ENVIRONMENTAL INVESTIGATION SERVICES

REPORT

TO

TUNBORN PTY LTD

ON

STAGE 2 ENVIRONMENTAL SITE ASSESSMENT

FOR

PROPOSED HOTEL REDEVELOPMENT

AT

187 SLADE ROAD, BEXLEY NORTH

19 MARCH 2018 **REF: E30293KHrpt2**

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EXECUTIVE SUMMARY

Nexus Project Delivery, on behalf of Tunborn Pty Ltd (‘the client’), commissioned Environmental Investigation Services (EIS) to undertake a Stage 2 Environmental Site Assessment (ESA) for the proposed hotel redevelopment at 187 Slade Road, Bexley North (‘the site’).

The ESA included a review of a previous Stage 1 ESA, walkover site inspection, soil sampling from six locations and groundwater sampling from two locations.

At the time of the inspection, the majority of site was occupied by a hotel building, with a semi-detached motel style accommodation building and a drive-thru bottle shop.

The historical assessment indicated the following potential site uses:
- Pre-1953 - Vacant with possible poultry farming;
- 1950’s - Development of the site occurred; and
- At least 1961 to present the site has been occupied by the existing Hotel.

Based on the scope of work undertaken for this assessment, EIS identified the following potential contamination sources/AEC:
- Fill material;
- Historical agricultural use (poultry farm);
- Use of pesticides;
- Hazardous Building Material;
- Two service stations were located approximately 75m and 150m up-gradient (south-west) of the site; and
- A former dry cleaners was located less than 50m to the south of the site.

Fill was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.3m to 6.5m. Fill was typically shallower than 1.6m, with the exception of BH102. A fibre-cement sheeting fragment was encountered in the fill material in BH101.

The fill was underlain by natural soil and sandstone bedrock.

Asbestos was encountered in the form of a FCF in the fill material in BH101. The source of the asbestos is considered likely to be the fill material, which may have been imported onto the site. In the present site configuration, the asbestos contamination presents a very low risk to site occupants as it is beneath a concrete pavement. The risk would increase if the pavement was removed and especially during excavation works.

Based on the results of the assessment, and at the time of reporting, the fill material in the vicinity of BH101 is classified as General Solid Waste (non-putrescible) containing Special Waste (asbestos). The fill material across the remainder of the site may be classified as General Solid Waste (non-putrescible) subject to further assessment to better assess the extent of the asbestos impacted material.

EIS are of the opinion that the natural soil and bedrock at the site meets the definition of VENM for off-site disposal or re-use purposes.

Asbestos was encountered in fill material in the north-west section of the site. At this stage further investigation, to better assess the extent of the contamination, is not possible due to the physical constraints of the site. It may be possible to undertake further investigation following demolition of the buildings at the site, however, this would likely result in significant delays to the project. Based on our experience, where asbestos is encountered in a discrete location in fill material by drilling boreholes, further, asbestos is usually encountered during excavation works. EIS consider that the most cost and time effective approach would be to take a conservative view of the contamination and assume that all fill material at the site is impacted by asbestos.

Based on the above, EIS make the following recommendations:

- A Remedial Action Plan (RAP) should be prepared outlining procedures to be undertaken during each stage of development/excavation, with respect to the asbestos contamination;
- A validation assessment should be undertaken on completion of remediation at each development stage; and
- An unexpected finds protocol should be implemented during excavation works at the site.

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

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ABBREVIATIONS

Asbestos Fines/Fibrous Asbestos	**AF/FA**
Ambient Background Concentrations	**ABC**
Added Contaminant Limits	**ACL**
Asbestos Containing Material	**ACM**
Australian Drinking Water Guidelines	**ADWG**
Area of Environmental Concern	**AEC**
Australian Height Datum	**AHD**
Acid Sulfate Soil	**ASS**
Above-Ground Storage Tank	**AST**
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**
Contaminant(s) of Potential Concern	**CoPC**
Chain of Custody	**COC**
Conceptual Site Model	**CSM**
Development Application	**DA**
Data Quality Indicator	**DQI**
Data Quality Objective	**DQO**
Detailed Site Investigation	**DSI**
Ecological Investigation Level	**EIL**
Environmental Investigation Services	**EIS**
Ecological Screening Level	**ESL**
Environmental Management Plan	**EMP**
Excavated Natural Material	**ENM**
Environment Protection Authority	**EPA**
Environmental Site Assessment	**ESA**
Ecological Screening Level	**ESL**
Fibre Cement Fragment(s)	**FCF**
General Approval of Immobilisation	**GAI**
Health Investigation Level	**HILs**
Hardness Modified Trigger Values	**HMTV**
Health Screening Level	**HSLs**
International Organisation of Standardisation	**ISO**
Lab Control Spike	**LCS**
Light Non-Aqueous Phase Liquid	**LNAPL**
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**
Potential ASS	**PASS**
Polychlorinated Biphenyls	**PCBs**

ABBREVIATIONS

Photo-ionisation Detector	**PID**
Protection of the Environment Operations	**POEO**
Practical Quantitation Limit	**PQL**
Quality Assurance	**QA**
Quality Control	**QC**
Remediation Action Plan	**RAP**
Relative Percentage Difference	**RPD**
Site Assessment Criteria	**SAC**
Sampling, Analysis and Quality Plan	**SAQP**
Site Audit Statement	**SAS**
Site Audit Report	**SAR**
Site Specific Assessment	**SSA**
Source, Pathway, Receptor	**SPR**
Specific Contamination Concentration	**SCC**
Standard Penetration Test	**SPT**
Standard Sampling Procedure	**SSP**
Standing Water Level	**SWL**
Trip Blank	**TB**
Toxicity Characteristic Leaching Procedure	**TCLP**
Total Recoverable Hydrocarbons	**TRH**
Trip Spike	**TS**
Upper Confidence Limit	**UCL**
United States Environmental Protection Agency	**USEPA**
Underground Storage Tank	**UST**
Virgin Excavated Natural Material	**VENM**
Volatile Organic Compounds	**VOC**
World Health Organisation	**WHO**
Work Health and Safety	**WHS**

Units

Litres	**L**
Metres BGL	**mBGL**
Metres	**m**
Millivolts	**mV**
Millilitres	**ml or mL**
Milliequivalents	**meq**
micro Siemens per Centimetre	**µS/cm**
Micrograms per Litre	**µg/L**
Milligrams per Kilogram	**mg/kg**
Milligrams per Litre	**mg/L**
Parts Per Million	**ppm**
Percentage	**%**

1 INTRODUCTION

Nexus Project Delivery, on behalf of Tunborn Pty Ltd ('the client'), commissioned Environmental Investigation Services (EIS)[1] to undertake a Stage 2 Environmental Site Assessment (ESA) for the proposed hotel redevelopment at 187 Slade Road, Bexley North ('the site'). The site location is shown on Figure 1 and the assessment was confined to the site boundaries as shown on Figure 2.

A geotechnical investigation was undertaken previously to with this assessment by JK Geotechnics[2]. The results of the investigation are presented in a separate report (Ref. 30293ZRrpt2-rev1, dated 25 September 2017[3]). This report should be read in conjunction with the JK report.

EIS have previously undertaken a Stage 1 (desktop) assessment at the site. A summary of this information has been included in Section 2.

1.1 Proposed Development Details

Based on a review of the provided information, we understand that a staged mixed use development is proposed, including:

- Stage 1: retention of existing pub and bottle store, and demolition of the southern portion of the existing hotel and existing motel over the eastern side of the site. New construction of a new six level hotel over the southern portion of the site and a new eight level residential apartment block over the eastern side of the site. The new hotel and apartment block will also include retail ground floor levels. The new buildings will be constructed over two and three levels of basement car park with a finished floor reduced level (RL) for the lower car park levels B2 and B3 at RL7.76m and RL4.46m, respectively. Excavations to depths between about 4.5m and 8.5m will be required to achieve design subgrade levels;
- Stage 2: demolish the existing pub and construction of a two storey pub and two storey apartment building over two basement car park levels. No further details have been provided at the time of preparing this report;
- The basement retention system will comprise an anchored or propped secant pile wall formed using 0.6m diameter piles; and
- The proposed twin Westconnex Tunnels will extend below the northern portion of the site in an east-west direction. The tunnel invert levels will be at approximately RL -16.6m and the upper limit of the Westconnex Tunnels acquisition zone will be 16m below existing ground level.

1.2 Aims and Objectives

The primary aims of the assessment were to identify any past or present potentially contaminating activities at the site, identify the potential for site contamination, and make a preliminary assessment of the soil and groundwater contamination conditions. The assessment objectives were to:

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[1] Environmental consulting division of Jeffery & Katauskas Pty Ltd (J&K)

[2] Geotechnical consulting division of J&K

[3] Referred to as JK Geotechnics (2017)

- Provide an appraisal of the past site use(s) based on a review of historical records;
- Assess the current site conditions and use(s) via a site walkover inspection;
- Identify potential contamination sources/areas of environmental concern (AEC) and contaminants of potential concern (CoPC);
- Assess the soil and groundwater contamination conditions via implementation of a preliminary sampling and analysis program;
- Prepare a conceptual site model (CSM);
- Assess the potential risks posed by contamination to the receptors identified in the CSM (Tier 1 assessment);
- Provide a preliminary waste classification for off-site disposal of soil;
- Assess whether the site is suitable or can be made suitable for the proposed development (from a contamination viewpoint); and
- Assess whether further intrusive investigation and/or remediation is required.

1.3 Scope of Work

The assessment was undertaken generally in accordance with an EIS proposal (Ref: EP46436KH) of 16 January 2018 and written acceptance from Nexus Project Delivery, on behalf of the client, of 18 January 2018. The scope of work included the following:

- Review of site information, including background and site history information from a Lotsearch Pty Ltd *Environmental Risk and Planning Report* and other sources;
- Preparation of a CSM;
- Design and implementation of a sampling, analysis and quality plan (SAQP);
- Interpretation of the analytical results against the adopted Site Assessment Criteria (SAC);
- Data Quality Assessment; and
- Preparation of a report including a Tier 1 risk assessment.

The scope of work was undertaken with reference to the National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)[4], other guidelines made under or with regards to the Contaminated Land Management Act (1997)[5] and State Environmental Planning Policy No.55 – Remediation of Land (1998)[6]. A list of reference documents/guidelines is included in the appendices.

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

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

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

2 SITE INFORMATION

2.1 Background

2.1.1 Stage 1 Preliminary Environmental Site Assessment

The Stage 1 Preliminary ESA (ref: E30293KHrpt) included a walkover site inspection and review of historical information.

At the time of the inspection, the majority of site was occupied by a hotel building, with a semi-detached motel style accommodation building and a drive-thru bottle shop.

The historical assessment indicated the following potential site uses:

- Pre-1953 - Vacant with possible poultry farming;
- 1950's - Development of the site occurred; and
- At least 1961 to present the site has been occupied by the existing Hotel.

Based on the scope of work undertaken for this assessment, EIS identified the following potential contamination sources/AEC:

- Fill material;
- Historical agricultural use (poultry farm);
- Use of pesticides;
- Hazardous Building Material;
- Two service stations were located approximately 75m and 150m up-gradient (south-west) of the site; and
- A former dry cleaners was located less than 50m to the south of the site.

Considering the above, and based on a qualitative assessment of various lines of evidence as discussed throughout this report, EIS were of the opinion that there is a moderate potential for site contamination.

Based on the potential contamination sources/AEC identified, and the perceived potential for contamination, further investigation of the contamination conditions was considered to be required.

Based on the scope of work undertaken for the assessment, EIS were of the opinion that the historical land uses and potential sources of contamination identified would not preclude the proposed development. However, the following was recommended to better assess the risks associated with the CoPC:

- A preliminary intrusive investigation should be undertaken to make an assessment of the soil and groundwater contamination conditions; and
- A hazardous building materials survey should be undertaken prior to demolition/alteration of the buildings. Following any demolition/removal works (and preferably prior to removal of the hardstand), an asbestos clearance certificate should be provided.

2.1.2 JK Geotechnical Investigation

The geotechnical investigation included drilling of five boreholes and installation of three groundwater wells. The boreholes encountered fill material to depths of approximately 0.2m to 4.75m, overlying natural clays and sandstone bedrock. The deep fill was encountered in the central-north section of the site.

2.2 Site Identification

Table 2-1: Site Identification

Current Site Owner:	Tunborn Pty Ltd
Site Address:	187 Slade Road, Bexley North
Lot & Deposited Plan:	Lot 30 DP 1222252
Current Land Use:	Commercial
Proposed Land Use:	Commercial/Residential
Local Government Authority:	Bayside Council
Current Zoning:	B4 Mixed Use
Site Area (m^2):	4,300
RL (AHD in m) (approx.):	10
Geographical Location (decimal degrees) (approx.):	Latitude: -33.9381 Longitude: 151.1152
Site Location Plan:	Figure 1
Sample Location Plan:	Figure 2

2.3 Site Location and Regional Setting

The site is located in a mixed residential and commercial area of Bexley North. The site is located in a depression and the regional topography generally falls to the north, north-east and north-west at approximately 2-3°. The area north of the site falls to the east and west towards a gully feature at approximately 1-2°.

The site itself generally falls to the north at approximately 2-3°, however steeper areas were observed in the south-east section of the site. Parts of the site appear to have been levelled to account for the slope and accommodate the existing development.

2.4 Site Inspection

A walkover inspection of the site was undertaken by EIS on 3 April 2017. The inspection was limited to accessible areas of the site and immediate surrounds. An internal inspection of buildings was not undertaken

At the time of the inspection, the majority of site was occupied by a hotel building, with a semi-detached motel style accommodation building and a drive-thru bottle shop.

A summary of the other inspection findings are outlined in the following subsections:

2.4.1 Buildings, Structures and Roads

The majority of the site was occupied by a single storey concrete hotel building with a basement cellar. A concrete clad bottle shop building extended from the north end of the hotel building.

A split level, brick accommodation building was located in the east section of the site. The building included a reception area at the south end with a possible laundry beneath. An undercroft car park extended beneath the majority of the building.

2.4.2 Boundary Conditions, Soil Stability and Erosion

Brick retaining walls up to approximately 1.2m high, were observed in the east section of the site. The walls retained a grass embankment in the south-east section of the site and extended parallel with the east site boundary. An additional wall retained the hotel level above the undercroft car park.

2.4.3 Visible or Olfactory Indicators of Contamination

No obvious visual indicators of contamination were observed at the site.

2.4.4 Presence of Drums/Chemicals, Waste and Fill Material

No chemicals or waste were observed stored on the site.

The most obvious signs of potential fill was the presence of the retaining walls in the east section of the site. It is not clear if these were created from cut or fill works.

2.4.5 Drainage and Services

Stormwater pits were observed in the undercroft car park and in the driveway for the bottle shop. The remainder of the site was either covered by buildings or grassed.

2.4.6 Sensitive Environments

Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified on site or in the immediate surrounds.

2.4.7 Landscaped Areas and Visible Signs of Plant Stress

Some small trees were observed adjacent to the motel building and a grassed area was observed in the south-east section of the site. No visible signs of vegetation stress were observed.

2.5 Surrounding Land Use

During the site inspection, EIS observed the following land uses in the immediate surrounds:

- North – Multi-storey residential buildings, with the railway corridor beyond.
- South – retail areas including commercial office space, restaurants, a bakery and TAB. A medical centre was located to the south-west of the retail area and included residential apartments above it.
- East – A residential area that included houses to the east and multi-storey apartment buildings to the south-east.
- West – an on-grade asphaltic concrete paved car park that extended to Bexley Road. A retail area was located west of Bexley Road that included restaurants, fast food and a massage parlour.

EIS did not observe any land uses in the immediate surrounds that were identified as potential contamination sources for the site.

2.6 Underground Services

The ‘Dial Before You Dig’ (DBYD) plans were reviewed for the assessment in order to establish whether any major underground services exist at the site or in the immediate vicinity that could act as a preferential pathway for contamination migration. No major services were identified that would be expected to act as preferential pathways for contamination migration.

2.7 Section 149 Planning Certificate

The s149 (2 and 5) planning certificates were reviewed for the assessment. Copies of the certificates are attached in the appendices. A summary of the relevant information is outlined below:

- The site is not located in an area of ecological significance;

- The site is not deemed to be: significantly contaminated; subject to a management order; subject of an approved voluntary management proposal; or subject to an on-going management order under the provisions of the CLM Act 1997;
- The site is not subject to a Site Audit Statement (SAS);
- The site is not located within an ASS risk area; and
- The site is not located in a heritage conservation area.

3 GEOLOGY AND HYDROGEOLOGY

3.1 Regional Geology

Regional geological information presented in the Lotsearch report (attached in the appendices) 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.

3.2 Acid Sulfate Soil 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.

3.3 Hydrogeology

Hydrogeological information presented in the Lotsearch report (attached in the appendices) indicated that the regional aquifer on-site and in the areas immediately surrounding the site includes porous, extensive aquifers of low to moderate productivity. There were a total of 15 registered bores within the report buffer of 2,000m. In summary:

- The nearest registered bore was located approximately 516m from the site. This was utilised for recreation purposes;
- The majority of the bores were registered for monitoring purposes;
- There were no nearby bores (i.e. within 500m) registered for domestic or irrigation uses; and
- The drillers log information from the closest registered bore identified fill and/or clay soil to depths of 4m, underlain by sandstone bedrock. The Standing Water Level (SWL) in the closest bore was 93mBGL.

The information reviewed for this assessment indicated that the subsurface conditions at the site are likely to consist of residual soils overlying relatively shallow bedrock. The potential for viable groundwater abstraction and use of groundwater under these conditions is considered to be low. Use of groundwater is not proposed as part of the development.

Considering the local topography and surrounding land features, EIS would generally expect groundwater to flow towards the north.

3.4 Receiving Water Bodies

Surface water bodies were not identified in the immediate vicinity of the site. The closest surface water body is Wolli Creek located approximately 150m to the north of the site. This may be a potential receptor, however the railway corridor located to the north of the site is in a cutting. This may restrict groundwater flow to the north.

5 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 site information (including the site inspection information) and the review of site history information. Reference should also be made to the figures attached in the appendices.

A review of the CSM in relation to source, pathway and receptor (SPR) linkages has been undertaken as part of the Tier 1 risk assessment process, as outlined in Section 10.

5.1 Potential Contamination Sources/AEC and CoPC

The potential contamination sources/AEC and CoPC are presented in the following table:

Table 5-1: 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.
Historical agricultural use – The site may have been used as a poultry farm This could have resulted in contamination across the site via use of machinery, application of pesticides and building/demolition of various structures. Asbestos pipes may also be present for irrigation purposes.	Heavy metals, TRH, PAHs, OCPs, PCBs and asbestos
Use of pesticides – Pesticides may have been used beneath the buildings and/or around the site.	Heavy metals, OCPs and OPPs
Hazardous Building Material – Hazardous building materials may be present in the existing buildings/ structures on site.	Asbestos, lead and PCBs
Off-site area 1 – Two service stations were located approximately 75m and 150m up-gradient of the site and are considered to be a potential source of contamination.	Heavy metals (lead), TRH and BTEX

Source / AEC	**CoPC**
Dry Cleaners – a former dry cleaners was located less than 50m to the south of the site	TRHs and VOCs, including tetrachloroethene (also known as perchloroethylene - PCE) and the breakdown products trichloroethene (TCE), cis-1,2-dichloroethene (cis-DCE) and vinyl chloride (VC).

5.2 Mechanism for Contamination, Affected Media, Receptors and Exposure Pathways

The mechanisms for contamination, affected media, receptors and exposure pathways relevant to the potential contamination sources/AEC are outlined in the following CSM table:

Table 5-2: CSM

Potential mechanism for contamination	Potential mechanisms for contamination include: • Fill material – importation of impacted material, 'top-down' impacts (e.g. leaching from surficial material), or sub-surface release (e.g. impacts from buried material); • Historical agricultural use – 'top-down' and spills (e.g. application of pesticides, refuelling or repairing machinery, and other activities at the ground surface level); • Use of pesticides – 'top-down' and spills (e.g. during normal use, application and/or improper storage); • Hazardous building materials – 'top-down' (e.g. demolition resulting in surficial impacts in unpaved areas); and • Off-site land uses – 'top-down', spill or sub-surface release. Impacts to the site could occur via migration of contaminated groundwater.
Affected media	Soil/soil vapour and groundwater have been identified as potentially affected media.
Receptor identification	Human receptors include site occupants/users, construction workers and intrusive maintenance workers. Off-site human receptors include adjacent land users, groundwater users and recreational water users within Wolli Creek. Ecological receptors include terrestrial organisms and plants within unpaved areas (including the proposed landscaped areas), and freshwater ecology in Wolli Creek (low risk).
Potential exposure pathways	Potential exposure pathways relevant to the human receptors include ingestion, dermal absorption and inhalation of dust (all contaminants) and vapours (volatile TRH, naphthalene and BTEX). The potential for exposure would typically be associated with the construction and excavation works, and use of unpaved areas (i.e. the gardens) and basement (i.e. vapour inhalation or incidental contact with groundwater seepage).

	Potential exposure pathways for ecological receptors include primary contact and ingestion. Exposure to groundwater is unlikely to occur in Wolli Creek through direct migration, however groundwater has the potential to enter the creek via the stormwater system (which may discharge into the creek) in a drained basement scenario.
Potential exposure mechanisms	The following have been identified as potential exposure mechanisms for site contamination: • Vapour intrusion into the proposed basement and/or building (either from soil contamination or volatilisation of contaminants from groundwater); • Contact (dermal, ingestion or inhalation) with exposed soils in landscaped areas and/or unpaved areas; • Migration of groundwater off-site and into nearby water bodies, including aquatic ecosystems and those being used for recreation; and • Migration of groundwater off-site into areas where groundwater is being utilised as a resource (i.e. for irrigation).
Presence of preferential pathways for contaminant movement	No obvious preferential pathways for contamination for observed at the site. The deep fill encountered in the central-north section of the site during the geotechnical investigation may represent a preferential pathway.

6 SAMPLING, ANALYSIS AND QUALITY PLAN

6.1 Data Quality Objectives (DQO)

Data Quality Objectives (DQOs) were developed to define the type and quality of data required to achieve the project objectives outlined in Section 1.2. The DQOs were prepared with reference to the process outlined in Schedule B2 of NEPM (2013) and the Guidelines for the NSW Site Auditor Scheme, 3rd Edition (2017)[7]. The seven-step DQO approach for this project is outlined in the following sub-sections.

The DQO process is validated in part by the Data Quality Assurance/Quality Control (QA/QC) Evaluation. The Data (QA/QC) Evaluation is summarised in Section 8.1 and the detailed evaluation is provided in the appendices.

6.1.1 Step 1 - State the Problem

The CSM identified potential sources of contamination/AEC at the site that may pose a risk to human health and the environment. Investigation data is required to assess the contamination status of the site, assess the risks posed by the contaminants in the context of the proposed development/intended land use, and assess whether remediation is required. This information will be considered by the consent authority in exercising its planning functions in relation to the development proposal.

A waste classification is required prior to off-site disposal of excavated soil/bedrock.

The investigation was subject to access constraints associated with the existing hotel buildings at the site.

6.1.2 Step 2 - Identify the Decisions of the Study

The objectives of the assessment are outlined in Section 1.2. The decisions to be made reflect these objectives and are as follows:

- Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?
- Are any results above the SAC?
- Do potential risks associated with contamination exist, and if so, what are they?
- Is remediation required?
- Is the site characterisation sufficient to provide adequate confidence in the above decisions?
- Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

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

6.1.3 Step 3 - Identify Information Inputs

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

- Existing relevant environmental data from previous reports;
- Site information, including site observations and site history documentation;
- Sampling of potentially affected media, including soil and groundwater;
- Observations of sub-surface variables such as soil type, photo-ionisation detector (PID) concentrations, odours and staining, and groundwater physiochemical parameters;
- Laboratory analysis of soils, fibre-cement and groundwater for the CoPC identified in the CSM; and
- Field and laboratory QA/QC data.

6.1.4 Step 4 - Define the Study Boundary

The sampling will be confined to the site boundaries as shown in Figure 2 (spatial boundary). The sampling was completed on 7 and 15 February 2018 (temporal boundary). The assessment of potential risk to adjacent land users has been made based on data collected within the site boundary.

Sampling was not undertaken within the existing building footprint due to access constraints.

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

6.1.5.1 Tier 1 Screening Criteria

The laboratory data will be assessed against relevant Tier 1 screening criteria (referred to as SAC), as outlined in Section 7. Exceedances of the SAC do not necessarily indicate a requirement for remediation or a risk to human health and/or the environment. Exceedances are considered in the context of the CSM and valid SPR-linkages.

For this assessment, the individual results have been assessed as either above or below the SAC. Statistical evaluation of the dataset via calculation of mean values and/or 95% upper confidence limit (UCL) values has not been undertaken due to the spatial distribution of the data and the number of samples submitted for analysis.

6.1.5.2 Field and Laboratory QA/QC

Field QA/QC included analysis of intra-laboratory duplicates, trip spike and trip blank samples. Further details regarding the sampling and analysis undertaken, and the acceptable limits adopted, is provided in the Data Quality (QA/QC) Evaluation in the appendices.

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the attached laboratory reports. These criteria were developed and implemented in accordance with the laboratory's National Association of Testing Authorities, Australia (NATA) accreditation and align with the acceptable limits for QA/QC samples as outlined in NEPM (2013) and other relevant guidelines.

In the event that acceptable limits are not met by the laboratory analysis, other lines of evidence are reviewed (e.g. field observations of samples, preservation, handling etc) and, where required, consultation with the laboratory is undertaken in an effort to establish the cause of the non-conformance. Where uncertainty exists, EIS typically adopt the most conservative concentration reported (or in some cases, consider the data from the affected sample as an estimate).

6.1.5.3 Appropriateness of Practical Quantitation Limits (PQLs)

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

6.1.6 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 undertaken with reference to Schedule B(3) of NEPM (2013) using the data quality assurance information collected.

Decision errors can be controlled through the use of hypothesis testing. The test can be used to show either that the baseline condition is false or that there is insufficient evidence to indicate that the baseline condition is false. The null hypothesis is an assumption that is assumed to be true in the absence of contrary evidence. For this assessment, the null hypothesis has been adopted which is that, there is considered to be a complete SPR linkage for the CoPC identified in the CSM unless this linkage can be proven not to (or unlikely to) exist. The null hypothesis has been adopted for this assessment.

6.1.7 Step 7 - Optimise the Design for Obtaining Data

The most resource-effective design will be used in an optimum manner to achieve the assessment objectives. Adjustment of the assessment design can occur following consultation or feedback from project stakeholders. For this investigation, the design was optimised via consideration of the various lines of evidence used to select the sample locations, the media being sampled, and also by the way in which the data were collected.

The sampling plan and methodology are outlined in the following sub-sections.

6.2 Soil Sampling Plan and Methodology

The soil sampling plan and methodology adopted for this assessment is outlined in the table below:

Table 6-1: Soil Sampling Plan and Methodology

Aspect	Input
Sampling Density	Samples were collected from six locations as shown on the attached Figure 2. Based on the site area (4,300m^2), this number of locations corresponded to a sampling density of approximately one sample per 700m^2. The sampling plan was not designed to meet the minimum sampling density for hotspot identification, as outlined in the NSW EPA Contaminated Sites Sampling Design Guidelines (1995)[8].
Sampling Plan	The sampling locations were placed on a judgemental sampling plan and were broadly positioned for site coverage, taking into consideration areas that were not easily accessible. This sampling plan was considered suitable to make a preliminary assessment of potential risks associated with the AEC and CoPC identified in the CSM, and assess whether further investigation is warranted.
Set-out and Sampling Equipment	Sampling locations were set out using a tape measure. In-situ sampling locations were cleared for underground services by an external contractor prior to sampling as outlined in the SSP. Samples were collected using a drill rig equipped with spiral flight augers. Soil samples were obtained from a Standard Penetration Test (SPT) split-spoon sampler, or directly from the auger when conditions did not allow use of the SPT sampler.
Sample Collection and Field QA/QC	Soil samples were obtained on 7 February 2018 in accordance with the standard sampling procedure (SSP) attached in the appendices. Soil samples were collected from the fill and natural profiles based on field observations. The sample depths are shown on the logs attached in the appendices. Samples were placed in glass jars with plastic caps and teflon seals with minimal headspace. Samples for asbestos analysis were placed in zip-lock plastic bags. During sampling, soil at selected depths was split into primary and duplicate samples for field QA/QC analysis.
Field Screening	A portable Photoionisation Detector (PID) fitted with a 10.6mV lamp was used to screen the samples for the presence of volatile organic compounds (VOCs). PID screening for VOCs was undertaken on soil samples using the soil sample headspace method. VOC data was obtained from partly filled zip-lock plastic bags following equilibration of the headspace gases. PID calibration records are maintained on file by EIS. Fill/spoil at the sampling locations was visually inspected during the works for the presence of fibre cement fragments.
Decontamination and Sample Preservation	Sampling personnel used disposable nitrile gloves during sampling activities. Re-usable sampling equipment was decontaminated as outlined in the SSP. Soil samples were preserved by immediate storage in an insulated sample container with ice in accordance with the SSP. On completion of the fieldwork, the samples were stored

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[8] NSW EPA, (1995), *Contaminated Sites Sampling Design Guidelines.* (referred to as EPA Sampling Design Guidelines 1995)

Aspect	Input
	temporarily in fridges in the EIS warehouse before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard chain of custody (COC) procedures.

6.3 Groundwater Sampling Plan and Methodology

The groundwater sampling plan and methodology is outlined in the table below:

Table 6-2: Groundwater Sampling Plan and Methodology

Aspect	Input
Sampling Plan	Groundwater monitoring wells were installed in BH102 (MW102) and BH106 (MW106). The wells were positioned to assess groundwater conditions coming onto the site (MW106) and groundwater conditions leaving the site via the deep fill area (MW102).
Monitoring Well Installation Procedure	The monitoring well construction details are documented on the appropriate borehole logs attached in the appendices. The monitoring wells were installed to a depth of approximately 6m below ground level. The wells were generally constructed as follows: • 50mm diameter Class 18 PVC (machine slotted screen) was installed in the lower section of the well to intersect groundwater; • 50mm diameter Class 18 PVC casing was installed in the upper section of the well (screw fixed); • A 2mm sand filter pack was used around the screen section for groundwater infiltration; • A hydrated bentonite seal/plug was used on top of the sand pack to seal the well; and • A gatic cover was installed at the surface with a concrete plug to limit the inflow of surface water.
Monitoring Well Development	The monitoring wells were developed on 8 February 2018 using a submersible electrical pump in accordance with the SSP. Due to the hydrogeological conditions, groundwater inflow into the wells was relatively low, therefore the wells were pumped until they were effectively dry. The field monitoring records and calibration data are attached in the appendices.
Groundwater Sampling	The monitoring wells were allowed to recharge for approximately five to seven days after development. Groundwater samples were obtained on 15 February 2018. Prior to sampling, the monitoring wells were checked for the presence of Light Non-Aqueous Phase Liquids (LNAPLs) using an inter-phase probe electronic dip meter. The monitoring well head space was checked for VOCs using a calibrated PID unit. The samples were obtained using a peristaltic pump. During sampling, the following parameters were monitored using calibrated field instruments (see SSP): • Standing water level (SWL) using an electronic dip meter; and

Aspect	Input
	• pH, temperature, electrical conductivity (EC), dissolved oxygen (DO) and redox potential (Eh) using a YSI Multi-probe water quality meter. Due to silty conditions, steady state conditions were not achieved prior to sampling. Groundwater samples were obtained directly from the single use PVC tubing and placed in the sample containers. Duplicate samples were obtained by alternate filling of sample containers. This technique was adopted to minimise disturbance of the samples and loss of volatile contaminants associated with mixing of liquids in secondary containers, etc. Groundwater removed from the wells during development and sampling was transported to EIS in jerry cans and stored in holding drums prior to collection by a licensed waste water contractor for off-site disposal. The field monitoring record and calibration data are attached in the appendices.
Decontaminant and Sample Preservation	The decontamination procedure adopted during sampling is outlined in the SSP attached in the appendices. During development, the pump was flushed between monitoring wells with potable water (single-use tubing was used for each well). The pump tubing was discarded after each sampling event and replaced therefore no decontamination procedure was considered necessary. The samples were preserved with reference to the analytical requirements and placed in an insulated container with ice in accordance with the SSP. On completion of the fieldwork, the samples were temporarily stored in a fridge at the EIS office, before being delivered in the insulated sample container to a NATA registered laboratory for analysis under standard COC procedures.

6.4 Analytical Schedule

The analytical schedule is outlined in the following table:

Table 6-3: Analytical Schedule

Analyte/CoPC	Fill Samples	Natural Soil Samples	Fibre Cement Material Samples	Groundwater Samples
Heavy Metals	10	2	-	2
TRH/BTEX	10	2	-	2
PAHs	10	2	-	2
OCPs/OPPs	6	-	-	-

Analyte/CoPC	Fill Samples	Natural Soil Samples	Fibre Cement Material Samples	Groundwater Samples
PCBs	6	-	-	-
Asbestos	10	2	1	-
pH/EC/hardness	-	-	-	2

6.4.1 Laboratory Analysis

Samples were analysed by an appropriate, NATA Accredited laboratory using the analytical methods detailed in Schedule B(3) of NEPM 2013. Reference should be made to the laboratory reports attached in the appendices for further details.

Table 6-4: Laboratory Details

Samples	Laboratory	Report Reference
All primary samples and field QA/QC samples including (intra-laboratory duplicates, trip blanks, trip spikes and field rinsate samples)	Envirolab Services Pty Ltd NSW, NATA Accreditation Number – 2901 (ISO/IEC 17025 compliance)	184710 and 185317

7 SITE ASSESSMENT CRITERIA (SAC)

The SAC were derived from the NEPM 2013 and other guidelines as discussed in the following sub-sections. The guideline values for individual contaminants are presented in the attached report tables and further explanation of the various criteria adopted is provided in the appendices.

7.1 Soil

Soil data were compared to relevant Tier 1 screening criteria in accordance with NEPM (2013) as outlined below.

7.1.1 Human Health

- Health Investigation Levels (HILs) for a 'residential with minimal opportunities for access to soil' exposure scenario (HIL-B);
- Health Screening Levels (HSLs) for a 'low-high density residential' exposure scenario (HSL-A & HSL-B). HSLs were calculated based on the soil type and the most conservative depth interval of 0m to 1m as the proposed development included excavation;
- Where exceedances of the HSLs were reported for hydrocarbons (TRH/BTEX and naphthalene), the soil health screening levels for direct contact presented in the CRC Care Technical Report No. 10 – Heath screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document (2011)[9] were considered; and
- Asbestos was assessed on the basis of presence/absence. Asbestos HSLs were not adopted as detailed asbestos quantification was not undertaken

7.1.2 Environment (Ecological – terrestrial ecosystems)

- Ecological Investigation Levels (EILs) and Ecological Screening Levels (ESLs) for an 'urban residential and public open space' (URPOS) exposure scenario. These have only been applied to the top 2m of soil as outlined in NEPM (2013). The criteria for benzo(a)pyrene has been increased from the value presented in NEPM (2013) based on the information presented in the CRC Care Technical Report No. 39 – Risk-based management and guidance for benzo(a)pyrene (2017)[10];
- ESLs were calculated based on the soil type. EILs for selected metals were calculated based on the most conservative added contaminant limit (ACL) values presented in Schedule B(1) of NEPM (2013) and published ambient background concentration (ABC) values presented in the

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[9] Cooperative Research Centre for Contamination Assessment and Remediation of the Environment (CRC Care), (2011). Technical Report No. 10 - *Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document*

[10] CRC Care, (2011). *Technical Report No. 39 - Risk-based management and guidance for benzo(a)pyrene*

document titled Trace Element Concentrations in Soils from Rural and Urban Areas of Australia (1995)[11]. This method is considered to be adequate for the Tier 1 screening.

7.1.3 Management Limits for Petroleum Hydrocarbons

Management limits for petroleum hydrocarbons (as presented in Schedule B1 of NEPM 2013) were considered (if required) following evaluation of human health and ecological risks, and risks to groundwater.

7.1.4 Waste Classification

Data for the waste classification assessment were assessed in accordance with the Waste Classification Guidelines, Part 1: Classifying Waste (2014)[12] as outlined in the following table:

Table 7-1: Waste Categories

Category	Description
General Solid Waste (non-putrescible)	• If Specific Contaminant Concentration (SCC) ≤ Contaminant Threshold (CT1) then Toxicity Characteristics Leaching Procedure (TCLP) not needed to classify the soil as general solid waste; and • If TCLP ≤ TCLP1 and SCC ≤ SCC1 then treat as general solid waste.
Restricted Solid Waste (non-putrescible)	• If SCC ≤ CT2 then TCLP not needed to classify the soil as restricted solid waste; and • If TCLP ≤ TCLP2 and SCC ≤ SCC2 then treat as restricted solid waste.
Hazardous Waste	• If SCC > CT2 then TCLP not needed to classify the soil as hazardous waste; and • If TCLP > TCLP2 and/or SCC > SCC2 then treat as hazardous waste.
Virgin Excavated Natural Material (VENM)	Natural material (such as clay, gravel, sand, soil or rock fines) that meet the following: • 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.

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[11] Olszowy, H., Torr, P., and Imray, P., (1995), *Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4*. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission.

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

7.2 Groundwater

Groundwater data were compared to relevant Tier 1 screening criteria in accordance with NEPM (2013), following an assessment of environmental values in accordance with the Guidelines for the Assessment and Management of Groundwater Contamination (2007)[13]. Environmental values for this assessment include aquatic ecosystems, human uses, and human-health risks in non-use scenarios.

7.2.1 Human Health

- HSLs for a 'low-high density residential' exposure scenario (HSL-A/HSL-B). HSLs were calculated based on the soil type and the observed depth to groundwater;
- The NEPM (2013) HSLs may not be applicable for this project as the proposed basement may intersect groundwater. On this basis, as a conservative measure, EIS have undertaken a site specific assessment (SSA) for the Tier 1 screening of human health risks posed by volatile contaminants in groundwater. The assessment included selection of alternative Tier 1 criteria that were considered suitably protective of human health. These criteria are based on drinking water guidelines and have been referred to as HSL-SSA. The criteria were based on the following (as shown in the attached report tables):
    - Australian Drinking Water Guidelines (2011)[14] for BTEX compounds and selected VOCs;
    - World Health Organisation (WHO) document titled Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality (2008)[15] for petroleum hydrocarbons;
    - USEPA Region 9 screening levels for naphthalene (threshold value for tap water); and
    - The use of the laboratory PQLs for other contaminants where there were no Australian guidelines.
- The Australian Drinking Water Guidelines (2011)[16] were adopted as screening criteria for consumption of groundwater; and
- The guidelines for recreational water quality (primary and secondary contact) presented in the Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000)[17] were adopted as screening criteria to assess risks associated with incidental contact with groundwater in the proposed basement.

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[13] NSW Department of Environment and Conservation, (2007). *Guidelines for the Assessment and Management of Groundwater Contamination*

[14] National Health and Medical Research Council (NHMRC), (2011). *National Water Quality Management Strategy, Australian Drinking Water Guidelines* (referred to as ADWG 2011)

[15] World Health Organisation (WHO), (2008). *Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality* (referred to as WHO 2008)

[16] National Health and Medical Research Council (NHMRC), (2011). *National Water Quality Management Strategy, Australian Drinking Water Guidelines* (referred to as ADWG 2011)

[17] ANZECC, (2000), *Australian and New Zealand Guidelines for Fresh and Marine Water Quality.* (referred to as ANZECC 2000)

7.2.2 Environment (Ecological - aquatic ecosystems)

- Groundwater Investigation Levels (GILs) for 95% trigger values for protection of freshwater/marine species presented in Australian and New Zealand Guidelines for Fresh and Marine Water Quality (2000). The 99% trigger values were adopted where required to account for bioaccumulation. Low and moderate reliability trigger values were also adopted for some contaminants where high-reliability trigger values don’t exist.

8 RESULTS

8.1 Summary of Data (QA/QC) Evaluation

The data evaluation is presented in the appendices. In summary, EIS are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

8.2 Subsurface Conditions

A summary of the subsurface conditions encountered during the investigation is presented in the table below. Reference should be made to the borehole logs attached in the appendices for further details.

Table 8-1: Summary of Subsurface Conditions

Profile	Description
Pavement	Asphaltic Concrete (AC) or Concrete pavement, approximately 30mm to 190mm thick, was encountered at the surface in BH101, BH103 and BH104.
Fill	Fill was encountered at the surface or beneath the pavement in all boreholes and extended to depths of approximately 0.3m to 6.5m. Fill was typically shallower than 1.6m, with the exception of BH102 . The fill typically comprised silty sand, silty clay and sandy clay with inclusions of ash, igneous and sandstone gravel. A fibre-cement sheeting fragment was encountered in the fill material in BH101.
Natural Soil	Natural silty clay, clayey sand or sandy clay soil was encountered beneath the fill in all boreholes and extended to the termination of BH101 to BH105 at a maximum depth of approximately 7.5m. Natural soil in BH106 extended to a depth of approximately 5.2m. The natural soil was typically grey or red-brown and contained traces of ironstone gravel.
Bedrock	Sandstone bedrock was encountered beneath the natural soil in BH106 and extended to the termination of the borehole at a depth of approximately 6m.
Groundwater	Groundwater seepage was encountered in BH102 at a depth of approximately 5m during drilling. All boreholes remained dry on completion of drilling and a short time after.

8.3 Field Screening

A summary of the field screening results are presented in the table below.

Table 8-2: Summary of Field Screening

Aspect	Details
PID Screening of Soil Samples for VOCs	PID soil sample headspace readings are presented in attached report tables and the COC documents attached in the appendices. All results were 0ppm isobutylene equivalents which indicates a lack of PID detectable VOCs.
Groundwater Depth & Flow	Groundwater monitoring wells were installed in BH102 and BH106. SWLs measured in the monitoring wells installed at the site were 4.75m and 4.09m, respectively. Excavation for the proposed basement may intercept groundwater. Groundwater would generally be expected to flow to the north towards the depression in the central-north section of the site and beyond to the north.
Groundwater Field Parameters	Field measurements recorded during sampling were as follows: - pH ranged from 6 to 6.19; - EC ranged from 992µS/cm to 1008µS/cm; - Eh ranged from 45.4mV to 56.9mV; and - DO ranged from 1.1ppm to 1.2ppm.
LNAPLs petroleum hydrocarbons	Phase separated product (i.e. LNAPL) were not detected using the interphase probe during groundwater sampling.

8.4 Soil Laboratory Results

The soil laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below:

8.4.1 Human Health and Environmental (Ecological) Assessment

Table 8-3: Summary of Soil Laboratory Results – Human Health and Environmental (Ecological)

Analyte	Results Compared to SAC
Heavy Metals	All heavy metals results were below the SAC.
TRH	All TRH results were below the SAC.
BTEX	All BTEX results were below the SAC.
PAHs	All PAH results were below the SAC.
OCPs and OPPs	All OCP and OPP results were below the SAC. All pesticide concentrations were below the laboratory PQLs.
PCBs	All PCB results were below the SAC. All PCB concentrations were below the laboratory PQLs.

Analyte	Results Compared to SAC
Asbestos	The fibre-cement fragment (FCF) encountered in the fill material in BH101 contained asbestos. The remaining asbestos results were below the SAC (i.e. asbestos was absent in the remaining samples analysed for the investigation).

8.4.2 Waste Classification Assessment

The laboratory results were assessed against the criteria presented in Part 1 of the Waste Classification Guidelines, as summarised previously in this report. The results are presented in the report tables attached in the appendices. A summary of the results is presented below.

Table 8-4: Summary of Soil Laboratory Results Compared to CT and SCC Criteria

Analyte	No. of Samples Analysed	No. of Results > CT Criteria	No. of Results > SCC Criteria	Comments
Heavy Metals	12	0	0	-
TRH	12	0	0	-
BTEX	12	0	0	-
Total PAHs	12	0	0	-
Benzo(a)pyrene	12	0	0	-
OCPs & OPPs	6	0	0	-
PCBs	6	0	0	-
Asbestos	13	1	-	Asbestos was detected in the FCF sample from BH101.

8.5 Groundwater Laboratory Results

The groundwater laboratory results are compared to the relevant SAC in the attached report tables. A summary of the results assessed against the SAC is presented below:

Table 8-5: Summary of Groundwater Laboratory Results – Human Health and Environmental (Ecological)

Analyte	Results Compared to SAC
Heavy Metals	The zinc results ranged from 9µg/L to 77µg/L and exceeded the ecological criterion of 8µg/L. The remaining heavy metals results were below the SAC.
TRH	All TRH results were below the SAC.
BTEX	All BTEX results were below the SAC.
Other VOCs	All VOC results were below the SAC.
PAHs	All PAH results were below the SAC. It should be noted that the PQL for benzo(a)pyrene was above the SAC for recreational use of groundwater.
Other Parameters	The results for pH, EC and hardness are summarised below: • pH ranged from 6.2 to 6.3; • EC ranged from 730µS/cm to 850µS/cm; and • Hardness values for both samples were 130mgCaCO$_3$/L.

9 WASTE CLASSIFICATION ASSESSMENT

9.1 Waste Classification of Fill

Based on the results of the assessment, and at the time of reporting, the fill material in the vicinity of BH101 is classified as **General Solid Waste (non-putrescible) containing Special Waste (asbestos)**. Surplus fill should be disposed of to a facility that is appropriately licensed to receive this waste stream. The facility should be contacted to obtain the required approvals prior to commencement of excavation.

The fill material across the remainder of the site may be classified as **General Solid Waste (non-putrescible)** subject to further assessment to better assess the extent of the asbestos impacted material.

9.2 Classification of Natural Soil and Bedrock

Based on the scope of work undertaken for this assessment/screening, and at the time of reporting, EIS are of the opinion that the natural soil and bedrock at the site meets the definition of **VENM** for off-site disposal or re-use purposes. VENM is considered suitable for re-use on-site, or alternatively, the information included in this report may be used to assess whether the material is suitable for beneficial reuse at another site as fill material. In accordance with Part 1 of the Waste Classification Guidelines, the VENM is pre-classified as general solid waste and can also be disposed of accordingly to a facility that is licensed to accept it.

10 DISCUSSION AND CONCLUSIONS

10.1 Tier 1 Risk Assessment and Review of CSM

For a contaminant to represent a risk to a receptor, the following three conditions must be present:

1. Source – The presence of a contaminant;
2. Pathway – A mechanism or action by which a receptor can become exposed to the contaminant; and
3. Receptor – The human or ecological entity which may be adversely impacted following exposure to contamination.

If one of the above components is missing, the potential for adverse risks is relatively low.

10.1.1 Soil

Asbestos was encountered in the form of a FCF in the fill material in BH101. The source of the asbestos is considered likely to be the fill material, which may have been imported onto the site.

In the present site configuration, the asbestos contamination presents a very low risk to site occupants as it is beneath a concrete pavement. The risk would increase if the pavement was removed and especially during excavation works.

Further investigation will be required to better assess the vertical and horizontal extent of the asbestos contamination. Ideally this would include a detailed site investigation for asbestos, however, we note that this would not be possible due to the existing structures on the site. As a conservative measure, the assumption could be made that all fill material at the site is impacted by asbestos and will required remediation and/or management.

10.1.2 Groundwater

The zinc results in the groundwater samples exceeded the ecological SAC. These results are considered likely to be indicative of regional condition rather than site specific contamination based on the following:

- The zinc concentrations in the soil samples analysed were typically low; and
- The zinc concentrations in the groundwater are typically of urban Sydney aquifers and may the result of leaking water infrastructure.

10.2 Decision Statements

The decision statements are addressed below:

> *Did the site inspection, or does the historical information identify potential contamination sources/AEC at the site?*

Yes, the main potential contamination sources were fill material, historical agricultural use (poultry farm), use of pesticides, hazardous Building Materials, two service stations located approximately 75m and 150m up-gradient (south-west) of the site and a former dry cleaners was located less than 50m to the south of the site.

Are any results above the SAC?

Yes, asbestos was encountered in the form of FCF in the fill in BH101. Zinc was encountered above the ecological SAC in groundwater.

Do potential risks associated with contamination exist, and if so, what are they?

Yes, the extent of the asbestos contamination is unknown and disturbance of the fill material may create a risk to site occupants and workers.

Is remediation required?

Remediation and/or management of the asbestos contamination may be required.

Is the site characterisation sufficient to provide adequate confidence in the above decisions?

No, a detailed site investigation for asbestos would be required to sufficiently characterise the site.

Is the site suitable for the proposed development, or can the site be made suitable subject to further characterisation and/or remediation?

The site can be made suitable for the proposed development provided that further investigation and subsequent remediation and/or management is undertaken.

10.3 Data Gaps

The assessment has identified the following data gaps:

- The minimum recommended sampling density was not met as much of the site was inaccessible due to the existing buildings;
- The extent of the asbestos contamination remains unknown, however, the contamination would be expected to be confined to the fill material; and
- The asbestos investigation to date has only included a preliminary assessment for the presence/absence of asbestos.

11 CONCLUSIONS AND RECOMMENDATIONS

EIS consider that the report objectives outlined in Section 1.2 have been addressed.

Asbestos was encountered in fill material in the north-west section of the site. At this stage further investigation, to better assess the extent of the contamination, is not possible due to the physical constraints of the site. It may be possible to undertake further investigation following demolition of the buildings at the site, however, this would likely result in significant delays to the project. Based on our experience, where asbestos is encountered in a discrete location in fill material by drilling boreholes, further, asbestos is usually encountered during excavation works. EIS consider that the most cost and time effective approach would be to take a conservative view of the contamination and assume that all fill material at the site is impacted by asbestos.

Based on the above, EIS make the following recommendations:

- A Remedial Action Plan (RAP) should be prepared outlining procedures to be undertaken during each stage of development/excavation, with respect to the asbestos contamination;
- A validation assessment should be undertaken on completion of remediation at each development stage; and
- The following unexpected finds protocol should be implemented during excavation works at the site.

11.1 Unexpected Finds Protocol

There is considered to be a relatively low potential for contamination-related unexpected finds (other than asbestos) to occur at the site during the proposed development works. Unexpected finds would typically be able to be identified by visual or olfactory indicators and could include:

- Waste materials in fill, including building and demolition waste;
- Friable asbestos;
- Stained fill/soil;
- Odorous soils (e.g. hydrocarbon odours); and/or
- Ash, slag and/or coal wash.

The following should be implemented in the event of an unexpected find:

- All work in the immediate vicinity should cease and temporary barricades should be erected to isolate the area;
- A suitably qualified contaminated land consultant[18] should be engaged to inspect the find and provide advice on the appropriate course of action; and
- Any actions should be implemented and validated to demonstrate that there are no unacceptable risks to the receptors.

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[18] EIS recommend that the consultancy engaged for the work be a member of the Australian Contaminated Land Consultants Associated (ACLCA), and/or the individual undertaking the works be certified under one of the NSW EPA endorsed certified practitioner schemes

The requirement to notify the NSW EPA of the site contamination under then NSW EPA Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997 (2015)[19] should be reviewed on completion of the remediation and validation works.

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[19] NSW EPA, (2015). *Guidelines on the Duty to Report Contamination under Section 60 of the CLM Act 1997* (referred to as Duty to Report Contamination)

12 LIMITATIONS

The report limitations are outlined below:

- EIS 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 EIS proposal; and terms of contract between EIS 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, EIS has not undertaken any verification process, except where specifically stated in the report;
- EIS 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;
- EIS 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;
- EIS 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. EIS 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.

LIST OF IN-TEXT TABLES

IMPORTANT INFORMATION ABOUT THIS REPORT

These notes have been prepared by EIS 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 EIS 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.

EIS/J&K 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 EIS 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

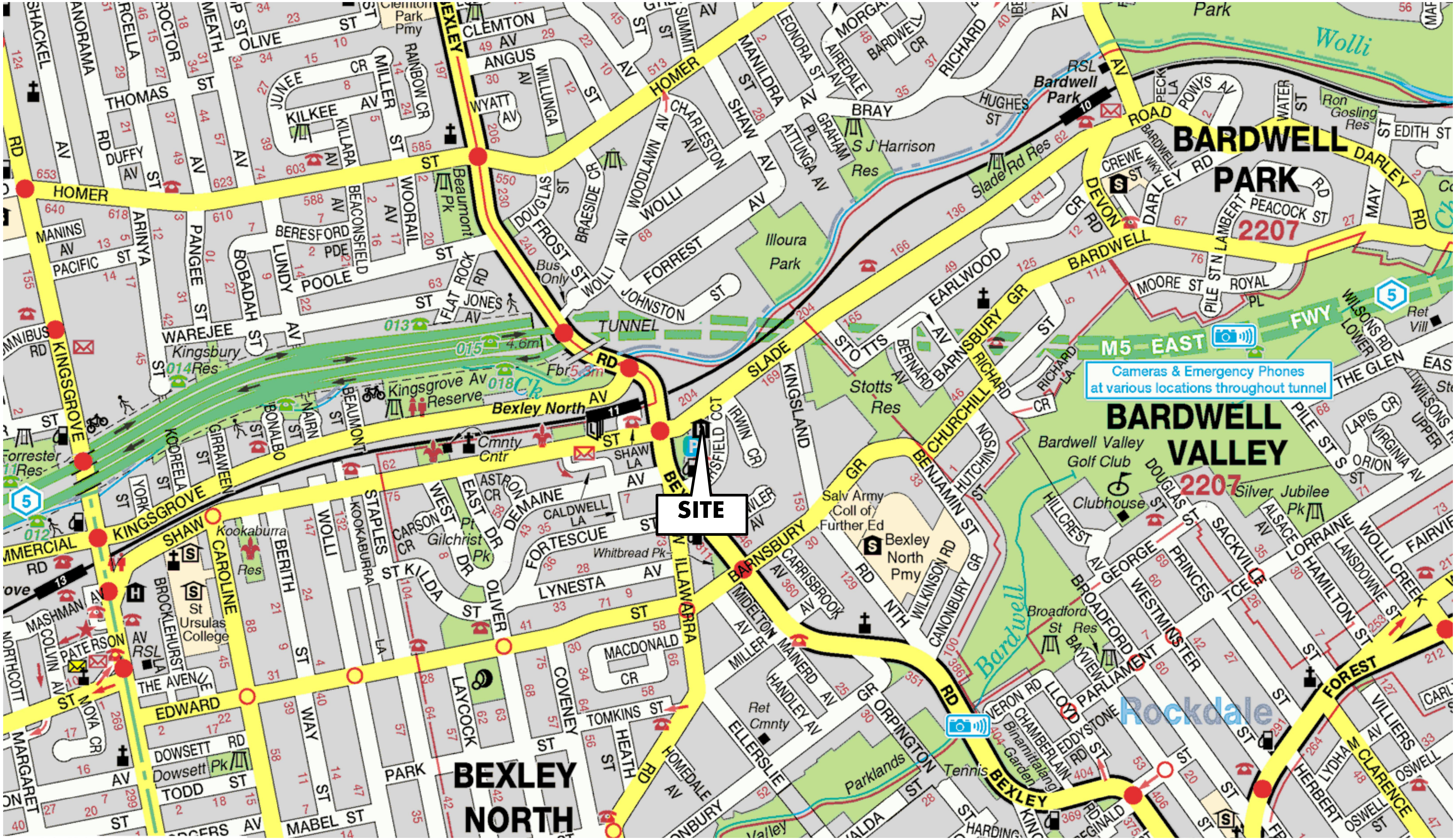
Borehole and test pit logs are prepared by environmental scientists, engineers or geologists based upon interpretation of field conditions and laboratory evaluation of field samples. Logs are normally provided in our reports and these should not be re-drawn for inclusion in site remediation or other 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.

REPORT FIGURES



N

NOTES:
Figure has been recreated from UBD on disc (version 7.1)

Figure is not to scale. UBD Map ref: 273 Q9

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

EIS
ENVIRONMENTAL INVESTIGATION SERVICES
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SITE LOCATION PLAN

187 SLADE ROAD,
BEXLEY, NSW

PROJECT ID: E30293KH

F1

N

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

- - -		Approximate site boundary
●	BH (Fill Depth)	Borehole location, number and depth of fill (m) (EIS 2015)
⊕	BH/MW	Groundwater monitoring well location

SCALE (m) @ A3: 0 5 10 15 20 25

EIS

ENVIRONMENTAL INVESTIGATION SERVICES

www.jkgroup.net.au

BOREHOLE LOCATION PLAN

187 SLADE ROAD,
BEXLEY NORTH, NSW

PROJECT ID: E30293KH

F2

LABORATORY SUMMARY TABLES

TABLE A

SOIL LABORATORY RESULTS COMPARED TO HIL-B: 'Residential with minimal opportunities for soil access; including dwellings with fully/permanently paved yards like high-rise buildings'

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 [1]	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)			500	150	500	30000	1200	120	1200	60000	400	4	15	400	500	10	90	600	10	340	1	Detected/Not Detected
Sample Reference	**Sample Depth**	**Sample Description**																				
BH101	0.2-0.4	Fill: silty sand	LPQL	LPQL	4	5	64	LPQL	2	29	1.1	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH101	0.5-0.95	Fill: sandy clay	10	LPQL	11	2	27	LPQL	2	25	0.52	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
BH102	0-0.2	Fill: silty sand	LPQL	LPQL	19	19	27	LPQL	8	50	2	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
BH102	1.5-1.95	Fill: sandy clay	LPQL	LPQL	9	17	38	LPQL	2	31	0.06	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH103	0.03-0.2	Fill: silty clay	LPQL	LPQL	11	20	15	LPQL	5	23	0.08	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH103	0.9-1.1	Fill: sandy clay	LPQL	LPQL	14	LPQL	9	LPQL	1	5	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
BH104	0.03-0.2	Fill: silty clay	4	LPQL	15	3	18	LPQL	2	11	0.2	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH104	0.5-0.95	Silty clay	LPQL	LPQL	9	2	9	LPQL	1	7	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
BH105	0-0.2	Fill: silty sand	LPQL	LPQL	11	11	56	LPQL	2	110	0.06	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH105	1.1-1.3	Clayey sand	LPQL	LPQL	10	1	6	LPQL	1	13	LPQL	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
BH106	0-0.2	Fill: silty sand	5	LPQL	13	31	40	LPQL	5	54	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	LPQL	No asbestos detected
BH106	0.5-0.8	Fill: silty sand	5	LPQL	17	9	22	LPQL	4	31	0.3	LPQL	NA	NA	NA	NA	NA	NA	NA	NA	NA	No asbestos detected
AMF1	-	Fibre-cement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of Samples			12	12	12	12	12	12	12	12	12	12	6	6	6	6	6	6	6	6	6	1
Maximum Value			10	<PQL	19	31	64	<PQL	8	110	2	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	NC

Concentration above the SAC	**VALUE**

TABLE B
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	3	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**								
BH101	0.2-0.4	Fill: silty sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH101	0.5-0.95	Fill: sandy clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH102	0-0.2	Fill: silty sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH102	1.5-1.95	Fill: sandy clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH103	0.03-0.2	Fill: silty clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH103	0.9-1.1	Fill: sandy clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH104	0.03-0.2	Fill: silty clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH104	0.5-0.95	Silty clay	0m to < 1m	Clay	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH105	0-0.2	Fill: silty sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH105	1.1-1.3	Clayey sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH106	0-0.2	Fill: silty sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
BH106	0.5-0.8	Fill: silty sand	0m to < 1m	Sand	<25	<50	<0.2	<0.5	<1	<3	<1	0
Total Number of Samples					12	12	12	12	12	12	12	12
Maximum Value					<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Concentration above the SAC **VALUE**

The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below

SITE ASSESSMENT CRITERIA

					C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services					25	50	0.2	0.5	1	3	1
NEPM 2013 HSL Land Use Category					**HSL-A/B:LOW/HIGH DENSITY RESIDENTIAL**						
Sample Reference	**Sample Depth**	**Sample Description**	**Depth Category**	**Soil Category**							
BH101	0.2-0.4	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH101	0.5-0.95	Fill: sandy clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH102	0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH102	1.5-1.95	Fill: sandy clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH103	0.03-0.2	Fill: silty clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH103	0.9-1.1	Fill: sandy clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH104	0.03-0.2	Fill: silty clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH104	0.5-0.95	Silty clay	0m to < 1m	Clay	50	280	0.7	480	NL	110	5
BH105	0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH105	1.1-1.3	Clayey sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH106	0-0.2	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3
BH106	0.5-0.8	Fill: silty sand	0m to < 1m	Sand	45	110	0.5	160	55	40	3

TABLE C
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																			
				pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	AGED HEAVY METALS-EILs						EILs		ESLs								
							Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>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	0.1	0.1	25	50	100	100	0.2	0.5	1	2	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**																				
BH101	0.2-0.4	Fill: silty sand	Coarse	NA	NA	NA	<4	4	5	64	2	29	<0.1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.2
BH101	0.5-0.95	Fill: sandy clay	Fine	NA	NA	NA	10	11	2	27	2	25	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.09
BH102	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	<4	19	19	27	8	50	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.3
BH102	1.5-1.95	Fill: sandy clay	Fine	NA	NA	NA	<4	9	17	38	2	31	<0.1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.06
BH103	0.03-0.2	Fill: silty clay	Fine	NA	NA	NA	<4	11	20	15	5	23	<0.1	<0.1	<25	<50	620	750	<0.2	<0.5	<1	<2	0.08
BH103	0.9-1.1	Silty clay	Fine	NA	NA	NA	<4	14	<1	9	1	5	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<0.05
BH104	0.03-0.2	Fill: silty clay	Fine	NA	NA	NA	4	15	3	18	2	11	<0.1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.06
BH104	0.5-0.95	Silty clay	Fine	NA	NA	NA	<4	9	2	9	1	7	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<0.05
BH105	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	<4	11	11	56	2	110	<0.1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.06
BH105	1.1-1.3	Clayey sand	Coarse	NA	NA	NA	<4	10	1	6	1	13	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<0.05
BH106	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	5	13	31	40	5	54	<0.1	<0.1	<25	<50	<100	<100	<0.2	<0.5	<1	<2	<0.05
BH106	0.5-0.8	Fill: silty sand	Coarse	NA	NA	NA	5	17	9	22	4	31	<0.1	NA	<25	<50	<100	<100	<0.2	<0.5	<1	<2	0.06
Total Number of Samples				0	0	0	12	12	12	12	12	12	12	6	12	12	12	12	12	12	12	12	12
Maximum Value				<PQL	<PQL	<PQL	10	19	31	64	8	110	<PQL	<PQL	<PQL	<PQL	620	750	<PQL	<PQL	<PQL	<PQL	0.3

Concentration above the SAC VALUE

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

Land Use Category				URBAN RESIDENTIAL AND PUBLIC OPEN SPACE																			
				pH	CEC (cmol$_c$/kg)	Clay Content (% clay)	AGED HEAVY METALS-EILs						EILs		ESLs								
							Arsenic	Chromium	Copper	Lead	Nickel	Zinc	Naphthalene	DDT	C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	>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	0.1	0.1	25	50	100	100	0.2	0.5	1	2	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**																				
BH101	0.2-0.4	Fill: silty sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	300	2800	50	85	70	105	33
BH101	0.5-0.95	Fill: sandy clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	1300	5600	60	105	125	45	33
BH102	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	300	2800	50	85	70	105	33
BH102	1.5-1.95	Fill: sandy clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	1300	5600	60	105	125	45	33
BH103	0.03-0.2	Fill: silty clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	1300	5600	60	105	125	45	33
BH103	0.9-1.1	Silty clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	1300	5600	60	105	125	45	33
BH104	0.03-0.2	Fill: silty clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	1300	5600	60	105	125	45	33
BH104	0.5-0.95	Silty clay	Fine	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	1300	5600	60	105	125	45	33
BH105	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	300	2800	50	85	70	105	33
BH105	1.1-1.3	Clayey sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	300	2800	50	85	70	105	33
BH106	0-0.2	Fill: silty sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	180	180	120	300	2800	50	85	70	105	33
BH106	0.5-0.8	Fill: silty sand	Coarse	NA	NA	NA	100	203	88	1263	35	192	170	--	180	120	300	2800	50	85	70	105	33

TABLE D

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	250	0.2	0.5	1	3	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**																									
BH101	0.2-0.4	Fill: silty sand	<4	<0.4	4	5	64	<0.1	2	29	1.1	0.2	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH101	0.5-0.95	Fill: sandy clay	10	<0.4	11	2	27	<0.1	2	25	0.52	0.09	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH102	0-0.2	Fill: silty sand	<4	<0.4	19	19	27	<0.1	8	50	2	0.3	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH102	1.5-1.95	Fill: sandy clay	<4	<0.4	9	17	38	<0.1	2	31	0.06	0.06	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH103	0.03-0.2	Fill: silty clay	<4	<0.4	11	20	15	<0.1	5	23	0.08	0.08	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	180	670	850	<0.2	<0.5	<1	<3	Not Detected
BH103	0.9-1.1	Fill: sandy clay	<4	<0.4	14	<1	9	<0.1	1	5	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH104	0.03-0.2	Fill: silty clay	4	<0.4	15	3	18	<0.1	2	11	0.2	0.06	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH104	0.5-0.95	Silty clay	<4	<0.4	9	2	9	<0.1	1	7	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH105	0-0.2	Fill: silty sand	<4	<0.4	11	11	56	<0.1	2	110	0.06	0.06	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH105	1.1-1.3	Clayey sand	<4	<0.4	10	1	6	<0.1	1	13	<0.05	<0.05	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH106	0-0.2	Fill: silty sand	5	<0.4	13	31	40	<0.1	5	54	<0.05	<0.05	<0.1	<0.1	<0.1	<0.1	<0.1	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
BH106	0.5-0.8	Fill: silty sand	5	<0.4	17	9	22	<0.1	4	31	0.3	0.06	NA	NA	NA	NA	NA	<25	<50	<100	<100	<PQL	<0.2	<0.5	<1	<3	Not Detected
AMF1	-	Fibre-cement	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	Detected
Total Number of samples			12	12	12	12	12	12	12	12	12	12	6	6	6	6	6	12	12	12	12	12	12	12	12	12	13
Maximum Value			10	<PQL	19	31	64	<PQL	8	110	2	0.3	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	180	670	850	<PQL	<PQL	<PQL	<PQL	NC

Concentration above the CT1	🟩 **VALUE**
Concentration above SCC1	🟧 **VALUE**
Concentration above the SCC2	🟥 **VALUE**

TABLE E
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	3	1	
NEPM 2013 - Land Use Category				**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**							
Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**								
MW102	4.75	4m to <8m	Clay	<10	<50	<1	<1	<1	<3	<1	0
MW106	4.09	4m to <8m	Clay	<10	<50	<1	<1	<1	<3	<1	0
Total Number of Samples				2	2	2	2	2	2	2	2
Maximum Value				<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL	<PQL

Concentration above the SAC	VALUE
Site specific assesment (SSA) required	VALUE

The guideline corresponding to the elevated value is highlighted in grey in the Site Assessment Criteria Table below

HSL GROUNDWATER ASSESSMENT CRITERIA

				C_6-C_{10} (F1)	>C_{10}-C_{16} (F2)	Benzene	Toluene	Ethylbenzene	Xylenes	Naphthalene
PQL - Envirolab Services				10	50	1	1	1	3	1
NEPM 2013 - Land Use Category				**HSL-A/B: LOW/HIGH DENSITY RESIDENTIAL**						
Sample Reference	**Water Depth**	**Depth Category**	**Soil Category**							
MW2	4.75	4m to <8m	Clay	NL	NL	5000	NL	NL	NL	NL
MW6	4.09	4m to <8m	Clay	NL	NL	5000	NL	NL	NL	NL

TABLE F

GROUNDWATER LABORATORY RESULTS COMPARED TO SITE SPECIFIC HSLs - RISK ASSESSMENT

All results in µg/L unless stated otherwise.

	PQL Envirolab Services	NHMRC ADWG 2011	WHO 2008	USEPA RSL Tapwater 2017	SAMPLES	
					MW102	MW106
Total Recoverable Hydrocarbons (TRH)						
C_6-C_9 Aliphatics (assessed using F1)	10	NSL	15000	-	<10	<10
>C_9-C_{14} Aliphatics (assessed using F2)	50	NSL	100	-	<50	<50
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)						
Benzene	1	1	-	-	<1	<1
Toluene	1	800	-	-	<1	<1
Ethylbenzene	1	300	-	-	<1	<1
Total xylenes	2	600	-	-	<3	<3
Polycyclic Aromatic Hydrocarbons (PAHs)						
Naphthalene	0.2	-	-	6.1	<1	<1
Volatile Organic Compounds (VOCs), including chlorinated VOCs						
Vinyl Chloride	10	0.3	-	-	<10	<10
1,1-Dichloroethene	1	30	-	-	<1	<1
Chloroform	1	250	-	-	<1	<1
Bromodichloromethane	1		-	-	<1	<1
1,2-dichloroethane	1	3	-	-	<1	<1
Chlorobenzene	1	300	-	-	<1	<1
1,3-dichlorobenzene	1	300	-	-	<1	<1
1,4-dichlorobenzene	1	40	-	-	<1	<1
1,2-dichlorobenzene	1	1500	-	-	<1	<1

Concentration above the HSL -SSA	VALUE
PQL exceeds HSL-SSA	**BOLD/RED**

TABLE G

SUMMARY OF GROUNDWATER LABORATORY RESULTS COMPARED TO ECOLOGICAL GILs SAC

All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZECC 2000 Fresh Waters	SAMPLES MW102	MW106
Inorganic Compounds and Parameters				
pH	0.1	6.5 - 8.5	6.2	6.3
Electrical Conductivity (µS/cm)	1	NSL	730	850
Hardness (mgCaCO$_3$/L)	3	NSL	130	130
Metals and Metalloids				
Arsenic (As III)	1	24	<1	<1
Cadmium	0.1	0.2	<0.1	0.1
Chromium (VI)	1	1	<1	<1
Copper	1	1.4	<1	<1
Lead	1	3.4	<1	<1
Total Mercury (inorganic)	0.05	0.06	<0.05	<0.05
Nickel	1	11	<1	13
Zinc	1	8	9	77
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)				
Benzene	1	950	<1	<1
Toluene	1	180	<1	<1
Ethylbenzene	1	80	<1	<1
m+p-xylene	2	75	<2	<2
o-xylene	1	350	<1	<1
Total xylenes	2	NSL	<3	<3
Volatile Organic Compounds (VOCs), including chlorinated VOCs				
Dichlorodifluoromethane	10	NSL	<10	<10
Chloromethane	10	NSL	<10	<10
Vinyl Chloride	10	100	<10	<10
Bromomethane	10	NSL	<10	<10
Chloroethane	10	NSL	<10	<10
Trichlorofluoromethane	10	NSL	<10	<10
1,1-Dichloroethene	1	700	<1	<1
Trans-1,2-dichloroethene	1	NSL	<1	<1
1,1-dichloroethane	1	90	<1	<1
Cis-1,2-dichloroethene	1	NSL	<1	<1
Bromochloromethane	1	NSL	<1	<1
Chloroform	1	370	<1	<1
2,2-dichloropropane	1	NSL	<1	<1
1,2-dichloroethane	1	1900	<1	<1
1,1,1-trichloroethane	1	270	<1	<1
1,1-dichloropropene	1	NSL	<1	<1
Cyclohexane	1	NSL	<1	<1
Carbon tetrachloride	1	240	<1	<1
Benzene	1	see BTEX	<1	<1
Dibromomethane	1	NSL	<1	<1
1,2-dichloropropane	1	900	<1	<1
Trichloroethene	1	NSL	<1	<1
Bromodichloromethane	1	NSL	<1	<1
trans-1,3-dichloropropene	1	NSL	<1	<1
cis-1,3-dichloropropene	1	NSL	<1	<1
1,1,2-trichloroethane	1	6500	<1	<1
Toluene	1	see BTEX	<1	<1
1,3-dichloropropane	1	1100	<1	<1
Dibromochloromethane	1	NSL	<1	<1
1,2-dibromoethane	1	NSL	<1	<1
Tetrachloroethene	1	70	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	<1
Chlorobenzene	1	55	<1	<1
Ethylbenzene	1	see BTEX	<1	<1
Bromoform	1	NSL	<1	<1
m+p-xylene	2	see BTEX	<2	<2
Styrene	1	NSL	<1	<1
1,1,2,2-tetrachloroethane	1	400	<1	<1
o-xylene	1	see BTEX	<1	<1
1,2,3-trichloropropane	1	NSL	<1	<1
Isopropylbenzene	1	30	<1	<1
Bromobenzene	1	NSL	<1	<1
n-propyl benzene	1	NSL	<1	<1
2-chlorotoluene	1	NSL	<1	<1
4-chlorotoluene	1	NSL	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	<1
Tert-butyl benzene	1	NSL	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	<1
1,3-dichlorobenzene	1	260	<1	<1
Sec-butyl benzene	1	NSL	<1	<1
1,4-dichlorobenzene	1	60	<1	<1
4-isopropyl toluene	1	NSL	<1	<1
1,2-dichlorobenzene	1	160	<1	<1
n-butyl benzene	1	NSL	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	<1
1,2,4-trichlorobenzene	1	85	<1	<1
Hexachlorobutadiene	1	NSL	<1	<1
1,2,3-trichlorobenzene	1	3	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)				
Naphthalene	0.2	16	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1
Phenanthrene	0.1	0.6	<0.1	<0.1
Anthracene	0.1	0.01	<0.1	<0.1
Fluoranthene	0.1	1	<0.1	<0.1
Pyrene	0.1	NSL	<0.1	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1
Chrysene	0.1	NSL	<0.1	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2
Benzo(a)pyrene	0.1	0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1

Concentration above the GIL	VALUE
PQL exceeds GIL	**BOLD/RED**

TABLE H

SUMMARY OF GROUNDAWATER LABORATORY RESULTS COMPARED TO HUMAN CONTACT GILs

All results in µg/L unless stated otherwise.

	PQL Envirolab Services	ANZECC 2000 Recreational	SAMPLES	
			MW102	MW106
Inorganic Compounds and Parameters				
pH	0.1	6.5 - 8.5	6.2	6.3
Electrical Conductivity (µS/cm)	1	NSL	730	850
Hardness (mgCaCo3/L)	3	500	130	130
Metals and Metalloids				
Arsenic (As lll)	1	50	<1	<1
Cadmium	0.1	5	<0.1	0.1
Chromium (total)	1	50	<1	<1
Copper	1	1000	<1	<1
Lead	1	50	<1	<1
Total Mercury (inorganic)	0.05	1	<0.05	<0.05
Nickel	1	100	<1	13
Zinc	1	5000	9	77
Monocyclic Aromatic Hydrocarbons (BTEX Compounds)				
Benzene	1	10	<1	<1
Toluene	1	NSL	<1	<1
Ethylbenzene	1	NSL	<1	<1
m+p-xylene	2	NSL	<2	<2
o-xylene	1	NSL	<1	<1
Total xylenes	2	NSL	<3	<3
Volatile Organic Compounds (VOCs), including chlorinated VOCs				
Dichlorodifluoromethane	10	NSL	<10	<10
Chloromethane	10	NSL	<10	<10
Vinyl Chloride	10	NSL	<10	<10
Bromomethane	10	NSL	<10	<10
Chloroethane	10	NSL	<10	<10
Trichlorofluoromethane	10	NSL	<10	<10
1,1-Dichloroethene	1	0.3	<1	<1
Trans-1,2-dichloroethene	1	NSL	<1	<1
1,1-dichloroethane	1	NSL	<1	<1
Cis-1,2-dichloroethene	1	NSL	<1	<1
Bromochloromethane	1	NSL	<1	<1
Chloroform	1	NSL	<1	<1
2,2-dichloropropane	1	NSL	<1	<1
1,2-dichloroethane	1	10	<1	<1
1,1,1-trichloroethane	1	NSL	<1	<1
1,1-dichloropropene	1	NSL	<1	<1
Cyclohexane	1	NSL	<1	<1
Carbon tetrachloride	1	3	<1	<1
Benzene	1	NSL	<1	<1
Dibromomethane	1	NSL	<1	<1
1,2-dichloropropane	1	NSL	<1	<1
Trichloroethene	1	30	<1	<1
Bromodichloromethane	1	NSL	<1	<1
trans-1,3-dichloropropene	1	NSL	<1	<1
cis-1,3-dichloropropene	1	NSL	<1	<1
1,1,2-trichloroethane	1	NSL	<1	<1
Toluene	1	NSL	<1	<1
1,3-dichloropropane	1	NSL	<1	<1
Dibromochloromethane	1	NSL	<1	<1
1,2-dibromoethane	1	NSL	<1	<1
Tetrachloroethene	1	10	<1	<1
1,1,1,2-tetrachloroethane	1	NSL	<1	<1
Chlorobenzene	1	NSL	<1	<1
Ethylbenzene	1	NSL	<1	<1
Bromoform	1	NSL	<1	<1
m+p-xylene	2	NSL	<2	<2
Styrene	1	NSL	<1	<1
1,1,2,2-tetrachloroethane	1	NSL	<1	<1
o-xylene	1	NSL	<1	<1
1,2,3-trichloropropane	1	NSL	<1	<1
Isopropylbenzene	1	NSL	<1	<1
Bromobenzene	1	NSL	<1	<1
n-propyl benzene	1	NSL	<1	<1
2-chlorotoluene	1	NSL	<1	<1
4-chlorotoluene	1	NSL	<1	<1
1,3,5-trimethyl benzene	1	NSL	<1	<1
Tert-butyl benzene	1	NSL	<1	<1
1,2,4-trimethyl benzene	1	NSL	<1	<1
1,3-dichlorobenzene	1	NSL	<1	<1
Sec-butyl benzene	1	NSL	<1	<1
1,4-dichlorobenzene	1	NSL	<1	<1
4-isopropyl toluene	1	NSL	<1	<1
1,2-dichlorobenzene	1	NSL	<1	<1
n-butyl benzene	1	NSL	<1	<1
1,2-dibromo-3-chloropropane	1	NSL	<1	<1
1,2,4-trichlorobenzene	1	NSL	<1	<1
Hexachlorobutadiene	1	NSL	<1	<1
1,2,3-trichlorobenzene	1	NSL	<1	<1
Polycyclic Aromatic Hydrocarbons (PAHs)				
Naphthalene	0.2	NSL	<0.2	<0.2
Acenaphthylene	0.1	NSL	<0.1	<0.1
Acenaphthene	0.1	NSL	<0.1	<0.1
Fluorene	0.1	NSL	<0.1	<0.1
Phenanthrene	0.1	NSL	<0.1	<0.1
Anthracene	0.1	NSL	<0.1	<0.1
Fluoranthene	0.1	NSL	<0.1	<0.1
Pyrene	0.1	NSL	<0.1	<0.1
Benzo(a)anthracene	0.1	NSL	<0.1	<0.1
Chrysene	0.1	NSL	<0.1	<0.1
Benzo(b,j+k)fluoranthene	0.2	NSL	<0.2	<0.2
Benzo(a)pyrene	0.1	**0.01**	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	0.1	NSL	<0.1	<0.1
Dibenzo(a,h)anthracene	0.1	NSL	<0.1	<0.1
Benzo(g,h,i)perylene	0.1	NSL	<0.1	<0.1

Concentration above the GIL	VALUE
PQL exceeds GIL	**BOLD/RED**

TABLE I
SOIL INTRA-LABORATORY DUPLICATE RESULTS & RPD CALCULATIONS
All results in mg/kg unless stated otherwise

SAMPLE	ANALYSIS	Envirolab PQL	INITIAL	REPEAT	MEAN	RPD %
Sample Ref = BH103 (0.03-0.2m)	Arsenic	4	<4	<4	NC	NC
Dup Ref = Dup HL1	Cadmium	0.4	<0.4	<0.4	NC	NC
	Chromium	1	11	12	11.5	9
Envirolab Report: 184710	Copper	1	20	15	17.5	29
	Lead	1	15	23	19.0	42
	Mercury	0.1	<0.1	<0.1	NC	NC
	Nickel	1	5	3	4.0	50
	Zinc	1	23	26	24.5	12
	Naphthalene	0.1	<0.1	<0.1	NC	NC
	Acenaphthylene	0.1	<0.1	<0.1	NC	NC
	Acenaphthene	0.1	<0.1	<0.1	NC	NC
	Fluorene	0.1	<0.1	<0.1	NC	NC
	Phenanthrene	0.1	<0.1	0.1	0.1	67
	Anthracene	0.1	<0.1	<0.1	NC	NC
	Fluoranthene	0.1	<0.1	0.2	0.1	120
	Pyrene	0.1	<0.1	0.2	0.1	120
	Benzo(a)anthracene	0.1	<0.1	0.1	0.1	67
	Chrysene	0.1	<0.1	0.1	0.1	67
	Benzo(b,j+k)fluoranthene	0.2	<0.2	0.2	0.2	67
	Benzo(a)pyrene	0.05	0.08	0.1	0.1	22
	Indeno(123-cd)pyrene	0.1	<0.1	<0.1	NC	NC
	Dibenzo(ah)anthracene	0.1	<0.1	<0.1	NC	NC
	Benzo(ghi)perylene	0.1	<0.1	<0.1	NC	NC
	TRH C_6-C_{10} (F1)	25	<25	<25	NC	NC
	TRH >C_{10}-C_{16} (F2)	50	<50	<50	NC	NC
	TRH >C_{16}-C_{34} (F3)	100	620	350	485.0	56
	TRH >C_{34}-C_{40} (F4)	100	750	420	585.0	56
	Benzene	0.5	<0.2	<0.2	NC	NC
	Toluene	0.5	<0.5	<0.5	NC	NC
	Ethylbenzene	1	<1	<1	NC	NC
	m+p-xylene	2	<2	<2	NC	NC
	o-xylene	1	<1	<1	NC	NC

Explanation:

The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

Results > 10 times PQL = RPD value <= 50% are acceptable
Results between 5 & 10 times PQL = RPD value <= 75% are acceptable
Results < 5 times PQL = RPD value <= 100% are acceptable
If result is LPQL then 50% of the PQL is used for the calculation

RPD Results Above the Acceptance Criteria	VALUE

TABLE J
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 = MW106	Arsenic	1	<1	<1	NC	NC
Dup Ref = Dup AM1	Cadmium	0.1	0.1	0.1	0	0
	Chromium	1	<1	<1	NC	NC
Envirolab Report: 185317	Copper	1	<1	<1	NC	NC
	Lead	1	<1	<1	NC	NC
	Mercury	0.05	<0.05	<0.05	NC	NC
	Nickel	1	13	13	13	0
	Zinc	1	77	78	78	1
	Naphthalene	0.1	<0.2	<0.2	NC	NC
	Acenaphthylene	0.1	<0.1	<0.1	NC	NC
	Acenaphthene	0.1	<0.1	<0.1	NC	NC
	Fluorene	0.1	<0.1	<0.1	NC	NC
	Phenanthrene	0.1	<0.1	<0.1	NC	NC
	Anthracene	0.1	<0.1	<0.1	NC	NC
	Fluoranthene	0.1	<0.1	<0.1	NC	NC
	Pyrene	0.1	<0.1	<0.1	NC	NC
	Benzo(a)anthracene	0.1	<0.1	<0.1	NC	NC
	Chrysene	0.1	<0.1	<0.1	NC	NC
	Benzo(b,j+k)fluoranthene	0.2	<0.2	<0.2	NC	NC
	Benzo(a)pyrene	0.1	<0.1	<0.1	NC	NC
	Indeno(123-cd)pyrene	0.1	<0.1	<0.1	NC	NC
	Dibenzo(ah)anthracene	0.1	<0.1	<0.1	NC	NC
	Benzo(ghi)perylene	0.1	<0.1	<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	<100	<100	NC	NC
	TRH >C34-C40 (F4)	100	<100	<100	NC	NC
	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

Explanation:

The RPD value is calculated as the absolute value of the difference between the initial and repeat results divided by the average value expressed as a percentage. The following acceptance criteria will be used to assess the RPD results:

Results > 10 times PQL = RPD value <= 50% are acceptable
Results between 5 & 10 times PQL = RPD value <= 75% are acceptable
Results < 5 times PQL = RPD value <= 100% are acceptable
If result is LPQL then 50% of the PQL is used for the calculation

RPD Results Above the Acceptance Criteria VALUE

TABLE K
SUMMARY OF FIELD QA/QC RESULTS

ANALYSIS	Envirolab PQL		TB1^{s}	TS1^{s}
			7/02/2018	7/02/2018
	mg/kg	µg/L	mg/kg	% Recovery
Benzene	1	1	<0.2	92
Toluene	1	1	<0.5	94
Ethylbenzene	1	1	<1	94
m+p-xylene	2	2	<2	94
o-xylene	1	1	<1	94

Explanation:

^{S} Sample type (sand)

BTEX concentrations in trip spikes are presented as % recovery

Values above PQLs/Acceptance criteria **VALUE**

Appendix A: Borehole Logs

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
101
1/1

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD
Project: PROPOSED ALTERATIONS AND ADDITIONS
Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH
Method: JK205
R.L. Surface: N/A
Date: 7/2/18
Datum:
Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION							0			CONCRETE: 190mm.t				
	■		■						-	FILL: silty sand, fine to medium grained, brown, trace of fine to coarse grained sandstone gravel, and ash.	M			
	■		■			N = 4 1,2,2	1			FILL: Sandy clay, low to medium plasticity, light orange brown, trace of fine to coarse grained igneous gravel, and ash.	MC>PL			FCF IN FILL SAMPLE AMF1
	■					N = 8 3,4,4			CL-CI	SILTY CLAY: low to medium plasticity, grey, with ironstone gravel.	MC≥PL			
							2			END OF BOREHOLE AT 2.0m				
							3							
							4							
							5							
							6							
							7							

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ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
102/MW102
1/2

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD
Project: PROPOSED ALTERATIONS AND ADDITIONS
Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH
Method: JK205
R.L. Surface: N/A
Date: 7/2/18
Datum:
Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES ES ASS ASB SAL DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION			0			FILL: Silty sand, fine to medium grained, brown, with fine to coarse igneous gravel.	D			
▶		N = 17 3,7,10 N = 2 0,1,1 N = 2 1,1,1 N = 2 0,1,1	1 2 3 4 5 6			FILL: Sandy clay, low to medium plasticity, brown, trace of fine to coarse grained igneous gravel, and ash.	MC>PL			
			7		CL-CI	SILTY CLAY: low to medium plasticity, brown mottled red brown.	MC≥PL			

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
102/MW102
2/2

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD
Project: PROPOSED ALTERATIONS AND ADDITIONS
Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH
Method: JK205
R.L. Surface: N/A
Date: 7/2/18
Datum:
Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES					Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
	ES	ASS	ASB	SAL	DB									
								▨						
							8 9 10 11 12 13 14			END OF BOREHOLE AT 7.5m				GROUNDWATER MONITORING WELL INSTALLED TO 6.0m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 6.0m TO 3.0m. CASING 3.0m TO 0.1m 2mm SAND PACK 6.0m TO 2.2m. BENTONITE SEAL 2.2m TO 1.3m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH CONCRETED GATIC COVER.

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
103
1/1

Environmental logs are not to be used for geotechnical purposes

DUPHL1

Client: TUNBORN PTY LTD

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH

Method: JK205

R.L. Surface: N/A

Date: 7/2/18

Datum:

Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■				0	▨	-	ASPHALTIC CONCRETE: 30mm.t FILL: low to medium plasticity, brown, with fine to coarse grained igneous gravel, trace of sandstone gravel, and ash.	MC≥PL			
	■		■			N = 15 5,8,7		▨		FILL: Silty clay, low to medium plasticity, yellow brown, trace of fine to coarse grained gravel, and ash.	MC≥PL			
	■						1	▧	CL-CI	SILTY CLAY: low to medium plasticity, red brown.	MC≥PL			
	■					N = 19 7,10,9		▧		as above, but grey mottled red brown.	MC≤PL			
							2			END OF BOREHOLE AT 2.0m				
							3							
							4							
							5							
							6							
							7							

ENVIRONMENTAL LOG

Borehole No.
104
1/1

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD
Project: PROPOSED ALTERATIONS AND ADDITIONS
Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH
Method: JK205
R.L. Surface: N/A
Date: 7/2/18
Datum:
Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■				0		-	ASPHALTIC CONCRETE: 30mm.t FILL: Silty clay, low to medium plasticity, red brown, trace of fine to coarse grained igneous gravel, and ash	MC<PL			
	■					N = 12 4,6,6			CI-CH	SILTY CLAY: medium to high plasticity, grey mottled red brown.	MC<PL			
							1			END OF BOREHOLE AT 1.0m				
							2							
							3							
							4							
							5							
							6							
							7							

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
105
1/1

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD

Project: PROPOSED ALTERATIONS AND ADDITIONS

Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH

Method: JK205

R.L. Surface: N/A

Date: 7/2/18

Datum:

Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES: ES	SAMPLES: ASS	SAMPLES: ASB	SAMPLES: SAL	SAMPLES: DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■			N = 16 6,8,8	0			FILL: Silty sand, fine to medium grained, brown, trace of fine to coarse grained sandstone gravel, and root fibres	D			GRASS COVER
	■						1		CL-CI	SILTY CLAY: low to medium plasticity, red brown, trace of fine to coarse grained ironstone gravel.	MC≥PL			POTENTIAL IRONSTONE BAND POSSIBLY FILL
	■								SC	CLAYEY SAND: fine to medium grained, yellow brown, trace of fine to coarse grained ironstone gravel.	D			
	■					N = 25 7,15,10			-	SANDY CLAY: low to medium plasticity, yellow brown, trace of fine to coarse grained ironstone gravel.	MC≥PL			
							2			END OF BOREHOLE AT 2.0m				
							3							
							4							
							5							
							6							
							7							

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

ENVIRONMENTAL LOG

Borehole No.
106/MW106
1/1

Environmental logs are not to be used for geotechnical purposes

Client: TUNBORN PTY LTD
Project: PROPOSED ALTERATIONS AND ADDITIONS
Location: 187 SLADE ROAD, BEXLEY, NSW

Job No. E30293KH
Method: JK205
R.L. Surface: N/A
Date: 7/2/18
Datum:
Logged/Checked by: H.L. & A.M./T.H.

Groundwater Record	SAMPLES ES	ASS	ASB	SAL	DB	Field Tests	Depth (m)	Graphic Log	Unified Classification	DESCRIPTION	Moisture Condition/ Weathering	Strength/ Rel. Density	Hand Penetrometer Readings (kPa.)	Remarks
DRY ON COMPLETION	■		■				0	▩		FILL: Silty sand, fine to medium grained, brown, trace of root fibres and ash	D			GRASS COVER
	■		■			N = 27 18,21,16		▩		FILL: Silty sand, fine to medium grained, brown, trace of fine to coarse grained sandstone gravel.	D			
	■						1 2 3	▨	CL-CI	SILTY CLAY: low to medium plasticity, red brown, trace of fine to coarse grained ironstone gravel.	MC≥PL			GROUNDWATER MONITORING WELL INSTALLED TO 6.0m. CLASS 18 MACHINE SLOTTED 50mm DIA. PVC STANDPIPE 6.0m TO 3.0m. CASING 3.0m TO 0.1m 2mm SAND PACK 6.0m TO 2.5m. BENTONITE SEAL 2.5m TO 1.7m. BACKFILLED WITH SAND TO THE SURFACE. COMPLETED WITH CONCRETED GATIC COVER.
							4 5	▨		as above, but light red brown.				
	■							⁞		SANDSTONE: red.	SW			
							6 7			END OF BOREHOLE AT 6.0m				

EXPLANATORY NOTES – ENVIRONMENTAL LOGS

INTRODUCTION

These notes have been provided to supplement the environmental report with regards to drilling and field logging. 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 manmade processes and therefore exhibits a variety of characteristics and properties which vary from place to place and can change with time. Environmental studies involve gathering and assimilating limited facts about these characteristics and properties in order to understand the ground on a particular site under certain conditions. These conditions 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, the SAA Site Investigation Code. 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 geotechnical practice.

Soil types are described according to the predominating particle size and behaviour as set out in the attached Unified Soil Classification Table qualified by the grading of other particles present (e.g. sandy clay) as set out below (note that unless stated in the report, the soil classification is based on a qualitative field assessment, not laboratory testing):

Soil Classification	Particle Size
Clay	less than 0.002mm
Silt	0.002 to 0.075mm
Sand	0.075 to 2mm
Gravel	2 to 60mm

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	less than 4
Loose	4 – 10
Medium dense	10 – 30
Dense	30 – 50
Very Dense	greater than 50

Cohesive soils are classified on the basis of strength (consistency) either by use of hand penetrometer, laboratory testing or engineering examination. The strength terms are defined as shown in the following table:

Classification	Unconfined Compressive Strength kPa
Very Soft	less than 25
Soft	25 – 50
Firm	50 – 100
Stiff	100 – 200
Very Stiff	200 – 400
Hard	Greater than 400
Friable	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 thinly bedded to laminated siltstone.

DRILLING OR EXCAVATION METHODS

The following is a brief summary of drilling and excavation methods currently adopted by the Company, and some comments on their use and application. All except test pits and hand auger drilling require the use of a mechanical drilling rig.

Test Pits: These are normally excavated with a backhoe or a tracked excavator, allowing close examination of the in-situ soils if it is safe to descend into the pit. The depth of penetration is limited to approximately 3m for a backhoe and up to 6m for an excavator. Limitations of test pits include problems associated with disturbance and difficulty of reinstatement; and the consequent effects on nearby structures. Care must be taken if construction is to be carried out near test pit locations to either properly re-compact 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. Premature refusal of the hand augers can occur on a variety of materials such as fill, hard clay, gravel or ironstone, 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 in-situ testing. This is a relatively economical means of drilling in clays and in sands above the water table. Samples are returned to the surface 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 relatively lower 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 fragments. 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 determined 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 such as Revert or Biogel. The mud tends to mask the cuttings and reliable identification is only possible from intermittent intact sampling (e.g. 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, an NMLC triple tube core barrel, which gives a core of about 50mm diameter, 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 CORE LOSS. The locations of losses are determined on site by the supervising engineer; where the location is uncertain, the loss is placed at the top end 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, "Methods of Testing Soils for Engineering Purposes" – Test F3.1.

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 63kg 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. Occasionally, the drop hammer is used to drive 50mm diameter thin walled sample tubes (U50) in clays. In such circumstances, the test results are shown on the borehole logs in brackets.

A modification to the SPT test 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 "Nc" 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 attached explanatory notes define the terms and symbols used in preparation of the logs.

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; and
- The use of water or mud as a drilling fluid will mask any groundwater inflow. Water has to be blown out of the hole and drilling mud must be washed out of the hole or 'reverted' chemically if water observations are to be made.

More reliable measurements can be made by installing standpipes which are read after stabilising 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 (e.g. bricks, concrete, plastic, slag/ash, 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 determine the extent of the fill.

The presence of fill materials is usually regarded with caution as the possible variation in density, strength and material type is much greater than with natural soil deposits. If the volume and quality of fill is of importance to a project, then frequent test pit excavations are preferable to boreholes

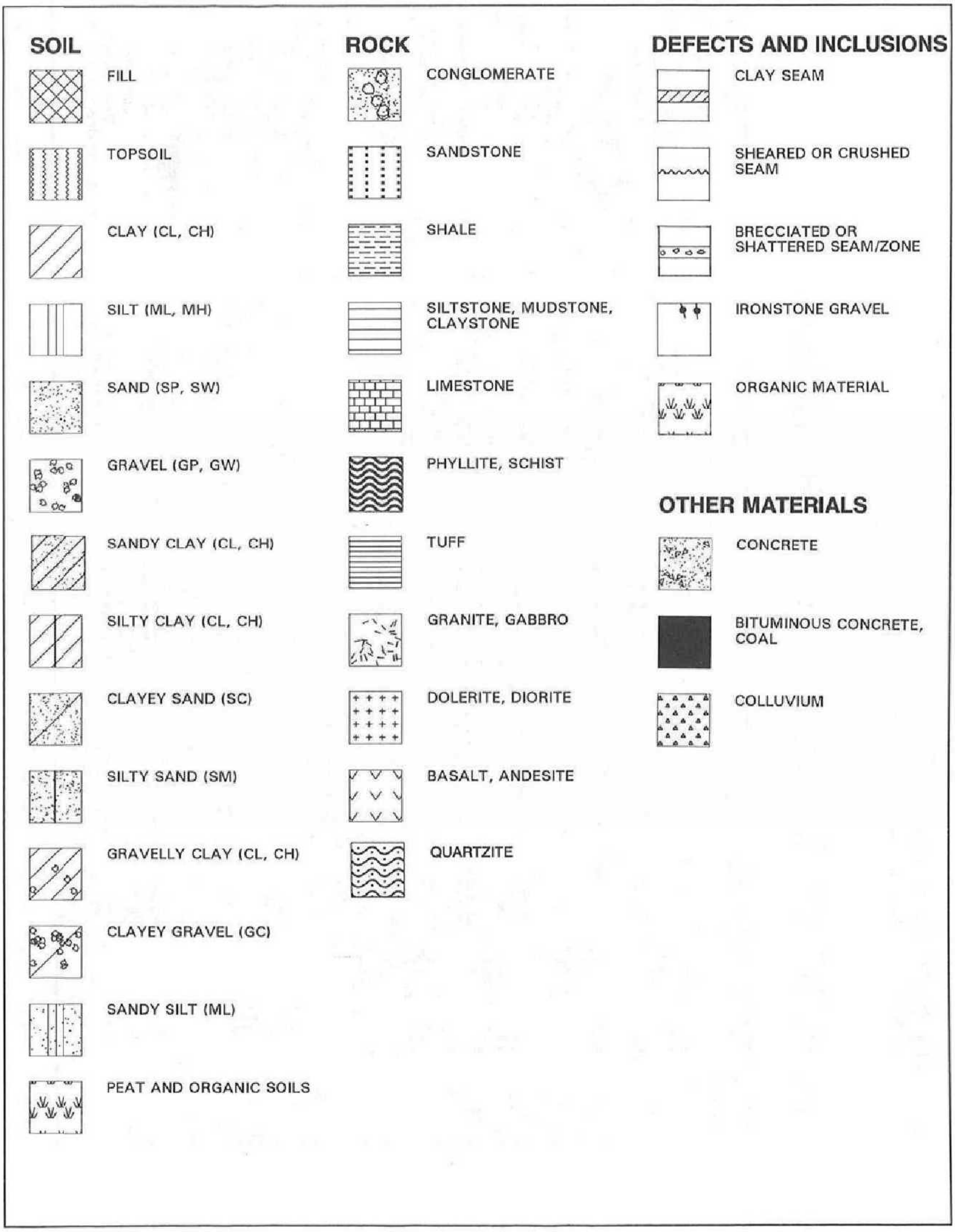
LABORATORY TESTING

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

SITE ANOMALIES

In the event that conditions encountered on site during construction appear to vary from those which were expected from the information contained in the report, EIS should be notified immediately.

GRAPHIC LOG SYMBOLS FOR SOIL AND ROCKS



SOIL

- FILL
- TOPSOIL
- CLAY (CL, CH)
- SILT (ML, MH)
- SAND (SP, SW)
- GRAVEL (GP, GW)
- SANDY CLAY (CL, CH)
- SILTY CLAY (CL, CH)
- CLAYEY SAND (SC)
- SILTY SAND (SM)
- GRAVELLY CLAY (CL, CH)
- CLAYEY GRAVEL (GC)
- SANDY SILT (ML)
- PEAT AND ORGANIC SOILS

ROCK

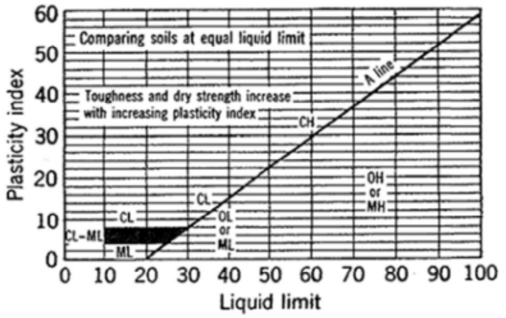
- CONGLOMERATE
- SANDSTONE
- SHALE
- SILTSTONE, MUDSTONE, CLAYSTONE
- LIMESTONE
- PHYLLITE, SCHIST
- TUFF
- GRANITE, GABBRO
- DOLERITE, DIORITE
- BASALT, ANDESITE
- QUARTZITE

DEFECTS AND INCLUSIONS

- CLAY SEAM
- SHEARED OR CRUSHED SEAM
- BRECCIATED OR SHATTERED SEAM/ZONE
- IRONSTONE GRAVEL
- ORGANIC MATERIAL

OTHER MATERIALS

- CONCRETE
- BITUMINOUS CONCRETE, COAL
- COLLUVIUM

Field Identification Procedures (Excluding particles larger than 75 μm and basing fractions on estimated weights)						Group Symbols[a]	Typical Names	Information Required for Describing Soils	Laboratory Classification Criteria			
Coarse-grained soils More than half of material is *larger* than 75 μm sieve size[b] (The 75 μm sieve size is about the smallest particle visible to naked eye)	Gravels More than half of coarse fraction is larger than 4 mm sieve size	Clean gravels (little or no fines)	Wide range in grain size and substantial amounts of all intermediate particle sizes			*GW*	Well graded gravels, gravel-sand mixtures, little or no fines	Give typical name; indicate approximate percentages of sand and gravel; maximum size; angularity, surface condition, and hardness of the coarse grains; local or geologic name and other pertinent descriptive information; and symbols in parentheses For undisturbed soils add information on stratification, degree of compactness, cementation, moisture conditions and drainage characteristics Example: *Silty sand*, gravelly; about 20% hard, angular gravel particles 12 mm maximum size; rounded and subangular sand grains coarse to fine, about 15% non-plastic fines with low dry strength; well compacted and moist in place; alluvial sand; (*SM*)	Use grain size curve in identifying the fractions as given under field identification	Determine percentages of gravel and sand from grain size curve Depending on percentage of fines (fraction smaller than 75 μm sieve size) coarse grained soils are classified as follows: Less than 5% *GW, GP, SW, SP* More than 12% *GM, GC, SM, SC* 5% to 12% *Borderline* cases requiring use of dual symbols	$C_U = \frac{D_{60}}{D_{10}}$ Greater than 4 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*GP*	Poorly graded gravels, gravel-sand mixtures, little or no fines				Not meeting all gradation requirements for *GW*	
		Gravels with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures see *ML* below)			*GM*	Silty gravels, poorly graded gravel-sand-silt mixtures				Atterberg limits below "A" line, or *PI* less than 4	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*GC*	Clayey gravels, poorly graded gravel-sand-clay mixtures				Atterberg limits above "A" line, with *PI* greater than 7	
	Sands More than half of coarse fraction is smaller than 4 mm sieve size	Clean sands (little or no fines)	Wide range in grain sizes and substantial amounts of all intermediate particle sizes			*SW*	Well graded sands, gravelly sands, little or no fines				$C_U = \frac{D_{60}}{D_{10}}$ Greater than 6 $C_C = \frac{(D_{30})^2}{D_{10} \times D_{60}}$ Between 1 and 3	
			Predominantly one size or a range of sizes with some intermediate sizes missing			*SP*	Poorly graded sands, gravelly sands, little or no fines				Not meeting all gradation requirements for *SW*	
		Sands with fines (appreciable amount of fines)	Nonplastic fines (for identification procedures, see *ML* below)			*SM*	Silty sands, poorly graded sand-silt mixtures				Atterberg limits below "A" line or *PI* less than 5	Above "A" line with *PI* between 4 and 7 are *borderline* cases requiring use of dual symbols
			Plastic fines (for identification procedures, see *CL* below)			*SC*	Clayey sands, poorly graded sand-clay mixtures				Atterberg limits below "A" line with *PI* greater than 7	
	Identification Procedures on Fraction Smaller than 380 μm Sieve Size											
			Dry Strength (crushing characteristics)	Dilatancy (reaction to shaking)	Toughness (consistency near plastic limit)							
Fine-grained soils More than half of material is *smaller* than 75 μm sieve size	Silts and clays liquid limit less than 50		None to slight	Quick to slow	None	*ML*	Inorganic silts and very fine sands, rock flour, silty or clayey fine sands with slight plasticity	Give typical name; indicate degree and character of plasticity, amount and maximum size of coarse grains; colour in wet condition, odour if any, local or geologic name, and other pertinent descriptive information, and symbol in parentheses For undisturbed soils add information on structure, stratification, consistency in undisturbed and remoulded states, moisture and drainage conditions Example: *Clayey silt*, brown; slightly plastic; small percentage of fine sand; numerous vertical root holes; firm and dry in place; loess; (*ML*)		 Plasticity chart for laboratory classification of fine grained soils		
			Medium to high	None to very slow	Medium	*CL*	Inorganic clays of low to medium plasticity, gravelly clays, sandy clays, silty clays, lean clays					
			Slight to medium	Slow	Slight	*OL*	Organic silts and organic silt-clays of low plasticity					
	Silts and clays liquid limit greater than 50		Slight to medium	Slow to none	Slight to medium	*MH*	Inorganic silts, micaceous or diatomaceous fine sandy or silty soils, elastic silts					
			High to very high	None	High	*CH*	Inorganic clays of high plasticity, fat clays					
			Medium to high	None to very slow	Slight to medium	*OH*	Organic clays of medium to high plasticity					
Highly Organic Soils			Readily identified by colour, odour, spongy feel and frequently by fibrous texture			*Pt*	Peat and other highly organic soils					

Note: 1 Soils possessing characteristics of two groups are designated by combinations of group symbols (eg. GW-GC, well graded gravel-sand mixture with clay fines).

2 Soils with liquid limits of the order of 35 to 50 may be visually classified as being of medium plasticity.

LOG SYMBOLS

LOG COLUMN	SYMBOL	DEFINITION
Groundwater Record	▼	Standing water level. Time delay following completion of drilling may be shown.
	—C—	Extent of borehole collapse shortly after drilling.
	▶—	Groundwater seepage into borehole or excavation noted during drilling or excavation.
Samples	ES	Soil 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 screening.
	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 show blows per 150mm penetration. 'R' as noted below.
	N_c = 5 7 3 R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60 degree solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of Undrained Shear Strength.
	PID = 100	Photoionisation detector reading in ppm (Soil sample heads pace test).
Moisture (Cohesive Soils)	MC>PL	Moisture content estimated to be greater than plastic limit.
	MC≈PL	Moisture content estimated to be approximately equal to plastic limit.
	MC<PL	Moisture content estimated to be less than plastic limit.
(Cohesionless)	D	DRY – Runs freely through fingers.
	M	MOIST – Does not run freely but no free water visible on soil surface.
	W	WET – Free water visible on soil surface.
Strength (Consistency) Cohesive Soils	VS	VERY SOFT – Unconfined compressive strength less than 25kPa
	S	SOFT – Unconfined compressive strength 25-5 0kPa
	F	FIRM – Unconfined compressive strength 50-1 00kPa
	St	STIFF – Unconfined compressive strength 100- 200kPa
	VSt	VERY STIFF – Unconfined compressive strength 200- 400kPa
	H	HARD – Unconfined compressive strength greater than 400kPa
	( )	Bracketed symbol indicates estimated consistency based o n tactile examination or other tests.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (ID) Range (%)** **SPT ' N' Value Range (Blows/300mm)**
	VL	Very Loose <15 0-4
	L	Loose 15-35 4-10
	MD	Medium Dense 35-65 10-30
	D	Dense 65-85 30-50
	VD	Very Dense >85 >50
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other tests.
Hand Penetrometer Readings	300 250	Numbers indicate individual test results in kPa on representative undisturbed material unless noted otherwise
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Tungsten carbide wing bit.
	$\mathbf{T}_{60}$	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.

LOG SYMBOLS CONTINUED

ROCK STRENGTH

Rock strength is defined by the Point Load Strength Index (Is 50) and refers to the strength of the rock substance in the bedding. The test procedure is described by the International Journal of Rock Mechanics, Mining and Geomechanics Abstract Volume 22, No 2, 1985.

TERM	SYMBOL	Is (50) MPa	FIELD GUIDE
Extremely Low:	EL	0.03	Easily remoulded by hand to a material with soil properties.
Very Low:	VL	0.1	May be crumbled in the hand. Sandstone is “sugary” and friable.
Low:	L	0.3	A piece of core 150 mm long x 50mm dia. may be broken by hand and easily scored with a knife. Sharp edges of core may be friable and break during handling.
Medium Strength:	M	1	A piece of core 150 mm long x 50mm dia. can be broken by hand with difficulty. Readily scored with knife.
High:	H	3	A piece of core 150 mm long x 50mm dia. core cannot be broken by hand, can be slightly scratched or scored with knife; rock rings under hammer.
Very High:	VH	10	A piece of core 150 mm long x 50mm dia. may be broken with hand-held pick after more than one blow. Cannot be scratched with pen knife; rock rings under hammer.
Extremely High:	EH		A piece of core 150 mm long x 50mm dia. is very difficult to break with h and-held hammer . Rings when struck with a hammer.

ROCK STRENGTH

ABBREVIATION	DESCRIPTION	NOTES
Be	Bedding Plane Parting	Defect orientations measured relative to the normal to (i.e. relative to horizontal for vertical holes)
CS	Clay Seam	
J	Joint	
P	Planar	
Un	Undulating	
S	Smooth	
R	Rough	
IS	Iron stained	
XWS	Extremely Weathered Seam	
Cr	Crushed Seam	
60t	Thickness of defect in millimetres	

Appendix B: Laboratory Reports & COC Documents

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CERTIFICATE OF ANALYSIS 184710

Client Details

Client	Environmental Investigation Services
Attention	Todd Hore
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E30293KH, Bexley**
Number of Samples	26 soil, 1 MATERIAL
Date samples received	07/02/2018
Date completed instructions received	07/02/2018

Analysis Details

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

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

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

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

Report Details

Date results requested by	14/02/2018
Date of Issue	14/02/2018

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Asbestos Approved By

Analysed by Asbestos Approved Identifier: Lulu Scott, Lucy Zhu
Authorised by Asbestos Approved Signatory: Lulu Scott

Results Approved By

Dragana Tomas, Senior Chemist
Jeremy Faircloth, Organics Supervisor
Long Pham, Team Leader, Metals
Lulu Scott, Asbestos Supervisor
Paul Ching, Senior Analyst
Steven Luong, Senior Chemist

Authorised By

David Springer, General Manager

vTRH(C6-C10)/BTEXN in Soil

Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
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	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	111	106	108	111	109

vTRH(C6-C10)/BTEXN in Soil

Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
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	<1	<1	<1	<1	<1
Surrogate aaa-Trifluorotoluene	%	109	107	107	111	110

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		184710-20	184710-21	184710-24	184710-25	184710-27
Your Reference	UNITS	BH106	BH106	TSAM1	TBAM1	DUPHL1
Depth		0-0.2	0.5-0.8	-	-	-
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
TRH C_6 - C_9	mg/kg	<25	<25	[NA]	<25	<25
TRH C_6 - C_{10}	mg/kg	<25	<25	[NA]	<25	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	<25	<25	[NA]	<25	<25
Benzene	mg/kg	<0.2	<0.2	92%	<0.2	<0.2
Toluene	mg/kg	<0.5	<0.5	94%	<0.5	<0.5
Ethylbenzene	mg/kg	<1	<1	94%	<1	<1
m+p-xylene	mg/kg	<2	<2	94%	<2	<2
o-Xylene	mg/kg	<1	<1	94%	<1	<1
naphthalene	mg/kg	<1	<1	[NA]	<1	<1
Total +ve Xylenes	mg/kg	<1	<1	[NA]	<1	<1
Surrogate aaa-Trifluorotoluene	%	111	113	95	111	112

svTRH (C10-C40) in Soil						
Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	180
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	670
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	620
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	750
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	1,400
Surrogate o-Terphenyl	%	82	80	81	79	89

svTRH (C10-C40) in Soil						
Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	<100	<100	<100
TRH C_{29} - C_{36}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	<100	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	<50	<50	<50
Surrogate o-Terphenyl	%	79	80	80	82	80

svTRH (C10-C40) in Soil				
Our Reference		184710-20	184710-21	184710-27
Your Reference	UNITS	BH106	BH106	DUPHL1
Depth		0-0.2	0.5-0.8	-
Date Sampled		07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018
TRH C_{10} - C_{14}	mg/kg	<50	<50	<50
TRH C_{15} - C_{28}	mg/kg	<100	<100	110
TRH C_{29} - C_{36}	mg/kg	<100	<100	370
TRH >C_{10} -C_{16}	mg/kg	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50	<50	<50
TRH >C_{16} -C_{34}	mg/kg	<100	<100	350
TRH >C_{34} -C_{40}	mg/kg	<100	<100	420
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	780
Surrogate o-Terphenyl	%	80	80	82

PAHs in Soil						
Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	0.1	0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	0.2	0.2	0.3	<0.1	<0.1
Pyrene	mg/kg	0.2	0.2	0.3	<0.1	<0.1
Benzo(a)anthracene	mg/kg	0.1	<0.1	0.2	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	0.2	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.2	<0.2	0.4	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.2	0.09	0.3	0.06	0.08
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.2	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	1.1	0.52	2.0	0.06	0.08
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	94	87	90	90	92

PAHs in Soil						
Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.1	<0.1	<0.1	<0.1
Pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(a)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chrysene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	<0.2	<0.2	<0.2
Benzo(a)pyrene	mg/kg	<0.05	0.06	<0.05	0.06	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	0.2	<0.05	0.06	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	96	87	88	97	93

PAHs in Soil				
Our Reference		184710-20	184710-21	184710-27
Your Reference	UNITS	BH106	BH106	DUPHL1
Depth		0-0.2	0.5-0.8	-
Date Sampled		07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018
Naphthalene	mg/kg	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	<0.1
Acenaphthene	mg/kg	<0.1	<0.1	<0.1
Fluorene	mg/kg	<0.1	<0.1	<0.1
Phenanthrene	mg/kg	<0.1	<0.1	0.1
Anthracene	mg/kg	<0.1	<0.1	<0.1
Fluoranthene	mg/kg	<0.1	0.1	0.2
Pyrene	mg/kg	<0.1	0.1	0.2
Benzo(a)anthracene	mg/kg	<0.1	<0.1	0.1
Chrysene	mg/kg	<0.1	<0.1	0.1
Benzo(b,j+k)fluoranthene	mg/kg	<0.2	<0.2	0.2
Benzo(a)pyrene	mg/kg	<0.05	0.06	0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1	<0.1	<0.1
Total +ve PAH's	mg/kg	<0.05	0.3	1.0
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	90	95	89

Organochlorine Pesticides in soil						
Our Reference		184710-1	184710-6	184710-10	184710-14	184710-16
Your Reference	UNITS	BH101	BH102	BH103	BH104	BH105
Depth		0.2-0.4	1.5-1.95	0.03-0.2	0.03-0.2	0-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
HCB	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	105	104	106	106

Organochlorine Pesticides in soil		
Our Reference		184710-20
Your Reference	UNITS	BH106
Depth		0-0.2
Date Sampled		07/02/2018
Type of sample		soil
Date extracted	-	08/02/2018
Date analysed	-	09/02/2018
HCB	mg/kg	<0.1
alpha-BHC	mg/kg	<0.1
gamma-BHC	mg/kg	<0.1
beta-BHC	mg/kg	<0.1
Heptachlor	mg/kg	<0.1
delta-BHC	mg/kg	<0.1
Aldrin	mg/kg	<0.1
Heptachlor Epoxide	mg/kg	<0.1
gamma-Chlordane	mg/kg	<0.1
alpha-chlordane	mg/kg	<0.1
Endosulfan I	mg/kg	<0.1
pp-DDE	mg/kg	<0.1
Dieldrin	mg/kg	<0.1
Endrin	mg/kg	<0.1
pp-DDD	mg/kg	<0.1
Endosulfan II	mg/kg	<0.1
pp-DDT	mg/kg	<0.1
Endrin Aldehyde	mg/kg	<0.1
Endosulfan Sulphate	mg/kg	<0.1
Methoxychlor	mg/kg	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1
Surrogate TCMX	%	108

Organophosphorus Pesticides						
Our Reference		184710-1	184710-6	184710-10	184710-14	184710-16
Your Reference	UNITS	BH101	BH102	BH103	BH104	BH105
Depth		0.2-0.4	1.5-1.95	0.03-0.2	0.03-0.2	0-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dichlorvos	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Surrogate TCMX	%	108	105	104	106	106

Organophosphorus Pesticides		
Our Reference		184710-20
Your Reference	UNITS	BH106
Depth		0-0.2
Date Sampled		07/02/2018
Type of sample		soil
Date extracted	-	08/02/2018
Date analysed	-	09/02/2018
Azinphos-methyl (Guthion)	mg/kg	<0.1
Bromophos-ethyl	mg/kg	<0.1
Chlorpyriphos	mg/kg	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1
Diazinon	mg/kg	<0.1
Dichlorvos	mg/kg	<0.1
Dimethoate	mg/kg	<0.1
Ethion	mg/kg	<0.1
Fenitrothion	mg/kg	<0.1
Malathion	mg/kg	<0.1
Parathion	mg/kg	<0.1
Ronnel	mg/kg	<0.1
Surrogate TCMX	%	108

PCBs in Soil						
Our Reference		184710-1	184710-6	184710-10	184710-14	184710-16
Your Reference	UNITS	BH101	BH102	BH103	BH104	BH105
Depth		0.2-0.4	1.5-1.95	0.03-0.2	0.03-0.2	0-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date extracted	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
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 TCLMX	%	108	105	104	106	106

PCBs in Soil		
Our Reference		184710-20
Your Reference	UNITS	BH106
Depth		0-0.2
Date Sampled		07/02/2018
Type of sample		soil
Date extracted	-	08/02/2018
Date analysed	-	09/02/2018
Aroclor 1016	mg/kg	<0.1
Aroclor 1221	mg/kg	<0.1
Aroclor 1232	mg/kg	<0.1
Aroclor 1242	mg/kg	<0.1
Aroclor 1248	mg/kg	<0.1
Aroclor 1254	mg/kg	<0.1
Aroclor 1260	mg/kg	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1
Surrogate TCLMX	%	108

Acid Extractable metals in soil						
Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Arsenic	mg/kg	<4	10	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	4	11	19	9	11
Copper	mg/kg	5	2	19	17	20
Lead	mg/kg	64	27	27	38	15
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	2	2	8	2	5
Zinc	mg/kg	29	25	50	31	23

Acid Extractable metals in soil						
Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Arsenic	mg/kg	<4	4	<4	<4	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	14	15	9	11	10
Copper	mg/kg	<1	3	2	11	1
Lead	mg/kg	9	18	9	56	6
Mercury	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Nickel	mg/kg	1	2	1	2	1
Zinc	mg/kg	5	11	7	110	13

Acid Extractable metals in soil				
Our Reference		184710-20	184710-21	184710-27
Your Reference	UNITS	BH106	BH106	DUPHL1
Depth		0-0.2	0.5-0.8	-
Date Sampled		07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	08/02/2018	08/02/2018	08/02/2018
Arsenic	mg/kg	5	5	<4
Cadmium	mg/kg	<0.4	<0.4	<0.4
Chromium	mg/kg	13	17	12
Copper	mg/kg	31	9	15
Lead	mg/kg	40	22	23
Mercury	mg/kg	<0.1	<0.1	<0.1
Nickel	mg/kg	5	4	3
Zinc	mg/kg	54	31	26

Moisture						
Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
Moisture	%	3.9	13	6.9	12	9.7

Moisture						
Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018	09/02/2018	09/02/2018
Moisture	%	11	15	14	5.8	6.3

Moisture				
Our Reference		184710-20	184710-21	184710-27
Your Reference	UNITS	BH106	BH106	DUPHL1
Depth		0-0.2	0.5-0.8	-
Date Sampled		07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil
Date prepared	-	08/02/2018	08/02/2018	08/02/2018
Date analysed	-	09/02/2018	09/02/2018	09/02/2018
Moisture	%	6.1	7.0	9.3

Asbestos ID - soils						
Our Reference		184710-1	184710-2	184710-4	184710-6	184710-10
Your Reference	UNITS	BH101	BH101	BH102	BH102	BH103
Depth		0.2-0.4	0.5-0.95	0-0.2	1.5-1.95	0.03-0.2
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	14/02/2018	14/02/2018	14/02/2018	14/02/2018	14/02/2018
Sample mass tested	g	Approx. 30g	Approx. 35g	Approx. 40g	Approx. 30g	Approx. 50g
Sample Description	-	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & rocks	Brown coarse-grained soil & bitumen
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils						
Our Reference		184710-12	184710-14	184710-15	184710-16	184710-18
Your Reference	UNITS	BH103	BH104	BH104	BH105	BH105
Depth		0.9-1.1	0.03-0.2	0.5-0.95	0-0.2	1.1-1.3
Date Sampled		07/02/2018	07/02/2018	07/02/2018	07/02/2018	07/02/2018
Type of sample		soil	soil	soil	soil	soil
Date analysed	-	14/02/2018	14/02/2018	14/02/2018	14/02/2018	14/02/2018
Sample mass tested	g	Approx. 40g	Approx. 40g	Approx. 50g	Approx. 25g	Approx. 40g
Sample Description	-	Red coarse-grained soil & rocks	Red coarse-grained soil & rocks	Grey clayey soil & rocks	Brown coarse-grained soil & rocks	Orange coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected
Trace Analysis	-	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected	No asbestos detected

Asbestos ID - soils			
Our Reference		184710-20	184710-21
Your Reference	UNITS	BH106	BH106
Depth		0-0.2	0.5-0.8
Date Sampled		07/02/2018	07/02/2018
Type of sample		soil	soil
Date analysed	-	14/02/2018	14/02/2018
Sample mass tested	g	Approx. 30g	Approx. 60g
Sample Description	-	Brown fine-grained soil & rocks	Brown coarse-grained soil & rocks
Asbestos ID in soil	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibre detected
Trace Analysis	-	No asbestos detected	No asbestos detected

Asbestos ID - materials		
Our Reference		184710-26
Your Reference	UNITS	AMF1
Depth		-
Date Sampled		07/02/2018
Type of sample		MATERIAL
Date analysed	-	13/02/2018
Mass / Dimension of Sample	-	30x25x5mm
Sample Description	-	Grey compressed fibre cement material
Asbestos ID in materials	-	Chrysotile asbestos detected Amosite asbestos detected

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.
Org-003	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.
Org-005	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-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-008	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC with dual ECD's.

Method ID	Methodology Summary
Org-012	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. '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-7	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			09/02/2018	1	09/02/2018	09/02/2018		09/02/2018	09/02/2018
TRH C_6 - C_9	mg/kg	25	Org-016	<25	1	<25	<25	0	83	87
TRH C_6 - C_{10}	mg/kg	25	Org-016	<25	1	<25	<25	0	83	87
Benzene	mg/kg	0.2	Org-016	<0.2	1	<0.2	<0.2	0	75	66
Toluene	mg/kg	0.5	Org-016	<0.5	1	<0.5	<0.5	0	83	90
Ethylbenzene	mg/kg	1	Org-016	<1	1	<1	<1	0	94	101
m+p-xylene	mg/kg	2	Org-016	<2	1	<2	<2	0	81	88
o-Xylene	mg/kg	1	Org-016	<1	1	<1	<1	0	95	104
naphthalene	mg/kg	1	Org-014	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	112	1	111	110	1	115	105

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	20	08/02/2018	08/02/2018		[NT]	[NT]
Date analysed	-			[NT]	20	09/02/2018	09/02/2018		[NT]	[NT]
TRH C_6 - C_9	mg/kg	25	Org-016	[NT]	20	<25	<25	0	[NT]	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-016	[NT]	20	<25	<25	0	[NT]	[NT]
Benzene	mg/kg	0.2	Org-016	[NT]	20	<0.2	<0.2	0	[NT]	[NT]
Toluene	mg/kg	0.5	Org-016	[NT]	20	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	mg/kg	1	Org-016	[NT]	20	<1	<1	0	[NT]	[NT]
m+p-xylene	mg/kg	2	Org-016	[NT]	20	<2	<2	0	[NT]	[NT]
o-Xylene	mg/kg	1	Org-016	[NT]	20	<1	<1	0	[NT]	[NT]
naphthalene	mg/kg	1	Org-014	[NT]	20	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-016	[NT]	20	111	111	0	[NT]	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			08/02/2018	1	09/02/2018	09/02/2018		08/02/2018	09/02/2018
TRH C_{10} - C_{14}	mg/kg	50	Org-003	<50	1	<50	<50	0	103	97
TRH C_{15} - C_{28}	mg/kg	100	Org-003	<100	1	<100	<100	0	101	95
TRH C_{29} - C_{36}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	88
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	<50	1	<50	<50	0	103	97
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	<100	1	<100	<100	0	101	95
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	<100	1	<100	<100	0	92	88
Surrogate o-Terphenyl	%		Org-003	83	1	82	83	1	90	91

QUALITY CONTROL: svTRH (C10-C40) in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	20	08/02/2018	08/02/2018		[NT]	[NT]
Date analysed	-			[NT]	20	09/02/2018	09/02/2018		[NT]	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-003	[NT]	20	<50	<50	0	[NT]	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-003	[NT]	20	<100	<100	0	[NT]	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-003	[NT]	20	<100	<100	0	[NT]	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-003	[NT]	20	<50	<50	0	[NT]	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-003	[NT]	20	<100	<100	0	[NT]	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-003	[NT]	20	<100	<100	0	[NT]	[NT]
Surrogate o-Terphenyl	%		Org-003	[NT]	20	80	80	0	[NT]	[NT]

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			09/02/2018	1	09/02/2018	09/02/2018		09/02/2018	09/02/2018
Naphthalene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	94	85
Acenaphthylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	95	89
Phenanthrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	0.2	67	98	99
Anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	<0.1	1	0.2	0.3	40	99	106
Pyrene	mg/kg	0.1	Org-012	<0.1	1	0.2	0.3	40	120	120
Benzo(a)anthracene	mg/kg	0.1	Org-012	<0.1	1	0.1	0.2	67	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	<0.1	1	0.1	0.2	67	93	99
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	<0.2	1	0.2	0.3	40	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	<0.05	1	0.2	0.2	0	101	115
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	<0.1	1	<0.1	0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	94	1	94	92	2	121	109

QUALITY CONTROL: PAHs in Soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date extracted	-			[NT]	20	08/02/2018	08/02/2018		[NT]	[NT]
Date analysed	-			[NT]	20	09/02/2018	09/02/2018		[NT]	[NT]
Naphthalene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Acenaphthylene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Fluorene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Phenanthrene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Anthracene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Pyrene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-012	[NT]	20	<0.2	<0.2	0	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-012	[NT]	20	<0.05	<0.05	0	[NT]	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-012	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	[NT]	20	90	90	0	[NT]	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			09/02/2018	1	09/02/2018	09/02/2018		09/02/2018	09/02/2018
HCB	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	92	90
gamma-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	89	87
Heptachlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	86
delta-BHC	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	84	83
Heptachlor Epoxide	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	89	89
gamma-Chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	88	88
Dieldrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	93	94
Endrin	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	84	86
pp-DDD	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	91	91
Endosulfan II	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	92	92
Methoxychlor	mg/kg	0.1	Org-005	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-005	106	1	108	108	0	124	115

QUALITY CONTROL: Organophosphorus Pesticides					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			09/02/2018	1	09/02/2018	09/02/2018		09/02/2018	09/02/2018
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	89	89
Chlorpyriphos-methyl	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Dichlorvos	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	85	82
Dimethoate	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	98	110
Fenitrothion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	109	101
Malathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	75	82
Parathion	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	98	113
Ronnel	mg/kg	0.1	Org-008	<0.1	1	<0.1	<0.1	0	103	98
Surrogate TCMX	%		Org-008	106	1	108	108	0	124	99

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-8	184710-6
Date extracted	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			09/02/2018	1	09/02/2018	09/02/2018		09/02/2018	09/02/2018
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	101	103
Aroclor 1260	mg/kg	0.1	Org-006	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCLMX	%		Org-006	106	1	108	108	0	124	99

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	184710-6
Date prepared	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Date analysed	-			08/02/2018	1	08/02/2018	08/02/2018		08/02/2018	08/02/2018
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	112	96
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	<0.4	<0.4	0	102	100
Chromium	mg/kg	1	Metals-020	<1	1	4	5	22	110	104
Copper	mg/kg	1	Metals-020	<1	1	5	5	0	111	97
Lead	mg/kg	1	Metals-020	<1	1	64	66	3	106	88
Mercury	mg/kg	0.1	Metals-021	<0.1	1	<0.1	<0.1	0	95	101
Nickel	mg/kg	1	Metals-020	<1	1	2	3	40	109	105
Zinc	mg/kg	1	Metals-020	<1	1	29	31	7	103	90

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Date prepared	-			[NT]	20	08/02/2018	08/02/2018		[NT]	[NT]
Date analysed	-			[NT]	20	08/02/2018	08/02/2018		[NT]	[NT]
Arsenic	mg/kg	4	Metals-020	[NT]	20	5	4	22	[NT]	[NT]
Cadmium	mg/kg	0.4	Metals-020	[NT]	20	<0.4	<0.4	0	[NT]	[NT]
Chromium	mg/kg	1	Metals-020	[NT]	20	13	15	14	[NT]	[NT]
Copper	mg/kg	1	Metals-020	[NT]	20	31	26	18	[NT]	[NT]
Lead	mg/kg	1	Metals-020	[NT]	20	40	33	19	[NT]	[NT]
Mercury	mg/kg	0.1	Metals-021	[NT]	20	<0.1	<0.1	0	[NT]	[NT]
Nickel	mg/kg	1	Metals-020	[NT]	20	5	7	33	[NT]	[NT]
Zinc	mg/kg	1	Metals-020	[NT]	20	54	51	6	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

Report Comments

Asbestos: A portion of the supplied sample was sub-sampled for asbestos analysis according to Envirolab procedures.
We cannot guarantee that this sub-sample is indicative of the entire sample. Envirolab recommends supplying
40-50g of sample in its own container.
Note: Samples 184710-12, 15, 18 & 21 were sub-sampled from jars provided by the client.

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	Todd Hore

Sample Login Details

Your reference	E30293KH, Bexley
Envirolab Reference	184710
Date Sample Received	07/02/2018
Date Instructions Received	07/02/2018
Date Results Expected to be Reported	14/02/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	26 soil, 1 MATERIAL
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	13.1
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:

Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticidesin soil	Organophosphorus Pesticides	PCBsin Soil	Acid Extractable metalsin soil	Asbestos ID - soils	Asbestos ID - materials	On Hold
BH101-0.2-0.4	✓	✓	✓	✓	✓	✓	✓	✓		
BH101-0.5-0.95	✓	✓	✓				✓	✓		
BH101-1.6-1.95										✓
BH102-0-0.2	✓	✓	✓				✓	✓		
BH102-0.5-0.95										✓
BH102-1.5-1.95	✓	✓	✓	✓	✓	✓	✓	✓		
BH102-3.0-3.45										✓
BH102-4.53-4.95										✓
BH102-6.5-6.7										✓
BH103-0.03-0.2	✓	✓	✓	✓	✓	✓	✓	✓		
BH103-0.5-0.9										✓
BH103-0.9-1.1	✓	✓	✓				✓	✓		
BH103-1.5-1.95										✓
BH104-0.03-0.2	✓	✓	✓	✓	✓	✓	✓	✓		
BH104-0.5-0.95	✓	✓	✓				✓	✓		
BH105-0-0.2	✓	✓	✓	✓	✓	✓	✓	✓		
BH105-0.85-0.95										✓
BH105-1.1-1.3	✓	✓	✓				✓	✓		
BH105-1.5-1.95										✓
BH106-0-0.2	✓	✓	✓	✓	✓	✓	✓	✓		
BH106-0.5-0.8	✓	✓	✓				✓	✓		
BH106-1.3-135										✓
BH106-5.2-5.3										✓
TSAM1	✓									
TBAM1	✓									
AMF1									✓	
DUPHL1	✓	✓	✓				✓			

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.

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: E30293KH

Date Results Required: STANDARD

Page: 1/2

FROM:
ENVIRONMENTAL INVESTIGATION SERVICES
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 **F: 02-9888 5001**
Attention: Todd Hore

Location: Bexley
Sampler: AM/HL

Sample Preserved in Esky on Ice

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	PH	Combo 3a	Combo 3	Combo 6a	8 Metals	PAHs	TRH/BTEX	BTEX	Asbestos	CEC	Clay content	
							Tests Required											
7/2/18	1	BH101	0.2-0.4	G, A	0	Fill Soil				X								
↓	2	↓	0.5-0.95	G,A	0	FS		X										
	3		1.6-1.95	G	0	Nat Soil												
	4	BH102	0-0.2	G,A	0	FS		X										
	5	↓	0.5-0.95	↓	0	FS												
	6		1.5-1.95		0	FS				X								
	7		3.0-3.45		0	FS												
	8		4.5-4.95		0	FS												
	9		6.5-6.7	G	0	NS												
	10	BH103	0.03-0.2	G,A	0	FS				X								
	11	↓	0.5-0.9	↓	0	FS												
	12		0.9-1.1	G	0	NS		X										
	13		1.5-1.95	↓	0	NS												
	14	BH104	0.03-0.2	G,A	0	FS				X								
	15	↓	0.5-0.95	G	0	NS		X										
	16	BH105	0-0.2	G,A	0	FS				X								
	17	↓	0.85-0.95	G	0	NS												
	18		1.1-1.3	↓	0	NS		X										
	19		1.5-1.95		0	NS												
	20	BH106	0-0.2	G,A	0	FS				X								
	21	↓	0.5-0.8	G	0	FS		X										
	22		1.3-1.5	↓	0	NS												
	23		5.2-5.3		0	Nat Rock												
	24	TSAM1	–	G	–	Spike								X				
	25	TBAM1	–	V	–	Blank								X				

Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 184710
Date Received: 7/2/18
Time Received: 15:45
Received by: AB
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:
Date: 7/2/18
Time: 2.30pm
Received By: AB/ELS
Date: 7/2/18

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: E30293KH

Date Results Required: STANDARD

Page: 2/2

FROM:
ENVIRONMENTAL
INVESTIGATION
SERVICES
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 F: 02-9888 5001
Attention: Todd Hore

Location: Bexley

Sampler: AM/HL

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	PH	Combo 3a	Combo 3	Combo 6a	8 Metals	PAHs	TRH/BTEX	BTEX	Asbestos	CEC	Clay content	
7/2/18	26	AMF1	—	~~G~~, A	—	Fragment									X			
↓	27	DUPHL1	—	G	—	FS			X									

Remarks (comments/detection limits required):

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

Relinquished By:

Date: 7/2/18

Time: 2.30pm

Received By: AB / ELS

Date: 7/2/18

184710

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

CERTIFICATE OF ANALYSIS 185317

Client Details

Client	Environmental Investigation Services
Attention	Todd Hore
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E30293KH, Bexley**
Number of Samples	3 water
Date samples received	15/02/2018
Date completed instructions received	15/02/2018

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	22/02/2018
Date of Issue	20/02/2018

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

Results Approved By
Jaimie Loa-Kum-Cheung, Senior Chemist
Jeremy Faircloth, Organics Supervisor
Leon Ow, Chemist
Priya Samarawickrama, Senior Chemist
Steven Luong, Senior Chemist

Authorised By

David Springer, General Manager

VOCs in water			
Our Reference		185317-1	185317-2
Your Reference	UNITS	MW2	MW6
Date Sampled		15/02/2018	15/02/2018
Type of sample		water	water
Date extracted	-	16/02/2018	16/02/2018
Date analysed	-	16/02/2018	16/02/2018
Dichlorodifluoromethane	µg/L	<10	<10
Chloromethane	µg/L	<10	<10
Vinyl Chloride	µg/L	<10	<10
Bromomethane	µg/L	<10	<10
Chloroethane	µg/L	<10	<10
Trichlorofluoromethane	µg/L	<10	<10
1,1-Dichloroethene	µg/L	<1	<1
Trans-1,2-dichloroethene	µg/L	<1	<1
1,1-dichloroethane	µg/L	<1	<1
Cis-1,2-dichloroethene	µg/L	<1	<1
Bromochloromethane	µg/L	<1	<1
Chloroform	µg/L	<1	<1
2,2-dichloropropane	µg/L	<1	<1
1,2-dichloroethane	µg/L	<1	<1
1,1,1-trichloroethane	µg/L	<1	<1
1,1-dichloropropene	µg/L	<1	<1
Cyclohexane	µg/L	<1	<1
Carbon tetrachloride	µg/L	<1	<1
Benzene	µg/L	<1	<1
Dibromomethane	µg/L	<1	<1
1,2-dichloropropane	µg/L	<1	<1
Trichloroethene	µg/L	<1	<1
Bromodichloromethane	µg/L	<1	<1
trans-1,3-dichloropropene	µg/L	<1	<1
cis-1,3-dichloropropene	µg/L	<1	<1
1,1,2-trichloroethane	µg/L	<1	<1
Toluene	µg/L	<1	<1
1,3-dichloropropane	µg/L	<1	<1
Dibromochloromethane	µg/L	<1	<1
1,2-dibromoethane	µg/L	<1	<1
Tetrachloroethene	µg/L	<1	<1
1,1,1,2-tetrachloroethane	µg/L	<1	<1
Chlorobenzene	µg/L	<1	<1
Ethylbenzene	µg/L	<1	<1
Bromoform	µg/L	<1	<1

VOCs in water			
Our Reference		185317-1	185317-2
Your Reference	UNITS	MW2	MW6
Date Sampled		15/02/2018	15/02/2018
Type of sample		water	water
m+p-xylene	µg/L	<2	<2
Styrene	µg/L	<1	<1
1,1,2,2-tetrachloroethane	µg/L	<1	<1
o-xylene	µg/L	<1	<1
1,2,3-trichloropropane	µg/L	<1	<1
Isopropylbenzene	µg/L	<1	<1
Bromobenzene	µg/L	<1	<1
n-propyl benzene	µg/L	<1	<1
2-chlorotoluene	µg/L	<1	<1
4-chlorotoluene	µg/L	<1	<1
1,3,5-trimethyl benzene	µg/L	<1	<1
Tert-butyl benzene	µg/L	<1	<1
1,2,4-trimethyl benzene	µg/L	<1	<1
1,3-dichlorobenzene	µg/L	<1	<1
Sec-butyl benzene	µg/L	<1	<1
1,4-dichlorobenzene	µg/L	<1	<1
4-isopropyl toluene	µg/L	<1	<1
1,2-dichlorobenzene	µg/L	<1	<1
n-butyl benzene	µg/L	<1	<1
1,2-dibromo-3-chloropropane	µg/L	<1	<1
1,2,4-trichlorobenzene	µg/L	<1	<1
Hexachlorobutadiene	µg/L	<1	<1
1,2,3-trichlorobenzene	µg/L	<1	<1
Surrogate Dibromofluoromethane	%	95	104
Surrogate toluene-d8	%	97	92
Surrogate 4-BFB	%	91	93

vTRH(C6-C10)/BTEXN in Water				
Our Reference	UNITS	185317-1	185317-2	185317-3
Your Reference		MW2	MW6	DUPAM1
Date Sampled		15/02/2018	15/02/2018	15/02/2018
Type of sample		water	water	water
Date extracted	-	16/02/2018	16/02/2018	16/02/2018
Date analysed	-	16/02/2018	16/02/2018	16/02/2018
TRH C_6 - C_9	µg/L	<10	<10	<10
TRH C_6 - C_{10}	µg/L	<10	<10	<10
TRH C_6 - C_{10} less BTEX (F1)	µg/L	<10	<10	<10
Benzene	µg/L	<1	<1	<1
Toluene	µg/L	<1	<1	<1
Ethylbenzene	µg/L	<1	<1	<1
m+p-xylene	µg/L	<2	<2	<2
o-xylene	µg/L	<1	<1	<1
Naphthalene	µg/L	<1	<1	<1
Surrogate Dibromofluoromethane	%	95	104	108
Surrogate toluene-d8	%	97	92	99
Surrogate 4-BFB	%	91	93	118

svTRH (C10-C40) in Water				
Our Reference		185317-1	185317-2	185317-3
Your Reference	UNITS	MW2	MW6	DUPAM1
Date Sampled		15/02/2018	15/02/2018	15/02/2018
Type of sample		water	water	water
Date extracted	-	16/02/2018	16/02/2018	16/02/2018
Date analysed	-	17/02/2018	17/02/2018	17/02/2018
TRH C_{10} - C_{14}	µg/L	<50	<50	<50
TRH C_{15} - C_{28}	µg/L	<100	<100	<100
TRH C_{29} - C_{36}	µg/L	<100	<100	<100
TRH >C_{10} - C_{16}	µg/L	<50	<50	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50	<50	<50
TRH >C_{16} - C_{34}	µg/L	<100	<100	<100
TRH >C_{34} - C_{40}	µg/L	<100	<100	<100
Surrogate o-Terphenyl	%	90	92	94

PAHs in Water - Low Level				
Our Reference		185317-1	185317-2	185317-3
Your Reference	UNITS	MW2	MW6	DUPAM1
Date Sampled		15/02/2018	15/02/2018	15/02/2018
Type of sample		water	water	water
Date extracted	-	16/02/2018	16/02/2018	16/02/2018
Date analysed	-	19/02/2018	19/02/2018	19/02/2018
Naphthalene	µg/L	<0.2	<0.2	<0.2
Acenaphthylene	µg/L	<0.1	<0.1	<0.1
Acenaphthene	µg/L	<0.1	<0.1	<0.1
Fluorene	µg/L	<0.1	<0.1	<0.1
Phenanthrene	µg/L	<0.1	<0.1	<0.1
Anthracene	µg/L	<0.1	<0.1	<0.1
Fluoranthene	µg/L	<0.1	<0.1	<0.1
Pyrene	µg/L	<0.1	<0.1	<0.1
Benzo(a)anthracene	µg/L	<0.1	<0.1	<0.1
Chrysene	µg/L	<0.1	<0.1	<0.1
Benzo(b,j+k)fluoranthene	µg/L	<0.2	<0.2	<0.2
Benzo(a)pyrene	µg/L	<0.1	<0.1	<0.1
Indeno(1,2,3-c,d)pyrene	µg/L	<0.1	<0.1	<0.1
Dibenzo(a,h)anthracene	µg/L	<0.1	<0.1	<0.1
Benzo(g,h,i)perylene	µg/L	<0.1	<0.1	<0.1
Benzo(a)pyrene TEQ	µg/L	<0.5	<0.5	<0.5
Total +ve PAH's	µg/L	NIL (+)VE	NIL (+)VE	NIL (+)VE
Surrogate p-Terphenyl-d14	%	99	102	98

HM in water - dissolved				
Our Reference	UNITS	185317-1	185317-2	185317-3
Your Reference		MW2	MW6	DUPAM1
Date Sampled		15/02/2018	15/02/2018	15/02/2018
Type of sample		water	water	water
Date prepared	-	16/02/2018	16/02/2018	16/02/2018
Date analysed	-	16/02/2018	16/02/2018	16/02/2018
Arsenic-Dissolved	µg/L	<1	<1	<1
Cadmium-Dissolved	µg/L	<0.1	0.1	0.1
Chromium-Dissolved	µg/L	<1	<1	<1
Copper-Dissolved	µg/L	<1	<1	<1
Lead-Dissolved	µg/L	<1	<1	<1
Mercury-Dissolved	µg/L	<0.05	<0.05	<0.05
Nickel-Dissolved	µg/L	<1	13	13
Zinc-Dissolved	µg/L	9	77	78

Miscellaneous Inorganics			
Our Reference		185317-1	185317-2
Your Reference	UNITS	MW2	MW6
Date Sampled		15/02/2018	15/02/2018
Type of sample		water	water
Date prepared	-	15/02/2018	15/02/2018
Date analysed	-	15/02/2018	15/02/2018
pH	pH Units	6.2	6.3
Electrical Conductivity	µS/cm	730	850

Cations in water Dissolved			
Our Reference		185317-1	185317-2
Your Reference	UNITS	MW2	MW6
Date Sampled		15/02/2018	15/02/2018
Type of sample		water	water
Date digested	-	16/02/2018	16/02/2018
Date analysed	-	16/02/2018	16/02/2018
Calcium - Dissolved	mg/L	43	29
Magnesium - Dissolved	mg/L	6.5	15
Hardness	mgCaCO 3 /L	130	130

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	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
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-W3	[NT]
Date extracted	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Date analysed	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Dichlorodifluoromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Vinyl Chloride	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromomethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloroethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trichlorofluoromethane	µg/L	10	Org-013	<10	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1-Dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trans-1,2-dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1-dichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	98	[NT]
Cis-1,2-dichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromochloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chloroform	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
2,2-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	110	[NT]
1,1,1-trichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	119	[NT]
1,1-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Cyclohexane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Carbon tetrachloride	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibromomethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Trichloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Bromodichloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	87	[NT]
trans-1,3-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
cis-1,3-dichloropropene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1,2-trichloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Toluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3-dichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibromochloromethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	84	[NT]
1,2-dibromoethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Tetrachloroethene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
1,1,1,2-tetrachloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Ethylbenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromoform	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
m+p-xylene	µg/L	2	Org-013	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Styrene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,1,2,2-tetrachloroethane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
o-xylene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

QUALITY CONTROL: VOCs in water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
1,2,3-trichloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Isopropylbenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Bromobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
n-propyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
2-chlorotoluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
4-chlorotoluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3,5-trimethyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Tert-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,4-trimethyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,3-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Sec-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,4-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
4-isopropyl toluene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
n-butyl benzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2-dibromo-3-chloropropane	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,4-trichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Hexachlorobutadiene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
1,2,3-trichlorobenzene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-013	96	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate toluene-d8	%		Org-013	99	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate 4-BFB	%		Org-013	92	[NT]	[NT]	[NT]	[NT]	94	[NT]

Client Reference: E30293KH, Bexley

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate					Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Date analysed	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
TRH C_6 - C_9	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-016	<10	[NT]	[NT]	[NT]	[NT]	84	[NT]
Benzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	92	[NT]
Toluene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	85	[NT]
Ethylbenzene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	81	[NT]
m+p-xylene	µg/L	2	Org-016	<2	[NT]	[NT]	[NT]	[NT]	80	[NT]
o-xylene	µg/L	1	Org-016	<1	[NT]	[NT]	[NT]	[NT]	80	[NT]
Naphthalene	µg/L	1	Org-013	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-016	96	[NT]	[NT]	[NT]	[NT]	108	[NT]
Surrogate toluene-d8	%		Org-016	99	[NT]	[NT]	[NT]	[NT]	98	[NT]
Surrogate 4-BFB	%		Org-016	92	[NT]	[NT]	[NT]	[NT]	94	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W2	[NT]
Date extracted	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Date analysed	-			17/02/2018	[NT]	[NT]	[NT]	[NT]	17/02/2018	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	99	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	130	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	120	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-003	<50	[NT]	[NT]	[NT]	[NT]	99	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	130	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-003	<100	[NT]	[NT]	[NT]	[NT]	120	[NT]
Surrogate o-Terphenyl	%		Org-003	75	[NT]	[NT]	[NT]	[NT]	105	[NT]

QUALITY CONTROL: PAHs in Water - Low Level					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W3	[NT]
Date extracted	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Date analysed	-			19/02/2018	[NT]	[NT]	[NT]	[NT]	19/02/2018	[NT]
Naphthalene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	76	[NT]
Acenaphthylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluorene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Phenanthrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	89	[NT]
Anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	79	[NT]
Pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	95	[NT]
Benzo(a)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	84	[NT]
Benzo(b,j+k)fluoranthene	µg/L	0.2	Org-012	<0.2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	101	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	0.1	Org-012	<0.1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-012	93	[NT]	[NT]	[NT]	[NT]	92	[NT]

QUALITY CONTROL: HM in water - dissolved						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	185317-2
Date prepared	-			16/02/2018	1	16/02/2018	16/02/2018		16/02/2018	16/02/2018
Date analysed	-			16/02/2018	1	16/02/2018	16/02/2018		16/02/2018	16/02/2018
Arsenic-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		103	[NT]
Cadmium-Dissolved	µg/L	0.1	Metals-022	<0.1	1	<0.1	[NT]		104	[NT]
Chromium-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		95	[NT]
Copper-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		93	[NT]
Lead-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		102	[NT]
Mercury-Dissolved	µg/L	0.05	Metals-021	<0.05	1	<0.05	<0.05	0	98	100
Nickel-Dissolved	µg/L	1	Metals-022	<1	1	<1	[NT]		102	[NT]
Zinc-Dissolved	µg/L	1	Metals-022	<1	1	9	[NT]		101	[NT]

QUALITY CONTROL: Miscellaneous Inorganics					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			15/02/2018	[NT]	[NT]	[NT]	[NT]	15/02/2018	[NT]
Date analysed	-			15/02/2018	[NT]	[NT]	[NT]	[NT]	15/02/2018	[NT]
pH	pH Units		Inorg-001	[NT]	[NT]	[NT]	[NT]	[NT]	102	[NT]
Electrical Conductivity	µS/cm	1	Inorg-002	<1	[NT]	[NT]	[NT]	[NT]	96	[NT]

QUALITY CONTROL: Cations in water Dissolved					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date digested	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Date analysed	-			16/02/2018	[NT]	[NT]	[NT]	[NT]	16/02/2018	[NT]
Calcium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Magnesium - Dissolved	mg/L	0.5	Metals-020	<0.5	[NT]	[NT]	[NT]	[NT]	103	[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.

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

Duplicates: <5xPQL - any RPD is acceptable; >5xPQL - 0-50% RPD is acceptable.

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

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

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

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

Measurement Uncertainty estimates are available for most tests upon request.

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	Todd Hore

Sample Login Details

Your reference	E30293KH, Bexley
Envirolab Reference	185317
Date Sample Received	15/02/2018
Date Instructions Received	15/02/2018
Date Results Expected to be Reported	22/02/2018

Sample Condition

Samples received in appropriate condition for analysis	YES
No. of Samples Provided	3 water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	11.5
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:

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	✓	✓	✓	✓	✓	✓	✓	✓
MW6	✓	✓	✓	✓	✓	✓	✓	✓
DUPAM1		✓	✓	✓	✓			

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.

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: E30293KH
Date Results Required: STANDARD
Page: 1 of 1

FROM:
ENVIRONMENTAL INVESTIGATION SERVICES
REAR OF 115 WICKS ROAD
MACQUARIE PARK, NSW 2113
P: 02-9888 5000 **F: 02-9888 5001**
Attention: Todd Hore

Location: Bexley
Sampler: HL/AM

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**
15/02/2018	1	MW2	G1, V, H	0.0	water	X	X	X	X
15/02/2018	2	MW6	G1, V, H	0.0	water	X	X	X	X
15/02/2018	3	DUPAM1	G1, V, H	0.0	water	X			

ENVIROLAB
Envirolab Services
12 Ashley St
Chatswood NSW 2067
Ph: (02) 9910 6200
Job No: 185317
Date Received: 15/2/18
Time Received: 15:30
Received by: AB
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:	**Date:** 15/2/2018	**Time:** 15:30	**Received By:** AB	**Date:** 15/2/18

Appendix C: Report Explanatory Notes

STANDARD SAMPLING PROCEDURE

These protocols specify the basic procedures to be used when sampling soils or groundwater for environmental site assessments undertaken by EIS. The purpose of these protocols is to provide standard methods for: sampling, decontamination procedures for sampling equipment, sample preservation, sample storage and sample handling. Deviations from these procedures must be recorded.

Soil Sampling

- Prepare a borehole/test pit log or made a note of the sample description for stockpiles.
- Layout sampling equipment on clean plastic sheeting to prevent direct contact with ground surface. The work area should be at a distance from the drill rig/excavator such that the machine can operate in a safe manner.
- Ensure all sampling equipment has been decontaminated prior to use.
- Remove any surface debris from the immediate area of the sampling location.
- Collect samples and place in glass jar with a Teflon seal. This should be undertaken as quickly as possible to prevent the loss of any volatiles. If possible, fill the glass jars completely.
- Collect samples for asbestos analysis and place in a zip-lock plastic bag.
- Label the sampling containers with the EIS job number, sample location (eg. BH1), sampling depth interval and date. If more than one sample container is used, this should also be indicated (eg. 2 = Sample jar 1 of 2 jars).
- Photoionisation detector (PID) screening of volatile organic compounds (VOCs) should be undertaken on samples using the soil sample headspace method. Headspace measurements are taken following equilibration of the headspace gasses in partly filled zip-lock plastic bags. PID headspace data is recorded on the borehole/test pit log and the chain of custody forms.
- Record the lithology of the sample and sample depth on the borehole/test pit log generally in accordance with AS1726-1993[20].
- Store the sample in a sample container cooled with ice or chill packs. On completion of the sampling the sample container should be delivered to the lab immediately or stored in the refrigerator prior to delivery to the lab. All samples are preserved in accordance with the standards outlined in the report.
- Check for the presence of groundwater after completion of each borehole using an electronic dip metre or water whistle. Boreholes should be left open until the end of fieldwork where it is safe to do so. All groundwater levels in the boreholes should be rechecked on the completion of the fieldwork.
- Backfill the boreholes/test pits with the excavation cuttings or clean sand prior to leaving the site.

Decontamination Procedures for Soil Sampling Equipment

- All sampling equipment should be decontaminated between every sampling location. This excludes single use PVC tubing used for push tubes etc. Equipment and materials required for the decontamination include:
  - Phosphate free detergent (Decon 90);
  - Potable water;
  - Stiff brushes; and
  - Plastic sheets.
- Ensure the decontamination materials are clean prior to proceeding with the decontamination.
- Fill both buckets with clean potable water and add phosphate free detergent to one bucket.

---

[20] Standards Australia, (1993), *Geotechnical Site Investigations.* (AS1726-1993)

- In the bucket containing the detergent, scrub the sampling equipment until all the material attached to the equipment has been removed.
- Rinse sampling equipment in the bucket containing potable water.
- Place cleaned equipment on clean plastic sheets.

If all materials are not removed by this procedure, high-pressure water cleaning is recommended. If any equipment is not completely decontaminated by both these processes, then the equipment should not be used until it has been thoroughly cleaned.

Groundwater Sampling

Groundwater samples are more sensitive to contamination than soil samples and therefore adhesion to this protocol is particularly important to obtain reliable, reproducible results. The recommendations detailed in AS/NZS 5667.1:1998 are considered to form a minimum standard.

The basis of this protocol is to maintain the security of the borehole and obtain accurate and representative groundwater samples. The following procedure should be used for collection of groundwater samples from previously installed groundwater monitoring wells.

- After monitoring well installation, at least three bore volumes should be pumped from the monitoring wells (well development) to remove any water introduced during the drilling process and/or the water that is disturbed during installation of the monitoring well. This should be completed prior to purging and sampling.
- Groundwater monitoring wells should then be left to recharge for at least three days before purging and sampling. Prior to purging or sampling, the condition of each well should observed and any anomalies recorded on the field data sheets. The following information should be noted: the condition of the well, noting any signs of damage, tampering or complete destruction; the condition and operation of the well lock; the condition of the protective casing and the cement footing (raised or cracked); and, the presence of water between protective casing and well.
- Measure the groundwater level from the collar of the piezometer/monitoring well using an electronic dip meter. The collar level should be taken (if required) during the site visit using a dumpy level and staff.
- Purging and sampling of piezometers/monitoring wells is done on the same site visit when using micro-purge (or other low flow) techniques.
- Layout and organize all equipment associated with groundwater sampling in a location where they will not interfere with the sampling procedure and will not pose a risk of contaminating samples. Equipment generally required includes:
    - Stericup single-use filters (for heavy metals samples);
    - Bucket with volume increments;
    - Sample containers: teflon bottles with 1 ml nitric acid, 75mL glass vials with 1 mL hydrochloric acid, 1 L amber glass bottles;
    - Bucket with volume increments;
    - Flow cell;
    - pH/EC/Eh/Temperature meters;
    - Plastic drums used for transportation of purged water;
    - Esky and ice;
    - Nitrile gloves;
    - Distilled water (for cleaning);
    - Electronic dip meter;
    - Low flow peristaltic pump and associated tubing; and
    - Groundwater sampling forms.

- Ensure all non-disposable sampling equipment is decontaminated or that new disposable equipment is available prior to any work commencing at a new location. The procedure for decontamination of groundwater equipment is outlined at the end of this section.
- Disposable gloves should be used whenever samples are taken to protect the sampler and to assist in avoidance of contamination.
- Groundwater samples are obtained from the monitoring wells using low flow sampling equipment to reduce the disturbance of the water column and loss of volatiles.
- During pumping to purge the well, the pH, temperature, conductivity, dissolved oxygen, redox potential and groundwater levels are monitored (where possible) using calibrated field instruments to assess the development of steady state conditions. Steady state conditions are generally considered to have been achieved when the difference in the pH measurements was less than 0.2 units and the difference in conductivity was less than 10%.
- All measurements are recorded on specific data sheets.
- Once steady state conditions are considered to have been achieved, groundwater samples are obtained directly from the pump tubing and placed in appropriate glass bottles, BTEX vials or plastic bottles.
- All samples are preserved in accordance with water sampling requirements specified by the laboratory and placed in an insulated container with ice. Groundwater samples are preserved by immediate storage in an insulated sample container with ice.
- At the end of each water sampling complete a chain of custody form for samples being sent to the laboratory.

Decontamination Procedures for Groundwater Sampling Equipment

- All equipment associated with the groundwater sampling procedure (other than single-use items) should be decontaminated between every sampling location.
- The following equipment and materials are required for the decontamination procedure:
    - Phosphate free detergent;
    - Potable water;
    - Distilled water; and
    - Plastic Sheets or bulk bags (plastic bags).
- Fill one bucket with clean potable water and phosphate free detergent, and one bucket with distilled water.
- Flush potable water and detergent through pump head. Wash sampling equipment and pump head using brushes in the bucket containing detergent until all materials attached to the equipment are removed.
- Flush pump head with distilled water.
- Change water and detergent solution after each sampling location.
- Rinse sampling equipment in the bucket containing distilled water.
- Place cleaned equipment on clean plastic sheets.
- If all materials are not removed by this procedure that equipment should not be used until it has been thoroughly cleaned

QA/QC DEFINITIONS

The QA/QC terms used in this report are defined below. The definitions are in accordance with US EPA publication SW-846, entitled *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* (1994)[21] methods and those described in *Environmental Sampling and Analysis, A Practical Guide,* (1991)[22].

Practical Quantitation Limit (PQL), Limit of Reporting (LOR) & Estimated Quantitation Limit (EQL)

These terms all refer to the concentration above which results can be expressed with a minimum 95% confidence level. The laboratory reporting limits are generally set at ten times the standard deviation for the Method Detection Limit for each specific analyte. For the purposes of this report the LOR, PQL, and EQL are considered to be equivalent.

When assessing laboratory data it should be borne in mind that values at or near the PQL have two important limitations: *"The uncertainty of the measurement value can approach, and even equal, the reported value. Secondly, confirmation of the analytes reported is virtually impossible unless identification uses highly selective methods. These issues diminish when reliably measurable amounts of analytes are present. Accordingly, legal and regulatory actions should be limited to data at or above the reliable detection limit*" (Keith, 1991).

Precision

The degree to which data generated from repeated measurements differ from one another due to random errors. Precision is measured using the standard deviation or Relative Percent Difference (RPD).

Accuracy

Accuracy is a measure of the agreement between an experimental result and the true value of the parameter being measured (i.e. the proximity of an averaged result to the true value, where all random errors have been statistically removed). The assessment of accuracy for an analysis can be achieved through the analysis of known reference materials or assessed by the analysis of surrogates, field blanks, trip spikes and matrix spikes. Accuracy is typically reported as percent recovery.

Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represents a characteristic of a population, parameter variations at a sampling point, or an environmental condition. Representativeness is primarily dependent upon the design and implementation of the sampling program. Representativeness of the data is partially ensured by the avoidance of contamination, adherence to sample handing and analysis protocols and use of proper chain-of-custody and documentation procedures.

Completeness

Completeness is a measure of the number of valid measurements in a data set compared to the total number of measurements made and overall performance against DQIs. The following information is assessed for completeness:

- Chain-of-custody forms;
- Sample receipt form;
- All sample results reported;

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[21] US EPA, (1994). *SW-846: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.* (US EPA SW-846)

[22] Keith., H, (1991). *Environmental Sampling and Analysis, A Practical Guide.*

- All blank data reported;
- All laboratory duplicate and RPDs calculated;
- All surrogate spike data reported;
- All matrix spike and lab control spike (LCS) data reported and RPDs calculated;
- Spike recovery acceptable limits reported; and
- NATA stamp on reports.

Comparability

Comparability is the evaluation of the similarity of conditions (e.g. sample depth, sample homogeneity) under which separate sets of data are produced. Data comparability checks include a bias assessment that may arise from the following sources:

- Collection and analysis of samples by different personnel; Use of different techniques;
- Collection and analysis by the same personnel using the same methods but at different times; and
- Spatial and temporal changes (due to environmental dynamics).

Blanks

The purpose of laboratory and field blanks is to check for artefacts and interferences that may arise during sampling, transport and analysis.

Matrix Spikes

Samples are spiked with laboratory grade standards to detect interactive effects between the sample matrix and the analytes being measured. Matrix Spikes are reported as a percent recovery and are prepared for 1 in every 20 samples. Sample batches that contain less than 20 samples may be reported with a Matrix Spike from another batch. The percent recovery is calculated using the formula below. Acceptable recovery limits are 70% to 130%.

$$\frac{(\text{Spike Sample Result} - \text{Sample Result}) \times 100}{\text{Concentration of Spike Added}}$$

Surrogate Spikes

Samples are spiked with a known concentration of compounds that are chemically related to the analyte being investigated but unlikely to be detected in the environment. The purpose of the Surrogate Spikes is to check the accuracy of the analytical technique. Surrogate Spikes are reported as percent recovery.

Duplicates

Laboratory duplicates measure precision, expressed as Relative Percent Difference. Duplicates are prepared from a single field sample and analysed as two separate extraction procedures in the laboratory. The RPD is calculated using the formula where D1 is the sample concentration and D2 is the duplicate sample concentration:

$$\frac{(D1 - D2) \times 100}{\{(D1 + D2)/2\}}$$

SCREENING CRITERIA DEFINITIONS

The following definitions have been adopted based on Schedule B(1) of NEPM (2013) and are relevant to Tier 1 screening criteria adopted for contamination assessments.

Health investigation levels (HILs) have been developed for a broad range of metals and organic substances. The HILs are applicable for assessing human health risk via all relevant pathways of exposure. The HILs are generic to all soil types and apply generally to a depth of 3 m below the surface for residential use. Site-specific conditions should determine the depth to which HILs apply for other land uses.

Health screening levels (HSLs) have been developed for selected petroleum compounds and fractions and are applicable to assessing human health risk via the inhalation and direct contact pathways. The HSLs depend on specific soil physicochemical properties, land use scenarios, and the characteristics of building structures. They apply to different soil types, and depths below surface to >4 m. HSLs have also been developed for asbestos and apply to the top 3m of soil.

Ecological investigation levels (EILs) have been developed for selected metals and organic substances and are applicable for assessing risk to terrestrial ecosystems. EILs depend on specific soil physicochemical properties and land use scenarios and generally apply to the top 2 m of soil.

Ecological screening levels (ESLs) have been developed for selected petroleum hydrocarbon compounds and total petroleum/recoverable hydrocarbon (TPH/TRH) fractions and are applicable for assessing risk to terrestrial ecosystems. ESLs broadly apply to coarse- and fine-grained soils and various land uses. They are generally applicable to the top 2 m of soil.

Groundwater investigation levels (GILs) are the concentrations of a contaminant in groundwater above which further investigation (point of extraction) or a response (point of use) is required. GILs are based on Australian water quality guidelines and drinking water guidelines and are applicable for assessing human health risk and ecological risk from direct contact (including consumption) with groundwater.

Management Limits for Petroleum hydrocarbons are applicable to petroleum hydrocarbon compounds only. They are applicable as screening levels following evaluation of human health and ecological risks and risks to groundwater resources. They are relevant for operating sites where significant sub-surface leakage of petroleum compounds has occurred and when decommissioning industrial and commercial sites.

Interim soil vapour health investigation levels (interim HILs) have been developed for selected volatile organic chlorinated compounds (VOCCs) and are applicable to assessing human health risk by the inhalational pathway. They have interim status pending further scientific work on volatile gas modelling from the sub-surface to building interiors for chlorinated compounds.

Appendix D: Data (QA/QC) Evaluation

DATA (QA/QC) EVALUATION

INTRODUCTION

This Data (QA/QC) Evaluation forms part of the validation process for the DQOs documented in Section 6.1 of this report. Checks were made to assess the data in terms of precision, accuracy, representativeness, comparability and completeness. These 'PARCC' parameters are referred to collectively as DQIs and are defined in the Report Explanatory Notes attached in the report appendices.

Field and Laboratory Considerations

The quality of the analytical data produced for this project has been considered in relation to the following:

- Sample collection, storage, transport and analysis;
- Laboratory PQLs;
- Field QA/QC results; and
- Laboratory QA/QC results.

Field QA/QC Samples and Analysis

A summary of the field QA/QC samples collected and analysed for this assessment is provided in the following table:

Sample Type	Sample Identification	Frequency (of Sample Type)	Analysis Performed
Intra-laboratory duplicate (soil)	Dup HL1 (primary sample BH103 0.03-0.2m)	Approximately 8% of primary samples	Heavy metals, TRH/BTEX and PAHs
Intra-laboratory duplicate (water)	Dup AM1 (primary sample MW106)	Approximately 50% of primary samples	Heavy metals, TRH/BTEX and PAHs
Trip spike (soil)	TS1 (7/2/18)	One per day of soil sampling	BTEX
Trip blank (soil)	TB1 (7/2/18)	One per day of soil sampling	BTEX

The results for the field QA/QC samples are detailed in the laboratory summary tables (Table I to Table K inclusive) attached to the assessment report and are discussed in the subsequent sections of this Data (QA/QC) Evaluation report.

Data Assessment Criteria

EIS adopted the following criteria for assessing the field and laboratory QA/QC analytical results:

Field Duplicates

Acceptable targets for precision of field duplicates in this report will be less than 50% RPD for concentrations greater than 10 times the PQL, less than 75% RPD for concentrations between five and 10 times the PQL and less than 100% RPD for concentrations that are less than five times the PQL. RPD failures will be considered qualitatively on a case-by-case basis taking into account factors such as the sample type, collection methods and the specific analyte where the RPD exceedance was reported.

Field Blanks

Acceptable targets for field blank samples in this report will be less than the PQL for organic analytes. Metals will be considered on a case-by-case basis with regards to typical background concentrations in soils and published drinking water guidelines for waters.

Trip Spikes

Acceptable targets for trip spike samples in this report will be 70% to 130%. This is in line with spike recovery limits adopted by the laboratory for organic analysis.

Laboratory QA/QC

The suitability of the laboratory data is assessed against the laboratory QA/QC criteria which is outlined in the laboratory reports. These criteria were 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 acceptable limits adopted by the primary laboratory (Envirolab) 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;
- 60-140% recovery acceptable for organics; and
- 10-140% recovery acceptable for VOCs.

Surrogate Spikes

- 60-140% recovery acceptable for general organics; and
- 10-140% recovery acceptable for VOCs.

Method Blanks

- All results less than PQL.

DATA EVALUATION

Sample Collection, Storage, Transport and Analysis

Samples were collected by trained field staff in accordance with the EIS SSP. The SSP was developed to be consistent with relevant guidelines, including NEPM (2013) and other guidelines made under the CLM Act 1997.

Appropriate sample preservation, handling and storage procedures were adopted. Laboratory analysis was undertaken within specified holding times in accordance with Schedule B(3) of NEPM (2013) and the laboratory NATA accredited methodologies.

Review of the project data also indicated that:

- COC documentation was adequately maintained;
- Sample receipt advice documentation was provided for all sample batches;
- All analytical results were reported; and
- Consistent units were used to report the analysis results.

Laboratory PQLs

Appropriate PQLs were adopted for the analysis and all PQLs were below the SAC.

Field QA/QC Sample Results

Field Duplicates

The results indicated that field precision was acceptable. RPD non-conformances were reported for several PAH compounds in Dup HL1/BH103 (0.03-0.2m).

Values outside the acceptable limits have been attributed to the very low concentrations of compounds present in the sample. As both the primary and duplicate sample results were less than the SAC, the exceedances are not considered to have had an adverse impact on the data set as a whole.

Field Blanks

During the investigation, one soil trip blank was placed in the esky during sampling and transported back to the laboratory. The results were all less than the PQLs, therefore cross contamination between samples that may have significance for data validity did not occur.

Trip Spikes

The results ranged from 92% to 94% and indicated that field preservation methods were appropriate.

Laboratory QA/QC

The analytical methods implemented by the laboratory were performed in accordance with their NATA accreditation and were consistent with Schedule B(3) of NEPM (2013). The frequency of data reported for the laboratory QA/QC (i.e. duplicates, spikes, blanks, LCS) was considered to be acceptable for the purpose of this assessment.

DATA QUALITY SUMMARY

EIS are of the opinion that the data are adequately precise, accurate, representative, comparable and complete to serve as a basis for interpretation to achieve the investigation objectives.

Appendix E: Field Work Documents

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

EIS

Client:	Tunborn Pty Ltd	**Job No.:**	**E30293KH**
Project:	Proposed Alterations and Additions	**Well No.:**	MW2
Location:	187 SLADE ROAD, BEXLEY, NSW	**Depth (m):**	6.17m

WELL FINISH DETAILS

Gatic Cover ☒ **Standpipe** ☐ **Other (describe)** ☐

WELL DEVELOPMENT DETAILS

Method:	electric pump.	**SWL – Before (m):**	4.76m
Date:	8/2/2018	**Time – Before:**	11:03am
Undertaken By:	HL/AM	**SWL – After (m):**	6.17
Total Vol. Removed:	2	**Time – After:**	11:04
PID Reading (ppm):	0.0		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	Temp (°C)	DO (mg/L)	EC (μS/m)	pH	Eh (mV)
~~2~~ 1	24.4	6.2	763	6.35	8.1
2	23	3.8	4034	6.28	17.5

Comments:Odours (YES / [✓ NO]) NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])

Pumped dry moderate silt loading

Tested By:	HL/AM
Date Tested:	8/2/2018
Checked By:	
Date:	

Remarks:
- All measurements are corrected to ground level
- All stated Volumes are in Litres
- SWL is an abbreviation for standing water level
- Steady state conditions - difference in the pH less than 0.2 units and difference in conductivity less than 10%
- Minimum 3 monitoring well volumes are purged

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

EIS

Client:	Tunborn Pty Ltd	**Job No.:**	**E30293KH**
Project:	Proposed Alterations and Additions	**Well No.:**	MW6.
Location:	187 SLADE ROAD, BEXLEY, NSW	**Depth (m):**	6.2m.

WELL FINISH DETAILS

	Gatic Cover ☒	**Standpipe** ☐	**Other (describe)** ☐

WELL DEVELOPMENT DETAILS

Method:	electric pump	**SWL – Before (m):**	4.72.
Date:	8/2/2018	**Time – Before:**	10:35.
Undertaken By:	HL/AM.	**SWL – After (m):**	6.2m
Total Vol. Removed:	3.5	**Time – After:**	10:47
PID Reading (ppm):	0.3.		

Comments:

DEVELOPMENT MEASUREMENTS

Volume Removed (L)	Temp (°C)	DO (mg/L)	EC (µS/m)	pH	Eh (mV)
1	27.2	6.6	979	5.94	37.6
2	27.9	4.7	1019	5.98	9.8

Comments:Odours (YES / NO), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]) Steady State Achieved (YES / [✓ NO])

Pumped dry and slight silt loading

Tested By:	HL/AM	**Remarks:** - All measurements are corrected to ground level - All stated Volumes are in Litres - SWL is an abbreviation for standing water level - Steady state conditions - difference in the pH less than 0.2 units and difference in conductivity less than 10% - Minimum 3 monitoring well volumes are purged
Date Tested:	8/2/2018	
Checked By:	HL/AM	
Date:		

ENVIRONMENTAL INVESTIGATION SERVICES
CONSULTING ENVIRONMENTAL ENGINEERS

Client:	Tunborn Pty Ltd	**Job No.:**	**E30293KH**
Project:	Proposed Alterations and Additions	**Well No.:**	MW2
Location:	187 SLADE ROAD, BEXLEY, NSW	**Depth (m):**	6.19

WELL FINISH

✓	**Gatic Cover**		**Standpipe**		**Other (describe)**

WELL PURGE DETAILS:

Method:	peristaltic pump	**SWL – Before:**	4.75
Date:	15/2/2018	**Time – Before:**	12:03
Undertaken By:	HL/AM	**Total Vol Removed:**	
Pump Program No:	—	**PID (ppm):**	0

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
12:12	488	1	silty, no odours.	26.1	1.6	1045	6.51	61.8
12:18	4.96	2		25.4	1.4	999	6.22	75.0
12:23	4.99	3		25.3	1.3	994	6.20	65.6
12:28	5.01	4		25.4	1.2	992	6.19	45.4
			Sampling ↓ ↓ ↓					

Comments: Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved ([✓ YES] / NO)

Silt loading in groundwater

Sampling Containers Used: 2 x glass amber, 4 x BTEX vials, 1 x H2NO3 plastic, ~~x H2SO4 plastic~~, ~~x unpreserved plastic.~~

Tested By: ~~Todd Hore.~~ HL/AM	**Remarks:**
Date Tested: 15/2/2018	- All measurements are corrected to ground level - SWL is an abbreviation for standing water level
Checked By:	- Steady state conditions - difference in the pH less than 0.2 units and difference in conductivity less than 10%
Date:	

ENVIRONMENTAL INVESTIGATION SERVICES

CONSULTING ENVIRONMENTAL ENGINEERS

EIS

Client:	Tunborn Pty Ltd	**Job No.:**	E30293KH
Project:	Proposed Alterations and Additions	**Well No.:**	MW6
Location:	187 SLADE ROAD, BEXLEY, NSW	**Depth (m):**	6.15

WELL FINISH

☒ Gatic Cover ☐ Standpipe ☐ Other (describe)

WELL PURGE DETAILS:

Method:	peristaltic pump	**SWL – Before:**	4.09
Date:	15/2/2018	**Time – Before:**	10:46
Undertaken By:	HL/AM	**Total Vol Removed:**	8.5L
Pump Program No:	74287	**PID (ppm):**	1.9

PURGING / SAMPLING MEASUREMENTS

Time (min)	SWL (m)	Vol (L)	Notes	Temp (°C)	DO (mg/L)	EC (µS/cm)	pH	Eh (mV)
10:55	4.21	1		24.6	1.6	1270	5.99	46.9
11:00	4.35	2		24.2	1.3	1232	5.99	39.5
11:05	4.59	3		23	1.1	1143	6.04	41.8
11:10	4.75	4		23.3	1.0	1102	6.00	43.3
11:14	4.90	5		24.1	1.1	1080	5.99	44.2
11:20	5.10	6		24.3	1.1	1008	6.00	56.9
			sampling ↓ ↓					

Comments: Odours (YES / [✓ NO]), NAPL/PSH (YES / [✓ NO]), Sheen (YES / [✓ NO]), Steady State Achieved (YES / [✓ NO])

Sampling Containers Used: 4 x glass amber, 6 x BTEX vials, 2 x H2NO3 plastic, ~~x H2SO4 plastic,~~ ~~x unpreserved plastic~~

Tested By: ~~Todd Hore~~ HL/AM

Date Tested: 15/2/2018

Checked By:

Date:

Remarks:
- All measurements are corrected to ground level
- SWL is an abbreviation for standing water level
- Steady state conditions - difference in the pH less than 0.2 units and difference in conductivity less than 10%

Appendix F: Guidelines and Reference Documents

Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). Acid Sulfate Soils Manual

Australian and New Zealand Environment Conservation Council (ANZECC), (2000). Australian and New Zealand Guidelines for Fresh and Marine Water Quality

CRC Care, (2011). Technical Report No. 10 – Health screening levels for hydrocarbons in soil and groundwater Part 1: Technical development document

CRC Care, (2017). Technical Report No. 39 – Risk-based management and guidance for benzo(a)pyrene

Contaminated Land Management Act 1997 (NSW)

Department of Land and Water Conservation, (1997). 1:25,000 Acid Sulfate Soil Risk Map (Series 9130N3, Ed 2)

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

National Health and Medical Research Council (NHMRC), (2011). National Water Quality Management Strategy, Australian Drinking Water Guidelines

NSW Department of Environment and Conservation, (2007). Guidelines for the Assessment and Management of Groundwater Contamination

NSW EPA, (1995). Contaminated Sites Sampling Design Guidelines

NSW EPA, (2014). Waste Classification Guidelines - Part 1: Classifying Waste

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

National Environmental Protection (Assessment of Site Contamination) Measure 1999 as amended (2013)

Olszowy, H., Torr, P., and Imray, P., (1995). Trace Element Concentrations in Soils from Rural and Urban Areas of Australia. Contaminated Sites Monograph Series No. 4. Department of Human Services and Health, Environment Protection Agency, and South Australian Health Commission

Protection of the Environment Operations Act 1997 (NSW)

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

World Health Organisation (WHO), (2008). Petroleum Products in Drinking-water, Background document for the development of WHO Guidelines for Drinking Water Quality

Western Australia Department of Health, (2009). Guidelines for the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia