27 July 2023
Ref: E35995BTlet-ASSMP

T&P Manly Land Pty Ltd
c/- Time and Place

Attention: Marcus Lewin
Email: Marcus.Lewin@timeplace.com.au

ACID SULFATE SOIL MANAGEMENT PLAN
PROPOSED MIXED USE DEVELOPMENT
35-39, 40, 41, 42 & 43 BELGRAVE STREET, MANLY, NSW

1 INTRODUCTION

Time & Place on behalf of T&P Manly Land Pty Ltd ('the client') commissioned JK Environments (JKE) to prepare an acid sulfate soil management plan (ASSMP) for the proposed mixed use development at 35-39, 40, 41, 42 & 43 Belgrave Street, Manly, NSW. The site is identified as SP 14133 (35-39 Belgrave Street), Lot 1 in DP100633 (40 Belgrave Street), Lot 1 in DP104766 (41 Belgrave Street), Lot 1 in DP34395 (42 Belgrave Street), and Lot 1 in DP719821 (43 Belgrave Street). The site location is shown on Figure 1 and the ASSMP applies to the entire site as shown on Figure 2 in Appendix A.

This letter has been prepared to support the lodgement of a Development Application (DA) with Northern Beaches Council. This ASSMP is to be implemented during the development works.

The objective of the ASSMP is to reduce the potential environmental impacts associated with disturbance of potential acid sulfate soils (PASS). JKE has previously undertaken a Preliminary Site Investigation (PSI) at the site (Ref: E35995BTrptRev1, dated 30 June 2023)[1], which included a preliminary acid sulfate soil (ASS) assessment. Relevant information is summarised and presented in this report.

General information on ASS/PASS is presented in Appendix C.

1.1 Proposed Development Details

The proposed development is at concept design stage and will likely comprise the construction of a four or five storey building overlying two basement levels. We anticipate that excavation to a maximum depth of approximately 7m below existing surface levels would be required to achieve the lowest basement level.

[1]JKE, (2023). *Report to T&P Manly Land Pty Ltd on Preliminary Site Investigation (PSI) for Proposed Mixed Use Development at 35-39, 40, 41, 42 & 43 Belgrave Street, Manly, NSW.* (referred to as PSI)

1.2 Guidelines

The ASS investigation and preparation of this report were undertaken with reference to the Acid Sulfate Soil Management Advisory Committee (ASSMAC) Acid Sulfate Soil Manual (1998)[2] Queensland Acid Sulfate Soil Technical Manual v 3.8 (2002) and to the National Acid Sulfate Soils Guidance (2018) documents.

2 SITE INFORMATION

2.1 Site Information and Description

Table 2-1: Site Identification

Site Address:	35-39, 40, 41, 42 & 43 Belgrave Street, Manly, NSW
Lot & Deposited Plan:	SP 14133 (35-39 Belgrave Street) Lot 1 in DP100633 (40 Belgrave Street) Lot 1 in DP104766 (41 Belgrave Street) Lot 1 in DP34395 (42 Belgrave Street) Lot 1 in DP719821 (43 Belgrave Street)
Current Land Use:	Mixed use (residential and commercial)
Site Area (m^2):	1,100
Site Elevation (metres Australian Height Datum – mAHD approx.)	10-11
Geographical Location (approx.):	Latitude: -33.795884276 Longitude: 151.28556130
Site Plans:	Appendix A

2.2 Site Description

The site is located in a mixed use (commercial/recreational) area of Manly and is bound by Belgrave Street to the west, Raglan Street to the north and Whistler Street to the east (see Figure 1). The site is located approximately 250m west of Manly Beach. The site is located within relatively flat terrain beyond the toe of an east facing hillside. Manly Beach and Manly Cove are located approximately 200m to the east and 400m to the south-west of the site, respectively.

At the time of the PSI, the site was occupied by numerous retail/shop fronts including a massage parlour, a chicken shop, a dry cleaner, a barber, a red cross shop (second hand clothing, etc.), and a tailer. The site also included a medical centre at the northern end with accountants and solicitors' offices upstairs. Residential units were also observed on the first floor of the other buildings on the site. Predominantly, areas outside of the building footprints comprised concrete pavements.

[2] Acid Sulfate Soils Management Advisory Committee (ASSMAC), (1998). *Acid Sulfate Soils Manual* (ASS Manual 1998)

At the time of the site inspection, the site buildings formed most boundaries. The majority of the site surface outside of the building footprints was paved. The site levels were generally in keeping with the surrounding development. It is considered likely that some filling of the site would have been undertaken for levelling purposes. This was confirmed by the boreholes drilled for the PSI.

Surface water at the site was expected to flow into stormwater drains along Whistler, Raglan and/or Belgrave Streets to the east, north and west respectively. Sensitive environments such as wetlands, ponds, creeks or extensive areas of natural vegetation were not identified on site or in the immediate surrounds. The site was entirely paved with no vegetation observed.

2.3 Summary of Regional Geology, Soils and Hydrogeology

2.3.1 Regional Geology

As documented in the PSI, regional geological information indicated that the site is underlain by Holocene aged costal deposits of marine and aeolian coastal sand dunes.

Boreholes drilled for the investigation encountered fill to depths of approximately 0.6m to 1.3m below ground level (BGL), underlain by sandy marine soils to the maximum depth of the investigation at 3mBGL.

2.3.2 Acid Sulfate Soil (ASS) Risk and Planning

As documented in the PSI report:

- A review of the ASS risk map prepared by Department of Land and Water Conservation (1997) indicated that the site is located in an area classed as having a 'low probability' of ASS occurrence at depths of greater than 3m below the ground surface;
- ASS information presented in the Lotsearch report (attached to the PSI) indicated that the site is located within a Class 4 ASS risk area. Works in a Class 4 risk area that could pose an environmental risk in terms of ASS include works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level; and
- The PSI identified PASS conditions at the site. Further details are discussed in Section 3.

2.3.3 Hydrology and Receiving Water Bodies

Hydrological information reviewed for the PSI indicated that there was a total of 53 registered bores within the search buffer of 2,000m. The nearest registered bore was located approximately 60m from the site. This was utilised for monitoring purposes. The majority of the bores were registered for water supply purposes, the closest of which was located approximately 440m to north of the site.

The information reviewed for the PSI indicates that the subsurface conditions at the site are expected to consist of high permeability (marine) soils overlying relatively deep bedrock. Abstraction and use of groundwater at the site or in the immediate surrounds may be viable under these conditions, however the use of groundwater is not proposed as part of the development. There is a reticulated water supply in the area and consumption of groundwater is not expected to occur.

The site location and regional topography indicates that excess surface water flows have the potential to enter Manly Beach located approximately 200m east of the site. This is considered to be a potential receptor given the regional geology and proximity of the water body.

3 CONCEPTUAL SITE MODEL FOR PASS MATERIALS

The PSI included soil sampling from two boreholes (BH1 and BH5). The associated borehole logs are attached in Appendix C and the laboratory report summary tables are attached in Appendix D. In summary:

- None of the pH_F results were below pH 4 and therefore none of the samples were indicative of actual ASS (AASS);
- The pH_{FOX} results ranged from pH 5.6 to pH 6.2. Reaction rates of the samples were generally in the low range with the deeper samples from BH2 in the medium range;
- None of the net acidity results exceeded the action criteria in the samples analysed; and
- Although at a low concentration, oxidisable sulfur (indicated by the chromium reducible sulfur % - S_{CR}) was reported in one sample analysed, suggesting that PASS may be present at the site.

Considering the above, for the purpose of management under this ASSMP, all natural soils are considered to be PASS unless demonstrated otherwise via additional sampling and analysis.

Reference should be made to the ASS laboratory summary table from the PSI which is attached in Appendix D.

4 MANAGEMENT PLAN

4.1 Application

Management requirements are triggered under this ASSMP for all soil disturbance that results in exposure of PASS to air. For this project, this may include (but is not limited to) excavation or exposure of the natural soils.

Notwithstanding the above, we recommend that a detailed investigation occurs following demolition to better delineate the extent of the PASS and characterise the groundwater for PASS management purposes. This investigation should broadly be designed as follows (in consultation with the project environmental consultant):

- Once the depths and construction methodologies are finalised for the building foundations and basement shoring system, an additional investigation should be designed to gather additional soil data, particularly in the north and eastern areas of the site;
- Soil sampling should occur using suitable drilling methodologies, with sampling occurring to at least 1m beyond the maximum depth where piling spoil will be generated (or to the top of bedrock, whichever is shallower);
- Soil samples are to be collected at approximately 0.5m intervals down the soil profile, to the termination depth of the borehole;
- Each soil sample is to be analysed for pH_F and pH_{FOX}, with these results subsequently assessed to identify the samples for further S_{CR} analysis;

- Groundwater samples are also to be collected from each existing groundwater monitoring well using low flow sampling techniques (following well development and purging) and analysed for[3]:
    - pH; alkalinity; acidity;
    - Sulfate and chloride;
    - electrical conductivity (EC); calcium;
    - Turbidity, total dissolved solids (TDS), total suspended solids (TSS), total organic carbon (TOC) and sodium absorption ratio (SAR);
    - Ionic balance, which includes major anions and the cation suite (including hardness);
    - Metals including Aluminium, arsenic, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, selenium, zinc; and
    - Nutrient suite, including ammonia, nitrate, total nitrogen, oxidised nitrogen, total phosphorus and reactive phosphorus.
- A report is to be prepared on completion and the ASSMP is to be updated where required (the report must also consider the results of the preliminary assessment as reported in the PSI). This must be submitted to the certifier and to the consent authority (Northern Beaches Council) prior to commencement of works that disturb or expose PASS

4.2 Roles and Responsibilities

The primary role and responsibility for implementing this ASSMP is the construction/excavation contractor. The construction/excavation contractor is responsible for obtaining a copy of this ASSMP and taking reasonable steps so that it is adequately implemented.

The construction/excavation contractor (or the client) is to engage a validation consultant to monitor the works and validate the implementation of the ASSMP. The construction/excavation contractor and validation consultant are also to refer to any specific requirements of Northern Beaches Council, as documented in the development consent to be provided. The consent authority must also specify whether any other plans or permits are required prior to the commencement of any works under this ASSMP, and the construction/excavation contractor/client is to ensure such plans/permits are obtained.

4.3 Preferred Strategies for Management

The preferred strategy for managing environmental risks associated with PASS is to eliminate disturbance of the PASS. Where this cannot occur, disturbance is to be limited to the extent practicable and the disturbance is to be managed under this ASSMP.

Based on the proposed development details, we anticipate that disturbance of the PASS cannot be avoided given that the excavation for the proposed basement will extend to the approximate depth where PASS is expected to occur, and piling spoil is expected to be generated from below this depth. The following works have been identified that would involve the disturbance of PASS:

- Excavation for the proposed basement; and

[3] We note that it would be prudent to expand the above groundwater analytical suite to align with the mandatory groundwater screening requirements for construction dewatering applications

- Piling and basement cut-off wall construction works generating spoil.

We understand that the basement cut-off wall will likely include a diaphragm wall extending down to bedrock. Construction of the diaphragm wall will generate spoil via excavation/displacement using rope clam shell grabs, hydraulic clam shell grabs or hydromill cutters. For simplicity herein, we have referred to this material and any material generated during alternative piling processes for the main structure collectively as spoil or piling spoil.

The strategy for managing PASS material generated during piling works will include ex-situ treatment, followed by waste classification and off-site disposal. The strategy for excavation of PASS material as part of basement construction (where applicable) will include in-situ and ex-situ treatment, followed by waste classification and off-site disposal.

Once the design and construction methodologies are finalised, the validation consultant is to undertake a review of these details in consultation with the client/construction/excavation contractor. If the scope of the ASSMP is not considered to be adequate to address the potential environmental risks associated with the disturbance of PASS materials during the development, an addendum or revised ASSMP is to be prepared (reference should also be made to Section 4.5 of this ASSMP in this regard). This must be submitted to the certifier and the consent authority (Northern Beaches Council) prior to commencement of works that disturb or expose PASS.

JKE is aware that some licenced facilities may be able to accept untreated PASS, provided that the material is managed appropriately and can meet the strict monitoring and pH testing requirements of the facility. This approach would most likely only be applicable to the natural PASS waste stream and would not apply for mixtures of PASS and fill (such as that material generated during piling which is expected to include a fill, natural non-PASS soils and PASS mixture). The client should make further enquiries in this regard to identify facilities that can accept untreated PASS and establish whether it is more cost effective to manage some of the PASS in this way. Should this alternative method be attempted, an addendum to this ASSMP is to be prepared by a suitably qualified consultant to reflect the specific handling, management and monitoring requirements of the receiving facility.

4.4 Management of PASS

4.4.1 Piling Spoil PASS (ex-situ treatment)

PASS material generated during piling works will be managed by the addition of lime to neutralise acid that may be produced during and after piling works. The treated material is then to be assigned a waste classification in accordance with the NSW EPA Waste Classification Guidelines - Part 1: Classifying Waste (2014)[4] and NSW EPA Waste Classification Guidelines - Part 4: Acid Sulfate Soils (2014)[5], and disposed off-site to landfill.

[4] NSW EPA, (2014). *Waste Classification Guidelines, Part 1: Classifying Waste.* (referred to as Part 1 of the Waste Classification Guidelines 2014)
[5] NSW EPA, (2014). *Waste Classification Guidelines, Part 4: Acid Sulfate Soils.* (referred to as Part 4 of the Waste Classification Guidelines 2014)

A slightly alkaline, low solubility product such as agricultural lime should be used. This form of lime is chemically stable and any excess lime takes a significant period of time (years) to influence soil pH beyond the depth of application. The lime particles eventually become coated with an insoluble layer of ferrihydrite (Fe[OH]3) that inhibits further reaction. Long term alteration of groundwater conditions is not expected to occur as a result of the use of lime above the groundwater mark during the proposed development works. Controlled applications of agricultural limes are generally not harmful to plants, humans and most aquatic species and, therefore, are considered suitable for use on the soils for this project.

The construction contractor is to ensure that an appropriate Work Health and Safety Plan (WHSP) and Construction Environmental Management Plan (CEMP) is prepared prior to the use of lime and commencement of construction/management works.

Reference is to be made to the following table for the ex-situ treatment and management procedure:

Table 4-1: Ex-situ Treatment/Management of PASS – Piling Spoil

Procedure	Details
Step 1: Lime selection and Liming Rate Calculations	A suitable lime product is to be selected as discussed above. A neutralising value (NV), effective neutralising value (ENV) and overall liming rate for ex-situ treatment of PASS is to be calculated based on the type of lime (and its properties) selected, the acid base accounting results presented in the PSI report and in accordance with the ASS Manual 1998. The initial lime calculations from the acid base accounting laboratory results indicated that the soils tested do not require liming. This must be confirmed via treatment trials during the initial stage of excavation works, and refined as required.
Step 2: Set up treatment area/s	A treatment area for the mixing of piling spoil with agricultural lime should be established. Treatment must occur either within a leak-proof containment area such as a bunded area on hardstand, or in a designated area where the ground surface is protected by a guard layer of lime. The pad of lime should be at least 100mm thick and this thickness should be maintained for the duration of treatment works. The purpose of this guard layer is to minimise the risk of acidic water leaching from the base of the treatment area into the shallow groundwater table. Dependent upon the rate of spoil generation, several bunded treatment areas may be necessary for stockpiling and treatment. An earthworks strategy should be prepared to ensure that sufficient space is available on-site to accommodate treatment of the PASS.
Step 3: Manage water run-off	During piling, PASS material is expected to be generated from at or below the water table and the treated material is likely to be wet. The treatment area should be designed to retain any water run-off from the treated materials. This could consist of a compacted clay bund (constructed of non-PASS material) and/or sandbags filled with a mixture of lime and sand. PASS material is expected to be generated from at or below the water table and the treated material is likely to be wet. The treatment area must be designed to retain any water run-off from the treated materials. This could consist of sandbags filled with a mixture of lime and sand. Reference should also be made to Section 4.5 for additional details of the water management measures required.

Procedure	Details
Step 4: Excavation & handling	During piling works, separation of PASS and non-PASS material is unlikely to be possible. In this case all piling spoil should be treated as PASS. PASS generated during piling works should be immediately transferred to the designated treatment area and spread out in 150mm thick layers. If possible, the layers should be allowed to dry in order to aid the mixing process. The layers should then be interspersed with the appropriate amount of lime to aid in the effective mixing of lime and soil. Lime should be applied to the excavated material within the treatment area as soon as possible. If circumstances prevent the spreading and treatment of the material, the surface area of the stockpile should be minimised by forming a relatively high coned shape and avoiding 'spreading-out' of the stockpile. This will limit the surface area exposed to oxidation. Water infiltration should be minimised by covering the stockpile during wet weather as noted in Step 3. This will limit the formation and transport of acid leachate due to rainfall. The stockpile should be bunded to prevent erosion of the PASS and any movement of potentially acid leachate. Upstream surface runoff water should also be diverted around the stockpile. It is noted that contaminants have been identified in the overlying fill soil (i.e. in soils above the PASS) as documented in the PSI report. Any additional requirements outlined by the project environmental consultant for managing such contamination must also be considered during piling given that the piling spoil to be generated will likely include (unless adequate segregation occurs) a mixture of the fill and PASS (i.e. piling is likely to extend through the fill and into the PASS, generating a mixed waste stream). An earthworks strategy should be developed to manage the stockpiles. It is noted that the validation testing (see Step 5 below) can take several days, therefore suitable allowances should be incorporated into the project timeline.
Step 5: Lime treatment & validation testing	An excavator or other suitable equipment (as deemed appropriate by the construction contractor) should be used to thoroughly mix the lime through the soil. Once treatment occurs, samples are to be collected from the treated soil at the rates required in the *National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual* (2018). A minimum of one sample is recommended per batch of treated soil prior to off-site disposal, and the overall validation frequency must be as follows: • <250m^3, two samples • 251-500m^3, three samples • 1,000m^3, four samples • >1,000 m^3, four samples plus one sample per additional 500m^3 Field pH may be used as a preliminary indicator where deemed appropriate by the validation consultant. Validation testing is to occur at a NATA accredited laboratory and will include acid base accounting using the chromium reducible sulfur method described in the *National Acid Sulfate Soil Guidance: National acid sulfate soils identification and laboratory methods manual* (2018). For piling spoil, if the works occur progressively, a minimum of one sample is required per batch of treated soil prior to off-site disposal, with no less than four samples in total for the project up to 500m^3 of material to be treated. The validation net acidity results should be zero or less than the laboratory practical quantitation limits (PQL), depending on how the laboratory report their results.

Procedure	Details
	It is noted that the validation testing takes 3-4 days, therefore suitable allowances should be incorporated into the project timeline and earthworks plan.
Step 6: Waste classification and off-site disposal	Following treatment, the material should be tested and assigned a waste classification in accordance with the Parts 1 and 4 of the Waste Classification Guidelines 2014. All neutralised material should be disposed of off-site to a facility licensed by the NSW EPA to accept treated PASS. The waste classification of a mixed fill and PASS waste stream must appropriately consider the available data from the overlying fill (e.g. that in the PSI report and any additional data that is collected). Waste disposal is to be tracked and kept on record.

4.4.2 PASS Disturbed/Exposed During Basement Excavation (in-situ/ex-situ treatment)

Notwithstanding the potential findings of further investigation (as outlined in Section 4.1), bulk excavation and detailed excavation (e.g. lift pits) for the proposed basement is anticipated to extend to, or possibly into, the PASS. Reference is to be made to the following table for the treatment and management procedure:

Table 4-2: In-situ/Ex-situ Treatment/Management of PASS – Basement Excavation

Procedure	Details
Step 1: Lime selection and Liming Rate Calculations	A suitable lime product is to be selected as discussed in Section 4.4.1.
Step 2: Set up treatment area/s	Treatment of bulk quantities of PASS with lime will take place within the footprint of the proposed basement area during excavation, following removal of the overlying fill material and non-PASS natural soils. It is assumed that the basement shoring system will have been installed around this area and that the area will be dewatered prior to excavation.
Step 3: Manage water run-off	The treatment area will be within the basement footprint which will retain any water run-off from the treated materials. Further reference should be made to Section 4.5 for details of the groundwater management measures required.
Step 4: Excavation & handling	It is expected that the initial surface of PASS material will become exposed from approximately 0.6mBGL to 1.3mBGL and may extend to further depths. Treatment trials are required to confirm liming rates for this material. Lime (as required) should be applied to any exposed PASS surfaces within the treatment area as soon as possible. The treatment of PASS within the basement excavation footprint will occur in 100mm layers (or similar, based on what is appropriate to achieve adequate neutralisation and materials handling). An appropriate amount of lime is to be applied to each layer, per square metre based on the volume/tonnage of soil to be treated in each layer. The layer is to be pushed or scraped up to appropriately mix in the lime, then the material is to be consolidated into one corner of the excavation to facilitate the validation testing. This process is to be repeated for each layer until the bulk excavation depth is achieved.

Procedure	Details
	If there are any localised/detailed excavations where excavation/treatment in layers is not practicable, material from these areas is to be excavated and treated using the ex-situ treatment methods described previously in Table 4-1. An earthworks strategy should be prepared incorporating the above procedure to ensure that adequate mixing of the neutralising agent (i.e. lime) and of the PASS material is achieved. It is noted that the validation testing (see Step 5 below) takes several days, therefore suitable allowances should be incorporated into the project timeline.
Step 5: Lime treatment & validation testing	An excavator or other suitable equipment (as deemed appropriate by the construction contractor) should be used to thoroughly mix the lime through the soil. Once treatment occurs, samples are to be collected from the treated soil at the rates required in the *National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual* (2018). A minimum of one sample is recommended per batch of treated soil prior to off-site disposal, and the overall validation frequency must be as follows: • <250m^3, two samples • 251-500m^3, three samples • 1,000m^3, four samples • >1,000 m^3, four samples plus one sample per additional 500m^3 Field pH may be used as a preliminary indicator where deemed appropriate by the validation consultant. Validation testing is to occur at a NATA accredited laboratory and will include acid base accounting using the chromium reducible sulfur method described in the *National Acid Sulfate Soil Guidance: National acid sulfate soils identification and laboratory methods manual* (2018). The validation net acidity results should be zero or less than the laboratory practical quantitation limits (PQL) (depending on how the laboratory report their results). It is noted that the validation testing takes 3-4 days, therefore suitable allowances should be incorporated into the project timeline and earthworks plan.
Step 6: Waste classification and off-site disposal	Following treatment, the material should be tested and assigned a waste classification in accordance with the Parts 1 and 4 of the Waste Classification Guidelines 2014. All neutralised material should be disposed of off-site to a facility licensed by the NSW EPA to accept treated PASS. Waste disposal is to be tracked and kept on record.

4.5 Groundwater Seepage and Dewatering

For this project, an engineered retention system will be installed prior to commencement of excavation for the proposed basement and piling (e.g. anchored or propped secant pile shoring walls) will occur so that the basement shoring would be a 'watertight' structure. Given the likelihood of shallow groundwater at the site, temporary dewatering is considered to be required to complete the basement excavation.

Based on the JK Geotechnics geotechnical report, it is assumed that the basement shoring system will need to extend to sufficient depth below bulk excavation level to limit groundwater drawdown outside the basement footprint and minimise settlement impacts beyond the site boundary (i.e. into bedrock). On this

basis, the potential to dewater PASS outside the basement excavation, to the extent that could cause prolonged oxidation and generation of acidic material, is considered to be low.

The details of dewatering are yet to be confirmed. Once the details of dewatering are confirmed, an *Acid Sulfate Soil Dewatering Management Plan* (ASSDMP) is to be prepared by the validation consultant. This is to be designed with reference to the *National Acid Sulfate Soil Guidance: Guidance for the dewatering of acid sulfate soils in shallow groundwater environments* (2018) and consider the site-specific requirements of the dewatering.

The dewatering plan is to be submitted to the relevant consent authorities (e.g. Northern Beaches Council and NSW Office of Water/Water NSW) for approval prior to the commencement of works. We note that Water NSW should be contacted for advice in relation to obtaining relevant approvals for dewatering, prior to preparation of the management plan.

4.6 Contingency Plan

In the event the results of soil neutralisation or groundwater monitoring tests (to be outlined in the ASSDMP) indicate a significant change in acidic conditions, the contingency plan should be implemented. Reference is to be made to the contingency plan below and to any other contingency plans documented in the *Acid Sulfate Soil Dewatering Management Plan* to be prepared for the project.

If soil monitoring indicates the presence of significantly more acidic material than expected, all excavation works should be placed on hold (where it is safe to do so) until further action is taken to limit the oxidation of PASS in the area of disturbance. Contingency works will be undertaken as follows:

- The pH of soils exposed to oxygen within the excavation will be measured to establish the source of the acidic conditions;
- Under the direction of the validation consultant, material found to be acidic may be selectively excavated and neutralised in accordance with the ex-situ treatment methods in Section 4.4.2 (Table 4-1). Exposed surfaces should be immediately 'dusted' with lime; and
- Where suitable, in-situ treatment involving lime addition and shallow in-situ mixing may be adopted.

Reference must also be made to the contingency plan to be outlined in the ASSDMP.

4.7 Documentation

On completion of the works requiring management under this ASSMP, a validation report is to be prepared by the validation consultant. The validation report is to document the works completed, present the validation testing results and comment on the adequacy of the overall compliance with the ASSMP. Any other specific conditions imposed by Northern Beaches Council on the development consent must also be adequately addressed.

5 LIMITATIONS

The report limitations are outlined below:

- JKE accepts no responsibility for any unidentified AASS or PASS 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;
- This report has been prepared based on site conditions which existed at the time of the investigation; scope of work and limitation outlined in the JKE proposal; and terms of contract between JKE and the client (as applicable);
- The conclusions presented in this report are based on investigation of conditions at specific locations, chosen to be as representative as possible under the given circumstances, visual observations of the site and immediate surrounds and documents reviewed as described in the report;
- Subsurface soil and rock conditions encountered between investigation locations may be found to be different from those expected. Groundwater conditions may also vary, especially after climatic changes;
- The investigation and preparation of this report have been undertaken in accordance with accepted practice for environmental consultants, with reference to applicable environmental regulatory authority and industry standards, guidelines and the assessment criteria outlined in the report;
- Where information has been provided by third parties, JKE has not undertaken any verification process, except where specifically stated in the report;
- JKE accept no responsibility for potentially asbestos containing materials that may exist at the site. These materials may be associated with demolition of pre-1990 constructed buildings or fill material at the site;
- JKE have not and will not make any determination regarding finances associated with the site;
- Additional investigation work may be required in the event of changes to the proposed development or landuse. JKE should be contacted immediately in such circumstances;
- 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;
- Copyright in this report is the property of JKE. JKE has used a degree of care, skill and diligence normally exercised by consulting professionals in similar circumstances and locality. No other warranty expressed or implied is made or intended. Subject to payment of all fees due for the investigation, the client alone shall have a licence to use this report;
- If the client, or any person, provides a copy of this report to any third party, such third party must not rely on this report except with the express written consent of JKE; and
- Any third party who seeks to rely on this report without the express written consent of JKE does so entirely at their own risk and to the fullest extent permitted by law, JKE accepts no liability whatsoever, in respect of any loss or damage suffered by any such third party.

If you have any questions concerning the contents of this letter please do not hesitate to contact us.

Kind Regards

Katrina Taylor
Associate | Environmental Scientist

Vittal Boggaram
Principal Associate

Appendices:

Appendix A: Report Figures

Appendix B: Laboratory Results Summary Tables

Appendix C: Information on Acid Sulfate Soils

Appendix D: Borehole Logs

Appendix E: Laboratory Reports & COC Documents

Appendix A: Report Figures

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

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

Title: **SITE LOCATION PLAN**

Location: 35-39, 40, 41, 42 & 43 BELGRAVE STREET, MANLY, NSW

Project No: E35999BT

Figure No: 1

JKEnvironments

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LEGEND

APPROXIMATE SITE BOUNDARY	
BH(Fill Depth)	BOREHOLE LOCATION, NUMBER AND DEPTH OF FILL (m)
SV1	SOIL VAPOUR PIN

AERIAL IMAGE SOURCE: MAPS.AU.NEARMAP.COM

0 2.5 5 7.5 10 12.5

SCALE 1:250 @A3 METRES

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

Title: **SAMPLE LOCATION PLAN**

Location: 35-39, 40, 41, 42 & 43 BELGRAVE STREET, MANLY, NSW

Project No: E35999BT

Figure No: 2

JKEnvironments

PLOT DATE: 18/05/2023 12:51:24 PM DWG FILE: K:\SC EIS JOBS\35000\SIE35999BT MANLY\CAD\E35999BT.DWG

Appendix B: Laboratory Results Summary Tables

ABBREVIATIONS AND EXPLANATIONS FOR ACID SULFATE SOIL TABLE

Abbreviations used in the Tables:

ANC_{BT}	Acid Neutralising Capacity - Back Titration
ANCE	Excess Acid Neutralising Capacity
$CaCO_3$	Calcium Carbonate
kg	kilogram
mol H^+/t	moles hydrogen per tonne
pHF	Field pH
pHFOX	Field peroxide pH
pH_{KCl}	Pottasium chloride pH
S	Sulfur
SCr	The symbol given to the result from the Chromium Reducible Sulfur method
S_{NAS}	Net Acid Soluble Sulfur
% w/w	Percentage by mass

Results have been assessed against the criteria specified in Table 1.1 of National Acid sulfate Soil Guidance - National acid sulfate soil identification and laboratory method manual. Water Quality Australia. June 2018

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TABLE A
SUMMARY OF LABORATORY RESULTS - ACID SULFATE SOIL ANALYSIS

Soil Texture: Coarse		Analysis	pH_F and pH_{FOX}				pH_{KCL}	Actual Acidity (Titratable Actual Acidity - TAA)	Potential Sulfidic Acidity		Retained Acidity	Acid Neutralising Capacity (ANC_{BT})	a-Net Acidity without ANCE	s-Net Acidity without ANCE	Liming Rate - without ANCE
			pH_F	pH_{FOX}	Reaction	pH_F - pH_{FOX}		(mol H^+/t)	(% SCr)	(mol H^+/t)	(%S_{NAS})	(% $CaCO_3$)	(mol H^+/t)	(%w/w S)	(kg $CaCO_3$/tonne)
National Acid Sulfate Soils Guidance (2018)			-	-	-	-	-	-	-	-	-	-	18	0.03	-
Sample Reference	**Sample Depth (m)**	**Sample Description**													
BH1	0-0.1	F: Silty Sand	7.1	5.8	Low reaction	1.3	-	-	-	-	-	-	-	-	-
BH1	0.6-0.8	Silty Sand	8.2	6	Low reaction	2.2	8.9	<5	<0.005	<3	[NT]	<0.05	<5	<0.005	<0.75
BH1	2-2.2	Silty Sand	7.9	6.2	Low reaction	1.7	7.9	<5	<0.005	<3	[NT]	0.05	<5	<0.005	<0.75
BH2	0.1-0.2	F: Silty Clayey Sand	7.6	5.9	Low reaction	1.7	8.3	<5	0.01	8	[NT]	<0.05	7.5	0.01	<0.75
BH2	1.3-1.5	Silty Sand	7.1	5.7	Medium reaction	1.4	-	-	-	-	-	-	-	-	-
BH2	2.5-2.7	Silty Sand	7	5.6	Medium reaction	1.4	7.4	<5	<0.005	<3	[NT]	<0.05	<5	<0.005	<0.75
Total Number of Samples			6	6	6	6	4	4	4	4	-	4	4	4	4
Minimum Value			7.0	5.6	Low reaction	1.3	7.4	<5	<0.005	8	-	0.05	<5	<0.005	<0.75
Maximum Value			8.2	6.2	Medium reaction	2.2	8.9	<5	0.01	8	-	0.05	7.5	0.01	<0.75

Values Exceeding Action Criteria

Appendix C: Information on Acid Sulfate Soils

A. Background

Acid Sulfate Soil (ASS) is formed from iron rich alluvial sediments and sulfate (found in seawater) in the presence of sulfate reducing bacteria and plentiful organic matter. These conditions are generally found in mangroves, salt marsh vegetation or tidal areas and at the bottom of coastal rivers and lakes. ASS materials are distinguished from other soil or sediment materials (referred to as 'soil materials' throughout the National Acid Sulfate Soils Guidance) by having properties and behaviour that have either:

1) Been affected considerably by the oxidation of Reduced Inorganic Sulfur (RIS), or
2) The capacity to be affected considerably by the oxidation of their RIS constituents.

Acid sulfate soil materials include potential acid sulfate soils (PASS or sulfidic soil materials) and actual acid sulfate soils (AASS or sulfuric soil materials). These are often found in the same profile, with AASS overlying PASS. PASS and AASS are defined further below:

- PASS are soil materials which contain RIS such as pyrite. The field pH of these soils in their undisturbed state is usually more than pH 4 and is commonly neutral to alkaline (pH 7–9). These soil materials are invariably saturated with water in their natural state. Their texture may be peat, clay, loam, silt or sand and is often dark grey in colour and soft in consistence, but these materials may also exhibit colours that are dark brown, or medium to pale grey to white; and
- AASS are soil materials which contained RIS such as pyrite that have undergone oxidation. This oxidation results in low pH (that is pH less than 4) and often a yellow (jarosite) and/or orange to red mottling (ferric iron oxides) in the soil profile. Actual ASS contains Actual Acidity, and commonly also contains RIS (the source of Potential Sulfuric Acidity) as well as Retained Acidity.

B. The ASS Planning Maps

The ASS planning maps provide an indication of the relative potential for disturbance of ASS to occur at locations within the council area. These maps do not provide an indication of the actual occurrence of ASS at a site or the likely severity of the conditions.

The maps are divided into five classes dependent upon the type of activities/works that if undertaken, may represent an environmental risk through the development of acidic conditions associated with ASS:

Table 1: Risk Classes

Risk Class	Description
Class 1	All works.
Class 2	All works below existing ground level and works by which the water table is likely to be lowered.
Class 3	Works at depths beyond 1m below existing ground level or works by which the water table is likely to be lowered beyond 1m below existing ground level.
Class 4	Works at depths beyond 2m below existing ground level or works by which the water table is likely to be lowered beyond 2m below existing ground level.
Class 5	Works within 500m of adjacent Class 1, 2, 3, 4 land which are likely to lower the water table below 1m AHD on the adjacent land.

C. The ASS Risk Maps

The ASS risk maps provide an indication of the probability of occurrence of ASS materials at a particular location based on interpretation from geological and soil landscape maps. The maps provide classes based on high probability, low probability, no known occurrence and areas of disturbed terrain (site specific assessment necessary) and the likely depth at which ASS materials are likely to be encountered.

D. Interpretation of ASS Field Tests

Tables A1 and A2 below provide some guidance on the interpretation of pH_F and pH_{FOX} test results, as detailed in the *National Acid Sulfate Soil Guidance: National acid sulfate soils sampling and identification methods manual* (2018):

Table A1: Interpretation of some pH_F test ranges

pH value	Result	Comments
$pH_F \leq 4$, jarosite not observed in the soil layer/horizon	May indicate an AASS indicating previous oxidation of RIS or may indicate naturally occurring, non ASS soils.	Generally not conclusive as naturally occurring, non ASS soils, such as many organic soils (for example peats) and heavily leached soils, often also return $pH_F \leq 4$.
$pH_F \leq 4$, jarosite observed in the soil layer/horizon	The soil material is an AASS.	Jarosite and other iron precipitate minerals in ASS such as schwertmannite require a pH < 4 to form and indicate prior oxidation of RIS.
$pH_F > 7$	Expected in waterlogged, unoxidised, or poorly drained soils.	Marine muds commonly have a pH > 7 which reflects a seawater (pH 8.2) influence. Oxidation of samples with H_2O_2 can help indicate if the soil materials contain RIS.

Source: Adapted from DER (2015a).

Table A2: Interpretation of pH_{FOX} test results

pH value and reaction	Result	Comments
Strong reaction of soil with H_2O_2 (that is X or V)	Useful indicator of the presence of RIS but cannot be used alone	Organic rich substrates such as peat and coffee rock, and soil constituents like manganese oxides, can also cause a reaction. Care must be exercised in interpreting these results. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} value at least one unit below field pH_F and strong reaction with H_2O_2 (that is X or V)	May indicate PASS	The difference between pH_F and pH_{FOX} is termed the ΔpH. Generally the larger the ΔpH the more indicative of PASS. The lower the final pH_{FOX} the better the likelihood of an appreciable RIS content. For example, a change from pH_F of 8 to pH_{FOX} of 7 (that is a ΔpH of 1) would not indicate PASS, however, a unit change from pH_F of 3.5 to pH_{FOX} of 2.5 would be indicative of PASS. Laboratory analyses are required to confirm if appreciable RIS is present.
$pH_{FOX} < 3$, large ΔpH and a strong reaction with H_2O_2 (that is X or V)	Strongly indicates PASS	The lower the pH_{FOX} below 3, the greater the likelihood that appreciable RIS is present. A combination of all three parameters – pH_{FOX}, ΔpH and reaction strength – gives the best indication of PASS. Laboratory analyses are required to confirm that appreciable RIS is present.

pH value and reaction	Result	Comments
A pH_{FOX} 3–4 and Low, Medium or Strong reaction with H_2O_2	Inconclusive	RIS may be present; however, organic matter may also be responsible for the decrease in pH. Laboratory analyses are required to confirm the presence of RIS.
pH_{FOX} 4–5	Inconclusive	RIS may be present in small quantities, or poorly reactive under rapid oxidation, or the sample may contain shell/ carbonate which neutralises some or all acid produced on oxidation. Equally, the pH_{FOX} value may be due to the production of organic acids with no RIS present. Laboratory analyses are required to confirm if appreciable RIS is present.
pH_{FOX} > 5, small or no ΔpH, but Low, Medium or Strong reaction with H_2O_2	Inconclusive	For neutral to alkaline pHF with shell or white concretions, the fizz test with 1 M HCl can be used to identify the presence of carbonates. Laboratory analyses are required to confirm if appreciable RIS is present and further testing is required to confirm that effective self-neutralising materials are present.

Source: Adapted from DER (2015a).

Appendix D: Borehole Logs

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. **BH1** **1/1**

SDUP1

Client: TIME AND PLACE

Project: PROPOSED MIXED USE DEVELOPMENT

Location: 43 BELGRAVE STREET, MANLY, NSW

Job No.: E35999BT **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 20/4/23 **Datum:** -

Plant Type: - **Logged/Checked by:** O.B./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 COMPLE-TION							0			FILL: Silty sand, fine to medium grained, dark grey mottled yellow brown, with sandstone gravel.	D			
							0.5		SM	Silty SAND: fine to medium grained, light brown mottled dark brown.	D			MARINE
							1							
							1.5							
							2			as above, but orange brown.	D			
							2.5							
							3			END OF BOREHOLE AT 3.0m				
							3.5							

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ENVIRONMENTAL LOG

Environmental logs are not to be used for geotechnical purposes

Log No. **BH2** **1/1**

SDUP1

Client: TIME AND PLACE

Project: PROPOSED MIXED USE DEVELOPMENT

Location: 43 BELGRAVE STREET, MANLY, NSW

Job No.: E35999BT **Method:** HAND AUGER **R.L. Surface:** N/A

Date: 20/4/23 **Datum:** -

Plant Type: - **Logged/Checked by:** O.B./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							0			CONCRETE: 100mm.t				
									-	FILL: Silty clayey sand, fine to medium grained, dark brown, trace of sandstone gravel.	D			
							0.5							
							1							
									SM	Silty SAND: fine to medium grained, light brown mottled orange and dark brown.	D			MARINE
							1.5							
							2							
							2.5							
							3			END OF BOREHOLE AT 3.0m				
							3.5							

ENVIRONMENTAL LOGS EXPLANATION NOTES

INTRODUCTION

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

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

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

DESCRIPTION AND CLASSIFICATION METHODS

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

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

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

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

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

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

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

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

INVESTIGATION METHODS

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

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

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

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

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

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

Wash Boring: The borehole is usually advanced by a rotary bit, with water being pumped down the drill rods and returned up the annulus, carrying the drill cuttings. Only major changes in stratification can be assessed from the cuttings, together with some information from "feel" and rate of penetration.

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

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

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

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

The test results are reported in the following form:

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

  N = 13
  4, 6, 7

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

  N > 30
  15, 30/40mm

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

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

LOGS

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

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

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

GROUNDWATER

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

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

More reliable measurements can be made by installing standpipes which are read after the groundwater level has stabilised at intervals ranging from several days to perhaps weeks for low permeability soils. Piezometers, sealed in a particular stratum, may be advisable in low permeability soils or where there may be interference from perched water tables or surface water.

FILL

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

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

LABORATORY TESTING

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

SYMBOL LEGENDS

SOIL


FILL


TOPSOIL


CLAY (CL, CI, CH)


SILT (ML, MH)


SAND (SP, SW)


GRAVEL (GP, GW)


SANDY CLAY (CL, CI, CH)


SILTY CLAY (CL, CI, CH)


CLAYEY SAND (SC)


SILTY SAND (SM)


GRAVELLY CLAY (CL, CI, CH)


CLAYEY GRAVEL (GC)


SANDY SILT (ML, MH)


PEAT AND HIGHLY ORGANIC SOILS (Pt)

ROCK


CONGLOMERATE


SANDSTONE


SHALE/MUDSTONE


SILTSTONE


CLAYSTONE


COAL


LAMINITE


LIMESTONE


PHYLLITE, SCHIST


TUFF


GRANITE, GABBRO


DOLERITE, DIORITE


BASALT, ANDESITE


QUARTZITE

OTHER MATERIALS


BRICKS OR PAVERS


CONCRETE


ASPHALTIC CONCRETE

CLASSIFICATION OF COARSE AND FINE GRAINED SOILS

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

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

Laboratory Classification Criteria

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

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

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

NOTES:

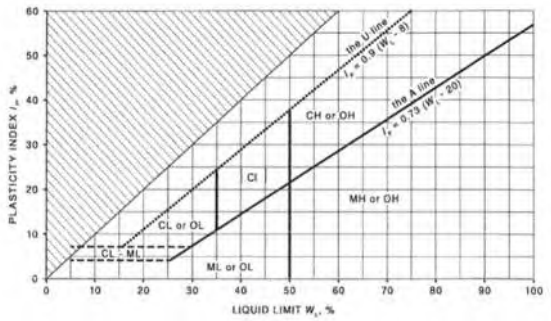
1 For a coarse grained soil with a fines content between 5% and 12%, the soil is given a dual classification comprising the two group symbols separated by a dash; for example, for a poorly graded gravel with between 5% and 12% silt fines, the classification is GP-GM.

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

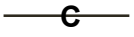
3 Clay soils with liquid limits > 35% and ≤ 50% may be classified as being of medium plasticity.

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

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



LOG SYMBOLS

Log Column	Symbol	Definition
Groundwater Record		Standing water level. Time delay following completion of drilling/excavation may be shown.
		Extent of borehole/test pit collapse shortly after drilling/excavation.
		Groundwater seepage into borehole or test pit noted during drilling or excavation.
Samples	ES	Sample taken over depth indicated, for environmental analysis.
	U50	Undisturbed 50mm diameter tube sample taken over depth indicated.
	DB	Bulk disturbed sample taken over depth indicated.
	DS	Small disturbed bag sample taken over depth indicated.
	ASB	Soil sample taken over depth indicated, for asbestos analysis.
	ASS	Soil sample taken over depth indicated, for acid sulfate soil analysis.
	SAL	Soil sample taken over depth indicated, for salinity analysis.
	PFAS	Soil sample taken over depth indicated, for analysis of Per- and Polyfluoroalkyl Substances.
Field Tests	N = 17 4, 7, 10	Standard Penetration Test (SPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration. 'Refusal' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	N_c = 5 7 3R	Solid Cone Penetration Test (SCPT) performed between depths indicated by lines. Individual figures show blows per 150mm penetration for 60° solid cone driven by SPT hammer. 'R' refers to apparent hammer refusal within the corresponding 150mm depth increment.
	VNS = 25	Vane shear reading in kPa of undrained shear strength.
	PID = 100	Photoionisation detector reading in ppm (soil sample headspace test).
Moisture Condition (Fine Grained Soils)	w > PL	Moisture content estimated to be greater than plastic limit.
	$w \approx$ PL	Moisture content estimated to be approximately equal to plastic limit.
	w < PL	Moisture content estimated to be less than plastic limit.
	$w \approx$ LL	Moisture content estimated to be near liquid limit.
	w > LL	Moisture content estimated to be wet of liquid limit.
(Coarse Grained Soils)	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 ≤ 25kPa.
	S	SOFT – unconfined compressive strength > 25kPa and ≤ 50kPa.
	F	FIRM – unconfined compressive strength > 50kPa and ≤ 100kPa.
	St	STIFF – unconfined compressive strength > 100kPa and ≤ 200kPa.
	VSt	VERY STIFF – unconfined compressive strength > 200kPa and ≤ 400kPa.
	Hd	HARD – unconfined compressive strength > 400kPa.
	Fr	FRIABLE – strength not attainable, soil crumbles.
	( )	Bracketed symbol indicates estimated consistency based on tactile examination or other assessment.
Density Index/ Relative Density (Cohesionless Soils)		**Density Index (I_D) Range (%)** / **SPT 'N' Value Range (Blows/300mm)** VERY LOOSE: ≤ 15 / 0 – 4 LOOSE: > 15 and ≤ 35 / 4 – 10 MEDIUM DENSE: > 35 and ≤ 65 / 10 – 30 DENSE: > 65 and ≤ 85 / 30 – 50 VERY DENSE: > 85 / > 50
	VL	
	L	
	MD	
	D	
	VD	
	( )	Bracketed symbol indicates estimated density based on ease of drilling or other assessment.

Log Column	Symbol	Definition
Hand Penetrometer Readings	300 250	Measures reading in kPa of unconfined compressive strength. Numbers indicate individual test results on representative undisturbed material unless noted otherwise.
Remarks	'V' bit	Hardened steel 'V' shaped bit.
	'TC' bit	Twin pronged tungsten carbide bit.
	T_{60}	Penetration of auger string in mm under static load of rig applied by drill head hydraulics without rotation of augers.
	Soil Origin	The geological origin of the soil can generally be described as: RESIDUAL – soil formed directly from insitu weathering of the underlying rock. No visible structure or fabric of the parent rock. EXTREMELY WEATHERED – soil formed directly from insitu weathering of the underlying rock. Material is of soil strength but retains the structure and/or fabric of the parent rock. ALLUVIAL – soil deposited by creeks and rivers. ESTUARINE – soil deposited in coastal estuaries, including sediments caused by inflowing creeks and rivers, and tidal currents. MARINE – soil deposited in a marine environment. AEOLIAN – soil carried and deposited by wind. COLLUVIAL – soil and rock debris transported downslope by gravity, with or without the assistance of flowing water. Colluvium is usually a thick deposit formed from a landslide. The description 'slopewash' is used for thinner surficial deposits. LITTORAL – beach deposited soil.

Classification of Material Weathering

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

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

Rock Material Strength Classification

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

Appendix E: Laboratory Reports & COC Documents

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CERTIFICATE OF ANALYSIS 321520

Client Details

Client	JK Environments
Attention	Katrina Taylor
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E35999BT**
Number of Samples	13 Soil, 1 Water
Date samples received	21/04/2023
Date completed instructions received	21/04/2023

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	01/05/2023
Date of Issue	01/05/2023

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Hannah Nguyen, Metals Supervisor
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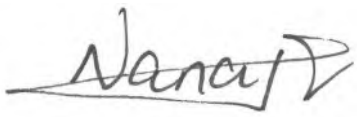

Nancy Zhang, Laboratory Manager

vTRH(C6-C10)/BTEXN in Soil						
Our Reference		321520-1	321520-4	321520-6	321520-8	321520-11
Your Reference	UNITS	BH1	BH1	BH2	BH2	TB1
Depth		0-0.1	2-2.2	0.1-0.2	1.3-1.5	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
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	%	102	104	106	104	99

vTRH(C6-C10)/BTEXN in Soil			
Our Reference		321520-12	321520-14
Your Reference	UNITS	TS1	S Dup1
Depth		-	-
Date Sampled		20/04/2023	20/04/2023
Type of sample		Soil	Soil
Date extracted	-	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023
TRH C_6 - C_9	mg/kg	[NA]	<25
TRH C_6 - C_{10}	mg/kg	[NA]	<25
vTPH C_6 - C_{10} less BTEX (F1)	mg/kg	[NA]	<25
Benzene	mg/kg	100%	<0.2
Toluene	mg/kg	108%	<0.5
Ethylbenzene	mg/kg	110%	<1
m+p-xylene	mg/kg	111%	<2
o-Xylene	mg/kg	110%	<1
Naphthalene	mg/kg	[NA]	<1
Total +ve Xylenes	mg/kg	[NA]	<1
Surrogate aaa-Trifluorotoluene	%	112	101

svTRH (C10-C40) in Soil						
Our Reference		321520-1	321520-4	321520-6	321520-8	321520-11
Your Reference	UNITS	BH1	BH1	BH2	BH2	TB1
Depth		0-0.1	2-2.2	0.1-0.2	1.3-1.5	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
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
Total +ve TRH (C10-C36)	mg/kg	<50	<50	<50	<50	<50
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	130	<100	<100
TRH >C_{34} -C_{40}	mg/kg	<100	<100	<100	<100	<100
Total +ve TRH (>C10-C40)	mg/kg	<50	<50	130	<50	<50
Surrogate o-Terphenyl	%	121	107	111	108	108

svTRH (C10-C40) in Soil		
Our Reference		321520-14
Your Reference	UNITS	S Dup1
Depth		-
Date Sampled		20/04/2023
Type of sample		Soil
Date extracted	-	26/04/2023
Date analysed	-	28/04/2023
TRH C_{10} - C_{14}	mg/kg	<50
TRH C_{15} - C_{28}	mg/kg	<100
TRH C_{29} - C_{36}	mg/kg	<100
Total +ve TRH (C10-C36)	mg/kg	<50
TRH >C_{10} -C_{16}	mg/kg	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	mg/kg	<50
TRH >C_{16} -C_{34}	mg/kg	<100
TRH >C_{34} -C_{40}	mg/kg	<100
Total +ve TRH (>C10-C40)	mg/kg	<50
Surrogate o-Terphenyl	%	107

PAHs in Soil						
Our Reference		321520-1	321520-4	321520-6	321520-8	321520-11
Your Reference	UNITS	BH1	BH1	BH2	BH2	TB1
Depth		0-0.1	2-2.2	0.1-0.2	1.3-1.5	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Naphthalene	mg/kg	<0.1	<0.1	<0.1	<0.1	<0.1
Acenaphthylene	mg/kg	<0.1	<0.1	0.3	<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	1.7	<0.1	<0.1
Anthracene	mg/kg	<0.1	<0.1	0.4	<0.1	<0.1
Fluoranthene	mg/kg	0.3	<0.1	3.9	0.1	<0.1
Pyrene	mg/kg	0.3	<0.1	3.7	0.1	<0.1
Benzo(a)anthracene	mg/kg	0.2	<0.1	2.7	<0.1	<0.1
Chrysene	mg/kg	0.1	<0.1	1.4	<0.1	<0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.4	<0.2	3.3	<0.2	<0.2
Benzo(a)pyrene	mg/kg	0.2	<0.05	1.5	0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1	<0.1	0.6	<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	0.2	<0.1	0.8	<0.1	<0.1
Total +ve PAH's	mg/kg	1.9	<0.05	20	0.3	<0.05
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5	<0.5	2.2	<0.5	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5	<0.5	2.2	<0.5	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5	<0.5	2.3	<0.5	<0.5
Surrogate p-Terphenyl-d14	%	133	119	131	128	131

PAHs in Soil		
Our Reference		321520-14
Your Reference	UNITS	S Dup1
Depth		-
Date Sampled		20/04/2023
Type of sample		Soil
Date extracted	-	26/04/2023
Date analysed	-	27/04/2023
Naphthalene	mg/kg	<0.1
Acenaphthylene	mg/kg	<0.1
Acenaphthene	mg/kg	<0.1
Fluorene	mg/kg	<0.1
Phenanthrene	mg/kg	<0.1
Anthracene	mg/kg	<0.1
Fluoranthene	mg/kg	0.3
Pyrene	mg/kg	0.3
Benzo(a)anthracene	mg/kg	0.2
Chrysene	mg/kg	0.1
Benzo(b,j+k)fluoranthene	mg/kg	0.3
Benzo(a)pyrene	mg/kg	0.1
Indeno(1,2,3-c,d)pyrene	mg/kg	<0.1
Dibenzo(a,h)anthracene	mg/kg	<0.1
Benzo(g,h,i)perylene	mg/kg	<0.1
Total +ve PAH's	mg/kg	1.2
Benzo(a)pyrene TEQ calc (zero)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(half)	mg/kg	<0.5
Benzo(a)pyrene TEQ calc(PQL)	mg/kg	<0.5
Surrogate p-Terphenyl-d14	%	131

Organochlorine Pesticides in soil				
Our Reference		321520-1	321520-6	321520-14
Your Reference	UNITS	BH1	BH2	S Dup1
Depth		0-0.1	0.1-0.2	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023
alpha-BHC	mg/kg	<0.1	<0.1	<0.1
HCB	mg/kg	<0.1	<0.1	<0.1
beta-BHC	mg/kg	<0.1	<0.1	<0.1
gamma-BHC	mg/kg	<0.1	<0.1	<0.1
Heptachlor	mg/kg	<0.1	<0.1	<0.1
delta-BHC	mg/kg	<0.1	<0.1	<0.1
Aldrin	mg/kg	<0.1	<0.1	<0.1
Heptachlor Epoxide	mg/kg	<0.1	<0.1	<0.1
gamma-Chlordane	mg/kg	<0.1	<0.1	<0.1
alpha-chlordane	mg/kg	<0.1	<0.1	<0.1
Endosulfan I	mg/kg	<0.1	<0.1	<0.1
pp-DDE	mg/kg	<0.1	<0.1	<0.1
Dieldrin	mg/kg	<0.1	<0.1	<0.1
Endrin	mg/kg	<0.1	<0.1	<0.1
Endosulfan II	mg/kg	<0.1	<0.1	<0.1
pp-DDD	mg/kg	<0.1	<0.1	<0.1
Endrin Aldehyde	mg/kg	<0.1	<0.1	<0.1
pp-DDT	mg/kg	<0.1	<0.1	<0.1
Endosulfan Sulphate	mg/kg	<0.1	<0.1	<0.1
Methoxychlor	mg/kg	<0.1	<0.1	<0.1
Total +ve DDT+DDD+DDE	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	119	117	116

Organophosphorus Pesticides in Soil				
Our Reference		321520-1	321520-6	321520-14
Your Reference	UNITS	BH1	BH2	S Dup1
Depth		0-0.1	0.1-0.2	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023
Dichlorvos	mg/kg	<0.1	<0.1	<0.1
Dimethoate	mg/kg	<0.1	<0.1	<0.1
Diazinon	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos-methyl	mg/kg	<0.1	<0.1	<0.1
Ronnel	mg/kg	<0.1	<0.1	<0.1
Fenitrothion	mg/kg	<0.1	<0.1	<0.1
Malathion	mg/kg	<0.1	<0.1	<0.1
Chlorpyriphos	mg/kg	<0.1	<0.1	<0.1
Parathion	mg/kg	<0.1	<0.1	<0.1
Bromophos-ethyl	mg/kg	<0.1	<0.1	<0.1
Ethion	mg/kg	<0.1	<0.1	<0.1
Azinphos-methyl (Guthion)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	119	117	116

PCBs in Soil				
Our Reference		321520-1	321520-6	321520-14
Your Reference	UNITS	BH1	BH2	S Dup1
Depth		0-0.1	0.1-0.2	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil
Date extracted	-	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023
Aroclor 1016	mg/kg	<0.1	<0.1	<0.1
Aroclor 1221	mg/kg	<0.1	<0.1	<0.1
Aroclor 1232	mg/kg	<0.1	<0.1	<0.1
Aroclor 1242	mg/kg	<0.1	<0.1	<0.1
Aroclor 1248	mg/kg	<0.1	<0.1	<0.1
Aroclor 1254	mg/kg	<0.1	<0.1	<0.1
Aroclor 1260	mg/kg	<0.1	<0.1	<0.1
Total +ve PCBs (1016-1260)	mg/kg	<0.1	<0.1	<0.1
Surrogate TCMX	%	119	117	116

Acid Extractable metals in soil						
Our Reference		321520-1	321520-4	321520-6	321520-8	321520-11
Your Reference	UNITS	BH1	BH1	BH2	BH2	TB1
Depth		0-0.1	2-2.2	0.1-0.2	1.3-1.5	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	28/04/2023	28/04/2023	28/04/2023	28/04/2023	28/04/2023
Arsenic	mg/kg	<4	<4	<4	<4	<4
Cadmium	mg/kg	0.6	<0.4	<0.4	<0.4	<0.4
Chromium	mg/kg	8	5	8	4	3
Copper	mg/kg	63	5	35	3	<1
Lead	mg/kg	140	9	200	18	3
Mercury	mg/kg	0.3	<0.1	0.5	<0.1	<0.1
Nickel	mg/kg	6	2	4	2	<1
Zinc	mg/kg	580	15	86	6	2

Acid Extractable metals in soil		
Our Reference		321520-14
Your Reference	UNITS	S Dup1
Depth		-
Date Sampled		20/04/2023
Type of sample		Soil
Date prepared	-	26/04/2023
Date analysed	-	28/04/2023
Arsenic	mg/kg	<4
Cadmium	mg/kg	<0.4
Chromium	mg/kg	10
Copper	mg/kg	38
Lead	mg/kg	130
Mercury	mg/kg	0.5
Nickel	mg/kg	5
Zinc	mg/kg	360

Moisture						
Our Reference		321520-1	321520-4	321520-6	321520-8	321520-11
Your Reference	UNITS	BH1	BH1	BH2	BH2	TB1
Depth		0-0.1	2-2.2	0.1-0.2	1.3-1.5	-
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	26/04/2023	26/04/2023	26/04/2023	26/04/2023	26/04/2023
Date analysed	-	27/04/2023	27/04/2023	27/04/2023	27/04/2023	27/04/2023
Moisture	%	9.4	5.1	5.5	1.6	4.8

Moisture		
Our Reference		321520-14
Your Reference	UNITS	S Dup1
Depth		-
Date Sampled		20/04/2023
Type of sample		Soil
Date prepared	-	26/04/2023
Date analysed	-	27/04/2023
Moisture	%	9.3

Asbestos ID - soils NEPM - ASB-001			
Our Reference		321520-1	321520-6
Your Reference	UNITS	BH1	BH2
Depth		0-0.1	0.1-0.2
Date Sampled		20/04/2023	20/04/2023
Type of sample		Soil	Soil
Date analysed	-	01/05/2023	01/05/2023
Sample mass tested	g	690.18	486.67
Sample Description	-	Grey fine-grained soil and rocks	Brown fine-grained soil and rocks
Asbestos ID in soil (AS4964) >0.1g/kg	-	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected	No asbestos detected at reporting limit of 0.1g/kg Organic fibres detected
Trace Analysis	-	No asbestos detected	No asbestos detected
Total Asbestos[#1]	g/kg	<0.1	<0.1
Asbestos ID in soil <0.1g/kg*	-	No visible asbestos detected	No visible asbestos detected
ACM >7mm Estimation*	g	–	–
FA and AF Estimation*	g	–	–
ACM >7mm Estimation*	%(w/w)	<0.01	<0.01
FA and AF Estimation*#2	%(w/w)	<0.001	<0.001

sPOCAS field test						
Our Reference		321520-1	321520-2	321520-4	321520-6	321520-8
Your Reference	UNITS	BH1	BH1	BH1	BH2	BH2
Depth		0-0.1	0.6-0.8	2-2.2	0.1-0.2	1.3-1.5
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil	Soil
Date prepared	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023	01/05/2023
Date analysed	-	01/05/2023	01/05/2023	01/05/2023	01/05/2023	01/05/2023
pH_F (field pH test)	pH Units	7.1	8.2	7.9	7.6	7.1
pH_{FOX} (field peroxide test)	pH Units	5.8	6.0	6.2	5.9	5.7
Reaction Rate*	-	Low reaction	Low reaction	Low reaction	Low reaction	Medium reaction

sPOCAS field test		
Our Reference		321520-10
Your Reference	UNITS	BH2
Depth		2.5-2.7
Date Sampled		20/04/2023
Type of sample		Soil
Date prepared	-	01/05/2023
Date analysed	-	01/05/2023
pH_F (field pH test)	pH Units	7.0
pH_{FOX} (field peroxide test)	pH Units	5.6
Reaction Rate*	-	Medium reaction

vTRH(C6-C10)/BTEXN in Water		
Our Reference		321520-13
Your Reference	UNITS	FR HA1
Depth		-
Date Sampled		20/04/2023
Type of sample		Water
Date extracted	-	24/04/2023
Date analysed	-	26/04/2023
TRH C_6 - C_9	µg/L	51
TRH C_6 - C_{10}	µg/L	51
TRH C_6 - C_{10} less BTEX (F1)	µg/L	51
Benzene	µg/L	<1
Toluene	µg/L	<1
Ethylbenzene	µg/L	<1
m+p-xylene	µg/L	<2
o-xylene	µg/L	<1
Naphthalene	µg/L	<1
Surrogate Dibromofluoromethane	%	106
Surrogate toluene-d8	%	101
Surrogate 4-BFB	%	96

svTRH (C10-C40) in Water		
Our Reference		321520-13
Your Reference	UNITS	FR HA1
Depth		-
Date Sampled		20/04/2023
Type of sample		Water
Date extracted	-	28/04/2023
Date analysed	-	29/04/2023
TRH C_{10} - C_{14}	µg/L	<50
TRH C_{15} - C_{28}	µg/L	<100
TRH C_{29} - C_{36}	µg/L	<100
Total +ve TRH (C10-C36)	µg/L	<50
TRH >C_{10} - C_{16}	µg/L	<50
TRH >C_{10} - C_{16} less Naphthalene (F2)	µg/L	<50
TRH >C_{16} - C_{34}	µg/L	<100
TRH >C_{34} - C_{40}	µg/L	<100
Total +ve TRH (>C10-C40)	µg/L	<50
Surrogate o-Terphenyl	%	76

PAHs in Water		
Our Reference		321520-13
Your Reference	UNITS	FR HA1
Depth		-
Date Sampled		20/04/2023
Type of sample		Water
Date extracted	-	28/04/2023
Date analysed	-	01/05/2023
Naphthalene	µg/L	<2
Acenaphthylene	µg/L	<1
Acenaphthene	µg/L	<1
Fluorene	µg/L	<1
Phenanthrene	µg/L	<1
Anthracene	µg/L	<1
Fluoranthene	µg/L	<1
Pyrene	µg/L	<1
Benzo(a)anthracene	µg/L	<1
Chrysene	µg/L	<1
Benzo(b,j+k)fluoranthene	µg/L	<2
Benzo(a)pyrene	µg/L	<1
Indeno(1,2,3-c,d)pyrene	µg/L	<1
Dibenzo(a,h)anthracene	µg/L	<1
Benzo(g,h,i)perylene	µg/L	<1
Benzo(a)pyrene TEQ	µg/L	<5
Total +ve PAH's	µg/L	NIL (+)VE
Surrogate p-Terphenyl-d14	%	100

Metals in Waters - Acid extractable		
Our Reference		321520-13
Your Reference	UNITS	FR HA1
Depth		-
Date Sampled		20/04/2023
Type of sample		Water
Date prepared	-	28/04/2023
Date analysed	-	28/04/2023
Arsenic - Total	mg/L	<0.05
Cadmium - Total	mg/L	<0.01
Chromium - Total	mg/L	<0.01
Copper - Total	mg/L	0.9
Lead - Total	mg/L	<0.03
Mercury - Total	mg/L	<0.0005
Nickel - Total	mg/L	<0.02
Zinc - Total	mg/L	<0.02

Method ID	Methodology Summary
ASB-001	Asbestos ID - Qualitative identification of asbestos in bulk samples using Polarised Light Microscopy and Dispersion Staining Techniques including Synthetic Mineral Fibre and Organic Fibre as per Australian Standard 4964-2004.
ASB-001	Asbestos ID - Identification of asbestos in soil samples using Polarised Light Microscopy and Dispersion Staining Techniques. Minimum 500mL soil sample was analysed as recommended by "National Environment Protection (Assessment of site contamination) Measure, Schedule B1 and "The Guidelines from the Assessment, Remediation and Management of Asbestos-Contaminated Sites in Western Australia - May 2009" with a reporting limit of 0.1g/kg (0.01% w/w) as per Australian Standard AS4964-2004. Results reported denoted with * are outside our scope of NATA accreditation. **NOTE** #1 Total Asbestos g/kg was analysed and reported as per Australian Standard AS4964 (This is the sum of ACM >7mm, <7mm and FA/AF) **NOTE** #2 The screening level of 0.001% w/w asbestos in soil for FA and AF only applies where the FA and AF are able to be quantified by gravimetric procedures. This screening level is not applicable to free fibres. Estimation = Estimated asbestos weight Results reported with "--" is equivalent to no visible asbestos identified using Polarised Light microscopy and Dispersion Staining Techniques.
Inorg-008	Moisture content determined by heating at 105+/-5 °C for a minimum of 12 hours.
Inorg-063	pH- measured using pH meter and electrode. Soil is oxidised with Hydrogen Peroxide or extracted with water. Based on section H, Acid Sulfate Soils Laboratory Methods Guidelines, Version 2.1 - June 2004. To ensure accurate results these tests are recommended to be done in the field as pH may change with time thus these results may not be representative of true field conditions.
Metals-020	Determination of various metals by ICP-AES.
Metals-021	Determination of Mercury by Cold Vapour AAS.
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis.

Method ID	Methodology Summary
Org-020	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-FID. F2 = (>C10-C16)-Naphthalene as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater (HSLs Tables 1A (3, 4)). Note Naphthalene is determined from the VOC analysis. Note, the Total +ve TRH PQL is reflective of the lowest individual PQL and is therefore "Total +ve TRH" is simply a sum of the positive individual TRH fractions (>C10-C40).
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD.
Org-021	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-ECD. Note, the Total +ve PCBs PQL is reflective of the lowest individual PQL and is therefore" Total +ve PCBs" is simply a sum of the positive individual PCBs.
Org-022	Determination of VOCs sampled onto coconut shell charcoal sorbent tubes, that can be desorbed using carbon disulphide, and analysed by GC-MS.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS.
Org-022/025	Soil samples are extracted with dichloromethane/acetone and waters with dichloromethane and analysed by GC-MS/GC-MSMS. Note, the Total +ve reported DDD+DDE+DDT PQL is reflective of the lowest individual PQL and is therefore simply a sum of the positive individually report DDD+DDE+DDT.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS/GC-MSMS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013.
Org-022/025	Soil samples are extracted with Dichloromethane/Acetone and waters with Dichloromethane and analysed by GC-MS and/or GC-MS/MS. Benzo(a)pyrene TEQ as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater - 2013. For soil results:- 1. 'EQ PQL'values are assuming all contributing PAHs reported as <PQL are actually at the PQL. This is the most conservative approach and can give false positive TEQs given that PAHs that contribute to the TEQ calculation may not be present. 2. 'EQ zero'values are assuming all contributing PAHs reported as <PQL are zero. This is the least conservative approach and is more susceptible to false negative TEQs when PAHs that contribute to the TEQ calculation are present but below PQL. 3. 'EQ half PQL'values are assuming all contributing PAHs reported as <PQL are half the stipulated PQL. Hence a mid-point between the most and least conservative approaches above. Note, the Total +ve PAHs PQL is reflective of the lowest individual PQL and is therefore "Total +ve PAHs" is simply a sum of the positive individual PAHs.
Org-023	Water samples are analysed directly by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater.
Org-023	Soil samples are extracted with methanol and spiked into water prior to analysing by purge and trap GC-MS. Water samples are analysed directly by purge and trap GC-MS. F1 = (C6-C10)-BTEX as per NEPM B1 Guideline on Investigation Levels for Soil and Groundwater. Note, the Total +ve Xylene PQL is reflective of the lowest individual PQL and is therefore "Total +ve Xylenes" is simply a sum of the positive individual Xylenes.

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	[NT]
TRH C_6 - C_9	mg/kg	25	Org-023	<25	1	<25	<25	0	119	[NT]
TRH C_6 - C_{10}	mg/kg	25	Org-023	<25	1	<25	<25	0	119	[NT]
Benzene	mg/kg	0.2	Org-023	<0.2	1	<0.2	<0.2	0	120	[NT]
Toluene	mg/kg	0.5	Org-023	<0.5	1	<0.5	<0.5	0	120	[NT]
Ethylbenzene	mg/kg	1	Org-023	<1	1	<1	<1	0	115	[NT]
m+p-xylene	mg/kg	2	Org-023	<2	1	<2	<2	0	120	[NT]
o-Xylene	mg/kg	1	Org-023	<1	1	<1	<1	0	127	[NT]
Naphthalene	mg/kg	1	Org-023	<1	1	<1	<1	0	[NT]	[NT]
Surrogate aaa-Trifluorotoluene	%		Org-023	117	1	102	102	0	103	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	[NT]
TRH C_{10} - C_{14}	mg/kg	50	Org-020	<50	1	<50	<50	0	120	[NT]
TRH C_{15} - C_{28}	mg/kg	100	Org-020	<100	1	<100	<100	0	107	[NT]
TRH C_{29} - C_{36}	mg/kg	100	Org-020	<100	1	<100	<100	0	100	[NT]
TRH >C_{10} -C_{16}	mg/kg	50	Org-020	<50	1	<50	<50	0	120	[NT]
TRH >C_{16} -C_{34}	mg/kg	100	Org-020	<100	1	<100	<100	0	107	[NT]
TRH >C_{34} -C_{40}	mg/kg	100	Org-020	<100	1	<100	<100	0	100	[NT]
Surrogate o-Terphenyl	%		Org-020	120	1	121	118	3	112	[NT]

QUALITY CONTROL: PAHs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	[NT]
Naphthalene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	[NT]
Acenaphthylene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Acenaphthene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	89	[NT]
Fluorene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	[NT]
Phenanthrene	mg/kg	0.1	Org-022/025	<0.1	1	0.1	0.2	67	86	[NT]
Anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Fluoranthene	mg/kg	0.1	Org-022/025	<0.1	1	0.3	0.7	80	94	[NT]
Pyrene	mg/kg	0.1	Org-022/025	<0.1	1	0.3	0.6	67	99	[NT]
Benzo(a)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	0.2	0.5	86	[NT]	[NT]
Chrysene	mg/kg	0.1	Org-022/025	<0.1	1	0.1	0.2	67	81	[NT]
Benzo(b,j+k)fluoranthene	mg/kg	0.2	Org-022/025	<0.2	1	0.4	0.7	55	[NT]	[NT]
Benzo(a)pyrene	mg/kg	0.05	Org-022/025	<0.05	1	0.2	0.3	40	94	[NT]
Indeno(1,2,3-c,d)pyrene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	0.1	0	[NT]	[NT]
Dibenzo(a,h)anthracene	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Benzo(g,h,i)perylene	mg/kg	0.1	Org-022/025	<0.1	1	0.2	0.2	0	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	129	1	133	134	1	115	[NT]

QUALITY CONTROL: Organochlorine Pesticides in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	[NT]
alpha-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	[NT]
HCB	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
beta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	[NT]
gamma-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Heptachlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	87	[NT]
delta-BHC	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	[NT]
Heptachlor Epoxide	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	94	[NT]
gamma-Chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
alpha-chlordane	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan I	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDE	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	105	[NT]
Dieldrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	106	[NT]
Endrin	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	[NT]
Endosulfan II	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDD	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	92	[NT]
Endrin Aldehyde	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
pp-DDT	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Endosulfan Sulphate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	70	[NT]
Methoxychlor	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	122	1	119	118	1	117	[NT]

QUALITY CONTROL: Organophosphorus Pesticides in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	[NT]
Dichlorvos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	111	[NT]
Dimethoate	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Diazinon	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Chlorpyriphos-methyl	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ronnel	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	91	[NT]
Fenitrothion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	93	[NT]
Malathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	95	[NT]
Chlorpyriphos	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	96	[NT]
Parathion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	89	[NT]
Bromophos-ethyl	mg/kg	0.1	Org-022	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Ethion	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	90	[NT]
Azinphos-methyl (Guthion)	mg/kg	0.1	Org-022/025	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-022/025	122	1	119	118	1	117	[NT]

QUALITY CONTROL: PCBs in Soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date extracted	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			27/04/2023	1	27/04/2023	27/04/2023		27/04/2023	[NT]
Aroclor 1016	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1221	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1232	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1242	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1248	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Aroclor 1254	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	115	[NT]
Aroclor 1260	mg/kg	0.1	Org-021	<0.1	1	<0.1	<0.1	0	[NT]	[NT]
Surrogate TCMX	%		Org-021	122	1	119	118	1	117	[NT]

QUALITY CONTROL: Acid Extractable metals in soil						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date prepared	-			26/04/2023	1	26/04/2023	26/04/2023		26/04/2023	[NT]
Date analysed	-			28/04/2023	1	28/04/2023	28/04/2023		28/04/2023	[NT]
Arsenic	mg/kg	4	Metals-020	<4	1	<4	<4	0	97	[NT]
Cadmium	mg/kg	0.4	Metals-020	<0.4	1	0.6	<0.4	40	94	[NT]
Chromium	mg/kg	1	Metals-020	<1	1	8	9	12	98	[NT]
Copper	mg/kg	1	Metals-020	<1	1	63	66	5	102	[NT]
Lead	mg/kg	1	Metals-020	<1	1	140	170	19	100	[NT]
Mercury	mg/kg	0.1	Metals-021	<0.1	1	0.3	0.3	0	83	[NT]
Nickel	mg/kg	1	Metals-020	<1	1	6	5	18	96	[NT]
Zinc	mg/kg	1	Metals-020	<1	1	580	450	25	97	[NT]

QUALITY CONTROL: sPOCAS field test						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-7	[NT]
Date prepared	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Date analysed	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
pH_F (field pH test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]
pH_{FOX} (field peroxide test)	pH Units		Inorg-063	[NT]	[NT]	[NT]	[NT]	[NT]	101	[NT]

QUALITY CONTROL: vTRH(C6-C10)/BTEXN in Water					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W4	[NT]
Date extracted	-			24/04/2023	[NT]	[NT]	[NT]	[NT]	24/04/2023	[NT]
Date analysed	-			26/04/2023	[NT]	[NT]	[NT]	[NT]	26/04/2023	[NT]
TRH C_6 - C_9	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	107	[NT]
TRH C_6 - C_{10}	µg/L	10	Org-023	<10	[NT]	[NT]	[NT]	[NT]	107	[NT]
Benzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Toluene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
Ethylbenzene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	107	[NT]
m+p-xylene	µg/L	2	Org-023	<2	[NT]	[NT]	[NT]	[NT]	107	[NT]
o-xylene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	105	[NT]
Naphthalene	µg/L	1	Org-023	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate Dibromofluoromethane	%		Org-023	104	[NT]	[NT]	[NT]	[NT]	101	[NT]
Surrogate toluene-d8	%		Org-023	97	[NT]	[NT]	[NT]	[NT]	99	[NT]
Surrogate 4-BFB	%		Org-023	100	[NT]	[NT]	[NT]	[NT]	99	[NT]

QUALITY CONTROL: svTRH (C10-C40) in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			28/04/2023	[NT]	[NT]	[NT]	[NT]	28/04/2023	[NT]
Date analysed	-			28/04/2023	[NT]	[NT]	[NT]	[NT]	28/04/2023	[NT]
TRH C_{10} - C_{14}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH C_{15} - C_{28}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH C_{29} - C_{36}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	86	[NT]
TRH >C_{10} - C_{16}	µg/L	50	Org-020	<50	[NT]	[NT]	[NT]	[NT]	95	[NT]
TRH >C_{16} - C_{34}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	108	[NT]
TRH >C_{34} - C_{40}	µg/L	100	Org-020	<100	[NT]	[NT]	[NT]	[NT]	86	[NT]
Surrogate o-Terphenyl	%		Org-020	84	[NT]	[NT]	[NT]	[NT]	72	[NT]

QUALITY CONTROL: PAHs in Water						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date extracted	-			28/04/2023	[NT]	[NT]	[NT]	[NT]	28/04/2023	[NT]
Date analysed	-			01/05/2023	[NT]	[NT]	[NT]	[NT]	01/05/2023	[NT]
Naphthalene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	78	[NT]
Acenaphthylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Acenaphthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	83	[NT]
Fluorene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Phenanthrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	90	[NT]
Anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Fluoranthene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	82	[NT]
Benzo(a)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Chrysene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	71	[NT]
Benzo(b,j+k)fluoranthene	µg/L	2	Org-022/025	<2	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(a)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	103	[NT]
Indeno(1,2,3-c,d)pyrene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Dibenzo(a,h)anthracene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Benzo(g,h,i)perylene	µg/L	1	Org-022/025	<1	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Surrogate p-Terphenyl-d14	%		Org-022/025	107	[NT]	[NT]	[NT]	[NT]	106	[NT]

QUALITY CONTROL: Metals in Waters - Acid extractable						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-W1	[NT]
Date prepared	-			28/04/2023	[NT]	[NT]	[NT]	[NT]	28/04/2023	[NT]
Date analysed	-			28/04/2023	[NT]	[NT]	[NT]	[NT]	28/04/2023	[NT]
Arsenic - Total	mg/L	0.05	Metals-020	<0.05	[NT]	[NT]	[NT]	[NT]	102	[NT]
Cadmium - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	97	[NT]
Chromium - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	101	[NT]
Copper - Total	mg/L	0.01	Metals-020	<0.01	[NT]	[NT]	[NT]	[NT]	102	[NT]
Lead - Total	mg/L	0.03	Metals-020	<0.03	[NT]	[NT]	[NT]	[NT]	103	[NT]
Mercury - Total	mg/L	0.0005	Metals-021	<0.0005	[NT]	[NT]	[NT]	[NT]	97	[NT]
Nickel - Total	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	98	[NT]
Zinc - Total	mg/L	0.02	Metals-020	<0.02	[NT]	[NT]	[NT]	[NT]	102	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

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

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

SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	Katrina Taylor

Sample Login Details

Your reference	E35999BT
Envirolab Reference	321520
Date Sample Received	21/04/2023
Date Instructions Received	21/04/2023
Date Results Expected to be Reported	01/05/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	13 Soil, 1 Water
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

Envirolab Services Pty Ltd
ABN 37 112 535 645
12 Ashley St Chatswood NSW 2067
ph 02 9910 6200 fax 02 9910 6201
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Sample ID	vTRH(C6-C10)/BTEXN in Soil	svTRH (C10-C40) in Soil	PAHs in Soil	Organochlorine Pesticides in soil	Organophosphorus Pesticides in Soil	PCBs in Soil	Acid Extractable metalsin soil	Asbestos ID - soils NEPM - ASB-001	sPOCAS field test	vTRH(C6-C10)/BTEXN in Water	svTRH (C10-C40) in Water	PAHsin Water	HM in water - total	On Hold
BH1-0-0.1	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH1-0.6-0.									✓					
BH1-1.3-1.5														✓
BH1-2-2.2	✓	✓	✓				✓		✓					
BH1-2.5-2.7														✓
BH2-0.1-0.2	✓	✓	✓	✓	✓	✓	✓	✓	✓					
BH2-0.6-0.8														✓
BH2-1.3-1.5	✓	✓	✓				✓		✓					
BH2-2-2.2														✓
BH2-2.5-2.7									✓					
TB1	✓	✓	✓				✓							
TS1	✓													
FR HA1										✓	✓	✓	✓	
S Dup1	✓	✓	✓	✓	✓	✓	✓							

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

Additional Info

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

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

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

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

SAMPLE AND CHAIN OF CUSTODY FORM

TO:		FROM:
ENVIROLAB SERVICES PTY LTD 12 ASHLEY STREET CHATSWOOD NSW 2067 P: (02) 99106200 F: (02) 99106201 Attention: Aileen	JKE Job Number: E35999BT Date Results Required: STANDARD Page: 1 of 1	JKEnvironments REAR OF 115 WICKS ROAD MACQUARIE PARK, NSW 2113 P: 02-9888 5000 F: 02-9888 5001 Attention: Ktaylor@jkenvironments.com.au

Location: Manly

Sampler: OB

Sample Preserved in Esky on Ice

Tests Required

Date Sampled	Lab Ref:	Sample Number	Depth (m)	Sample Container	PID	Sample Description	#6 - HM/TRH/BTEX	#3 - TRH/BTEXN/PA Asbestos (WA 500mL method)	Asbestos (Detection)	ASS Field Test (pH F and pH Chromium Reducible Suite	BTEX
20/04/2023	1	BH1	0-0.1	G, A, P	0.2	F: Silty Sand	X	X		X	
20/04/2023	2	BH1	0.6-0.8	G, A, P	0.4	Silty Sand				X	
20/04/2023	3	BH1	1.3-1.5	P		Silty Sand					
20/04/2023	4	BH1	2-2.2	G, P	0.2	Silty Sand		X		X	
20/04/2023	5	BH1	2.5-2.7	P		Silty Sand					
20/04/2023	6	BH2	0.1-0.2	G, A, P	0.2	F: Silty Clayey Sand	X		X	X	
20/04/2023	7	BH2	0.6-0.8	P		F: Silty Clayey Sand					
20/04/2023	8	BH2	1.3-1.5	G, A, P	0.2	Silty Sand		X		X	
20/04/2023	9	BH2	2-2.2	P		Silty Sand					
20/04/2023	10	BH2	2.5-2.7	P		Silty Sand				X	
20/04/2023	11	TB1		G				X			
20/04/2023	12	TS1		V							X
20/04/2023	13	FR HA 1		G1, V, H				X			
20/04/2023	14	S DUP 1		G			X				

ENVIROLAB

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

Job No: 321520

Date Received: 21/4/23

Time Received: 1430

Received By: OZ

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: OB	Date: 21/04/23 10:15am	Time:	Received By:	Date:

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 321520-A

Client Details

Client	JK Environments
Attention	Katrina Taylor
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**E35999BT**
Number of Samples	additional analysis
Date samples received	21/04/2023
Date completed instructions received	02/05/2023

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	09/05/2023
Date of Issue	09/05/2023

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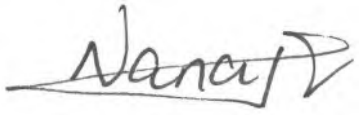
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Nick Sarlamis, Assistant Operation Manager

Authorised By



Nancy Zhang, Laboratory Manager

Chromium Suite					
Our Reference		321520-A-2	321520-A-4	321520-A-6	321520-A-10
Your Reference	UNITS	BH1	BH1	BH2	BH2
Depth		0.6-0.8	2-2.2	0.1-0.2	2.5-2.7
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Soil	Soil	Soil	Soil
Date prepared	-	08/05/2023	08/05/2023	08/05/2023	08/05/2023
Date analysed	-	08/05/2023	08/05/2023	08/05/2023	08/05/2023
pH $_{kcl}$	pH units	8.9	7.9	8.3	7.4
s-TAA pH 6.5	%w/w S	<0.01	<0.01	<0.01	<0.01
TAA pH 6.5	moles H^+ /t	<5	<5	<5	<5
Chromium Reducible Sulfur	%w/w	<0.005	<0.005	0.01	<0.005
a-Chromium Reducible Sulfur	moles H^+ /t	<3	<3	8	<3
S_{HCl}	%w/w S	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	<0.05	0.05	<0.05	<0.05
s-ANC_{BT}	%w/w S	<0.05	<0.05	<0.05	<0.05
s-Net Acidity	%w/w S	<0.005	<0.005	0.012	<0.005
a-Net Acidity	moles H^+ /t	<5	<5	7.5	<5
Liming rate	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75
a-Net Acidity without ANCE	moles H^+ /t	<5	<5	7.5	<5
Liming rate without ANCE	kg $CaCO_3$ /t	<0.75	<0.75	<0.75	<0.75
s-Net Acidity without ANCE	%w/w S	<0.005	<0.005	0.012	<0.005

Method ID	Methodology Summary
Inorg-068	Chromium Reducible Sulfur - Hydrogen Sulfide is quantified by iodometric titration after distillation to determine potential acidity. Net acidity including ANC has a safety factor of 1.5 applied. Neutralising value (NV) of 100% is assumed for liming rate. Based on National acid sulfate soils identification and laboratory methods manual June 2018. The recommendation that the SHCL concentration be multiplied by a factor of 2 to ensure retained acidity is not underestimated, has not been applied in the SHCL results reported.

QUALITY CONTROL: Chromium Suite						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			08/05/2023	[NT]	[NT]	[NT]	[NT]	08/05/2023	[NT]
Date analysed	-			08/05/2023	[NT]	[NT]	[NT]	[NT]	08/05/2023	[NT]
pH $_{kcl}$	pH units		Inorg-068	[NT]	[NT]	[NT]	[NT]	[NT]	99	[NT]
s-TAA pH 6.5	%w/w S	0.01	Inorg-068	<0.01	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
TAA pH 6.5	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	106	[NT]
Chromium Reducible Sulfur	%w/w	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	108	[NT]
a-Chromium Reducible Sulfur	moles H^+ /t	3	Inorg-068	<3	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{HCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{KCl}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
S_{NAS}	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
ANC_{BT}	% $CaCO_3$	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	125	[NT]
s-ANC_{BT}	%w/w S	0.05	Inorg-068	<0.05	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
a-Net Acidity without ANCE	moles H^+ /t	5	Inorg-068	<5	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
Liming rate without ANCE	kg $CaCO_3$ /t	0.75	Inorg-068	<0.75	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]
s-Net Acidity without ANCE	%w/w S	0.005	Inorg-068	<0.005	[NT]	[NT]	[NT]	[NT]	[NT]	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Envirolab Services Pty Ltd
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	JK Environments
Attention	Katrina Taylor

Sample Login Details

Your reference	E35999BT
Envirolab Reference	321520-A
Date Sample Received	21/04/2023
Date Instructions Received	02/05/2023
Date Results Expected to be Reported	09/05/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	additional analysis
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	8
Cooling Method	Ice Pack
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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

Sample ID	Chromium Suite	On Hold
BH1-0-0.1		✓
BH1-0.6-0.8	✓	
BH1-1.3-1.5		✓
BH1-2-2.2	✓	
BH1-2.5-2.7		✓
BH2-0.1-0.2	✓	
BH2-0.6-0.8		✓
BH2-1.3-1.5		✓
BH2-2-2.2		✓
BH2-2.5-2.7	✓	
TB1		✓
TS1		✓
FR HA1		✓
S Dup1		✓

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

Additional Info

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

Ming To

From: Katrina Taylor <KTaylor@jkenvironments.com.au>
Sent: Tuesday, 2 May 2023 9:48 AM
To: Samplereceipt
Subject: FW: Results for Registration 321520 E35999BT
Attachments: 321520-[R00].pdf; 321520-COC.pdf; JK Environment Soil for Envirolab 321520.xlsx; 321520.Excel.xlsx

Ref: 321520-A
TAT: Standard.
Due: 09/05/2023
MT.

Morning,

Please schedule the following on standard TA:

SCr
BH1 (0.6-0.8) 2
BH1 (2-2.2) 4
BH2 (0.1-0.2) 6
BH2 (2.5-2.7) 10

Thank you.

Regards
Katrina Taylor
Associate | Environmental Scientist
NSW Licensed Asbestos Assessor

T: +612 9888 5000
D: 0418 481 628
E: KTaylor@jkenvironments.com.au
www.jkenvironments.com.au

PO Box 976
NORTH RYDE BC NSW 1670
115 Wicks Road
MACQUARIE PARK NSW 2113

JKEnvironments

From: Nancy Zhang <NZhang@envirolab.com.au>
Sent: Monday, 1 May 2023 5:52 PM
To: Katrina Taylor <KTaylor@jkenvironments.com.au>
Subject: Results for Registration 321520 E35999BT

Please refer to attached for:
a copy of the Certificate of Analysis
a copy of the COC/paperwork received from you
an Excel or .csv file containing the results

Please note that a hard copy will not be posted.

Enquiries should be made directly to:
customerservice@envirolab.com.au

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 321454

Client Details

Client	JK Environments
Attention	Katrina Taylor
Address	PO Box 976, North Ryde BC, NSW, 1670

Sample Details

Your Reference	**Manly**
Number of Samples	9 Air
Date samples received	21/04/2023
Date completed instructions received	21/04/2023

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	01/05/2023
Date of Issue	01/05/2023

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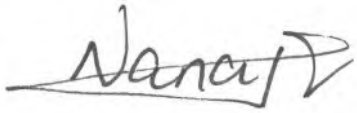
Accredited for compliance with ISO/IEC 17025 - Testing. **Tests not covered by NATA are denoted with ***

Results Approved By
Amanda Chui, Air Toxics Team Leader
Kyle Gavrily, Senior Chemist

Authorised By



Nancy Zhang, Laboratory Manager

TO15 in Canisters/Bags					
Our Reference		321454-1	321454-3	321454-5	321454-7
Your Reference	UNITS	SV1	SV2	SV3	SVDUP1
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Air	Air	Air	Air
Air Kit Security No.		3524	1694	2293	1866
Vacuum before Shipment	Hg"	-30	-30	-30	-30
Vacuum before Analysis	Hg"	-5	-5	-5	-5
Date prepared	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Date analysed	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Propylene	ppbv	38	<3	<1	<3
Dichlorodifluoromethane	ppbv	<0.5	<3	<1	<3
Chloromethane	ppbv	<0.5	<3	<1	<3
1,2-Dichlorotetrafluoroethane	ppbv	<0.5	<3	<1	<3
Vinyl chloride	ppbv	<0.5	<3	<1	<3
1,3-Butadiene	ppbv	<0.5	<3	<1	<3
Bromomethane	ppbv	<0.5	<3	<1	<3
Chloroethane	ppbv	<0.5	<3	<1	<3
Ethanol	ppbv	70	90	77	100
Acrolein	ppbv	<5	<30	<10	<30
Trichlorofluoromethane (Freon 11)	ppbv	<0.5	<3	<1	<3
Acetone	ppbv	50	100	470	110
Isopropyl Alcohol	ppbv	<5	<30	10	<30
1,1-Dichloroethene	ppbv	<0.5	<3	<1	<3
1,1,2-Trichlorotrifluoroethane	ppbv	<0.5	<3	<1	<3
Methylene chloride (Dichloromethane)	ppbv	<5	<30	<10	<30
Carbon Disulfide	ppbv	<5	<30	<10	<30
trans-1,2-dichloroethene	ppbv	<0.5	<3	<1	<3
MTBE	ppbv	<0.5	<3	<1	<3
1,1- Dichloroethane	ppbv	<0.5	<3	<1	<3
Vinyl Acetate	ppbv	<0.5	<3	<1	<3
MEK	ppbv	<5	<30	<10	<30
Hexane	ppbv	31	<3	6.0	<3
cis-1,2-Dichloroethene	ppbv	<0.5	15	4	16
Ethyl Acetate	ppbv	0.7	<3	<1	<3
Chloroform	ppbv	<0.5	75	5.2	77
Tetrahydrofuran	ppbv	<0.5	<3	<1	<3
1,1,1-Trichloroethane	ppbv	<0.5	<3	<1	<3
1,2-Dichloroethane	ppbv	<0.5	<3	<1	<3
Benzene	ppbv	2	<3	4	<3
Carbon tetrachloride	ppbv	<0.5	<3	<1	<3

TO15 in Canisters/Bags					
Our Reference		321454-1	321454-3	321454-5	321454-7
Your Reference	UNITS	SV1	SV2	SV3	SVDUP1
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Air	Air	Air	Air
Air Kit Security No.		3524	1694	2293	1866
Cyclohexane	ppbv	<0.5	<3	6.5	<3
Heptane	ppbv	14	<3	4	<3
Trichloroethene	ppbv	<0.5	27	33	28
1,2-Dichloropropane	ppbv	<0.5	<3	<1	<3
1,4-Dioxane	ppbv	<0.5	<3	<1	<3
Bromodichloromethane	ppbv	<0.5	5.7	<1	5.9
Methyl Methacrylate	ppbv	<0.5	<3	<1	<3
MIBK	ppbv	<5	<30	<10	<30
cis-1,3-Dichloropropene	ppbv	<0.5	<3	<1	<3
trans-1,3-Dichloropropene	ppbv	<0.5	<3	<1	<3
Toluene	ppbv	4	<3	10	<3
1,1,2-Trichloroethane	ppbv	<0.5	<3	<1	<3
Methyl Butyl Ketone	ppbv	0.5	<3	<1	<3
Dibromochloromethane	ppbv	<0.5	<3	<1	<3
Tetrachloroethene	ppbv	190	5,800	1,900	5,700
1,2-Dibromoethane	ppbv	<0.5	<3	<1	<3
Chlorobenzene	ppbv	<0.5	<3	<1	<3
Ethylbenzene	ppbv	2	<3	2	<3
m-& p-Xylene	ppbv	6	<5	7	<5
Styrene	ppbv	1	<3	<1	<3
o-Xylene	ppbv	3	<3	3	<3
Bromoform	ppbv	<0.5	<3	<1	<3
1,1,2,2-Tetrachloroethane	ppbv	<0.5	<3	<1	<3
4-ethyl toluene	ppbv	1	<3	<1	<3
1,3,5-Trimethylbenzene	ppbv	1	<3	1	<3
1,2,4-Trimethylbenzene	ppbv	3	<3	2	<3
1,3-Dichlorobenzene	ppbv	<0.5	<3	<1	<3
Benzyl chloride	ppbv	<0.5	<3	<1	<3
1,4-Dichlorobenzene	ppbv	1	<3	<1	<3
1,2-Dichlorobenzene	ppbv	<0.5	<3	<1	<3
1,2,4-Trichlorobenzene	ppbv	<0.5	<3	<1	<3
Naphthalene	ppbv	<0.5	<3	<1	<3
Hexachloro- 1,3-butadiene	ppbv	<0.5	<3	<1	<3
Surrogate-Bromochloromethane	% rec	108	103	109	101
Surrogate -1,4-Difluorobenzene	% rec	104	101	103	100
Surrogate-Chlorobenzene-D5	% rec	103	102	103	101

TO15 in Canisters µg/m3					
Our Reference		321454-1	321454-3	321454-5	321454-7
Your Reference	UNITS	SV1	SV2	SV3	SVDUP1
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Air	Air	Air	Air
Air Kit Security No.		3524	1694	2293	1866
Vacuum before Shipment	Hg"	-30	-30	-30	-30
Vacuum before Analysis	Hg"	-5	-5	-5	-5
Date prepared	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Date analysed	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Propylene	µg/m³	66	<4.5	<1.8	<4.5
Dichlorodifluoromethane	µg/m³	<2.5	<12.5	<5	<12.5
Chloromethane	µg/m³	<1	<5	<2	<5
1,2-Dichlorotetrafluoroethane	µg/m³	<2.5	<12.5	<5	<12.5
Vinyl chloride	µg/m³	<1.3	<6.5	<2.6	<6.5
1,3-Butadiene	µg/m³	<1.1	<5.5	<2.2	<5.5
Bromomethane	µg/m³	<1.9	<9.5	<3.8	<9.5
Chloroethane	µg/m³	<1.3	<6.5	<2.6	<6.5
Ethanol	µg/m³	130	170	150	200
Acrolein	µg/m³	<11	<55	<22	<55
Trichlorofluoromethane (Freon 11)	µg/m³	<2.8	<14	<5.6	<14
Acetone	µg/m³	100	240	1,100	250
Isopropyl Alcohol	µg/m³	<12	<60	30	<60
1,1-Dichloroethene	µg/m³	<2	<10	<4	<10
1,1,2-Trichlorotrifluoroethane	µg/m³	<3.8	<19	<7.6	<19
Methylene chloride (Dichloromethane)	µg/m³	<17	<85	<34	<85
Carbon Disulfide	µg/m³	<16	<80	<32	<80
trans-1,2-dichloroethene	µg/m³	<2	<10	<4	<10
MTBE	µg/m³	<1.8	<9	<3.6	<9
1,1- Dichloroethane	µg/m³	<2	<10	<4	<10
Vinyl Acetate	µg/m³	<1.8	<9	<3.6	<9
MEK	µg/m³	<15	<75	<30	<75
Hexane	µg/m³	110	<9	21	<9
cis-1,2-Dichloroethene	µg/m³	<2	61	20	61
Ethyl Acetate	µg/m³	3	<9	<3.6	<9
Chloroform	µg/m³	<2.4	370	25	380
Tetrahydrofuran	µg/m³	<1.5	<7.5	<3	<7.5
1,1,1-Trichloroethane	µg/m³	<2.7	<13.5	<5.4	<13.5
1,2-Dichloroethane	µg/m³	<2	<10	<4	<10
Benzene	µg/m³	6	<8	10	<8
Carbon tetrachloride	µg/m³	<3.1	<15.5	<6.2	<15.5

TO15 in Canisters µg/m3					
Our Reference		321454-1	321454-3	321454-5	321454-7
Your Reference	UNITS	SV1	SV2	SV3	SVDUP1
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Air	Air	Air	Air
Air Kit Security No.		3524	1694	2293	1866
Cyclohexane	µg/m³	<1.7	<8.5	22	<8.5
Heptane	µg/m³	57	<10	20	<10
Trichloroethene	µg/m³	<2.7	140	180	150
1,2-Dichloropropane	µg/m³	<2.3	<11.5	<4.6	<11.5
1,4-Dioxane	µg/m³	<1.8	<9	<3.6	<9
Bromodichloromethane	µg/m³	<3.4	38	<6.8	39
Methyl Methacrylate	µg/m³	<2	<10	<4	<10
MIBK	µg/m³	<20	<100	<40	<100
cis-1,3-Dichloropropene	µg/m³	<2.3	<11.5	<4.6	<11.5
trans-1,3-Dichloropropene	µg/m³	<2.3	<11.5	<4.6	<11.5
Toluene	µg/m³	20	<9.5	38	<9.5
1,1,2-Trichloroethane	µg/m³	<2.7	<13.5	<5.4	<13.5
Methyl Butyl Ketone	µg/m³	2	<10	<4	<10
Dibromochloromethane	µg/m³	<1.6	<8	<3.2	<8
Tetrachloroethene	µg/m³	1,300	40,000	13,000	39,000
1,2-Dibromoethane	µg/m³	<3.8	<19	<7.6	<19
Chlorobenzene	µg/m³	<2.3	<11.5	<4.6	<11.5
Ethylbenzene	µg/m³	7	<11	8	<11
m-& p-Xylene	µg/m³	30	<21.5	30	<21.5
Styrene	µg/m³	5	<10.5	<4.2	<10.5
o-Xylene	µg/m³	10	<11	10	<11
Bromoform	µg/m³	<5.2	<26	<10.4	<26
1,1,2,2-Tetrachloroethane	µg/m³	<3.4	<17	<6.8	<17
4-ethyl toluene	µg/m³	5	<12.5	<5	<12.5
1,3,5-Trimethylbenzene	µg/m³	7	<12.5	5	<12.5
1,2,4-Trimethylbenzene	µg/m³	10	<12.5	9	<12.5
1,3-Dichlorobenzene	µg/m³	<3	<15	<6	<15
Benzyl chloride	µg/m³	<2.6	<13	<5.2	<13
1,4-Dichlorobenzene	µg/m³	6	<15	<6	<15
1,2-Dichlorobenzene	µg/m³	<3	<15	<6	<15
1,2,4-Trichlorobenzene	µg/m³	<3.7	<18.5	<7.4	<18.5
Naphthalene	µg/m³	<2.6	<13	<5.2	<13
Hexachloro- 1,3-butadiene	µg/m³	<5.3	<26.5	<10.6	<26.5
Surrogate-Bromochloromethane	% rec	108	103	109	101
Surrogate -1,4-Difluorobenzene	% rec	104	101	103	100
Surrogate-Chlorobenzene-D5	% rec	103	102	103	101

TPH Air/ Air Phase Hydrocarbon					
Our Reference		321454-1	321454-3	321454-5	321454-7
Your Reference	UNITS	SV1	SV2	SV3	SVDUP1
Date Sampled		20/04/2023	20/04/2023	20/04/2023	20/04/2023
Type of sample		Air	Air	Air	Air
Air Kit Security No.		3524	1694	2293	1866
Date prepared	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
Date analysed	-	24/04/2023	24/04/2023	24/04/2023	24/04/2023
TPH C_5 - C_8 Aliphatic	µg/m^3	1,300	18,000	6,300	18,000
TPH C_9 - C_{12} Aliphatic	µg/m^3	200	<250	<100	<250
TPH C_9 - C_{10} Aromatic	µg/m^3	<100	<500	<200	<500
TPH C_6 - C_{10} - BTEX (F1)	µg/m^3	<200	16,000	2,700	17,000
TPH >C_{10} - C_{12} - Naphthalene (F2)	µg/m^3	160	<200	<80	<200

VOC in Carbon tubes		
Our Reference		321454-9
Your Reference	UNITS	Shroud
Date Sampled		20/04/2023
Type of sample		Air
Air Kit Security No.		171504646
Date extracted	-	26/04/2023
Date analysed	-	26/04/2023
Isopropyl Alcohol*	µg/tube	58
Surrogate Toluene-d8	%	81
Surrogate 4-Bromofluorobenzene	%	82

VOC in Carbon tubes		
Our Reference		321454-9
Your Reference	UNITS	Shroud
Date Sampled		20/04/2023
Type of sample		Air
Air Kit Security No.		171504646
Date prepared	-	26/04/2023
Date analysed	-	26/04/2023
Tube Sampling rate	mL/min	50
Tube Sampling Time	mins	1.0
Volume sampled	m^3	0.00005000
Isopropyl Alcohol	$\mu g/m^3$	1,200,000

Method ID	Methodology Summary
AT-005	Measurement of Air-Phase Petroleum Hydrocarbons and Ozone Precursors by GC-MS.
ORG-022	Determination of volatile organic compounds in charcoal tubes/badges/sorbents using CS2 extraction, determined by GC/GC-MS. Desorption efficiencies are not applied to results. Note where µg/m^3 results are supplied for SKC badges, the factors used are for 575-001, if 575-001 data is unavailable for an analyte then use 575-002 then 575-003 (exposure time must be supplied). Otherwise a sampling rate may be used for a similar analyte on request. Analytes such as (where applicable) Iodomethane, Chloroprene, Nitrobenzene, Naphthalene and 1, 2, 3 // 1, 2, 4 Trichlorobenzenes are considered to be semi-quant analyses using CS2 desorption from charcoal tubes. The latter three compounds are better served by XAD-2 collection and analysis. Note - air volume measurements are not covered by Envirolab's NATA accreditation.
TO15	USEPA TO15 - Analysis of VOC's in air using USEPA TO15 and in house method AT-002. Note, longer term stability of some oxygenated compounds is questionable where significant humidity is present.
USEPA 18	Measurement of Gaseous Organic Compound Emissions by Gas Chromatography using USEPA m18.

QUALITY CONTROL: TO15 in Canisters/Bags					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Vacuum before Shipment	Hg"			[NT]	1	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	1	-5	-5	0	[NT]	[NT]
Date prepared	-			24/04/2023	1	24/04/2023	24/04/2023		24/04/2023	[NT]
Date analysed	-			24/04/2023	1	24/04/2023	24/04/2023		24/04/2023	[NT]
Propylene	ppbv	0.5	TO15	<0.5	1	38	39	3	107	[NT]
Dichlorodifluoromethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Chloromethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Vinyl chloride	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,3-Butadiene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Bromomethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Chloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Ethanol	ppbv	5	TO15	<5	1	70	71	1	[NT]	[NT]
Acrolein	ppbv	5	TO15	<5	1	<5	<5	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Acetone	ppbv	5	TO15	<5	1	50	50	0	[NT]	[NT]
Isopropyl Alcohol	ppbv	5	TO15	<5	1	<5	<5	0	[NT]	[NT]
1,1-Dichloroethene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	ppbv	5	TO15	<5	1	<5	<5	0	[NT]	[NT]
Carbon Disulfide	ppbv	5	TO15	<5	1	<5	<5	0	[NT]	[NT]
trans-1,2-dichloroethene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
MTBE	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,1- Dichloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Vinyl Acetate	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
MEK	ppbv	5	TO15	<5	1	<5	5	0	[NT]	[NT]
Hexane	ppbv	0.5	TO15	<0.5	1	31	32	3	97	[NT]
cis-1,2-Dichloroethene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Ethyl Acetate	ppbv	0.5	TO15	<0.5	1	0.7	0.7	0	[NT]	[NT]
Chloroform	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Tetrahydrofuran	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,1,1-Trichloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,2-Dichloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Benzene	ppbv	0.5	TO15	<0.5	1	2	2	0	95	[NT]
Carbon tetrachloride	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Cyclohexane	ppbv	0.5	TO15	<0.5	1	<0.5	0.5	0	91	[NT]
Heptane	ppbv	0.5	TO15	<0.5	1	14	14	0	102	[NT]

QUALITY CONTROL: TO15 in Canisters/Bags						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Trichloroethene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,2-Dichloropropane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,4-Dioxane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Bromodichloromethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Methyl Methacrylate	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
MIBK	ppbv	5	TO15	<5	1	<5	<5	0	[NT]	[NT]
cis-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
trans-1,3-Dichloropropene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Toluene	ppbv	0.5	TO15	<0.5	1	4	4	0	101	[NT]
1,1,2-Trichloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Methyl Butyl Ketone	ppbv	0.5	TO15	<0.5	1	0.5	<0.5	0	[NT]	[NT]
Dibromochloromethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Tetrachloroethene	ppbv	0.5	TO15	<0.5	1	190	200	5	[NT]	[NT]
1,2-Dibromoethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Chlorobenzene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Ethylbenzene	ppbv	0.5	TO15	<0.5	1	2	2	0	103	[NT]
m-& p-Xylene	ppbv	1	TO15	<1	1	6	6	0	100	[NT]
Styrene	ppbv	0.5	TO15	<0.5	1	1	1	0	100	[NT]
o-Xylene	ppbv	0.5	TO15	<0.5	1	3	3	0	102	[NT]
Bromoform	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
4-ethyl toluene	ppbv	0.5	TO15	<0.5	1	1	1	0	103	[NT]
1,3,5-Trimethylbenzene	ppbv	0.5	TO15	<0.5	1	1	1	0	101	[NT]
1,2,4-Trimethylbenzene	ppbv	0.5	TO15	<0.5	1	3	3	0	103	[NT]
1,3-Dichlorobenzene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Benzyl chloride	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,4-Dichlorobenzene	ppbv	0.5	TO15	<0.5	1	1	0.7	35	[NT]	[NT]
1,2-Dichlorobenzene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
1,2,4-Trichlorobenzene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Naphthalene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	ppbv	0.5	TO15	<0.5	1	<0.5	<0.5	0	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	100	1	108	107	1	106	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	97	1	104	103	1	100	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	96	1	103	102	1	101	[NT]

QUALITY CONTROL: TO15 in Canisters µg/m3					Duplicate				Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Vacuum before Shipment	Hg"			[NT]	1	-30	-30	0	[NT]	[NT]
Vacuum before Analysis	Hg"			[NT]	1	-5	-5	0	[NT]	[NT]
Date prepared	-			24/04/2023	1	24/04/2023	24/04/2023		[NT]	[NT]
Date analysed	-			24/04/2023	1	24/04/2023	24/04/2023		[NT]	[NT]
Propylene	µg/m³	0.9	TO15	<0.9	1	66	67	2	[NT]	[NT]
Dichlorodifluoromethane	µg/m³	2.5	TO15	<2.5	1	<2.5	<2.5	0	[NT]	[NT]
Chloromethane	µg/m³	1.0	TO15	<1.0	1	<1	<1	0	[NT]	[NT]
1,2-Dichlorotetrafluoroethane	µg/m³	2.5	TO15	<2.5	1	<2.5	<2.5	0	[NT]	[NT]
Vinyl chloride	µg/m³	1.3	TO15	<1.3	1	<1.3	<1.3	0	[NT]	[NT]
1,3-Butadiene	µg/m³	1.1	TO15	<1.1	1	<1.1	<1.1	0	[NT]	[NT]
Bromomethane	µg/m³	1.9	TO15	<1.9	1	<1.9	<1.9	0	[NT]	[NT]
Chloroethane	µg/m³	1.3	TO15	<1.3	1	<1.3	<1.3	0	[NT]	[NT]
Ethanol	µg/m³	9	TO15	<9	1	130	130	0	[NT]	[NT]
Acrolein	µg/m³	11	TO15	<11	1	<11	<11	0	[NT]	[NT]
Trichlorofluoromethane (Freon 11)	µg/m³	2.8	TO15	<2.8	1	<2.8	<2.8	0	[NT]	[NT]
Acetone	µg/m³	11.9	TO15	<11.9	1	100	100	0	[NT]	[NT]
Isopropyl Alcohol	µg/m³	12	TO15	<12	1	<12	<12	0	[NT]	[NT]
1,1-Dichloroethene	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
1,1,2-Trichlorotrifluoroethane	µg/m³	3.8	TO15	<3.8	1	<3.8	<3.8	0	[NT]	[NT]
Methylene chloride (Dichloromethane)	µg/m³	17	USEPA 18	<17	1	<17	<17	0	[NT]	[NT]
Carbon Disulfide	µg/m³	16	TO15	<16	1	<16	<16	0	[NT]	[NT]
trans-1,2-dichloroethene	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
MTBE	µg/m³	1.8	TO15	<1.8	1	<1.8	<1.8	0	[NT]	[NT]
1,1- Dichloroethane	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
Vinyl Acetate	µg/m³	1.8	TO15	<1.8	1	<1.8	<1.8	0	[NT]	[NT]
MEK	µg/m³	15	TO15	<15	1	<15	<15	0	[NT]	[NT]
Hexane	µg/m³	1.8	TO15	<1.8	1	110	110	0	[NT]	[NT]
cis-1,2-Dichloroethene	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
Ethyl Acetate	µg/m³	1.8	TO15	<1.8	1	3	2	40	[NT]	[NT]
Chloroform	µg/m³	2.4	TO15	<2.4	1	<2.4	<2.4	0	[NT]	[NT]
Tetrahydrofuran	µg/m³	1.5	TO15	<1.5	1	<1.5	<1.5	0	[NT]	[NT]
1,1,1-Trichloroethane	µg/m³	2.7	TO15	<2.7	1	<2.7	<2.7	0	[NT]	[NT]
1,2-Dichloroethane	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
Benzene	µg/m³	1.6	TO15	<1.6	1	6	6	0	[NT]	[NT]
Carbon tetrachloride	µg/m³	3.1	TO15	<3.1	1	<3.1	<3.1	0	[NT]	[NT]
Cyclohexane	µg/m³	1.7	TO15	<1.7	1	<1.7	2	16	[NT]	[NT]
Heptane	µg/m³	2.0	TO15	<2.0	1	57	58	2	[NT]	[NT]

QUALITY CONTROL: TO15 in Canisters µg/m3						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	[NT]	[NT]
Trichloroethene	µg/m³	2.7	TO15	<2.7	1	<2.7	<2.7	0	[NT]	[NT]
1,2-Dichloropropane	µg/m³	2.3	TO15	<2.3	1	<2.3	<2.3	0	[NT]	[NT]
1,4-Dioxane	µg/m³	1.8	TO15	<1.8	1	<1.8	<1.8	0	[NT]	[NT]
Bromodichloromethane	µg/m³	3.4	TO15	<3.4	1	<3.4	<3.4	0	[NT]	[NT]
Methyl Methacrylate	µg/m³	2.0	TO15	<2.0	1	<2	<2	0	[NT]	[NT]
MIBK	µg/m³	20	TO15	<20	1	<20	<20	0	[NT]	[NT]
cis-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	1	<2.3	<2.3	0	[NT]	[NT]
trans-1,3-Dichloropropene	µg/m³	2.3	TO15	<2.3	1	<2.3	<2.3	0	[NT]	[NT]
Toluene	µg/m³	1.9	TO15	<1.9	1	20	20	0	[NT]	[NT]
1,1,2-Trichloroethane	µg/m³	2.7	TO15	<2.7	1	<2.7	<2.7	0	[NT]	[NT]
Methyl Butyl Ketone	µg/m³	2.0	TO15	<2.0	1	2	<2	0	[NT]	[NT]
Dibromochloromethane	µg/m³	1.6	TO15	<1.6	1	<1.6	<1.6	0	[NT]	[NT]
Tetrachloroethene	µg/m³	3.4	TO15	<3.4	1	1300	1300	0	[NT]	[NT]
1,2-Dibromoethane	µg/m³	3.8	TO15	<3.8	1	<3.8	<3.8	0	[NT]	[NT]
Chlorobenzene	µg/m³	2.3	TO15	<2.3	1	<2.3	<2.3	0	[NT]	[NT]
Ethylbenzene	µg/m³	2.2	TO15	<2.2	1	7	7	0	[NT]	[NT]
m-& p-Xylene	µg/m³	4.3	TO15	<4.3	1	30	30	0	[NT]	[NT]
Styrene	µg/m³	2.1	TO15	<2.1	1	5	5	0	[NT]	[NT]
o-Xylene	µg/m³	2.2	TO15	<2.2	1	10	10	0	[NT]	[NT]
Bromoform	µg/m³	5.2	TO15	<5.2	1	<5.2	<5.2	0	[NT]	[NT]
1,1,2,2-Tetrachloroethane	µg/m³	3.4	TO15	<3.4	1	<3.4	<3.4	0	[NT]	[NT]
4-ethyl toluene	µg/m³	2.5	TO15	<2.5	1	5	5	0	[NT]	[NT]
1,3,5-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	1	7	6	15	[NT]	[NT]
1,2,4-Trimethylbenzene	µg/m³	2.5	TO15	<2.5	1	10	10	0	[NT]	[NT]
1,3-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	1	<3	<3	0	[NT]	[NT]
Benzyl chloride	µg/m³	2.6	TO15	<2.6	1	<2.6	<2.6	0	[NT]	[NT]
1,4-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	1	6	4	40	[NT]	[NT]
1,2-Dichlorobenzene	µg/m³	3.0	TO15	<3.0	1	<3	<3	0	[NT]	[NT]
1,2,4-Trichlorobenzene	µg/m³	3.7	TO15	<3.7	1	<3.7	<3.7	0	[NT]	[NT]
Naphthalene	µg/m³	2.6	TO15	<2.6	1	<2.6	<2.6	0	[NT]	[NT]
Hexachloro- 1,3-butadiene	µg/m³	5.3	TO15	<5.3	1	<5.3	<5.3	0	[NT]	[NT]
Surrogate-Bromochloromethane	% rec		TO15	100	1	108	107	1	[NT]	[NT]
Surrogate -1,4-Difluorobenzene	% rec		TO15	97	1	104	103	1	[NT]	[NT]
Surrogate-Chlorobenzene-D5	% rec		TO15	96	1	103	102	1	[NT]	[NT]

QUALITY CONTROL: TPH Air/ Air Phase Hydrocarbon						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date prepared	-			24/04/2023	1	24/04/2023	24/04/2023		24/04/2023	[NT]
Date analysed	-			24/04/2023	1	24/04/2023	24/04/2023		24/04/2023	[NT]
TPH C_5 - C_8 Aliphatic	µg/m^3	200	AT-005	<200	1	1300	1300	0	98	[NT]
TPH C_9 - C_{12} Aliphatic	µg/m^3	50	AT-005	<50	1	200	200	0	[NT]	[NT]
TPH C_9 - C_{10} Aromatic	µg/m^3	100	AT-005	<100	1	<100	<100	0	100	[NT]
TPH C_6 - C_{10} - BTEX (F1)	µg/m^3	200	TO15	<200	1	<200	<200	0	98	[NT]
TPH >C_{10} - C_{12} - Naphthalene (F2)	µg/m^3	40	TO15	<40	1	160	180	12	98	[NT]

QUALITY CONTROL: VOC in Carbon tubes						Duplicate			Spike Recovery %	
Test Description	Units	PQL	Method	Blank	#	Base	Dup.	RPD	LCS-1	[NT]
Date extracted	-			26/04/2023	[NT]	[NT]	[NT]	[NT]	26/04/2023	[NT]
Date analysed	-			26/04/2023	[NT]	[NT]	[NT]	[NT]	26/04/2023	[NT]
Isopropyl Alcohol*	µg/tube	5	ORG-022	<5	[NT]	[NT]	[NT]	[NT]	102	[NT]
Surrogate Toluene-d8	%		ORG-022	94	[NT]	[NT]	[NT]	[NT]	92	[NT]
Surrogate 4-Bromofluorobenzene	%		ORG-022	99	[NT]	[NT]	[NT]	[NT]	96	[NT]

Result Definitions

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

Quality Control Definitions

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

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

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

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

Laboratory Acceptance Criteria

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

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

Spikes for Physical and Aggregate Tests are not applicable.

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

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

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

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

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

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

Where matrix spike recoveries fall below the lower limit of the acceptance criteria (e.g. for non-labile or standard Organics <60%), positive result(s) in the parent sample will subsequently have a higher than typical estimated uncertainty (MU estimates supplied on request) and in these circumstances the sample result is likely biased significantly low.

Measurement Uncertainty estimates are available for most tests upon request.

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

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

Report Comments

PQL has been raised due to interference from analytes (other than those being tested) in the sample/s.

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ph 02 9910 6200 fax 02 9910 6201
customerservice@envirolab.com.au
www.envirolab.com.au

SAMPLE RECEIPT ADVICE

Client Details

Client	JK Environments
Attention	Katrina Taylor

Sample Login Details

Your reference	Manly
Envirolab Reference	321454
Date Sample Received	21/04/2023
Date Instructions Received	21/04/2023
Date Results Expected to be Reported	01/05/2023

Sample Condition

Samples received in appropriate condition for analysis	Yes
No. of Samples Provided	9 Air
Turnaround Time Requested	Standard
Temperature on Receipt (°C)	n/a
Cooling Method	Not applicable
Sampling Date Provided	YES

Comments

Nil

Please direct any queries to:

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

Analysis Underway, details on the following page:

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Sample ID	TO15 in Canisters/Bags	TO15 in Canisters µg/m3	TPH Air/ Air Phase Hydrocarbon	VOC in Carbon tubes	VOC in Carbon tubes	On Hold
SV1	✓	✓	✓			
SV1						✓
SV2	✓	✓	✓			
SV2						✓
SV3	✓	✓	✓			
SV3						✓
SVDUP1	✓	✓	✓			
SVDUP1						✓
Shroud				✓	✓	

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

Additional Info

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

CHAIN OF CUSTODY - CANISTERS / BAGS / TD TUBES

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ENVIROLAB GROUP
National phone number 1300 424 344

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

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

Melbourne Lab - Envirolab Services
25 Research Drive, Croydon South, VIC 3136
03 9763 2500 | melbourne@envirolab.com.au

Adelaide Office - Envirolab Services
7a The Parade, Norwood, SA 5067
08 7087 6800 | adelaide@envirolab.com.au

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

Darwin Office - Envirolab Services
Unit 20/119 Reichardt Road, Winnellie, NT 0820

Client: JK Environments	Client Project Name / Number / Site etc. (i.e. report title): Preliminary Site Investigation (PSI)
Contact Person: Harley Wang	
Project Mgr: Katrina Taylor	PO No.: E35999BT Manly
Sampler: Harley Wang	Envirolab Quote No.:
Address: 115 Wicks Road, Macquarie Park	Date results required: Or choose: standard *Note: Inform lab in advance if urgent turnaround is required - surcharges apply*
Phone: 9888 5000 Mob:	Additional report format: esdat / equis /
Email: ktaylor@jkenvironments.com.au	Lab Comments:

Sample Information												Tests Required								
Envirolab Sample ID	Client Sample ID (Field Location)	Canister / TD Tube #	Soil Gas Train / Mass Flow Controller #	Leak Test Passed (Y/N)	PID Reading (ppmv)	Date of Collection	Collection Time		Canister Vacuum (Hg")		Flow Rate (Bags/TD Tubes only)	TO-15 (Cans)	TRH (F1 & F2)	IPA					Purge volume	Carbon tube ID
							Time On	Time Off	Initial	Final										
1,2	SV1	3524	1745	Yes	0.6	20/04/2023	10:18am	10:34am	-30Hg"	-6Hg"	100mL/min	X	X						300mL	171504648
3,4	SV2	1694	1742	Yes	5.5	20/04/2023	11:01am	11:19am	-30Hg"	-6Hg"	100mL/min	X	X						300mL	171504654
5,6	SV3	2293	1976	Yes	2.9	20/04/2023	11:51am	12:05pm	-29Hg"	-6Hg"	100mL/min	X	X						300mL	171504651
7,8	SVDUP1	1866	1750	Yes	NA	20/04/2023	11:01am	11:19am	-30Hg"	-6Hg"	100mL/min	X	X						100mL	Not taken
9	Shroud	-	-	-	NA	20/04/2023	10:39am	10:40am	-	-	-			X					50mL	171504646

* General Gases - Please tick one:

- ☐ 1) Methane, Oxygen, Carbon dioxide, Carbon monoxide, Nitrogen
- ☐ 2) Methane, Oxygen, Carbon dioxide, Carbon monoxide, Helium, Hydrogen
- ☐ 3) Specify analytes (NB: If both Nitrogen and Helium/Hydrogen are require, please contact the laboratory

Notes:

SV1 installed at 8:59am to 200mm. Approx 30mm void beneath tile

SV2 installed at 9:08am to 200mm. SV3 installed at 10:00am to 200mm

Relinquished by (Company):	Received by (Company): 321454	Lab Use Only:
Print Name: Harley Wang	Print Name: DTOKED	Job Number: 321454
Date & Time: 21/04/23 at 10;23am	Date & Time: 21/04/23 14:00	Security seal: Intact / Broken / None
Signature:	Signature:	TAT Req - SAME day / 1 / 2 / 3 / 4 / STD