typically not as significant as those where concentrations are reported at least five or 10 times the PQL), sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Trip Blanks

Acceptable targets for trip blank samples will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to the reference material used as the blank medium.

Trip Spikes

Acceptable targets for trip spike samples will be 70% to 130%.

Laboratory QA/QC

The suitability of the laboratory data will be assessed against the laboratory QA/QC criteria. These criteria are developed and implemented in accordance with the laboratory's NATA accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

A summary of the typical limits is provided below:

RPDs

- Results that are <5 times the PQL, any RPD is acceptable; and
- Results >5 times the PQL, RPDs between 0-50% are acceptable.

Laboratory Control Samples (LCS) and Matrix Spikes

- 70-130% recovery acceptable for metals and inorganics; and
- 60-140% recovery acceptable for organics.

Surrogate Spikes

- 60-140% recovery acceptable for general organics.

Method Blanks

- All results less than PQL.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence will be reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is to be undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, the validation consultant is to adopt the most conservative concentration reported.

7.3.5.3 Appropriateness of PQLs

The PQLs of the analytical methods are to be considered in relation to the VAC to confirm that the PQLs are less than the VAC. In cases where the PQLs are greater than the VAC, a discussion of this is to be provided.

7.3.6 Step 6 – Specify Limits on Decision Errors

To limit the potential for decision errors, a range of quality assurance processes are adopted. A quantitative assessment of the potential for false positives and false negatives in the analytical results is to be undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

7.3.7 Step 7 - Optimise the Design for Obtaining Data

The design is to be optimised via the collection of validation data to demonstrate the success of the key aspects of the remediation. Data collection will be via various methods including inspections and sampling.

7.3.8 Sampling Plan

The proposed sampling plan for the validation of imported materials is described in Section 7.1.

7.4 Validation Report and Long Term EMP

As part of the site validation process, a validation report will be prepared on completion of remediation and validation by the validation consultant. The report will outline the remediation work undertaken at the site and any deviations to the remediation strategy. The report will present the results of the validation assessment and will be prepared in accordance with the Consultants Reporting on Contaminated Land (2020)[12] guidelines. The report should draw conclusions regarding the success of the remediation/validation and the suitability of the site for the proposed development (from a contamination viewpoint).

A long-term EMP will be required to manage the contamination that is to be capped at the site (if required) and the long-term EMP will be documented as part of the overall validation process. In the even capping is required for the site a public notification and enforcement mechanisms for the long-term EMP should be arranged and Woollahra Municipal Council is to be provided with a draft copy of the long-term EMP for consultation prior to finalisation of the document.

The notification and enforcement mechanisms are to include notation on the planning certificate under Section 10.7 of the Environmental Planning and Assessment Act (1979) and a covenant registered on the title to land under Section 88B of the Conveyancing Act (1919).

The long-term EMP will include requirements for passive management of the capping system that will focus on maintaining the capping layers to minimise the potential of exposure to the underlying fill. The long-term EMP will also include contingencies for managing intrusive works in the event that the capping system is breached.

[12] NSW EPA, (2020). *Consultants reporting on contaminated land, Contaminated Land Guidelines.* (referred to as Consultants Reporting Guidelines)

8 CONTINGENCY PLAN

A review of the proposed remediation works has indicated that the greatest risks that may affect the success of the remediation include unexpected finds. A contingency plan for remediation is provided below:

8.1 Unexpected Finds

Residual hazards that may exist at the site would generally be expected to be detectable through visual or olfactory means. At this site, these types of hazards may include: underground storage tanks (USTs); asbestos containing material (ACM); or odorous/stained hydrocarbon impacted soils. The procedure to be followed in the event of an unexpected find is presented below:

- In the event of an unexpected find, all work in the immediate vicinity should cease and the remediation contractor should contact the validation consultant and the project manager;
- Temporary barricades should be erected to isolate the area from access to workers;
- The validation consultant is to attend the site, adequately characterise the contamination and provide advice in relation to site management and remediation. In the event that remediation differs from the procedures outlined in this RAP, an addendum RAP or RWP must be prepared in consultation with the project stakeholders and submitted to the determining authority; and
- Contamination should be remediated and validated in accordance with the advice provided, and the results should be included in the validation report.

8.2 Importation Failure for VENM or other Imported Materials

Where material to be imported onto the site does not meet the importation VAC detailed in Section 7.2, the material should not be imported. Alternative material must be sourced that meets the importation requirements.

8.3 Alternative Strategy / Contingency for Failure of Remediation Strategy

Considering the contaminants of concern and the simplicity of the proposed remediation strategy, the potential for the remediation strategy to fail is considered to be negligible. We note that based on the results of the pre-remediation validation assessment, it may be possible to limit the extent of remediation (i.e. removal of fill). However, this will need to be evaluated in detail in the pre-remediation validation report via a risk-based assessment of the additional data.

In the event of a soil validation failure when validating fill removal, the client should be advised that the excavation should be extended in the direction of the failure (in consultation with the validation consultant, client and other relevant stakeholders) and the area re-validated.

JKE consider that a possible contingency option for the site remediation could include a ‘cap and contain’ strategy whereby the fill is buried in a cell within the footprint of proposed buildings/structures. The feasibility of this option would require careful consideration and Council would need to endorse a strategy that requires an on-going EMP for the site. JKE recommend that the client carefully consider the feasibility of this option after the pre-remediation validation.

8.4 Fill Remaining On-site

In the unexpected event that 'pockets' of fill cannot be excavated and disposed off-site, this material must be validated to assess its suitability to remain on site and the potential risks posed by this soil in the context of the future land use. Sampling of any remnant fill should occur at a rate of at least one sample per fill profile, for each discrete area, up to a maximum area of 50m^2. If an area exceeds 50m^2, sampling should continue at a rate of one location per additional 50m^2 (e.g. a 50m^2 area requires one sample location, a 50-100m^2 area requires two locations, a 100-150m^2 area requires three locations etc). Validation samples are to be analysed for lead and PAHs and assessed with regards to the VAC.

9 SITE MANAGEMENT PLAN FOR REMEDIATION WORKS

The information outlined in this section of the RAP is for the remediation work only. The client should make reference to the development consent for specific site management requirements for the overall development of the site.

9.1 Project Contacts

Emergency procedures and contact telephone numbers should be displayed in a prominent position at the site entrance gate and within the main site working areas. The available contact details are summarised in the following table:

Table 9-1: Project Contacts

Role	Company	Contact Details
Client/developer	Mahady Management	Terry Mahady P: 0411 510 073
Project Manager	Mahady Management	Terry Mahady P: 0411 510 073
Remediation Contractor	To be appointed	-
Validation Consultant	JK Environments – subject to being formally engaged	Anthony Barkway JK Environments P: 9888 5000
Certifier	To be appointed	-
NSW EPA	Pollution Line	131 555
Emergency Services	Ambulance, Police, Fire	000

9.2 Security

Appropriate fencing should be installed as required to secure the site. Warning signs should be erected, which outline the personal protective equipment (PPE) required for remediation work.

9.3 Timing and Sequencing of Remediation Works

The anticipated sequence of remediation works is outlined in Section 6.3. Based on the current strategy, remediation can occur prior to the commencement of any construction. The client is to review the development consent conditions in this regard to check that the sequence of works is in compliance with the consent. If any inconsistencies are identified between the development consent and the RAP, these must be resolved with the certifying authority prior to the commencement of remediation.

9.4 Site Soil and Water Management Plan

The remediation contractor is to prepare a detailed soil and water management plan prior to the commencement of site works. Silt fences should be used to control the surface water runoff at all appropriate locations of the site and appropriate measures are to be implemented to manage soil/water disturbance to the satisfaction of the regulator/determining authority. Reference should be made to the consent conditions for further details.

All stockpiled materials should be placed within an erosion containment boundary with silt fences and sandbags employed to limit sediment movement. The containment area should be located away from drainage lines/low-points, gutters, stormwater pits and inlets and the site boundary. No liquid waste or runoff should be discharged to the stormwater or sewerage system without the approval of the appropriate authorities.

9.5 Noise and Vibration Control Plan

The guidelines for minimisation of noise on construction sites outlined in AS-2460 (2002)[13] should be adopted. Other measures specified in the consent conditions should also be complied with. Noise producing machinery and equipment should only be operated between the hours approved by the determining authority (refer to consent documents).

All practicable measures should be taken to reduce the generation of noise and vibration to within acceptable limits. In the event that short-term noisy operations are necessary, and where these are likely to affect residences, notifications should be provided to the relevant authorities and the residents by the project manager, specifying the expected duration of the noisy works.

9.6 Dust Control Plan

All practicable measures should be taken to reduce dust emanating from the site. Factors that contribute to dust production are:

- Wind over a cleared surface;
- Wind over stockpiled material; and
- Movement of machinery in unpaved areas.

Visible dust should not be present at the site boundary. Measures to minimise the potential for dust generation include:

- Use of water sprays on unsealed or exposed soil surfaces;
- Covering of stockpiled materials and excavation faces (particularly during periods of site inactivity and/or during windy conditions) or alternatively the erection of hessian fences around stockpiled soil or large exposed areas of soil;
- Establishment of dust screens consisting of a 2m high shade cloth or similar material secured to a chain wire fence;

[13] Australian Standard, (2002). *AS2460: Acoustics - Measurement of the Reverberation Time in Rooms.*

- Maintenance of dust control measures to keep the facilities in good operating condition;
- Stopping work during strong winds;
- Loading or unloading of dry soil as close as possible to stockpiles to prevent spreading of loose material around the development area; and
- Geofabric/geotextile could be placed over exposed soils in the event that excavation is staged.

If stockpiles are to remain on-site or soil remains exposed for a period of longer than several days, dust monitoring should be undertaken at the site. If excessive dust is generated all site activities should cease until either wind conditions are more acceptable or a revised method of excavation/remediation is developed.

Dust is also produced during the transfer of material to and from the site. All material should be covered during transport and should be properly disposed of on delivery. No material is to be left in an exposed, un-monitored condition.

All equipment and machinery should be brushed or washed down before leaving the site to limit dust and sediment movement off-site. In the event of prolonged rain and lack of paved areas all vehicles should be washed down prior to exit from the site, and any soil or dirt on the wheels of the vehicles removed. Water used to clean the vehicles should be collected and tested prior to appropriate disposal under the relevant waste classification guidelines.

9.7 Dewatering

Temporary dewatering is not anticipated to be required as part of the remediation works. If a rain event occurs during the construction of the cell, this water should be managed appropriately on site in accordance with the remediation contractor's soil and water management plan. This water should not be pumped to stormwater or sewer unless a prior application is made and this is approved by the relevant authorities.

9.8 Odour Control Plan

All activities undertaken at the site should be completed in a manner that minimises emissions of smoke, fumes and vapour into the atmosphere and any odours arising from the works or stockpiled material should be controlled. Control measures may include:

- Maintenance of construction equipment so that exhaust emissions comply with the Clean Air Regulations issued under the Protection of the Environment Operations Act (1997) (POEO);
- Demolition materials and other combustible waste should not be burnt on site;
- The spraying of a suitable proprietary product to suppress any odours that may be generated by excavated materials; and
- Use of protective covers (e.g. builder's plastic).

All practicable measures should be taken to reduce fugitive emissions emanating from the site so that associated odours do not constitute a nuisance and that the ambient air quality is not adversely impacted.

The following odour management plan should be implemented to limit the exposure of site personnel and surrounding residents to unpleasant odours:

- Excavation and stockpiling of material should be scheduled during periods with low winds if possible;
- A suitable proprietary product could be sprayed on material during excavation and following stockpiling to reduce odours (subject to an appropriate assessment of the product by the validation consultant);
- All complaints from workers and neighbours should be logged and a response provided. Work should be rescheduled as necessary to minimise odour problems;
- The site foreman should consider the following odour control measures:
  - reduce the exposed surface of the odorous materials;
  - time excavation activities to reduce off-site nuisance (particularly during strong winds); and
  - cover exposed excavation faces overnight or during periods of low excavation activity.
- If continued complaints are received, alternative odour management strategies should be considered and implemented.

9.9 Work Health and Safety (WHS) Plan

A site specific WHS plan should be prepared by the remediation contractor for all work to be undertaken at the site. The WHS plan should meet all the requirements outlined in SafeWork NSW WHS regulations.

As a minimum requirement, personnel must wear appropriate protective clothing, including long sleeve shirts, long trousers, steel cap boots and hard hats. Washroom and lunchroom facilities should also be provided to allow workers to remove potential contamination from their hands and clothing prior to eating or drinking.

9.10 Waste Management

Prior to commencement of remedial works and excavation for the proposed development, the remediation contractor should develop a waste management or recycling plan to minimise the amount of waste produced by the site.

9.11 Incident Management Contingency

The validation consultant should be contacted if any unexpected conditions are encountered at the site. This should enable the scope of remedial/validation works to be adjusted as required. Similarly, if any incident occurs at the site, the validation consultant should be advised to assess potential impacts on contamination conditions and the remediation/validation timetable.

9.12 Hours of Operation

Hours of operation should be between those approved by the determining authority under the development approval process.

9.13 Community Consultation and Complaints

The remediation contractor should provide details for managing community consultation and complaints within their site management plans developed for construction.

10 CONCLUSIONS

JKE have previously undertaken a PSI at the site which identified historically imported fill (soil) impacted by PAHs, TRHs and heavy metals. For the purpose of this RAP, the fill is considered to be characterised by carcinogenic PAHs and lead above the human health-based SAC applicable to 'residential with accessible soils' (Type A) land use scenario, and TRH F3 above the ecological SAC applicable to 'urban residential and public open space' exposure scenario. Fill is present at the surface and extends to depths of approximately 0.2mBGL to 6.2mBGL.

The remediation strategy includes excavation and off-site disposal of contaminated fill. If required, capping is to be provided for contaminated material to be left in-situ, which should be managed via a long-term EMP. This remediation method was assessed to be technically achievable to implement concurrently with the proposed development works. On this basis, JKE are of the opinion that the site can be made suitable for the proposed development provided this RAP is implemented.

A pre-remediation validation report is to be prepared following completion of the assessment as outlined in Section 4 of this RAP which is to be undertaken following site establishment and removal of all pavements/access way etc. RWP is to be prepared and implemented and should be based on the outcomes of the pre-remediation validation assessment and overall validation requirements. A site validation report and if required a long term EMP is to be prepared on completion of remediation activities and submitted to the determining authority/Woollahra Municipal Council to demonstrate that the site is suitable for the proposed development.

The RAP has met the objectives outlined in Section 1.2.

10.1 Remediation Category

Site remediation can fall under the following two categories outlined in SEPP55:

Table 10-1: Remediation Category

Category	Details
Category 1	Category 1 remediation works are those undertaken in the following areas specified under Clause 9 of SEPP55: • A designated development; • Carried out on land declared to be a critical habitat; • Development for which another SEPP or REP requires a development consent; or • Carried out in an area or zone classified as: ➢ Coastal Protection; ➢ Conservation or heritage conservation; ➢ Habitat protection, or habitat or wildlife corridor; ➢ Environmental protection; ➢ Escarpment, escarpment protection or preservation; ➢ Floodway or wetland; ➢ Nature reserve, scenic area or scenic protection; etc. • Work that is not carried out in accordance with the site management provisions contained in the consent authority Development Control Plan (DCP)/Local Environmental Plan (LEP) etc.

Category	Details
	Approval is required from the consent authority for Category 1 remediation work. The RAP needs to be assessed as part of the development consent. Category 1 remediation work is identified as advertised development work unless the remediation work is a designated development or a state significant development (Clause 13 of SEPP55).
Category 2	Remediation works which do not fall under the above category are classed as Category 2. Development consent is not required for Category 2 remediation works, however the consent authority should **be given 30 days' notice prior to commencement of works**.

In the context of the proposed remediation at the site, the remediation works would fall within Category 2 under the draft Remediation of Land SEPP. However, this should be confirmed by the client's planner following finalisation of the design.

10.2 Regulatory Requirements

The regulatory requirements applicable for the remediation are discussed in the following table:

Table 10-2: Regulatory Requirement

Guideline / Legislation / Policy	Applicability
SEPP55	At least a 30-day notice of Category 2 remediation work is to be provided to the consent authority in accordance with Clause 16 of SEPP55. Under Clause 17 of SEPP55, a notice of completion of remediation work is to be given to council within 30 days of completion of the work. The notice of completion of remediation works must be in accordance with Clause 18 of SEPP55.
POEO Act 1997	Section 143 of the POEO Act 1997 states that if waste is transported to a place that cannot lawfully be used as a waste facility for that waste, then the transporter and owner of the waste are each guilty of an offence. The transporter and owner of the waste have a duty to ensure that the waste is disposed of in an appropriate manner. Appropriate waste tracking is required for all waste that is disposed off-site. Activities should be carried out in a manner which does not result in the pollution of waters.
POEO (Waste) Regulation 2014	Part 7 of the POEO Waste Regulation 2014 set outs the requirements for the transportation and management of asbestos waste and Clause 79 of the POEO Waste Regulation requires waste transporters to provide information to the NSW EPA regarding the movement of any load in NSW of more than 10 square meters of asbestos sheeting, or 100 kilograms of asbestos waste. To fulfil these legal obligations, asbestos waste transporters must use WasteLocate.
SafeWork NSW Code of Practice: How to manage and control asbestos in the workplace (2019)	Sites with asbestos become a 'workplace' when work is carried out there and require a register and AMP. Appropriate SafeWork NSW notification will be required for licensed (e.g. Class A) asbestos removal works or handling.

11 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified contamination issues at the site. Any unexpected problems/subsurface features that may be encountered during development works should be inspected by an environmental consultant as soon as possible;
- Previous use of this site may have involved excavation for the foundations of buildings, services, and similar facilities. In addition, unrecorded excavation and burial of material may have occurred on the site. Backfilling of excavations could have been undertaken with potentially contaminated material that may be discovered in discrete, isolated locations across the site during construction work;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE has not undertaken any assessment of off-site areas that may be potential contamination sources or may have been impacted by site contamination, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- Material considered to be suitable from a geotechnical point of view may be unsatisfactory from a soil contamination viewpoint, and vice versa; and
- This report has been prepared for the particular project described and no responsibility is accepted for the use of any part of this report in any other context or for any other purpose.

Important Information About This Report

These notes have been prepared by JKE to assist with the assessment and interpretation of this report.

The Report is based on a Unique Set of Project Specific Factors
This report has been prepared in response to specific project requirements as stated in the JKE proposal document which may have been limited by instructions from the client. This report should be reviewed, and if necessary, revised if any of the following occur:

- The proposed land use is altered;
- The defined subject site is increased or sub-divided;
- The proposed development details including size, configuration, location, orientation of the structures or landscaped areas are modified;
- The proposed development levels are altered, eg addition of basement levels; or
- Ownership of the site changes.

JKE will not accept any responsibility whatsoever for situations where one or more of the above factors have changed since completion of the assessment. If the subject site is sold, ownership of the assessment report should be transferred by JKE to the new site owners who will be informed of the conditions and limitations under which the assessment was undertaken. No person should apply an assessment for any purpose other than that originally intended without first conferring with the consultant.

Changes in Subsurface Conditions
Subsurface conditions are influenced by natural geological and hydrogeological process and human activities. Groundwater conditions are likely to vary over time with changes in climatic conditions and human activities within the catchment (e.g. water extraction for irrigation or industrial uses, subsurface waste water disposal, construction related dewatering). Soil and groundwater contaminant concentrations may also vary over time through contaminant migration, natural attenuation of organic contaminants, ongoing contaminating activities and placement or removal of fill material. The conclusions of an assessment report may have been affected by the above factors if a significant period of time has elapsed prior to commencement of the proposed development.

This Report is based on Professional Interpretations of Factual Data
Site assessments identify actual subsurface conditions at the actual sampling locations at the time of the investigation. Data obtained from the sampling and subsequent laboratory analyses, available site history information and published regional information is interpreted by geologists, engineers or environmental scientists and opinions are drawn about the overall subsurface conditions, the nature and extent of contamination, the likely impact on the proposed development and appropriate remediation measures.

Actual conditions may differ from those inferred, because no professional, no matter how qualified, and no subsurface exploration program, no matter how comprehensive, can reveal what is hidden by earth, rock and time. The actual interface between materials may be far more gradual or abrupt than an assessment indicates. Actual conditions in areas not sampled may differ from predictions. Nothing can be done to prevent the unanticipated, but steps can be taken to help minimise the impact. For this reason, site owners should retain the services of their consultants throughout the development stage of the project, to identify variances, conduct additional tests which may be needed, and to recommend solutions to problems encountered on site.

Assessment Limitations
Although information provided by a site assessment can reduce exposure to the risk of the presence of contamination, no environmental site assessment can eliminate the risk. Even a rigorous professional assessment may not detect all contamination on a site. Contaminants may be present in areas that were not surveyed or sampled, or may migrate to areas which showed no signs of contamination when sampled. Contaminant analysis cannot possibly cover every type of contaminant which may occur; only the most likely contaminants are screened.

Misinterpretation of Site Assessments by Design Professionals

Costly problems can occur when other design professionals develop plans based on misinterpretation of an assessment report. To minimise problems associated with misinterpretations, the environmental consultant should be retained to work with appropriate professionals to explain relevant findings and to review the adequacy of plans and specifications relevant to contamination issues.

Logs Should not be Separated from the Assessment Report

Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other design drawings, as subtle but significant drafting errors or omissions may occur in the transfer process. Photographic reproduction can eliminate this problem, however contractors can still misinterpret the logs during bid preparation if separated from the text of the assessment. If this occurs, delays, disputes and unanticipated costs may result. In all cases it is necessary to refer to the rest of the report to obtain a proper understanding of the assessment. Please note that logs with the 'Environmental Log' header are not suitable for geotechnical purposes as they have not been peer reviewed by a Senior Geotechnical Engineer.

To reduce the likelihood of borehole and test pit log misinterpretation, the complete assessment should be available to persons or organisations involved in the project, such as contractors, for their use. Denial of such access and disclaiming responsibility for the accuracy of subsurface information does not insulate an owner from the attendant liability. It is critical that the site owner provides all available site information to persons and organisations such as contractors.

Read Responsibility Clauses Closely

Because an environmental site assessment is based extensively on judgement and opinion, it is necessarily less exact than other disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, model clauses have been developed for use in written transmittals. These are definitive clauses designed to indicate consultant responsibility. Their use helps all parties involved recognise individual responsibilities and formulate appropriate action. Some of these definitive clauses are likely to appear in the environmental site assessment, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to any questions.

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

This plan should be read in conjunction with the Environmental report.

Title: **SITE LOCATION PLAN**

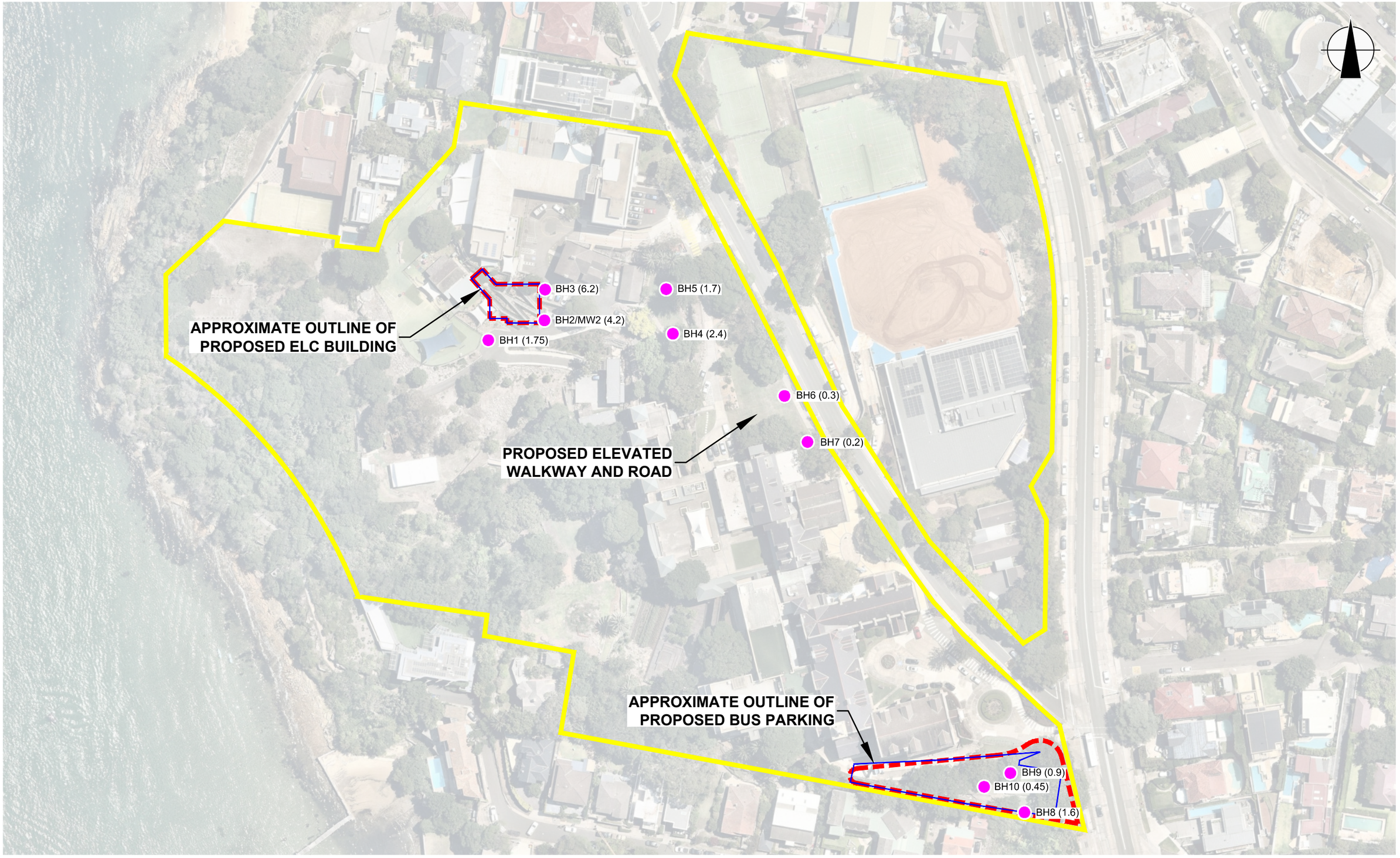
Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 1

JKEnvironments

PLOT DATE: 2/03/2020 1:39:28 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000'S\E32915BD VAUCLUSE\CAD\E32915BD.DWG



LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH(Fill depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

0 13 26 39 52 65

SCALE 1:1300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SAMPLE LOCATION PLAN**

Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 2

JKEnvironments

PLOT DATE: 3/03/2020 2:13:03 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000SIE32915BD VAULCLUSE\CAD\E32915BD.DWG

BH2	0.75-0.95m
LEAD	810mg/kg

MW2	
pH	6.1
Zinc	21µg/L
Phenanthrene	2.9µg/L
Anthracene	0.8µg/L
Fluoranthene	3.3µg/L
Benzo(a)pyrene	1.6µg/L

BH1	0.05-0.15m
TRH (F3)	350mg/kg

BH3 (6.2)
BH5 (1.7)
BH2/MW2 (4.2)
BH4 (2.4)
BH1 (1.75)
BH6 (0.3)
BH7 (0.2)

APPROXIMATE OUTLINE OF PROPOSED ELC BUILDING

PROPOSED ELEVATED WALKWAY AND ROAD

APPROXIMATE OUTLINE OF PROPOSED BUS PARKING

BH9 (0.9)
BH10 (0.45)
BH8 (1.6)

BH8	0.6-0.7m
Carcenogenic PAHs	6.9mg/kg

BH8	0.6-0.7m
TRH (F3)	340mg/kg

LEGEND

- APPROXIMATE SITE BOUNDARY
- APPROXIMATE WIDER PROPERTY BOUNDARY
- BH(Fill depth) — BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)

SAMPLE ID	DEPTH (metres)
CHEMICAL	CONCENTRATION

SOIL/SURFACE SAMPLE EXCEEDANCE

SAMPLE ID	-
CHEMICAL	CONCENTRATION (µg/L)

GROUNDWATER SAMPLE EXCEEDANCE

- SOIL/SURFACE CONTAMINATION ABOVE SAC FOR HUMAN HEALTH RISK
- SOIL CONTAMINATION ABOVE SAC FOR ECOLOGICAL RISK
- GROUNDWATER CONTAMINATION ABOVE SAC

0 13 26 39 52 65
SCALE 1:1300 @A3 METRES

This plan should be read in conjunction with the Environmental report.

Title: **SITE CONTAMINATION PLAN**

Location: CORNER NEW SOUTH HEAD ROAD AND VAUCLUSE ROAD, VAUCLUSE, NSW (Lot 104 in DP1092747)

Project No: E32915BD

Figure: 3

JKEnvironments

PLOT DATE: 30/3/2020 1:59:07 PM DWG FILE: Z:\5 EIS\5C EIS JOBS\32000SIE32915BD VAULCLUSE\CAD\E32915BD.DWG

Appendix B: Selected Proposed Development Plans

0 10 25 50m

EXISTING BUILDINGS + PRECINCTS
SITE PLAN

PRECINCT A:

1. EARLY LEARNING CENTRE EXTENSION
2. JUNIOR SHOOL - ASSEMBLY + GLA'S
3. JUNIOR SCHOOL - GLA'S
4. JUNIOR SCHOOL - VERTICAL CIRCULATION LINK
5. JUNIOR SCHOOL - GLA'S + AMPHITHEATRE

PRECINCT B:

6. SENIOR SCHOOL - MAIN ENTRY RECEPETION +FOYER, ADMINISTRATION +LEADERSHIP OFFICES (LVL 02)
7. SENIOR SCHOOL - MAIN ENTRY FORECOURT, LANDSCAPING + ACCESSIBLE ENTRY RAMP
8. SENIOR SCHOOL -YEAR 8 CENTRE (LVL 03)
9. TRAFFIC MANAGEMENT - PROPOSED SECONDARY ENTRY
10. TRAFFIC MANAGEMENT - PROPOSED PICK UP AND DROP OFF WITH WIDENING OF EXIT ROAD

PRECINCT B (CONCEPT DA):

11. SENIOR SCHOOL - CIRCULATION HUB
12. SENIOR SCHOOL - HUGHES CENTRE
13. TRAFFIC MANAGEMENT - BUS + CAR PARKING

PRECINCT C (CONCEPT DA):

14. BOARDING ACCOMMODATION - EXTENSION

0 10 25 50m

PROPOSED PROJECT LOCATIONS + TRAFFIC MANAGEMENT STRATEGY
SITE PLAN

KINCOPPAL SCHOOL, ROSE BAY
STATE SIGNIFICANT DEVELOPMENT APPLICATION
PRECINCT A - JUNIOR SCHOOL AND EARLY LEARNING CENTRE

DRAWING LIST

Sheet Number	Sheet Name	Rev	Current Revision Date
A-A0-01	LOCATION PLAN	1	09.10.19
A-A0-02	EXISTING SITE PLAN	1	09.10.19
A-B1-01	ELC - PROPOSED GA PLAN - LEVEL -03	2	09.10.19
A-B1-04	PROPOSED GA PLAN - LEVEL -02	2	09.10.19
A-B1-05	PROPOSED GA PLAN - LEVEL -01	2	09.10.19
A-B1-06	PROPOSED GA PLAN - LEVEL 00	2	09.10.19
A-C0-01	EXISTING & DEMOLITION ELEVATIONS - NORTH AND EAST		
A-C0-02	EXISTING & DEMOLITION ELEVATIONS - SOUTH & WEST		
A-C1-01	PROPOSED ELEVATIONS - NORTH & EAST	2	09.10.19
A-C1-02	PROPOSED ELEVATIONS - SOUTH & WEST	2	09.10.19
A-D1-01	GA SECTIONS	2	09.10.19
A-D1-02	GA SECTIONS	2	09.10.19
A-D1-03	GA SECTIONS	2	09.10.19
A-X1-01	ELC - SCHEDULE OF ACCOMMODATION		
A-Y1-01	MATERIALS AND FINISHES	1	09.10.19
A-X1-02	JS - SCHEDULE OF ACCOMMODATION		
A-B0-06	EXISTING/DEMOLITION PLAN - LEVEL 00	1	09.10.19
A-B0-07	EXISTING/DEMOLITION PLAN - LEVEL 01	1	09.10.19
A-B0-08	EXISTING/DEMOLITION PLAN - LEVEL 02		
A-B0-09	EXISTING/DEMOLITION PLAN - LEVEL 03	1	09.10.19

DRAWING LIST

Sheet Number	Sheet Name	Rev	Current Revision Date
A-B0-10	EXISTING/DEMOLITION PLAN - ROOF	1	09.10.19
A-B0-01	ELC - EXISTING/DEMOLITION PLAN - LEVEL -03	1	09.10.19
A-B0-04	EXISTING/DEMOLITION PLAN - LEVEL -02	1	09.10.19
A-B0-05	EXISTING/DEMOLITION PLAN - LEVEL -01	1	09.10.19
A-B1-07	PROPOSED GA PLAN - LEVEL 01	2	09.10.19
A-B1-08	PROPOSED GA PLAN - LEVEL 02	2	09.10.19
A-B1-09	PROPOSED GA PLAN - LEVEL 03	2	09.10.19
A-B1-10	PROPOSED GA PLAN - ROOF	2	09.10.19
A-C1-03	PROPOSED ELEVATION - EAST	1	09.10.19
A-A1-02	PROPOSED SITE PLAN WITH SURVEY OVERLAY	3	09.10.19
A-A0-00	COVER SHEET	1	03.09.19
M-01-01	AXONOMETRIC	2	09.10.19
A-T1-01	PROPOSED - SHADOW STUDIES JUNE 21ST	1	09.10.19
A-T0-01	EXISTING - SHADOW STUDIES JUNE 21ST	1	09.10.19
A-B0-02	ELC - EXISTING/DEMOLITION PLAN - LEVEL -02	1	09.10.19
A-B1-02	ELC - PROPOSED GA PLAN - LEVEL -02	1	09.10.19
A-B1-03	ELC - PROPOSED ROOF PLAN	1	09.10.19
A-U1-01	PROPOSED GFA PLANS	1	09.10.19
A-U0-01	EXISTING GFA PLANS	1	09.10.19

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MAHADY MANAGEMENT
MOB. 0411 510 073

CLIENT

STATE SIGNIFICANT DEVELOPMENT APPLICATION

PRECINCT A

PROJECT

JUNIOR SCHOOL AND ELC

CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER

1802002

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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SCALE

@A1

STATUS

FOR COORDINATION

DRAWING

COVER SHEET

ISSUE

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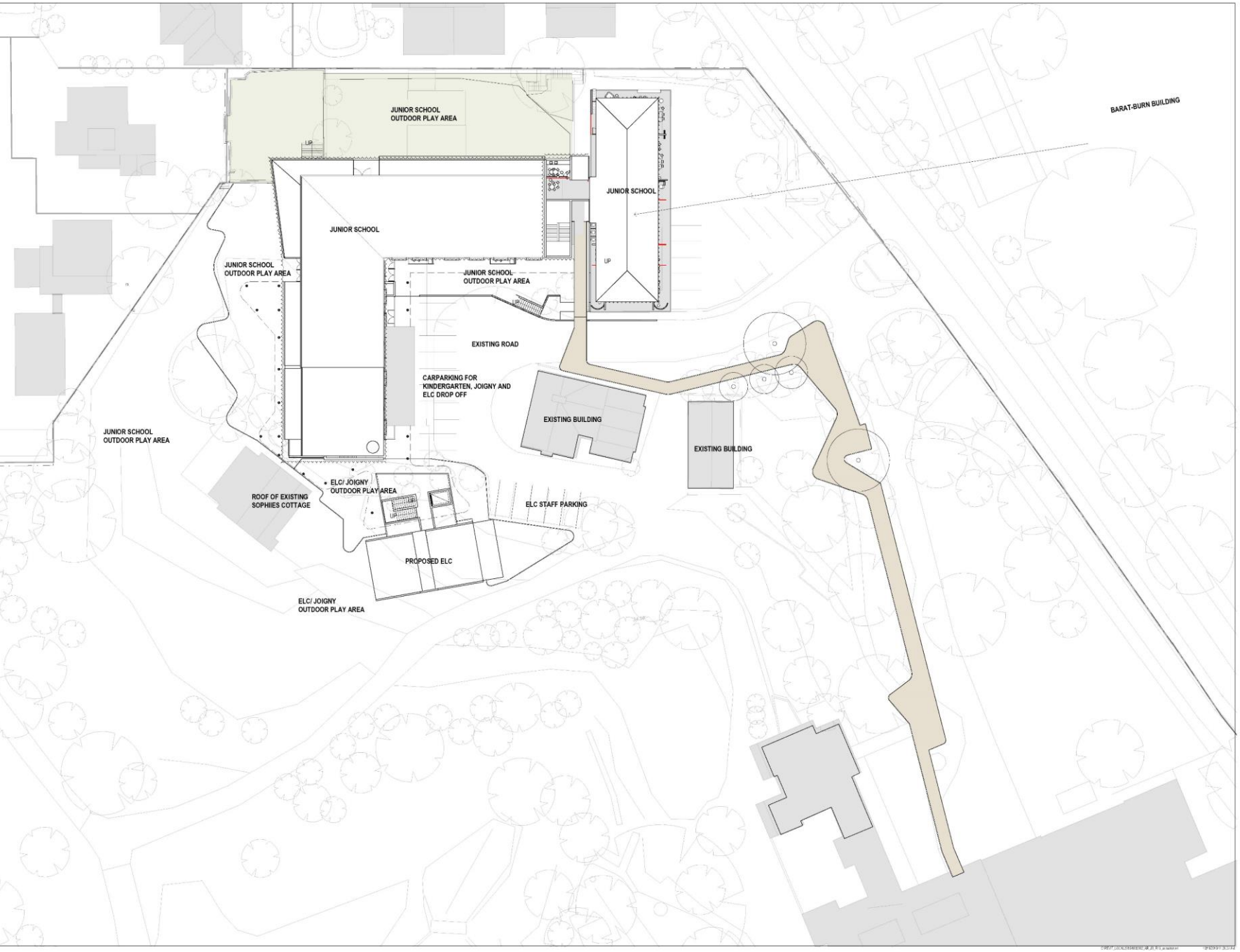

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PRECINCT A
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CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER

1802002
DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE

0 2000

SCALE

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STATUS

FOR COORDINATION
DRAWING

PROPOSED SITE PLAN WI
SURVEY OVERLAY

ISSUE

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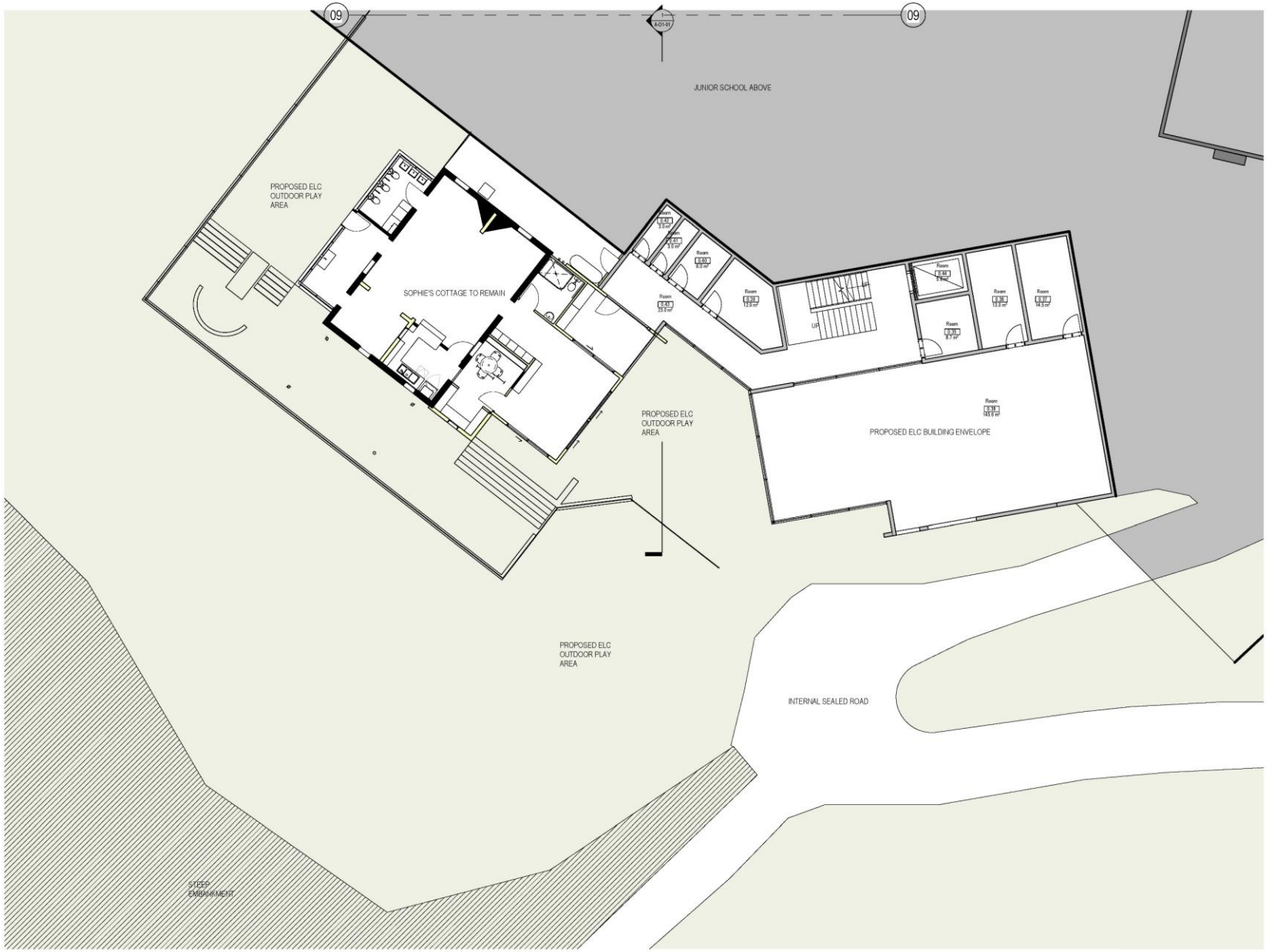

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CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER
1802002
DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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STATUS
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ELC - PROPOSED GA PLAN
LEVEL -03

AR-A-B1-01

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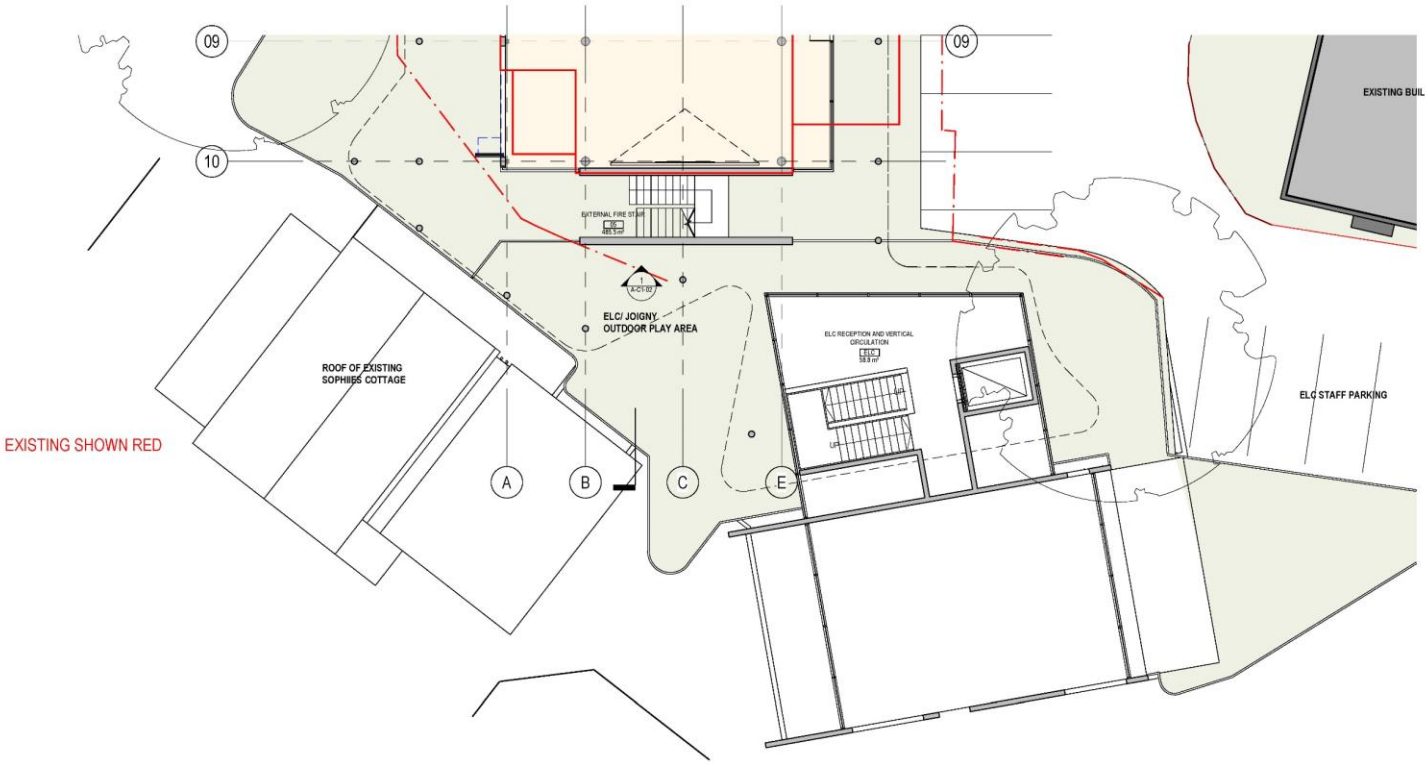

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NSW 2030

BVN PROJECT NUMBER
1802002

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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SCALE
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STATUS
FOR COORDINATION

DRAWING
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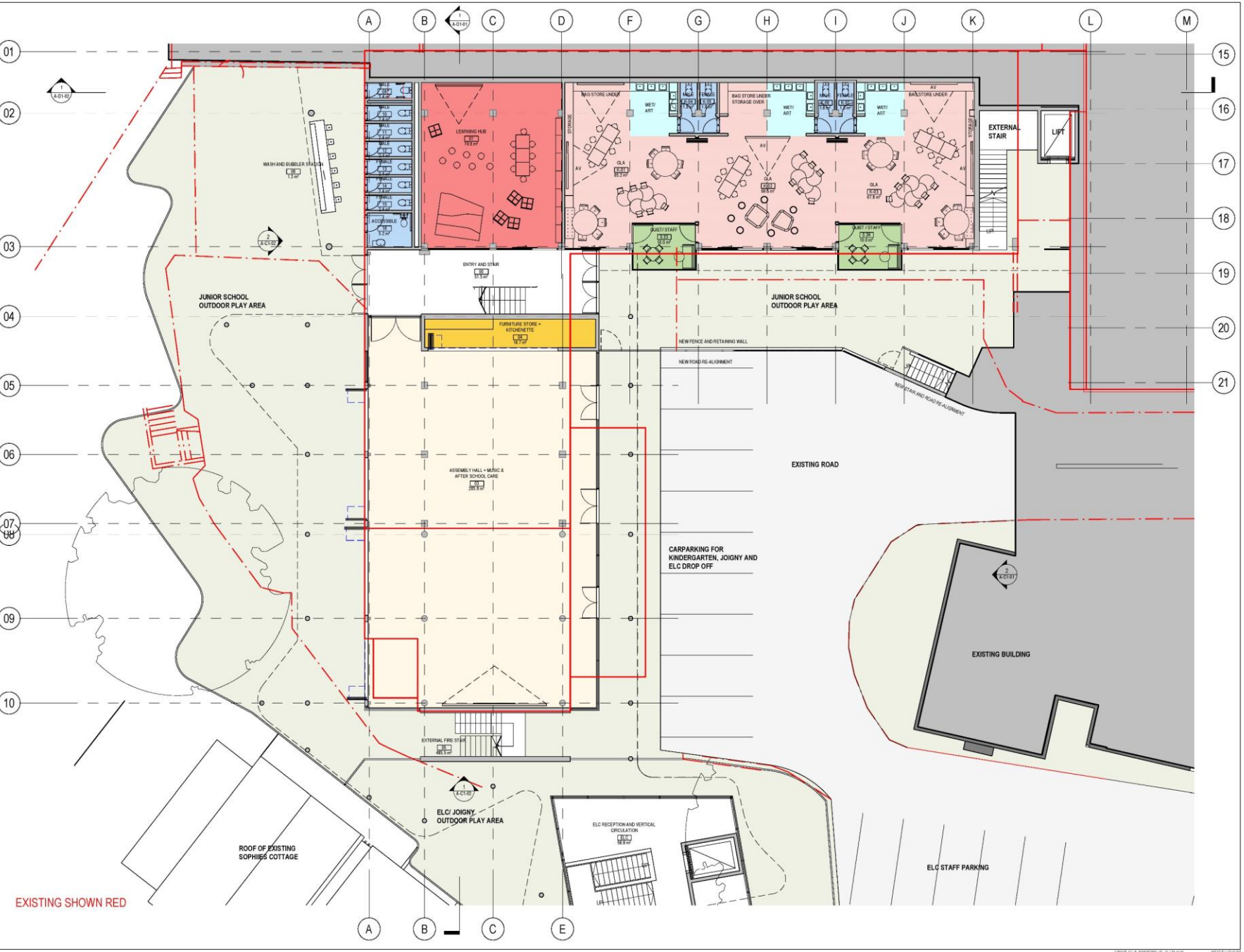

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PRECINCT A
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NSW 2030

BVN PROJECT NUMBER
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DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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STATUS
FOR COORDINATION

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PROPOSED GA PLAN - LEVEL -02

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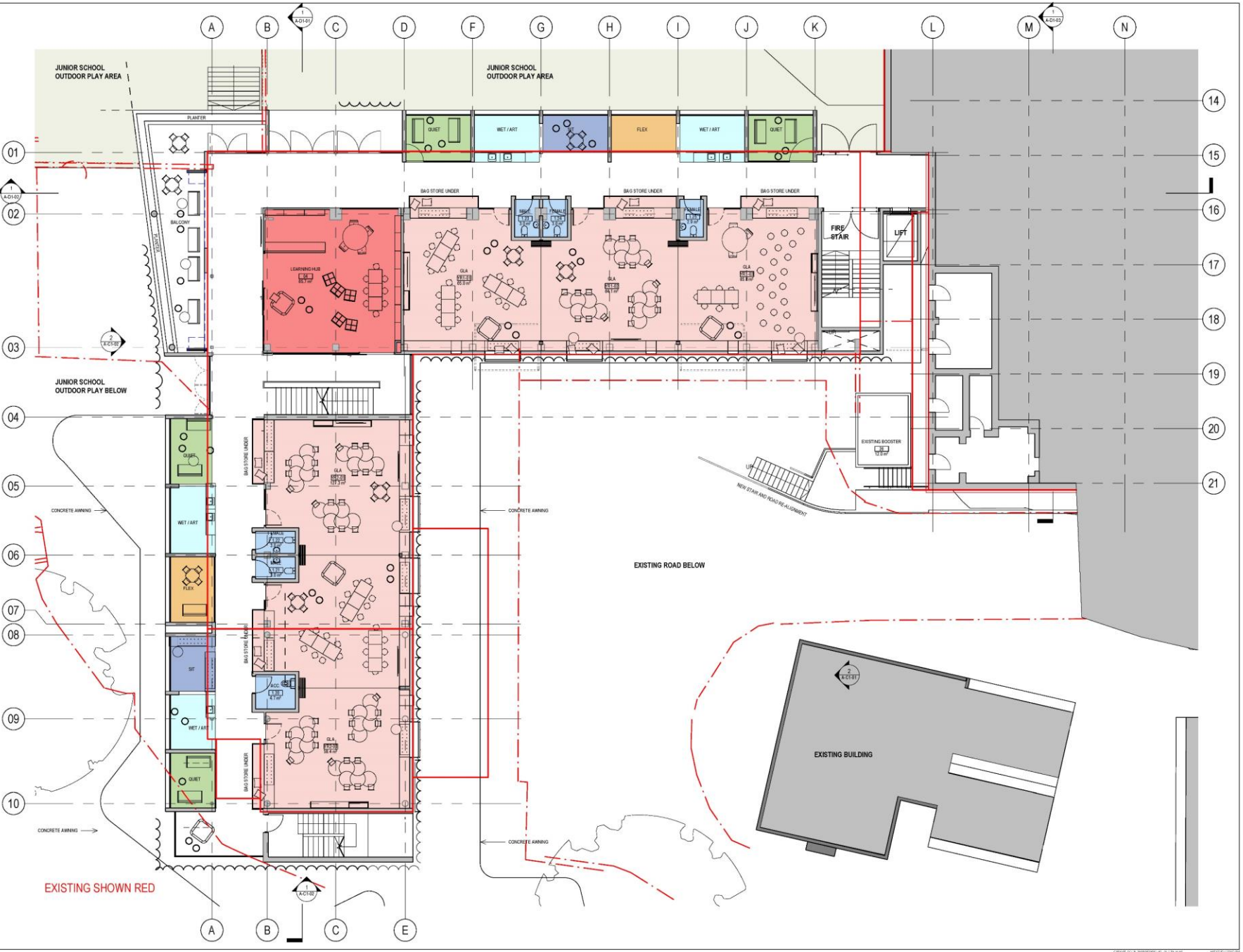

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CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER
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GRAPHIC SCALE
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SCALE
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STATUS
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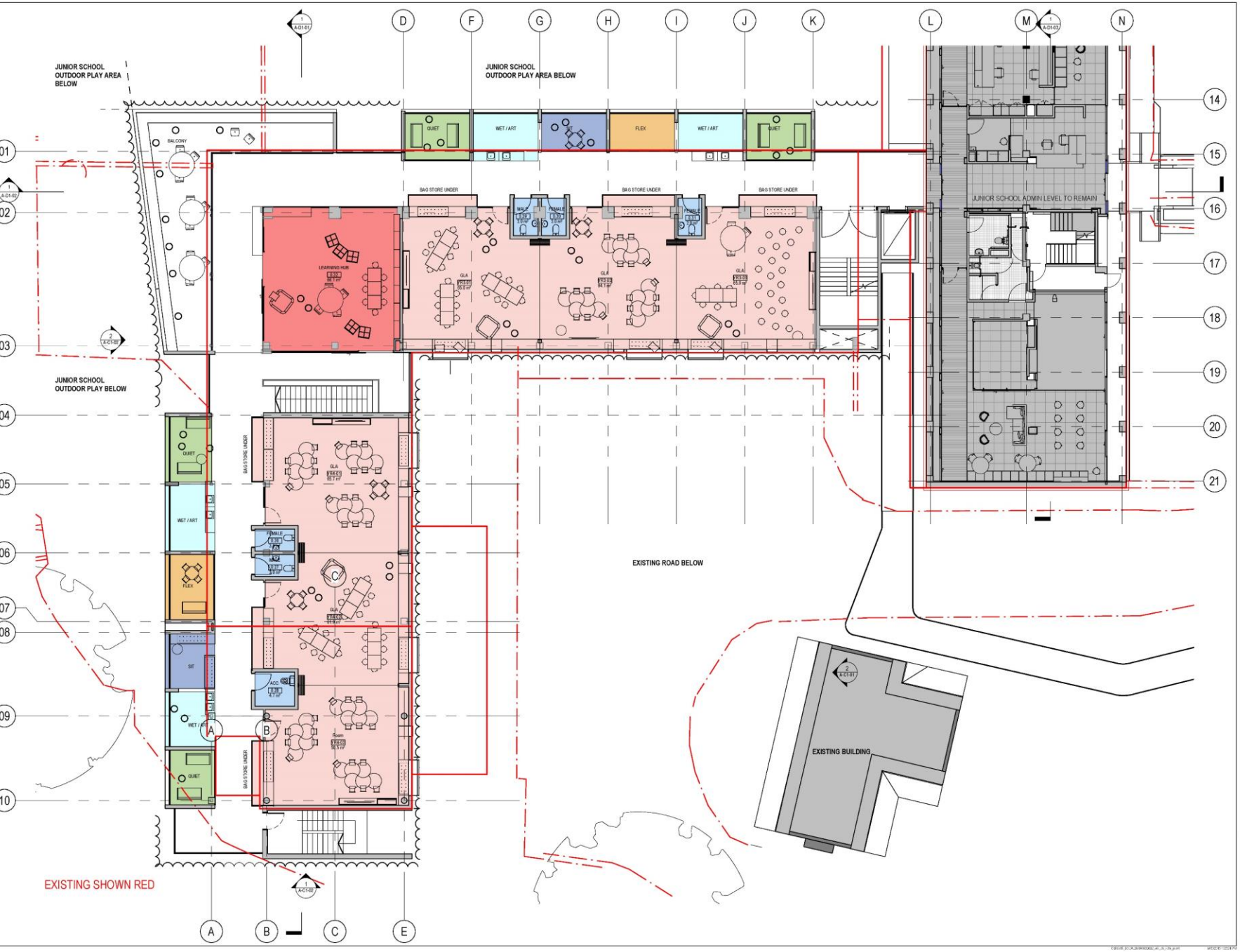
PROPOSED GA PLAN - LEVEL -01

AR-A-B1-05 | ISSUE 2



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PRECINCT A
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JUNIOR SCHOOL AND ELC

CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER
1802002

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STATUS
FOR COORDINATION

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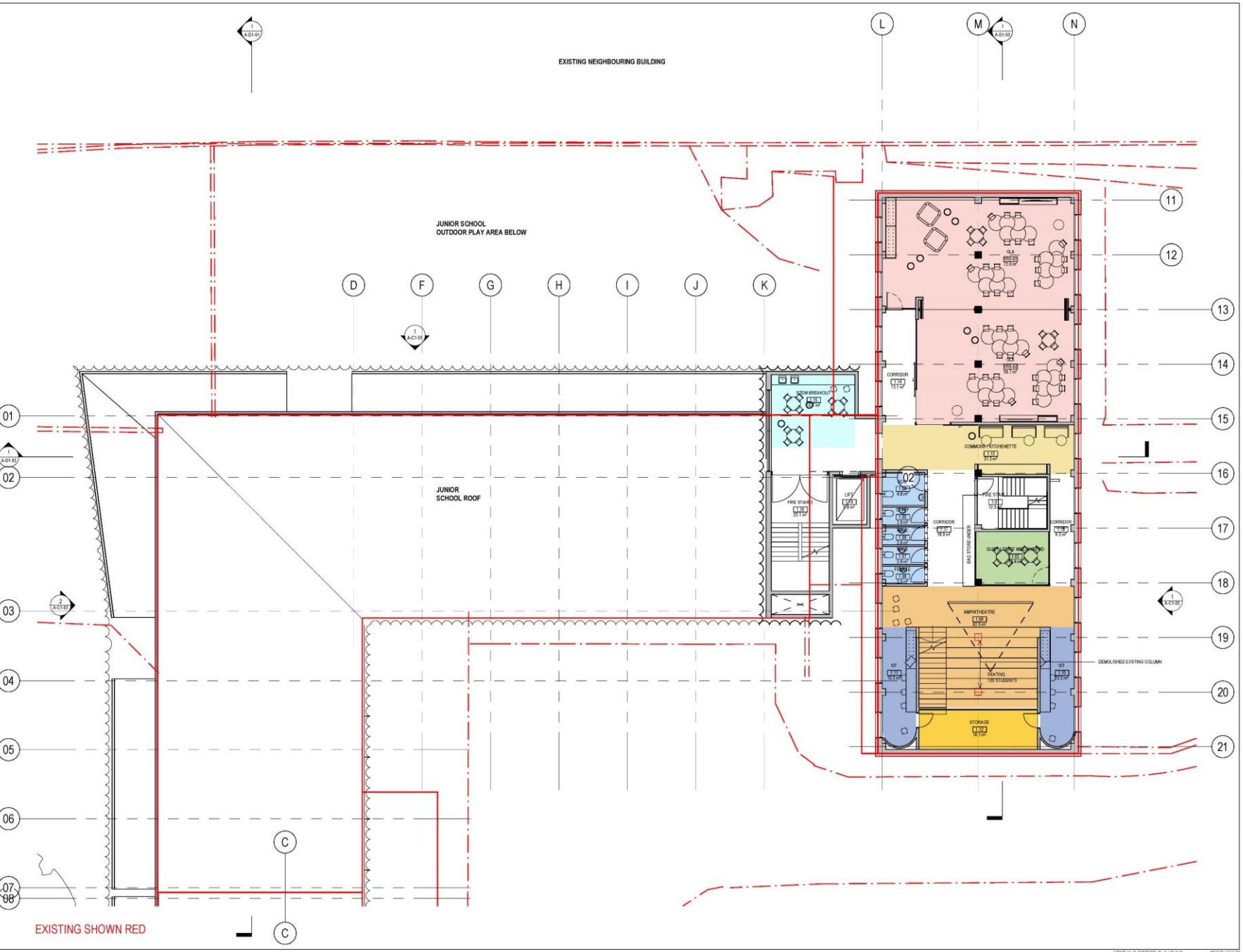
PROPOSED GA PLAN - LEVEL 00

AR-A-B1-06 | ISSUE 2



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PRECINCT A
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CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER
1802002
DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE
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SCALE
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STATUS
FOR COORDINATION
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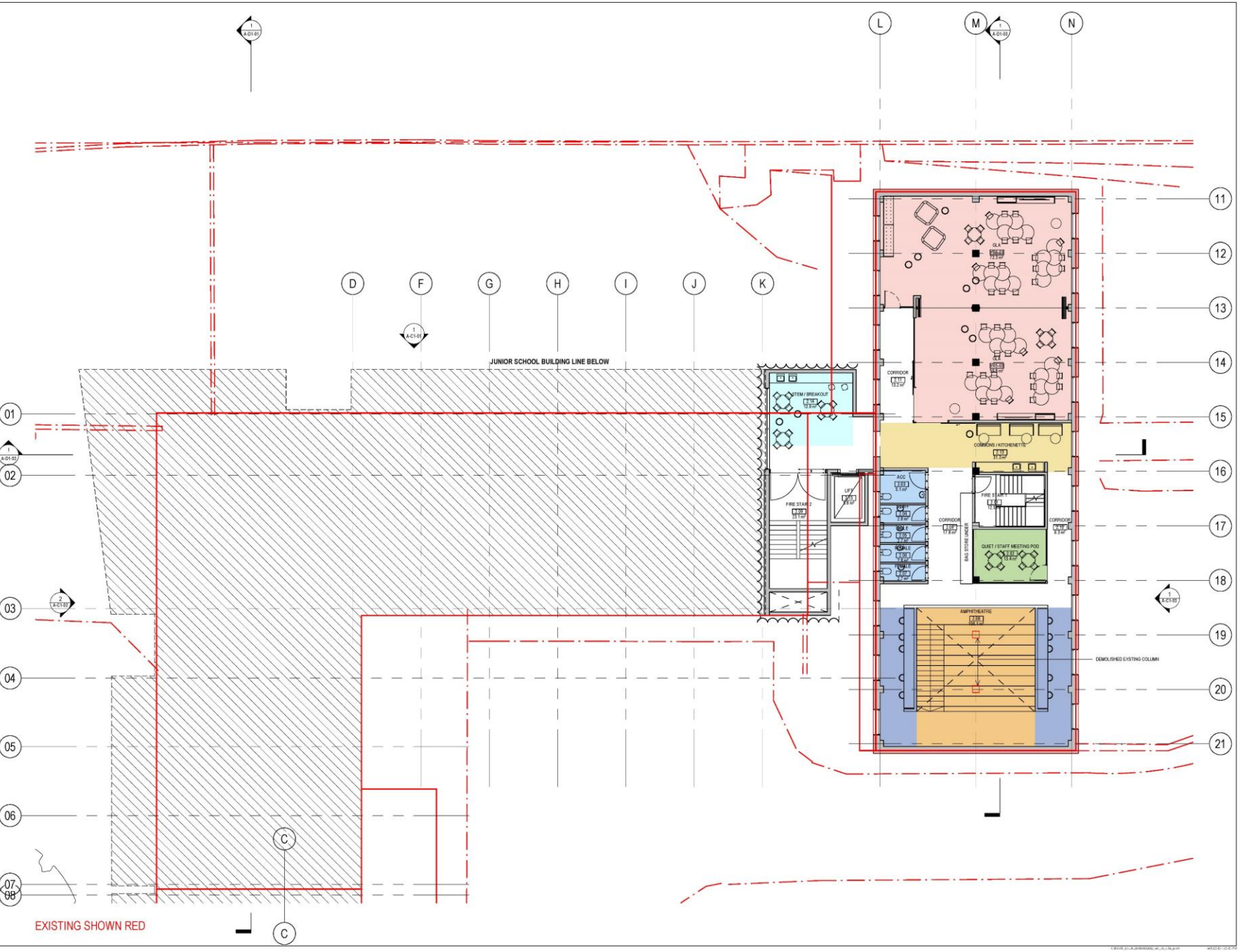
PROPOSED GA PLAN - LEVEL 01

AR-A-B1-07 ISSUE 2



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MAHADY MANAGEMENT
MOB. 0411 510 073
CLIENT

KINCOPPAL ROSE BAY
CLIENT NUMBER

PRECINCT A
PROJECT

JUNIOR SCHOOL AND ELC
CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER
1802002
DRAWING KEY

TRUE NORTH
PROJECT NORTH
GRAPHIC SCALE
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STATUS
FOR COORDINATION
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PROPOSED GA PLAN - LEVEL 02

AR-A-B1-08

ISSUE
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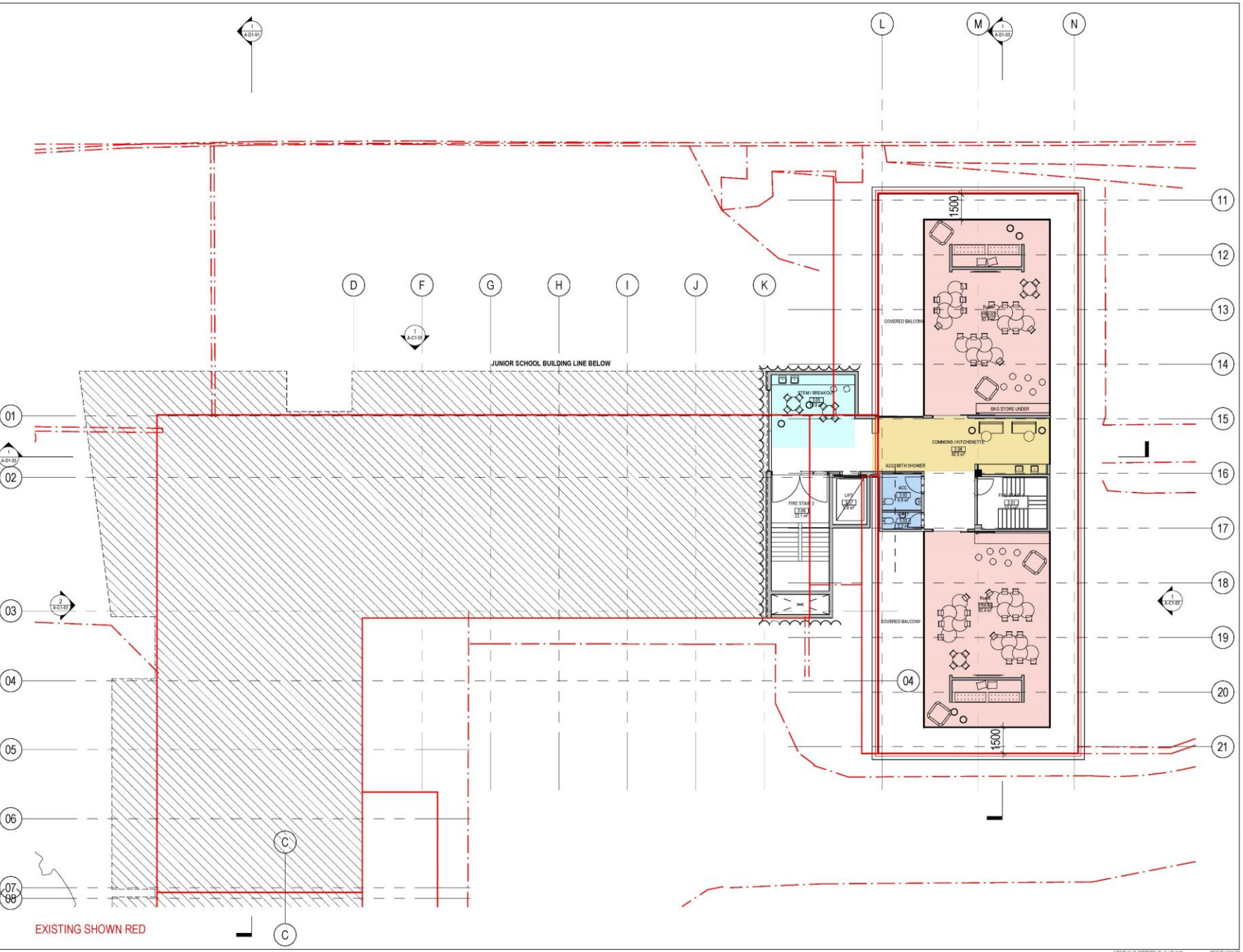

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STATE SIGNIFICANT DEVELOPMENT APPLICATION

PRECINCT A

PROJECT

JUNIOR SCHOOL AND ELC

CNR NEW SOUTH HEAD ROAD & VAUCLUSE RD, VA
NSW 2030

BVN PROJECT NUMBER

1802002

DRAWING KEY

TRUE NORTH PROJECT NORTH

GRAPHIC SCALE

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SCALE

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STATUS

FOR COORDINATION

DRAWING

PROPOSED GA PLAN - LEVEL 03

AR-A-B1-09

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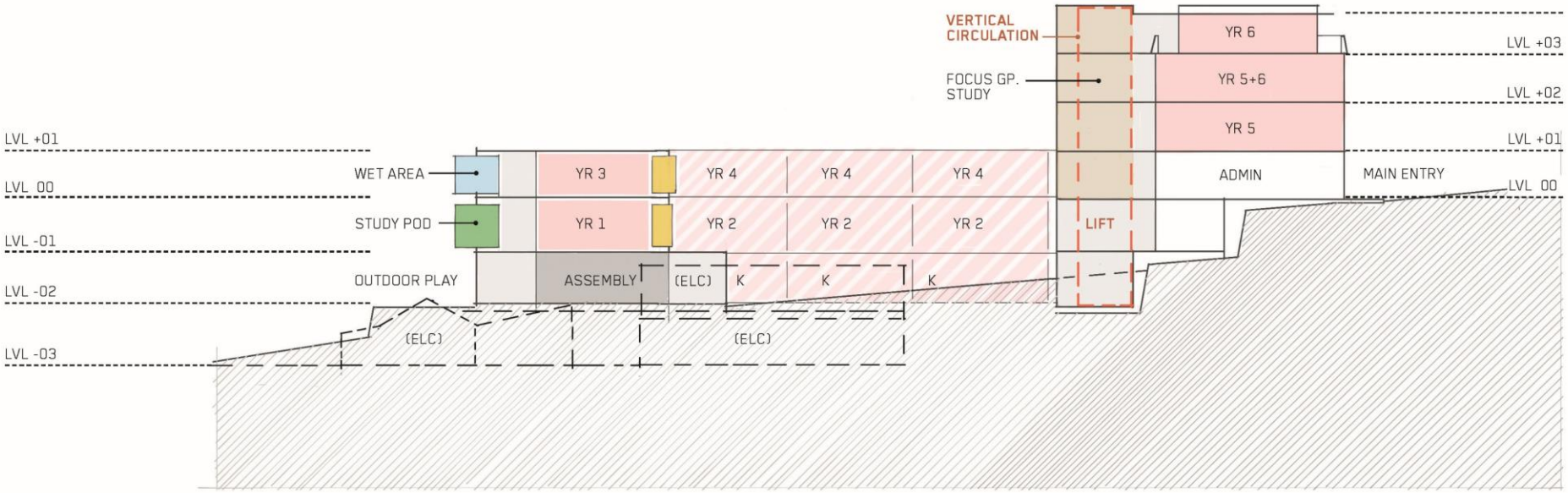
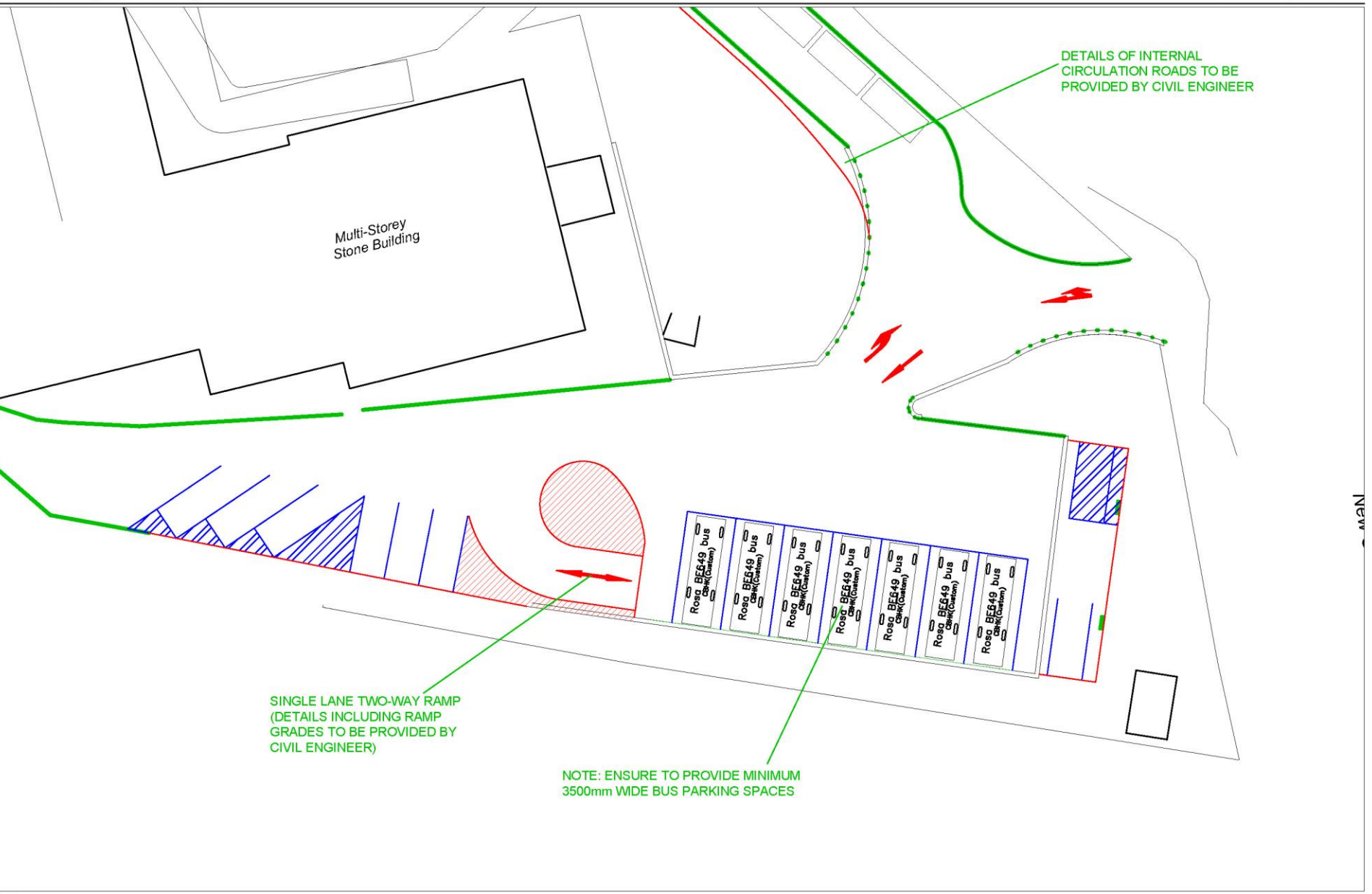


JUNIOR SCHOOL + EARLY LEARNING CENTRE - LEVELS -03 - +03

PROPOSED SECTION



TE:
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RVEY AND FINAL DESIGN. TRAFFIC MEASURES
OPOSED IN THIS PLAN ARE CONCEPT ONLY AND
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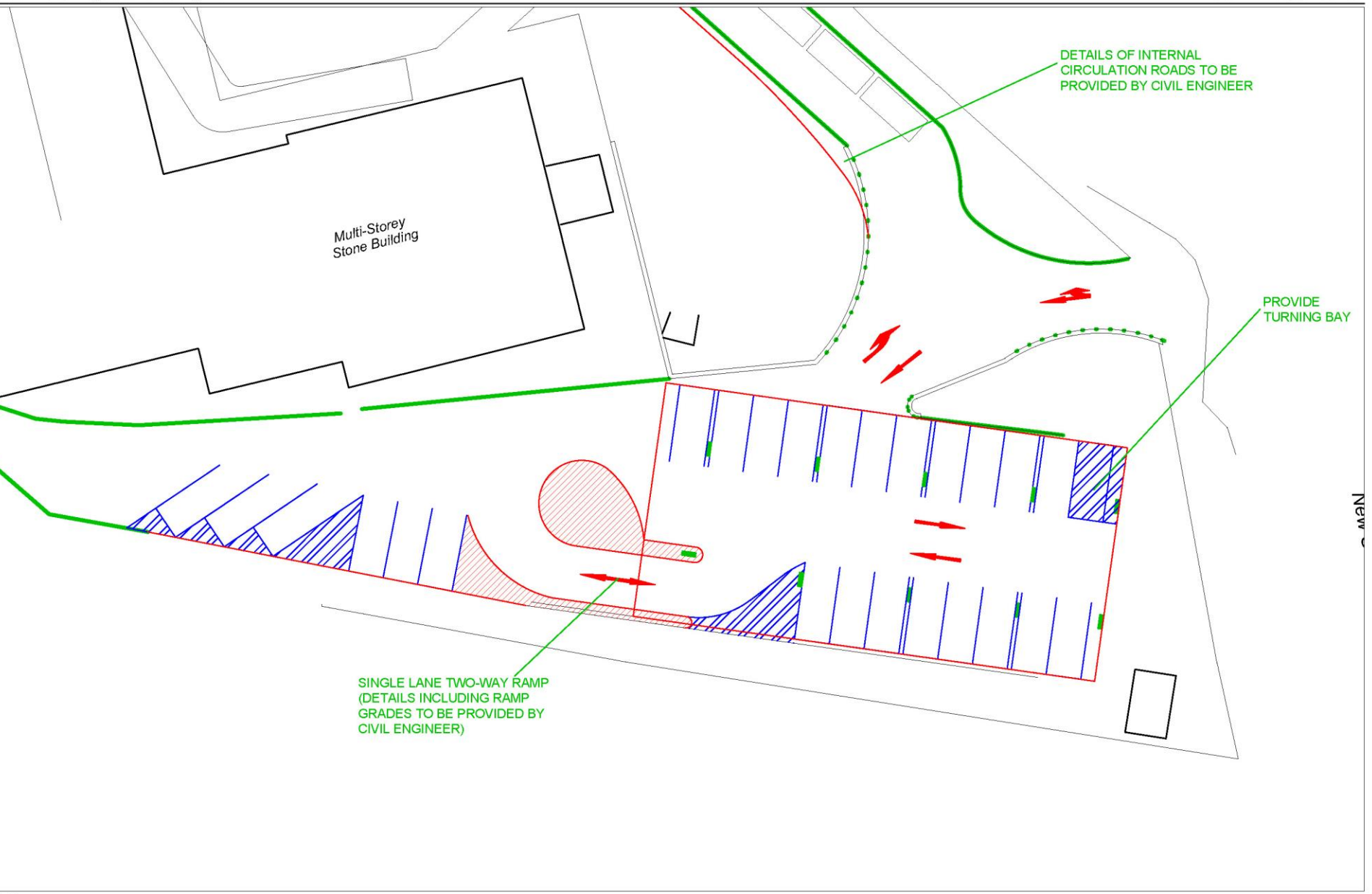
CONCEPT BUS PARKING LAYOUT



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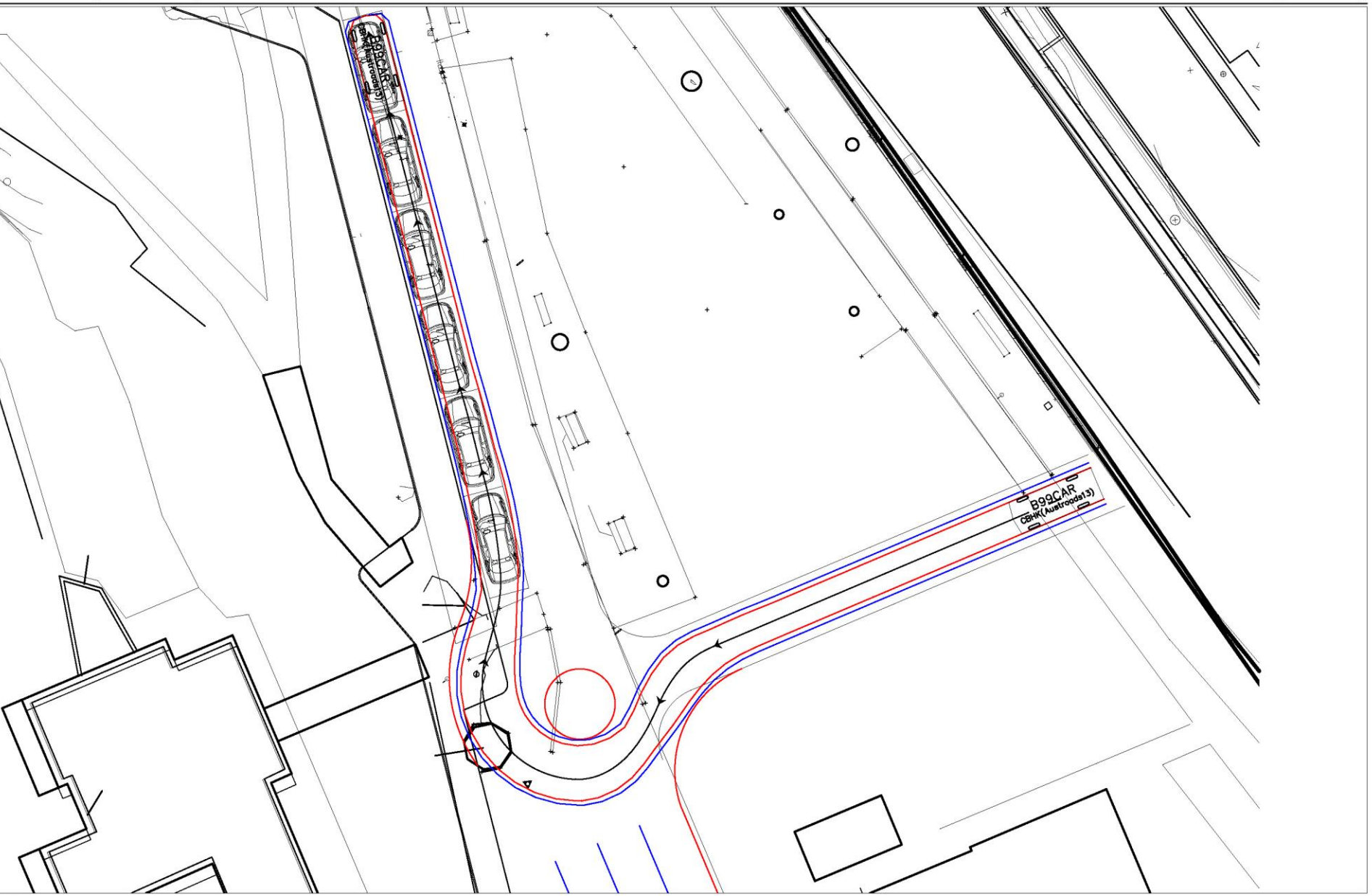
CONCEPT BASEMENT PARKING LAYOUT

DRAWN BY CBRK Pty Ltd_mr Ref: 11096 11 September 2019



TE:
ETCH PLAN ONLY. PROPERTY BOUNDARIES,
ILITIES, KERBLINES & DIMENSIONS ARE SUBJECT TO
RVEY AND FINAL DESIGN. TRAFFIC MEASURES
OPOSED IN THIS PLAN ARE CONCEPT ONLY AND
E SUBJECT TO FINAL DESIGN BY CIVIL ENGINEERS.

Swept Path of Vehicle Body
Swept Path of Clearance to Vehicle Body

B99 VEHICLE SWEPT PATHS
- OPTION 2
(MOUNTABLE ROUNDABOUT)

DRAWN BY CBRK Pty Ltd_mr Ref: 11096 8 October 2019

Appendix C: JKE PSI Attachments

Sub-surface Record

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BOREHOLE LOG

Borehole No. 1

1 / 1

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 35.1 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION						35			-	ASPHALTIC CONCRETE: 50mm.t	M			
										FILL: Gravelly silty sand, fine to coarse grained, light grey, fine to medium grained igneous gravel.				APPEARS MODERATELY COMPACTED
					N = 11 5,6,5					FILL: Silty sand, fine to coarse grained, light brown, trace of clay and fine to medium grained sandstone gravel.				
						34	1							
					N > 3 2,3/ 100mm REFUSAL				-	SANDSTONE: fine to coarse grained, light grey and red brown.	DW	M - H		HAWKESBURY SANDSTONE
							2			END OF BOREHOLE AT 2.00 m				HIGH 'TC' BIT RESISTANCE
						33								'TC' BIT REFUSAL
							3							
						32								
							4							
						31								
							5							
						30								
							6							
						29								

JKGeotechnics

BOREHOLE LOG

Borehole No. 2

1 / 2

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
										ASPHALTIC CONCRETE: 90mm.t				
					N = 4 2,2,2	38	1		-	FILL: Silty sand, fine to coarse grained, brown, with brick fragments, trace of sandstone gravel and clay.	M			APPEARS POORLY COMPACTED
					N = 7 4,4,3	37	2							
					N = 4 6,2,2	36	3							
						35	4							
					N = 8 4,5,3	34	5		SM	Silty SAND: fine to coarse grained, light orange brown, with clay, trace of fine to coarse grained ironstone gravel.	M	L		CONTINUAL SPIRAL AUGER DRILLING (i.e. NO INSITU TESTING) BELOW 4.95m IN ORDER TO ATTEMPT TO PROVE BEDROCK
						33	6							
						32								

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BOREHOLE LOG

Borehole No. 2
2 / 2

PROPOSED ELC BUILDING

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 38.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON 3/2/20						31	8		SM	Silty SAND: fine to coarse grained, light orange brown, with clay, trace of fine to coarse grained ironstone gravel.	M	L		
ON COMPLETION OF AUGERING	■			■		30	9		SW	Gravelly SAND: fine to coarse grained, light orange brown, fine to coarse grained ironstone gravel, with clay .	W			
						29	10			END OF BOREHOLE AT 9.20 m				GROUNDWATER MONITORING WELL INSTALLED TO 9.2m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 3.2m TO 9.2m. CASING 3.2m TO 0.2m. 2mm SAND FILTER PACK 2.8m TO 9.2m. BENTONITE SEAL 2.4m TO 2.8m. BACKFILLED WITH CUTTINGS TO THE SURFACE. COMPLETED WITH A CONCRETED GATIC COVER.
						28	11							
						27	12							
						26	13							
						25								

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BOREHOLE LOG

Borehole No. 3

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									-	ASPHALTIC CONCRETE: 50mm.t FILL: Silty sand, fine grained, brown, trace of clay. FILL: Silty sand, fine to medium grained, brown and light brown. FILL: Silty sand, fine to coarse grained, brown and dark brown, trace of igneous gravel and brick fragments.	M			APPEARS WELL COMPACTED
					N = 21 10,11,10	40	1							
					N = 6 5,4,2	39	2							APPEARS POORLY COMPACTED
					N = 15 7,4,11	38	3							APPEARS WELL COMPACTED
						37	4			as above, but with sandstone boulders and cobbles.				BANDS OF LOW 'TC' BIT RESISTANCE
					Nc = 12	36	5							
					15		6							
					11 /100mm REFUSAL	35			-	SANDSTONE: fine to coarse grained, light grey, grey and red brown, with occasional medium strength bands.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW RESISTANCE WITH MODERATE BANDS
						34								

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BOREHOLE LOG

Borehole No. 3

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH1 **Method:** SPIRAL AUGER **R.L. Surface:** 40.6 m

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
						33	8		-	SANDSTONE: fine to coarse grained, light grey and grey, with occasional medium strength iron indurated bands.	XW - DW	Hd - VL		VERY LOW RESISTANCE WITH MODERATE BANDS
						32	9				DW	M - H		HIGH RESISTANCE
						31	10			END OF BOREHOLE AT 9.30 m				'TC' BIT REFUSAL
						30	11							
						29	12							
						28	13							
						27								

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BOREHOLE LOG

Borehole No. 4

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									FILL: Silty sand, fine to coarse grained, brown and light brown, trace of root fibres.	M			GRASS COVER APPEARS POORLY COMPACTED
					N = 7 3,4,3	1							
									as above, but light orange brown.				
					N = 2 5,1,1	2							
								-	SANDSTONE: fine to coarse grained, orange brown.	XW - DW	Hd - VL		HAWKESBURY SANDSTONE VERY LOW 'TC' BIT RESISTANCE
						3			as above, but light grey.	SW	M - H		MODERATE TO HIGH RESISTANCE
									END OF BOREHOLE AT 3.20 m				'TC' BIT REFUSAL
						4							
						5							
						6							

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BOREHOLE LOG

Borehole No. 5

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** SPIRAL AUGER **R.L. Surface:** N/A

Date: 28/1/20 **Datum:** AHD

Plant Type: JK205 **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION									FILL: Silty sand, fine to coarse grained, brown and dark brown, with sandstone cobbles and boulders, trace of root fibres.	M			GRASS COVER APPEARS MODERATELY COMPACTED
					N > 13 6,13/ 150mm REFUSAL	1							
								-	SANDSTONE: fine to coarse grained, light brown.	DW	M		HAWKESBURY SANDSTONE MODERATE TO HIGH 'TC' BIT RESISTANCE
						2							
									END OF BOREHOLE AT 2.50 m				'TC' BIT REFUSAL
						3							
						4							
						5							
						6							

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BOREHOLE LOG

Borehole No. 6

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.4 m

Date: 3/2/20 **Datum:** AHD

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■		■	■	REFER TO DCP TEST RESULTS					FILL: Silty sand, fine to coarse grained, dark brown, trace of roots and root fibres.	M			GRASS COVER
				■		51			SM	Silty SAND: fine to medium grained, orange brown, trace of clay.	M	MD		RESIDUAL
										END OF BOREHOLE AT 0.50 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK

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BOREHOLE LOG

Borehole No. 7

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH2 **Method:** HAND AUGER **R.L. Surface:** 51.8 m

Date: 3/2/20 **Datum:** AHD

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	RL (m AHD)	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■				REFER TO DCP TEST RESULTS					FILL: Silty sand, fine to coarse grained, dark brown, trace of roots and root fibres.	M			
	■			■					SM		M	D		RESIDUAL
										Silty SAND: fine to coarse grained, light orange brown.				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
										END OF BOREHOLE AT 0.40 m				
						51	1							
						50	2							
						49	3							
						48	4							
						47	5							
						46	6							
						45								

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BOREHOLE LOG

Borehole No. 8

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
ON COMPELTION OF AUGERING					REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to medium grained, brown, trace of roots and root fibres.	M			GRASS COVER APPEARS MODERATELY COMPACTED
						1			as above, but grey and light brown, trace of fine to medium grained ironstone gravel, concrete fragments and slag.				APPEARS POORLY COMPACTED
								SC	Clayey SAND: fine to coarse grained, light brown.	W	VL		RESIDUAL
						2			REFER TO CORED BOREHOLE LOG				
						3							
						4							
						5							
						6							

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CORED BOREHOLE LOG

Borehole No. 8 **2 / 2**

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Core Size:** TT56 **R.L. Surface:** N/A

Date: 3/2/20 **Inclination:** VERTICAL **Datum:**

Plant Type: MELVELLE **Bearing:** N/A **Logged/Checked By:** D.A.F./A.J.H.

Water Loss\Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION: Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ (VL -0.1, L -0.3, M -1, H -3, VH -10, EH)	DEFECT DETAILS: SPACING (mm) (600, 200, 60, 20)	DEFECT DETAILS: DESCRIPTION (Specific / General)	Formation
				START CORING AT 1.80m						
		2		NO CORE 0.32m						
				SANDSTONE: fine to coarse grained, light grey, orange brown and red brown, bedded at 0-15°.	DW	M	0.50, 0.80		(2.36m) Be, 0°, Fe Sn	Hawkesbury Sandstone
		3		as above, but light grey and grey.	FR					
				NO CORE 0.15m						
100% RETURN		4		SANDSTONE: fine to coarse grained, light grey. with grey laminae, bedded at 0-20°.	FR	M	0.60, 0.90, 1.0, 1.0, 0.80, 1.0			Hawkesbury Sandstone
		5								
		6		END OF BOREHOLE AT 5.95 m						
		7								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 9

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION OF AUGERING	■			■	REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to coarse grained, brown and dark brown, trace of fine to medium grained sandstone gravel, roots and root fibres.	M			GRASS COVER APPEARS POORLY COMPACTED
	■			■					FILL: Silty sand, fine to coarse grained, light orange brown and brown, with fine to medium grained sandstone gravel and clay.				
						1			REFER TO CORED BOREHOLE LOG				
						2							
						3							
						4							
						5							
						6							

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CORED BOREHOLE LOG

Borehole No. 9 **2 / 2**

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Core Size:** TT56 **R.L. Surface:** N/A

Date: 3/2/20 **Inclination:** VERTICAL **Datum:**

Plant Type: MELVELLE **Bearing:** N/A **Logged/Checked By:** D.A.F./A.J.H.

Water Loss\Level	Barrel Lift	Depth (m)	Graphic Log	CORE DESCRIPTION Rock Type, grain characteristics, colour, texture and fabric, features, inclusions and minor components	Weathering	Strength	POINT LOAD STRENGTH INDEX $I_s(50)$ VL 0.1 L 0.3 M 1 H 3 VH 10 EH	DEFECT DETAILS SPACING (mm) 600 200 60 20	DEFECT DETAILS DESCRIPTION Type, orientation, defect shape and roughness, defect coatings and seams, openness and thickness Specific / General	Formation
				START CORING AT 0.90m						
100% RETURN		1		SANDSTONE: fine to coarse grained, red brown and orange brown, bedded at 10-20°.	DW	H	1.2		(1.40m) Be, 10°, Fe Sn	Hawkesbury Sandstone
							1.1			
		2			SW - FR	M	0.70			
				SANDSTONE: fe to coarse grained, light grey, with occasional grey laminae, bedded at 5-15°.			0.90		(2.42m) Be, 10°, Fe Sn	
		3					0.60			
				NO CORE 0.13m						
		4		SANDSTONE: fine to coarse grained, light grey, with occasional grey laminae, bedded at 5-15°.	FR	M	0.80			Hawkesbury Sandstone
							0.80			
				END OF BOREHOLE AT 4.70 m						
		5								
		6								

FRACTURES NOT MARKED ARE CONSIDERED TO BE DRILLING AND HANDLING BREAKS

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BOREHOLE LOG

Borehole No. 10

1 / 1

Client: KINCOPPAL - ROSE BAY SCHOOL

Project: PROPOSED DEVELOPMENTS AT KINCOPPAL ROSE BAY SCHOOL

Location: CNR NEW SOUTH HEAD ROAD & VAUCLUSE ROAD, VAUCLUSE, NSW

Job No.: 32915PH3 **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 3/2/20 **Datum:**

Plant Type: **Logged/Checked By:** D.A.F./A.J.H.

Groundwater Record	SAMPLES ES	SAMPLES U50	SAMPLES DB	SAMPLES DS	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel Density	Hand Penetrometer Readings (kPa)	Remarks
DRY ON COMPLETION	■			■	REFER TO DCP TEST RESULTS				FILL: Silty sand, fine to coarse grained, dark brown, trace of fine to coarse grained sandstone gravel.	M			APPEARS POORLY COMPACTED
									END OF BOREHOLE AT 0.45 m				HAND AUGER REFUSAL ON INFERRED SANDSTONE BEDROCK
						1							
						2							
						3							
						4							
						5							
						6							

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

These notes have been provided to amplify the environmental report in regard to classification methods, field procedures and certain matters relating to the logging of soil and rock. Not all notes are necessarily relevant to all reports.

Where geotechnical borehole logs are utilised for environmental purpose, reference should also be made to the explanatory notes included in the geotechnical report. Environmental logs are not suitable for geotechnical purposes.

The ground is a product of continuing natural and man-made processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies include gathering and assimilating limited facts about these characteristics and properties in order to understand or predict the behaviour of the ground on a particular site under certain conditions. This report may contain such facts obtained by inspection, excavation, probing, sampling, testing or other means of investigation. If so, they are directly relevant only to the ground at the place where and time when the investigation was carried out.

DESCRIPTION AND CLASSIFICATION METHODS

The methods of description and classification of soils and rocks used in this report are based on Australian Standard 1726:2017 *'Geotechnical Site Investigations'*. In general, descriptions cover the following properties – soil or rock type, colour, structure, strength or density, and inclusions. Identification and classification of soil and rock involves judgement and the Company infers accuracy only to the extent that is common in current geoenvironmental practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached soil classification table qualified by the grading of other particles present (eg. sandy clay) as set out below:

Soil Classification	Particle Size
Clay	< 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2.36mm
Gravel	2.36 to 63mm
Cobbles	63 to 200mm
Boulders	> 200mm

Non-cohesive soils are classified on the basis of relative density, generally from the results of Standard Penetration Test (SPT) as below:

Relative Density	SPT 'N' Value (blows/300mm)
Very loose (VL)	< 4
Loose (L)	4 to 10
Medium dense (MD)	10 to 30
Dense (D)	30 to 50
Very Dense (VD)	> 50

Cohesive soils are classified on the basis of strength (consistency) either by use of a hand penetrometer, vane shear, laboratory testing and/or tactile engineering examination. The strength terms are defined as follows.

Classification	Unconfined Compressive Strength (kPa)	Indicative Undrained Shear Strength (kPa)
Very Soft (VS)	≤ 25	≤ 12
Soft (S)	> 25 and ≤ 50	> 12 and ≤ 25
Firm (F)	> 50 and ≤ 100	> 25 and ≤ 50
Stiff (St)	> 100 and ≤ 200	> 50 and ≤ 100
Very Stiff (VSt)	> 200 and ≤ 400	> 100 and ≤ 200
Hard (Hd)	> 400	> 200
Friable (Fr)	Strength not attainable – soil crumbles	

Rock types are classified by their geological names, together with descriptive terms regarding weathering, strength, defects, etc. Where relevant, further information regarding rock classification is given in the text of the report. In the Sydney Basin, 'shale' is used to describe fissile mudstone, with a weakness parallel to bedding. Rocks with alternating inter-laminations of different grain size (eg. siltstone/claystone and siltstone/fine grained sandstone) are referred to as 'laminite'.

INVESTIGATION METHODS

The following is a brief summary of investigation methods currently adopted by the Company and some comments on their use and application. All methods except test pits, hand auger drilling and portable Dynamic Cone Penetrometers require the use of a mechanical rig which is commonly mounted on a truck chassis or track base.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the insitu soils and 'weaker' bedrock if it is safe to descend into the pit. The depth of penetration is limited to about 3m for a backhoe and up to 6m for a large excavator. Limitations of test pits are the problems associated with disturbance and difficulty of reinstatement and the consequent effects on close-by structures. Care must be taken if construction is to be carried out near test pit locations to either properly recompact the backfill during construction or to design and construct the

structure so as not to be adversely affected by poorly compacted backfill at the test pit location.

Hand Auger Drilling: A borehole of 50mm to 100mm diameter is advanced by manually operated equipment. Refusal of the hand auger can occur on a variety of materials such as obstructions within any fill, tree roots, hard clay, gravel or ironstone, cobbles and boulders, and does not necessarily indicate rock level.

Continuous Spiral Flight Augers: The borehole is advanced using 75mm to 115mm diameter continuous spiral flight augers, which are withdrawn at intervals to allow sampling and insitu testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface by the flights or may be collected after withdrawal of the auger flights, but they can be very disturbed and layers may become mixed. Information from the auger sampling (as distinct from specific sampling by SPTs or undisturbed samples) is of limited reliability due to mixing or softening of samples by groundwater, or uncertainties as to the original depth of the samples. Augering below the groundwater table is of even lesser reliability than augering above the water table.

Rock Augering: Use can be made of a Tungsten Carbide (TC) bit for auger drilling into rock to indicate rock quality and continuity by variation in drilling resistance and from examination of recovered rock cuttings. This method of investigation is quick and relatively inexpensive but provides only an indication of the likely rock strength and predicted values may be in error by a strength order. Where rock strengths may have a significant impact on construction feasibility or costs, then further investigation by means of cored boreholes may be warranted.

Wash Boring: The borehole is usually 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 assessed from the cuttings, together with some information from "feel" and rate of penetration.

Mud Stabilised Drilling: Either Wash Boring or Continuous Core Drilling can use drilling mud as a circulating fluid to stabilise the borehole. The term 'mud' encompasses a range of products ranging from bentonite to polymers. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (eg. from SPT and U50 samples) or from rock coring, etc.

Continuous Core Drilling: A continuous core sample is obtained using a diamond tipped core barrel. Provided full core recovery is achieved (which is not always possible in very low strength rocks and granular soils), this technique provides a very reliable (but relatively expensive) method of investigation. In rocks, NMLC or HQ triple tube core barrels, which give a core of about 50mm and 61mm diameter, respectively, is usually used with water flush. The length of core recovered is compared to the length drilled and any length not recovered is shown as NO CORE. The location of NO CORE recovery is determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the bottom of the drill run.

Standard Penetration Tests: Standard Penetration Tests (SPT) are used mainly in non-cohesive soils, but can also be used in cohesive soils, as a means of indicating density or strength and also of obtaining a relatively undisturbed sample. The test procedure is described in Australian Standard 1289.6.3.1–2004 (R2016) *'Methods of Testing Soils for Engineering Purposes, Soil Strength and Consolidation Tests – Determination of the Penetration Resistance of a Soil – Standard Penetration Test (SPT)'*.

The test is carried out in a borehole by driving a 50mm diameter split sample tube with a tapered shoe, under the impact of a 63.5kg hammer with a free fall of 760mm. It is normal for the tube to be driven in three successive 150mm increments and the 'N' value is taken as the number of blows for the last 300mm. In dense sands, very hard clays or weak rock, the full 450mm penetration may not be practicable and the test is discontinued.

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

- In a case 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

  N > 30
  15, 30/40mm

The results of the test can be related empirically to the engineering properties of the soil.

A modification to the SPT is where the same driving system is used with a solid 60° tipped steel cone of the same diameter as the SPT hollow sampler. The solid cone can be continuously driven for some distance in soft clays or loose sands, or may be used where damage would otherwise occur to the SPT. The results of this Solid Cone Penetration Test (SCPT) are shown as 'N_c' on the borehole logs, together with the number of blows per 150mm penetration.

LOGS

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

The terms and symbols used in preparation of the logs are defined in the following pages.

Interpretation of the information shown on the logs, and its application to design and construction, should therefore take into account the spacing of boreholes or test pits, the method of drilling or excavation, the frequency of sampling and testing and the possibility of other than 'straight line' variations between the boreholes or test pits. Subsurface conditions between boreholes or test pits may vary significantly from conditions encountered at the borehole or test pit locations.

GROUNDWATER

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

- Although groundwater may be present, in low permeability soils it 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 weather changes and may not be the same at the time of construction.
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if reliable water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to 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 perched water tables or surface water.

FILL

The presence of fill materials can often be determined only by the inclusion of foreign objects (eg. bricks, steel, etc) or by distinctly unusual colour, texture or fabric. Identification of the extent of fill materials will also depend on investigation methods and frequency. Where natural soils similar to those at the site are used for fill, it may be difficult with limited testing and sampling to reliably assess the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density and material type is much greater than with natural soil deposits. Consequently, there is an increased risk of adverse environmental characteristics or behaviour. If the volume and nature of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes.

LABORATORY TESTING

Laboratory testing has not been undertaken to confirm the soil classification and rock strengths indicated on the environmental logs unless noted in the report.

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

Major Divisions		Group Symbol	Typical Names	Field Classification of Sand and Gravel	Laboratory Classification	
Coarse grained soil (more than 65% of soil excluding oversize fraction is greater than 0.075mm)	GRAVEL (more than half of coarse fraction is larger than 2.36mm	GW	Gravel and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 4$ $1 < C_c < 3$
		GP	Gravel and gravel-sand mixtures, little or no fines, uniform gravels	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		GM	Gravel-silt mixtures and gravel-sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	Fines behave as silt
		GC	Gravel-clay mixtures and gravel-sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	Fines behave as clay
	SAND (more than half of coarse fraction is smaller than 2.36mm)	SW	Sand and gravel-sand mixtures, little or no fines	Wide range in grain size and substantial amounts of all intermediate sizes, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	$C_u > 6$ $1 < C_c < 3$
		SP	Sand and gravel-sand mixtures, little or no fines	Predominantly one size or range of sizes with some intermediate sizes missing, not enough fines to bind coarse grains, no dry strength	≤ 5% fines	Fails to comply with above
		SM	Sand-silt mixtures	'Dirty' materials with excess of non-plastic fines, zero to medium dry strength	≥ 12% fines, fines are silty	N/A
		SC	Sand-clay mixtures	'Dirty' materials with excess of plastic fines, medium to high dry strength	≥ 12% fines, fines are clayey	

Major Divisions		Group Symbol	Typical Names	Field Classification of Silt and Clay			Laboratory Classification
				Dry Strength	Dilatancy	Toughness	% < 0.075mm
Fine grained soils (more than 35% of soil excluding oversize fraction is less than 0.075mm)	SILT and CLAY (low to medium plasticity)	ML	Inorganic silt and very fine sand, rock flour, silty or clayey fine sand or silt with low plasticity	None to low	Slow to rapid	Low	Below A line
		CL, CI	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay	Medium to high	None to slow	Medium	Above A line
		OL	Organic silt	Low to medium	Slow	Low	Below A line
	SILT and CLAY (high plasticity)	MH	Inorganic silt	Low to medium	None to slow	Low to medium	Below A line
		CH	Inorganic clay of high plasticity	High to very high	None	High	Above A line
		OH	Organic clay of medium to high plasticity, organic silt	Medium to high	None to very slow	Low to medium	Below A line
	Highly organic soil	Pt	Peat, highly organic soil	–	–	–	–

Laboratory Classification Criteria

A well graded coarse grained soil is one for which the coefficient of uniformity $Cu > 4$ and the coefficient of curvature $1 < C_c < 3$. Otherwise, the soil is poorly graded. These coefficients are given by:

$$C_U = \frac{D_{60}}{D_{10}} \qquad and \qquad C_C = \frac{(D_{30})^2}{D_{10}\, D_{60}}$$

Where D_{10}, D_{30} and D_{60} are those grain sizes for which 10%, 30% and 60% of the soil grains, respectively, are smaller.

NOTES:

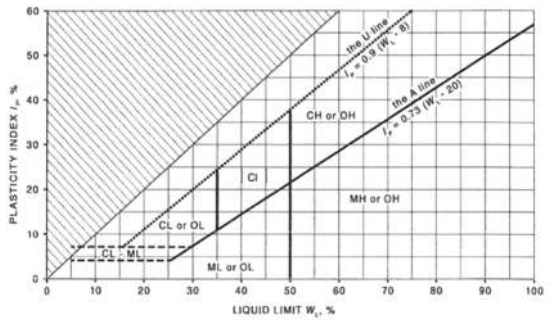
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

2 Where the grading is determined from laboratory tests, it is defined by coefficients of curvature (C_c) and uniformity (C_u) derived from the particle size distribution curve.

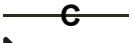
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

4 The U line on the Modified Casagrande Chart is an approximate upper bound for most natural soils.

Modified Casagrande Chart for Classifying Silts and Clays according to their Behaviour



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25 PID = 100	Vane shear reading in kPa of undrained shear strength. Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	$w > PL$ $w \approx PL$ $w < PL$ $w \approx LL$ $w > LL$	Moisture content estimated to be greater than plastic limit. Moisture content estimated to be approximately equal to plastic limit. Moisture content estimated to be less than plastic limit. Moisture content estimated to be near liquid limit. Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	D M W	DRY – runs freely through fingers. MOIST – does not run freely but no free water visible on soil surface. WET – free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS S F St VSt Hd Fr ( )	VERY SOFT – unconfined compressive strength ≤ 25kPa. SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa. FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa. STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa. VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa. HARD – unconfined compressive strength > 400kPa. FRIABLE – strength not attainable, soil crumbles. Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)	VL L MD D VD ( )	**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE ≤ 15 / 0 – 4 LOOSE > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE > 35 and ≤ 65 / 10 – 30 DENSE > 65 and ≤ 85 / 30 – 50 VERY DENSE > 85 / > 50 Bracketed symbol indicates estimated density based on ease of drilling or other assessment.
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.

Log Column	Symbol	Definition
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

Term		Abbreviation		Definition
Residual Soil		RS		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are no longer visible, but the soil has not been significantly transported.
Extremely Weathered		XW		Material is weathered to such an extent that it has soil properties. Mass structure and material texture and fabric of original rock are still visible.
Highly Weathered	Distinctly Weathered (Note 1)	HW	DW	The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable. Rock strength is significantly changed by weathering. Some primary minerals have weathered to clay minerals. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores.
Moderately Weathered		MW		The whole of the rock material is discoloured, usually by iron staining or bleaching to the extent that the colour of the original rock is not recognisable, but shows little or no change of strength from fresh rock.
Slightly Weathered		SW		Rock is partially discoloured with staining or bleaching along joints but shows little or no change of strength from fresh rock.
Fresh		FR		Rock shows no sign of decomposition of individual minerals or colour changes.

NOTE 1: The term 'Distinctly Weathered' is used where it is not practicable to distinguish between 'Highly Weathered' and 'Moderately Weathered' rock. 'Distinctly Weathered' is defined as follows: *'Rock strength usually changed by weathering. The rock may be highly discoloured, usually by iron staining. Porosity may be increased by leaching, or may be decreased due to deposition of weathering products in pores'*. There is some change in rock strength.

Rock Material Strength Classification

Term	Abbreviation	Uniaxial Compressive Strength (MPa)	Guide to Strength	
			Point Load Strength Index $Is_{(50)}$ (MPa)	Field Assessment
Very Low Strength	VL	0.6 to 2	0.03 to 0.1	Material crumbles under firm blows with sharp end of pick; can be peeled with knife; too hard to cut a triaxial sample by hand. Pieces up to 30mm thick can be broken by finger pressure.
Low Strength	L	2 to 6	0.1 to 0.3	Easily scored with a knife; indentations 1mm to 3mm show in the specimen with firm blows of the pick point; has dull sound under hammer. A piece of core 150mm long by 50mm diameter may be broken by hand. Sharp edges of core may be friable and break during handling.
Medium Strength	M	6 to 20	0.3 to 1	Scored with a knife; a piece of core 150mm long by 50mm diameter can be broken by hand with difficulty.
High Strength	H	20 to 60	1 to 3	A piece of core 150mm long by 50mm diameter cannot be broken by hand but can be broken by a pick with a single firm blow; rock rings under hammer.
Very High Strength	VH	60 to 200	3 to 10	Hand specimen breaks with pick after more than one blow; rock rings under hammer.
Extremely High Strength	EH	> 200	> 10	Specimen requires many blows with geological pick to break through intact material; rock rings under hammer.

Summary Results Tables

ABBREVIATIONS AND EXPLANATIONS

Abbreviations used in the Tables:

ABC:	Ambient Background Concentration
ACM:	Asbestos Containing Material
ADWG:	AustralianDrinking Water Guidelines
AF:	Asbestos Fines
ANZG	Australian and New Zealand Guidelines
B(a)P:	Benzo(a)pyrene
CEC:	Cation Exchange Capacity
CRC:	Cooperative Research Centre
CT:	Contaminant Threshold
EILs:	Ecological Investigation Levels
ESLs:	Ecological Screening Levels
FA:	Fibrous Asbestos
GIL:	Groundwater Investigation Levels
GSW:	General Solid Waste
HILs:	Health Investigation Levels
HSLs:	Health Screening Levels
HSL-SSA:	Health Screening Level-SiteSpecific Assessment
kg/L	kilograms per litre
NA:	Not Analysed
NC:	Not Calculated
NEPM:	National Environmental Protection Measure
NHMRC:	National Health and Medical Research Council
NL:	Not Limiting
NSL:	No Set Limit
OCP:	Organochlorine Pesticides
OPP:	Organophosphorus Pesticides
PAHs:	Polycyclic Aromatic Hydrocarbons
%w/w:	weight per weight
ppm:	Parts per million
PCBs:	Polychlorinated Biphenyls
PCE:	Perchloroethylene (Tetrachloroethylene or Teterachloroethene)
pH_{KCL} :	pH of filtered 1:20, 1M KCL extract, shaken overnight
pH_{ox} :	pH of filtered 1:20 1M KCl after peroxide digestion
PQL:	Practical Quantitation Limit
RS:	Rinsate Sample
RSL:	Regional Screening Levels
RSW:	Restricted Solid Waste
SAC:	Site Assessment Criteria
SCC:	Specific Contaminant Concentration
S_{Cr}:	Chromium reducible sulfur
S_{POS}:	Peroxide oxidisable Sulfur
SSA:	Site Specific Assessment
SSHSLs:	Site Specific Health Screening Levels
TAA:	Total Actual Acidity in 1M KCL extract titrated to pH6.5
TB:	Trip Blank
TCA:	1,1,1 Trichloroethane (methyl chloroform)
TCE:	Trichloroethylene (Trichloroethene)
TCLP:	Toxicity Characteristics Leaching Procedure
TPA:	Total Potential Acidity, 1M KCL peroxide digest
TS:	Trip Spike
TRH:	Total Recoverable Hydrocarbons
TSA:	Total Sulfide Acidity (TPA-TAA)
UCL:	Upper Level Confidence Limit on Mean Value
USEPA	United States Environmental Protection Agency
VOCC:	Volatile Organic Chlorinated Compounds
WHO:	World Health Organisation

Table Specific Explanations:

HIL Tables:

- The chromium results are for Total Chromium which includes Chromium III and VI. For initial screening purposes, we have assumed that the samples contain only Chromium VI unless demonstrated otherwise by additional analysis.
- Carcinogenic PAHs is a toxicity weighted sum of analyte concentrations for a specific list of PAH compounds relative to B(a)P. It is also refered to as the B(a)P Toxic Equivalence Quotient (TEQ).
- Statistical calculations are undertaken using ProUCL (USEPA). Statistical calculation is usually undertaken using data from fill samples.

EIL/ESL Table:

Site specific ABC values for specific metals have been adopted.

Waste Classification and TCLP Table:

- Data assessed using the NSW EPA Waste Classification Guidelines, Part 1: Classifying Waste (2014).
- The assessment of Total Moderately Harmful pesticides includes: Dichlorovos, Dimethoate, Fenitrothion, Ethion, Malathion and Parathion.
- Assessment of Total Scheduled pesticides include: HBC, alpha-BHC, gamma-BHC, beta-BHC, Heptachlor, Aldrin, Heptachlor Epoxide, gamma-Chlordane, alpha-chlordane, pp-DDE, Dieldrin, Endrin, pp-DDD, pp-DDT, Endrin Aldehyde.

QA/QC Table:

- Field blank, Inter and Intra laboratory duplicate results are reported in mg/kg.
- Trip spike results are reported as percentage recovery.
- Field rinsate results are reported in µg/L.

TABLE S1
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013.
HIL-A: 'Residential with garden/accessible soils; children's day care centers; preschools; and primary schools'

All data in mg/kg unless stated otherwise			HEAVY METALS								PAHs		ORGANOCHLORINE PESTICIDES (OCPs)							OP PESTICIDES (OPPs)	TOTAL PCBs	ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	Carcinogenic PAHs	HCB	Endosulfan	Methoxychlor	Aldrin & Dieldrin	Chlordane	DDT, DDD & DDE	Heptachlor	Chlorpyrifos		
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.5	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	100
Site Assessment Criteria (SAC)			100	20	100	6000	300	40	400	7400	300	3	10	270	300	6	50	240	6	160	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	**12**	**54**	**17**	<0.1	**8**	**39**	**11**	**1.1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH1	0.05-0.15	F: Gravelly silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.1-0.2	F: Silty sand	**9**	<0.4	**84**	**51**	**250**	**0.2**	**15**	**91**	**1.2**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH2	0.75-0.95	F: Silty sand	**12**	<0.4	**9**	**25**	**810**	**2.4**	**3**	**330**	**0.72**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	**8**	<1	**6**	<0.1	<1	**6**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH3	0.4-0.5	F: Silty sand	**34**	<0.4	**8**	**9**	**69**	**0.2**	**5**	**39**	**0.5**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	**5**	**10**	**45**	<0.1	**1**	**42**	**3.9**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH4	0.5-0.6	F: Silty sand	<4	<0.4	**7**	**3**	**16**	<0.1	**1**	**13**	**0.1**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH5	0-0.1	F: Silty sand	<4	<0.4	**6**	**14**	**49**	<0.1	**2**	**55**	**15**	**1.6**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	**17**	**2**	**19**	<0.1	**1**	**31**	<0.05	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	**6**	<0.4	**8**	**23**	**81**	<0.1	**3**	**61**	**5.4**	**1**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH6 (Lab Replicate)	0-0.1	F: Silty sand	**7**	<0.4	**12**	**21**	**83**	**0.1**	**3**	**59**	**3.5**	**0.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0-0.1	F: Silty sand	**6**	<0.4	**6**	**20**	**86**	<0.1	**3**	**53**	**9.6**	**1.7**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	**3**	**6**	**32**	<0.1	<1	**15**	**0.6**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	0-0.1	F: Silty sand	**9**	**0.4**	**11**	**36**	**160**	**0.1**	**4**	**130**	**1.3**	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH8	0.6-0.7	F: Silty sand	**6**	<0.4	**10**	**80**	**160**	**0.1**	**7**	**190**	**40**	**6.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH8	1.6-1.8	Clayey Sand	**5**	<0.4	**15**	**10**	**29**	<0.1	**1**	**20**	**1.3**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH9	0-0.1	F: Silty sand	**33**	**0.4**	**13**	**43**	**190**	**0.1**	**4**	**150**	**6.1**	**0.9**	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	Not Detected
BH10	0-0.1	F: Silty sand	**24**	<0.4	**9**	**34**	**200**	**0.1**	**4**	**160**	<0.05	<0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	NA
SDUP2	-	Field Duplicate	**6**	<0.4	**62**	**51**	**170**	**0.1**	**12**	**130**	**0.73**	<0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
SDUP6	-	Field Duplicate	**32**	<0.4	**10**	**43**	**160**	**0.1**	**3**	**140**	**5.7**	**0.9**	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Total Number of Samples			20	20	20	20	20	20	20	20	20	20	10	10	10	10	10	10	10	10	10	6
Maximum Value			34	0.4	84	80	810	2.4	15	330	40	6.9	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	Not Detected

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S2
SOIL LABORATORY RESULTS COMPARED TO HSLs
All data in mg/kg unless stated otherwise

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	Field PID Measurement
PQL - Envirolab Services					25	50	0.2	0.5	1	1	1	ppm
NEPM 2013 HSL Land Use Category					**HSL-A/B:LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**								
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.4
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.6
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.9
BH2	0.2-0.5	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	1.1
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.5
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	2.2
BH4	0.1-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	3.4
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	7.7
BH5	0-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA	-
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH6 (Lab Replicate)	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	<25	**51**	<0.2	<0.5	<1	<3	<1	1.1
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	6.2
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.9
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0.1
SDUP2	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	NA
SDUP6	-	Field Duplicate	0m to <1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples					20	20	20	20	20	20	20	18
Maximum Value					<PQL	51	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the concentration above the SAC is highlighted in grey in the Site Assessment Criteria Table below

HSL SOIL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH1	0.05-0.15	F: Gravelly silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.75-0.95	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	4.8-4.95	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH2	0.2-0.5	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH3	0.4-0.5	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.5-0.6	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH4	0.1-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	1.7-1.8	Sanstone	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH5	0-0.3	F: Silty sand	0m to <1m	Sand	NA	NA	NA	NA	NA	NA	NA
BH6	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH6 (Lab Replicate)	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH7	0.2-0.3	Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	0.6-0.7	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH8	1.6-1.8	Clayey Sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH9	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
BH10	0-0.1	F: Silty sand	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP2	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3
SDUP6	-	Field Duplicate	0m to <1m	Sand	45	110	0.5	160	55	40	3

TABLE S3
SOIL LABORATORY RESULTS COMPARED TO MANAGEMENT LIMITS
All data in mg/kg unless stated otherwise

			C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
PQL - Envirolab Services			25	50	100	100
NEPM 2013 Land Use Category			**RESIDENTIAL, PARKLAND & PUBLIC OPEN SPACE**			
Sample Reference	**Sample Depth**	**Soil Texture**				
BH1	0.05-0.15	Coarse	<25	<50	**350**	**360**
BH1	0.05-0.15	Coarse	NA	NA	NA	NA
BH2	0.1-0.2	Coarse	<25	<50	**190**	**350**
BH2	0.75-0.95	Coarse	<25	<50	<100	<100
BH2	4.8-4.95	Coarse	<25	<50	<100	<100
BH2	0.2-0.5	Coarse	NA	NA	NA	NA
BH3	0.4-0.5	Coarse	<25	<50	<100	<100
BH4	0-0.1	Coarse	<25	<50	<100	<100
BH4	0.5-0.6	Coarse	<25	<50	<100	<100
BH4	0.1-0.3	Coarse	NA	NA	NA	NA
BH5	0-0.1	Coarse	<25	<50	**160**	<100
BH5	1.7-1.8	Coarse	<25	<50	<100	<100
BH5	0-0.3	Coarse	NA	NA	NA	NA
BH6	0-0.1	Coarse	<25	<50	<100	<100
BH6 (Lab Replicate)	0-0.1	Coarse	<25	<50	**100**	<100
BH7	0-0.1	Coarse	<25	**51**	**110**	<100
BH7	0.2-0.3	Coarse	<25	<50	<100	<100
BH8	0-0.1	Coarse	<25	<50	<100	<100
BH8	0.6-0.7	Coarse	<25	<50	**340**	**100**
BH8	1.6-1.8	Coarse	<25	<50	<100	<100
BH9	0-0.1	Coarse	<25	<50	<100	<100
BH10	0-0.1	Coarse	<25	<50	<100	<100
SDUP2	-	Coarse	<25	<50	**230**	**400**
SDUP6	-	Coarse	<25	<50	<100	<100
Total Number of Samples			20	20	20	20
Maximum Value			<PQL	51	340	400

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

MANAGEMENT LIMIT ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Soil Texture**	C_6-C_{10} (F1) plus BTEX	>C_{10}-C_{16} (F2) plus napthalene	>C_{16}-C_{34} (F3)	>C_{34}-C_{40} (F4)
BH1	0.05-0.15	Coarse	700	1000	2500	10000
BH1	0.05-0.15	Coarse	--	--	--	--
BH2	0.1-0.2	Coarse	700	1000	2500	10000
BH2	0.75-0.95	Coarse	700	1000	2500	10000
BH2	4.8-4.95	Coarse	700	1000	2500	10000
BH2	0.2-0.5	Coarse	--	--	--	--
BH3	0.4-0.5	Coarse	700	1000	2500	10000
BH4	0-0.1	Coarse	700	1000	2500	10000
BH4	0.5-0.6	Coarse	700	1000	2500	10000
BH4	0.1-0.3	Coarse	--	--	--	--
BH5	0-0.1	Coarse	700	1000	2500	10000
BH5	1.7-1.8	Coarse	700	1000	2500	10000
BH5	0-0.3	Coarse	--	--	--	--
BH6	0-0.1	Coarse	700	1000	2500	10000
BH6 (Lab Replicate)	0-0.1	Coarse	700	1000	2500	10000
BH7	0-0.1	Coarse	700	1000	2500	10000
BH7	0.2-0.3	Coarse	700	1000	2500	10000
BH8	0-0.1	Coarse	700	1000	2500	10000
BH8	0.6-0.7	Coarse	700	1000	2500	10000
BH8	1.6-1.8	Coarse	700	1000	2500	10000
BH9	0-0.1	Coarse	700	1000	2500	10000
BH10	0-0.1	Coarse	700	1000	2500	10000
SDUP2	-	Coarse	700	1000	2500	10000
SDUP6	-	Coarse	700	1000	2500	10000

TABLE S4
SOIL LABORATORY RESULTS COMPARED T0 DIRECT CONTACT CRITERIA
All data in mg/kg unless stated otherwise

Analyte		C_6-C_{10}	>C_{10}-C_{16}	>C_{16}-C_{34}	>C_{34}-C_{40}	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services		25	50	100	100	0.2	0.5	1	1	1	
CRC 2011 -Direct contact Criteria		4,400	3,300	4,500	6,300	100	14,000	4,500	12,000	1,400	
Site Use		RESIDENTIAL WITH ACCESSIBLE SOIL- DIRECT SOIL CONTACT									
Sample Reference	**Sample Depth**										
BH1	0.05-0.15	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	<1	**0.4**
BH1	0.05-0.15	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH2	0.1-0.2	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	<1	**0.3**
BH2	0.75-0.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.6**
BH2	4.8-4.95	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.9**
BH2	0.2-0.5	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH3	0.4-0.5	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH4	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.5**
BH4	0.5-0.6	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**2.2**
BH4	0.1-0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH5	0-0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	<1	**3.4**
BH5	1.7-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**7.7**
BH5	0-0.3	NA	NA	NA	NA	NA	NA	NA	NA	NA	-
BH6	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH6 (Lab Replicate)	0-0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	<1	0
BH7	0-0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	<1	**1.1**
BH7	0.2-0.3	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**6.2**
BH8	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.9**
BH8	0.6-0.7	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	<1	0
BH8	1.6-1.8	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	0
BH10	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	**0.1**
SDUP2	-	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<1	NA
SDUP6	-	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<1	NA
Total Number of Samples		20	20	20	20	20	20	20	20	20	18
Maximum Value		<PQL	51	350	400	<PQL	<PQL	<PQL	<PQL	<PQL	7.7

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**

TABLE S5
ASBESTOS QUANTIFICATION - FIELD OBSERVATIONS AND LABORATORY RESULTS
HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

HSL-A: Residential with garden/accessible soils; children's day care centers; preschools; and primary schools

FIELD DATA															LABORATORY DATA										
Date Sampled	Sample reference	Sample Depth	Visible ACM in top 100mm	Approx. Volume of Soil (L)	Soil Mass (g)	Mass ACM (g)	Mass Asbestos in ACM (g)	[Asbestos from ACM in soil] (%w/w)	Mass ACM <7mm (g)	Mass Asbestos in ACM <7mm (g)	[Asbestos from ACM <7mm in soil] (%w/w)	Mass FA (g)	Mass Asbestos in FA (g)	[Asbestos from FA in soil] (%w/w)	Lab Report Number	Sample refeference	Sample Depth	Sample Mass (g)	Asbestos ID in soil (AS4964) >0.1g/kg	Trace Analysis	Total Asbestos (g/kg)	Asbestos ID in soil <0.1g/kg	ACM >7mm Estimation (g)	FA and AF Estimation (g)	ACM >7mm Estimation %(w/w)	FA and AF Estimation %(w/w)
SAC			**No**					**0.01**			**0.001**			**0.001**											**0.01**	**0.001**
28/01/2020	BH1	0.05-0.15	No	-	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH1	0.05-0.15	961.42	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH2	0.2-0.5	No	-	11,400	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH2	0.2-0.5	766.54	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH4	0.1-0.3	No	-	9,700	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH4	0.1-0.3	988.25	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
28/01/2020	BH5	0-0.3	No	-	7,650	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	235671	BH5	0-0.3	773.5	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH8	0-0.1	No	-	10,100	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH8	0-0.1	597.78	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH9	0-0.1	No	-	9,200	No ACM observed	--	--	No ACM <7mm observed	--	--	No FA observed	--	--	236009	BH9	0-0.1	631.41	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected: Synthetic mineral fibres detected	No asbestos detected	<0.1	No visible asbestos detected	–	–	<0.01	<0.001
3/02/2020	BH7	0-0.1	NA	-											236009	BH7	0-0.1	15	No asbestos detected at reporting limit of 0.1g/kg: Organic fibres detected	No asbestos detected	–	–	–	–	–	–

Concentration above the SAC **VALUE**

JKEnvironments

TABLE S6
SOIL LABORATORY RESULTS COMPARED TO NEPM 2013 EILs AND ESLs
All data in mg/kg unless stated otherwise

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																	
							AGED HEAVY METALS-EILs						EILs		ESLs							
				pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
PQL - Envirolab Services				-	1	-	4	1	1	1	1	1	1	0.1	25	50	100	100	0.2	0.5	1	1	0.05
Ambient Background Concentration (ABC)				-	-	-	NSL	13	28	163	5	122	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL	NSL
Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**																				
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	<4	**12**	**54**	**17**	**8**	**39**	<1	<0.1	<25	<50	**350**	**360**	<0.2	<0.5	<1	<3	**0.8**
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	**9**	**84**	**51**	**250**	**15**	**91**	<1	<0.1	<25	<50	**190**	**350**	<0.2	<0.5	<1	<3	**0.2**
BH2	0.75-0.95	F: Silty sand	Coarse	**10.2**	**45**	**9**	**12**	**9**	**25**	**810**	**3**	**330**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	<4	**8**	<1	**6**	<1	**6**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH2	0.2-0.5	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	**34**	**8**	**9**	**69**	**5**	**39**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**5**	**10**	**45**	**1**	**42**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.4**
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	<4	**7**	**3**	**16**	**1**	**13**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH4	0.1-0.3	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	<4	**6**	**14**	**49**	**2**	**55**	<1	<0.1	<25	<50	**160**	<100	<0.2	<0.5	<1	<3	**1.2**
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	<4	**17**	**2**	**19**	**1**	**31**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
BH5	0-0.3	F: Silty sand	Coarse	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**8**	**23**	**81**	**3**	**61**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.66**
BH6 (Lab Replicate)	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**7**	**12**	**21**	**83**	**3**	**59**	<1	<0.1	<25	<50	**100**	<100	<0.2	<0.5	<1	<3	**0.4**
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**6**	**6**	**20**	**86**	**3**	**53**	<1	<0.1	<25	**51**	**110**	<100	<0.2	<0.5	<1	<3	**1.2**
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	<4	**3**	**6**	**32**	<1	**15**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.1**
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**9**	**11**	**36**	**160**	**4**	**130**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	**6**	**10**	**80**	**160**	**7**	**190**	<1	NA	<25	<50	**340**	**100**	<0.2	<0.5	<1	<3	**4.7**
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	**5**	**15**	**10**	**29**	**1**	**20**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.2**
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**33**	**13**	**43**	**190**	**4**	**150**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.63**
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	**24**	**9**	**34**	**200**	**4**	**160**	<1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<3	<0.05
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	**6**	**62**	**51**	**170**	**12**	**130**	<1	NA	<25	<50	**230**	**400**	<0.2	<0.5	<1	<3	<0.05
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	**32**	**10**	**43**	**160**	**3**	**140**	<1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<3	**0.62**
Total Number of Samples				1	1	1	20	20	20	20	20	20	20	10	20	20	20	20	20	20	20	20	20
Maximum Value				10.2	45	9	34	84	80	810	15	330	<PQL	<PQL	<PQL	51	350	400	<PQL	<PQL	<PQL	<PQL	4.7

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the EIL and ESL Assessment Criteria Table below

EIL AND ESL ASSESSMENT CRITERIA

Sample Reference	**Sample Depth**	**Sample Description**	**Soil Texture**	pH	CEC (cmolc/kg)	Clay Content (% clay)	Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	$>C_{10}$-C_{16} (F2) plus napthalene	$>C_{16}$-C_{34} (F3)	$>C_{34}$-C_{40} (F4)	Benzene	Toluene	Ethylbenzene	Total Xylenes	B(a)P
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH1	0.05-0.15	F: Gravelly silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH2	0.1-0.2	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH2	0.75-0.95	F: Silty sand	Coarse	10.2	45	9	100	410	260	1300	560	1400	170	--	180	120	300	2800	50	85	70	105	20
BH2	4.8-4.95	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH2	0.2-0.5	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH3	0.4-0.5	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH4	0.5-0.6	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH4	0.1-0.3	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH5	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH5	1.7-1.8	Sanstone	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH5	0-0.3	F: Silty sand	Coarse	NA	NA	NA	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
BH6	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH6 (Lab Replicate)	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH7	0.2-0.3	Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH8	0.6-0.7	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH8	1.6-1.8	Clayey Sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
BH9	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
BH10	0-0.1	F: Silty sand	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	180	180	120	300	2800	50	85	70	105	20
SDUP2	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20
SDUP6	-	Field Duplicate	Coarse	NA	NA	NA	100	200	90	1300	35	190	170	--	180	120	300	2800	50	85	70	105	20

TABLE S7
SOIL LABORATORY RESULTS COMPARED TO WASTE CLASSIFICATION GUIDELINES
All data in mg/kg unless stated otherwise

			HEAVY METALS								PAHs		OC/OP PESTICIDES				Total PCBs	TRH					BTEX COMPOUNDS				ASBESTOS FIBRES
			Arsenic	Cadmium	Chromium	Copper	Lead	Mercury	Nickel	Zinc	Total PAHs	B(a)P	Total Endosulfans	Chloropyrifos	Total Moderately Harmful	Total Scheduled		C_6-C_9	C_{10}-C_{14}	C_{15}-C_{28}	C_{29}-C_{36}	Total C_{10}-C_{36}	Benzene	Toluene	Ethyl benzene	Total Xylenes	
PQL - Envirolab Services			4	0.4	1	1	1	0.1	1	1	-	0.05	0.1	0.1	0.1	0.1	0.1	25	50	100	100	50	0.2	0.5	1	1	100
General Solid Waste CT1			100	20	100	NSL	100	4	40	NSL	200	0.8	60	4	250	50	50	650		NSL		10,000	10	288	600	1,000	-
General Solid Waste SCC1			500	100	1900	NSL	1500	50	1050	NSL	200	10	108	7.5	250	50	50	650		NSL		10,000	18	518	1,080	1,800	-
Restricted Solid Waste CT2			400	80	400	NSL	400	16	160	NSL	800	3.2	240	16	1000	50	50	2600		NSL		40,000	40	1,152	2,400	4,000	-
Restricted Solid Waste SCC2			2000	400	7600	NSL	6000	200	4200	NSL	800	23	432	30	1000	50	50	2600		NSL		40,000	72	2,073	4,320	7,200	-
Sample Reference	**Sample Depth**	**Sample Description**																									
BH1	0.05-0.15	F: Gravelly silty sand	<4	<0.4	**12**	**54**	**17**	<0.1	**8**	**39**	**11**	**0.8**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	**170**	**280**	**450**	<0.2	<0.5	<1	<3	NA
BH1	0.05-0.15	F: Gravelly silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH2	0.1-0.2	F: Silty sand	**9**	<0.4	**84**	**51**	**250**	**0.2**	**15**	**91**	**1.2**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	**200**	**200**	<0.2	<0.5	<1	<3	NA
BH2	0.75-0.95	F: Silty sand	**12**	<0.4	**9**	**25**	**810**	**2.4**	**3**	**330**	**0.72**	**0.1**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	4.8-4.95	Silty sand	<4	<0.4	**8**	<1	**6**	<0.1	<1	**6**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH2	0.2-0.5	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH3	0.4-0.5	F: Silty sand	**34**	<0.4	**8**	**9**	**69**	**0.2**	**5**	**39**	**0.5**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0-0.1	F: Silty sand	<4	<0.4	**5**	**10**	**45**	<0.1	**1**	**42**	**3.9**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0.5-0.6	F: Silty sand	<4	<0.4	**7**	**3**	**16**	<0.1	**1**	**13**	**0.1**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH4	0.1-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH5	0-0.1	F: Silty sand	<4	<0.4	**6**	**14**	**49**	<0.1	**2**	**55**	**15**	**1.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	1.7-1.8	Sanstone	<4	<0.4	**17**	**2**	**19**	<0.1	**1**	**31**	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH5	0-0.3	F: Silty sand	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Not Detected
BH6	0-0.1	F: Silty sand	**6**	<0.4	**8**	**23**	**81**	<0.1	**3**	**61**	**5.4**	**0.66**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH6 (Lab Replicate)	0-0.1	F: Silty sand	**7**	<0.4	**12**	**21**	**83**	**0.1**	**3**	**59**	**3.5**	**0.4**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH7	0-0.1	F: Silty sand	**6**	<0.4	**6**	**20**	**86**	<0.1	**3**	**53**	**9.6**	**1.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	**52**	<100	<100	**52**	<0.2	<0.5	<1	<3	NA
BH7	0.2-0.3	Silty sand	<4	<0.4	**3**	**6**	**32**	<0.1	<1	**15**	**0.6**	**0.1**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH8	0-0.1	F: Silty sand	**9**	**0.4**	**11**	**36**	**160**	**0.1**	**4**	**130**	**1.3**	**0.2**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH8	0.6-0.7	F: Silty sand	**6**	<0.4	**10**	**80**	**160**	**0.1**	**7**	**190**	**40**	**4.7**	NA	NA	NA	NA	NA	<25	<50	**190**	**190**	**380**	<0.2	<0.5	<1	<3	NA
BH8	1.6-1.8	Clayey Sand	**5**	<0.4	**15**	**10**	**29**	<0.1	**1**	**20**	**1.3**	**0.2**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
BH9	0-0.1	F: Silty sand	**33**	**0.4**	**13**	**43**	**190**	**0.1**	**4**	**150**	**6.1**	**0.63**	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	Not Detected
BH10	0-0.1	F: Silty sand	**24**	<0.4	**9**	**34**	**200**	**0.1**	**4**	**160**	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
SDUP2	-	Field Duplicate	**6**	<0.4	**62**	**51**	**170**	**0.1**	**12**	**130**	**0.73**	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	**220**	**220**	<0.2	<0.5	<1	<3	NA
SDUP6	-	Field Duplicate	**32**	<0.4	**10**	**43**	**160**	**0.1**	**3**	**140**	**5.7**	**0.62**	NA	NA	NA	NA	NA	<25	<50	<100	<100	<50	<0.2	<0.5	<1	<3	NA
Total Number of Samples			20	20	20	20	20	20	20	20	20	20	10	10	10	10	10	20	20	20	20	20	20	20	20	20	6
Maximum Value			34	0.4	84	80	810	2.4	15	330	40	4.7	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	52	190	280	450	<PQL	<PQL	<PQL	<PQL	Not Detected
Statistical Analysis on Fill Samples																											
Number of Fill Samples			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Mean Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
Standard Deviation			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
% UCL			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC
UCL Value			NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC	NC

Concentration above the CT1 — **VALUE**
Concentration above SCC1 — **VALUE**
Concentration above the SCC2 — **VALUE**
Concentration above PQL — **Bold**

TABLE S8

SOIL LABORATORY TCLP RESULTS

All data in mg/L unless stated otherwise

			Lead	B(a)P
PQL - Envirolab Services			0.03	0.001
TCLP1 - General Solid Waste			5	0.04
TCLP2 - Restricted Solid Waste			20	0.16
TCLP3 - Hazardous Waste			>20	>0.16
Sample Reference	**Sample Depth**	**Sample Description**		
BH2	0.1-0.2	F: Silty sand	**0.3**	NA
BH2	0.75-0.95	F: Silty sand	**1.2**	NA
BH5	0-0.1	F: Silty sand	NA	<0.001
BH7	0-0.1	F: Silty sand	NA	<0.001
BH8	0-0.1	F: Silty sand	<0.03	NA
BH8	0.6-0.7	F: Silty sand	**0.07**	<0.001
BH9	0-0.1	F: Silty sand	**0.06**	NA
BH10	0-0.1	F: Silty sand	**0.1**	NA
Total Number of samples			6	3
Maximum Value			1.20	<PQL

General Solid Waste	**VALUE**
Restricted Solid Waste	**VALUE**
Hazardous Waste	**VALUE**
Concentration above PQL	**Bold**

TABLE S9
SOIL QA/QC SUMMARY

			TRH C6 - C10	TRH >C10-C16	TRH >C16-C34	TRH >C34-C40	Benzene	Toluene	Ethylbenzene	m+p-xylene	o-Xylene
	PQL Envirolab SYD		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1*	*2*	*1*
	PQL Envirolab VIC		*25*	*50*	*100*	*100*	*0.2*	*0.5*	*1.0*	*2.0*	*1.0*
Intra laboratory duplicate	BH2	0.1-0.2	<25	<50	190	350	<0.2	<0.5	<1	<2	<1
	SDUP2		<25	<50	230	400	<0.2	<0.5	<1	<2	<1
	MEAN		nc	nc	210	375	nc	nc	nc	nc	nc
	RPD %		nc	nc	19%	13%	nc	nc	nc	nc	nc
Intra laboratory duplicate	BH9	0-0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1
	SDUP6		<25	<50	<100	<100	<0.2	<0.5	<1	<2	<1
	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc
Field Blank	STB1 3/02/20		NA	NA	NA	NA	<0.2	<0.5	<1	<2	<1
Trip Spike	STS1 3/02/20		-	-	-	-	103%	102%	108%	101%	113%
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	<1	<1	<1	<2	<1

			Naphthalene	Acenaphthylene	Acenaph-thene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benzo(a)anthracene	Chrysene	Benzo(b,j+k)fluoranthene	Benzo(a)pyrene	Indeno(1,2,3-c,d)pyrene	Dibenzo(a,h)anthra-cene	Benzo(g,h,i)perylene
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.05*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.2*	*0.1*	*0.1*	*0.1*	*0.1*
Intra laboratory duplicate	BH2	0.1-0.2	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.3	<0.1	<0.1	0.2	0.2	<0.1	<0.1	0.1
	SDUP2		<0.1	<0.1	<0.1	<0.1	0.1	<0.1	0.2	0.2	0.1	0.2	<0.2	<0.05	<0.1	<0.1	<0.1
	MEAN		nc	nc	nc	nc	0.1	nc	0.2	0.25	0.075	0.125	0.15	0.1125	nc	nc	0.075
	RPD %		nc	nc	nc	nc	0%	nc	0%	40%	67%	120%	67%	156%	nc	nc	67%
Intra laboratory duplicate	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	0.4	<0.1	1	1	0.6	0.7	1	0.63	0.4	0.1	0.4
	SDUP6		<0.1	<0.1	<0.1	<0.1	0.2	<0.1	0.8	0.9	0.6	0.7	1	0.62	0.3	0.1	0.4
	MEAN		nc	nc	nc	nc	0.3	nc	0.9	0.95	0.6	0.7	1	0.625	0.35	0.1	0.4
	RPD %		nc	nc	nc	nc	67%	nc	22%	11%	0%	0%	0%	2%	29%	0%	0%
Field Blank	STB1 3/02/20		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			HCB	alpha- BHC	gamma- BHC	beta- BHC	Heptachlor	delta- BHC	Aldrin	Heptachlor Epoxide	Gamma- Chlordane	alpha- chlordane	Endosulfan I	pp- DDE	Dieldrin	Endrin	pp- DDD	Endosulfan II	pp- DDT	Endrin Aldehyde	Endosulfan Sulphate	Methoxychlor
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*
Intra laboratory duplicate	BH2	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
	SDUP2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Intra laboratory duplicate	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
	SDUP6		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc
Field Blank	STB1 3/02/20		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

			Azinphos-methyl (Guthion)	Bromophos-ethyl	Chlorpyriphos	Chlorpyriphos-methyl	Diazinon	Dichlorvos	Dimethoate	Ethion	Fenitrothion	Malathion	Parathion	Ronnel	Total PCBS	Arsenic	Cadmium	Chromium VI	Copper	Lead	Mercury	Nickel	Zinc
	PQL Envirolab SYD		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4*	*0.4*	*1*	*1*	*1*	*0.1*	*1*	*1*
	PQL Envirolab VIC		*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*0.1*	*4.0*	*0.4*	*1.0*	*1.0*	*1.0*	*0.1*	*1.0*	*1.0*
Intra laboratory duplicate	BH2	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	9	<0.4	84	51	250	0.2	15	91
	SDUP2		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	6	<0.4	62	51	170	0.1	12	130
	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	7.5	nc	73	51	210	0.15	13.5	110.5
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	40%	nc	30%	0%	38%	67%	22%	35%
Intra laboratory duplicate	BH9	0-0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	33	0.4	13	43	190	0.1	4	150
	SDUP6		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	32	<0.4	10	43	160	0.1	3	140
	MEAN		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	32.5	0.3	11.5	43	175	0.1	3.5	145
	RPD %		nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	nc	3%	67%	26%	0%	17%	0%	29%	7%
Field Blank	STB1 3/02/20		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Trip Spike	STS1 3/02/20		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Field Rinsate	SFR1 3/02/20	µg/L	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

Result outside of QA/QC acceptance criteria

TABLE G1
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO ECOLOGICAL GILs SAC
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZG 2018 Marine Waters	SAMPLES MW2	MW2 (Lab Replicate)	WDUP1
Inorganic Compounds and Parameters					
pH		7 - 8.5	6.1	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA
Metals and Metalloids					
Arsenic (As III)	1	2.3	<1	<1	<1
Cadmium	0.1	0.7	<0.1	<0.1	<0.1
Chromium (SAC for Cr III adopted)	1	27	**6**	**6**	**6**
Copper	1	1.3	<1	<1	**1**
Lead	1	4.4	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	0.1	<0.05	<0.05	<0.05
Nickel	1	7	**3**	**3**	**3**
Zinc	1	15	**19**	**20**	**21**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	500	<1	<1	<1
Toluene	1	180	<1	<1	<1
Ethylbenzene	1	5	<1	<1	<1
m+p-xylene	2	75	<2	<2	<2
o-xylene	1	350	<1	<1	<1
Total xylenes	2	NSL	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	NA
Chloromethane	10	NSL	<10	<10	NA
Vinyl Chloride	10	100	<10	<10	NA
Bromomethane	10	NSL	<10	<10	NA
Chloroethane	10	NSL	<10	<10	NA
Trichlorofluoromethane	10	NSL	<10	<10	NA
1,1-Dichloroethene	1	700	<1	<1	NA
Trans-1,2-dichloroethene	1	NSL	<1	<1	NA
1,1-dichloroethane	1	250	<1	<1	NA
Cis-1,2-dichloroethene	1	NSL	<1	<1	NA
Bromochloromethane	1	NSL	<1	<1	NA
Chloroform	1	370	<1	<1	NA
2,2-dichloropropane	1	NSL	<1	<1	NA
1,2-dichloroethane	1	1900	<1	<1	NA
1,1,1-trichloroethane	1	270	<1	<1	NA
1,1-dichloropropene	1	NSL	<1	<1	NA
Cyclohexane	1	NSL	<1	<1	NA
Carbon tetrachloride	1	240	<1	<1	NA
Benzene	1	500	<1	<1	NA
Dibromomethane	1	NSL	<1	<1	NA
1,2-dichloropropane	1	900	<1	<1	NA
Trichloroethene	1	330	<1	<1	NA
Bromodichloromethane	1	NSL	<1	<1	NA
trans-1,3-dichloropropene	1	NSL	<1	<1	NA
cis-1,3-dichloropropene	1	NSL	<1	<1	NA
1,1,2-trichloroethane	1	1900	<1	<1	NA
Toluene	1	180	<1	<1	NA
1,3-dichloropropane	1	1100	<1	<1	NA
Dibromochloromethane	1	NSL	<1	<1	NA
1,2-dibromoethane	1	NSL	<1	<1	NA
Tetrachloroethene	1	70	<1	<1	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	NA
Chlorobenzene	1	55	<1	<1	NA
Ethylbenzene	1	5	<1	<1	NA
Bromoform	1	NSL	<1	<1	NA
m+p-xylene	2	75	<2	<2	NA
Styrene	1	NSL	<1	<1	NA
1,1,2,2-tetrachloroethane	1	400	<1	<1	NA
o-xylene	1	350	<1	<1	NA
1,2,3-trichloropropane	1	NSL	<1	<1	NA
Isopropylbenzene	1	30	<1	<1	NA
Bromobenzene	1	NSL	<1	<1	NA
n-propyl benzene	1	NSL	<1	<1	NA
2-chlorotoluene	1	NSL	<1	<1	NA
4-chlorotoluene	1	NSL	<1	<1	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	NA
Tert-butyl benzene	1	NSL	<1	<1	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	NA
1,3-dichlorobenzene	1	260	<1	<1	NA
Sec-butyl benzene	1	NSL	<1	<1	NA
1,4-dichlorobenzene	1	60	<1	<1	NA
4-isopropyl toluene	1	NSL	<1	<1	NA
1,2-dichlorobenzene	1	160	<1	<1	NA
n-butyl benzene	1	NSL	<1	<1	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	NA
1,2,4-trichlorobenzene	1	20	<1	<1	NA
Hexachlorobutadiene	1	NSL	<1	<1	NA
1,2,3-trichlorobenzene	1	3	<1	<1	NA
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	50	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	**0.3**
Acenaphthene	0.1	NSL	<0.1	<0.1	**0.2**
Fluorene	0.1	NSL	<0.1	<0.1	**0.3**
Phenanthrene	0.1	0.6	**0.8**	**0.8**	**2.9**
Anthracene	0.1	0.01	**0.2**	**0.3**	**0.8**
Fluoranthene	0.1	1	**0.9**	**0.9**	**3.3**
Pyrene	0.1	NSL	**0.9**	**0.9**	**3.4**
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	**1.9**
Chrysene	0.1	NSL	**0.5**	**0.5**	**1.6**
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	**2**
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	**1.6**
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	**0.6**
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	**0.2**
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	**0.6**

Concentration above the SAC	**VALUE**
Concentration above the PQL	**Bold**
GIL >PQL	Red

TABLE G2
SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO HUMAN CONTACT GILs
All results in µg/L unless stated otherwise.

	PQL Envirolab Services	Recreational (10 x NHMRC ADWG)	SAMPLES MW2	MW2 (Lab Replicate)	WDUP1
Inorganic Compounds and Parameters					
pH		6.5 - 8.5	6.1	NA	NA
Electrical Conductivity (µS/cm)	1	NSL	**450**	NA	NA
Turbidity (NTU)		NSL	NA	NA	NA
Metals and Metalloids					
Arsenic (As III)	1	100	<1	<1	<1
Cadmium	0.1	20	<0.1	<0.1	<0.1
Chromium (total)	1	500	**6**	**6**	**6**
Copper	1	20000	<1	<1	**1**
Lead	1	100	**1**	**1**	**1**
Total Mercury (inorganic)	0.05	10	<0.05	<0.05	<0.05
Nickel	1	200	**3**	**3**	**3**
Zinc	1	30000	**19**	**20**	**21**
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)					
Benzene	1	10	<1	<1	<1
Toluene	1	8000	<1	<1	<1
Ethylbenzene	1	3000	<1	<1	<1
m+p-xylene	2	NSL	<2	<2	<2
o-xylene	1	NSL	<1	<1	<1
Total xylenes	2	6000	<2	<2	<2
Volatile Organic Compounds (VOCs), including chlorinated VOCs					
Dichlorodifluoromethane	10	NSL	<10	<10	NA
Chloromethane	10	NSL	<10	<10	NA
Vinyl Chloride	10	3	<10	<10	NA
Bromomethane	10	NSL	<10	<10	NA
Chloroethane	10	NSL	<10	<10	NA
Trichlorofluoromethane	10	NSL	<10	<10	NA
1,1-Dichloroethene	1	300	<1	<1	NA
Trans-1,2-dichloroethene	1	600	<1	<1	NA
1,1-dichloroethane	1	NSL	<1	<1	NA
Cis-1,2-dichloroethene	1	600	<1	<1	NA
Bromochloromethane	1	2500	<1	<1	NA
Chloroform	1		<1	<1	NA
2,2-dichloropropane	1	NSL	<1	<1	NA
1,2-dichloroethane	1	30	<1	<1	NA
1,1,1-trichloroethane	1	NSL	<1	<1	NA
1,1-dichloropropene	1	NSL	<1	<1	NA
Cyclohexane	1	NSL	<1	<1	NA
Carbon tetrachloride	1	30	<1	<1	NA
Benzene	1	10	<1	<1	NA
Dibromomethane	1	NSL	<1	<1	NA
1,2-dichloropropane	1	NSL	<1	<1	NA
Trichloroethene	1	NSL	<1	<1	NA
Bromodichloromethane	1	NSL	<1	<1	NA
trans-1,3-dichloropropene	1	1000	<1	<1	NA
cis-1,3-dichloropropene	1	1000	<1	<1	NA
1,1,2-trichloroethane	1	NSL	<1	<1	NA
Toluene	1	8000	<1	<1	NA
1,3-dichloropropane	1	NSL	<1	<1	NA
Dibromochloromethane	1	NSL	<1	<1	NA
1,2-dibromoethane	1	NSL	<1	<1	NA
Tetrachloroethene	1	500	<1	<1	NA
1,1,1,2-tetrachloroethane	1	NSL	<1	<1	NA
Chlorobenzene	1	3000	<1	<1	NA
Ethylbenzene	1	3000	<1	<1	NA
Bromoform	1	NSL	<1	<1	NA
m+p-xylene	2	NSL	<2	<2	NA
Styrene	1	300	<1	<1	NA
1,1,2,2-tetrachloroethane	1	NSL	<1	<1	NA
o-xylene	1	NSL	<1	<1	NA
1,2,3-trichloropropane	1	NSL	<1	<1	NA
Isopropylbenzene	1	NSL	<1	<1	NA
Bromobenzene	1	NSL	<1	<1	NA
n-propyl benzene	1	NSL	<1	<1	NA
2-chlorotoluene	1	NSL	<1	<1	NA
4-chlorotoluene	1	NSL	<1	<1	NA
1,3,5-trimethyl benzene	1	NSL	<1	<1	NA
Tert-butyl benzene	1	NSL	<1	<1	NA
1,2,4-trimethyl benzene	1	NSL	<1	<1	NA
1,3-dichlorobenzene	1	200	<1	<1	NA
Sec-butyl benzene	1	NSL	<1	<1	NA
1,4-dichlorobenzene	1	400	<1	<1	NA
4-isopropyl toluene	1	NSL	<1	<1	NA
1,2-dichlorobenzene	1	15000	<1	<1	NA
n-butyl benzene	1	NSL	<1	<1	NA
1,2-dibromo-3-chloropropane	1	NSL	<1	<1	NA
1,2,4-trichlorobenzene	1	300	<1	<1	NA
1,2,3-trichlorobenzene	1		<1	<1	NA
Hexachlorobutadiene	1	7	<1	<1	NA
Polycyclic Aromatic Hydrocarbons (PAHs)					
Naphthalene	0.2	NSL	<0.2	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1	**0.3**
Acenaphthene	0.1	NSL	<0.1	<0.1	**0.2**
Fluorene	0.1	NSL	<0.1	<0.1	**0.3**
Phenanthrene	0.1	NSL	**0.8**	**0.8**	**2.9**
Anthracene	0.1	NSL	**0.2**	**0.3**	**0.8**
Fluoranthene	0.1	NSL	**0.9**	**0.9**	**3.3**
Pyrene	0.1	NSL	**0.9**	**0.9**	**3.4**
Benzo(a)anthracene	0.1	NSL	**0.5**	**0.5**	**1.9**
Chrysene	0.1	NSL	**0.5**	**0.5**	**1.6**
Benzo(b,j+k)fluoranthene	0.2	NSL	**0.6**	**0.6**	**2**
Benzo(a)pyrene	0.1	0.1	**0.4**	**0.5**	**1.6**
Indeno(1,2,3-c,d)pyrene	0.1	NSL	**0.2**	**0.2**	**0.6**
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1	**0.2**
Benzo(g,h,i)perylene	0.1	NSL	**0.2**	**0.2**	**0.6**

Concentration above the SAC — **VALUE**
Concentration above the PQL — **Bold**
GIL >PQL — Red

TABLE G3
GROUNDWATER LABORATORY RESULTS COMPARED TO HSLs
All data in µg/L unless stated otherwise

				C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene	PID
PQL - Envirolab Services				10	50	1	1	1	2	1	
NEPM 2013 - Land Use Category				**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**								
MW2	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	1.2
MW2 (Lab Replicate)	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	NA
WDUP1	8.02	4m to <8m	Sand	<10	<50	<1	<1	<1	<2	<1	NA
Total Number of Samples				3	3	3	3	3	3	3	1
Maximum Value				<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	1.2

Concentration above the SAC **VALUE**
Concentration above the PQL **Bold**
The guideline corresponding to the elevated value is highlighted in grey in the Groundwater Assessment Criteria Table below

HSL GROUNDWATER ASSESSMENT CRITERIA

Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
MW2	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL
MW2 (Lab Replicate)	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL
WDUP1	8.02	4m to <8m	Sand	1000	1000	800	NL	NL	NL	NL

TABLE G4
GROUNDWATER INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in µg/L unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = MW2	Arsenic	1	<1	<1	NC	NC
Dup Ref = WDUP1	Cadmium	0.1	<0.1	<0.1	NC	NC
	Chromium	1	6	6	6	0
Envirolab Report: 236004	Copper	1	<1	1	1	67
	Lead	1	1	1	1	0
	Mercury	0.05	<0.05	<0.05	NC	NC
	Nickel	1	3	3	3	0
	Zinc	1	19	21	20	10
	Naphthalene	0.2	<0.2	<0.2	NC	NC
	Acenaphthylene	0.1	<0.1	0.3	0	143
	Acenaphthene	0.1	<0.1	0.2	0	120
	Fluorene	0.1	<0.1	0.3	0	143
	Phenanthrene	0.1	0.8	2.9	2	114
	Anthracene	0.1	0.2	0.8	1	120
	Fluoranthene	0.1	0.9	3.3	2	114
	Pyrene	0.1	0.9	3.4	2	116
	Benzo(a)anthracene	0.1	0.5	1.9	1	117
	Chrysene	0.1	0.5	1.6	1	105
	Benzo(b,j+k)fluoranthene	0.2	0.6	2	1	108
	Benzo(a)pyrene	0.1	0.4	1.6	1	120
	Indeno(123-cd)pyrene	0.1	0.2	0.6	0	100
	Dibenzo(ah)anthracene	0.1	<0.1	0.2	0	120
	Benzo(ghi)perylene	0.1	0.2	0.6	0	100
	Total OCPs	0.1	-	-	NC	NC
	Total OPPs	0.1	-	-	NC	NC
	Total PCBs	0.1	-	-	NC	NC
	TRH C6-C10 (F1)	10	<10	<10	NC	NC
	TRH >C10-C16 (F2)	50	<50	<50	NC	NC
	TRH >C16-C34 (F3)	100	110	290	200	90
	TRH >C34-C40 (F4)	100	<100	110	80	75
	Benzene	1	<1	<1	NC	NC
	Toluene	1	<1	<1	NC	NC
	Ethylbenzene	1	<1	<1	NC	NC
	m+p-xylene	2	<2	<2	NC	NC
	o-xylene	1	<1	<1	NC	NC

RPD Results Above the Acceptance Criteria VALUE

Laboratory Reports and Chain of Custody Documentation

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CERTIFICATE OF ANALYSIS 235671

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	35 Soil
Date samples received	22/01/2020
Date completed instructions received	22/01/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	07/02/2020
Date of Issue	07/02/2020

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Asbestos Approved By
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Results Approved By
Josh Williams, Senior Chemist
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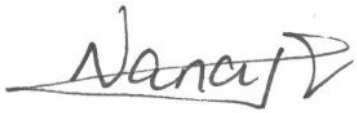

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	95	80	91	86	80

vTRH(C6-C10)/BTEXN in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	100	85	86	91

svTRH (C10-C40) in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020	05/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	170	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	280	200	<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	350	190	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	360	350	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	720	540	<50	<50	<50
Surrogate o-Terphenyl	%	113	72	70	66	78

svTRH (C10-C40) in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	220
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	160	<100	230
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	400
Total +ve TRH (>C10-C40)	mg/kg	<50	160	<50	630
Surrogate o-Terphenyl	%	102	64	85	88

PAHs in Soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	1.7	0.1	<0.1	<0.1	0.2
Anthracene	mg/kg	0.4	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	2.2	0.2	0.2	0.1	0.6
Pyrene	mg/kg	2.3	0.3	0.2	0.2	0.7
Benzo(a)anthracene	mg/kg	0.9	<0.1	0.1	<0.1	0.4
Chrysene	mg/kg	1	<0.1	0.1	0.1	0.4
Benzo(b,j+k)fluoranthene	mg/kg	1	0.2	<0.2	<0.2	0.7
Benzo(a)pyrene	mg/kg	0.80	0.2	0.1	<0.05	0.4
Indeno(1,2,3-c,d)pyrene	mg/kg	0.3	<0.1	<0.1	<0.1	0.2
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	0.5	0.1	<0.1	<0.1	0.3
Total +ve PAH's	mg/kg	11	1.2	0.72	0.5	3.9
Benzo(a)pyrene TEQ calc (zero)	mg/kg	1.0	<0.5	<0.5	<0.5	0.6
Benzo(a)pyrene TEQ calc(half)	mg/kg	1.1	<0.5	<0.5	<0.5	0.6
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1.1	<0.5	<0.5	<0.5	0.7
Surrogate p-Terphenyl-d14	%	84	85	83	80	83

PAHs in Soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Naphthalene	mg/kg	<0.1	0.2	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	0.9	<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	2.0	<0.1	0.1
Anthracene	mg/kg	<0.1	0.6	<0.1	<0.1
Fluoranthene	mg/kg	0.1	2.7	<0.1	0.2
Pyrene	mg/kg	<0.1	2.6	<0.1	0.2
Benzo(a)anthracene	mg/kg	<0.1	1.3	<0.1	0.1
Chrysene	mg/kg	<0.1	1.3	<0.1	0.2
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	1.2	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.5	<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	0.6	<0.1	<0.1
Total +ve PAH's	mg/kg	0.1	15	<0.05	0.73
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	1.6	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	1.6	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	1.6	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	81	87	83	76

Organochlorine Pesticides in soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

Organophosphorus Pesticides in Soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

PCBs in Soil					
Our Reference		235671-1	235671-6	235671-21	235671-27
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.1-0.2	0-0.1	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date extracted	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	122	116	123	119

Acid Extractable metals in soil						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Arsenic	mg/kg	<4	9	12	34	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	12	84	9	8	5
Copper	mg/kg	54	51	25	9	10
Lead	mg/kg	17	250	810	69	45
Mercury	mg/kg	<0.1	0.2	2.4	0.2	<0.1
Nickel	mg/kg	8	15	3	5	1
Zinc	mg/kg	39	91	330	39	42

Acid Extractable metals in soil					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Arsenic	mg/kg	<4	<4	<4	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	7	6	17	62
Copper	mg/kg	3	14	2	51
Lead	mg/kg	16	49	19	170
Mercury	mg/kg	<0.1	<0.1	<0.1	0.1
Nickel	mg/kg	1	2	1	12
Zinc	mg/kg	13	55	31	130

Moisture						
Our Reference		235671-1	235671-6	235671-7	235671-15	235671-21
Your Reference	UNITS	BH1	BH2	BH2	BH3	BH4
Depth		0.05-0.15	0.1-0.2	0.75-0.95	0.4-0.5	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Moisture	%	8.1	5.2	8.1	12	5.1

Moisture					
Our Reference		235671-22	235671-27	235671-30	235671-33
Your Reference	UNITS	BH4	BH5	BH5	SDUP2
Depth		0.5-0.6	0-0.1	1.7-1.8	-
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	01/02/2020	01/02/2020	01/02/2020	01/02/2020
Date analysed	-	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Moisture	%	4.3	9.3	6.9	4.8

Asbestos ID - soils NEPM - ASB-001					
Our Reference		235671-5	235671-13	235671-26	235671-31
Your Reference	UNITS	BH1	BH2	BH4	BH5
Depth		0.05-0.15	0.2-0.5	0.1-0.3	0-0.3
Date Sampled		28/01/2020	28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil	Soil
Date analysed	-	05/02/2020	05/02/2020	05/02/2020	05/02/2020
Sample mass tested	g	961.42	766.54	988.25	773.5
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–	–	–
FA and AF Estimation*	g	–	–	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001	<0.001	<0.001

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).

Method ID	Methodology Summary
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	104	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	104	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	102	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	105	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	93	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	79	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	76	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	123	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	79	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	76	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	123	[NT]
Surrogate o-Terphenyl	%		Org-003	100	[NT]	[NT]	[NT]	[NT]	108	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	120	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	[NT]	[NT]	[NT]	[NT]	114	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	82	[NT]	[NT]	[NT]	[NT]	88	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
HCB	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	79	[NT]
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	96	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Endrin	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	130	[NT]
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	94	[NT]
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	87	[NT]
Malathion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	91	[NT]
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Parathion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	102	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: PCBs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date extracted	-			01/02/2020	[NT]	[NT]	[NT]	[NT]	01/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate TCMX	%		Org-006	123	[NT]	[NT]	[NT]	[NT]	119	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-10	[NT]
Date prepared	-			03/02/2020	[NT]	[NT]	[NT]	[NT]	03/02/2020	[NT]
Date analysed	-			03/02/2020	[NT]	[NT]	[NT]	[NT]	03/02/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	106	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	103	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	109	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	111	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	88	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	113	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	235671
Date Sample Received	22/01/2020
Date Instructions Received	22/01/2020
Date Results Expected to be Reported	07/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	35 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.0
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	On Hold
BH1-0.05-0.15	✓	✓	✓	✓	✓	✓	✓		
BH1-0.6-0.7									✓
BH1-1.3-1.5									✓
BH1-1.75-1.85									✓
BH1-0.05-0.15								✓	
BH2-0.1-0.2	✓	✓	✓	✓	✓	✓	✓		
BH2-0.75-0.95	✓	✓	✓				✓		
BH2-1.7-1.95									✓
BH2-2.8-3									✓
BH2-4.2-4.3									✓
BH2-4.8-4.95									✓
BH2-8.5-8.7									✓
BH2-0.2-0.5								✓	
BH3-0.05-0.15									✓
BH3-0.4-0.5	✓	✓	✓				✓		
BH3-0.7-0.95									✓
BH3-1.7-1.95									✓
BH3-3.3-3.45									✓
BH3-4.3-4.5									✓
BH3-6.2-6.4									✓
BH4-0-0.1	✓	✓	✓	✓	✓	✓	✓		
BH4-0.5-0.6	✓	✓	✓				✓		
BH4-1-1.15									✓
BH4-1.7-1.95									✓
BH4-2.7-2.9									✓
BH4-0.1-0.3								✓	
BH5-0-0.1	✓	✓	✓	✓	✓	✓	✓		
BH5-0.4-0.5									✓
BH5-1-1.1									✓
BH5-1.7-1.8	✓	✓	✓				✓		
BH5-0-0.3								✓	
SDUP1									✓

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	On Hold
SDUP2	✓	✓	✓				✓		
SDUP3									✓
SDUP4									✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

ENVIROLAB

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

COC 30/1

Job No: 235671

Date Received: 30/1/20
Time Received: 15:50.
Received by: SYH.

29/1/20 } samples.
16:09

15:50

Temp: Cool/Ambient
Cooling: Ice/Icepack

SAMPLE AND CHAIN OF CUSTODY FORM

TO: Security: Intact/Broken/None
ENVIROLAB SERVICES PTY LTD
12 ASHLEY STREET
CHATSWOOD NSW 2067
P: (02) 99106200
F: (02) 99106201

Attention: Aileen

EIS Job Number: E32915BD

Date Results Required: STANDARD

Page: 1 of 2

FROM:
JKEnvironments
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention:
abarkaway@jkenvironments.com.au

Location: Vaucluse
Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 3	Combo 6	Asbestos WA	HOLD
28.1.20	1	BH1	0.05-0.15	G, A	0.4	F: Gravelly silty sand		X		
28.1.20	2	BH1	0.6-0.7	G, A	0.6	F: Silty sand				X
28.1.20	3	BH1	1.3-1.5	G, A	1.5	F: Silty sand				X
28.1.20	4	BH1	1.75-1.85	G	1.6	Sandstone				X
28.1.20	5	BH1	0.05-0.15	A	-	F: Gravelly silty sand			X	
28.1.20	6	BH2	0.1-0.2	G, A	0.3	F: Silty sand		X		
28.1.20	7	BH2	0.75-0.95	G, A	0.6	F: Silty sand	X			
28.1.20	8	BH2	1.7-1.95	G, A	0.7	F: Silty sand				X
28.1.20	9	BH2	2.8-3	G, A	0.3	F: Silty sand				X
28.1.20	10	BH2	4.2-4.3	G	1.4	Silty sand				X
28.1.20	11	BH2	4.8-4.95	G	1.9	Silty sand				X
28.1.20	12	BH2	8.5-8.7	G	8.9	Sandstone				X
28.1.20	13	BH2	0.2-0.5	A	-	F: Silty sand			X	
28.1.20	14	BH3	0.05-0.15	G, A	0.6	F: Silty sand				X
28.1.20	15	BH3	0.4-0.5	G, A	1.1	F: Silty sand	X			
28.1.20	16	BH3	0.7-0.95	G, A	0.5	F: Silty sand				X
28.1.20	17	BH3	1.7-1.95	G, A	0.5	F: Silty sand				X
28.1.20	18	BH3	3.3-3.45	G, A	0.8	F: Silty sand				X
28.1.20	19	BH3	4.3-4.5	G, A	2.2	F: Silty sand				X
28.1.20	20	BH3	6.2-6.4	G	4.2	Sandstone				X
28.1.20	21	BH4	0-0.1	G, A	0.5	F: Silty sand		X		
28.1.20	22	BH4	0.5-0.6	G, A	2.2	F: Silty sand	X			
28.1.20	23	BH4	1-1.15	G, A	0.4	F: Silty sand				X
28.1.20	24	BH4	1.7-1.95	G, A	1.6	F: Silty sand				X
28.1.20	25	BH4	2.7-2.9	G	2	Sandstone				X

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 30.01.2020	Time:	Received By:	Date: 30/1

4.9°C.

235671

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E32915BD Date Results Required: STANDARD Page: 2 of 2	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: abarkaway@jkenvironments.com.au

Location: Vaucluse

Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description			Combo 3	Combo 6		Asbestos WA	HOLD						
28.1.20	26	BH4	0.1-0.3	A	-	F: Silty sand						X							
28.1.20	27	BH5	0-0.1	G, A	3.4	F: Silty sand				X									
28.1.20	28	BH5	0.4-0.5	G, A	2.8	F: Silty sand							X						
28.1.20	29	BH5	1-1.1	G, A	6.4	F: Silty sand							X						
28.1.20	30	BH5	1.7-1.8	G	7.7	Sanstone			X										
28.1.20	31	BH5	0-0.3	G	-	F: Silty sand						X							
28.1.20	32	SDUP1	-	G	-	Soil							X						
28.1.20	33	SDUP2	-	G	-	Soil			X										
28.1.20	34	SDUP3	-	G	-	Soil							X						
28.1.20	35	SDUP4	-	G	-	Soil							X						

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 30.01.2020	Time:	Received By:	Date: 30/1

Envirolab Services Pty Ltd
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ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 235671-A

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	35 Soil
Date samples received	22/01/2020
Date completed instructions received	12/02/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	19/02/2020
Date of Issue	19/02/2020

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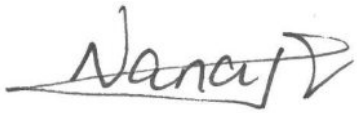
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Diego Bigolin, Team Leader, Inorganics
Josh Williams, Senior Chemist
Ken Nguyen, Reporting Supervisor
Loren Bardwell, Senior Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
TRH C_6 - C_9	mg/kg	<25
TRH C_6 - C_{10}	mg/kg	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25
Benzene	mg/kg	<0.2
Toluene	mg/kg	<0.5
Ethylbenzene	mg/kg	<1
m+p-xylene	mg/kg	<2
o-Xylene	mg/kg	<1
naphthalene	mg/kg	<1
Total +ve Xylenes	mg/kg	<3
Surrogate aaa-Trifluorotoluene	%	98

svTRH (C10-C40) in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	101

PAHs in Soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	13/02/2020
Date analysed	-	14/02/2020
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	<0.1
Pyrene	mg/kg	<0.1
Benzo(a)anthracene	mg/kg	<0.1
Chrysene	mg/kg	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2
Benzo(a)pyrene	mg/kg	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	87

Acid Extractable metals in soil		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	13/02/2020
Date analysed	-	14/02/2020
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	8
Copper	mg/kg	<1
Lead	mg/kg	6
Mercury	mg/kg	<0.1
Nickel	mg/kg	<1
Zinc	mg/kg	6

Moisture		
Our Reference		235671-A-11
Your Reference	UNITS	BH2
Depth		4.8-4.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	13/02/2020
Date analysed	-	14/02/2020
Moisture	%	13

Metals in TCLP USEPA1311				
Our Reference		235671-A-6	235671-A-7	235671-A-27
Your Reference	UNITS	BH2	BH2	BH5
Depth		0.1-0.2	0.75-0.95	0-0.1
Date Sampled		28/01/2020	28/01/2020	28/01/2020
Type of sample		Soil	Soil	Soil
Date extracted	-	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020
pH of soil for fluid# determ.	pH units	9.5	9.4	9.0
pH of soil TCLP (after HCl)	pH units	2.1	2.6	1.8
Extraction fluid used	-	1	1	1
pH of final Leachate	pH units	5.7	6.0	4.9
Lead in TCLP	mg/L	0.3	1.2	[NA]

PAHs in TCLP (USEPA 1311)		
Our Reference		235671-A-27
Your Reference	UNITS	BH5
Depth		0-0.1
Date Sampled		28/01/2020
Type of sample		Soil
Date extracted	-	14/02/2020
Date analysed	-	17/02/2020
Naphthalene in TCLP	mg/L	<0.001
Acenaphthylene in TCLP	mg/L	<0.001
Acenaphthene in TCLP	mg/L	<0.001
Fluorene in TCLP	mg/L	<0.001
Phenanthrene in TCLP	mg/L	<0.001
Anthracene in TCLP	mg/L	<0.001
Fluoranthene in TCLP	mg/L	<0.001
Pyrene in TCLP	mg/L	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001
Chrysene in TCLP	mg/L	<0.001
Benzo(bjk)fluoranthene in TCLP	mg/L	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001
Total +ve PAH's	mg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	84

Misc Inorg - Soil		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	14/02/2020
Date analysed	-	14/02/2020
pH 1:5 soil:water	pH Units	10.2

Clay 50-120g		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	17/02/2020
Date analysed	-	18/02/2020
Clay in soils <2µm	% (w/w)	9

CEC		
Our Reference		235671-A-7
Your Reference	UNITS	BH2
Depth		0.75-0.95
Date Sampled		28/01/2020
Type of sample		Soil
Date prepared	-	17/02/2020
Date analysed	-	18/02/2020
Exchangeable Ca	meq/100g	44
Exchangeable K	meq/100g	0.5
Exchangeable Mg	meq/100g	0.21
Exchangeable Na	meq/100g	<0.1
Cation Exchange Capacity	meq/100g	45

Method ID	Methodology Summary
AS1289.3.6.3	Determination Particle Size Analysis using AS1289.3.6.3 and AS1289.3.6.1 and in house method INORG-107. Clay fraction at <2µm reported.
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-009	Determination of exchangeable cations and cation exchange capacity in soils using 1M Ammonium Chloride exchange and ICP-AES analytical finish.
Metals-020	Determination of various metals by ICP-AES.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-012/017	Leachates are extracted with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.

Method ID	Methodology Summary
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	87	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	[NT]	[NT]	[NT]	[NT]	87	[NT]
Benzene	mg/kg	0.2	Org-016	<0.2	[NT]	[NT]	[NT]	[NT]	89	[NT]
Toluene	mg/kg	0.5	Org-016	<0.5	[NT]	[NT]	[NT]	[NT]	113	[NT]
Ethylbenzene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	81	[NT]
m+p-xylene	mg/kg	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	76	[NT]
o-Xylene	mg/kg	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	70	[NT]
naphthalene	mg/kg	1	Org-014	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	110	[NT]	[NT]	[NT]	[NT]	113	[NT]

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

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

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			13/02/2020	[NT]	[NT]	[NT]	[NT]	13/02/2020	[NT]
Date analysed	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Arsenic	mg/kg	4	Metals-020	<4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	[NT]	[NT]	[NT]	[NT]	101	[NT]
Chromium	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	104	[NT]
Copper	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Lead	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	106	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Nickel	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	100	[NT]
Zinc	mg/kg	1	Metals-020	<1	[NT]	[NT]	[NT]	[NT]	102	[NT]

QUALITY CONTROL: Metals in TCLP USEPA1311						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: PAHs in TCLP (USEPA 1311)					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			14/02/2020	[NT]	[NT]	[NT]	[NT]	14/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Naphthalene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	101	[NT]
Acenaphthylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	93	[NT]
Phenanthrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	92	[NT]
Anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	92	[NT]
Pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	120	[NT]
Benzo(bjk)fluoranthene in TCLP	mg/L	0.002	Org-012/017	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	75	[NT]
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	113	[NT]	[NT]	[NT]	[NT]	82	[NT]

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

QUALITY CONTROL: CEC					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Exchangeable Ca	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable K	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	110	[NT]
Exchangeable Mg	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Exchangeable Na	meq/100g	0.1	Metals-009	<0.1	[NT]	[NT]	[NT]	[NT]	114	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

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

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SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	235671-A
Date Sample Received	22/01/2020
Date Instructions Received	12/02/2020
Date Results Expected to be Reported	19/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	35 Soil
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	15.0
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Lead in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	Misc Inorg - Soil	Clay 50-120g	CEC	On Hold
BH1-0.05-0.15																														✓
BH1-0.6-0.7																														✓
BH1-1.3-1.5																														✓
BH1-1.75-1.85																														✓
BH1-0.05-0.15																														✓
BH2-0.1-0.2					✓	✓	✓	✓	✓																					
BH2-0.75-0.95					✓	✓	✓	✓	✓																		✓	✓	✓	
BH2-1.7-1.95																														✓
BH2-2.8-3																														✓
BH2-4.2-4.3																														✓
BH2-4.8-4.95	✓	✓	✓	✓																										
BH2-8.5-8.7																														✓
BH2-0.2-0.5																														✓
BH3-0.05-0.15																														✓
BH3-0.4-0.5																														✓
BH3-0.7-0.95																														✓
BH3-1.7-1.95																														✓
BH3-3.3-3.45																														✓
BH3-4.3-4.5																														✓
BH3-6.2-6.4																														✓

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Acid Extractable metalsin soil	pH of soil for fluid#determ.	pH of soil TCLP (after HCl)	Extraction fluid used	pH of final Leachate	Lead in TCLP	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	Misc Inorg - Soil	Clay 50-120g	CEC	On Hold
BH4-0-0.1																													✓
BH4-0.5-0.6																													✓
BH4-1-1.15																													✓
BH4-1.7-1.95																													✓
BH4-2.7-2.9																													✓
BH4-0.1-0.3																													✓
BH5-0-0.1					✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓			
BH5-0.4-0.5																													✓
BH5-1-1.1																													✓
BH5-1.7-1.8																													✓
BH5-0-0.3																													✓
SDUP1																													✓
SDUP2																													✓
SDUP3																													✓
SDUP4																													✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt. Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Andrew (Fitzy) Fitzsimons

From: Ken Nguyen
Sent: Wednesday, 12 February 2020 11:12 AM
To: Anthony Barkway
Cc: Andrew (Fitzy) Fitzsimons
Subject: RE: JKE - Extra testing request for Registration 235671 E32915BD, Vaucluse

Follow Up Flag: Follow up
Flag Status: Flagged

Ref: 235671-A
TAT: Std
Due: 19/2/20

Hi Anthony,

No problem, we'll get it logged in.

Kind Regards,
Ken

Kind Regards,

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

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Wednesday, 12 February 2020 9:37 AM
To: Ken Nguyen <KNguyen@envirolab.com.au>
Subject: JKE - Extra testing request for Registration 235671 E32915BD, Vaucluse

Hi Ken,

Could I please request extra testing for some of the samples within the above batch as follows:

Sample Number + Depth	Lab Ref:	Tests Required
BH2 0.1-0.2	6	TCLP Lead
BH2 0.75-0.95	7	TCLP Lead, pH+CEC+Clay Content
BH2 4.8-4.95	11	Combo 3
BH5 0.0-0.1	27	TCLP PAHs

Thank you!

Kind Regards

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CERTIFICATE OF ANALYSIS 236009

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	16 SOIL, 1 WATER
Date samples received	05/02/2020
Date completed instructions received	05/02/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	12/02/2020
Date of Issue	11/02/2020

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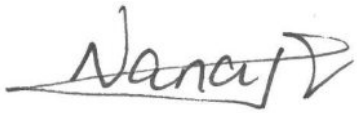
Asbestos Approved By
Analysed by Asbestos Approved Identifier: Lucy Zhu
Authorised by Asbestos Approved Signatory: Lucy Zhu

Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Lucy Zhu, Asbestos Supervisor
Steven Luong, Organics Supervisor

Authorised By



Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	88	84	91	84	90

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		236009-7	236009-8	236009-11	236009-14	236009-15
Your Reference	UNITS	BH8	BH9	BH10	SDUP6	STB1
Depth		1.6-1.8	0-0.1	0-0.1	-	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	<25	<25	<25	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	<25	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	<25	<25	<25
Benzene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	<1	<1	<1
m+p-xylene	mg/kg	<2	<2	<2	<2	<2
o-Xylene	mg/kg	<1	<1	<1	<1	<1
naphthalene	mg/kg	<1	<1	<1	<1	<1
Total +ve Xylenes	mg/kg	<3	<3	<3	<3	<3
Surrogate aaa-Trifluorotoluene	%	76	87	72	70	93

vTRH(C6-C10)/BTEXN in Soil		
Our Reference		236009-16
Your Reference	UNITS	STS1
Depth		-
Date Sampled		03/02/2020
Type of sample		SOIL
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Benzene	mg/kg	103%
Toluene	mg/kg	102%
Ethylbenzene	mg/kg	108%
m+p-xylene	mg/kg	101%
o-Xylene	mg/kg	113%
Surrogate aaa-Trifluorotoluene	%	95

svTRH (C10-C40) in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	52	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	190
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	190
TRH >C_{10} -C_{16}	mg/kg	<50	51	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	51	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	110	<100	<100	340
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	100
Total +ve TRH (>C10-C40)	mg/kg	<50	160	<50	<50	450
Surrogate o-Terphenyl	%	72	81	81	72	87

svTRH (C10-C40) in Soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50
Surrogate o-Terphenyl	%	70	70	69	72

PAHs in Soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.7
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	0.2	0.3	<0.1	<0.1	2.0
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	0.4
Fluoranthene	mg/kg	0.8	1.2	0.1	0.2	5.3
Pyrene	mg/kg	0.9	1.4	0.1	0.2	5.7
Benzo(a)anthracene	mg/kg	0.5	0.9	0.1	0.1	3.8
Chrysene	mg/kg	0.6	1.1	0.1	0.2	4.2
Benzo(b,j+k)fluoranthene	mg/kg	1	2	<0.2	0.3	7.0
Benzo(a)pyrene	mg/kg	0.66	1.2	0.1	0.2	4.7
Indeno(1,2,3-c,d)pyrene	mg/kg	0.3	0.7	<0.1	<0.1	2.4
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.2	<0.1	<0.1	0.8
Benzo(g,h,i)perylene	mg/kg	0.4	0.9	<0.1	0.1	2.9
Total +ve PAH's	mg/kg	5.4	9.6	0.60	1.3	40
Benzo(a)pyrene TEQ calc (zero)	mg/kg	0.9	1.7	<0.5	<0.5	6.9
Benzo(a)pyrene TEQ calc(half)	mg/kg	0.9	1.7	<0.5	<0.5	6.9
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	1	1.7	<0.5	<0.5	6.9
Surrogate p-Terphenyl-d14	%	90	94	95	84	91

PAHs in Soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.4	<0.1	0.2
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	1	<0.1	0.8
Pyrene	mg/kg	0.2	1	<0.1	0.9
Benzo(a)anthracene	mg/kg	0.2	0.6	<0.1	0.6
Chrysene	mg/kg	0.2	0.7	<0.1	0.7
Benzo(b,j+k)fluoranthene	mg/kg	0.3	1	<0.2	1
Benzo(a)pyrene	mg/kg	0.2	0.63	<0.05	0.62
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	0.4	<0.1	0.3
Dibenzo(a,h)anthracene	mg/kg	<0.1	0.1	<0.1	0.1
Benzo(g,h,i)perylene	mg/kg	0.1	0.4	<0.1	0.4
Total +ve PAH's	mg/kg	1.3	6.1	<0.05	5.7
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	0.9	<0.5	0.9
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	0.9	<0.5	0.9
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	0.9	<0.5	0.9
Surrogate p-Terphenyl-d14	%	97	92	95	96

Organochlorine Pesticides in soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

Organophosphorus Pesticides in Soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

PCBs in Soil						
Our Reference		236009-1	236009-3	236009-5	236009-8	236009-11
Your Reference	UNITS	BH6	BH7	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0-0.1	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	08/02/2020	08/02/2020	08/02/2020	08/02/2020	08/02/2020
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	96	108	110	96	101

Acid Extractable metals in soil						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Arsenic	mg/kg	6	6	<4	9	6
Cadmium	mg/kg	<0.4	<0.4	<0.4	0.4	<0.4
Chromium	mg/kg	8	6	3	11	10
Copper	mg/kg	23	20	6	36	80
Lead	mg/kg	81	86	32	160	160
Mercury	mg/kg	<0.1	<0.1	<0.1	0.1	0.1
Nickel	mg/kg	3	3	<1	4	7
Zinc	mg/kg	61	53	15	130	190

Acid Extractable metals in soil					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Arsenic	mg/kg	5	33	24	32
Cadmium	mg/kg	<0.4	0.4	<0.4	<0.4
Chromium	mg/kg	15	13	9	10
Copper	mg/kg	10	43	34	43
Lead	mg/kg	29	190	200	160
Mercury	mg/kg	<0.1	0.1	0.1	0.1
Nickel	mg/kg	1	4	4	3
Zinc	mg/kg	20	150	160	140

Moisture						
Our Reference		236009-1	236009-3	236009-4	236009-5	236009-6
Your Reference	UNITS	BH6	BH7	BH7	BH8	BH8
Depth		0-0.1	0-0.1	0.2-0.3	0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020	07/02/2020
Moisture	%	13	11	3.1	8.1	6.9

Moisture					
Our Reference		236009-7	236009-8	236009-11	236009-14
Your Reference	UNITS	BH8	BH9	BH10	SDUP6
Depth		1.6-1.8	0-0.1	0-0.1	-
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL
Date prepared	-	06/02/2020	06/02/2020	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020	07/02/2020	07/02/2020
Moisture	%	24	12	10	20

Asbestos ID - soils		
Our Reference		236009-3
Your Reference	UNITS	BH7
Depth		0-0.1
Date Sampled		03/02/2020
Type of sample		SOIL
Date analysed	-	08/02/2020
Sample mass tested	g	Approx. 15g
Sample Description	-	Brown fine-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected

Asbestos ID - soils NEPM - ASB-001			
Our Reference		236009-5	236009-8
Your Reference	UNITS	BH8	BH9
Depth		0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020
Type of sample		SOIL	SOIL
Date analysed	-	10/02/2020	10/02/2020
Sample mass tested	g	597.78	631.41
Sample Description	-	Brown fine-grained soil & rocks	Brown fine-grained soil & rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected Synthetic mineral fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected
Total Asbestos#1	g/kg	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–
FA and AF Estimation*	g	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001

BTEX in Water		
Our Reference		236009-17
Your Reference	UNITS	SFR1
Depth		-
Date Sampled		03/02/2020
Type of sample		WATER
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Surrogate Dibromofluoromethane	%	104
Surrogate toluene-d8	%	98
Surrogate 4-BFB	%	107

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
AT-008	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).

Method ID	Methodology Summary
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-006	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.
Org-012/017	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS and/or GC-MS/MS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-014	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	83	91
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	83	91
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	82	88
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	79	86
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	87	95
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	81	92
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	78	89
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	88	1	88	78	12	89	83

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			07/02/2020	1	07/02/2020	07/02/2020		07/02/2020	07/02/2020
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	105	98
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	108	80
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	123	#
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	105	98
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	100	0	108	80
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	123	#
Surrogate o-Terphenyl	%		Org-003	73	1	72	71	1	83	81

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Naphthalene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	86	96
Acenaphthylene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	84	104
Phenanthrene	mg/kg	0.1	Org-012/017	<0.1	1	0.2	0.1	67	92	86
Anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012/017	<0.1	1	0.8	0.5	46	88	86
Pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.9	0.6	40	84	81
Benzo(a)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	0.5	0.3	50	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012/017	<0.1	1	0.6	0.3	67	64	80
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012/017	<0.2	1	1	0.8	22	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012/017	<0.05	1	0.66	0.4	49	80	70
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012/017	<0.1	1	0.3	0.2	40	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012/017	<0.1	1	0.4	0.3	29	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	94	1	90	84	7	92	89

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
alpha-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	106	106
HCB	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	106
gamma-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	102	94
delta-BHC	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	118	107
Heptachlor Epoxide	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	99
gamma-Chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	99
Dieldrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	122	101
Endrin	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	104	99
Endosulfan II	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	104	88
Endrin Aldehyde	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	104
Methoxychlor	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	83	1	96	92	4	82	94

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Dichlorvos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	110	88
Dimethoate	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	108	98
Fenitrothion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	90	91
Malathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	97	93
Chlorpyriphos	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	114	96
Parathion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	98
Bromophos-ethyl	mg/kg	0.1	AT-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	100	94
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-012/017	83	1	96	92	4	82	94

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			08/02/2020	1	08/02/2020	08/02/2020		08/02/2020	08/02/2020
Aroclor 1016	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	74	67
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-006	83	1	96	92	4	82	94

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	236009-3
Date prepared	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Arsenic	mg/kg	4	Metals-020	<4	1	6	7	15	98	100
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	97	92
Chromium	mg/kg	1	Metals-020	<1	1	8	12	40	107	97
Copper	mg/kg	1	Metals-020	<1	1	23	21	9	102	103
Lead	mg/kg	1	Metals-020	<1	1	81	83	2	112	118
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	0.1	0	97	86
Nickel	mg/kg	1	Metals-020	<1	1	3	3	0	97	95
Zinc	mg/kg	1	Metals-020	<1	1	61	59	3	107	92

QUALITY CONTROL: BTEX in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	86	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	77	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	81	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	79	[NT]
Surrogate Dibromofluoromethane	%		Org-016	100	[NT]	[NT]	[NT]	[NT]	97	[NT]
Surrogate toluene-d8	%		Org-016	99	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate 4-BFB	%		Org-016	110	[NT]	[NT]	[NT]	[NT]	100	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

TRH Soil C10-C40 NEPM - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 236009-3 has caused interference.

Asbestos: Excessive sample volume was provided for asbestos analysis.
A portion of the supplied sample was sub-sampled according to Envirolab procedures. We cannot guarantee that this sub-sample is indicative of the entire sample.
Envirolab recommends supplying 40-50g (50mL) of sample in its own container as per AS4964-2004.
Note: Sample 236009-3 was sub-sampled from a bag provided by the client.

Asbestos-ID in soil: NEPM
This report is consistent with the reporting recommendations in the National Environment Protection (Assessment of Site Contamination) Measure, Schedule B1, May 2013. This is reported outside our scope of NATA accreditation.

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SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236009
Date Sample Received	05/02/2020
Date Instructions Received	05/02/2020
Date Results Expected to be Reported	12/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	16 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12.8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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Analysis Underway, details on the following page:

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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils	Asbestos ID - soils NEPM - ASB-001	BTEX in Water	On Hold
BH6-0-0.1	✓	✓	✓	✓	✓	✓	✓				
BH6-0.3-0.4											✓
BH7-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓			
BH7-0.2-0.3	✓	✓	✓				✓				
BH8-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓		
BH8-0.6-0.7	✓	✓	✓				✓				
BH8-1.6-1.8	✓	✓	✓				✓				
BH9-0-0.1	✓	✓	✓	✓	✓	✓	✓		✓		
BH9-0.6-0.7											✓
BH9-0.8-0.9											✓
BH10-0-0.1	✓	✓	✓	✓	✓	✓	✓				
BH10-0.3-0.4											✓
SDUP5											✓
SDUP6	✓	✓	✓				✓				
STB1	✓										
STS1	✓										
SFR1										✓	

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.

Requests for longer term sample storage must be received in writing.

Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.

TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	EIS Job Number: E32915BD Date Results Required: STANDARD Page: 1 of 1	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: abarkaway@jkenvironments.com.au

Location: Vaucluse

Sampler: MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	Combo 3	Combo 6	Combo 6a	Asbestos WA	HOLD	BTEX					
3.2.20	1	BH6	0-0.1	G, A	0	F: Silty sand		X									
3.2.20	2	BH6	0.3-0.4	G, A	0	Silty sand					X						
3.2.20	3	BH7	0-0.1	G, A	1.1	F: Silty sand			X								
3.2.20	4	BH7	0.2-0.3	G, A	6.2	Silty sand	X										
3.2.20	5	BH8	0-0.1	G, A	0.9	F: Silty sand		X		X							
3.2.20	6	BH8	0.6-0.7	G, A	0	F: Silty sand	X										
3.2.20	7	BH8	1.6-1.8	G	0	Clayey Sand	X										
3.2.20	8	BH9	0-0.1	G, A	0	F: Silty sand		X		X							
3.2.20	9	BH9	0.6-0.7	G, A	0	F: Silty sand					X						
3.2.20	10	BH9	0.8-0.9	G, A	0	F: Silty sand					X						
3.2.20	11	BH10	0-0.1	G, A	0.1	F: Silty sand		X									
3.2.20	12	BH10	0.3-0.4	G, A	0	F: Silty sand					X						
3.2.20	13	SDUP5	-	G	-						X						
3.2.20	14	SDUP6	-	G	-		X										
3.2.20	15	STB1	-	V	-							X					
3.2.20	16	STS1	-	V	-							X					
3.2.20	17	SFR1	-	V	-							X					

ENVIROLAB

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

Job No: 236009

Date Received: 5.02.2020

Time Received: 12:45

Received By: EC

Temp: Cool/Ambient

Cooling: Ice/Icepack

Security: Intact/Broken/None

Remarks (comments/detection limits required):

Sample Containers:
G - 250mg Glass Jar
A - Ziplock Asbestos Bag
P - Plastic Bag

Relinquished By: Anthony Barkway	Date: 05.02.2020	Time:	Received By: EZS Trinidad Carvalho	Date: 5.02.2020

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

CERTIFICATE OF ANALYSIS 236009-A

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	16 SOIL, 1 WATER
Date samples received	05/02/2020
Date completed instructions received	12/02/2020

Analysis Details

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

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

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

Report Details

Date results requested by	19/02/2020
Date of Issue	19/02/2020

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Results Approved By
Josh Williams, Senior Chemist
Loren Bardwell, Senior Chemist

Authorised By

Nancy Zhang, Laboratory Manager

Metals in TCLP USEPA1311						
Our Reference		236009-A-3	236009-A-5	236009-A-6	236009-A-8	236009-A-11
Your Reference	UNITS	BH7	BH8	BH8	BH9	BH10
Depth		0-0.1	0-0.1	0.6-0.7	0-0.1	0-0.1
Date Sampled		03/02/2020	03/02/2020	03/02/2020	03/02/2020	03/02/2020
Type of sample		SOIL	SOIL	SOIL	SOIL	SOIL
Date extracted	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
Date analysed	-	17/02/2020	17/02/2020	17/02/2020	17/02/2020	17/02/2020
pH of soil for fluid# determ.	pH units	6.6	6.7	6.9	6.6	6.7
pH of soil TCLP (after HCl)	pH units	1.7	1.7	1.7	1.7	1.7
Extraction fluid used	-	1	1	1	1	1
pH of final Leachate	pH units	4.9	4.9	4.9	4.9	4.9
Lead in TCLP	mg/L	[NA]	<0.03	0.07	0.06	0.1

PAHs in TCLP (USEPA 1311)			
Our Reference		236009-A-3	236009-A-6
Your Reference	UNITS	BH7	BH8
Depth		0-0.1	0.6-0.7
Date Sampled		03/02/2020	03/02/2020
Type of sample		SOIL	SOIL
Date extracted	-	18/02/2020	18/02/2020
Date analysed	-	19/02/2020	19/02/2020
Naphthalene in TCLP	mg/L	<0.001	<0.001
Acenaphthylene in TCLP	mg/L	0.001	<0.001
Acenaphthene in TCLP	mg/L	<0.001	<0.001
Fluorene in TCLP	mg/L	0.001	<0.001
Phenanthrene in TCLP	mg/L	<0.001	<0.001
Anthracene in TCLP	mg/L	<0.001	<0.001
Fluoranthene in TCLP	mg/L	<0.001	<0.001
Pyrene in TCLP	mg/L	<0.001	<0.001
Benzo(a)anthracene in TCLP	mg/L	<0.001	<0.001
Chrysene in TCLP	mg/L	<0.001	<0.001
Benzo(bjk)fluoranthene in TCLP	mg/L	<0.002	<0.002
Benzo(a)pyrene in TCLP	mg/L	<0.001	<0.001
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	<0.001	<0.001
Dibenzo(a,h)anthracene in TCLP	mg/L	<0.001	<0.001
Benzo(g,h,i)perylene in TCLP	mg/L	<0.001	<0.001
Total +ve PAH's	mg/L	0.0021	NIL (+)VE
Surrogate p-Terphenyl-d14	%	132	121

Method ID	Methodology Summary
EXTRACT.7	Toxicity Characteristic Leaching Procedure (TCLP) using Zero Headspace Extraction (zHE) using AS4439 and USEPA 1311.
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-004	Toxicity Characteristic Leaching Procedure (TCLP) using in house method INORG-004. Please note that the mass used may be scaled down from the default based on sample mass available.
Metals-020 ICP-AES	Determination of various metals by ICP-AES.
Org-012/017	Leachates are extracted with Dichloromethane and analysed by GC-MS and/or GC-MS/MS.

QUALITY CONTROL: Metals in TCLP USEPA1311						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Date analysed	-			17/02/2020	[NT]	[NT]	[NT]	[NT]	17/02/2020	[NT]
Lead in TCLP	mg/L	0.03	Metals-020 ICP-AES	<0.03	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: PAHs in TCLP (USEPA 1311)					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			18/02/2020	[NT]	[NT]	[NT]	[NT]	18/02/2020	[NT]
Date analysed	-			19/02/2020	[NT]	[NT]	[NT]	[NT]	19/02/2020	[NT]
Naphthalene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	84	[NT]
Acenaphthylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	76	[NT]
Phenanthrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	74	[NT]
Anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	70	[NT]
Pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	76	[NT]
Benzo(a)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	97	[NT]
Benzo(bjk)fluoranthene in TCLP	mg/L	0.002	Org-012/017	<0.002	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	94	[NT]
Indeno(1,2,3-c,d)pyrene - TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene in TCLP	mg/L	0.001	Org-012/017	<0.001	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	117	[NT]	[NT]	[NT]	[NT]	121	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236009-A
Date Sample Received	05/02/2020
Date Instructions Received	12/02/2020
Date Results Expected to be Reported	19/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	16 SOIL, 1 WATER
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	12.8
Cooling Method	Ice
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

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

Sample ID	Metals in TCLP USEPA1311	Naphthalene in TCLP	Acenaphthylene in TCLP	Acenaphthene in TCLP	Fluorene in TCLP	Phenanthrene in TCLP	Anthracene in TCLP	Fluoranthene in TCLP	Pyrene in TCLP	Benzo(a)anthracene in TCLP	Chrysene in TCLP	Benzo(bjk)fluoranthene in TCLP	Benzo(a)pyrene in TCLP	Indeno(1,2,3-c,d)pyrene - TCLP	Dibenzo(a,h)anthracene in TCLP	Benzo(g,h,i)perylene in TCLP	Total +vePAH's	Surrogate p-Terphenyl-d14	On Hold
BH6-0-0.1																			✓
BH6-0.3-0.4																			✓
BH7-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BH7-0.2-0.3																			✓
BH8-0-0.1	✓																		
BH8-0.6-0.7	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	
BH8-1.6-1.8																			✓
BH9-0-0.1	✓																		
BH9-0.6-0.7																			✓
BH9-0.8-0.9																			✓
BH10-0-0.1	✓																		
BH10-0.3-0.4																			✓
SDUP5																			✓
SDUP6																			✓
STB1																			✓
STS1																			✓
SFR1																			✓

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

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Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt. Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

Jessica Hie

From: Nick Sarlamis
Sent: Wednesday, 12 February 2020 10:18 AM
To: Anthony Barkway
Cc: Jessica Hie
Subject: RE: JKE - Extra testing request for Registration 236009 E32915BD, Vaucluse

236009-A
Due: 19/2/20
Std TAT

Morning Anthony,

We will get that organized.

Kind Regards,

Nick Sarlamis | Inorganics Supervisor | Envirolab Services Pty Ltd

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

From: Anthony Barkway <ABarkway@jkenvironments.com.au>
Sent: Wednesday, 12 February 2020 10:00 AM
To: Nick Sarlamis <NSarlamis@envirolab.com.au>
Subject: JKE - Extra testing request for Registration 236009 E32915BD, Vaucluse

Hi Nick,

Could I please request extra testing for some of the samples within the above batch as follows:

Sample Number + Depth	Lab Ref:	Tests Required
BH7 0.0-0.1	3	TCLP PAHs
BH8 0.0-0.1	5	TCLP Lead
BH8 0.6-0.7	6	TCLP Lead & TCLP PAHs
BH9 0.0-0.1	8	TCLP Lead
BH10 0.0-0.1	11	TCLP Lead

Thank you!

Kind Regards

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www.envirolab.com.au

CERTIFICATE OF ANALYSIS 236004

Client Details

Client	Environmental Investigation Services
Attention	A Barkway
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E32915BD, Vaucluse**
Number of Samples	2 Water
Date samples received	05/02/2020
Date completed instructions received	05/02/2020

Analysis Details

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

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

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

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

Report Details

Date results requested by	12/02/2020
Date of Issue	12/02/2020

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Results Approved By
Jaimie Loa-Kum-Cheung, Metals Supervisor
Josh Williams, Senior Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Organics Supervisor

Authorised By

Nancy Zhang, Laboratory Manager

VOCs in water		
Our Reference		236004-1
Your Reference	UNITS	MW2
Date Sampled		03/02/2020
Type of sample		Water
Date extracted	-	06/02/2020
Date analysed	-	06/02/2020
Dichlorodifluoromethane	µg/L	<10
Chloromethane	µg/L	<10
Vinyl Chloride	µg/L	<10
Bromomethane	µg/L	<10
Chloroethane	µg/L	<10
Trichlorofluoromethane	µg/L	<10
1,1-Dichloroethene	µg/L	<1
Trans-1,2-dichloroethene	µg/L	<1
1,1-dichloroethane	µg/L	<1
Cis-1,2-dichloroethene	µg/L	<1
Bromochloromethane	µg/L	<1
Chloroform	µg/L	<1
2,2-dichloropropane	µg/L	<1
1,2-dichloroethane	µg/L	<1
1,1,1-trichloroethane	µg/L	<1
1,1-dichloropropene	µg/L	<1
Cyclohexane	µg/L	<1
Carbon tetrachloride	µg/L	<1
Benzene	µg/L	<1
Dibromomethane	µg/L	<1
1,2-dichloropropane	µg/L	<1
Trichloroethene	µg/L	<1
Bromodichloromethane	µg/L	<1
trans-1,3-dichloropropene	µg/L	<1
cis-1,3-dichloropropene	µg/L	<1
1,1,2-trichloroethane	µg/L	<1
Toluene	µg/L	<1
1,3-dichloropropane	µg/L	<1
Dibromochloromethane	µg/L	<1
1,2-dibromoethane	µg/L	<1
Tetrachloroethene	µg/L	<1
1,1,1,2-tetrachloroethane	µg/L	<1
Chlorobenzene	µg/L	<1
Ethylbenzene	µg/L	<1

VOCs in water		
Our Reference		236004-1
Your Reference	UNITS	MW2
Date Sampled		03/02/2020
Type of sample		Water
Bromoform	µg/L	<1
m+p-xylene	µg/L	<2
Styrene	µg/L	<1
1,1,2,2-tetrachloroethane	µg/L	<1
o-xylene	µg/L	<1
1,2,3-trichloropropane	µg/L	<1
Isopropylbenzene	µg/L	<1
Bromobenzene	µg/L	<1
n-propyl benzene	µg/L	<1
2-chlorotoluene	µg/L	<1
4-chlorotoluene	µg/L	<1
1,3,5-trimethyl benzene	µg/L	<1
Tert-butyl benzene	µg/L	<1
1,2,4-trimethyl benzene	µg/L	<1
1,3-dichlorobenzene	µg/L	<1
Sec-butyl benzene	µg/L	<1
1,4-dichlorobenzene	µg/L	<1
4-isopropyl toluene	µg/L	<1
1,2-dichlorobenzene	µg/L	<1
n-butyl benzene	µg/L	<1
1,2-dibromo-3-chloropropane	µg/L	<1
1,2,4-trichlorobenzene	µg/L	<1
Hexachlorobutadiene	µg/L	<1
1,2,3-trichlorobenzene	µg/L	<1
Surrogate Dibromofluoromethane	%	106
Surrogate toluene-d8	%	98
Surrogate 4-BFB	%	109

vTRH(C6-C10)/BTEXN in Water			
Our Reference	UNITS	236004-1	236004-2
Your Reference		MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
TRH C_6 - C_9	µg/L	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10
Benzene	µg/L	<1	<1
Toluene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
m+p-xylene	µg/L	<2	<2
o-xylene	µg/L	<1	<1
Naphthalene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	106	106
Surrogate toluene-d8	%	98	101
Surrogate 4-BFB	%	109	108

svTRH (C10-C40) in Water			
Our Reference		236004-1	236004-2
Your Reference	UNITS	MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	07/02/2020	07/02/2020
TRH C_{10} - C_{14}	µg/L	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	150
TRH C_{29} - C_{36}	µg/L	<100	190
TRH >C_{10} - C_{16}	µg/L	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50
TRH >C_{16} - C_{34}	µg/L	110	290
TRH >C_{34} - C_{40}	µg/L	<100	110
Surrogate o-Terphenyl	%	84	83

PAHs in Water - Low Level			
Our Reference	UNITS	236004-1	236004-2
Your Reference		MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date extracted	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
Naphthalene	µg/L	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	0.3
Acenaphthene	µg/L	<0.1	0.2
Fluorene	µg/L	<0.1	0.3
Phenanthrene	µg/L	0.8	2.9
Anthracene	µg/L	0.2	0.8
Fluoranthene	µg/L	0.9	3.3
Pyrene	µg/L	0.9	3.4
Benzo(a)anthracene	µg/L	0.5	1.9
Chrysene	µg/L	0.5	1.6
Benzo(b,j+k)fluoranthene	µg/L	0.6	2
Benzo(a)pyrene	µg/L	0.4	1.6
Indeno(1,2,3-c,d)pyrene	µg/L	0.2	0.6
Dibenzo(a,h)anthracene	µg/L	<0.1	0.2
Benzo(g,h,i)perylene	µg/L	0.2	0.6
Benzo(a)pyrene TEQ	µg/L	<0.5	2.2
Total +ve PAH's	µg/L	5.0	20
Surrogate p-Terphenyl-d14	%	84	84

HM in water - dissolved			
Our Reference	UNITS	236004-1	236004-2
Your Reference		MW2	WDUP1
Date Sampled		03/02/2020	03/02/2020
Type of sample		Water	Water
Date prepared	-	06/02/2020	06/02/2020
Date analysed	-	06/02/2020	06/02/2020
Arsenic-Dissolved	µg/L	<1	<1
Cadmium-Dissolved	µg/L	<0.1	<0.1
Chromium-Dissolved	µg/L	6	6
Copper-Dissolved	µg/L	<1	1
Lead-Dissolved	µg/L	1	1
Mercury-Dissolved	µg/L	<0.05	<0.05
Nickel-Dissolved	µg/L	3	3
Zinc-Dissolved	µg/L	19	21

Miscellaneous Inorganics		
Our Reference	UNITS	236004-1
Your Reference		MW2
Date Sampled		03/02/2020
Type of sample		Water
Date prepared	-	05/02/2020
Date analysed	-	05/02/2020
pH	pH Units	6.1
Electrical Conductivity	µS/cm	450

Cations in water Dissolved		
Our Reference		236004-1
Your Reference	UNITS	MW2
Date Sampled		03/02/2020
Type of sample		Water
Date digested	-	06/02/2020
Date analysed	-	06/02/2020
Calcium - Dissolved	mg/L	50
Magnesium - Dissolved	mg/L	3.6
Hardness	mgCaCO 3 /L	140

Method ID	Methodology Summary
Inorg-001	pH - Measured using pH meter and electrode in accordance with APHA latest edition, 4500-H+. Please note that the results for water analyses are indicative only, as analysis outside of the APHA storage times.
Inorg-002	Conductivity and Salinity - measured using a conductivity cell at 25°C in accordance with APHA latest edition 2510 and Rayment & Lyons.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Metals-022	Determination of various metals by ICP-MS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-012/017	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-013	Water samples are analysed directly by purge and trap GC-MS.
Org-016	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Date analysed	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Dichlorodifluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Bromomethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Chloroethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-013	<10	1	<10	<10	0	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	82	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chloroform	µg/L	1	Org-013	<1	1	<1	<1	0	84	[NT]
2,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	82	[NT]
1,1,1-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	81	[NT]
1,1-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Cyclohexane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromomethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Trichloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	86	[NT]
Bromodichloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	73	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-013	<1	1	<1	<1	0	71	[NT]
1,2-dibromoethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-013	<1	1	<1	<1	0	84	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromoform	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
m+p-xylene	µg/L	2	Org-013	<2	1	<2	<2	0	[NT]	[NT]
Styrene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
o-xylene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Bromobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-013	99	1	106	99	7	97	[NT]
Surrogate toluene-d8	%		Org-013	98	1	98	100	2	100	[NT]
Surrogate 4-BFB	%		Org-013	105	1	109	105	4	97	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
Date analysed	-			06/02/2020	1	06/02/2020	07/02/2020		06/02/2020	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	1	<10	<10	0	82	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	1	<10	<10	0	82	[NT]
Benzene	µg/L	1	Org-016	<1	1	<1	<1	0	81	[NT]
Toluene	µg/L	1	Org-016	<1	1	<1	<1	0	86	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	1	<1	<1	0	78	[NT]
m+p-xylene	µg/L	2	Org-016	<2	1	<2	<2	0	82	[NT]
o-xylene	µg/L	1	Org-016	<1	1	<1	<1	0	79	[NT]
Naphthalene	µg/L	1	Org-013	<1	1	<1	<1	0	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	99	1	106	99	7	97	[NT]
Surrogate toluene-d8	%		Org-016	98	1	98	100	2	100	[NT]
Surrogate 4-BFB	%		Org-016	105	1	109	105	4	97	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	[NT]
Date analysed	-			07/02/2020	1	07/02/2020	07/02/2020		07/02/2020	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	1	<50	<50	0	104	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	1	<100	<100	0	105	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	1	<100	<100	0	114	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	1	<50	<50	0	104	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	1	110	100	10	105	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	1	<100	<100	0	114	[NT]
Surrogate o-Terphenyl	%		Org-003	83	1	84	78	7	114	[NT]

QUALITY CONTROL: PAHs in Water - Low Level						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	236004-2
Date extracted	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Naphthalene	µg/L	0.2	Org-012/017	<0.2	1	<0.2	<0.2	0	108	80
Acenaphthylene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	98	72
Phenanthrene	µg/L	0.1	Org-012/017	<0.1	1	0.8	0.8	0	96	#
Anthracene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.3	40	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012/017	<0.1	1	0.9	0.9	0	96	62
Pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.9	0.9	0	100	64
Benzo(a)anthracene	µg/L	0.1	Org-012/017	<0.1	1	0.5	0.5	0	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012/017	<0.1	1	0.5	0.5	0	110	74
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012/017	<0.2	1	0.6	0.6	0	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.4	0.5	22	78	#
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.2	0	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012/017	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012/017	<0.1	1	0.2	0.2	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012/017	82	1	84	80	5	90	77

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	236004-2
Date prepared	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Date analysed	-			06/02/2020	1	06/02/2020	06/02/2020		06/02/2020	06/02/2020
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	94	95
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	<0.1	0	103	102
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	6	6	0	101	101
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	<1	0	101	98
Lead-Dissolved	µg/L	1	Metals-022	<1	1	1	1	0	105	102
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	100	97
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	3	3	0	99	98
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	19	20	5	99	101

QUALITY CONTROL: Miscellaneous Inorganics						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
Date analysed	-			05/02/2020	[NT]	[NT]	[NT]	[NT]	05/02/2020	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	103	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]

QUALITY CONTROL: Cations in water Dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Date analysed	-			06/02/2020	[NT]	[NT]	[NT]	[NT]	06/02/2020	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	107	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

PAHs in Water - Low Level - # Percent recovery for the matrix spike is not possible to report as the high concentration of analytes in sample 236004-2 have caused interference.

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

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

SAMPLE RECEIPT ADVICE

Client Details

Client	Environmental Investigation Services
Attention	A Barkway

Sample Login Details

Your reference	E32915BD, Vaucluse
Envirolab Reference	236004
Date Sample Received	05/02/2020
Date Instructions Received	05/02/2020
Date Results Expected to be Reported	12/02/2020

Sample Condition

Samples received in appropriate condition for analysis	Holding time exceedance
No. of Samples Provided	2 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	9.6
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Holding time exceedance - pH

Please contact the laboratory within 24 hours if you wish to cancel the aformentioned testing. Otherwise testing will proceed as per the COC and hence invoice accordingly.

Please direct any queries to:

Aileen Hie	Jacinta Hurst
Phone: 02 9910 6200	**Phone: 02 9910 6200**
Fax: 02 9910 6201	**Fax: 02 9910 6201**
Email: ahie@envirolab.com.au	**Email: jhurst@envirolab.com.au**

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
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12 Ashley St Chatswood NSW 2067
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Sample ID	VOCs in water	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHs in Water - Low Level	HM in water - dissolved	pH	Electrical Conductivity	Cations in water Dissolved
MW2	✓	✓	✓	✓	✓	✓	✓	✓
WDUP1		✓	✓	✓	✓			

The '✓' indicates the testing you have requested. **THIS IS NOT A REPORT OF THE RESULTS.**

Additional Info

Sample storage - Waters are routinely disposed of approximately 1 month and soils approximately 2 months from receipt.
Requests for longer term sample storage must be received in writing.
Please contact the laboratory immediately if observed settled sediment present in water samples is to be included in the extraction and/or analysis (exceptions include certain Physical Tests (pH/EC/BOD/COD/Apparent Colour etc.), Solids testing, Total Recoverable metals and PFAS analysis where solids are included by default.
TAT for Micro is dependent on incubation. This varies from 3 to 6 days.

SAMPLE AND CHAIN OF CUSTODY FORM

TO: **ENVIROLAB SERVICES PTY LTD** **12 ASHLEY STREET** **CHATSWOOD NSW 2067** **P: (02) 99106200** **F: (02) 99106201** **Attention: Aileen**	**EIS Job Number:** E32915BD **Date Results Required:** STANDARD **Page:** 1 of 1	**FROM:** JKEnvironments **REAR OF 115 WICKS ROAD** **MACQUARIE PARK, NSW 2113** **P: 02-9888 5000 F: 02-9888 5001** **Attention:** abarkaway@jkenvironments.com.au

Location:	Vaucluse
Sampler:	MMP

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Sample Containers	PID	Sample Description		Combo 3L	VOCs	pH / EC	Hardness							
3.2.20	1	MW2	2x G1, 4xV, 1xH, 1xPVC	1.2	Water		X	X	X	X							
3.2.20	2	WDUP1	2x G1, 4xV, 1xH, 1xPVC	-	Water		X										

ENVIROLAB Envirolab Services 12 Ashley St Chatswood NSW 2067 Ph: (02) 9910 6200
Job No: 236009
Date Received: 5-02-2020
Time Received: 12:45
Received By: TC
Temp: Cool/Ambient
Cooling: Ice/Icepack
Security: Intact/Broken/None

Remarks (comments/detection limits required):

All analysis PQLs to ANZECC (2000) Detection Limits Please

Sample Containers:
G1 - 500mL Amber Glass Bottle G2 - 1L Amber Glass Bottle
V - BTEX Vial H - HNO3 Wash PVC
PVC - HDPE Plastic Bottles

Relinquished By: Anthony Barkway	**Date:** 05.02.2020	**Time:**	**Received By:** ELS Trinidad Canales.	**Date:** 5-02-2020 12:45

Appendix D: Guidelines and Reference Documents

Contaminated Land Management Act 1997 (NSW)

Conveyancing Act (1919) (NSW).

Environmental Planning and Assessment Act 1979 (NSW)

Managing Land Contamination, Planning Guidelines SEPP55 – Remediation of Land (1998)

NSW EPA, (2015). Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997

NSW EPA, (2017). Guidelines for the NSW Site Auditor Scheme, 3rd Edition

NSW EPA, (2020). Consultants Reporting on Contaminated Land, Contaminated Land Guidelines

National Environment Protection Council (NEPC), (2013). National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)

Protection of the Environment Operations Act 1997 (NSW)

State Environmental Planning Policy No.55 – Remediation of Land 1998 (NSW)