GEO-ENVIRONMENTAL
SOLUTIONS

Proposed Building 3 – Student Services and Library Building,
design by John Wardle Architects

ENVIRONMENTAL SITE ASSESSMENT – V2

Footprint of Building 3 - UTAS Development

2 Invermay Road, Invermay

June 2019

Report for John Wardle Architects

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DOCUMENT CONTROL

Title	Version	Date	Author	Reviewed By
DRAFT Environmental Site Assessment. *Building 3 UTAS Development; 2 Invermay Road, Invermay.*	DRAFT Version 1	18 June 2019	Sarah Joyce	JP Cumming
Environmental Site Assessment V2. *Building 3 UTAS Development; 2 Invermay Road, Invermay.*	Version 2	21 June 2019	Sarah Joyce	JP Cumming

EXECUTIVE SUMMARY

This report presents the findings from Environmental Site Assessment (ESA) undertaken by Geo-Environmental Solutions Pty. Ltd. (GES) at 2 Invermay Road, Invermay in the footprint of Building 3 – the proposed student services building of the University of Tasmania (UTAS) - hereby referred to as 'The Site'. GES was engaged by *John Wardle Architects* on behalf of their client *University Of Tasmania* to conduct this investigation. The report will assist with providing information to the Launceston City Council for the current Development Application. The Client has designed a 3-story student services building.

This report has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in NEPM (2013) guidelines and key regulations and policies.

The objective of the ESA was to meet the Tasmanian Interim Planning Schemes criteria for a *Change of Use* and *Excavation Works* (It is anticipated that limited excavations will extent to 0.5m below ground surface to account for the removal of the existing carpark plus the service trenches, lift and stair footprints) and to assess the actual contamination levels at the site and determine:

- Whether the site is suitable for the proposed use/development;
- Whether any site contamination presents an occupational health and safety risk to workers involved in redevelopment of the site or future site users;
- Whether any site contamination is likely to present an environmental risk from excavation conducted during development at the site; and
- Whether any specific remediation and/or protection measures are required to be implemented before use or excavation commences.

The following conclusions have been made from the soil investigation in the footprint of building 3:

- Hydrocarbon contamination was confirmed in most boreholes at shallow depths (0.5-0.6 m bgs), and the hydrocarbon fractions identified (C^{16}-C^{34}) are indicative of diesel, oils, or older degraded fuels.
- There was an absence of volatile hydrocarbons which rules out an indoor vapour risk, a risk to trench workers and/ or a dermal contact risk to construction workers.
- Slightly elevated levels of metals were detected with ecological investigation levels exceedances for copper zinc and arsenic in a small number of samples.
- There were no health investigation level exceedances for land use D Commercial and Industrial.
- There is one health investigation level exceedancs for land use C recreational use, this was for Arsenic at 0.5-0.6m bgs in BH03.
- Groundwater was not encountered during drilling to a depth of 2m even though the boreholes were at an elevation of approximately 2.2-2.4m above sea level.
- For proposed excavation works the results were compared against *Information Bulletin 105* guidelines. The material tested is classified as a mix of Level 1 (clean fill) and Level 2 Material (low level contaminated soil).

GES recommends the following work should be undertaken to mitigate risk during and post construction at the site;

- A Contamination Management Plan be completed and implemented for all stages of the development. All construction workers should be informed of the contamination at the site during their site induction.
- Clean soil should be imported to site for the proposed Indigenous Garden Bed.

This investigation only investigated the area of the proposed footprint of Building 3. If the design of the proposed development is altered, then there may be a requirement to assess the soil results against alternative guidelines or conduct further site investigations outside the current proposed footprint.

<u>Statement of Suitability</u>

Based upon the results of the current investigation soil contamination at the site does not pose a risk to Human Health or the Environment (ecosystems) and the site is suitable for its intended use; provided the above recommendations are followed. It is also concluded that no further contamination remediation or management measures are necessary during the site development works.

Table of Contents

Plates

Figures

Tables

ABREVIATIONS

ADWG	Australian Drinking Water Guidelines
AEC	Areas of Environmental Concern
AHD	Australian Height Datum
ALS	Analytical Laboratory Services
ANZECC	Australia and New Zealand Environment and Conservation Council
AWQG	Australian Water Quality Guidelines
BGS	Below Ground Surface
BH	Borehole
BTEX	Benzene Toluene Ethylbenzene Xylene
CMP	Contamination Management Plan
COA	Certificate of Analysis
COC	Chain of Custody
COPC	Contaminant of Potential Concern
CRC CARE	Corporative Research Centre for Contamination Assessment and Remediation of the Environment
CSM	Conceptual Site Model
DQO	Data Quality Objectives
DWS	Depth Water Struck
EC	Electrical Conductivity
EOH	End Of Hole
EIL	Ecological Investigation Levels
ESL	Ecological Screening Levels
EPA	Environmental Protection Authority
EPN	Environmental Protection Notice
ESA	Environmental Site Assessment
GDA94	Geocentric Datum of Australia 1994
GES	Geo-Environmental Solutions Pty. Ltd.
GME	Groundwater Monitoring Event
HIL	Health Investigation Levels
HSL	Health Screening Levels
IL	Investigation Levels
IN	Investigation Notice
IP	Interface Probe
LiDAR	Light Detection And Ranging
LOR	Limits of Reporting
MCRWBA	Minimum Construction Requirements for Water Bores in Australia
MDL	Mean Detection Limit
MW	Monitoring Well
NATA	National Association of Testing Authorities
NEPM ASC	National Environmental Protection (Assessment of Site Contamination) Measure
NHMRC	National Health and Medical Research Council

NRMMC	Natural Resource Management Ministerial Council
NL	Non Limiting
NRMMC	Natural Resource Management Ministerial Council
PAH	Polynuclear Aromatic Hydrocarbons
PCP	Physico-Chemical Parameters
PEV	Protected Environmental Values
PHC	Petroleum Hydrocarbons
PID	Photo-Ionisation Detector
PPA	Preferential (PVI) Pathways Assessment
PSH	Phase Separated Hydrocarbons
PVI	Petroleum Vapour Intrusion
Redox	Reduction / Oxidation Potential
RN	Remediation Notice
SCA	Site Contamination Assessment
SCM	Site Contamination Model
SWL	Standing Water Level
TDS	Total Dissolved Solids
TOC	Top of Casing
TPH	Total Petroleum Hydrocarbons
TRH	Total Recoverable Hydrocarbons
USCS	Unified Soil Classification System
VME	Vapour Monitoring Event
VP	Vapour Probe
WRG	Water Resource Group

1 INTRODUCTION

1.1 General

This report presents the findings from *Environmental Site Assessment* (ESA) undertaken by Geo-Environmental Solutions Pty. Ltd. (GES) at 2 Invermay Road, Invermay in the footprint of Building 3 – the proposed student services building of the University of Tasmania (UTAS) - hereby referred to as 'The Site'. GES was engaged by *John Wardle Architects* on behalf of their client *University Of Tasmania* to conduct this investigation. The report will assist with providing information to the Launceston City Council for the current Development Application (DA).

The Site location is presented in Figure 1, an image of the existing it conditions is presented in Plate 1 and the current site aerial photograph is presented in Figure 2.

The Client has designed a 3-story student services building. The ground floor level will house a student space, a small retail tenancy plus two flights of stairs, amenities and a lift. The two upper levels will be a build for purpose Library. The rooftop will be decked with solar panels. Excavations are anticipated to be limited as the proposed building design will employ driven piles for foundations.

This report has been prepared by a suitably qualified and experience practitioner in accordance with procedures and practices detailed in NEPM (2013) guidelines and key regulations and policies identified in the References section of this document. Personnel engaged in preparing this *ESA* are listed in Appendix 1 along with their relevant qualifications and years of experience.

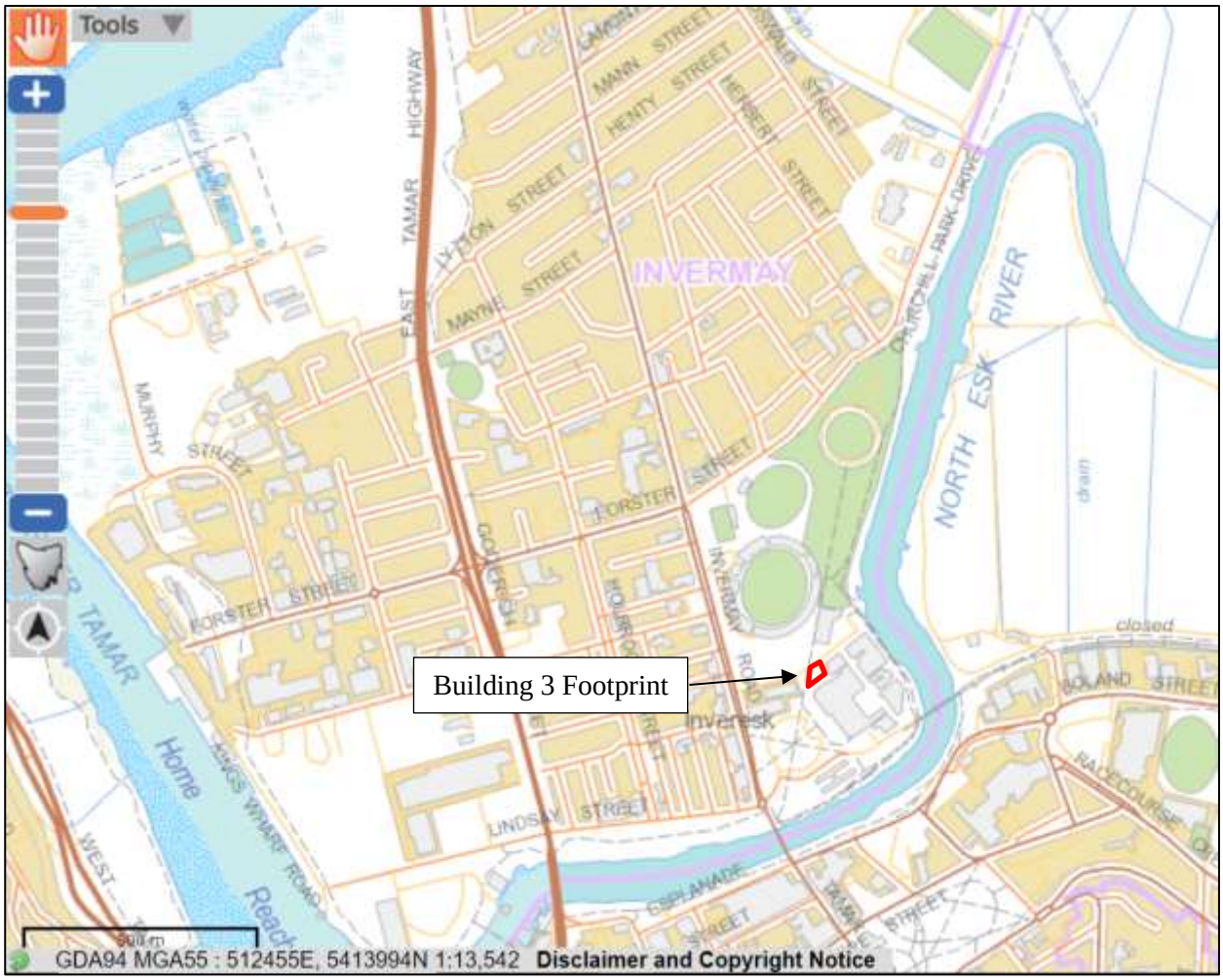


Figure 1 Site Location (image sourced from the LIST)

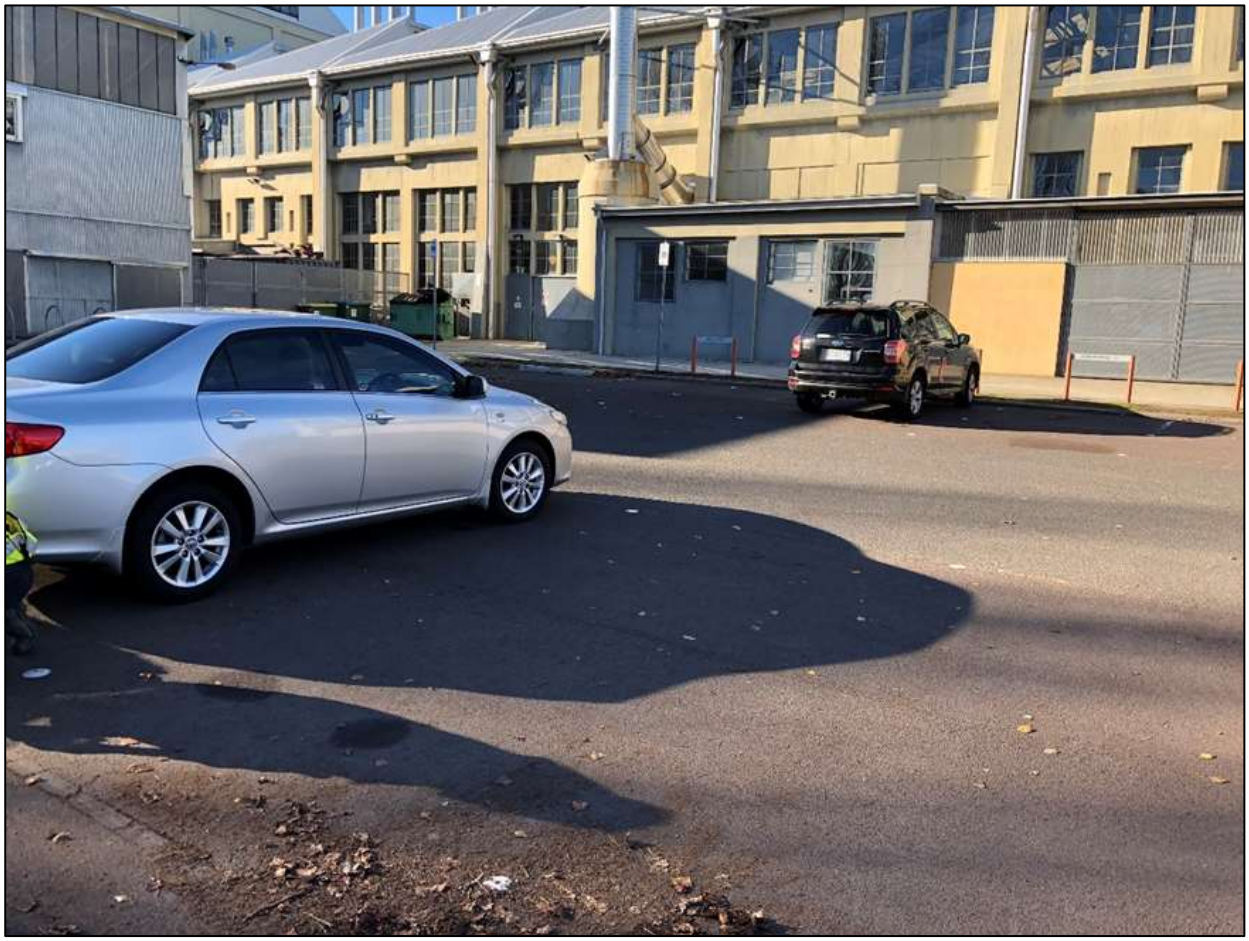


Plate 1 Image existing site conditions – asphalt carpark.

Figure 2 Current Site Conditions

1.2 Site Details

Site details are presented in Table 1.

Table 1 Site Details

Site Address 2 Invermay Road, Invermay
Current Title identification details PID 3389971 Title Reference 174633/2
Current land use Mixed use site UTAS campus buildings and public open spaces
Current Ownership (as per current certificates of title; the LIST) *Launceston City Council; PO BOX 396 Launceston, 7250 Tasmania.*
Zoning The site is *Particular Purpose use* under the Launceston Interim Planning Scheme, 2015. Precinct Map: Cultural and Public Purpose
Local Council Launceston City Council
Proposed Site Use Cultural and Public Purpose: Educational and Cultural – Student Services Building. Commercial site use.
Requirement for current Investigation Proposed property redevelopment, including a change of land use and potential excavation on a potentially contaminated site; former Railyard.

1.3 Investigation Objectives

The objective of the ESA was to meet the Tasmanian Interim Planning Schemes criteria for a *Change of Use* and *Excavation Works* and to assess the actual contamination levels at the site and determine:

- Whether the site is suitable for the proposed use/development;
- Whether any site contamination presents an occupational health and safety risk to workers involved in redevelopment of the site or future site users;
- Whether any site contamination is likely to present an environmental risk from excavation conducted during development at the site; and
- Whether any specific remediation and/or protection measures are required to be implemented before use or excavation commences.

1.4 Scope of Works

The scope of works of this ESA was to:

- Review previous documents on the site and conduct an invasive soil investigation in the footprint of the proposed Building 3 – Student Services Building;
- Drill a total of 8 bore holes, to collect 16 primary soil samples, these samples were tested for Total Recoverable Hydrocarbons (TRH), Benzene Toluene Ethylbenzene Xylene Naphthalene (BTEXN), Polynuclear Aromatic Hydrocarbons (PAHs) and a suite of 15 Metals, plus PCBs and cyanide in select samples.
- All soil samples were sent to a National Association of Testing Authorities (NATA) accredited laboratory to determine the presence/ absence of contamination and at what level;
- All samples were sent with quality assurance/quality control samples for analysis;
- All analytical results against were compared against NEPM ASC (2013) guidelines as well as other relevant guidelines for assessing hydrocarbon vapour and soil dermal contact risks; and
- Present the findings of the site investigation, conduct a risk assessment and develop a conceptual site model (CSM) plus present future contamination management recommendations.

2 PLANNING

2.1 Zoning

The site is zoned *Particular Purpose* under the Tasmanian Interim Planning Scheme of 2015 (Figure 3) and is surrounded by *General Residential, Environmental Management, Community purpose, Commercial, Inner Residential, Light Industrial, General Industrial, Open Space and Utilities*.

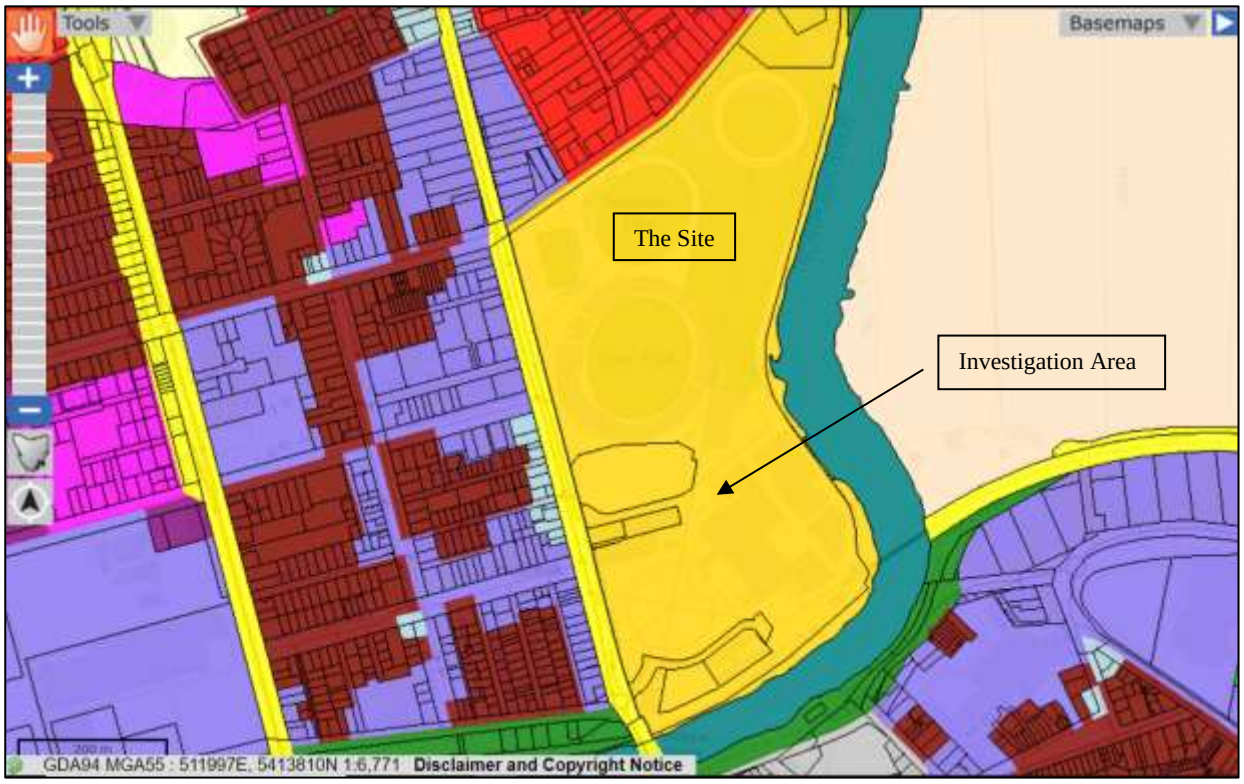


Figure 3 Council planning zones (2015) under the Tasmanian Interim Planning Scheme

2.2 Planning Scheme Requirements

The need for this assessment was triggered by the *Tasmania Interim Planning Scheme 2015* as the Site falls within the Launceston City Councils (LCC) contaminated site overlay/ register and is described as a site that may have been potentially contaminated land. Potentially contaminated land means land that is, or adjoins, land that the applicant or the planning authority may have involved a potentially contaminating activity. As the site formally hosted as railyard and has had 'petroleum product storage', is proposed to have a change of use and will involve excavation works, the site needs to be assessed in accordance with the interim planning scheme codes: *E2.5 A1- Change of Use; and E2.6.2 P1- Excavation.*

As there are no acceptable solutions to ***change of use*** and ***excavation works*** at the site, ***E2.5 P1*** and ***E2.6.2 P1*** performance criteria are to be addressed.

2.2.1 Change of Use (E2.5 P1)

As there is proposed change of use of the site and there are no acceptable solutions to change of use, E2.5 P1 performance criteria are to be addressed. The performance criteria identify that for there to be a change of use, the objective is that it must be suitable for the intended use, having regard to:

(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or

(b) an environmental site assessment that demonstrates that the level of contamination does not present a risk to human health or the environment; or

(c) a plan to manage contamination and associated risk to human health or the environment that includes:

  i. an environmental site assessment;

  ii. (any specific remediation and protection measures required to be implemented before any use commences; and

  iii. a statement that the land is suitable for the intended use.

2.2.2 Excavation Works E2.6.2 P1

As there is proposed excavation works at the site, there are no acceptable solutions to proposed works, E2.6.2 P1 performance criteria are to be addressed. The objective of the performance criteria is to identify that the excavation works must not adversely impact on health and the environment, having regard to:

(a) an environmental site assessment that demonstrates there is no evidence the land is contaminated; or

(b) a plan to manage contamination and associated risk to human health and the environment that includes:

i. an environmental site assessment;

ii. any specific remediation and protection measures required to be implemented before excavation commences; and

iii. a statement that the excavation does not adversely impact on human health or the environment.

2.3 Proposed Site Redevelopment Works

Relevant architectural designs, June 2019 are presented in Appendix 2. The Client has designed a 3-story student services building. The ground floor level will house a student space, a small retail tenancy plus two flights of stairs, amenities and a lift. The two upper levels will be a build for purpose Library. The rooftop will be decked with solar panels. The current ground level is 2.2-2.4 and the finished floor level will be 2.9. Excavations are anticipated to be limited as the proposed building design will have driven piles for foundations.

3 BACKGROUND

3.1 Geology

The geology of the site has been mapped by Mineral Resources Tasmania (Figure 4). The site is inferred to be underlain with Quaternary Sediments. The surrounding geology comprises of quaternary and Triassic sediments.

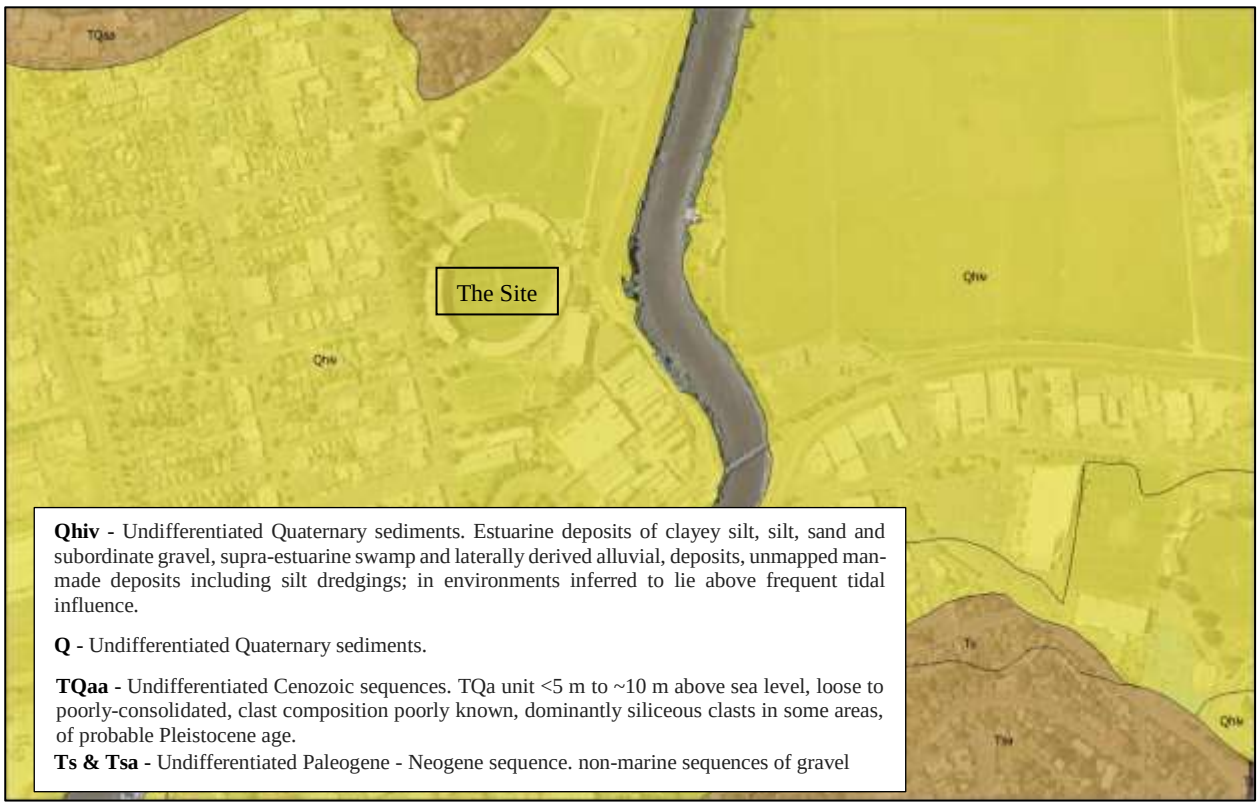


Figure 4 Mineral Resources Tasmania 1:25000 Scale Mapping (The LIST).

3.2 Environmental Protection Authority - Property Information Request

A property information request was provided by the Environmental Protection Authority (EPA) Tasmania on the 24th April 2019. The letter is included in Appendix 3 and are summarised below:

'The site historically hosted the Launceston railyards and workshops. Pioneer Concrete works and sporting grounds. It now hosts the Launceston Showgrounds, Queen Victoria Museum and the University of Tasmania (UTAS) Inveresk Campus'

The following has been directly extracted from the letter:

EPA Tasmania has numerous volumes of documents regarding the redevelopment and repurposing of the Site during the 1990s. These include, but are not limited to:

- *Environmental Audit - Inveresk Railway Workshops Redevelopment project Launceston Tasmania for Launceston City Council Volume 1: Site History*, dated February 1992, prepared by Dames and Moore
- *Queen Victoria Museum and Art Gallery - Inveresk Railyard Redevelopment – Contamination Assessment Report – Land*, dated June 1999, prepared by SEMF
- *Queen Victoria Museum and Art Gallery - Inveresk Railyard Redevelopment – Contamination Assessment Report – Buildings*, dated June 1999, prepared by SEMF
- *Launceston City Council August 1999 York Park Environmental Site assessment*, prepared by SKM
- *Department. of State Development - Inveresk Railyard Redevelopment Project - Site Management Plan*, dated August 2000, prepared by SEMF

In March 2019, EPA Tasmania approved the transport of 4200m^3 of low-level contaminated (Level 2) soil from UTAS Stadium to the Launceston Waste Centre.

No further records relating to contamination or potentially contaminating activities at the Site were found. The following records relating to neighbouring properties:

129-139 Invermay Road

- Historic WorkSafe Tasmania (WST) records indicate that dangerous goods were stored in underground storage tanks (USTs) at the property between 1949 and 1960. The record refers to WST file number N27.
- EPA Tasmania received notification in September 1999 of an incident at the Mobil Service Station having the potential to cause harm. Approval to remove the contaminated soil to the Launceston Waste Centre was given in 2000.

- Currently the property hosts a United Petroleum Service Station with four active UPSS with a total volume of 85,000L.

103 Invermay Road

- Six UPSS were registered at the Coles Express Service station in September 2010. EPA Tasmania received advice that three Underground Storage Tanks were removed and another decommissioned in situ at the property in November 2011 due to leaking.
- Remediation Notice 8655/1 (RN) was issued in July 2013 to require further works to address petroleum hydrocarbon contamination in groundwater and vapour risk concerns. The RN was revoked in November 2014.
- EPA Tasmania hold several documents regarding this property. The most recent is:

  Environmental Site Assessment - Coles Express Invermay Service Station - 103 Invermay Road Invermay, dated 31 March 2014, prepared by ERM

3-11 Dry Street

- Three UPSS were registered at the Caltas Petrol Station in June 2010.
- A decommissioning form stated that two UPSS were removed in December 2015.

32-38 Invermay Road

- Four UPSS with a total volume of 89,000L are registered at the Caltas service station.

1-19 Lindsay Street (Scottsdale Levee)

- Site Management Notice 8655/1, relating to the burial of approximately 300 m^3 of hydrocarbon contaminated Soil, is registered on the property.
- EPA Tasmania holds the following report regarding the contaminated soil:

  Summary Report - Burial of PAH Contaminated Soil Scottsdale Levee, dated October 2011, prepared by Pitt and Sherry

No other records relating to contamination or potentially contaminating activities at adjacent properties were found.

3.3 Historical Aerial Photographs

The historical aerial photographs area presented in Appendix 4. Photographs from the following dates are included; 2016, 2013, 2008, 2006, 1995, 1984, 1978 and 1956. The entire site hosted has the Inveresk Railway since prior to 1956.

In summary, with reference to the footprint of building 3 – the student services building; the rail line ran through the centre of the investigation area. Transport carriages also appeared to be stored at this location. By 1995 when the site was starting to be redeveloped, the surface of the investigation appears to have been scraped back. Staining was present along the former rail line location across this area. It is understood from SEMF 1995, that contaminated soil was removed at this time.

3.4 Historical Investigations

For a list of historical investigations that were reviewed as part of this investigation see the References section of this report. Figure 5 summarises the information obtained in these reports.

3.4.1 Entire Site

Dames & Moore (1992), general findings; The contamination assessment has shown that heavy metal contamination (principally lead. copper and zinc) is widespread the site. with the heaviest areas of contamination being in southern half. The total petroleum hydrocarbon (TPH) contaminant is not as widespread, the heaviest contamination being in the vicinity of the diesel filling station, in the central portion of the site (Precinct D & E). TPH contamination also in areas contaminated with heavy metals. Therefore, the site can be divided into three contamination status groups follows;

- Areas contaminated with heavy metals only;
- Areas contaminated with heavy metals and TPH•, and
- Areas contaminated With TPH only (the eastern portion of precinct D).

Samples were also tested for a range volatile organic compounds including monocyclic aromatic hydrocarbons (benzene, toluene, ethyl benzene, and xylene) and many chlorinated volatile hydrocarbons, but none were detected. This was confirmed the intra-lab quality control testing using different sampling and testing procedures.

Contaminated Fill: The entire site has been reclaimed and filled with of an nature. It is suspected that the neighbouring industry has used the Site as a tipping area. Aerial photographs from 1949 and later, indicate filling in the northern portion ff the site. The fill does not appear to be only soil. Anecdotal information has suggested foundry wastes, entire manufacturing machines, ash, dinker and sundry other wastes were also disposed with the fill.

Hydrocarbon Spills: observations made by Dames & Moore have identified areas of hydrocarbon contamination from the diesel shop, diesel waste tank, diesel fuel shed, and greases and Oil from general maintenance. Diesel spills and diesel pipe breakages have been reported are sources of contamination. Anecdotal information suggests that following heavy rain, diesel floats to surface on the shallow water table.

Asbestos: It noted many of the buildings on the site were roofed and /or cladded with asbestos sheeting of various widths and asbestos warning signs have been placed on numerous items of equipment within buildings. material is only a hazard when disturbed and site development will therefore need to include a provision for asbestos management.

It is possible that asbestos has been disposed to landfill at unknown locations in disused. This eventuality will also need to be addressed in future management of the site.

It is understood Tasrail has previously carried out a study of the extent of on the site should that information be required in detail.

Summary of hydrocarbon detections:

- No detections of TPH C_6 to C_{14} in SL13 and SL14 near the exhibition building carpark as well as in SL18 near the AGM Entertainment Area. TPH C_6 to C_{14} are normally used to identify vapour intrusion risks, indicating a low likelihood sourcing from the soil in these locations. Can not rule out a vapour intrusion risk due possibly vapour migration from the water table.

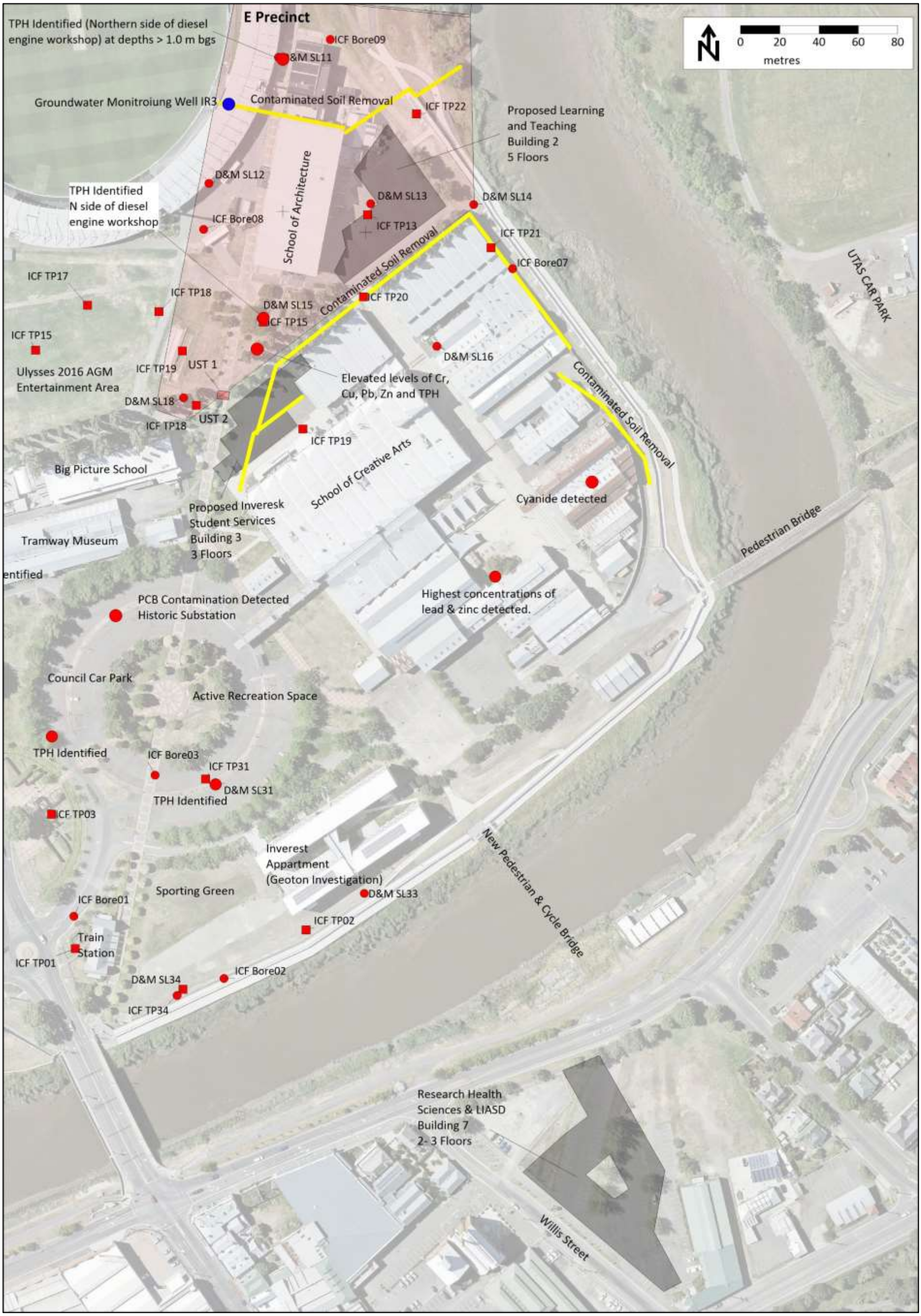


Figure 5 Summary of Previously documented COPC for the entire southern part of the site
Note the following abbreviations:

ICF Pty LTD – environmental consultants. (1993); UST – Underground storage tank; D&M – Dames & Moore; PCB - polychlorinated biphenyl

- Low TPH C_{15} to C_{28} concentrations ranging from 22 to 26 mg/kg in SL13 and SL14 near the exhibition building carpark and 8 mg/kg in SL18 near the AGM Entertainment Area.
- Not detect of very low TPH C_{29} to C_{36} in SL18 near the AGM Entertainment Area and in SL13 and SL14 near the exhibition building carpark
- PAH compounds are identified in fill across much of the site.

Summary of other contaminants:

- No detections of VOC's in samples collected at the site;
- No detections of phenols or chlorophenols in primary samples collected at the site;
- A single detection of PCB in SL27 located on the northern side of the circular Inveresk car park near the historical power station. It is possible PCB's have leached to the water table and migrated towards the south towards the proposed building near the train station.

3.4.2 Footprint of Building 3 – Student Services and Library

The following was extracted from Dames & More Findings – Exhibition Building Carpark & AGM Entertainment Area (Boreholes SL112 to SL18). Summary of ***metal concentrations*** in relation to NEPM ASC 2013 HIL's:

- Concentrations of copper, arsenic, zinc, cadmium, chromium, nickel, and mercury in analysed samples do not exceeded any NEPM ASC 2013 guideline limits;
- Single sample in exhibition building carpark (SL13 0.0 to 0.5 m) with concentrations of lead at 1540 mg/kg exceeding commercial guideline limit of 1500 mg/kg.
- Single sample in exhibition building carpark (SL13 0.0 to 0.5 m) with concentrations of lead at 1540 mg/kg exceeding commercial guideline limit of 1500 mg/kg and recreational guideline limits at 600 mg/kg;
- A single sample near the AGM Entertainment Area (SL18 0.0 to 0.5) with concentrations of lead at 631 mg/kg exceeded recreational guideline limits for lead;

3.5 Potential Contamination Issues

3.5.1 Areas of Potential Concern

As determined in the previous investigations, there were many potentially contaminating activities associated with hosting the historical railyards at the site. With relevance to the footprint of the proposed student services building and this current investigation (see Figure 6), the following areas of potential concern (AOPC) have been identified (SEMF 1995);

- Former rail lines intersected the investigation area trending in a southwest to northeasterly direction; contaminated surface material was removed along that former path;
- Two former underground storage tanks (USTs) were situated approximately 20 m north of the footprint were, and
- Elevated metals were detected in soil samples 60 m north of the proposed building footprint.

It is also possible that there may be other areas on the site where potentially contaminating activities have occurred.

3.5.2 Contaminants of Potential Concern

As determined in previous contamination investigations, the following contaminants of potential concern (COPC) associated with hosting a railyards at the site have been identified and confirmed on site:

- Total Petroleum/Recoverable Hydrocarbons (TPH/TRH);
- Volatile monoaromatic hydrocarbons: Benzene, Toluene, Ethylbenzene, Xylene (BTEX) and derivatives;
- Polycyclic Aromatic Hydrocarbons (PAH) including Benzo(a)pyrene (B(a)p) and
- Heavy metals, in particular; antimony; arsenic; cadmium; chromium; copper; lead; mercury, tin; and zinc.
- Chlorinated hydrocarbons including Polychlorinated Biphenyls (PCB's);
- Phenolic compounds including chlorophenols;
- Acid or alkaline conditions;

- Volatile organohalides including methylene chloride, etc;
- Cyanides; and
- Asbestos.

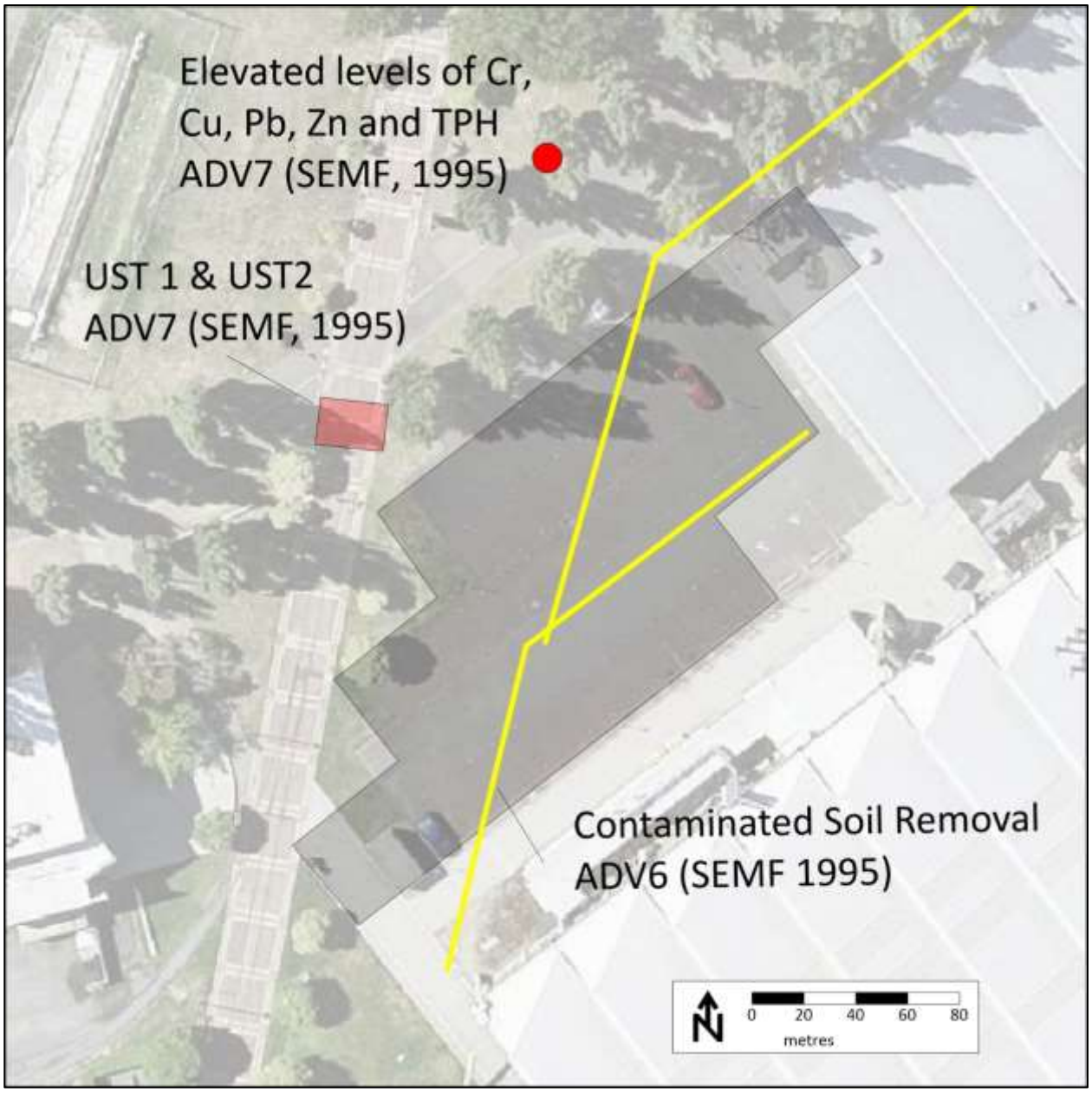


Figure 6 Summary of Previously documented site information for the footprint of Building 3.

Other potential Contaminants: Other potential contamination can be associated with the following:

- In foundries there is the potential for metal contamination, phenols from phenolic resins to make molds and the cyanide from quenching baths. Cyanide may have been used to mark metal for cutting;
- The painting areas have potential to pollute with solvents as paint thinners, metals in the paint pigment and pesticides in the paint as termite protection;
- Chlorinated solvent may have been used as degreasing agents;
- The ash and clinker from steam locos is likely to cause polycyclic aromatic hydrocarbon (PAH) and cyanide contamination;
- Switch gear and early hydraulic fluids may have the potential for polychlorinated biphenyl (PCB) contamination; and
- If the timber in the drying areas was treated with timber preservatives such as copper chrome arsenic (CCA) or tributyl tin (TBTO) there may be potential for the leaching of copper, chromium, arsenic and tin compounds. Furthermore, if the timber was treated with creosote there is also the potential for PAH, phenol and cresol contamination.

4 FIELD INVESTIGATION PROCEDURES

4.1 Works Summary

One site visit was conducted to complete the environmental site assessment, see details in Table 2; borehole locations are presented in Figure 7. Photographs of site works are presented in Appendix 5.

A total of 16 primary soil samples were collected and selected for analysis. QA/QC samples included 1 '*duplicate*', 1 Intra-lab duplicate split and 1 *Rinsate blank*.

Table 2 Summary of Site Investigation Details

Scope	Data	Lab Report	Details
Drilling/ Sample collection	31th May 2019	EM1908628 Primary Lab	Sampled BH01 – BH08; 16 Primary Samples collected and analysised
		Rebatch EM1909096	Secondary Laboratory samples (ES1917553): Intra-lab duplicate split

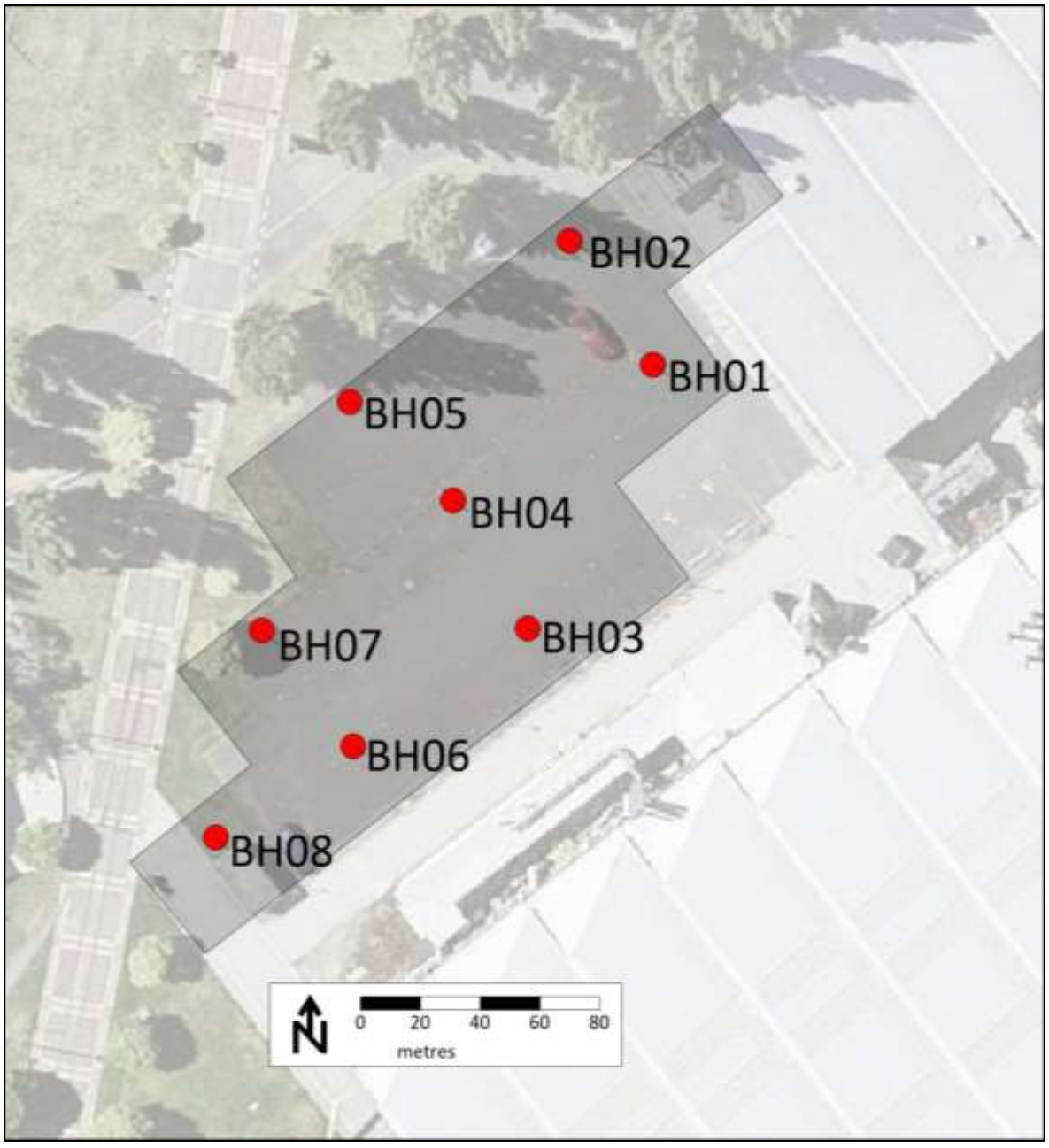


Figure 7 Borehole Plan
Note: BH#-Soil bores

4.2 Soil Investigation

4.2.1 Borehole Drilling

At each of the bore locations, the following precautions were put in place to avoid disrupting underground service assets:

- Dial Before You Dig plans were obtained;
- Archers Underground Service were engaged; and
- The first meter of the bore was cleared with a hand auger.

A total of eight (8) 65 mm diameter soil bores were drilled for assessing site geology and sampling for contamination impact. The bores were drilled by GES using the industry recognized Geoprobe direct push drilling system. The selected drilling method involved using a Geoprobe dual tube to retain wall integrity and eliminates risk of profile collapse whilst allowing extraction of 1.0 m length sample cores and allows for deployment of pre-packed well systems. Soil samples were collected from the cores in accordance with procedures set out in Table 3.

4.2.2 Soil Sampling

Soil bore soil sampling was conducted per the National Environmental Protection (Assessment of Site Contamination) Measure (NEPM ASC 2013) and AS4482 sampling guidelines. Table 3 presents a summary of the soil assessment methodology adopted at the site.

Table 3 Summary of Soil Sampling Methods

Activity	Details / Comments
Drilling Method	Soil bores were drilled: • Hand auger over the first meter to clear for services; • Industry recognized Geoprobe direct push drilling system.
Soil Logging	Logging the soil was conducted in accordance with the unified soil classification system (USCS) as detailed in AS1726 (1993).
Decontamination of Sampling Equipment	Decon 90 was used to decontaminate reusable sampling equipment (hand auger and core trays) which was triple rinsed, the final rinse with deionised water.
Soil Sample Collection	In accordance with AS4482.2. Individual soil samples were collected using disposable nitrile gloves from approximately at 0.5 intervals below ground surface (bgs) and/or change in geology. Sampling was either grab sampling from the push tube core or taken directly from the hand auger.
Soil Screening	In accordance with AS4482.2. Collected samples were screened for volatile fractions using a Photoionisation Detector (PID). This was done by placing the samples within snap lock bags and analysing the headspace with a PID probe. A service record for GES's PID is included in Appendix 6 for the second round of sampling.
Sample Selection	A minimum number of samples were carefully selected which would provide enough information to identify hydrocarbon contamination in soils.
Sample preservation	Samples were placed into a jar for laboratory analysis. Soil jars were placed in a pre-chilled cool box with ice bricks.
Sample holding times	Sample holding times were within acceptable range (based on NEPM B3-2013) from collection to extraction.

4.2.3 Soil Analysis

Primary and QC samples were submitted to Analytical Laboratory Services (ALS) Environmental, Springvale Avenue in Melbourne for analysis. Inter lab duplicate split sample was sent to ALS Environmental, located in Smithfield, NSW. All 16 samples were selected for analysis which included TPH/TRH, BTEX, PAH, and a suite of 15 Metals. PCB and cyanide were tested in two samples only.

Chain of Custody (COC) documentation was completed and is provided in Appendix 7 plus the Sample Receipt Notification (SRN) for each batch presented in Appendix 8. Table 4 presents a summary of the laboratory analyses undertaken for the soil samples.

Table 4 Overview of Soil Analysis and Quality Control

Analytes	Primary Soil Samples	Duplicates[a]	IlS[b]	Rinate Blank[c]
TPH/TRH	16	1	1	1
BTEX	16	1	1	1
PAH	16	1	1	1
15 Metals	16	1	1	1
PCB/ Cyanide	2	-	-	-

Sampling Quality Control Standards (AS4482):
a – One (1) in twenty (20) inter laboratory duplicate samples
b - One (1) in twenty (20) intra laboratory split (ILS) samples
c - Single Rinsate Blank sample per piece of equipment per day

Given that a full 15 metal suite was analysed in 4 samples, there was requirement to assess the following soil physical properties to determine soil threshold investigation levels:

- Soil grain class (sand/silt or clay)
- % Clay content;
- Cation exchange capacity; and
- Soil pH

The soil physical properties were assessed through site assessment and chemical properties were based on knowledge of similar soil types encountered around Launceston.

5 QUALITY CONTROL

All Field and laboratory Quality Assurance and Quality Control (QA/QC) details, outputs and reports are presented in Appendix 8.

5.1 Field

It is standard to expect up to 10% error in field duplication and up to 10% laboratory error. Therefore, in theory up to 20% error can be assumed on duplicate analysis. Some variation may exist in soil and groundwater because even though all efforts are made to split samples homogeneously of materials may bias samples in certain elements.

Relative Percentage Differences (RPDs) for the duplicate and triplicate samples where applicable are calculated using the method outlined below.

The acceptance criteria used for the RPDs depend on the levels of contaminants detected and the laboratory's Method Detection Limits (MDL). The closer the levels detected are to the MDL the greater the acceptable RPD. RPDs are calculated as follows:

- RPD <50% for low level results (<20 * MDL)
- RPD <30% for medium level results (20-100 * MDL)
- RPD <15% for high level results (>100 * MDL)
- No limit applies at <2 * MDL (Method Detection Limit)

Field QA/QC procedures and compliance are summarised in Table 5.

Table 5 Field QA/QC procedures and Compliance

QA/QC Requirement	Compliance	Comments
Appropriate sampling strategy used, and representative samples collected	Yes	Sampling program was undertaken in accordance with AS4482.1-2005
Appropriate and well documented sample collection, handling, logging and transportation procedures.	Yes	Appropriate and well documented
Decontamination	Yes	Appropriate decontamination such as cleaning tools before sampling and between sample locations was undertaken
Chain-of-custody documentation completed	Yes	COC were completed in accordance with NEPM Schedule B2, Section 5.4.5 and transported under strict COC procedures. The signed COC documents are included in this report, which includes the condition report on arrival of samples to the Laboratory, cross checking of sample identification and paperwork and preservation method.
Required number of splits: Duplicate & inter-lab splits:1 per 20 primary samples	Yes	A total of 16 Primary samples were selected for analysis;1 duplicate and 1 ILS sample was required.
QA/QC samples reported method detection limits within indicated guidelines.	Yes/No	For Duplicate and BH05 0.5-0.6 pairs, 84% of analytes complied. For INTER LAB SPLIT and BH06 0.5-0.6 pairs, there were no non-compliances.
Trip blanks collected with no laboratory detections?	Yes	According to AS4482.2-1999, N/A not required
Required numbers of rinse blank samples collected with no laboratory detections?	Yes	One rinse blank was collected as per AS4482.1-2005. Rinse blank sample was clean (all COPC's <LOR) indicating adequate field procedures were employed to reduce the risk of cross contamination between samples.
Samples delivered to the laboratory within sample holding times and with correct preservative	Yes	All samples were sent to the laboratory within holding times and correct preservative.

5.2 Laboratory

Laboratory QA/QC procedures and compliance are summarised in Table 6.

Table 6 Soil Laboratory QA/QC Procedures and Compliance

QA/QC Requirement	Compliance	Comments
All analyses NATA accredited	Yes	ALS Laboratories is NATA Accredited. Appropriate analytical methods used, in accordance with Schedule B(3) of the NEPM ASC 2013. Acceptable laboratory limits of reporting (LORs) adopted.
Method Blanks: zero to <Practical Quantitation Limit (PQL)	Yes	There were no method blank value outliers in the QC1 report.
Laboratory Control Samples: 70% to 130% recovery for soil.	Yes	There were no laboratory control outliers in the QC1 report.
Matrix spikes: 70% to 130% recovery for organics or 80%-120% recovery for inorganics	Yes	There were no matrix spike outliers in the QC1 reports.
Duplicate Samples: 0% to <20% RPD.	Yes	There were no duplicate sample outliers.
Surrogates: 70% to 130% recovery	Yes	There were no surrogate recovery outliers.
Analysis holding time outliers	Yes	No hold-time outliners exist for the QCI report.
Quality Control Sample Frequency Outliers	No	The following duplicate frequency outliers were identified: PAH/Phenols (GC/MS - SIM) with 0% and 10% expected TRH - Semivolatile Fraction with 0% and 10% expected The following matrix spike frequency outliers were identified: PAH/Phenols (GC/MS - SIM) with 0% and 5% expected TRH - Semivolatile Fraction with 0% and 5% expected (EM1908628)

There were no outliners for the inter-laboratory duplicate split sample (ES19417553) or the rebatch analysis (EM1909096).

6 FIELD INVESTIGATION FINDINGS

6.1 Site Walkover

The site visit was conducted on the 31st May 2019. See site photographs in Plate 2 and Plate 3; additional photographs are presented in Appendix 5.

Plate 2 View across the Investigation Area to the northwest; York Park Stadium.

Plate 3 View across the Investigation Area to the northeast; Academy of the Arts building

6.2 Soil Bores

Pictorials of borehole material are presented in Appendix 5 and borehole logs are presented in Appendix 9. During the soil sampling no groundwater was encountered however there was a slight sheen to the material at 1.6m bgs.

6.2.1 Geological Interpretation

In general, the Mineral Resources Tasmania (MRT) geological mapping was consistent with the ground conditions encountered during the investigation. The profile of BH01 to BH08-1 comprised 0.0 to 0.20 m of ASPHALT; 0.20 – 0.80 M Silty SAND black, mixed, trace clay, gravels and charcoal, moist medium dense; 0.80 m to 1.20 m silty CLAY black mixed, high plasticity, moist firm consistency and 1.20 m to 2.0 m Clayey SILT olive brown, moist medium dense consistency .

Sediments in this area are considerably think as confirmed by Pitt & Sherry 2009 in BH_SL12, see Figure 5 where dolerite was encountered in at 18 m bgs. This was confirmed during the current investigation as no rock was encountered.

6.2.2 Grain Class Interpretation

Grain size classifications are applied to all soils at the site to determine threshold screening level concentrations for hydrocarbons to assess soil ecological and human health risks.

Grain class threshold values are determined based on either the:

- sample grain size (in the case of ecological screening levels or chromium limits); or
- average grain class overlying the sample point (when assessing petroleum vapour screening levels).

When assessing petroleum vapour intrusion screening levels, where soil is proposed to be excavated from the site, the excavated material is excluded from the grain class averaging. The corresponding depth class from which the sample is collected is also shallowed based on the renewed basement depth. Table 7 provides a summary of the grain class averages for material overlying the sample.

Table 7 Summary of Grain Class Based on USCS Classification – BH01 – BH08

Sample	Footing Excavation Depth^ - Red Fill Thickness^ - Green	Sample PVI Depth (m) Relative to Slab/Cut Depth	Soil Grain Size Class Averaging Above Soil Sample																	Attenuation			Petroleum Vapour Intrusion HSL Grain Class*	SAMPLE USCS
			GW	GP	GM	GC	SW	SP	SM	SC	ML	CL	OL	MH	CH	OH	CI	Rock (R)	Existing Pavement (P)	Crawl Space Thickness (m)	Proposed CONCRETE (CH)	Crawl Space	Biodegradation	
BH01 0.5-0.6	0.4	1.1	0.4								0.3								0.2	NA	0.2	1.0	1.0	CLAY	ML
BH01 1.4-1.5	0.4	2.0	0.4								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH02 0.5-0.6	0.3	1.2	0.5								0.3								0.2	NA	0.2	1.0	1.0	SAND	ML
BH02 1.4-1.5	0.3	2.1	0.5								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH03 0.5-0.6	0.4	1.1	0.4								0.3								0.2	NA	0.2	1.0	1.0	CLAY	ML
BH03 1.4-1.5	0.4	2.0	0.4								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH04 0.5-0.6	0.3	1.2	0.5								0.3								0.2	NA	0.2	1.0	1.0	SAND	ML
BH04 1.4-1.5	0.3	2.1	0.5								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH05 0.5-0.6	0.3	1.2	0.5								0.3								0.2	NA	0.2	1.0	1.0	SAND	ML
BH05 1.4-1.5	0.3	2.1	0.5								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH06 0.5-0.6	0.5	1.0	0.3								0.3								0.2	NA	0.2	1.0	1.0	CLAY	ML
BH06 1.4-1.5	0.5	1.9	0.3								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH07 0.5-0.6	0.5	1.0	0.3								0.3								0.2	NA	0.2	1.0	1.0	CLAY	ML
BH07 1.4-1.5	0.5	1.9	0.3								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML
BH08 0.5-0.6	0.5	1.0	0.3								0.3								0.2	NA	0.2	1.0	1.0	CLAY	ML
BH08 1.4-1.5	0.5	1.9	0.3								0.8				0.4				0.2	NA	0.2	1.0	1.0	CLAY	ML

7 SOIL ECOLOGICAL IMPACT ASSESSMENT

7.1 Protected Environmental Values

The requirement for protecting soil from contaminated activities in Tasmania is managed under the Environmental Management and Pollution Control Act 1994 (EMPCA) which states in Part 5A:

(2) An area of land is a contaminated site if –

(a) there is in, on or under that area of land a pollutant in a concentration that –

(i) is above the background concentration; and

(ii) is causing or is likely to be causing serious or material environmental harm or environmental nuisance, or is likely to cause serious or material environmental harm or environmental nuisance in the future if not appropriately managed;

Potential soil impact at the site is assessed through application of the following environmental investigation guidelines.

7.2 NEPM ASC (2013) Guidelines

The following ecological investigation guidelines are to be addressed to assess acceptable levels of risk to terrestrial ecosystems:

- NEPM ASC (2013) Ecological Investigation Levels (EIL's) – have been developed for selected metal and organic substances. EIL's depend on specific soil and physicochemical properties and land use scenarios and generally apply to the top two (2) metres of the soil profile (NEPM 2013);
- NEPM ASC (2013) Ecological Screening Levels (ESL's) – have been developed for selected petroleum hydrocarbon compounds and total petroleum hydrocarbon fractions. ESL's broadly apply to coarse- and fine-grained soils and various land use scenarios within the top two (2) metres of the soil profile (NEPM ASC 2013).

Soil analytical results are compared against Ecological Screening Levels (ESL's) and Ecological Investigation Levels (EIL's) limits presented in Table 8.

Table 8 Summary of Soil Investigation Limits Considered at the Site based in NEPM ASC (2013)

Investigation Levels (IL)	Analytes Investigated						
	Hydrocarbons				Metals		DDT
	BTEX	TRH (F1 to F4)	Benzo(a) pyrene (PAH)	Naphthalene (PAH)	Zn, Cu, Cr(III), Ni & As	Lead	
ESL's	Analysed	Analysed	Analysed				
EIL's				Analysed	Analysed	Analysed	Not Analysed

7.3 Guidelines

7.3.1 Ecological Screening Levels

The following compounds were compared against NEPM (2013) Ecological Screening Levels (ESL's):

- BTEX;
- F1 to F4 TRH; and
- Benzo(a)pyrene

Selection of ESL threshold investigation limits are set out in the NEPM (2013) guidelines and require classification of the soil according to:

- Land use sensitivity:
    - Areas of ecological significance
    - Urban residential and public open space; and
- Dominant particle size passing through a 2 mm sieve into:
    - Coarse – sand sizes and greater; and
    - Fine – clay and silt sizes.

Adopted NEPM (2013) soil and land use classifications are presented below.

7.3.2 Ecological Investigation Levels

The following compounds were compared against Environmental Investigation Levels:

- Lead;
- Nickel;
- Chromium;
- Zinc;
- Copper;
- Arsenic; and
- Naphthalene.

There was a requirement to classify the soil according to physicochemical properties given that the above listed compounds. Selection of EIL threshold investigation limits are set out in the NEPM ASC (2013) guidelines and require classification of the soil per specific soil and physicochemical properties which are presented in the results tables.

Given the surround sensitive land use of residential/ public open spaces, these guidelines have been applied to the EILS. pH tested in 4 samples and ranged from 5.4-7.7.

7.4 Findings

7.4.1 Ecological Screening Levels

Laboratory analytical results for soil are presented in Appendix 10. Table 9 summaries all soil analytical results against relevant ESLs guideline limits for urban residential/ public open spaces land use. Concentrations which exceed laboratory limits of reporting (LOR) are highlighted in bold. ESL exceedances are highlighted with a coloured cell. Samples within the proposed excavation zone are marked with an X.

A total of 6 of the 16 primary samples had detections above laboratory LORs. A total of 6 samples had hydrocarbon detections above the ESL guideline limits for urban residential/ public open spaces and included the following exceedances:

- One sample had a laboratory detection for TRH Fraction F2 and another had a detection of benzene.
- A total of all 2 samples that had ESL exceedances were for TRH Fraction F3 (Borehole #1); 2 additional samples had laboratory detections but were below guideline limits.
- A total of 8 samples from 16 samples were clean and had no detections; the majority of which were deeper at 1.4-1.5m bgs.

The following was also observed as illustrated in Figure 8:

- The ESL exceedances were localised in BH01.
- The hydrocarbon detections were at 0.5-0.6m bgs,
- Deeper soil samples at 1.5-1.6m bgs were generally free of hydrocarbon contamination.
- Groundwater was not encounter even though boreholes were 2.2-2.4m above sea level with the North Esk River, approximately 200m to the east of the investigation area.

Therefore, as best practice a Contamination Management Plan (CMP) will be required to manage soil/ water run off during construction to ensure contaminated soil or surface water does not enter the waterways.

Table 9 Summary of Soil Analytical Results Compared with Ecological Screening Level's for urban residential/ public open spaces – BH01-BH08

NEPM Ecological Screening Levels for Soil				BTEX				PAH	TRH			
Bold - Indicates LOR Exceedances X - Indicates Sample has been Excavated				Benzene	Toluene	Ethylbenzene	Xylenes	Benzo(a)pyrene	F1 (C6 - C10)	F2 (>C10 - C16)	F3 (>C16 - C34)	F4 (>C34 - C40)
Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x												
Sample ID	Sample Date	Soil Texture Class (fine /coarse)	Land Use	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 0.5	LOR 10	LOR 50	LOR 100	LOR 100
BH01 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**1620**	**280**
BH01 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	**110**	**1540**	**320**
BH02 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**840**	**130**
BH02 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH03 0.5-0.6	31/5/19	F	URBAN	**0.3**	<0.5	<0.5	<0.5	<0.5	<10	<50	**580**	**140**
BH03 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH04 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH04 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH05 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**130**	<100
BH05 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH06 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**480**	**140**
BH06 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH07 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**980**	**210**
BH07 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100
BH08 0.5-0.6	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	**150**	<100
BH08 1.4-1.5	31/5/19	F	URBAN	<0.2	<0.5	<0.5	<0.5	<0.5	<10	<50	<100	<100

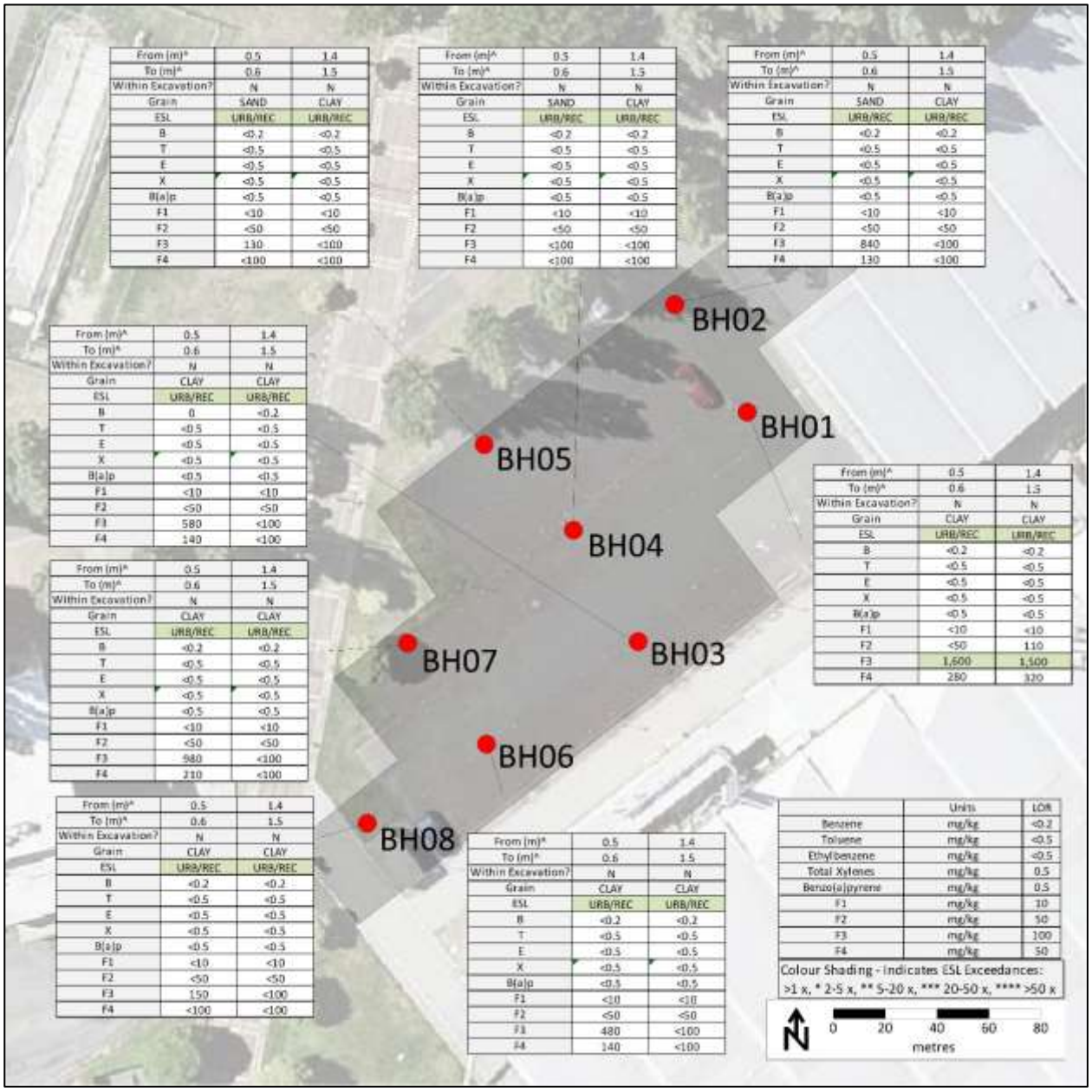


Figure 8 Trail of ESL Exceedances in Soil Across the Site (Borehole #1 only)

7.4.2 Ecological Investigation Levels

Laboratory analytical results are presented in Appendix 11. Table 10 compares all soil analytical results against relevant ecological investigation limits (EIL's) for urban residential/ public open spaces land use. Concentrations which exceed laboratory LOR are detailed in the table. EIL exceedances are highlighted with a coloured cell and samples within the proposed excavation zone are marked with an X. At this stage none of the samples are proposed to be excavated.

There were four shallow soil samples, 0.5-0.6m bgs that had heavy metal detections that exceeded EIL guidelines. Details are as follows:

- BH01 copper 1x the limit
- BH02 copper 5-20x the limit
- BH03 copper, zinc 1x the limit; and Arsenic 2-5x the limit
- BH07 copper 5-20x the limit

Note some pH values were inferred and others obtained during analysis. A risk to ecological receptors in terms of EILs has been identified.

Table 10 Soil Analytical Results Compared Against Ecological Investigation Levels for urban residential/ public open spaces – BH01-BH08

NEPM Ecological Investigation Levels for Soil													
Bold - Indicates LOR Exceedances X - Indicates Sample Withiin Inferred Excavation													
Colour Shading - Indicates ESL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x													
Sample ID	Sample Date	EIL Land Use Sensitivity Class	Soil CEC (cmolc/kg)	Soil pH	Soil Texture Class (fine /coarse)	Copper (CEC)	Copper (pH)	Nickel	Zinc	Chromium III	Lead	Arsenic	Naphthalene
						mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
BH01 0.5-0.6	31/5/19	URBAN	20	7.7 (1)	F	411	411	47	283	65	228	18	<1
BH01 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	46	46	68	77	65	23	8	<1
BH02 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	1850**	1850**	45	345	39	167	13	<1
BH02 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	19	19	25	49	64	11	10	<1
BH03 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	379	379	42	436	38	550	307*	<1
BH03 1.4-1.5	31/5/19	URBAN	20	5.6 (1)	F	23	23	33	57	58	15	11	<1
BH04 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	86	86	10	136	7	119	18	<1
BH04 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	19	19	25	48	63	10	10	<1
BH05 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	159	159	16	206	10	229	31	<1
BH05 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	16	16	31	51	76	9	8	<1
BH06 0.5-0.6	31/5/19	URBAN	20	6.3 (1)	F	166	166	21	125	19	211	24	<1
BH06 1.4-1.5	31/5/19	URBAN	20	5.4 (1)	F	18	18	32	52	64	11	8	<1
BH07 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	2280**	2280**	35	353	16	364	48	<1
BH07 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	22	22	50	65	66	11	9	<1
BH08 0.5-0.6	31/5/19	URBAN	20	6.25 (3)	F	62	62	11	63	6	74	40	<1
BH08 1.4-1.5	31/5/19	URBAN	20	6.25 (3)	F	14	14	25	50	66	11	12	<1

pH Designation:

1) Using 0.01M CaCl2 extract. Rayment, G.E. and Lyons, D.J. (2011). "Soil Chemical Methods – Australasia". 495+20 pp. CSIRO Publishing, Melbourne.

2) pHF (1:5). Adjusted by subtracting 0.75 with +/- 0.25 error to calibrate to the CaCl2 method (per comm. ALS Brisbane Acid Sulphate Soils Laboratory). Methods in accordance with Ahern, C.R., Stone Y., and Blunden B. (1998b). 'Acid Sulphate Soils Assessment Guidelines'. Acid Sulphate Soils Management Advisory Committee, Wollongbar, NSW, Australia.

3) Classified in accordance with parent material typical soil pH as per the Tasmanian soils database / or on-site testing

8 SOIL HUMAN HEALTH DIRECT CONTACT ASSESSMENT

8.1 Guidelines

Guidelines presented herein are based on potential exposure of human receptors to soil impact which may include:

- Onsite excavation works which may include basement carpark and deep foundations. Receptors include onsite commercial contractors, offsite residential receptors as well as sensitive land use and recreational receptors;
- Proposed future onsite residential land users which may be exposed to potential shallow soil impact in non-paved areas of the site – not likely given the entire site will be sealed by a concrete carpark;
- Trench workers repairing or building services (typically to 1 m bgs) as assessed against commercial worker guidelines for dermal contact and HIL's.

8.1.1 Land Use Classification

The NEPM (2013) guidelines have been referenced to ensure that the correct land use and density category has been adopted for the site and the surrounding properties (where applicable). As per NEPM (2013) guidelines, the adopted land use class is dependent on the building density and the opportunity for soil access by site occupants (exposure to potentially impacted soil). Aspects needing to be considered include:

- Whether the site is of sensitive land use such as a childcare centre, preschool, primary school or aged care facility in which case land use Class A is applicable;
- The proportion of paved area to determine direct contact exposure risk and therefore classification as low or high density; and
- Classification based on residential, recreational or commercial/industrial setting.

8.1.2 Adopted Land Use Classification

The adopted land use class is presented in Table 11.

Table 11 Summary of Land Use Spatial and Temporal Setting for Determining Exposure Risk

Soil Bores	Construction Phase	Location	Land Use	Pathway*	Land Use Class
	During	Site	Commercial contractors	ALL	D
		Offsite	Recreational land use – surrounding open spaces	ALL	C
			Commercial users – Art School	DI	D
	Post	Site	Commercial users – Art School	ALL	D
			Recreational land use – surrounding open spaces	ALL	C
			Trench Workers	ALL	D & Standard

* Pathways:
DC – Dermal Contact – HSL Trench Worker Guidelines (CRC CARE 2013); DI – Dust Inhalation - HIL Guidelines (NEPM ASC 2013); SI – Soil Ingestion - HIL Guidelines (NEPM ASC 2013); ALL – All of above

8.2 Findings

8.2.1 Dermal Contact - Petroleum Hydrocarbons

Laboratory analytical results are presented in Appendix 11. Table 12 presents soil hydrocarbon analytical results compared against CRC CARE (Friebel & Nadebaum, 2011) Health Screening Levels (HSL) guidelines for assessing dermal contact risk HSL C, HSL D and Trench workers. Concentrations which exceeded laboratory LOR are highlighted in bold. HSL exceedances would be highlighted with a coloured cell indicating the highest HSL land used class which is exceeded. Samples within the proposed excavation zone would be marked with an X.

There were detections of hydrocarbons in 8 of the 16 samples sent for analysis, most detections were in the shallow samples (0.5-0.6m bgs). There were higher detections in both samples from BH01. There were no exceedances above the HSL C guidelines for *recreational use,* HSL D guidelines for *commercial/ industrial land use* or *to trench workers* for Dermal Contact. Therefore, no dermal contact risk has been identified.

Table 12 Soil Analytical Results Compared Against CRC CARE Guidelines for Dermal Contact – BH01-BH08

CRC CARE Health Screening Level Dermal Contact Hazard from Soil Hydrocarbons'		EP080: BTEXN					EP080/071: TRH			
		Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction
Units		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	1	10	50	100	100
HSL C Recreational		120	18000	5300	15000	1900	5100	3800	5300	7400
HSL D Commercial/Industrial		430	99000	27000	81000	11000	26000	20000	27000	38000
Intrusive Maintenance Worker		1100	120000	85000	130000	29000	82000	62000	85000	120000
Date	Sample									
31/05/2019	BH01 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**1620**	**280**
31/05/2019	BH01 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	**110**	**1540**	**320**
31/05/2019	BH02 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**840**	**130**
31/05/2019	BH02 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH03 0.5-0.6	**0.3**	<0.5	<0.5	<0.5	<1	<10	<50	**580**	**140**
31/05/2019	BH03 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH04 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH04 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH05 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**130**	<100
31/05/2019	BH05 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH06 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**480**	**140**
31/05/2019	BH06 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH07 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**980**	**210**
31/05/2019	BH07 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100
31/05/2019	BH08 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	**150**	<100
31/05/2019	BH08 1.4-1.5	<0.2	<0.5	<0.5	<0.5	<1	<10	<50	<100	<100

8.2.2 Dust Inhalation & Soil Ingestion

Laboratory analytical results are presented in Appendix 11. Table 13 presents the soil analytical results compared against combined dust inhalation and soil ingestion risk is assessed through the application of NEPM (2013) Health Investigation Levels (HILs) for exposure to soil contaminants. Concentrations which exceeded laboratory LOR are highlighted in bold, metals are simply reported. HIL exceedances are highlighted with a coloured cell indicating the highest HIL land used class which is exceeded. Samples within the proposed excavation zone are marked with an X.

There were no HIL D *commercial land use* exceedances at the site. There was one HIL C exceedance for *recreational land use*. This was arsenic in BH03 at 0.5-0.6m bgs. During construction a contamination Management Plan must be used to manage the risk; see recommendations.

Table 13 Soil Analytical Results Compared Against NEPM (2013) Health Investigation Limit Guidelines – BH01-BH08

Bold - Indicates LOR Exceedance in Non Metalic Compounds		EA002 : pH (Soils)	EA055: Moisture Content	EG005T: Total Metals by ICP-AES														EG035T: Total Recoverable Mercury by FIMS	EP066:	EP075(SIM)B: Polynuclear Aromatic Hydrocarbons																			
NEPM Health Investigation Levels (HIL's) **Dust Inhalation and Soil Ingestion Assessment** X - Indicates Sample Within Proposed Excavation Zone		pH Value	Moisture Content	Arsenic	Barium	Beryllium	Boron	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Mercury	PCBs	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	PAHs	Benzo(a)pyrene TEQ (WHO)
Units		pH Unit	%	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.1	1	5	10	1	50	1	2	2	5	5	5	2	5	5	5	0.1	0.1	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
HIL C Recreational	☑ HIL C			300		90	20000	90		300	17000	600	19000	1200	700		30000	80	1																	300	3
HIL D Commerial/Industrial	☑ HIL D			3000		500	300000	900		4000	240000	1500	60000	6000	10000		400000	730	7																	4000	40
Sample date:	Sample ID																																				
31/05/2019	BH01 0.5-0.6	7.7	18.8	18	240	<1	<50	4	65	12	411	228	377	47	<5	40	283	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH01 1.4-1.5	----	44.2	8	80	2	<50	<1	65	16	46	23	176	68	<5	53	77	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH02 0.5-0.6	----	9.7	13	160	<1	<50	2	39	10	1850	167	622	45	<5	20	345	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH02 1.4-1.5	----	41.6	10	40	2	<50	<1	64	7	19	11	81	25	<5	78	49	<0.1	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH03 0.5-0.6	----	19	307	580	<1	<50	2	38	10	379	550	462	42	<5	29	436	0.2	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.8	0.7	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**2**	<0.5
31/05/2019	BH03 1.4-1.5	5.6	40.3	11	20	2	<50	<1	58	11	23	15	69	33	<5	64	57	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH04 0.5-0.6	----	16.7	18	50	<1	<50	<1	7	4	86	119	187	10	<5	12	136	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH04 1.4-1.5	----	42.5	10	20	2	<50	<1	63	8	19	10	68	25	<5	69	48	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH05 0.5-0.6	----	14.3	31	50	<1	<50	<1	10	5	159	229	147	16	<5	17	206	0.2	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH05 1.4-1.5	----	39.8	8	20	2	<50	<1	76	11	16	9	95	31	<5	66	51	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH06 0.5-0.6	6.3	19.8	24	80	<1	<50	<1	19	5	166	211	205	21	<5	46	125	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH06 1.4-1.5	5.4	41.6	8	20	2	<50	<1	64	8	18	11	64	32	<5	69	52	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH07 0.5-0.6	----	27.4	48	160	<1	<50	1	16	9	2280	364	461	35	<5	19	353	2.3	<0.1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	0.9	1.0	0.5	<0.5	0.6	<0.5	<0.5	<0.5	<0.5	<0.5	**3**	<0.5
31/05/2019	BH07 1.4-1.5	----	39.5	9	20	2	<50	<1	66	19	22	11	100	50	<5	60	65	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH08 0.5-0.6	----	18.6	40	60	<1	<50	<1	6	4	62	74	120	11	<5	11	63	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH08 1.4-1.5	----	40.3	12	30	1	<50	<1	66	8	14	11	74	25	<5	82	50	<0.1	----	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5

Note: cyanide was also tested in two samples; BH01 1.4-1.5 results were non detect; and BH07 0.5-0.6 cyanide was measured at 2 mg/kg. HIL C for cyanide is 240 mg/kg and for HIL D 1500 mg/kg. Thus, making the results well below guideline limits.

9 INDOOR INHABITANT PVI ASSESSMENT – HSL's

This PVI assessment has been conducted in accordance with relevant CRC CARE Technical Documentation and NEPM 2013 guidelines presented in references section of this report. The HSL assessment approach is generally the first (Tier 1) investigation phase adopted for assessing PVI risk at petroleum hydrocarbon (PHC) impacted sites. HSL guidelines have been applied for samples collected from the site to account for risks that may be associated with volatile hydrocarbon vapour intrusion into confined spaces where there may be an inhalation risk through longer term exposure. This does not constitute a full vapour risk assessment but provides additional information from which to further quantify any risk.

A detailed investigation (Tier 2 to 3) is recommended over an HSL assessment where an acute risk has been identified at the site (CRC CARE 2013) because of:

- Migrating product on surface soils beneath buildings;
- Strong PHC odours;
- Flammable risk in confined spaces; and/or
- Health complaints from occupants.

Based on the site visits, none of the above conditions have been identified at the site. If the outcome of this Tier 1 assessment reveals HSL exceedances for hydrocarbon vapour intrusion, a more detailed (Tier 2) assessment will be required to further evaluate the human health risk.

PVI risk is initially interpreted through the development of HSL threshold limits from the following classifications:

- The geology and or hydrogeology of the investigation point; and
- Land use sensitivity:

The resulting HSL threshold limits are compared with laboratory analytical results.

9.1 Selected Media for Assessing PVI Risk

Table 14 presents a summary of the preferred HSL approach to assessing PVI risk. In this case, all soil investigated was within the excavation zone and within the water table.

Table 14 Preferred Methods for Determining Site PVI Risk

Media Analysed	Method	Limitations	Order of Preference
Soil Gas	Concentrations of a soil gas through a soil vapor probe	This approach provides the most reliable data in interpreting PVI risk, although direct modelling should be applied if concentrations exceed HSL threshold limits.	Primary
Groundwater	Concentrations of PHC in groundwater through deployment of monitoring wells	More robust and reliable that soil in determining onsite and in particular, offsite risks. Determining PVI risk based on groundwater is inherently conservative when interpreting vapour risk to account for not readily discernible preferential pathways. Reference may be drawn to alternative assessment approaches: 1) Application of site-specific conditions to the CRC CARE model for assessing PVI risk 2) Soil gas interpretation for areas where a PVI risk is identified from groundwater analysis.	Secondary
Soil	Concentrations of PHC in soil	Concentrations in soil may be subject variability due to soil moisture, organic content and oxygen ingress all which create significant bias in threshold values. Reliance is place on utilizing groundwater analysis over soil. Soil results provide localised information.	Tertiary

9.2 Land Use Class

For surrounding properties, the potential PVI risk is characterized through application of CRC CARE HSL's for each individual property based on their existing land use (NEPM 2013; Friebel & Nadebaum 2010). The CRC CARE guidelines have been referenced to ensure that the correct land use and density category has been adopted for surrounding land use to ensure health risks are consistent with the HSL models. Aspects considered include the:

- Sensitivity of the existing or potential land use;
- Percentage of paved area for defining potential vapour migration risk;
- Type of basement garage which may influence the confinement of PHC vapours;
- Presence of a slab or cavity for discerning vapour intrusion risk.

If hydrocarbon impacted soil is discerned at the site, consideration is given to downgradient receptors. Where applicable, land use class therefore considers:

- Downgradient receptors where onsite HSL exceedances have been identified in soil; and
- Variations in land use for different parts of the proposed development.

The following land use classes are applied:

- *HSL D for all commercial spaces* within the student services building and adjacent buildings.

9.3 Soil Assessment

Laboratory analytical results are presented in Appendix 11. Table 15 presents the results against a potential indoor vapour risk. Concentrations which exceeded laboratory LOR are highlighted in bold. HSL exceedances are highlighted with a coloured cell. Although there were detections in two samples; results were below guideline limits. Therefore no the indoor vapour risk has been identified associated with soil impact.

Table 15 Soil Analytical Results Compared Against HSL D for Indoor Vapour Risk – BH01-BH08

Soil Hydrocarbon HSL's for Assessing Indoor Vapour Intrusion (NEPM 2013) **Soil Sample Analysis**					EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances					Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	F1	F2
Colour Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, *** 20-50 x, **** >50 x											
Sample ID	Sample Date	Depth Class	Grain Class	HSL	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
					LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
BH01 0.5-0.6	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH01 1.4-1.5	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	**110**
BH02 0.5-0.6	31/05/2019	1 - 2	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH02 1.4-1.5	31/05/2019	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH03 0.5-0.6	31/05/2019	1 - 2	CLAY	D	**0.3**	<0.5	<0.5	<0.5	<1	<10	<50
BH03 1.4-1.5	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH04 0.5-0.6	31/05/2019	1 - 2	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH04 1.4-1.5	31/05/2019	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH05 0.5-0.6	31/05/2019	1 - 2	SAND	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH05 1.4-1.5	31/05/2019	2 - 4	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH06 0.5-0.6	31/05/2019	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH06 1.4-1.5	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH07 0.5-0.6	31/05/2019	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH07 1.4-1.5	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH08 0.5-0.6	31/05/2019	0 - 1	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH08 1.4-1.5	31/05/2019	1 - 2	CLAY	D	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

10 TRENCH WORKER PVI ASSESSMENT – HSL's

10.1 Classification

The following Health Screening Assessment is based on hydrocarbon vapour intrusion risk to subsurface excavation workers within excavations. This is assessed through analysis of vapours from soil and soil vapours. Groundwater is generally not used to assess risk as threshold limits for all depth and grain classes are non-limiting. Land use classes are not applicable when assessing vapour intrusion into trenches.

Soil and soil vapour HSL's for assessing hydrocarbon risk to maintenance workers are based on CRC CARE Technical Report 10 guidelines (Friebel & Nadebaum 2011) and the following variables:

- Dominant grain size class of material at the soil sample depth or based on the dominant grain class of the backfill material based on US Agriculture Soil Classification System (SCS) and partitioning into either sand, silt or clay; and
- Classifying soil according to depth ranges: 0 to 2 m; 2 to 4 m; 4 to 8 m; and greater than 8 m;

10.2 Findings

Laboratory analytical results are presented in Appendix 11. Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers are presented in Table 16. Concentrations that exceeded laboratory LOR are highlighted in bold, and if there were any HSL exceedances they would be highlighted with a coloured cell. There were no exceedances of the CRC CARE HSL guidelines for Assessing PVI Risk to Trench Workers and no risk identified.

Table 16 Summary of Soil Analytical Results Compared against HSL's for Assessing PVI Risk to Trench Workers – BH01-BH08

CRC CARE Health Screening Level Assessment for PHC Inhalation Risk To Trench Workers From Soil Sample Analysis				EP080: BTEXN					EP080/071: TRH	
Bold - Indicates LOR Exceedances										
Dark Grey Shading - Indicates HSL Exceedances: >1 x, * 2-5 x, ** 5-20 x, * 20-50 x, **** >50 x**				Benzene	Toluene	Ethylbenzene	Total Xylenes	Naphthalene	C6 - C10 Fraction	>C10 - C16 Fraction
Sample ID	Sample Date	Depth Class	Grain Class	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
				LOR 0.2	LOR 0.5	LOR 0.5	LOR 0.5	LOR 1	LOR 10	LOR 50
BH01 0.5-0.6	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH01 1.4-1.5	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	**110**
BH02 0.5-0.6	31/05/2019	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH02 1.4-1.5	31/05/2019	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH03 0.5-0.6	31/05/2019	0 to 2m	CLAY	**0.3**	<0.5	<0.5	<0.5	<1	<10	<50
BH03 1.4-1.5	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH04 0.5-0.6	31/05/2019	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH04 1.4-1.5	31/05/2019	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH05 0.5-0.6	31/05/2019	0 to 2m	SAND	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH05 1.4-1.5	31/05/2019	2 to 4m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH06 0.5-0.6	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH06 1.4-1.5	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH07 0.5-0.6	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH07 1.4-1.5	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH08 0.5-0.6	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50
BH08 1.4-1.5	31/05/2019	0 to 2m	CLAY	<0.2	<0.5	<0.5	<0.5	<1	<10	<50

11 SOIL DISPOSAL ASSESSSMENT

11.1 Guidelines

Soil which is excavated from the site for landfill disposal is to be assessed against Information Bulletin 105 (IB105) for Classification and Management of Contaminated Soil for Disposal. The Environmental Protection Authority (EPA) uses 4 categories to classify contaminated soil as per Table 17:

- (Level 1) Fill Material;
- (Level 2) Low Level Contaminated Soil;
- (Level 3) Contaminated Soil; and
- (Level 4) Contaminated Soil.

Fixed numerical values are presented for soil concentrations and leachable fraction concentrations.

Table 17 Summary of IB105 Classification Guidelines

	Classification (with reference to Table 2)	Controlled Waste[1]	Comments
Fill Material[2] (Level 1)	Soil that exhibits levels of contaminants below the limits defined under *Fill Material* in Table 2.	Unlikely	Soil classified as *Fill Material* can still be a 'pollutant' under the *Environmental Management and Pollution Control Act 1994* and needs to be responsibly managed.
Low Level Contaminated Soil (Level 2)	Soil that exhibits levels of contaminants above the limits defined under *Fill Material* but below the limits defined under *Low Level Contaminated Soil* in Table 2.	Likely	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil (Level 3)	Soil that exhibits levels of contaminants above the limits defined under *Low Level Contaminated Soil* but below the limits defined under *Contaminated Soil* in Table 2.	Yes	Where leachable concentrations have not been prescribed, maximum total concentrations will be used to classify the soil.
Contaminated Soil for Remediation (Level 4)	Soil that exhibits levels of contaminants above the limits defined under *Contaminated Soil* in Table 2 (regardless of the maximum total concentrations) is generally ***not*** considered acceptable for off-site disposal without prior treatment.	Yes	Soil that contains contaminants that do not have criteria for leachable concentrations (*e.g.* petroleum hydrocarbons), and the levels of contaminants exceed the maximum total concentrations listed in *Contaminated Soil*, are generally classified as *Contaminated Soil for Remediation*.

[1] Controlled Waste is defined in the *Environmental Management and Pollution Control Act 1994*.
[2] Criteria for *Fill Material* are the limits set by the Director for the purposes of R.9(2)(a)(ii) in the *Regulations*.

11.2 Findings

The soil samples were compared against IB105 guidelines for soil disposal, see Table 18 and Table 19. Most of the material was classified as Level 2 Material – Low Level Contaminated Soil due to the presence of multiple heavy metal detections and hydrocarbons in three samples.

Elevated metals above Level 1 classification included arsenic, beryllium, cadmium, copper, lead (in two samples only) and zinc. The following metals only exceeded IB105 in one sample; barium, manganese, mercury and nickel.

Material in two boreholes were classified as Level 3 material for Arsenic in BH03 0.5-0.6 and copper in BH07 0.5-0.6. Leachate testing confirmed that the leachable fraction of this material did not exceed Level 2 classification; therefore, this material can also be considered as Level 2 material.

Careful management of this material will be required during the excavation phase of the work; see the recommendations section of this report.

Table 18 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Dry Weight Concentrations

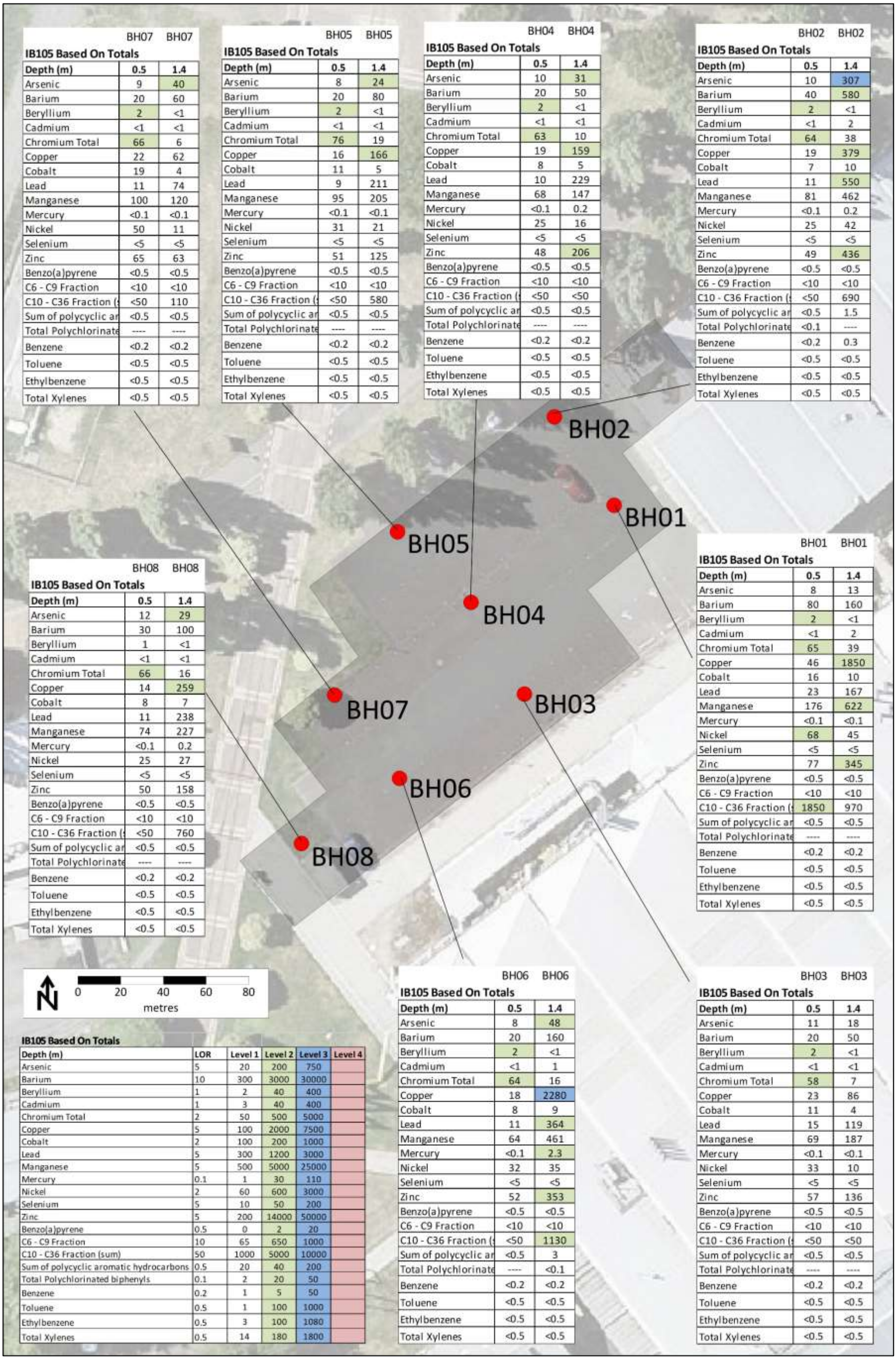
Information Bulletin 105 Classification and Management of Contaminated Soil For Disposal		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Benzo(a)pyrene	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Sum of polycyclic aromatic hydrocarbons	Total Polychlorinated biphenyls	Benzene	Toluene	Ethylbenzene	Total Xylenes	Total Cyanide
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		5	10	1	1	2	5	2	5	5	0.1	2	5	5	0.5	10	50	0.5	0.1	0.2	0.5	0.5	0.5	1
Investigation Level Selected																								
IB105 Level 1		<20	<300	<2	<3	<50	<100	<100	<300	<500	<1	<60	<10	<200	<0.08	<65	<1000	<20	<2	<1	<1	<3	<14	<32
IB105 Level 2		20	300	2	3	50	100	100	300	500	1	60	10	200	0.08	65	1000	20	2	1	1	3	14	32
IB105 Level 3		200	3000	40	40	500	2000	200	1200	5000	30	600	50	14000	2	650	5000	40	20	5	100	100	180	1000
IB105 Level 4		750	30000	400	400	5000	7500	1000	3000	25000	110	3000	200	50000	20	1000	10000	200	50	50	1000	1080	1800	2500
31/05/2019	BH01 0.5-0.6	18	240	<1	4	65	411	12	228	377	<0.1	47	<5	283	<0.5	<10	1880	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH01 1.4-1.5	8	80	2	<1	65	46	16	23	176	<0.1	68	<5	77	<0.5	<10	1850	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH02 0.5-0.6	13	160	<1	2	39	1850	10	167	622	<0.1	45	<5	345	<0.5	<10	970	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH02 1.4-1.5	10	40	2	<1	64	19	7	11	81	<0.1	25	<5	49	<0.5	<10	<50	<0.5	<0.1	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH03 0.5-0.6	307	580	<1	2	38	379	10	550	462	0.2	42	<5	436	<0.5	<10	690	1.5	----	0.3	<0.5	<0.5	<0.5	
31/05/2019	BH03 1.4-1.5	11	20	2	<1	58	23	11	15	69	<0.1	33	<5	57	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH04 0.5-0.6	18	50	<1	<1	7	86	4	119	187	<0.1	10	<5	136	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH04 1.4-1.5	10	20	2	<1	63	19	8	10	68	<0.1	25	<5	48	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH05 0.5-0.6	31	50	<1	<1	10	159	5	229	147	0.2	16	<5	206	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH05 1.4-1.5	8	20	2	<1	76	16	11	9	95	<0.1	31	<5	51	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH06 0.5-0.6	24	80	<1	<1	19	166	5	211	205	<0.1	21	<5	125	<0.5	<10	580	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH06 1.4-1.5	8	20	2	<1	64	18	8	11	64	<0.1	32	<5	52	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH07 0.5-0.6	48	160	<1	1	16	2280	9	364	461	2.3	35	<5	353	<0.5	<10	1130	3	<0.1	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH07 1.4-1.5	9	20	2	<1	66	22	19	11	100	<0.1	50	<5	65	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH08 0.5-0.6	40	60	<1	<1	6	62	4	74	120	<0.1	11	<5	63	<0.5	<10	110	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	BH08 1.4-1.5	12	30	1	<1	66	14	8	11	74	<0.1	25	<5	50	<0.5	<10	<50	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	Duplicate X	29	100	<1	<1	16	259	7	238	227	0.2	27	<5	158	<0.5	<10	760	<0.5	----	<0.2	<0.5	<0.5	<0.5	
31/05/2019	INTER LAB SPLIT X	20	70	<1	<1	18	179	6	191	213	<0.1	25	<5	112	<0.5	<10	440	<0.5	----	<0.2	<0.5	<0.5	<0.5	

Note: cyanide was also tested in two samples; BH01 1.4-1.5 results were non detect; and BH07 0.5-0.6 cyanide was measured at 2 mg/kg. Level 1 upper limit for cyanide is 32 mg/kg; therefore total cyanide can be classified as Level 1 material.

Table 19 Soil Analytical Results Compared Against IB105 Investigation Limits for soil Disposal – Leachable Fractions

Information Bulletin 105 **Classification and Management of Contaminated Soil For Disposal** **Leachable Fraction** *Italic/** - Based On Soil (Total) Limit **Bold** - Based On Leach Limit		Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Copper	Cobalt	Lead	Manganese	Mercury	Nickel	Selenium	Zinc	Aldrin + Dieldrin	DDT + DDD + DDE	Benzo(a)pyrene	C6 - C9 Fraction	C10 - C36 Fraction (sum)	Benzo(a)pyrene (TEQ)	Polychlorinated biphenyls (PCB's)	Benzene	Toluene	Ethylbenzene	Total Xylenes
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	µg/L			µg/L	µg/L	µg/L	µg/L	µg/L	µg/L
LOR		0.1	0.1	0.05	0.05	0.1	0.1		0.1	0.1	0.001	0.1	0.1	0.1	0.5	0.5	0.5			0.5	1	1	2	2	2
Investigation Level Selected																									
IB105 Level 1																									
IB105 Level 2		<0.5	<35	<1	<0.1	<0.5	<10		<0.5	<25	<0.01	<1	<0.1	<25	<3	<200	<0.5			<0.5	<1	<50	<1400	<3000	<5000
IB105 Level 3		0.5	35	1	0.1	0.5	10		0.5	25	0.01	1	0.1	25	3	200	0.5			0.5	1	50	1400	3000	5000
IB105 Level 4		5	350	4	0.5	5	100		5	250	0.1	8	1	250	30	2000	5				2	500	14000	30000	50000
31/05/2019	BH03 0.5-0.6	**<0.1**	*				*		*					*							----				
31/05/2019	BH07 0.5-0.6	*					**0.3**		*		*			*					*		<0.1				

Note:
Leachable fraction analysis will take precedence over soil analysis when calculating IB105 Limits.
There are no leachable fraction investigation limits for certain compounds eg. Cobalt, and therefore the solids limit is applied. Where solid Level 2 or greater exceedances are present, these are represented with a * in the sheet
Leachable fraction limits are not available for Level 1 classification, and therefore a minimum leachable fraction Level 2 limit is applied if the solid results exceed Level 1 guideline limits for solids, alternatively Level 1 is applied
Leachable fraction exceedances are represented with a bold and highlighted cell and Level 2 solid exceedances are defined with italics and bold highlighting
Where the benzo(a)pyrene (TEQ) limit is exceeded, the assessment is based on soil total limits



BH07 BH07

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	9	40
Barium	20	60
Beryllium	2	<1
Cadmium	<1	<1
Chromium Total	66	6
Copper	22	62
Cobalt	19	4
Lead	11	74
Manganese	100	120
Mercury	<0.1	<0.1
Nickel	50	11
Selenium	<5	<5
Zinc	65	63
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	110
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH05 BH05

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	8	24
Barium	20	80
Beryllium	2	<1
Cadmium	<1	<1
Chromium Total	76	19
Copper	16	166
Cobalt	11	5
Lead	9	211
Manganese	95	205
Mercury	<0.1	<0.1
Nickel	31	21
Selenium	<5	<5
Zinc	51	125
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	580
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH04 BH04

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	10	31
Barium	20	50
Beryllium	2	<1
Cadmium	<1	<1
Chromium Total	63	10
Copper	19	159
Cobalt	8	5
Lead	10	229
Manganese	68	147
Mercury	<0.1	0.2
Nickel	25	16
Selenium	<5	<5
Zinc	48	206
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	<50
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH02 BH02

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	10	307
Barium	40	580
Beryllium	2	<1
Cadmium	<1	2
Chromium Total	64	38
Copper	19	379
Cobalt	7	10
Lead	11	550
Manganese	81	462
Mercury	<0.1	0.2
Nickel	25	42
Selenium	<5	<5
Zinc	49	436
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	690
Sum of polycyclic ar	<0.5	1.5
Total Polychlorinate	<0.1	----
Benzene	<0.2	0.3
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH08 BH08

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	12	29
Barium	30	100
Beryllium	1	<1
Cadmium	<1	<1
Chromium Total	66	16
Copper	14	259
Cobalt	8	7
Lead	11	238
Manganese	74	227
Mercury	<0.1	0.2
Nickel	25	27
Selenium	<5	<5
Zinc	50	158
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	760
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH01 BH01

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	8	13
Barium	80	160
Beryllium	2	<1
Cadmium	<1	2
Chromium Total	65	39
Copper	46	1850
Cobalt	16	10
Lead	23	167
Manganese	176	622
Mercury	<0.1	<0.1
Nickel	68	45
Selenium	<5	<5
Zinc	77	345
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	1850	970
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

IB105 Based On Totals

Depth (m)	LOR	Level 1	Level 2	Level 3	Level 4
Arsenic	5	20	200	750	
Barium	10	300	3000	30000	
Beryllium	1	2	40	400	
Cadmium	1	3	40	400	
Chromium Total	2	50	500	5000	
Copper	5	100	2000	7500	
Cobalt	2	100	200	1000	
Lead	5	300	1200	3000	
Manganese	5	500	5000	25000	
Mercury	0.1	1	30	110	
Nickel	2	60	600	3000	
Selenium	5	10	50	200	
Zinc	5	200	14000	50000	
Benzo(a)pyrene	0.5	0	2	20	
C6 - C9 Fraction	10	65	650	1000	
C10 - C36 Fraction (sum)	50	1000	5000	10000	
Sum of polycyclic aromatic hydrocarbons	0.5	20	40	200	
Total Polychlorinated biphenyls	0.1	2	20	50	
Benzene	0.2	1	5	50	
Toluene	0.5	1	100	1000	
Ethylbenzene	0.5	3	100	1080	
Total Xylenes	0.5	14	180	1800	

BH06 BH06

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	8	48
Barium	20	160
Beryllium	2	<1
Cadmium	<1	1
Chromium Total	64	16
Copper	18	2280
Cobalt	8	9
Lead	11	364
Manganese	64	461
Mercury	<0.1	2.3
Nickel	32	35
Selenium	<5	<5
Zinc	52	353
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	1130
Sum of polycyclic ar	<0.5	3
Total Polychlorinate	----	<0.1
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

BH03 BH03

IB105 Based On Totals

Depth (m)	0.5	1.4
Arsenic	11	18
Barium	20	50
Beryllium	2	<1
Cadmium	<1	<1
Chromium Total	58	7
Copper	23	86
Cobalt	11	4
Lead	15	119
Manganese	69	187
Mercury	<0.1	<0.1
Nickel	33	10
Selenium	<5	<5
Zinc	57	136
Benzo(a)pyrene	<0.5	<0.5
C6 - C9 Fraction	<10	<10
C10 - C36 Fraction (s	<50	<50
Sum of polycyclic ar	<0.5	<0.5
Total Polychlorinate	----	----
Benzene	<0.2	<0.2
Toluene	<0.5	<0.5
Ethylbenzene	<0.5	<0.5
Total Xylenes	<0.5	<0.5

Figure 9 IB105 Exceedances in Soil Across the Site
Note leachate testing for BH03 0.5-0.6 (Arsenic) and BH07 0.5-0.6 (Copper) confirmed the material can be reclassified as Level 2 Material.

12 CONCEPTUAL SITE MODEL

12.1 Primary Sources of Contamination

12.1.1 Confirmed Primary Source

Primary sources of contamination have been identified on site as the following:

- Former rail line that intersected the site;
- Storage of rail carts on site;
- Former refuelling infrastructure north of the investigation area, two USTs.

No other potential upgradient primary sources of contamination have been identified. Groundwater was not encountered.

12.1.2 Potential Primary Sources

There may be unknown potential sources of onsite impact (outside of the sampling areas) which GES are unaware of and therefore have not been investigated at this time.

12.1.3 Contaminates of Potential Concern

Contaminants of potential concern associated with these potential sources include hydrocarbons and heavy metals.

12.2 Secondary Sources of Contamination

Secondary source contamination includes impacted soil, groundwater, surface water and vapour which may originate from a primary source. Secondary sources may have a direct pathway linkage to receptors of interest.

12.2.1 Confirmed Secondary Source

No offsite (outside the footprint of proposed Building 3) sampling has been conducted, and therefore there is no confirmed offsite secondary sources of contamination. Note groundwater was not encountered therefore this is an unknown risk.

12.2.2 Potential Secondary Source

There is the potential that the offsite aquifer comprises a secondary source of hydrocarbon contamination. Soil in contact with any impacted groundwater may also comprises a secondary source.

12.3 Transport Mechanisms and Exposure Pathways

Transport Mechanisms considered as part of the CSM are presented in Figure 10 and include:

- Wind erosion/ dispersion
- Stormwater/ surface runoff
- Leaching of heavy metals from the soil
- Volatile hydrocarbon vapours sourcing from contaminated groundwater.

Exposure Pathways considered at the site are presented in Figure 10 and include:

- Dermal contact
- Dust Inhalation and Soil Ingestion
- Vapour intrusion; and
- Stormwater drains.

12.4 Potential Receptors

The following presents a summary of all potential receptors considered in the assessment.

12.4.1 Potential Ecological Receptors

There are no onsite ecological receptors. The following offsite ecological receptors have been identified:

- North Esk River, approximately 200m to the east of the investigation area which feeds into the River Tamar.

Stormwater is identified as a likely pathway to these receptors. A risk to the waterways is likely through uncontrolled/unmanaged release of site groundwater into the stormwater system.

12.4.2 Potential Human Receptors

Potential current and future onsite human receptors are depictured in Figure 10 and discussed in Table 20.

Table 20 Explanatory Notes Regarding Potential Receptors

Medium	Specific Receptor	Exposure risk/ Management Strategies
Soil Impact (shallow 0-1m)	Current Commercial Workers	No risk to current commercial workers in surrounding buildings as under regular circumstances have no opportunity to come in contact with soil as the site is a sealed carpark.
	Future construction workers and trench workers	Limited contamination has been identified in the soil. As a precautionary measure a Contamination Management Plan (CMP) should be developed to manage soil and water on the site during the site redevelopment.
	Future onsite inhabitants - commercial workers (University Students visiting during the day only)	It is assumed that once the site redevelopment has been completed the contaminated material will be either removed and or sealed by a concrete floor level 1 of Building 3, thus mitigating the soil contact risk to future site users. No soil HSL exceedances and no vapour risk to onsite users was not identified
	Off-site Human Receptors during the construction phase	Neighbouring human receptors - University Students visiting during the day only – no Dermal contact risk. HIL's dust inhalation and soil ingestion risk will be managed with the CMP.
	Off Site Ecological receptors	As there were ESL/ EIL exceedances identified at the site, there is a risk of impacted soil and water entering the stormwater system through site erosion. This will need to be managed through a dedicated CMP.
Soil Impact (deep >1m)	Future construction workers and trench workers	Limited contamination has been identified in the soil and no risk to construction workers or trench workers has been identified.
	Future onsite inhabitants - commercial workers	It is assumed that once the site redevelopment has been completed the contaminated material will be either removed and or sealed by a concrete floor level 1 of Building 3, thus mitigating the soil contact risk to future site users. A vapour risk to onsite users was not identified
Groundwater Impact	Not identified	Groundwater not intercepted. Hydrocarbon contamination in groundwater is not expected as deeper soil samples at 1.5-1.6m bgs were generally free from hydrocarbons. There is the potential for heavy metals to be present in the groundwater, but this will not pose a risk to human health.

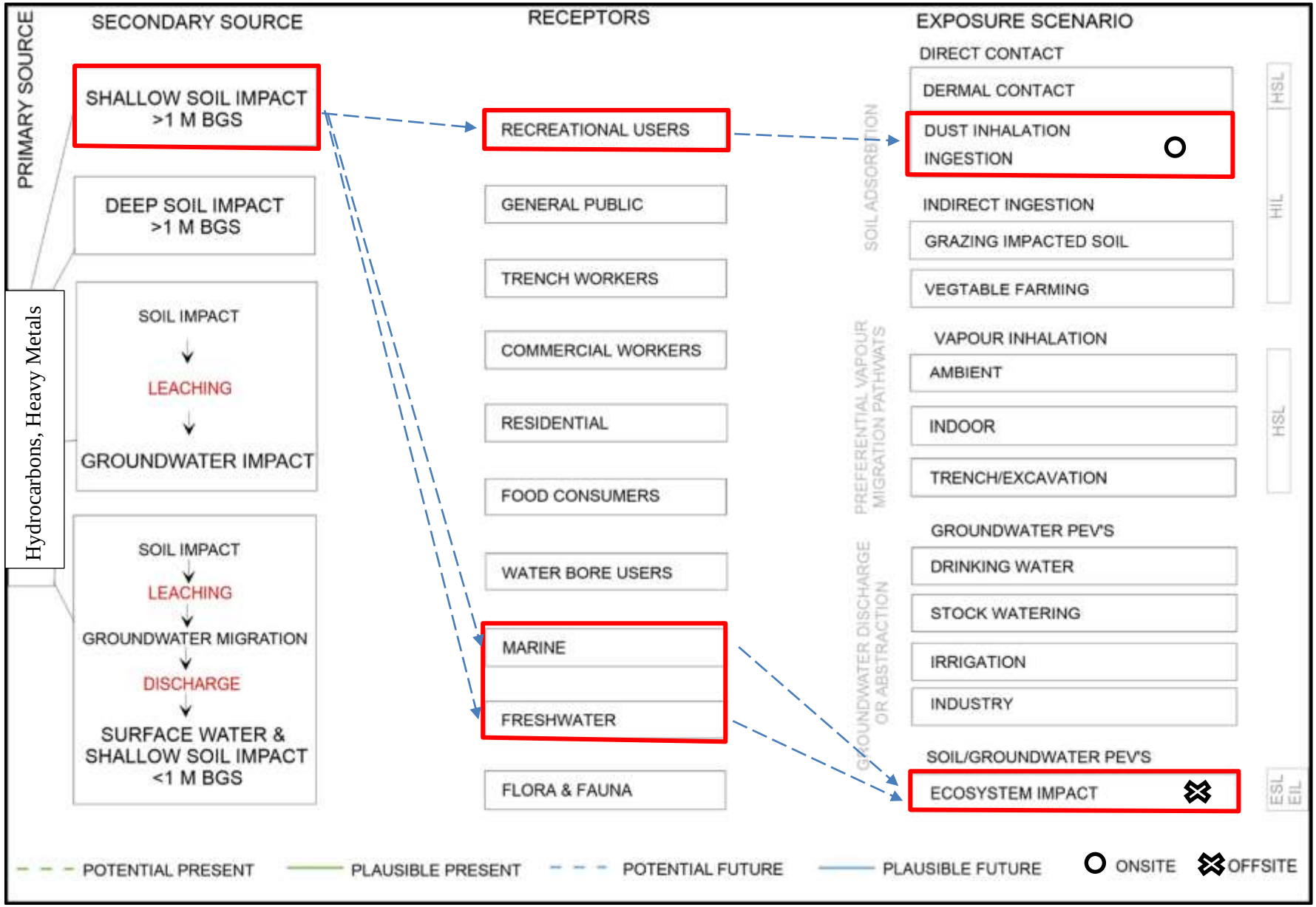


Figure 10 Conceptual Site Model

It is assumed, the soil exposure risk will only be present during the construction phase of the site redevelopment as the site is currently sealed. Post construction, any human exposure risk associated with soil impact will be dramatically reduced once the source of the contamination has been removed or sealed beneath the building.

13 CONCLUSIONS

13.1 Site History

The following can be summarised about the site history:

- The site is a low-lying area, 2-3m ASL, that formally hosted the AN TASRAIL Inveresk Railyards. Estuarine deposits underly the site overlaid with fill from 0.3-1.2m thick.
- Former potentially contaminating activities in the localised area surrounding the proposed footprint of Building 3 relate to former rail path that went across the investigation area and two former underground storage tanks (USTs) were situated approximately 20 m north of the footprint.
- The following contaminants of potential concern (COPC) are associated with hosting a railyards and have been confirmed elsewhere across the site: Total Petroleum/Recoverable Hydrocarbons (TPH/TRH); Volatile monoaromatic hydrocarbons: Benzene, Toluene, Ethylbenzene, Xylene (BTEX) and derivatives; Polycyclic Aromatic Hydrocarbons (PAH) including Benzo(a)pyrene (B(a)p) and heavy metals, in particular; antimony; arsenic; cadmium; chromium; copper; lead; mercury, tin; and zinc. Plus, chlorinated hydrocarbons including polychlorinated Biphenyls (PCB's); phenolic compounds including chlorophenols; acid or alkaline conditions; volatile organohalides including methylene chloride; cyanides and asbestos.
- It was noted that the centre of the investigation area has previously had contaminated fill removed (SEMF, 1995).

13.2 Adopted Land Use Settings

The following investigation limits/guidelines were adopted for the site for the proposed development:

- Ecosystem – the following guidelines were adopted:
  - Soil – Primarily urban residential and open spaces EILs and ESLs
- Current users:
  - HSL C open spaces
  - HSL D for vapour intrusion risk to trench & maintenance workers
- The period during site development works:
  - HSL D for vapour intrusion risk to onsite commercial workers;
  - CRC CARE for assessing dermal contact risk to onsite commercial workers;
  - HIL D for assessing dust inhalation and soil ingestion risk to onsite commercial workers; and
  - HIL C for assessing dust inhalation and soil ingestion risk to offsite land use receptors;
- Contamination exposure to trench workers:
  - HSL D for vapour intrusion risk based on commercial land use;
  - Trench worker guidelines for assessing dermal contact risk; and
  - HIL D for assessing dust inhalation and soil ingestion risk
- Future land users access to soil – there will be no access to soil as the proposed development will cover the entire footprint, with the exceptions of an indigenous garden at the entrance to the building:
  - HIL D for soil ingestion and inhalation;
  - CRC CARE for dermal contact; and
  - HSL D for indoor vapour inhalation risk – for commercial site users – Note the concrete floor will act as a barrier plus not risk identified.

It is anticipated that limited excavations will extent to 0.5m below ground surface to account for the removal of the existing carpark plus the service trenches, lift and stair footprints.

13.3 Soil Assessment

The following conclusions have been made from the soil investigation in the footprint of building 3:

- Shallow soil (0.5-0.6 m bgs) hydrocarbon contamination was confirmed in most boreholes and only exceeding ecological screening levels for TPH Fractions C^{16}-C^{34} in Borehole # 1 and to a greater depth in this hole. It is assumed that the worst of the contaminated material has already been removed. As a precaution this should be managed in the CMP.

- TPH Fractions C^{16}-C^{34} are indicative of diesel, oils or older degraded fuels.
- There was an absence of volatile hydrocarbons which rules out a risk to indoor vapour risk, a risk to trench workers and/ or a dermal contact risk to construction workers.
- There were some slightly elevated levels of metals detected. There were four shallow samples that has ecological investigation levels exceedances for copper zinc and arsenic.
- There were no health investigation level exceedances for land use D Commercial and Industrial. There was one health investigation level exceedances for land use C recreational use, this was for Arsenic at 0.5-0.6m bgs in BH03.
- Groundwater was not encountered even though boreholes were 2.2-2.4m above sea level with the North Esk River, approximately 200m to the east of the investigation area.
- For reference for future proposed excavation works material tested at the site was compared against *Information Bulletin 105* guidelines. Post leachate testing all the material was classified as Level 1 (clean fill) or Level 2 Material (low level contaminated soil).
- The following trends were observed in the soil results:
    - Shallow samples; 0.5-0.6m bgs had consistently higher levels of Arsenic, Copper and Zinc;
    - Deeper samples; 1.5-1.6m bgs has consistently higher levels of Beryllium and Chromium;
    - BH01 and BH07 had the highest levels of hydrocarbons and to a lesser extent but noticeably BH02.

14 RECOMMENDATIONS

GES considers that substantial data regarding the site contamination has been acquired during the invasive site assessment and recommends the following work should be undertaken to mitigate risk during and post construction at the site;

- A Contamination Management Plan (CMP) must be prepared and implemented at the beginning of the redevelopment phase of work; all construction workers and trench workers should be informed of the contamination at the site during their site induction.
- The CMP will include but not be limited to the following:
    - Soil management considerations including dust, wind, and water erosion in terms of human health and the environment;
    - Consideration to the duration of stockpile exposure and physical barriers to stockpiles plus standard building site security fencing
    - Classification and management advice in accordance with EPA IB105.
    - If the site is to be excavated below the water table, consideration need to be given to removing the risk of a release of hydrocarbon/ heavy metal impact water into the stormwater system.
- Clean soil be imported to site for the proposed Indigenous Garden Bed as this is the area most likely for human receptors to have contact with the soil at the site.

This investigation only investigated the area of the proposed footprint of Building 3. If the design of the proposed development is altered, then there may be a requirement to assess the soil results against alternative guidelines or conduct further site investigations outside the current proposed footprint.

14.1 Statement of Suitability

The findings from the desktop investigation and results from the invasive soil investigation confirm that contamination at the site should not pose a risk to Human Health or the Environment (ecosystems) providing the above recommendations are followed. No further contamination remediation or management measures will be required during the site redevelopment works.

Yours faithfully,

Sarah Joyce BSc (Hons)

Environmental Geologist

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LIMITATIONS STATEMENT

This ESA Report has been prepared in accordance with the scope of services between Geo-Environmental Solutions Pty. Ltd. (GES) and *John Wardle Architects* ('the Client') on behalf of their client. To the best of GES's knowledge, the information presented herein represents the Client's requirements at the time of printing of the Report. However, the passage of time, manifestation of latent conditions or impacts of future events may result in findings differing from that described in this Report. In preparing this Report, GES has relied upon data, surveys, analyses, designs, plans and other information provided by the Client and other individuals and organisations referenced herein. Except as otherwise stated in this Report, GES has not verified the accuracy or completeness of such data, surveys, analyses, designs, plans and other information.

The scope of this study does not allow for the review of every possible soil and groundwater contaminant over the whole area of the site. Samples collected from the investigation area are assumed to be representative of the areas from where they were collected and indicative of the contamination status of the site at that point in time. The conclusions described within this report are based on these samples, the results of their analysis and an assessment of their contamination status.

This report does not purport to provide legal advice. Readers of the report should engage professional legal practitioners for this purpose as required.

No responsibility is accepted for use of any part of this report in any other context or for any other purpose by third party.

Appendix 1 GES Staff

GES is a specialist geotechnical and environmental consultancy providing advice on all aspects of soils, geology, hydrology, and soil and groundwater contamination across a diverse range of industries.

Geo Environmental Solutions Pty Ltd:

- ACN – 115 004 834
- ABN – 24 115 004 834

GES STAFF - ENGAGED IN SITE INVESTIGATION WORKS

Dr John Paul Cumming B.Agr.Sc (Hons) Phd CPSS GAICD

- Director
- PhD in Environmental Soil Chemistry from the University of Tasmania in 2007
- 18 years' experience in environmental contamination assessment and site remediation.

Ms Sarah Joyce BSc (Hons)

- Environmental Geologist
- Honours in Geography and Environmental Science at the University of Tasmania in 2003;
- Undergraduate Degree Double Major in Geology and Geography & Environmental Science
- 15 years professional work experience and 7 years contaminated site assessment

Mr Grant McDonald (Adv. cert. hort.)

- Soil Technician
- 10 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater.

GES STAFF – WITH CONTAMINATED SITES EXPERIENCE

Mr Kris Taylor Bsc (Hons)

- Senior Environmental & Engineering Geologist
- Honours in Environmental Geology at the University of Tasmania in 1998
- 20 years' experience in environmental contamination assessments and hydrogeology (including honours in mine site tailing pollution assessment). Including 15 years' experience in asbestos assessment.

Mr Aaron Plummer(Cert. IV)

- Soil Technician
- 5 years' experience in hydrocarbon and heavy metal contamination sampling of soils and groundwater.

Mr Mark Downie B.Agr.Sc (Hons)

- Soil Scientist
- 8 Year experience in contamination assessment and reporting of soils and groundwater.

Ms Peri Lucas B.Agr.Sc (Hons)

- Soil Scientist
- 2 Year experience in contamination assessment and reporting of soils and groundwater.

Appendix 2 Architects Plans

VIEW FROM NORTH WEST

DETAIL VIEW FROM NORTH WEST - COLONNADE

VIEW FROM WEST

VIEW FROM SOUTH WEST

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Project: UTAS INVERESK CAMPUS
LIBRARY & STUDENT SERVICES BUILDING

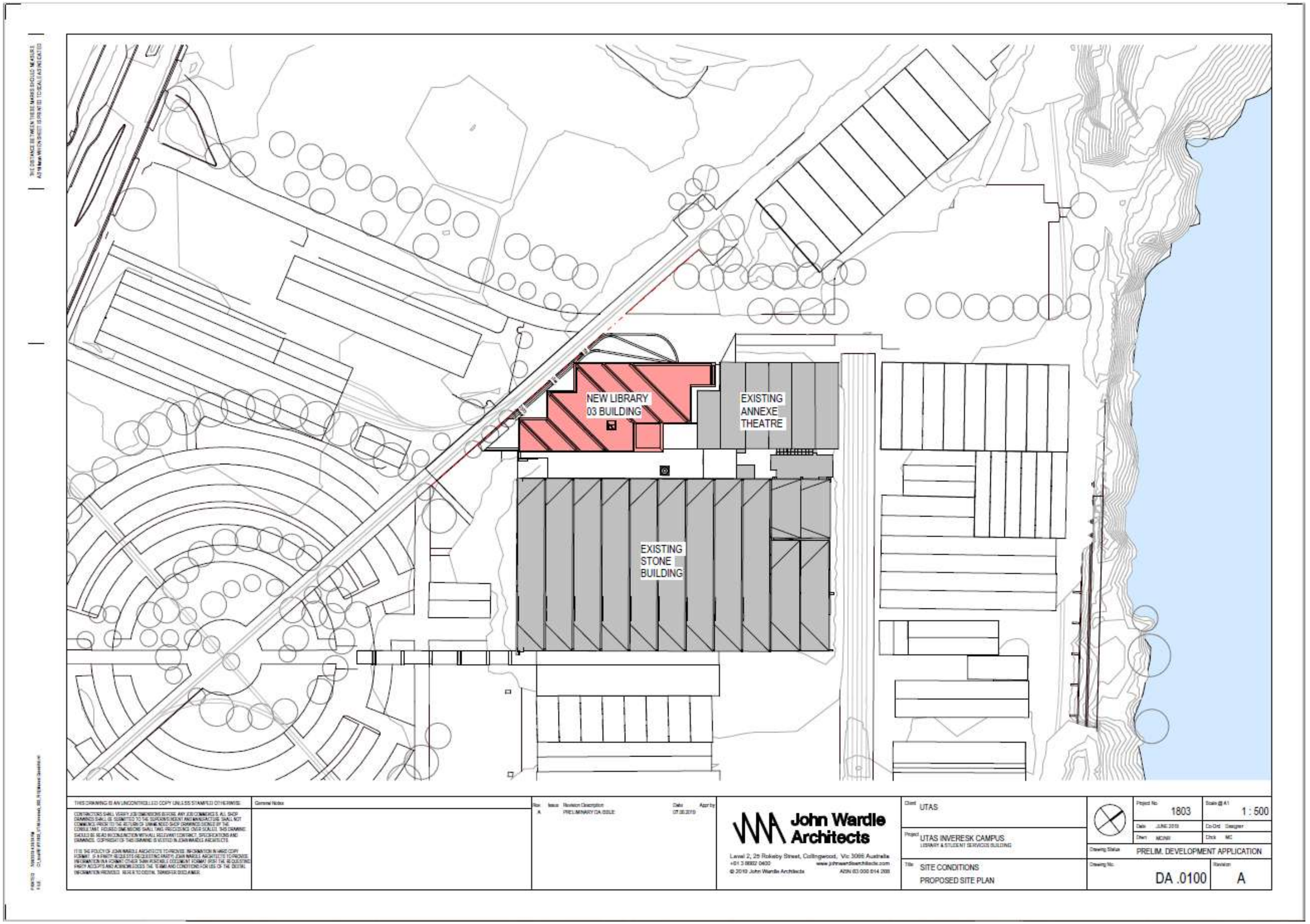
Title: 3D VIEWS
RENDERS

Project No: 1803
Date: JUNE 2019
Drawn: MC/NS
Checked: MC
Co-Ord: Designer
Scale @ A1

Drawing Status: PRELIM. DEVELOPMENT APPLICATION

Drawing No: DA .0001

Revision: A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SITE CONDITIONS
PROPOSED SITE PLAN
Project No.
1803
Scale @ A1
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Co-Ord
Designer
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DA .0100
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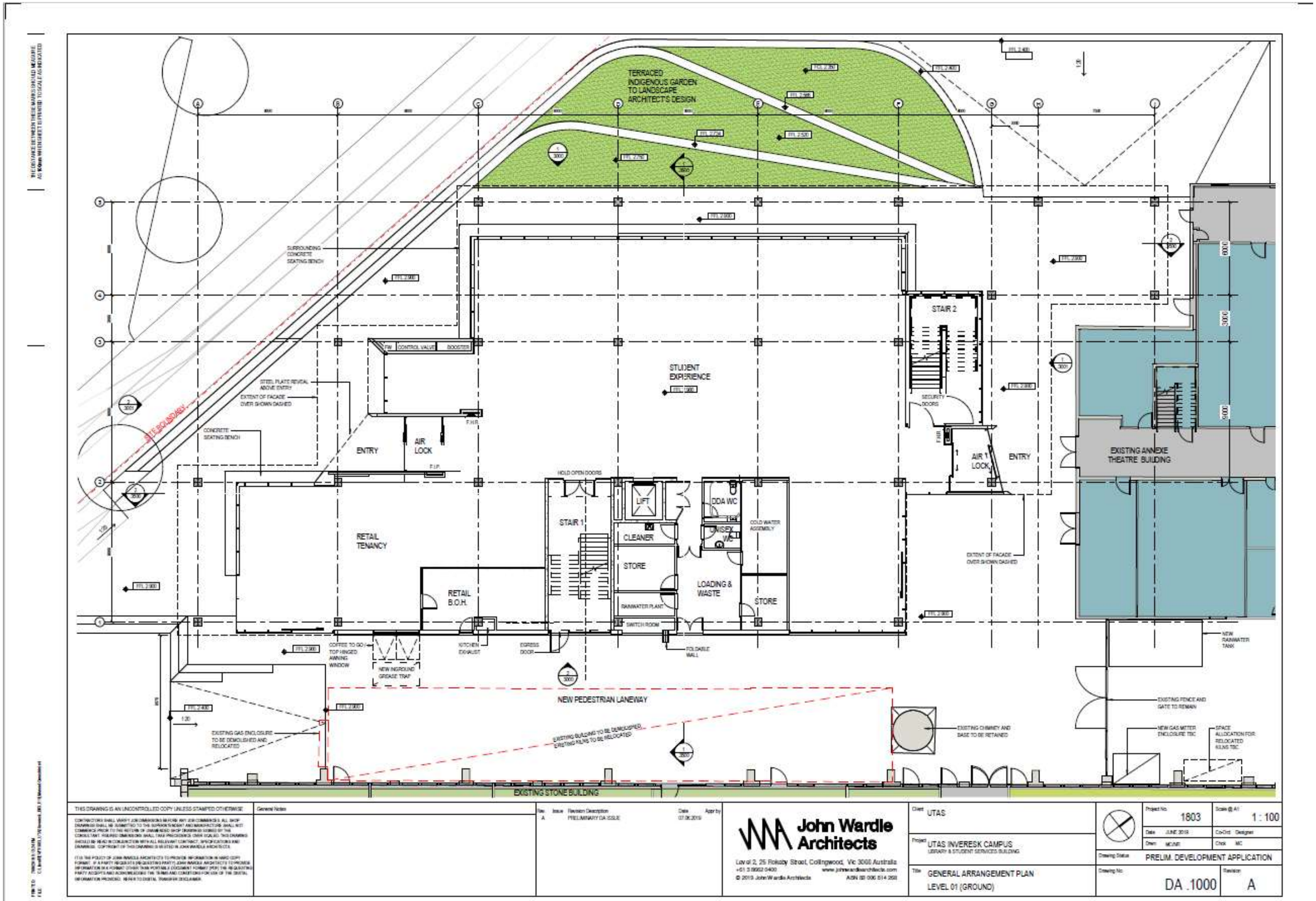
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STEEL PLATE REVEAL ABOVE ENTRY
EXTENT OF FACADE OVER SHOWN DASHED
CONCRETE SEATING BENCH
STEEL SUNSHADE
ENTRY
AIR LOCK
FW
CONTROL VALVE
BOOSTER
STUDENT EXPERIENCE
STAIR 2
SECURITY DOORS
AIR LOCK
ENTRY
EXISTING ANNEXE THEATRE BUILDING
HOLD OPEN DOORS
STAIR 1
LIFT
CLEANER
STORE
RAINWATER PLANT
SWITCH ROOM
ODA WC
UNISEX WC
COLD WATER ASSEMBLY
LOADING & WASTE
STORE
FOLDABLE WALL
RETAIL TENANCY
RETAIL B.O.H.
EXTENT OF FACADE OVER SHOWN DASHED
NEW RAINWATER TANK
COFFEE TO GO / TOP HINGED AWNING WINDOW
NEW INGROUND GREASE TRAP
KITCHEN EXHAUST
EGRESS DOOR
NEW PEDESTRIAN LANEWAY
EXISTING FENCE AND GATE TO REMAIN
EXISTING GAS ENCLOSURE TO BE DEMOLISHED AND RELOCATED
EXISTING BUILDING TO BE DEMOLISHED EXISTING KILNS TO BE RELOCATED
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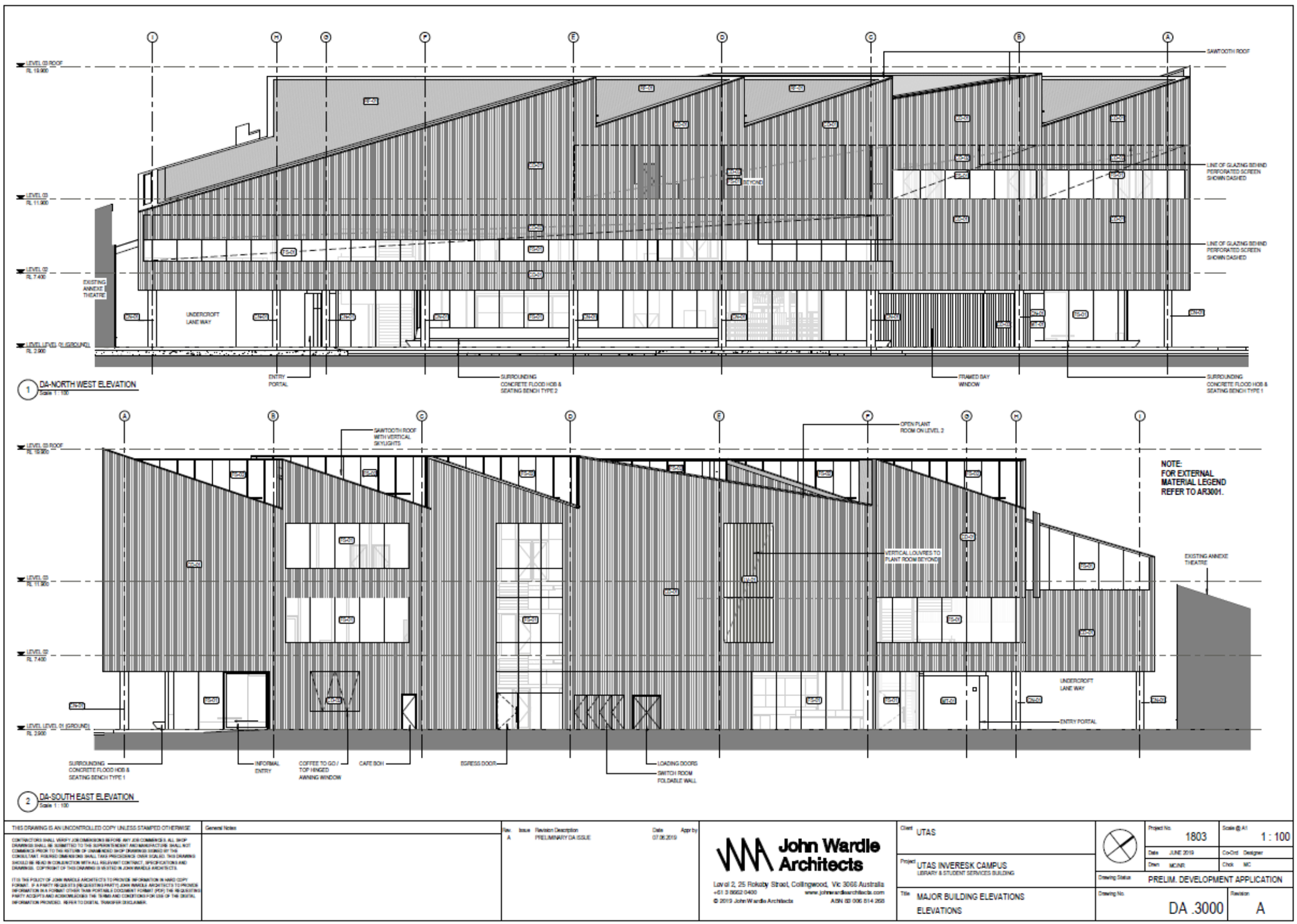
Client UTAS
Project UTAS INVERESK CAMPUS
LIBRARY & STUDENT SERVICES BUILDING
Title GENERAL ARRANGEMENT PLAN
LEVEL 01 (GROUND)
Project No. 1803
Scale @ A1 1 : 100
Date JUNE 2019
Co-Ord Designer
Drawn MC/AR
Chck MC
Drawing Status PRELIM. DEVELOPMENT APPLICATION
Drawing No. DA .1000
Revision A


LEVEL 03 ROOF
RL 19.900
LEVEL 03
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LEVEL 02
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LEVEL LEVEL 01 (GROUND)
RL 2.900
SAWTOOTH ROOF
LINE OF GLAZING BEHIND PERFORATED SCREEN SHOWN DASHED
LINE OF GLAZING BEHIND PERFORATED SCREEN SHOWN DASHED
EXISTING ANNEXE THEATRE
UNDERCROFT LANE WAY
ENTRY PORTAL
SURROUNDING CONCRETE FLOOD HOB & SEATING BENCH TYPE 2
FRAMED BAY WINDOW
SURROUNDING CONCRETE FLOOD HOB & SEATING BENCH TYPE 1
1 DA-NORTH WEST ELEVATION
Scale 1 : 100
SAWTOOTH ROOF WITH VERTICAL SKYLIGHTS
OPEN PLANT ROOM ON LEVEL 2
NOTE:
FOR EXTERNAL MATERIAL LEGEND REFER TO AR3001.
VERTICAL LOUVRES TO PLANT ROOM BEYOND
EXISTING ANNEXE THEATRE
UNDERCROFT LANE WAY
ENTRY PORTAL
SURROUNDING CONCRETE FLOOD HOB & SEATING BENCH TYPE 1
INFORMAL ENTRY
COFFEE TO GO / TOP HINGED AWNING WINDOW
CAFE BOH
EGRESS DOOR
LOADING DOORS
SWITCH ROOM FOLDABLE WALL
2 DA-SOUTH EAST ELEVATION
Scale 1 : 100
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Client UTAS
Project UTAS INVERESK CAMPUS
LIBRARY & STUDENT SERVICES BUILDING
Title MAJOR BUILDING ELEVATIONS
ELEVATIONS
Project No. 1803
Scale @ A1 1 : 100
Date JUNE 2019
Co-Ord Designer
Drawn MC/NR
Chck MC
Drawing Status PRELIM. DEVELOPMENT APPLICATION
Drawing No. DA .3000
Revision A

Appendix 3 EPA Documentation

Level 7, 134 Macquarie Street, Hobart TAS
GPO Box 1550, Hobart, TAS 7001 Australia

Enquiries: Contaminated Sites Unit
Phone: (03) 6165 4599
Email: contaminatedsites@epa.tas.gov.au
Web: www.epa.tas.gov.au
Our Ref: (EN-EM-AV-100706_39: M445836) sma

ENVIRONMENT PROTECTION AUTHORITY

24 April 2019

Ms Sarah Joyce
Geo-Environmental Solutions
sjoyce@geosolutions.net.au

Dear Ms Joyce

PROPERTY INFORMATION REQUEST
2 Invermay Road, Invermay
Certificate of Title: 174633/2

On 26 March 2019, the Contaminated Sites Unit received your Property Information Request relating to the land referred to above (the Site). A search of relevant databases and records has been undertaken.

The Site historically hosted the Launceston railyards and workshops, Pioneer Concrete works, and sporting grounds. It now hosts the Launceston Showgrounds, Queen Victoria Museum and the University of Tasmania (UTAS) Inveresk Campus.

EPA Tasmania has numerous volumes of documents regarding the redevelopment and repurposing of the Site during the 1990s. These include, but are not limited to:

- *Environmental Audit - Inveresk Railway Workshops Redevelopment project Launceston Tasmania for Launceston City Council Volume 1: Site History,* dated February 1992, prepared by Dames and Moore
- *Queen Victoria Museum and Art Gallery - Inveresk Railyard Redevelopment – Contamination Assessment Report – Land*, dated June 1999, prepared by SEMF
- *Queen Victoria Museum and Art Gallery - Inveresk Railyard Redevelopment – Contamination Assessment Report – Buildings*, dated June 1999, prepared by SEMF
- *Launceston City Council August 1999 York Park Environmental Site assessment,* prepared by SKM
- *Department. of State Development - Inveresk Railyard Redevelopment Project - Site Management Plan*, dated August 2000, prepared by SEMF

In March 2019, EPA Tasmania approved the transport of 4200m^3 of low-level contaminated (Level 2) soil from UTAS Stadium to the Launceston Waste Centre.

No further records relating to contamination or potentially contaminating activities at the Site were found. The following records relating to neighbouring properties:

129-139 Invermay Road

- Historic WorkSafe Tasmania (WST) records indicate that dangerous goods were stored in underground storage tanks (USTs) at the property between 1949 and 1960. The record refers to WST file number N27.
- EPA Tasmania received notification in September 1999 of an incident at the Mobil Service Station having the potential to cause harm. Approval to remove the contaminated soil to the Launceston Waste Centre was given in 2000.

- Currently the property hosts a United Petroleum Service Station with four active UPSS with a total volume of 85,000L.

103 Invermay Road

- Six UPSS were registered at the Coles Express Service station in September 2010. EPA Tasmania received advice that three Underground Storage Tanks were removed and another decommissioned in situ at the property in November 2011 due to leaking.
- Remediation Notice 8655/1 (RN) was issued in July 2013 to require further works to address petroleum hydrocarbon contamination in groundwater and vapour risk concerns. The RN was revoked in November 2014.
- EPA Tasmania hold several documents regarding this property. The most recent is:

  Environmental Site Assessment - Coles Express Invermay Service Station - 103 Invermay Road Invermay, dated 31 March 2014, prepared by ERM

3-11 Dry Street

- Three UPSS were registered at the Caltas Petrol Station in June 2010.
- A decommissioning form stated that two UPSS were removed in December 2015.

32-38 Invermay Road

- Four UPSS with a total volume of 89,000L are registered at the Caltas service station.

1-19 Lindsay Street (Scottsdale Levee)

- Site Management Notice 8655/1, relating to the burial of approximately 300 m^3 of hydrocarbon contaminated Soil, is registered on the property.
- EPA Tasmania holds the following report regarding the contaminated soil:

  Summary Report - Burial of PAH Contaminated Soil Scottsdale Levee, dated October 2011, prepared by Pitt and Sherry

No other records relating to contamination or potentially contaminating activities at adjacent properties were found.

The search of records is restricted to those held by EPA Tasmania and includes records relating to: The *Environmental Management and Pollution Control (Underground Petroleum Storage Systems) Regulations 2010;* Industrial Sites (which are or have been regulated by EPA Tasmania); historical landfills; and contamination issues reported to the Contaminated Sites Unit. In addition, the Incidents and Complaints database and records relating to the historical storage of dangerous goods (as detailed below) are searched.

WorkSafe Tasmania (1300 366 322 or wstinfo@justice.tas.gov.au) may have issued dangerous goods licences and/or may hold relevant records for the Site and adjoining properties. As the storage of dangerous goods/fuels is an environmentally relevant activity, you may wish to contact them for further information.

Please note that the dangerous goods licensing records referred to by EPA Tasmania are for sites with underground storage tanks that ceased holding Dangerous Goods Licences prior to 1993. WorkSafe Tasmania hold the records for these Licences after 1993.

EPA Tasmania does not hold records on all sites that are or may be contaminated. You should consider obtaining a site history to determine the likelihood of contamination. If contamination on the Site or an adjacent property is considered likely, further assessment by a competent environmental assessment practitioner is recommended. Site assessments should be conducted in accordance with the *National Environment Protection (Assessment of Site Contamination) Measure 1999*, National Environment Protection Council (or as varied). http://epa.tas.gov.au/regulation/contaminated-sites/identification-and-assessment-of-contaminated-land/contaminated-site-assessment

Please note since 1 July 2015, the Director has required all environmental site assessments and reports submitted to the Contaminated Sites Unit for consideration to be prepared by a person certified as a specialist contaminated sites consultant under a scheme approved by the Director. Effective 30 June 2018, the endorsed scheme is operated by Certified Environmental Practitioners (CEnvP): Consultants certified under this scheme are approved to use the seal **CEnvP Site Contamination**. https://www.cenvp.org. Further details are available at: http://epa.tas.gov.au/regulation/contaminated-sites/identification-and-assessment-of-contaminated-land/engaging-a-contaminated-site-assessment-consultant.

As local councils are able to issue Environment Protection Notices, Environmental Infringement Notices and record complaints, you may wish to contact them for additional information that may be relevant to the site. Further, if the Site has historically been subject to a permit under the *Land Use Planning and Approvals Act 1993*, the Council would have issued the permit.

Under the *Right to Information Act 2009* (RTI Act), you are entitled to apply for any records mentioned within this letter such as reports, letters, or other relevant documents. For further information on how the RTI process works and how to request information under the RTI Act please visit the Department of Primary Industries, Parks, Water and Environment website.

If you are purchasing a property, you should consider Part 5A of the *Environmental Management and Pollution Control Act 1994* (EMPCA) which defines and specifies requirements for managing contaminated sites. If there is reason to believe the site is, or is likely to be, contaminated there are certain requirements that you must meet (e.g. notification of a likely contaminated site to the Director, EPA as outlined in section 74B of the EMPCA).

Although all due care has been taken in the preparation of this letter, the Crown gives no warranty, express or implied, as to the accuracy or completeness of the information provided. The Crown and its servants or agents accept no responsibility for any loss or damage arising from reliance upon this letter, and any person relying on the letter does so at their own risk absolutely.

If you have any queries in relation to the matters above, please contact the Contaminated Sites Unit using the details at the head of this correspondence or refer to the EPA website at www.epa.tas.gov.au and click on 'Regulation' to locate information on Underground Fuel Tanks and Contaminated Sites.

As you are aware, property searches incur a charge of $237.00. An invoice will be emailed as instructed. If you require this letter and invoice posted, please advise the Contaminated Sites Unit.

Yours sincerely

Bruce Napier
ENVIRONMENTAL OFFICER - CONTAMINATED SITES

Invoice: Miran Shoemark

Email: Miran@geosolutions.net.au

3

Appendix 4 Historical Aerial Photographs

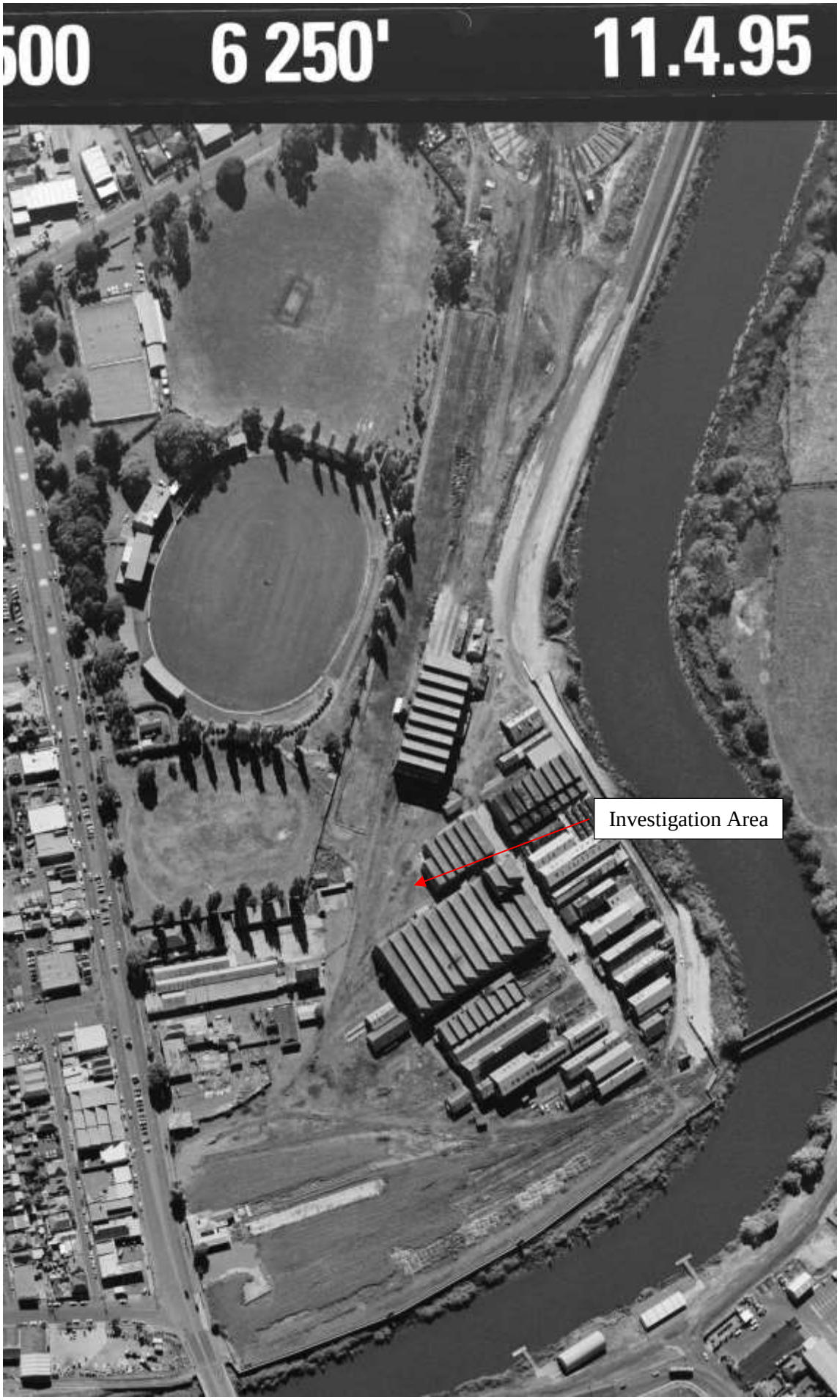
9 Jan 2016

15 Feb 2013

12 January 2008 (Google Earth)

2006 Launceston Historical Aerial

2006 Historical Aerial Photograph – close up of Building 3



1995 Historical Aerial Photograph – Former rail yards site

1995 Historical Aerial Photograph – Close up

1984 Historical Aerial Photograph – Former rail yards site

1984 Historical Aerial Photograph – Close up

1978 Historical Aerial Photograph – Former rail yards site

1978 Historical Aerial Photograph – Close up

1956 Historical Aerial Photograph – Former rail yards site

Appendix 5 Site Photographs


3

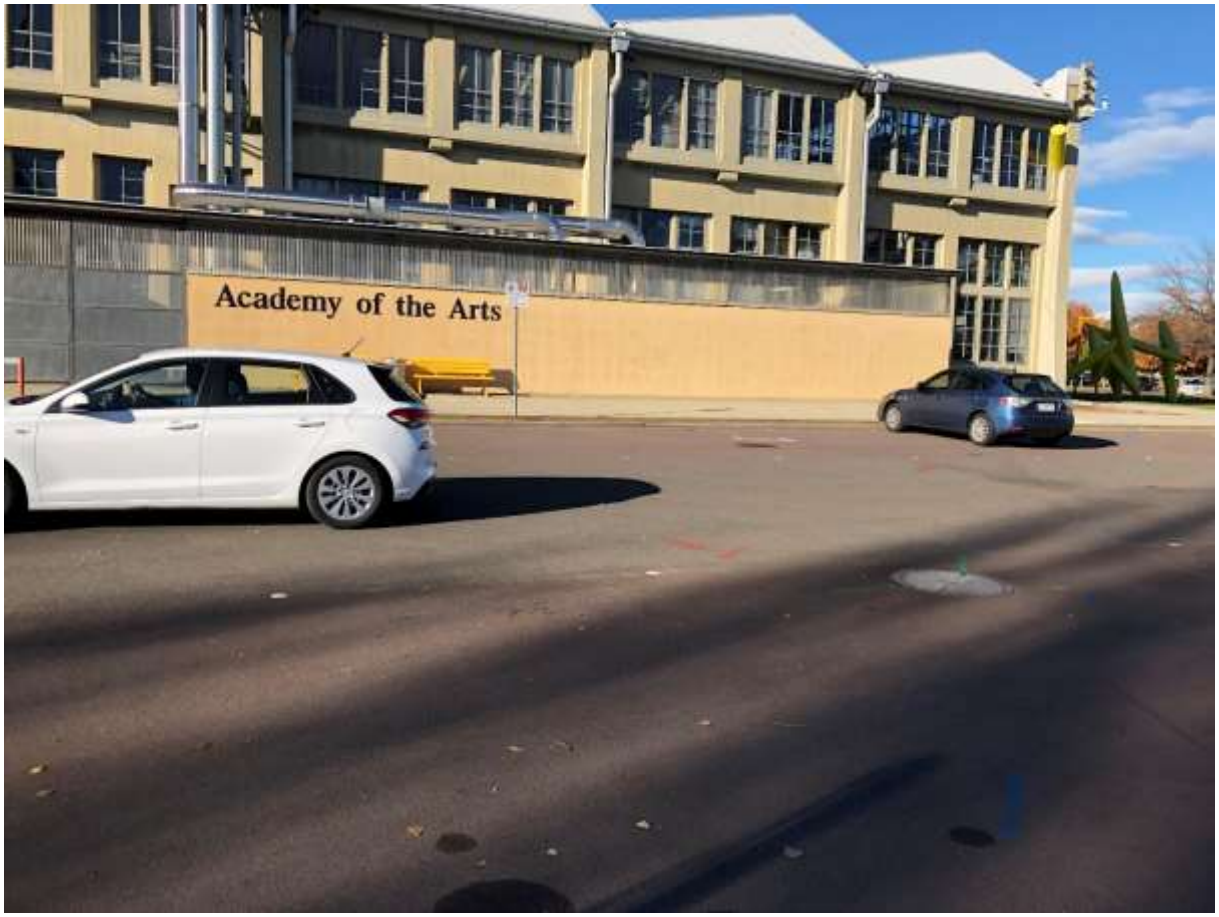

GES


GES


GES


4


Annexe
GES


Academy of the Arts

Appendix 6 PID Calibration Record

imbros

Imbros Pty Ltd
ABN 29 009 525 053
1059 Cambridge Road, Cambridge
Tasmania Australia 7170

Phone (03) 6214 1500
Fax (03) 6214 1555
info@imbros.com.au

Calibration Test Certificate
29/01/2019 16:05:00 PM

Device					
Serial Number:	590-902123		Device Type:		MiniRAE Lite
Manufacturer:	RAE Systems		Next Cal Due:		28/07/2019
Test Result	Pass				
Sensors					
Type:	ISO				
Result:	Pass				
Final Reading:	50%				
Next Calibration Due:	28/07/2019				
Set Points					
Type:	ISO				
High Alarm:	10.00%				
Low Alarm:	5.00%				
TWA Alarm:					
STEL Alarm:					
Options					
Datalog Interval:	15 seconds		Unit Programmed: CO STEL Period:		N/A
H2S STEL Period:	15 minutes				15 minutes
Test Station					
Dock Serial Number:	Z309-002181		Dock Location:		Imbros Cal Lab
	Inlet 1:	Inlet 2:	Inlet 3:	Inlet 4:	Inlet 5:
Used:	Yes	Yes	No	No	No
Concentration:	20.9%	100ppm			
Type:	Purge	ISO 100ppm by volume			
Notes:	NOTE: Calibration all Ok.				

Technology for Laboratory and Marine Science

Imbros Pty Ltd
1059 Cambridge Road
Cambridge TAS 7170 Australia
info@imbros.com.au
www.imbros.com.au
ABN 29 009 525 053
Ph: (03) 6216 1500
Fax: (03) 6216 1555

SERVICE / REPAIR REPORT

Customer:

Cash Sales
Aaron Plummer
0400 821 977
aplummer@geosolutions.net.au

Job No: 3825
Cust ABN:
Date: 30/01/2019
Service Engineer: Blackwell, Damian

Reported Fault / Required Service:

RAE SYSTEMS PGM7300 MiniRAE Lite
Serial Number: 590-902123

Service and calibration

Work Performed / Recommendation (if any):

Incoming evaluation - no faults found.

Calibration carried out successfully.
Functionality test - passed.

See calibration sheet for full details.

Technology for Laboratory and Marine Science

Appendix 7 Laboratory Chain of Custody

SCANNED

FREIGHT

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT:	GEOENVIRONMENTAL SOLUTIONS	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	★ Standard TAT (List due date): ☐ Non Standard or urgent TAT (List due date):
OFFICE:	29 Kirksway Pl, Battery Point TAS 7004		
PROJECT:	Building 3	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7
ORDER NUMBER:			OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	SJ	CONTACT PH:	
SAMPLER:	JAC	SAMPLER MOBILE:	RELINQUISHED BY: / RECEIVED BY: SAM (ALS) / RELINQUISHED BY: / RECEIVED BY:
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to jcumming@geosolutions.net.au; sjoyce@geosolutions.net.au		DATE/TIME: 3·6·19	DATE/TIME: 4/6/19 9:35 / DATE/TIME: / DATE/TIME:
Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, sjoyce@geosolutions.net.au			

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). TPH, BTEX, PAH, 15 Metals	pH	Additional Information
1	BH01 0.5-0.6	31.5.19	S	Jar	1	✓	✓	
2	BH01 1.4-1.5				1	✓		
3	BH02 0.5-0.6				1	✓		
4	BH02 1.4-1.5				1	✓		
5	BH03 0.5-0.6				1	✓		
6	BH03 1.4-1.5				1	✓	✓	
7	BH04 0.5-0.6				1	✓		
8	BH04 1.4-1.5				1	✓		
9	BH05 0.5-0.6				1	✓		
10	BH05 1.4-1.5				1	✓		
11	BH06 0.5-0.6				1	✓	✓	
12	BH06 1.4-1.5	"	"	"	1	✓	✓	
				TOTAL				

Environmental Division Melbourne
Work Order Reference
EM1908628

Telephone : + 61-3-8549 9600

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT:	GEOENVIRONMENTAL SOLUTIONS	TURNAROUND REQUIREMENTS : (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	★ Standard TAT (List due date):
OFFICE:	29 Kirksway Pl, Battery Point TAS 7004		☐ Non Standard or urgent TAT (List due date):
PROJECT:	Building 3	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle) COC: 1 2 3 4 5 6 7
ORDER NUMBER:			OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	SJ	CONTACT PH:	
SAMPLER:	JPC	SAMPLER MOBILE:	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to jcumming@geosolutions.net.au; sjoyce@geosolutions.net.au			
Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, sjoyce@geosolutions.net.au			

RELINQUISHED BY:	RECEIVED BY: SAM (ALS)	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME: 3·6·19	DATE/TIME: 4/6/19 4:35	DATE/TIME:	DATE/TIME:

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required). TPH, BTEX, PAH, 15 Metals	Additional Information
13	BH07 0·5-0·6	31·5·19	S	Jar	1	✓	
14	BH07 1·4-1·5	〃	〃	〃	1	✓	
15	BH08 0·5-0·6	〃	〃	〃	1	✓	
16	BH08 1·4-1·5	〃	〃	〃	1	✓	
17	Duplicate	〃	〃	〃	1	✓	
18	Rinsate	〃	W	2V 1P 1A	4	✓	
				TOTAL			

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

ALS Environmental

CHAIN OF CUSTODY

ALS Laboratory: please tick →

ADELAIDE 21 Burma Road Pooraka SA 5095 Ph: 08 8359 0890 E: adelaide@alsglobal.com

BRISBANE 32 Shand Street Stafford QLD 4053 Ph: 07 3243 7222 E: samples.brisbane@alsglobal.com

GLADSTONE 46 Callemondah Drive Clinton QLD 4680 Ph: 07 7471 5600 E: gladstone@alsglobal.com

MACKAY 78 Harbour Road Mackay QLD 4740 Ph: 07 4944 0177 E: mackay@alsglobal.com

MELBOURNE 2-4 Westall Road Springvale VIC 3171 Ph: 03 8549 9600 E: samples.melbourne@alsglobal.com

MUDGEE 27 Sydney Road Mudgee NSW 2850 Ph: 02 6372 6735 E: mudgee.mail@alsglobal.com

NEWCASTLE 5 Rose Gum Road Warabrook NSW 2304 Ph: 02 4958 8150 E: samples.newcastle@alsglobal.com

PERTH 11 Hod Way Malaga WA 6090 Ph: 08 9209 7655 E: samples.perth@alsglobal.com

TOWNSVILLE 14-15 Desma Court Bohle QLD 4818 Ph: 07 4796 0600 E: townsville.environmental@alsglobal.com

WOLLONGONG 99 Kenny Street Wollongong NSW 2500 Ph: 02 4225 3125 E: portkembla@alsglobe.com

SYDNEY 277-289 Woodpark Road Smithfield NSW 2164 Ph: 02 8784 8555 E: samples.sydney@alsglobal.com

CLIENT:	GEOENVIRONMENTAL SOLUTIONS	TURNAROUND REQUIREMENTS: (Standard TAT may be longer for some tests e.g. Ultra Trace Organics)	★ Standard TAT (List due date): Sydney
OFFICE:	29 Kirksway Pl, Battery Point TAS 7004		☐ Non Standard or urgent TAT (List due date):
PROJECT:	Building 3	ALS QUOTE NO.:	COC SEQUENCE NUMBER (Circle): COC 1 2 3 4 5 6 7
ORDER NUMBER:			OF: 1 2 3 4 5 6 7
PROJECT MANAGER:	SJ	CONTACT PH:	
SAMPLER:	JPC	SAMPLER MOBILE:	
COC emailed to ALS? (YES / NO)		EDD FORMAT (or default):	
Email Reports to jcumming@geosolutions.net.au; sjoyce@geosolutions.net.au			
Email Invoice to jcumming@geosolutions.net.au; miran@geosolutions.net.au, sjoyce@geosolutions.net.au			

RELINQUISHED BY:	RECEIVED BY:	RELINQUISHED BY:	RECEIVED BY:
DATE/TIME: 3·6·19	DATE/TIME: 4/6/19 9:35	DATE/TIME: 5/6/19	DATE/TIME: 6/6/19 1:00pm 4pm

COMMENTS/SPECIAL HANDLING/STORAGE OR DISPOSAL:

ANALYSIS REQUIRED including SUITES (NB. Suite Codes must be listed to attract suite price) Where Metals are required, specify Total (unfiltered bottle required) or Dissolved (field filtered bottle required).

LAB ID	SAMPLE ID	DATE / TIME	MATRIX	TYPE & PRESERVATIVE (refer to codes below)	TOTAL CONTAINERS	TPH, BTEX, PAH, 15 Metals	Additional Information
	Inter Lab Split	31·5·19	S	Jar	1	✓	Comments on likely contaminant levels, dilutions, or samples requiring specific QC analysis etc.
					TOTAL		

Environmental Division Sydney
Work Order Reference
ES1917553

Telephone : + 61-2-8784 8555

Water Container Codes: P = Unpreserved Plastic; N = Nitric Preserved Plastic; ORC = Nitric Preserved ORC; SH = Sodium Hydroxide/Cd Preserved; S = Sodium Hydroxide Preserved Plastic; AG = Amber Glass Unpreserved; AP - Airfreight Unpreserved Plastic
V = VOA Vial HCl Preserved; VB = VOA Vial Sodium Bisulphate Preserved; VS = VOA Vial Sulfuric Preserved; AV = Airfreight Unpreserved Vial SG = Sulfuric Preserved Amber Glass; H = HCl preserved Plastic; HS = HCl preserved Speciation bottle; SP = Sulfuric Preserved Plastic; F = Formaldehyde Preserved Glass;
Z = Zinc Acetate Preserved Bottle; E = EDTA Preserved Bottles; ST = Sterile Bottle; ASS = Plastic Bag for Acid Sulphate Soils; B = Unpreserved Bag.

Rebatch

Client / Client code: GEOENVSOL
Project: Building 3
Project Manager: Sarah Joyce
Date /time sample rec: 4/6/19 @ 9:35am
Date/time Instructions rec: 13/6/19 @ 10:45am
Due date: ASAP
Due date surcharge: ASAP

CS Contact: Kane
Additional Information:

URGENT

Sample information								Analysis										
								Standard					Leach					
New Lab ID	Client ID	Sampling Date / Time	Previous Work Order Reference	Previous ALS ID	Tray Number(s)	Container	Number of Containers	PCB	Cyanide				TCLP	Arsenic	Copper			Shortest Holding time expiry
1	BH01 1.4-1.5	31/05/2019 0:00	EM1908628	2	MS:2344-45	Jar	1	X	X									14-Jun-19
2	BH07 0.5-0.6	31/05/2019 0:00	EM1908628	13	MS:2344-45	Jar	1	X	X				X		X			14-Jun-19
3	BH03 0.5-0.6	31/05/2019 0:00	EM1908628	5	MS:2344-45	Jar	1						X	X				27-Nov-19
						TOTAL	2											

Environmental Division
Melbourne
Work Order Reference
EM1909096

Telephone : +61-3-8549 9600

MJ 2471-72

Rebatch

Issue Date	05-Jun-2019
Page	2 of 3
Work Order	EM1908628 Amendment 0
Client	GEO-ENVIRONMENTAL SOLUTIONS

ALS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

13·6·19

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

2 Day turn around

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)	PCB	Cyanide
EM1908628-001	31-May-2019 00:00	BH01 0.5-0.6	✓	✓	✓	✓		
EM1908628-002	31-May-2019 00:00	BH01 1.4-1.5		✓	✓	✓	✓	✓
EM1908628-003	31-May-2019 00:00	BH02 0.5-0.6		✓	✓	✓		
EM1908628-004	31-May-2019 00:00	BH02 1.4-1.5		✓	✓	✓		
EM1908628-005	31-May-2019 00:00	BH03 0.5-0.6		✓	✓	✓		
EM1908628-006	31-May-2019 00:00	BH03 1.4-1.5	✓	✓	✓	✓		
EM1908628-007	31-May-2019 00:00	BH04 0.5-0.6		✓	✓	✓		
EM1908628-008	31-May-2019 00:00	BH04 1.4-1.5		✓	✓	✓		
EM1908628-009	31-May-2019 00:00	BH05 0.5-0.6		✓	✓	✓		
EM1908628-010	31-May-2019 00:00	BH05 1.4-1.5		✓	✓	✓		
EM1908628-011	31-May-2019 00:00	BH06 0.5-0.6	✓	✓	✓	✓		
EM1908628-012	31-May-2019 00:00	BH06 1.4-1.5	✓	✓	✓	✓		
EM1908628-013	31-May-2019 00:00	BH07 0.5-0.6		✓	✓	✓	✓	✓
EM1908628-014	31-May-2019 00:00	BH07 1.4-1.5		✓	✓	✓		
EM1908628-015	31-May-2019 00:00	BH08 0.5-0.6		✓	✓	✓		
EM1908628-016	31-May-2019 00:00	BH08 1.4-1.5		✓	✓	✓		
EM1908628-017	31-May-2019 00:00	Duplicate		✓	✓	✓		

Matrix: **WATER**

Laboratory sample ID	*Client sampling date / time*	*Client sample ID*	WATER - W-03 15 Metals (NEPM Suite)	WATER - W-07 TRH/BTEXN/PAH
EM1908628-018	31-May-2019 00:00	Rinsate	✓	✓

Proactive Holding Time Report

Appendix 8 Laboratory Sample Receipt Notification

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM1908628**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: sjoyce@geosolutions.net.au	E-mail	: shirley.lecornu@Alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: Building 3	Page	: 1 of 3
Order number	:	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JOHN PAUL CUMMING		

Dates

Date Samples Received	: 04-Jun-2019 09:35	Issue Date	: 05-Jun-2019
Client Requested Due Date	: 11-Jun-2019	Scheduled Reporting Date	: **11-Jun-2019**

Delivery Details

Mode of Delivery	: Carrier	Security Seal	: Intact.
No. of coolers/boxes	: 2	Temperature	: 3.9
Receipt Detail	:	No. of samples received / analysed	: 18 / 18

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

RIGHT SOLUTIONS | RIGHT PARTNER

Issue Date	: 05-Jun-2019
Page	: 2 of 3
Work Order	: EM1908628 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA001 pH (CaCl)	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)
EM1908628-001	31-May-2019 00:00	BH01 0.5-0.6	✓	✓	✓	✓
EM1908628-002	31-May-2019 00:00	BH01 1.4-1.5		✓	✓	✓
EM1908628-003	31-May-2019 00:00	BH02 0.5-0.6		✓	✓	✓
EM1908628-004	31-May-2019 00:00	BH02 1.4-1.5		✓	✓	✓
EM1908628-005	31-May-2019 00:00	BH03 0.5-0.6		✓	✓	✓
EM1908628-006	31-May-2019 00:00	BH03 1.4-1.5	✓	✓	✓	✓
EM1908628-007	31-May-2019 00:00	BH04 0.5-0.6		✓	✓	✓
EM1908628-008	31-May-2019 00:00	BH04 1.4-1.5		✓	✓	✓
EM1908628-009	31-May-2019 00:00	BH05 0.5-0.6		✓	✓	✓
EM1908628-010	31-May-2019 00:00	BH05 1.4-1.5		✓	✓	✓
EM1908628-011	31-May-2019 00:00	BH06 0.5-0.6	✓	✓	✓	✓
EM1908628-012	31-May-2019 00:00	BH06 1.4-1.5	✓	✓	✓	✓
EM1908628-013	31-May-2019 00:00	BH07 0.5-0.6		✓	✓	✓
EM1908628-014	31-May-2019 00:00	BH07 1.4-1.5		✓	✓	✓
EM1908628-015	31-May-2019 00:00	BH08 0.5-0.6		✓	✓	✓
EM1908628-016	31-May-2019 00:00	BH08 1.4-1.5		✓	✓	✓
EM1908628-017	31-May-2019 00:00	Duplicate		✓	✓	✓

Matrix: **WATER**

Laboratory sample ID	Client sampling date / time	Client sample ID	WATER - W-03 15 Metals (NEPM Suite)	WATER - W-07 TRH/BTEXN/PAH
EM1908628-018	31-May-2019 00:00	Rinsate	✓	✓

Proactive Holding Time Report

Issue Date	: 05-Jun-2019
Page	: 3 of 3
Work Order	: EM1908628 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	jcumming@geosolutions.net.au
SARAH JOYCE		
- *AU Certificate of Analysis - NATA (COA)	Email	sjoyce@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sjoyce@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sjoyce@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sjoyce@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	sjoyce@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	sjoyce@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	sjoyce@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	sjoyce@geosolutions.net.au

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **ES1917553**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Sydney
Contact	: DR JOHN PAUL CUMMING	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
E-mail	: jcumming@geosolutions.net.au	E-mail	: shirley.lecornu@Alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Facsimile	: +61 03 6223 4539	Facsimile	: +61-2-8784 8500
Project	: Building 3	Page	: 1 of 2
Order number	:	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	: JPC		

Dates

Date Samples Received	: 06-Jun-2019 13:00	Issue Date	: 07-Jun-2019
Client Requested Due Date	: 14-Jun-2019	Scheduled Reporting Date	: **14-Jun-2019**

Delivery Details

Mode of Delivery	: Undefined	Security Seal	: Intact.
No. of coolers/boxes	: 1	Temperature	: 8.1'c - Ice present
Receipt Detail	:	No. of samples received / analysed	: 1 / 1

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please direct any queries you have regarding this work order to the above ALS laboratory contact.
- Analytical work for this work order will be conducted at ALS Sydney.
- Sample Disposal - Aqueous (3 weeks), Solid (2 months ± 1 week) from receipt of samples.
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date	: 07-Jun-2019
Page	: 2 of 2
Work Order	: ES1917553 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - S-03 15 Metals (NEPM 2013 Suite - incl. Digestion)	SOIL - S-07 TRH/BTEXN/PAH (SIM)
ES1917553-001	31-May-2019 00:00	INTER LAB SPLIT	✓	✓	✓

Proactive Holding Time Report

Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
JOHN PAUL CUMMING		
- *AU Certificate of Analysis - NATA (COA)	Email	jcumming@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	jcumming@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	jcumming@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	jcumming@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	jcumming@geosolutions.net.au
- Attachment - Report (SUBCO)	Email	jcumming@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	jcumming@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	jcumming@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	jcumming@geosolutions.net.au
M IRAN		
- A4 - AU Tax Invoice (INV)	Email	miran@geosolutions.net.au
SARAH JOYCE		
- *AU Certificate of Analysis - NATA (COA)	Email	sjoyce@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sjoyce@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sjoyce@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sjoyce@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	sjoyce@geosolutions.net.au
- Attachment - Report (SUBCO)	Email	sjoyce@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	sjoyce@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	sjoyce@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	sjoyce@geosolutions.net.au

ALS Environmental

SAMPLE RECEIPT NOTIFICATION (SRN)

Work Order : **EM1909096**

Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
E-mail	: sjoyce@geosolutions.net.au	E-mail	: shirley.lecornu@Alsglobal.com
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Facsimile	: +61 03 6223 4539	Facsimile	: +61-3-8549 9626
Project	: Building 3	Page	: 1 of 2
Order number	:	Quote number	: EB2017GEOENVSOL0001 (EN/222)
C-O-C number	: ----	QC Level	: NEPM 2013 B3 & ALS QC Standard
Site	: ----		
Sampler	:		

Dates

Date Samples Received	: 04-Jun-2019 09:35	Issue Date	: 13-Jun-2019
Client Requested Due Date	: 17-Jun-2019	Scheduled Reporting Date	: **20-Jun-2019**

Delivery Details

Mode of Delivery	: Samples On Hand	Security Seal	: Not Available
No. of coolers/boxes	: ----	Temperature	: ----
Receipt Detail	:	No. of samples received / analysed	: 3 / 3

General Comments

- This report contains the following information:
  - Sample Container(s)/Preservation Non-Compliances
  - Summary of Sample(s) and Requested Analysis
  - Proactive Holding Time Report
  - Requested Deliverables
- **The scheduled reporting date has been extended due to laboratory capacity.**
- **Please direct any queries related to sample condition / numbering / breakages to Client Services.**
- Sample Disposal - Aqueous (3 weeks), Solid (2 months) from receipt of samples.
- **Analytical work for this work order will be conducted at ALS Springvale.**
- **Please refer to the Proactive Holding Time Report table below which summarises breaches of recommended holding times that have occurred prior to samples/instructions being received at the laboratory. The absence of this summary table indicates that all samples have been received within the recommended holding times for the analysis requested.**
- Please be aware that APHA/NEPM recommends water and soil samples be chilled to less than or equal to 6°C for chemical analysis, and less than or equal to 10°C but unfrozen for Microbiological analysis. Where samples are received above this temperature, it should be taken into consideration when interpreting results. Refer to ALS EnviroMail 85 for ALS recommendations of the best practice for chilling samples after sampling and for maintaining a cool temperature during transit.

Issue Date	: 13-Jun-2019
Page	: 2 of 2
Work Order	: EM1909096 Amendment 0
Client	: GEO-ENVIRONMENTAL SOLUTIONS

Sample Container(s)/Preservation Non-Compliances

All comparisons are made against pretreatment/preservation AS, APHA, USEPA standards.

- **No sample container / preservation non-compliance exists.**

Summary of Sample(s) and Requested Analysis

Some items described below may be part of a laboratory process necessary for the execution of client requested tasks. Packages may contain additional analyses, such as the determination of moisture content and preparation tasks, that are included in the package.
If no sampling time is provided, the sampling time will default 00:00 on the date of sampling. If no sampling date is provided, the sampling date will be assumed by the laboratory and displayed in brackets without a time component

Matrix: **SOIL**

Laboratory sample ID	Client sampling date / time	Client sample ID	SOIL - EA055-103 Moisture Content	SOIL - EG005C Leachable Metals by ICPAES	SOIL - EK026SF (Solids) Total Cyanide By Segmented Flow Analyser	SOIL - EN33a TCLP Leachate	SOIL - EP066 (solids) Polychlorinated Biphenyls by GCMS
EM1909096-001	31-May-2019 00:00	BH01 1.4-1.5	✓		✓		✓
EM1909096-002	31-May-2019 00:00	BH07 0.5-0.6	✓	✓	✓	✓	✓
EM1909096-003	31-May-2019 00:00	BH03 0.5-0.6		✓		✓	

Proactive Holding Time Report

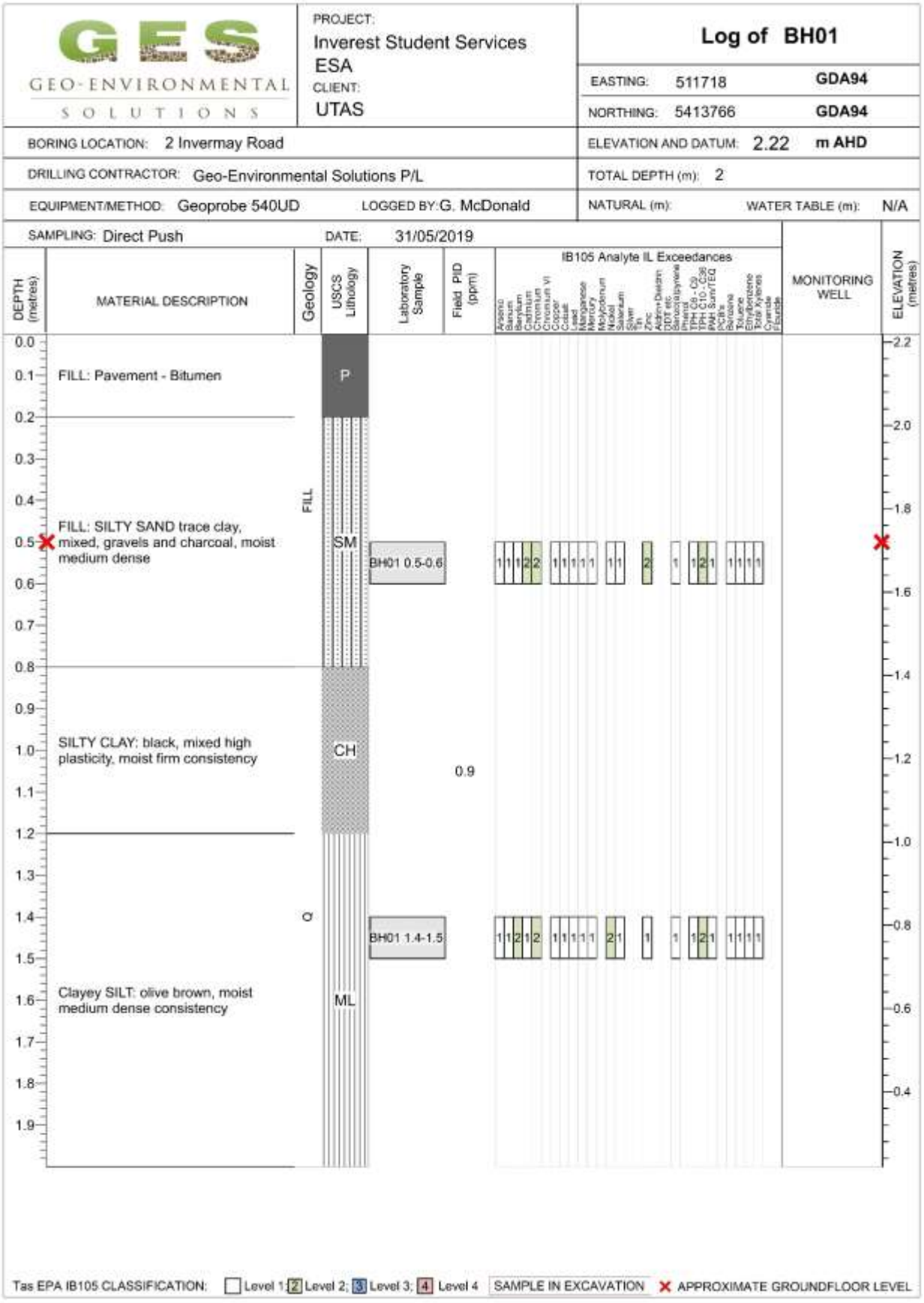
Sample(s) have been received within the recommended holding times for the requested analysis.

Requested Deliverables

All Invoices		
- A4 - AU Tax Invoice (INV)	Email	smcintosh@geosolutions.net.au
KRIS TAYLOR		
- *AU Certificate of Analysis - NATA (COA)	Email	ktaylor@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	ktaylor@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	ktaylor@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	ktaylor@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	ktaylor@geosolutions.net.au
- Attachment - Report (SUBCO)	Email	ktaylor@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	ktaylor@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	ktaylor@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	ktaylor@geosolutions.net.au
SARAH JOYCE		
- *AU Certificate of Analysis - NATA (COA)	Email	sjoyce@geosolutions.net.au
- *AU Interpretive QC Report - DEFAULT (Anon QCI Rep) (QCI)	Email	sjoyce@geosolutions.net.au
- *AU QC Report - DEFAULT (Anon QC Rep) - NATA (QC)	Email	sjoyce@geosolutions.net.au
- A4 - AU Sample Receipt Notification - Environmental HT (SRN)	Email	sjoyce@geosolutions.net.au
- A4 - AU Tax Invoice (INV)	Email	sjoyce@geosolutions.net.au
- Attachment - Report (SUBCO)	Email	sjoyce@geosolutions.net.au
- Chain of Custody (CoC) (COC)	Email	sjoyce@geosolutions.net.au
- EDI Format - ENMRG (ENMRG)	Email	sjoyce@geosolutions.net.au
- EDI Format - XTab (XTAB)	Email	sjoyce@geosolutions.net.au

Appendix 9 Borehole Logs

Note the logs have anticipated excavations to 0.5m below ground surface to account for the removal of the existing carpark plus the service trenches, lift and stair footprints.

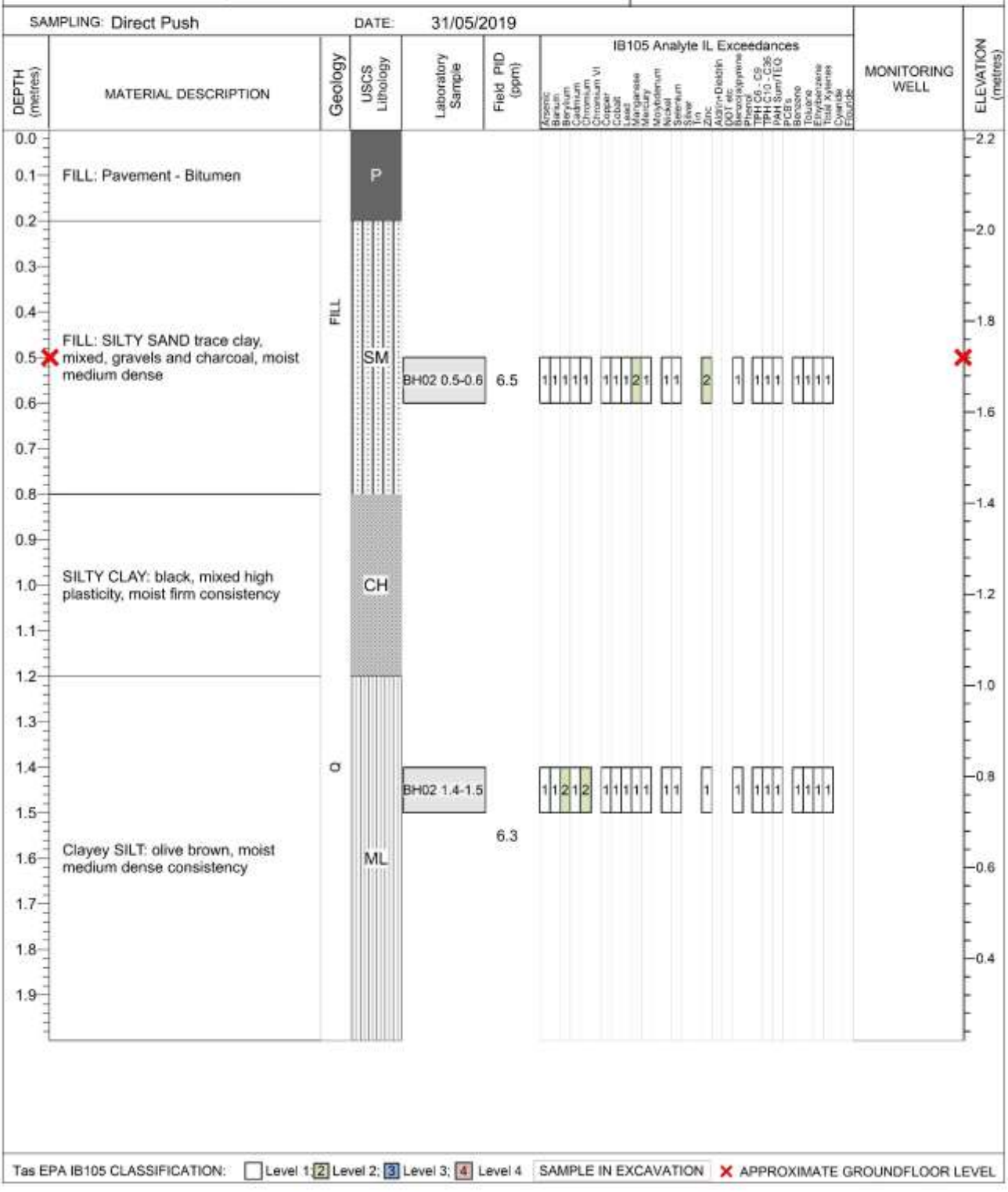


GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH02

EASTING: 511711 GDA94
NORTHING: 5413776 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019



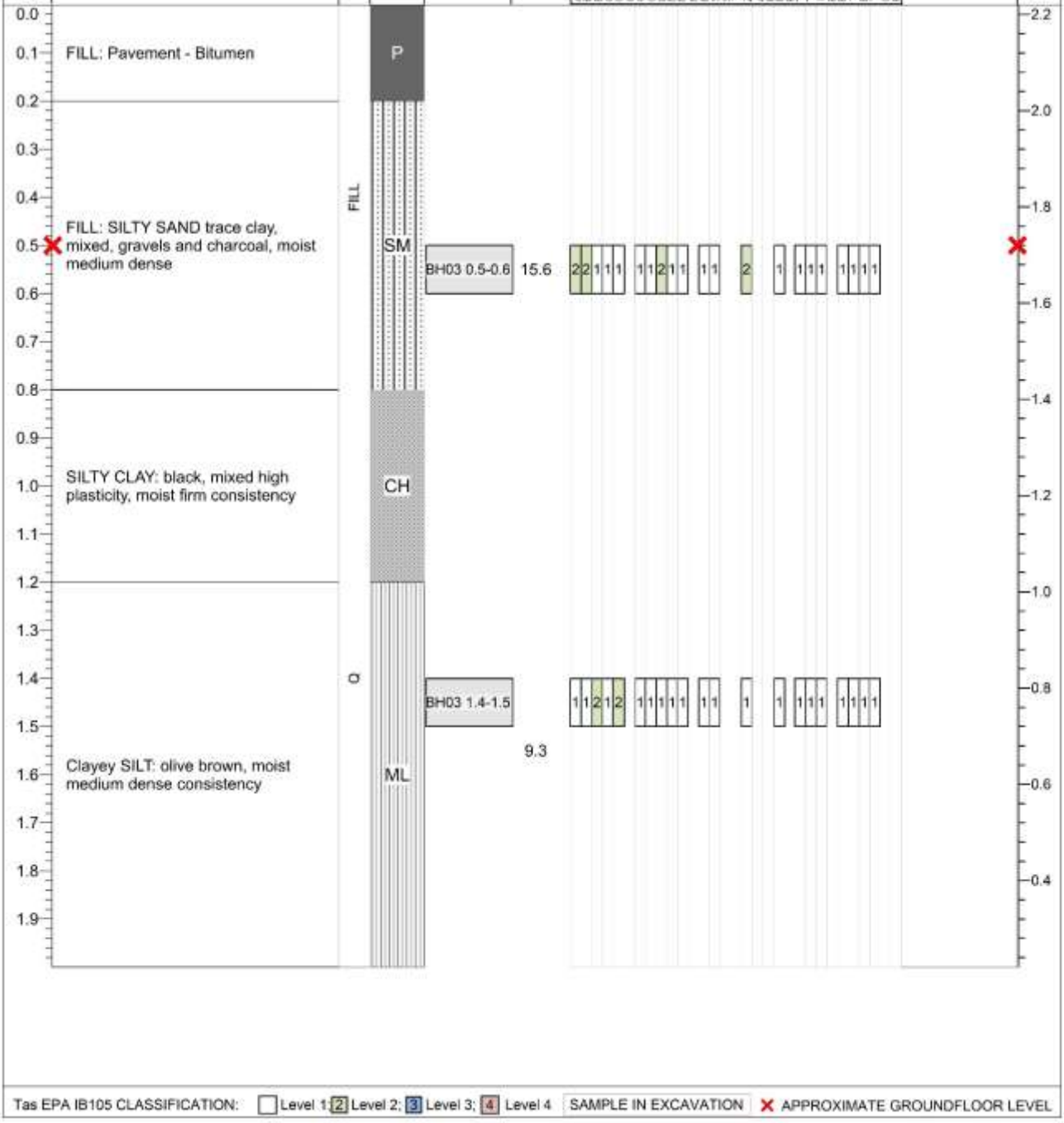
Tas EPA IB105 CLASSIFICATION: Level 1; Level 2; Level 3; Level 4 SAMPLE IN EXCAVATION APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH03

EASTING: 511708 GDA94
NORTHING: 5413746 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019



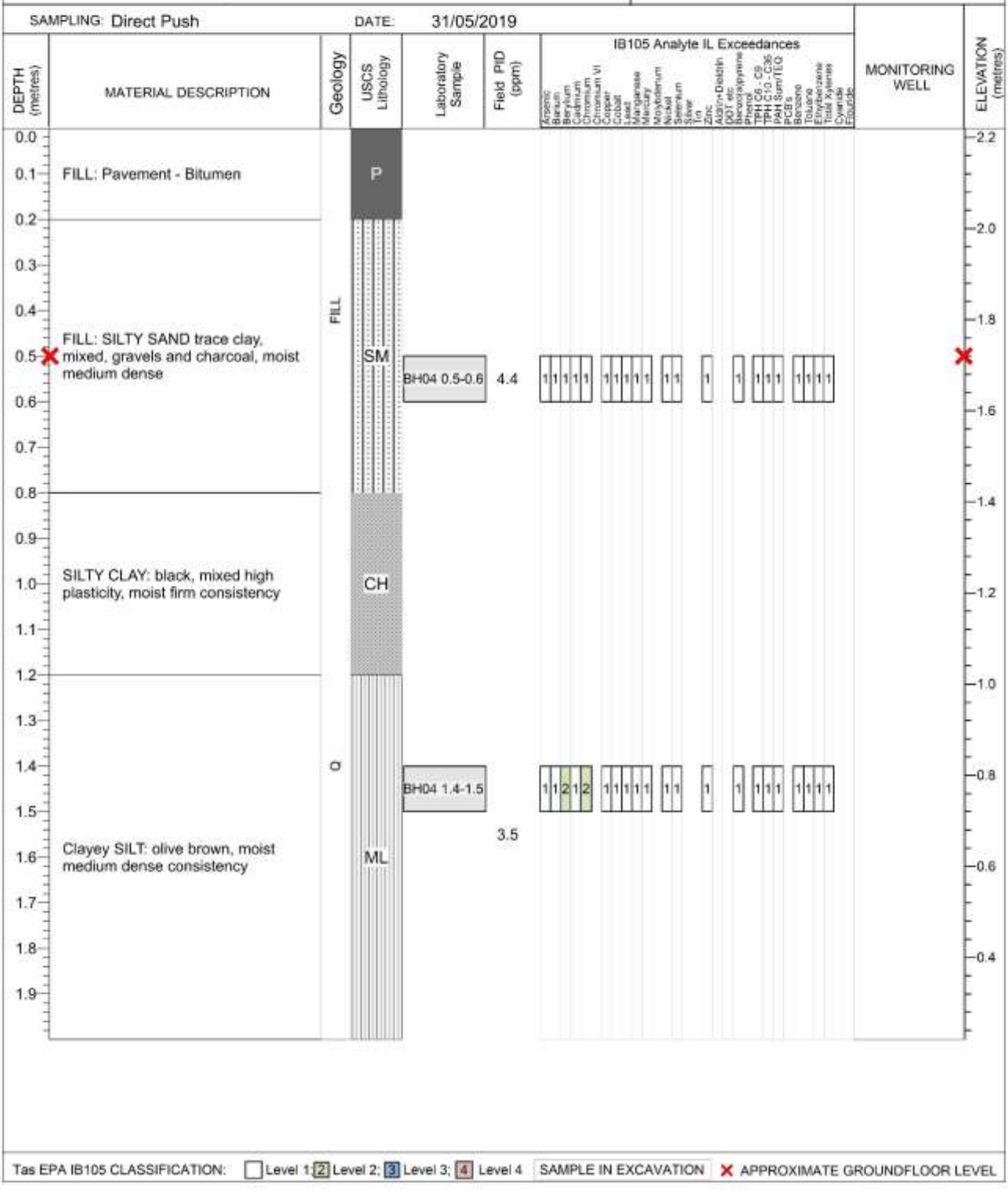
Tas EPA IB105 CLASSIFICATION: Level 1; Level 2; Level 3; Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH04

EASTING: 511702 GDA94
NORTHING: 5413756 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019



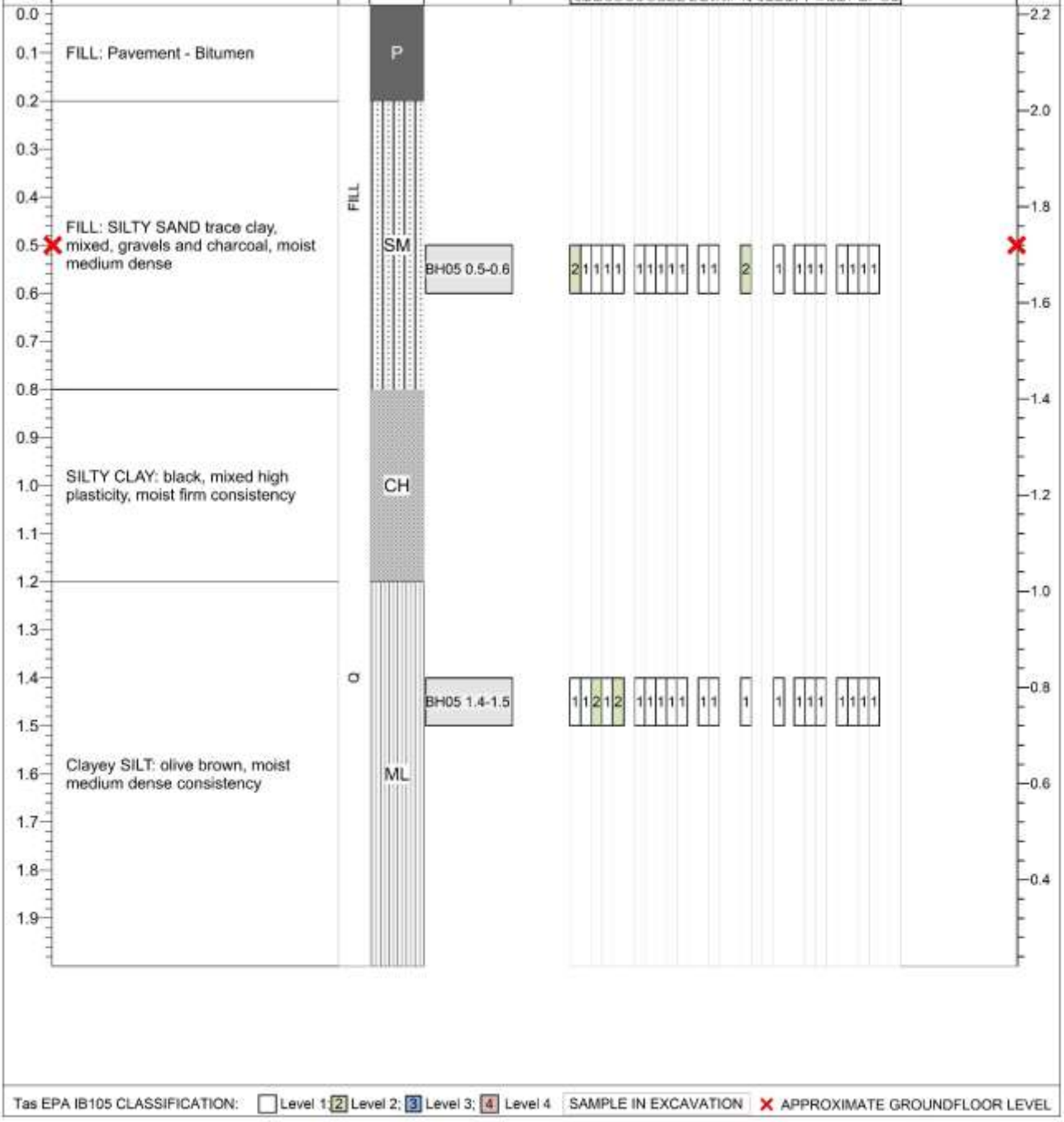
Tas EPA IB105 CLASSIFICATION: Level 1; Level 2; Level 3; Level 4 SAMPLE IN EXCAVATION APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH05

EASTING:	511694	GDA94
NORTHING:	5413763	GDA94
BORING LOCATION:	2 Invermay Road	
ELEVATION AND DATUM:	2.22	m AHD
DRILLING CONTRACTOR:	Geo-Environmental Solutions P/L	
TOTAL DEPTH (m):	2	
EQUIPMENT/METHOD:	Geoprobe 540UD	
LOGGED BY:	G. McDonald	
NATURAL (m):		
WATER TABLE (m):	N/A	
SAMPLING:	Direct Push	
DATE:	31/05/2019	



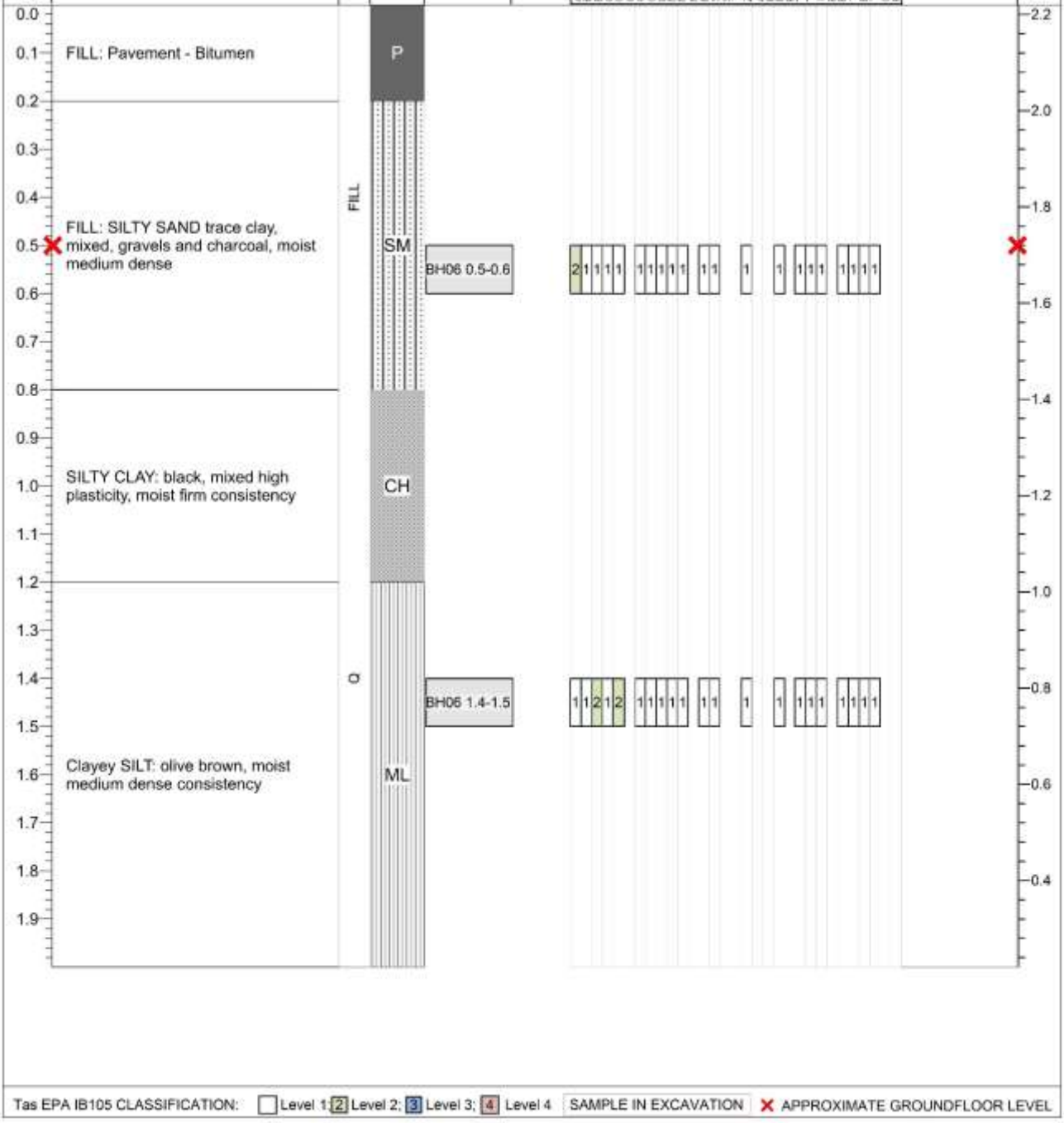
Tas EPA IB105 CLASSIFICATION: Level 1; Level 2; Level 3; Level 4 | SAMPLE IN EXCAVATION | APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH06

EASTING: 511695 GDA94
NORTHING: 5413737 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019



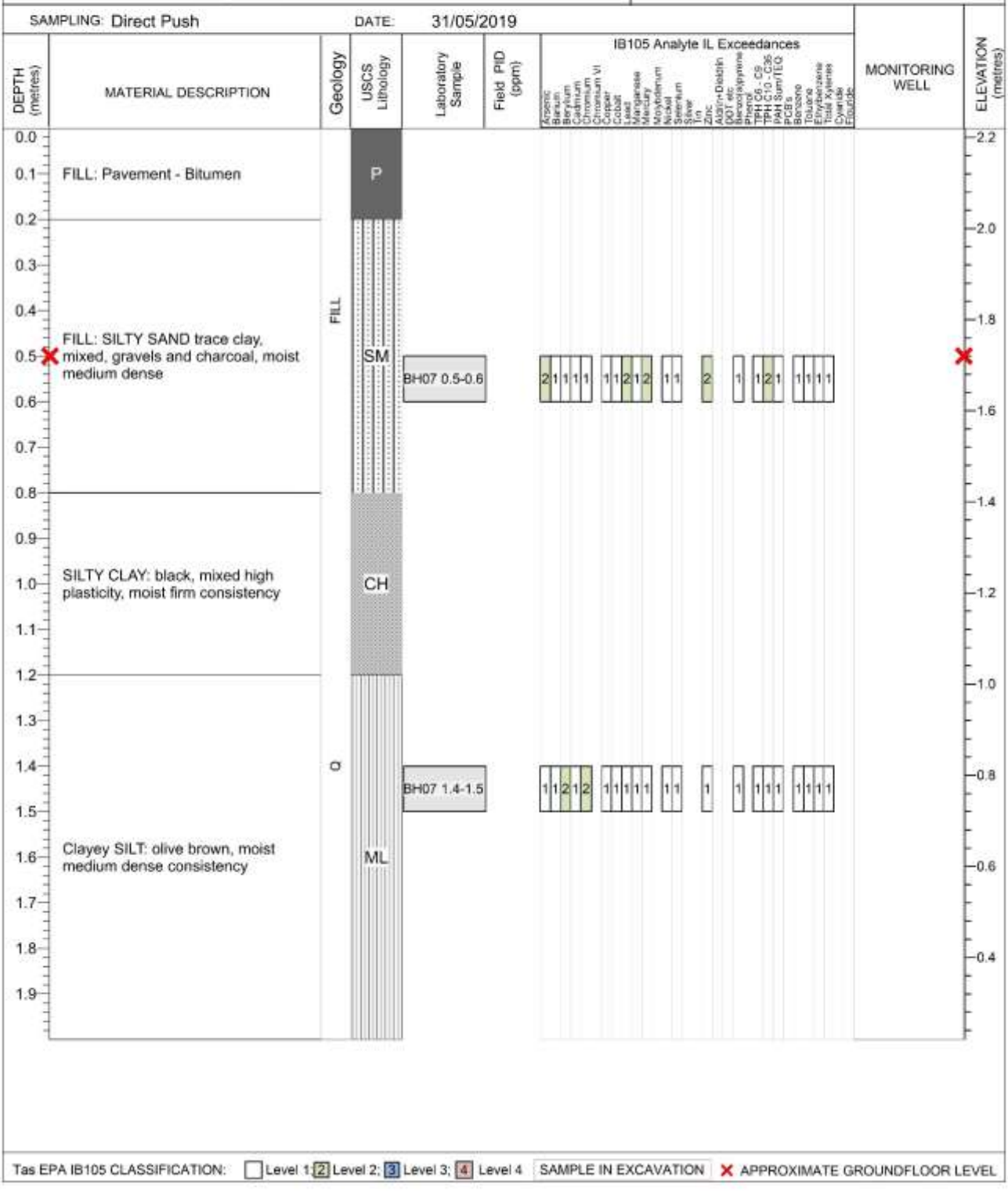
Tas EPA IB105 CLASSIFICATION: ☐ Level 1 [2] Level 2; [3] Level 3; [4] Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH07

EASTING: 511688 GDA94
NORTHING: 5413746 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019



Tas EPA IB105 CLASSIFICATION: ☐ Level 1 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

GES GEO-ENVIRONMENTAL SOLUTIONS

PROJECT: Inverest Student Services ESA
CLIENT: UTAS

Log of BH08

EASTING: 511684 GDA94
NORTHING: 5413730 GDA94
BORING LOCATION: 2 Invermay Road
ELEVATION AND DATUM: 2.22 m AHD
DRILLING CONTRACTOR: Geo-Environmental Solutions P/L
TOTAL DEPTH (m): 2
EQUIPMENT/METHOD: Geoprobe 540UD LOGGED BY: G. McDonald
NATURAL (m): WATER TABLE (m): N/A
SAMPLING: Direct Push DATE: 31/05/2019

DEPTH (metres)	MATERIAL DESCRIPTION	Geology	USCS Lithology	Laboratory Sample	Field PID (ppm)	IB105 Analyte IL Exceedances	MONITORING WELL	ELEVATION (metres)
0.0–0.2	FILL: Pavement - Bitumen	FILL	P					2.2–2.0
0.2–0.8	FILL: SILTY SAND trace clay, mixed, gravels and charcoal, moist medium dense	FILL	SM	BH08 0.5-0.6		2 1 1 1 1 / 1 1 1 1 1 / 1 1 / 1 / 1 / 1 1 1 / 1 1 1 1		2.0–1.4
0.8–1.2	SILTY CLAY: black, mixed high plasticity, moist firm consistency		CH					1.4–1.2
1.2–1.9	Clayey SILT: olive brown, moist medium dense consistency	Q	ML	BH08 1.4-1.5		1 1 1 1 2 / 1 1 1 1 1 / 1 1 / 1 / 1 / 1 1 1 / 1 1 1 1		1.0–0.4

Tas EPA IB105 CLASSIFICATION: ☐ Level 1 2 Level 2; 3 Level 3; 4 Level 4 SAMPLE IN EXCAVATION ✕ APPROXIMATE GROUNDFLOOR LEVEL

Appendix 10 Quality Assurance and Quality Control Documentation

Duplicate Comparrison	Sample	Arsenic	Barium	Beryllium	Cadmium	Chromium Total	Cobalt	Copper	Lead	Manganese	Nickel	Vanadium	Zinc	Mercury
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		5	10	1	1	2	2	5	5	5	2	5	5	0.1
31/05/2019	Duplicate	29	100	<1	<1	16	7	259	238	227	27	21	158	0.2
31/05/2019	BH05 0.5-0.6	31	50	<1	<1	10	5	159	229	147	16	17	206	0.2
Relative Percentage Difference (RPD) %		6.7	66.7	NA	NA	46.2	33.3	47.8	3.9	42.8	51.2	21.1	26.4	0.0
RPD Compliance Limit %		50	50	NA	NA	50	50	30	30	30	50	50	30	50
Method Detection Limit (MDL)		100	200	NA	NA	40	40	500	500	500	40	100	500	2
MDL Class		LOW	LOW	NONE	NONE	LOW	LOW	MED	MED	MED	LOW	LOW	MED	LOW
RPD Compliance With MDL?	47/56 (84%)	YES	NO	YES	YES	YES	YES	NO	YES	NO	NO	YES	YES	YES
31/05/2019	INTER LAB SPLIT	20	70	<1	<1	18	6	179	191	213	25	28	112	<0.1
31/05/2019	BH06 0.5-0.6	24	80	<1	<1	19	5	166	211	205	21	46	125	<0.1
Relative Percentage Difference (RPD) %		18.2	13.3	NA	NA	5.4	18.2	7.5	10.0	3.8	17.4	48.6	11.0	NA
RPD Compliance Limit %		50	50	NA	NA	50	50	30	30	30	50	50	30	NA
Method Detection Limit (MDL)		100	200	NA	NA	40	40	500	500	500	40	100	500	NA
MDL Class		LOW	LOW	NONE	NONE	LOW	LOW	MED	MED	MED	LOW	LOW	MED	NONE
RPD Compliance With MDL?	56/56 (100%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Duplicate Comparrison	Sample	Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydr	Benzo(a)pyrene TEQ (WHO)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5
31/05/2019	Duplicate	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH05 0.5-0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?	47/56 (84%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES
31/05/2019	INTER LAB SPLIT	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
31/05/2019	BH06 0.5-0.6	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE
RPD Compliance With MDL?	56/56 (100%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Duplicate Comparrison	Sample	Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Sum of BTEX	Total Xylenes	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	F1	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	F2	Benzo(a)pyrene TEQ (half LOR)	Benzo(a)pyrene TEQ (LOR)
Unit		mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
LOR		0.2	0.5	0.5	0.5	0.5	0.2	0.5	1	10	50	100	100	50	10	10	50	100	100	50	50	0.5	0.5
31/05/2019	Duplicate	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	380	380	760	<10	<10	<50	620	190	810	<50	0.6	1.2
31/05/2019	BH05 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	<100	<100	<50	<10	<10	<50	130	<100	130	<50	0.6	1.2
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	130.7	NA	144.7	NA	0.0	0.0
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50	50	50	NA	NA	NA	50	NA	50	NA	NA	50
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000	2000	1000	NA	NA	NA	2000	NA	1000	NA	NA	10
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW	LOW	LOW	NONE	NONE	NONE	LOW	NONE	LOW	NONE	NONE	LOW
RPD Compliance With MDL?	47/56 (84%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	NO	NO	NO	YES	YES	YES	NO	YES	NO	YES	YES	YES
31/05/2019	INTER LAB SPLIT	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	220	220	440	<10	<10	<50	360	120	480	<50	0.6	1.2
31/05/2019	BH06 0.5-0.6	<0.2	<0.5	<0.5	<0.5	<0.5	<0.2	<0.5	<1	<10	<50	290	290	580	<10	<10	<50	480	140	620	<50	0.6	1.2
Relative Percentage Difference (RPD) %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	27.5	27.5	27.5	NA	NA	NA	28.6	15.4	25.5	NA	0.0	0.0
RPD Compliance Limit %		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	50	50	50	NA	NA	NA	50	NA	50	NA	NA	50
Method Detection Limit (MDL)		NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	2000	2000	1000	NA	NA	NA	2000	NA	1000	NA	NA	10
MDL Class		NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	NONE	LOW	LOW	LOW	NONE	NONE	NONE	LOW	NONE	LOW	NONE	NONE	LOW
RPD Compliance With MDL?	56/56 (100%)	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES	YES

Rinsate Blank

Quality Control Blanks		EG020F: Dissolved Metals by ICP-MS														EP080
		Arsenic	Beryllium	Barium	Cadmium	Chromium	Cobalt	Copper	Lead	Manganese	Nickel	Selenium	Vanadium	Zinc	Boron	Mercury
Unit		mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
LOR		0.001	0.001	0.001	0.0001	0.001	0.001	0.001	0.001	0.001	0.001	0.01	0.01	0.005	0.05	0.0001
Date	Sample															
31/05/2019	Rinsate	<0.001	<0.001	<0.001	<0.0001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.01	<0.01	<0.005	<0.05	<0.0001

Quality Control Blanks						EP080/071				EP080/071											
		Benzene	Toluene	Ethylbenzene	meta- & para-Xylene	ortho-Xylene	Total Xylenes	Sum of BTEX	Naphthalene	C6 - C9 Fraction	C10 - C14 Fraction	C15 - C28 Fraction	C29 - C36 Fraction	C10 - C36 Fraction (sum)	C6 - C10 Fraction	C6 - C10 Fraction minus BTEX (F1)	>C10 - C16 Fraction	>C16 - C34 Fraction	>C34 - C40 Fraction	>C10 - C40 Fraction (sum)	>C10 - C16 Fraction minus Naphthalene (F2)
Unit		μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
LOR		1	2	2	2	2	2	1	5	20	50	100	50	50	20	20	100	100	100	100	100
Date	Sample																				
31/05/2019	Rinsate	<1	<2	<2	<2	<2	<2	<1	<5	<20	<50	<100	<50	<50	<20	<20	<100	<100	<100	<100	<100

Quality Control Blanks		Naphthalene	Acenaphthylene	Acenaphthene	Fluorene	Phenanthrene	Anthracene	Fluoranthene	Pyrene	Benz(a)anthracene	Chrysene	Benzo(b+j)fluoranthene	Benzo(k)fluoranthene	Benzo(a)pyrene	Indeno(1.2.3.cd)pyrene	Dibenz(a.h)anthracene	Benzo(g.h.i)perylene	Sum of polycyclic aromatic hydrocarbons	Benzo(a)pyrene TEQ (zero)
Unit		μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L	μg/L
LOR		1	1	1	1	1	1	1	1	1	1	1	1	0.5	1	1	1	0.5	0.5
Date	Sample																		
31/05/2019	Rinsate	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<0.5	<1.0	<1.0	<1.0	<0.5	<0.5

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1908628**	Page	: 1 of 11
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019
Order number	:	Date Analysis Commenced	: 05-Jun-2019
C-O-C number	: ----	Issue Date	: 12-Jun-2019
Sampler	: JOHN PAUL CUMMING		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 18		
No. of samples analysed	: 18		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

Page	: 2 of 11
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2390833)									
EM1908628-001	BH01 0.5-0.6	EG005T: Chromium	7440-47-3	2	mg/kg	65	56	14.5	0% - 20%
EM1908628-010	BH05 1.4-1.5	EG005T: Chromium	7440-47-3	2	mg/kg	76	72	4.56	0% - 20%
EM1908628-001	BH01 0.5-0.6	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	4	3	47.6	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	240	230	5.01	0% - 20%
		EG005T: Cobalt	7440-48-4	2	mg/kg	12	15	17.1	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	47	56	16.4	0% - 20%
		EG005T: Arsenic	7440-38-2	5	mg/kg	18	22	19.2	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	411	417	1.44	0% - 20%
		EG005T: Lead	7439-92-1	5	mg/kg	228	257	11.8	0% - 20%
		EG005T: Manganese	7439-96-5	5	mg/kg	377	433	13.7	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	40	28	34.9	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	283	302	6.58	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EM1908628-010	BH05 1.4-1.5	EG005T: Beryllium	7440-41-7	1	mg/kg	2	2	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	20	20	0.00	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	11	11	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	31	33	8.36	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	8	10	24.0	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	16	20	21.5	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	9	12	26.7	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	95	109	13.3	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit

Page : 3 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2390833) - continued									
EM1908628-010	BH05 1.4-1.5	EG005T: Vanadium	7440-62-2	5	mg/kg	66	79	17.3	0% - 50%
		EG005T: Zinc	7440-66-6	5	mg/kg	51	57	10.8	0% - 50%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EA001: pH in soil using 0.01M CaCl extract (QC Lot: 2392312)									
EM1908567-003	Anonymous	EA001: pH (CaCl2)	----	0.1	pH Unit	8.2	8.6	4.76	0% - 20%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2392617)									
EM1908472-034	Anonymous	EA055: Moisture Content	----	0.1	%	11.7	11.7	0.00	0% - 50%
EM1908628-007	BH04 0.5-0.6	EA055: Moisture Content	----	0.1	%	16.7	19.8	16.7	0% - 50%
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2392618)									
EM1908628-017	Duplicate	EA055: Moisture Content	----	0.1	%	15.2	19.4	24.2	0% - 50%
EM1908637-010	Anonymous	EA055: Moisture Content	----	0.1	%	13.1	13.3	1.40	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2390834)									
EM1908628-001	BH01 0.5-0.6	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	0.2	70.5	No Limit
EM1908628-010	BH05 1.4-1.5	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2392433)									
EM1908628-001	BH01 0.5-0.6	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EM1908628-011	BH06 0.5-0.6	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

Page : 4 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2392433) - continued									
EM1908628-011	BH06 0.5-0.6	EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2389780)									
EM1908628-001	BH01 0.5-0.6	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EM1908628-011	BH06 0.5-0.6	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2392434)									
EM1908628-001	BH01 0.5-0.6	EP071: C15 - C28 Fraction	----	100	mg/kg	1170	1070	8.84	0% - 50%
		EP071: C29 - C36 Fraction	----	100	mg/kg	710	680	3.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	1880	1750	7.16	0% - 20%
EM1908628-011	BH06 0.5-0.6	EP071: C15 - C28 Fraction	----	100	mg/kg	290	290	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	290	300	4.56	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	580	590	1.71	0% - 50%
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2389780)									
EM1908628-001	BH01 0.5-0.6	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EM1908628-011	BH06 0.5-0.6	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2392434)									
EM1908628-001	BH01 0.5-0.6	EP071: >C16 - C34 Fraction	----	100	mg/kg	1620	1510	7.20	0% - 50%
		EP071: >C34 - C40 Fraction	----	100	mg/kg	280	280	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	1900	1790	5.96	0% - 20%
EM1908628-011	BH06 0.5-0.6	EP071: >C16 - C34 Fraction	----	100	mg/kg	480	490	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	140	150	10.3	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
		EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	620	640	3.17	0% - 50%
EP080: BTEXN (QC Lot: 2389780)									
EM1908628-001	BH01 0.5-0.6	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

Page : 5 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: SOIL				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP080: BTEXN (QC Lot: 2389780) - continued									
EM1908628-001	BH01 0.5-0.6	EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
EM1908628-011	BH06 0.5-0.6	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit

Sub-Matrix: WATER				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2393314)									
EM1908629-004	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.036	0.036	0.00	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.004	0.005	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.075	0.074	0.00	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	0.067	0.068	0.00	0% - 20%
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.066	0.064	3.76	0% - 50%
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	0.06	0.06	0.00	No Limit
EM1908400-002	Anonymous	EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
		EG020A-F: Arsenic	7440-38-2	0.001	mg/L	0.003	0.003	0.00	No Limit
		EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Barium	7440-39-3	0.001	mg/L	0.034	0.032	6.69	0% - 20%
		EG020A-F: Chromium	7440-47-3	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	<0.001	0.00	No Limit
		EG020A-F: Copper	7440-50-8	0.001	mg/L	0.002	0.002	0.00	No Limit
		EG020A-F: Lead	7439-92-1	0.001	mg/L	0.001	0.001	0.00	No Limit
		EG020A-F: Manganese	7439-96-5	0.001	mg/L	0.048	0.044	8.98	0% - 20%
		EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.001	0.00	No Limit
		EG020A-F: Zinc	7440-66-6	0.005	mg/L	0.010	0.009	0.00	No Limit
		EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit

Page : 6 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG020F: Dissolved Metals by ICP-MS (QC Lot: 2393314) - continued									
EM1908400-002	Anonymous	EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	<0.01	0.00	No Limit
		EG020A-F: Boron	7440-42-8	0.05	mg/L	5.47	5.02	8.51	0% - 20%
EG035F: Dissolved Mercury by FIMS (QC Lot: 2393315)									
EM1908669-007	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EM1908400-002	Anonymous	EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	<0.0001	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2389363)									
EM1908436-001	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	20	<20	0.00	No Limit
EM1908522-003	Anonymous	EP080: C6 - C9 Fraction	----	20	µg/L	<20	<20	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2389363)									
EM1908436-001	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	30	30	0.00	No Limit
EM1908522-003	Anonymous	EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	<20	0.00	No Limit
EP080: BTEXN (QC Lot: 2389363)									
EM1908436-001	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	55	58	5.75	0% - 50%
EM1908522-003	Anonymous	EP080: Benzene	71-43-2	1	µg/L	<1	<1	0.00	No Limit
		EP080: Toluene	108-88-3	2	µg/L	8	9	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	2	µg/L	<2	<2	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	<2	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	2	µg/L	<2	<2	0.00	No Limit
		EP080: Naphthalene	91-20-3	5	µg/L	<5	<5	0.00	No Limit

Page	: 7 of 11
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2390833)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	94.1	78	107
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	93.2	76	110
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	98.1	84	113
EG005T: Boron	7440-42-8	50	mg/kg	<50	33.2 mg/kg	97.1	84	126
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	88.3	76	108
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	91.3	78	110
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	93.1	78	112
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	93.8	78	108
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	89.5	78	106
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	98.3	81	110
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	95.3	80	109
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	101	92	110
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	90.8	78	106
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	97.1	79	110
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2390834)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	98.8	77	104
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2392433)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	3 mg/kg	105	77	129
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	3 mg/kg	109	74	130
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	3 mg/kg	104	78	129
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	3 mg/kg	104	78	128
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	3 mg/kg	105	83	130
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	3 mg/kg	111	76	129
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	3 mg/kg	110	79	134
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	3 mg/kg	111	84	135
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	3 mg/kg	110	72	125
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	3 mg/kg	109	76	135
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	3 mg/kg	101	69	123
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	3 mg/kg	106	77	131
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	3 mg/kg	103	65	116
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	3 mg/kg	96.6	65	124
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	3 mg/kg	101	66	127
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	3 mg/kg	94.9	65	124

Page : 8 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2389780)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	36 mg/kg	92.4	61	127
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2392434)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	688 mg/kg	105	72	122
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	3100 mg/kg	108	84	123
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	1490 mg/kg	98.2	79	119
EP071: C10 - C36 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2389780)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	45 mg/kg	89.0	60	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2392434)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	1050 mg/kg	103	77	121
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	3960 mg/kg	100	83	121
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	280 mg/kg	108	65	123
EP071: >C10 - C40 Fraction (sum)	----	50	mg/kg	<50	----	----	----	----
EP080: BTEXN (QCLot: 2389780)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	2 mg/kg	99.5	63	119
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	2 mg/kg	96.5	67	126
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	2 mg/kg	95.1	66	124
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	4 mg/kg	95.6	68	128
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	2 mg/kg	98.1	73	128
EP080: Naphthalene	91-20-3	1	mg/kg	<1	0.5 mg/kg	89.6	61	123

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2393314)								
EG020A-F: Arsenic	7440-38-2	0.001	mg/L	<0.001	0.1 mg/L	98.0	91	107
EG020A-F: Beryllium	7440-41-7	0.001	mg/L	<0.001	0.1 mg/L	86.3	82	113
EG020A-F: Barium	7440-39-3	0.001	mg/L	<0.001	0.1 mg/L	90.6	84	106
EG020A-F: Cadmium	7440-43-9	0.0001	mg/L	<0.0001	0.1 mg/L	88.7	84	104
EG020A-F: Chromium	7440-47-3	0.001	mg/L	<0.001	0.1 mg/L	88.3	83	103
EG020A-F: Cobalt	7440-48-4	0.001	mg/L	<0.001	0.1 mg/L	85.7	83	106
EG020A-F: Copper	7440-50-8	0.001	mg/L	<0.001	0.1 mg/L	85.3	82	103
EG020A-F: Lead	7439-92-1	0.001	mg/L	<0.001	0.1 mg/L	89.1	83	105
EG020A-F: Manganese	7439-96-5	0.001	mg/L	<0.001	0.1 mg/L	87.0	83	105
EG020A-F: Nickel	7440-02-0	0.001	mg/L	<0.001	0.1 mg/L	88.3	82	106
EG020A-F: Selenium	7782-49-2	0.01	mg/L	<0.01	0.1 mg/L	87.3	82	109
EG020A-F: Vanadium	7440-62-2	0.01	mg/L	<0.01	0.1 mg/L	85.3	83	106
EG020A-F: Zinc	7440-66-6	0.005	mg/L	<0.005	0.1 mg/L	88.6	85	109

Page : 9 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2393314) - continued								
EG020A-F: Boron	7440-42-8	0.05	mg/L	<0.05	0.5 mg/L	96.9	84	116
EG035F: Dissolved Mercury by FIMS (QCLot: 2393315)								
EG035F: Mercury	7439-97-6	0.0001	mg/L	<0.0001	0.01 mg/L	88.5	76	114
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2388359)								
EP075(SIM): Naphthalene	91-20-3	1	µg/L	<1.0	5 µg/L	64.7	48	110
EP075(SIM): Acenaphthylene	208-96-8	1	µg/L	<1.0	5 µg/L	77.5	50	117
EP075(SIM): Acenaphthene	83-32-9	1	µg/L	<1.0	5 µg/L	74.7	53	117
EP075(SIM): Fluorene	86-73-7	1	µg/L	<1.0	5 µg/L	77.4	54	118
EP075(SIM): Phenanthrene	85-01-8	1	µg/L	<1.0	5 µg/L	80.1	59	119
EP075(SIM): Anthracene	120-12-7	1	µg/L	<1.0	5 µg/L	82.7	51	113
EP075(SIM): Fluoranthene	206-44-0	1	µg/L	<1.0	5 µg/L	82.5	61	120
EP075(SIM): Pyrene	129-00-0	1	µg/L	<1.0	5 µg/L	83.2	56	120
EP075(SIM): Benz(a)anthracene	56-55-3	1	µg/L	<1.0	5 µg/L	83.3	53	120
EP075(SIM): Chrysene	218-01-9	1	µg/L	<1.0	5 µg/L	67.3	57	122
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	1	µg/L	<1.0	5 µg/L	91.0	56	131
EP075(SIM): Benzo(k)fluoranthene	207-08-9	1	µg/L	<1.0	5 µg/L	92.3	59	124
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	µg/L	<0.5	5 µg/L	93.7	54	124
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	1	µg/L	<1.0	5 µg/L	86.6	55	124
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	1	µg/L	<1.0	5 µg/L	86.5	54	124
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	1	µg/L	<1.0	5 µg/L	91.0	56	124
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2388357)								
EP071: C10 - C14 Fraction	----	50	µg/L	<50	4030 µg/L	52.1	50	129
EP071: C15 - C28 Fraction	----	100	µg/L	<100	15600 µg/L	65.6	55	132
EP071: C29 - C36 Fraction	----	50	µg/L	<50	7820 µg/L	62.4	55	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2389363)								
EP080: C6 - C9 Fraction	----	20	µg/L	<20	360 µg/L	100	65	126
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2388357)								
EP071: >C10 - C16 Fraction	----	100	µg/L	<100	5960 µg/L	59.5	53	129
EP071: >C16 - C34 Fraction	----	100	µg/L	<100	20700 µg/L	61.6	56	131
EP071: >C34 - C40 Fraction	----	100	µg/L	<100	1520 µg/L	59.6	53	136
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2389363)								
EP080: C6 - C10 Fraction	C6_C10	20	µg/L	<20	450 µg/L	95.4	64	124
EP080: BTEXN (QCLot: 2389363)								
EP080: Benzene	71-43-2	1	µg/L	<1	20 µg/L	97.4	69	123
EP080: Toluene	108-88-3	2	µg/L	<2	20 µg/L	102	73	124
EP080: Ethylbenzene	100-41-4	2	µg/L	<2	20 µg/L	99.2	71	125

Page : 10 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **WATER**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080: BTEXN (QCLot: 2389363) - continued								
EP080: meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	40 µg/L	105	72	129
EP080: ortho-Xylene	95-47-6	2	µg/L	<2	20 µg/L	106	76	129
EP080: Naphthalene	91-20-3	5	µg/L	<5	5 µg/L	99.5	70	125

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2390833)							
EM1908628-002	BH01 1.4-1.5	EG005T: Arsenic	7440-38-2	50 mg/kg	87.4	78	124
		EG005T: Barium	7440-39-3	50 mg/kg	92.3	71	135
		EG005T: Beryllium	7440-41-7	50 mg/kg	93.7	85	125
		EG005T: Cadmium	7440-43-9	50 mg/kg	93.6	84	116
		EG005T: Chromium	7440-47-3	50 mg/kg	98.2	79	121
		EG005T: Copper	7440-50-8	50 mg/kg	90.2	82	124
		EG005T: Lead	7439-92-1	50 mg/kg	81.7	76	124
		EG005T: Manganese	7439-96-5	50 mg/kg	80.9	68	136
		EG005T: Nickel	7440-02-0	50 mg/kg	90.7	78	120
		EG005T: Selenium	7782-49-2	50 mg/kg	75.2	71	125
		EG005T: Vanadium	7440-62-2	50 mg/kg	91.7	76	124
		EG005T: Zinc	7440-66-6	50 mg/kg	85.1	74	128
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2390834)							
EM1908628-002	BH01 1.4-1.5	EG035T: Mercury	7439-97-6	0.5 mg/kg	110	76	116
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2392433)							
EM1908628-003	BH02 0.5-0.6	EP075(SIM): Acenaphthene	83-32-9	3 mg/kg	95.6	67	117
		EP075(SIM): Pyrene	129-00-0	3 mg/kg	88.7	52	148
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2389780)							
EM1908628-002	BH01 1.4-1.5	EP080: C6 - C9 Fraction	----	28 mg/kg	63.6	42	131
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2392434)							
EM1908628-002	BH01 1.4-1.5	EP071: C10 - C14 Fraction	----	688 mg/kg	111	53	123
		EP071: C15 - C28 Fraction	----	3100 mg/kg	102	70	124
		EP071: C29 - C36 Fraction	----	1490 mg/kg	88.5	64	118
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2389780)							

Page : 11 of 11
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2389780) - continued							
EM1908628-002	BH01 1.4-1.5	EP080: C6 - C10 Fraction	C6_C10	33 mg/kg	59.4	39	129
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2392434)							
EM1908628-002	BH01 1.4-1.5	EP071: >C10 - C16 Fraction	----	1050 mg/kg	105	65	123
		EP071: >C16 - C34 Fraction	----	3960 mg/kg	93.6	67	121
		EP071: >C34 - C40 Fraction	----	280 mg/kg	81.8	44	126
EP080: BTEXN (QCLot: 2389780)							
EM1908628-002	BH01 1.4-1.5	EP080: Benzene	71-43-2	2 mg/kg	86.5	50	136
		EP080: Toluene	108-88-3	2 mg/kg	85.5	56	139

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG020F: Dissolved Metals by ICP-MS (QCLot: 2393314)							
EM1908400-002	Anonymous	EG020A-F: Arsenic	7440-38-2	0.2 mg/L	102	85	131
		EG020A-F: Beryllium	7440-41-7	0.2 mg/L	94.5	73	141
		EG020A-F: Barium	7440-39-3	0.2 mg/L	116	75	127
		EG020A-F: Cadmium	7440-43-9	0.05 mg/L	83.6	81	133
		EG020A-F: Chromium	7440-47-3	0.2 mg/L	81.4	71	135
		EG020A-F: Cobalt	7440-48-4	0.2 mg/L	97.5	78	132
		EG020A-F: Copper	7440-50-8	0.2 mg/L	90.4	76	130
		EG020A-F: Lead	7439-92-1	0.2 mg/L	90.7	75	133
		EG020A-F: Manganese	7439-96-5	0.2 mg/L	102	64	134
		EG020A-F: Nickel	7440-02-0	0.2 mg/L	90.9	73	131
		EG020A-F: Vanadium	7440-62-2	0.2 mg/L	87.8	73	131
		EG020A-F: Zinc	7440-66-6	0.2 mg/L	86.8	75	131
EG035F: Dissolved Mercury by FIMS (QCLot: 2393315)							
EM1908532-008	Anonymous	EG035F: Mercury	7439-97-6	0.01 mg/L	84.0	70	120
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2389363)							
EM1908436-002	Anonymous	EP080: C6 - C9 Fraction	----	280 µg/L	78.8	43	125
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2389363)							
EM1908436-002	Anonymous	EP080: C6 - C10 Fraction	C6_C10	330 µg/L	73.9	44	122
EP080: BTEXN (QCLot: 2389363)							
EM1908436-002	Anonymous	EP080: Benzene	71-43-2	20 µg/L	99.4	68	130
		EP080: Toluene	108-88-3	20 µg/L	103	72	132

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1908628**	Page	: 1 of 9
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019
Site	: ----	Issue Date	: 12-Jun-2019
Sampler	: JOHN PAUL CUMMING	No. of samples received	: 18
Order number	:	No. of samples analysed	: 18

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **Quality Control Sample Frequency Outliers exist - please see following pages for full details.**

Page	: 2 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Outliers : Frequency of Quality Control Samples

Matrix: **WATER**

Quality Control Sample Type / Method	Count		Rate (%)		Quality Control Specification
	QC	Regular	Actual	Expected	
Laboratory Duplicates (DUP)					
PAH/Phenols (GC/MS - SIM)	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	3	0.00	10.00	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)					
PAH/Phenols (GC/MS - SIM)	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	0	3	0.00	5.00	NEPM 2013 B3 & ALS QC Standard

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / *Container* / Client Sample ID(s)		*Sample Date*	*Extraction / Preparation*			*Analysis*		
			Date extracted	Due for extraction	Evaluation	*Date analysed*	Due for analysis	Evaluation
EA001: pH in soil using 0.01M CaCl extract								
Soil Glass Jar - Unpreserved (EA001)								
BH01 0.5-0.6,	BH03 1.4-1.5,	**31-May-2019**	**07-Jun-2019**	07-Jun-2019	✓	**07-Jun-2019**	07-Jun-2019	✓
BH06 0.5-0.6,	BH06 1.4-1.5							
EA055: Moisture Content (Dried @ 105-110°C)								
Soil Glass Jar - Unpreserved (EA055)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	----	----	----	**07-Jun-2019**	14-Jun-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								

Page	: 3 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005(ED093)T: Total Metals by ICP-AES								
Soil Glass Jar - Unpreserved (EG005T)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**08-Jun-2019**	27-Nov-2019	✓	**11-Jun-2019**	27-Nov-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								
EG035T: Total Recoverable Mercury by FIMS								
Soil Glass Jar - Unpreserved (EG035T)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**08-Jun-2019**	28-Jun-2019	✓	**08-Jun-2019**	28-Jun-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Soil Glass Jar - Unpreserved (EP075(SIM))								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**07-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	17-Jul-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								

Page	: 4 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)		Sample Date	Extraction / Preparation			Analysis		
			Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080/071: Total Petroleum Hydrocarbons								
Soil Glass Jar - Unpreserved (EP080)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								
Soil Glass Jar - Unpreserved (EP071)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**07-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	17-Jul-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
Soil Glass Jar - Unpreserved (EP080)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								
Soil Glass Jar - Unpreserved (EP071)								
BH01 0.5-0.6,	BH01 1.4-1.5,	**31-May-2019**	**07-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	17-Jul-2019	✓
BH02 0.5-0.6,	BH02 1.4-1.5,							
BH03 0.5-0.6,	BH03 1.4-1.5,							
BH04 0.5-0.6,	BH04 1.4-1.5,							
BH05 0.5-0.6,	BH05 1.4-1.5,							
BH06 0.5-0.6,	BH06 1.4-1.5,							
BH07 0.5-0.6,	BH07 1.4-1.5,							
BH08 0.5-0.6,	BH08 1.4-1.5,							
Duplicate								

Page	: 5 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
BH01 0.5-0.6, BH01 1.4-1.5, BH02 0.5-0.6, BH02 1.4-1.5, BH03 0.5-0.6, BH03 1.4-1.5, BH04 0.5-0.6, BH04 1.4-1.5, BH05 0.5-0.6, BH05 1.4-1.5, BH06 0.5-0.6, BH06 1.4-1.5, BH07 0.5-0.6, BH07 1.4-1.5, BH08 0.5-0.6, BH08 1.4-1.5, Duplicate	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓

Matrix: **WATER**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG020F: Dissolved Metals by ICP-MS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG020A-F)							
Rinsate	**31-May-2019**	----	----	----	**07-Jun-2019**	27-Nov-2019	✓
EG035F: Dissolved Mercury by FIMS							
Clear Plastic Bottle - Filtered; Lab-acidified (EG035F)							
Rinsate	**31-May-2019**	----	----	----	**11-Jun-2019**	28-Jun-2019	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP075(SIM))							
Rinsate	**31-May-2019**	**05-Jun-2019**	07-Jun-2019	✓	**06-Jun-2019**	15-Jul-2019	✓
EP080/071: Total Petroleum Hydrocarbons							
Amber Glass Bottle - Unpreserved (EP071)							
Rinsate	**31-May-2019**	**05-Jun-2019**	07-Jun-2019	✓	**06-Jun-2019**	15-Jul-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Amber Glass Bottle - Unpreserved (EP071)							
Rinsate	**31-May-2019**	**05-Jun-2019**	07-Jun-2019	✓	**06-Jun-2019**	15-Jul-2019	✓
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓
EP080: BTEXN							
Amber VOC Vial - Sulfuric Acid (EP080)							
Rinsate	**31-May-2019**	**06-Jun-2019**	14-Jun-2019	✓	**07-Jun-2019**	14-Jun-2019	✓

Page	: 6 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	4	40	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
pH in soil using a 0.01M CaCl2 extract	EA001	1	7	14.29	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	17	11.76	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	4	20	20.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	10.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	17	5.88	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	5.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Dissolved Mercury by FIMS	EG035F	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	2	19	10.53	10.00	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	3	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	3	0.00	10.00	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	18	11.11	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							

Page	: 7 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Control Samples (LCS) - Continued							
Dissolved Mercury by FIMS	EG035F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Dissolved Mercury by FIMS	EG035F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	3	**33.33**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Dissolved Mercury by FIMS	EG035F	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Dissolved Metals by ICP-MS - Suite A	EG020A-F	1	19	**5.26**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	0	3	**0.00**	**5.00**	×	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	18	**5.56**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Page	: 8 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl2 extract	EA001	SOIL	In house: Referenced to Rayment and Lyons (2011) 4B3 (mod.) or 4B4 (mod.) 10 g of soil is mixed with 50 mL of 0.01M CaCl2 and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3)
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM amended 2013.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM amended 2013.
Dissolved Metals by ICP-MS - Suite A	EG020A-F	WATER	In house: Referenced to APHA 3125; USEPA SW846 - 6020, ALS QWI-EN/EG020. Samples are 0.45µm filtered prior to analysis. The ICPMS technique utilizes a highly efficient argon plasma to ionize selected elements. Ions are then passed into a high vacuum mass spectrometer, which separates the analytes based on their distinct mass to charge ratios prior to their measurement by a discrete dynode ion detector.
Dissolved Mercury by FIMS	EG035F	WATER	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2)(Cold Vapour generation) AAS) Samples are 0.45µm filtered prior to analysis. FIM-AAS is an automated flameless atomic absorption technique. A bromate/bromide reagent is used to oxidise any organic mercury compounds in the filtered sample. The ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	WATER	In house: Referenced to USEPA SW 846 - 8015A The sample extract is analysed by Capillary GC/FID and quantification is by comparison against an established 5 point calibration curve of n-Alkane standards. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)

Page	: 9 of 9
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Methods	Method	Matrix	Method Descriptions
PAH/Phenols (GC/MS - SIM)	EP075(SIM)	WATER	In house: Referenced to USEPA SW 846 - 8270D Sample extracts are analysed by Capillary GC/MS in SIM Mode and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH Volatiles/BTEX	EP080	WATER	In house: Referenced to USEPA SW 846 - 8260B Water samples are directly purged prior to analysis by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. Alternatively, a sample is equilibrated in a headspace vial and a portion of the headspace determined by GCMS analysis. This method is compliant with the QC requirements of NEPM (2013) Schedule B(3)

Preparation Methods	Method	Matrix	Method Descriptions
pH in soil using a 0.01M CaCl2 extract	EA001-PR	SOIL	In house: Referenced to Rayment and Higginson 4B1, 10 g of soil is mixed with 50 mL of 0.01M CaCl2 and tumbled end over end for 1 hour. pH is measured from the continuous suspension. This method is compliant with NEPM (2013) Schedule B(3) (Method 103)
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.
Separatory Funnel Extraction of Liquids	ORG14	WATER	In house: Referenced to USEPA SW 846 - 3510B 100 mL to 1L of sample is transferred to a separatory funnel and serially extracted three times using DCM for each extract. The resultant extracts are combined, dehydrated and concentrated for analysis. This method is compliant with NEPM (2013) Schedule B(3) . ALS default excludes sediment which may be resident in the container.
Volatiles Water Preparation	ORG16-W	WATER	A 5 mL aliquot or 5 mL of a diluted sample is added to a 40 mL VOC vial for sparging.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **ES1917553**	Page	: 1 of 8
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Sydney
Contact	: DR JOHN PAUL CUMMING	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 06-Jun-2019
Order number	:	Date Analysis Commenced	: 11-Jun-2019
C-O-C number	: ----	Issue Date	: 14-Jun-2019
Sampler	: JPC		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

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

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

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

Page	: 2 of 8
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2398067)									
ES1917618-072	Anonymous	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	20	20	0.00	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	9	14	41.7	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	4	4	0.00	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	6	5	0.00	No Limit
		EG005T: Arsenic	7440-38-2	5	mg/kg	5	14	88.2	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	9	10	0.00	No Limit
		EG005T: Lead	7439-92-1	5	mg/kg	37	29	24.8	No Limit
		EG005T: Manganese	7439-96-5	5	mg/kg	298	292	2.04	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit
		EG005T: Vanadium	7440-62-2	5	mg/kg	13	12	0.00	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	32	45	32.5	No Limit
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
ES1917553-001	INTER LAB SPLIT	EG005T: Beryllium	7440-41-7	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Cadmium	7440-43-9	1	mg/kg	<1	<1	0.00	No Limit
		EG005T: Barium	7440-39-3	10	mg/kg	70	90	20.7	No Limit
		EG005T: Chromium	7440-47-3	2	mg/kg	18	12	39.2	No Limit
		EG005T: Cobalt	7440-48-4	2	mg/kg	6	7	15.5	No Limit
		EG005T: Nickel	7440-02-0	2	mg/kg	25	24	4.82	0% - 50%
		EG005T: Arsenic	7440-38-2	5	mg/kg	20	30	42.6	No Limit
		EG005T: Copper	7440-50-8	5	mg/kg	179	212	16.8	0% - 20%
		EG005T: Lead	7439-92-1	5	mg/kg	191	228	17.7	0% - 20%
		EG005T: Manganese	7439-96-5	5	mg/kg	213	231	7.96	0% - 20%
		EG005T: Selenium	7782-49-2	5	mg/kg	<5	<5	0.00	No Limit

Page : 3 of 8
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EG005(ED093)T: Total Metals by ICP-AES (QC Lot: 2398067) - continued									
ES1917553-001	INTER LAB SPLIT	EG005T: Vanadium	7440-62-2	5	mg/kg	28	18	40.0	No Limit
		EG005T: Zinc	7440-66-6	5	mg/kg	112	114	1.82	0% - 20%
		EG005T: Boron	7440-42-8	50	mg/kg	<50	<50	0.00	No Limit
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2398072)									
ES1917618-010	Anonymous	EA055: Moisture Content	----	0.1	%	12.4	11.7	5.67	0% - 50%
ES1917618-077	Anonymous	EA055: Moisture Content	----	0.1	%	15.4	15.3	0.656	0% - 50%
EG035T: Total Recoverable Mercury by FIMS (QC Lot: 2398068)									
ES1917553-001	INTER LAB SPLIT	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
ES1917641-009	Anonymous	EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	0.00	No Limit
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2394409)									
ES1917585-001	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
ES1917585-007	Anonymous	EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit

Page : 4 of 8
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QC Lot: 2394409) - continued									
ES1917585-007	Anonymous	EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP075(SIM): Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2394408)									
ES1917585-001	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1917585-007	Anonymous	EP071: C15 - C28 Fraction	----	100	mg/kg	430	400	8.63	No Limit
		EP071: C29 - C36 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: C10 - C14 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
EP080/071: Total Petroleum Hydrocarbons (QC Lot: 2394444)									
ES1917553-001	INTER LAB SPLIT	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
ES1917585-006	Anonymous	EP080: C6 - C9 Fraction	----	10	mg/kg	<10	<10	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2394408)									
ES1917585-001	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	<50	0.00	No Limit
ES1917585-007	Anonymous	EP071: >C16 - C34 Fraction	----	100	mg/kg	410	390	5.17	No Limit
		EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	<100	0.00	No Limit
		EP071: >C10 - C16 Fraction	----	50	mg/kg	50	<50	0.00	No Limit
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QC Lot: 2394444)									
ES1917553-001	INTER LAB SPLIT	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
ES1917585-006	Anonymous	EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	<10	0.00	No Limit
EP080: BTEXN (QC Lot: 2394444)									
ES1917553-001	INTER LAB SPLIT	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit
		EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit
ES1917585-006	Anonymous	EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	<0.2	0.00	No Limit

Page	: 5 of 8
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	*Client sample ID*	*Method: Compound*	*CAS Number*	*LOR*	*Unit*	*Original Result*	*Duplicate Result*	*RPD (%)*	*Recovery Limits (%)*
EP080: BTEXN (QC Lot: 2394444) - continued									
ES1917585-006	Anonymous	EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	<0.5	0.00	No Limit
		EP080: Naphthalene	91-20-3	1	mg/kg	<1	<1	0.00	No Limit

Page	: 6 of 8
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2398067)								
EG005T: Arsenic	7440-38-2	5	mg/kg	<5	21.7 mg/kg	99.8	86	126
EG005T: Barium	7440-39-3	10	mg/kg	<10	143 mg/kg	94.3	85	115
EG005T: Beryllium	7440-41-7	1	mg/kg	<1	5.63 mg/kg	106	90	113
EG005T: Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
EG005T: Cadmium	7440-43-9	1	mg/kg	<1	4.64 mg/kg	96.0	83	113
EG005T: Chromium	7440-47-3	2	mg/kg	<2	43.9 mg/kg	80.5	76	128
EG005T: Cobalt	7440-48-4	2	mg/kg	<2	16 mg/kg	96.5	88	120
EG005T: Copper	7440-50-8	5	mg/kg	<5	32 mg/kg	95.0	86	120
EG005T: Lead	7439-92-1	5	mg/kg	<5	40 mg/kg	99.8	80	114
EG005T: Manganese	7439-96-5	5	mg/kg	<5	130 mg/kg	94.7	85	117
EG005T: Nickel	7440-02-0	2	mg/kg	<2	55 mg/kg	89.1	87	123
EG005T: Selenium	7782-49-2	5	mg/kg	<5	5.37 mg/kg	88.0	75	131
EG005T: Vanadium	7440-62-2	5	mg/kg	<5	29.6 mg/kg	103	92	122
EG005T: Zinc	7440-66-6	5	mg/kg	<5	60.8 mg/kg	103	80	122
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2398068)								
EG035T: Mercury	7439-97-6	0.1	mg/kg	<0.1	2.57 mg/kg	79.2	70	105
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2394409)								
EP075(SIM): Naphthalene	91-20-3	0.5	mg/kg	<0.5	6 mg/kg	115	77	125
EP075(SIM): Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	6 mg/kg	118	72	124
EP075(SIM): Acenaphthene	83-32-9	0.5	mg/kg	<0.5	6 mg/kg	107	73	127
EP075(SIM): Fluorene	86-73-7	0.5	mg/kg	<0.5	6 mg/kg	114	72	126
EP075(SIM): Phenanthrene	85-01-8	0.5	mg/kg	<0.5	6 mg/kg	114	75	127
EP075(SIM): Anthracene	120-12-7	0.5	mg/kg	<0.5	6 mg/kg	113	77	127
EP075(SIM): Fluoranthene	206-44-0	0.5	mg/kg	<0.5	6 mg/kg	118	73	127
EP075(SIM): Pyrene	129-00-0	0.5	mg/kg	<0.5	6 mg/kg	114	74	128
EP075(SIM): Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	6 mg/kg	103	69	123
EP075(SIM): Chrysene	218-01-9	0.5	mg/kg	<0.5	6 mg/kg	96.1	75	127
EP075(SIM): Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	6 mg/kg	91.9	68	116
EP075(SIM): Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	6 mg/kg	85.8	74	126
EP075(SIM): Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	6 mg/kg	107	70	126
EP075(SIM): Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	6 mg/kg	86.0	61	121
EP075(SIM): Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	6 mg/kg	80.1	62	118
EP075(SIM): Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg	<0.5	6 mg/kg	92.6	63	121

Page : 7 of 8
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

Method: Compound	CAS Number	LOR	Unit	Method Blank (MB) Report: Result	Laboratory Control Spike (LCS) Report: Spike Concentration	Spike Recovery (%): LCS	Recovery Limits (%): Low	Recovery Limits (%): High
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2394408)								
EP071: C10 - C14 Fraction	----	50	mg/kg	<50	300 mg/kg	96.2	75	129
EP071: C15 - C28 Fraction	----	100	mg/kg	<100	450 mg/kg	106	77	131
EP071: C29 - C36 Fraction	----	100	mg/kg	<100	300 mg/kg	96.1	71	129
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2394444)								
EP080: C6 - C9 Fraction	----	10	mg/kg	<10	26 mg/kg	85.8	68	128
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2394408)								
EP071: >C10 - C16 Fraction	----	50	mg/kg	<50	375 mg/kg	95.5	77	125
EP071: >C16 - C34 Fraction	----	100	mg/kg	<100	525 mg/kg	98.8	74	138
EP071: >C34 - C40 Fraction	----	100	mg/kg	<100	225 mg/kg	83.8	63	131
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2394444)								
EP080: C6 - C10 Fraction	C6_C10	10	mg/kg	<10	31 mg/kg	84.5	68	128
EP080: BTEXN (QCLot: 2394444)								
EP080: Benzene	71-43-2	0.2	mg/kg	<0.2	1 mg/kg	86.7	62	116
EP080: Toluene	108-88-3	0.5	mg/kg	<0.5	1 mg/kg	88.2	67	121
EP080: Ethylbenzene	100-41-4	0.5	mg/kg	<0.5	1 mg/kg	87.4	65	117
EP080: meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg	<0.5	2 mg/kg	89.4	66	118
EP080: ortho-Xylene	95-47-6	0.5	mg/kg	<0.5	1 mg/kg	88.8	68	120
EP080: Naphthalene	91-20-3	1	mg/kg	<1	1 mg/kg	108	63	119

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Matrix Spike (MS) Report: Spike Concentration	SpikeRecovery(%): MS	Recovery Limits (%): Low	Recovery Limits (%): High
EG005(ED093)T: Total Metals by ICP-AES (QCLot: 2398067)							
ES1917553-001	INTER LAB SPLIT	EG005T: Arsenic	7440-38-2	50 mg/kg	116	70	130
		EG005T: Cadmium	7440-43-9	50 mg/kg	98.8	70	130
		EG005T: Chromium	7440-47-3	50 mg/kg	89.2	70	130
		EG005T: Copper	7440-50-8	250 mg/kg	98.3	70	130
		EG005T: Lead	7439-92-1	250 mg/kg	105	70	130
		EG005T: Nickel	7440-02-0	50 mg/kg	104	70	130
		EG005T: Zinc	7440-66-6	250 mg/kg	113	70	130
EG035T: Total Recoverable Mercury by FIMS (QCLot: 2398068)							
ES1917553-001	INTER LAB SPLIT	EG035T: Mercury	7439-97-6	5 mg/kg	95.8	70	130

Page : 8 of 8
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons (QCLot: 2394409)							
ES1917585-001	Anonymous	EP075(SIM): Acenaphthene	83-32-9	10 mg/kg	99.1	70	130
		EP075(SIM): Pyrene	129-00-0	10 mg/kg	106	70	130
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2394408)							
ES1917585-001	Anonymous	EP071: C10 - C14 Fraction	----	523 mg/kg	104	73	137
		EP071: C15 - C28 Fraction	----	2319 mg/kg	114	53	131
		EP071: C29 - C36 Fraction	----	1714 mg/kg	113	52	132
EP080/071: Total Petroleum Hydrocarbons (QCLot: 2394444)							
ES1917553-001	INTER LAB SPLIT	EP080: C6 - C9 Fraction	----	32.5 mg/kg	128	70	130
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2394408)							
ES1917585-001	Anonymous	EP071: >C10 - C16 Fraction	----	860 mg/kg	99.8	73	137
		EP071: >C16 - C34 Fraction	----	3223 mg/kg	124	53	131
		EP071: >C34 - C40 Fraction	----	1058 mg/kg	112	52	132
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions (QCLot: 2394444)							
ES1917553-001	INTER LAB SPLIT	EP080: C6 - C10 Fraction	C6_C10	37.5 mg/kg	126	70	130
EP080: BTEXN (QCLot: 2394444)							
ES1917553-001	INTER LAB SPLIT	EP080: Benzene	71-43-2	2.5 mg/kg	113	70	130
		EP080: Toluene	108-88-3	2.5 mg/kg	116	70	130
		EP080: Ethylbenzene	100-41-4	2.5 mg/kg	114	70	130
		EP080: meta- & para-Xylene	108-38-3 106-42-3	2.5 mg/kg	109	70	130
		EP080: ortho-Xylene	95-47-6	2.5 mg/kg	112	70	130
		EP080: Naphthalene	91-20-3	2.5 mg/kg	94.2	70	130

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **ES1917553**	Page	: 1 of 4
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Sydney
Contact	: DR JOHN PAUL CUMMING	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 06-Jun-2019
Site	: ----	Issue Date	: 14-Jun-2019
Sampler	: JPC	No. of samples received	: 1
Order number	:	No. of samples analysed	: 1

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Page	: 2 of 4
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL**

Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
INTER LAB SPLIT	31-May-2019	----	----	----	11-Jun-2019	14-Jun-2019	✓
EG005(ED093)T: Total Metals by ICP-AES							
Soil Glass Jar - Unpreserved (EG005T)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	27-Nov-2019	✓	11-Jun-2019	27-Nov-2019	✓
EG035T: Total Recoverable Mercury by FIMS							
Soil Glass Jar - Unpreserved (EG035T)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	28-Jun-2019	✓	12-Jun-2019	28-Jun-2019	✓
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons							
Soil Glass Jar - Unpreserved (EP075(SIM))							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	12-Jun-2019	21-Jul-2019	✓
EP080/071: Total Petroleum Hydrocarbons							
Soil Glass Jar - Unpreserved (EP071)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	12-Jun-2019	21-Jul-2019	✓
Soil Glass Jar - Unpreserved (EP080)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	13-Jun-2019	14-Jun-2019	✓
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions							
Soil Glass Jar - Unpreserved (EP071)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	12-Jun-2019	21-Jul-2019	✓
Soil Glass Jar - Unpreserved (EP080)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	13-Jun-2019	14-Jun-2019	✓
EP080: BTEXN							
Soil Glass Jar - Unpreserved (EP080)							
INTER LAB SPLIT	31-May-2019	11-Jun-2019	14-Jun-2019	✓	13-Jun-2019	14-Jun-2019	✓

Page	: 3 of 4
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	*Method*	*QC*	*Regular*	***Actual***	***Expected***	*Evaluation*	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
PAH/Phenols (SIM)	EP075(SIM)	2	16	**12.50**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	2	20	**10.00**	**10.00**	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
PAH/Phenols (SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
PAH/Phenols (SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
PAH/Phenols (SIM)	EP075(SIM)	1	16	**6.25**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Mercury by FIMS	EG035T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
Total Metals by ICP-AES	EG005T	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH - Semivolatile Fraction	EP071	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard
TRH Volatiles/BTEX	EP080	1	20	**5.00**	**5.00**	✓	NEPM 2013 B3 & ALS QC Standard

Page	: 4 of 4
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Total Metals by ICP-AES	EG005T	SOIL	In house: Referenced to APHA 3120; USEPA SW 846 - 6010. Metals are determined following an appropriate acid digestion of the soil. The ICPAES technique ionises samples in a plasma, emitting a characteristic spectrum based on metals present. Intensities at selected wavelengths are compared against those of matrix matched standards. This method is compliant with NEPM (2013) Schedule B(3)
Total Mercury by FIMS	EG035T	SOIL	In house: Referenced to AS 3550, APHA 3112 Hg - B (Flow-injection (SnCl2) (Cold Vapour generation) AAS) FIM-AAS is an automated flameless atomic absorption technique. Mercury in solids are determined following an appropriate acid digestion. Ionic mercury is reduced online to atomic mercury vapour by SnCl2 which is then purged into a heated quartz cell. Quantification is by comparing absorbance against a calibration curve. This method is compliant with NEPM (2013) Schedule B(3)
TRH - Semivolatile Fraction	EP071	SOIL	In house: Referenced to USEPA SW 846 - 8015A Sample extracts are analysed by Capillary GC/FID and quantified against alkane standards over the range C10 - C40. Compliant with NEPM amended 2013.
PAH/Phenols (SIM)	EP075(SIM)	SOIL	In house: Referenced to USEPA SW 846 - 8270D. Extracts are analysed by Capillary GC/MS in Selective Ion Mode (SIM) and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 502 and 507)
TRH Volatiles/BTEX	EP080	SOIL	In house: Referenced to USEPA SW 846 - 8260B. Extracts are analysed by Purge and Trap, Capillary GC/MS. Quantification is by comparison against an established 5 point calibration curve. Compliant with NEPM amended 2013.

Preparation Methods	Method	Matrix	Method Descriptions
Hot Block Digest for metals in soils sediments and sludges	EN69	SOIL	In house: Referenced to USEPA 200.2. Hot Block Acid Digestion 1.0g of sample is heated with Nitric and Hydrochloric acids, then cooled. Peroxide is added and samples heated and cooled again before being filtered and bulked to volume for analysis. Digest is appropriate for determination of selected metals in sludge, sediments, and soils. This method is compliant with NEPM (2013) Schedule B(3) (Method 202)
Methanolic Extraction of Soils for Purge and Trap	ORG16	SOIL	In house: Referenced to USEPA SW 846 - 5030A. 5g of solid is shaken with surrogate and 10mL methanol prior to analysis by Purge and Trap - GC/MS.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

ALS Environmental

QUALITY CONTROL REPORT

Work Order	: **EM1909096**	Page	: 1 of 3
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019
Order number	:	Date Analysis Commenced	: 14-Jun-2019
C-O-C number	: ----	Issue Date	: 20-Jun-2019
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 3		
No. of samples analysed	: 3		

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

This Quality Control Report contains the following information:

- Laboratory Duplicate (DUP) Report; Relative Percentage Difference (RPD) and Acceptance Limits
- Method Blank (MB) and Laboratory Control Spike (LCS) Report; Recovery and Acceptance Limits
- Matrix Spike (MS) Report; Recovery and Acceptance Limits

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nancy Wang	2IC Organic Chemist	Melbourne Inorganics, Springvale, VIC
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC

Page	: 2 of 3
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

General Comments

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

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

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

Key : Anonymous = Refers to samples which are not specifically part of this work order but formed part of the QC process lot
CAS Number = CAS registry number from database maintained by Chemical Abstracts Services. The Chemical Abstracts Service is a division of the American Chemical Society.
LOR = Limit of reporting
RPD = Relative Percentage Difference
# = Indicates failed QC

Laboratory Duplicate (DUP) Report

The quality control term Laboratory Duplicate refers to a randomly selected intralaboratory split. Laboratory duplicates provide information regarding method precision and sample heterogeneity. The permitted ranges for the Relative Percent Deviation (RPD) of Laboratory Duplicates are specified in ALS Method QWI-EN/38 and are dependent on the magnitude of results in comparison to the level of reporting: Result < 10 times LOR: No Limit; Result between 10 and 20 times LOR: 0% - 50%; Result > 20 times LOR: 0% - 20%.

Sub-Matrix: **SOIL**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EA055: Moisture Content (Dried @ 105-110°C) (QC Lot: 2406706)									
EM1908427-052	Anonymous	EA055: Moisture Content	----	0.1	%	17.8	17.8	0.00	0% - 50%
EM1908427-086	Anonymous	EA055: Moisture Content	----	0.1	%	13.8	14.5	5.08	0% - 50%
EK026SF: Total CN by Segmented Flow Analyser (QC Lot: 2406082)									
EM1909096-001	BH01 1.4-1.5	EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	<1	0.00	No Limit
EP066: Polychlorinated Biphenyls (PCB) (QC Lot: 2404824)									
EM1909096-001	BH01 1.4-1.5	EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	0.00	No Limit

Sub-Matrix: **WATER**

				Laboratory Duplicate (DUP) Report					
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	LOR	Unit	Original Result	Duplicate Result	RPD (%)	Recovery Limits (%)
EG005(ED093)C: Leachable Metals by ICPAES (QC Lot: 2416387)									
EM1909096-002	BH07 0.5-0.6	EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.00	No Limit
		EG005C: Copper	7440-50-8	0.1	mg/L	0.3	0.3	0.00	No Limit
EM1909145-005	Anonymous	EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	<0.1	0.00	No Limit
		EG005C: Copper	7440-50-8	0.1	mg/L	<0.1	<0.1	0.00	No Limit

Page	: 3 of 3
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Method Blank (MB) and Laboratory Control Spike (LCS) Report

The quality control term Method / Laboratory Blank refers to an analyte free matrix to which all reagents are added in the same volumes or proportions as used in standard sample preparation. The purpose of this QC parameter is to monitor potential laboratory contamination. The quality control term Laboratory Control Spike (LCS) refers to a certified reference material, or a known interference free matrix spiked with target analytes. The purpose of this QC parameter is to monitor method precision and accuracy independent of sample matrix. Dynamic Recovery Limits are based on statistical evaluation of processed LCS.

Sub-Matrix: **SOIL**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2406082)								
EK026SF: Total Cyanide	57-12-5	1	mg/kg	<1	20 mg/kg	100	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 2404824)								
EP066: Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	1.27 mg/kg	95.5	63	115

Sub-Matrix: **WATER**

				Method Blank (MB) Report	Laboratory Control Spike (LCS) Report			
					Spike	Spike Recovery (%)	Recovery Limits (%)	
Method: Compound	CAS Number	LOR	Unit	Result	Concentration	LCS	Low	High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 2416387)								
EG005C: Arsenic	7440-38-2	0.1	mg/L	<0.1	1 mg/L	102	89	119
EG005C: Copper	7440-50-8	0.1	mg/L	<0.1	1 mg/L	97.7	88	115

Matrix Spike (MS) Report

The quality control term Matrix Spike (MS) refers to an intralaboratory split sample spiked with a representative set of target analytes. The purpose of this QC parameter is to monitor potential matrix effects on analyte recoveries. Static Recovery Limits as per laboratory Data Quality Objectives (DQOs). Ideal recovery ranges stated may be waived in the event of sample matrix interference.

Sub-Matrix: **SOIL**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EK026SF: Total CN by Segmented Flow Analyser (QCLot: 2406082)							
EM1909096-002	BH07 0.5-0.6	EK026SF: Total Cyanide	57-12-5	20 mg/kg	79.5	70	130
EP066: Polychlorinated Biphenyls (PCB) (QCLot: 2404824)							
EM1909096-002	BH07 0.5-0.6	EP066: Total Polychlorinated biphenyls	----	1.27 mg/kg	94.6	44	144

Sub-Matrix: **WATER**

				Matrix Spike (MS) Report			
				Spike	SpikeRecovery(%)	Recovery Limits (%)	
Laboratory sample ID	Client sample ID	Method: Compound	CAS Number	Concentration	MS	Low	High
EG005(ED093)C: Leachable Metals by ICPAES (QCLot: 2416387)							
EM1909096-003	BH03 0.5-0.6	EG005C: Arsenic	7440-38-2	1 mg/L	110	88	124
		EG005C: Copper	7440-50-8	1 mg/L	103	91	121

ALS Environmental

QA/QC Compliance Assessment to assist with Quality Review

Work Order	: **EM1909096**	Page	: 1 of 4
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019
Site	: ----	Issue Date	: 20-Jun-2019
Sampler	: ----	No. of samples received	: 3
Order number	:	No. of samples analysed	: 3

This report is automatically generated by the ALS LIMS through interpretation of the ALS Quality Control Report and several Quality Assurance parameters measured by ALS. This automated reporting highlights any non-conformances, facilitates faster and more accurate data validation and is designed to assist internal expert and external Auditor review. Many components of this report contribute to the overall DQO assessment and reporting for guideline compliance.

Brief method summaries and references are also provided to assist in traceability.

Summary of Outliers

Outliers : Quality Control Samples

This report highlights outliers flagged in the Quality Control (QC) Report.

- **NO Method Blank value outliers occur.**
- **NO Duplicate outliers occur.**
- **NO Laboratory Control outliers occur.**
- **NO Matrix Spike outliers occur.**
- **For all regular sample matrices, NO surrogate recovery outliers occur.**

Outliers : Analysis Holding Time Compliance

- **NO Analysis Holding Time Outliers exist.**

Outliers : Frequency of Quality Control Samples

- **NO Quality Control Sample Frequency Outliers exist.**

Page	: 2 of 4
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analysis Holding Time Compliance

If samples are identified below as having been analysed or extracted outside of recommended holding times, this should be taken into consideration when interpreting results.

This report summarizes extraction / preparation and analysis times and compares each with ALS recommended holding times (referencing USEPA SW 846, APHA, AS and NEPM) based on the sample container provided. Dates reported represent first date of extraction or analysis and preclude subsequent dilutions and reruns. A listing of breaches (if any) is provided herein.

Holding time for leachate methods (e.g. TCLP) vary according to the analytes reported. Assessment compares the leach date with the shortest analyte holding time for the equivalent soil method. These are: organics 14 days, mercury 28 days & other metals 180 days. A recorded breach does not guarantee a breach for all non-volatile parameters.

Holding times for ***VOC in soils*** vary according to analytes of interest. Vinyl Chloride and Styrene holding time is 7 days; others 14 days. A recorded breach does not guarantee a breach for all VOC analytes and should be verified in case the reported breach is a false positive or Vinyl Chloride and Styrene are not key analytes of interest/concern.

Matrix: **SOIL** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EA055: Moisture Content (Dried @ 105-110°C)							
Soil Glass Jar - Unpreserved (EA055)							
BH01 1.4-1.5, BH07 0.5-0.6	**31-May-2019**	----	----	----	**14-Jun-2019**	14-Jun-2019	✓
EK026SF: Total CN by Segmented Flow Analyser							
Soil Glass Jar - Unpreserved (EK026SF)							
BH01 1.4-1.5, BH07 0.5-0.6	**31-May-2019**	**14-Jun-2019**	14-Jun-2019	✓	**17-Jun-2019**	28-Jun-2019	✓
EN33: TCLP Leach							
Non-Volatile Leach: 180 day HT (e.g. PFAS, metals ex.Hg) (EN33a)							
BH07 0.5-0.6, BH03 0.5-0.6	**31-May-2019**	**17-Jun-2019**	27-Nov-2019	✓	----	----	----
EP066: Polychlorinated Biphenyls (PCB)							
Soil Glass Jar - Unpreserved (EP066)							
BH01 1.4-1.5, BH07 0.5-0.6	**31-May-2019**	**14-Jun-2019**	14-Jun-2019	✓	**14-Jun-2019**	24-Jul-2019	✓

Matrix: **WATER** Evaluation: × = Holding time breach ; ✓ = Within holding time.

Method / Container / Client Sample ID(s)	Sample Date	Extraction / Preparation			Analysis		
		Date extracted	Due for extraction	Evaluation	Date analysed	Due for analysis	Evaluation
EG005(ED093)C: Leachable Metals by ICPAES							
Clear Plastic Bottle - Nitric Acid; Unfiltered (EG005C)							
BH07 0.5-0.6, BH03 0.5-0.6	**17-Jun-2019**	**20-Jun-2019**	14-Dec-2019	✓	**20-Jun-2019**	14-Dec-2019	✓

Page	: 3 of 4
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Quality Control Parameter Frequency Compliance

The following report summarises the frequency of laboratory QC samples analysed within the analytical lot(s) in which the submitted sample(s) was(were) processed. Actual rate should be greater than or equal to the expected rate. A listing of breaches is provided in the Summary of Outliers.

Matrix: **SOIL**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Moisture Content	EA055	2	15	13.33	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Polychlorinated Biphenyls (PCB)	EP066	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Polychlorinated Biphenyls (PCB)	EP066	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Polychlorinated Biphenyls (PCB)	EP066	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Polychlorinated Biphenyls (PCB)	EP066	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Total Cyanide by Segmented Flow Analyser	EK026SF	1	2	50.00	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Matrix: **WATER**

Evaluation: × = Quality Control frequency not within specification ; ✓ = Quality Control frequency within specification.

Quality Control Sample Type		Count		Rate (%)			Quality Control Specification
Analytical Methods	Method	QC	Regular	Actual	Expected	Evaluation	
Laboratory Duplicates (DUP)							
Leachable Metals by ICPAES	EG005C	2	13	15.38	10.00	✓	NEPM 2013 B3 & ALS QC Standard
Laboratory Control Samples (LCS)							
Leachable Metals by ICPAES	EG005C	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Method Blanks (MB)							
Leachable Metals by ICPAES	EG005C	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard
Matrix Spikes (MS)							
Leachable Metals by ICPAES	EG005C	1	13	7.69	5.00	✓	NEPM 2013 B3 & ALS QC Standard

Page	: 4 of 4
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Brief Method Summaries

The analytical procedures used by the Environmental Division have been developed from established internationally recognized procedures such as those published by the US EPA, APHA, AS and NEPM. In house developed procedures are employed in the absence of documented standards or by client request. The following report provides brief descriptions of the analytical procedures employed for results reported in the Certificate of Analysis. Sources from which ALS methods have been developed are provided within the Method Descriptions.

Analytical Methods	Method	Matrix	Method Descriptions
Moisture Content	EA055	SOIL	In house: A gravimetric procedure based on weight loss over a 12 hour drying period at 105-110 degrees C. This method is compliant with NEPM (2013) Schedule B(3) Section 7.1 and Table 1 (14 day holding time).
Leachable Metals by ICPAES	EG005C	SOIL	In house: referenced to APHA 3120; USEPA SW 846 - 6010: The ICPAES technique ionises leachate sample atoms emitting a characteristic spectrum. This spectrum is then compared against matrix matched standards for quantification. This method is compliant with NEPM (2013) Schedule B(3)
Total Cyanide by Segmented Flow Analyser	EK026SF	SOIL	In house: Referenced to APHA 4500-CN C / ASTM D7511. Caustic leachates of soil samples are introduced into an automated segmented flow analyser. Complex bound cyanide is decomposed in a continuously flowing stream, at a pH of 3.8, by the effect of UV light. A UV-B lamp (312 nm) and a decomposition spiral of borosilicate glass are used to filter out UV light with a wavelength of less than 290 nm thus preventing the conversion of thiocyanate into cyanide. The hydrogen cyanide present at a pH of 3.8 is separated by gas dialysis. The hydrogen cyanide is then determined photometrically, based on the reaction of cyanide with chloramine-T to form cyanogen chloride. This then reacts with 4-pyridine carboxylic acid and 1,3-dimethylbarbituric acid to give a red colour which is measured at 600 nm. This method is compliant with NEPM (2013) Schedule B(3)
Polychlorinated Biphenyls (PCB)	EP066	SOIL	In house: Referenced to USEPA SW 846 - 8270D Extracts are analysed by Capillary GC/MS and quantification is by comparison against an established 5 point calibration curve. This method is compliant with NEPM (2013) Schedule B(3) (Method 504)

Preparation Methods	Method	Matrix	Method Descriptions
NaOH leach for CN in Soils	CN-PR	SOIL	In house: APHA 4500 CN. Samples are extracted by end-over-end tumbling with NaOH.
Digestion for Total Recoverable Metals in TCLP Leachate	EN25C	SOIL	In house: Referenced to USEPA SW846-3005. Method 3005 is a Nitric/Hydrochloric acid digestion procedure used to prepare surface and ground water samples for analysis by ICPAES or ICPMS. This method is compliant with NEPM (2013) Schedule B(3)
TCLP for Non & Semivolatile Analytes	EN33a	SOIL	In house QWI-EN/33 referenced to USEPA SW846-1311: The TCLP procedure is designed to determine the mobility of both organic and inorganic analytes present in wastes. The standard TCLP leach is for non-volatile and Semivolatile test parameters.
Tumbler Extraction of Solids	ORG17	SOIL	In house: Mechanical agitation (tumbler). 10g of sample, Na2SO4 and surrogate are extracted with 30mL 1:1 DCM/Acetone by end over end tumble. The solvent is decanted, dehydrated and concentrated (by KD) to the desired volume for analysis.

Appendix 11 Analytical Results - Certificate of Analysis

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1908628**	Page	: 1 of 18
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019 09:35
Order number	:	Date Analysis Commenced	: 05-Jun-2019
C-O-C number	: ----	Issue Date	: 12-Jun-2019 16:56
Sampler	: JOHN PAUL CUMMING		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 18		
No. of samples analysed	: 18		

ilac-MRA NATA

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Xing Lin	Senior Organic Chemist	Melbourne Organics, Springvale, VIC

RIGHT SOLUTIONS | RIGHT PARTNER

Page	: 2 of 18
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

General Comments

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

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

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

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

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

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

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

- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero.
- Benzo(a)pyrene Toxicity Equivalent Quotient (TEQ) per the NEPM (2013) is the sum total of the concentration of the eight carcinogenic PAHs multiplied by their Toxicity Equivalence Factor (TEF) relative to Benzo(a)pyrene. TEF values are provided in brackets as follows: Benz(a)anthracene (0.1), Chrysene (0.01), Benzo(b+j) & Benzo(k)fluoranthene (0.1), Benzo(a)pyrene (1.0), Indeno(1.2.3.cd)pyrene (0.1), Dibenz(a.h)anthracene (1.0), Benzo(g.h.i)perylene (0.01). Less than LOR results for 'TEQ Zero' are treated as zero, for 'TEQ 1/2LOR' are treated as half the reported LOR, and for 'TEQ LOR' are treated as being equal to the reported LOR. Note: TEQ 1/2LOR and TEQ LOR will calculate as 0.6mg/Kg and 1.2mg/Kg respectively for samples with non-detects for all of the eight TEQ PAHs.
- EP080: Particular sample EM-1908628-005 shows minor BTEX hits. Confirmed by re-analysis.

Page : 3 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH01 0.5-0.6	BH01 1.4-1.5	BH02 0.5-0.6	BH02 1.4-1.5	BH03 0.5-0.6
			Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit	EM1908628-001	EM1908628-002	EM1908628-003	EM1908628-004	EM1908628-005
				Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract								
pH (CaCl2)	----	0.1	pH Unit	7.7	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	18.8	44.2	9.7	41.6	19.0
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	18	8	13	10	307
Barium	7440-39-3	10	mg/kg	240	80	160	40	580
Beryllium	7440-41-7	1	mg/kg	<1	2	<1	2	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	4	<1	2	<1	2
Chromium	7440-47-3	2	mg/kg	65	65	39	64	38
Cobalt	7440-48-4	2	mg/kg	12	16	10	7	10
Copper	7440-50-8	5	mg/kg	411	46	1850	19	379
Lead	7439-92-1	5	mg/kg	228	23	167	11	550
Manganese	7439-96-5	5	mg/kg	377	176	622	81	462
Nickel	7440-02-0	2	mg/kg	47	68	45	25	42
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	40	53	20	78	29
Zinc	7440-66-6	5	mg/kg	283	77	345	49	436
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	<0.1	0.2
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	0.8
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	0.7
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Page : 4 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH01 0.5-0.6	BH01 1.4-1.5	BH02 0.5-0.6	BH02 1.4-1.5	BH03 0.5-0.6
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-001	EM1908628-002	EM1908628-003	EM1908628-004	EM1908628-005
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	1.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	0.6	0.6	0.6	0.6
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	1.2	1.2	1.2	1.2
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		1170	1100	630	<100	390
C29 - C36 Fraction	----	100	mg/kg		710	750	340	<100	300
^ C10 - C36 Fraction (sum)	----	50	mg/kg		1880	1850	970	<50	690
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	110	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		1620	1540	840	<100	580
>C34 - C40 Fraction	----	100	mg/kg		280	320	130	<100	140
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		1900	1970	970	<50	720
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	110	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	0.3
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	0.3
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		69.6	96.8	71.9	92.5	81.8

Page	: 5 of 18
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH01 0.5-0.6	BH01 1.4-1.5	BH02 0.5-0.6	BH02 1.4-1.5	BH03 0.5-0.6
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-001	EM1908628-002	EM1908628-003	EM1908628-004	EM1908628-005
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		68.3	97.6	71.0	93.7	81.4
2.4.6-Tribromophenol	118-79-6	0.5	%		45.1	93.5	50.9	86.1	67.3
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		104	108	104	103	107
Anthracene-d10	1719-06-8	0.5	%		103	120	107	115	109
4-Terphenyl-d14	1718-51-0	0.5	%		105	118	105	110	108
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		124	60.8	71.4	63.9	80.2
Toluene-D8	2037-26-5	0.2	%		107	57.2	63.8	60.8	74.8
4-Bromofluorobenzene	460-00-4	0.2	%		123	72.0	76.6	82.2	81.2

Page : 6 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH03 1.4-1.5	BH04 0.5-0.6	BH04 1.4-1.5	BH05 0.5-0.6	BH05 1.4-1.5
			Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit	EM1908628-006	EM1908628-007	EM1908628-008	EM1908628-009	EM1908628-010
				Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract								
pH (CaCl2)	----	0.1	pH Unit	5.6	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	40.3	16.7	42.5	14.3	39.8
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	11	18	10	31	8
Barium	7440-39-3	10	mg/kg	20	50	20	50	20
Beryllium	7440-41-7	1	mg/kg	2	<1	2	<1	2
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	<1	<1	<1
Chromium	7440-47-3	2	mg/kg	58	7	63	10	76
Cobalt	7440-48-4	2	mg/kg	11	4	8	5	11
Copper	7440-50-8	5	mg/kg	23	86	19	159	16
Lead	7439-92-1	5	mg/kg	15	119	10	229	9
Manganese	7439-96-5	5	mg/kg	69	187	68	147	95
Nickel	7440-02-0	2	mg/kg	33	10	25	16	31
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	64	12	69	17	66
Zinc	7440-66-6	5	mg/kg	57	136	48	206	51
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	<0.1	0.2	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Page : 7 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH03 1.4-1.5	BH04 0.5-0.6	BH04 1.4-1.5	BH05 0.5-0.6	BH05 1.4-1.5
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-006	EM1908628-007	EM1908628-008	EM1908628-009	EM1908628-010
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.6**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
C29 - C36 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		<100	<100	<100	**130**	<100
>C34 - C40 Fraction	----	100	mg/kg		<100	<100	<100	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	<50	<50	**130**	<50
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**94.6**	**63.5**	**95.0**	**75.8**	**94.8**

Page : 8 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH03 1.4-1.5	BH04 0.5-0.6	BH04 1.4-1.5	BH05 0.5-0.6	BH05 1.4-1.5
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-006	EM1908628-007	EM1908628-008	EM1908628-009	EM1908628-010
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		95.5	65.0	96.3	77.0	95.8
2.4.6-Tribromophenol	118-79-6	0.5	%		93.8	42.6	82.3	56.8	83.9
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		106	103	103	110	106
Anthracene-d10	1719-06-8	0.5	%		118	101	120	109	119
4-Terphenyl-d14	1718-51-0	0.5	%		114	104	111	109	112
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		67.4	70.1	60.6	67.7	65.3
Toluene-D8	2037-26-5	0.2	%		65.9	64.0	59.2	62.6	64.8
4-Bromofluorobenzene	460-00-4	0.2	%		80.9	75.4	78.0	76.2	79.8

Page : 9 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH06 0.5-0.6	BH06 1.4-1.5	BH07 0.5-0.6	BH07 1.4-1.5	BH08 0.5-0.6
			Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit	EM1908628-011	EM1908628-012	EM1908628-013	EM1908628-014	EM1908628-015
				Result	Result	Result	Result	Result
EA001: pH in soil using 0.01M CaCl extract								
pH (CaCl2)	----	0.1	pH Unit	6.3	5.4	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	19.8	41.6	27.4	39.5	18.6
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	24	8	48	9	40
Barium	7440-39-3	10	mg/kg	80	20	160	20	60
Beryllium	7440-41-7	1	mg/kg	<1	2	<1	2	<1
Boron	7440-42-8	50	mg/kg	<50	<50	<50	<50	<50
Cadmium	7440-43-9	1	mg/kg	<1	<1	1	<1	<1
Chromium	7440-47-3	2	mg/kg	19	64	16	66	6
Cobalt	7440-48-4	2	mg/kg	5	8	9	19	4
Copper	7440-50-8	5	mg/kg	166	18	2280	22	62
Lead	7439-92-1	5	mg/kg	211	11	364	11	74
Manganese	7439-96-5	5	mg/kg	205	64	461	100	120
Nickel	7440-02-0	2	mg/kg	21	32	35	50	11
Selenium	7782-49-2	5	mg/kg	<5	<5	<5	<5	<5
Vanadium	7440-62-2	5	mg/kg	46	69	19	60	11
Zinc	7440-66-6	5	mg/kg	125	52	353	65	63
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	<0.1	2.3	<0.1	<0.1
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	0.9	<0.5	<0.5
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	1.0	<0.5	<0.5
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	0.5	<0.5	<0.5
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	0.6	<0.5	<0.5
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	<0.5	<0.5	<0.5

Page : 10 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH06 0.5-0.6	BH06 1.4-1.5	BH07 0.5-0.6	BH07 1.4-1.5	BH08 0.5-0.6
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-011	EM1908628-012	EM1908628-013	EM1908628-014	EM1908628-015
					Result	Result	Result	Result	Result
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	**3.0**	<0.5	<0.5
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	**0.7**	**0.6**	**0.6**
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	**1.2**	**1.2**	**1.2**
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	<10	<10	<10
C10 - C14 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
C15 - C28 Fraction	----	100	mg/kg		**290**	<100	**610**	<100	<100
C29 - C36 Fraction	----	100	mg/kg		**290**	<100	**520**	<100	**110**
^ C10 - C36 Fraction (sum)	----	50	mg/kg		**580**	<50	**1130**	<50	**110**
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	<10	<10	<10
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	<10	<10	<10
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	<50	<50	<50
>C16 - C34 Fraction	----	100	mg/kg		**480**	<100	**980**	<100	**150**
>C34 - C40 Fraction	----	100	mg/kg		**140**	<100	**210**	<100	<100
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		**620**	<50	**1190**	<50	**150**
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	<50	<50	<50
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	<0.2	<0.2	<0.2
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	<0.5	<0.5	<0.5
Naphthalene	91-20-3	1	mg/kg		<1	<1	<1	<1	<1
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**66.6**	**97.2**	**74.4**	**96.6**	**70.1**

Page	: 11 of 18
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH06 0.5-0.6	BH06 1.4-1.5	BH07 0.5-0.6	BH07 1.4-1.5	BH08 0.5-0.6
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00
Compound	CAS Number	LOR	Unit		EM1908628-011	EM1908628-012	EM1908628-013	EM1908628-014	EM1908628-015
					Result	Result	Result	Result	Result
EP075(SIM)S: Phenolic Compound Surrogates - Continued									
2-Chlorophenol-D4	93951-73-6	0.5	%		69.6	98.7	76.9	97.9	70.7
2.4.6-Tribromophenol	118-79-6	0.5	%		52.8	93.3	64.3	91.4	55.6
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		104	108	107	109	103
Anthracene-d10	1719-06-8	0.5	%		106	122	115	124	104
4-Terphenyl-d14	1718-51-0	0.5	%		108	116	112	116	105
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		68.4	71.5	65.0	70.1	66.4
Toluene-D8	2037-26-5	0.2	%		65.0	66.4	59.6	67.0	61.7
4-Bromofluorobenzene	460-00-4	0.2	%		76.2	81.1	72.9	86.9	74.3

Page : 12 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	BH08 1.4-1.5	Duplicate	----	----	----
			Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit	EM1908628-016	EM1908628-017	--------	--------	--------
				Result	Result	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	40.3	15.2	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	12	29	----	----	----
Barium	7440-39-3	10	mg/kg	30	100	----	----	----
Beryllium	7440-41-7	1	mg/kg	1	<1	----	----	----
Boron	7440-42-8	50	mg/kg	<50	<50	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	<1	----	----	----
Chromium	7440-47-3	2	mg/kg	66	16	----	----	----
Cobalt	7440-48-4	2	mg/kg	8	7	----	----	----
Copper	7440-50-8	5	mg/kg	14	259	----	----	----
Lead	7439-92-1	5	mg/kg	11	238	----	----	----
Manganese	7439-96-5	5	mg/kg	74	227	----	----	----
Nickel	7440-02-0	2	mg/kg	25	27	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	<5	----	----	----
Vanadium	7440-62-2	5	mg/kg	82	21	----	----	----
Zinc	7440-66-6	5	mg/kg	50	158	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	0.2	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	<0.5	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	<0.5	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	<0.5	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	<0.5	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	<0.5	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	<0.5	----	----	----

Page : 13 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH08 1.4-1.5	Duplicate	----	----	----
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM1908628-016	EM1908628-017	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		**0.6**	**0.6**	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		**1.2**	**1.2**	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	<10	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	<50	----	----	----
C15 - C28 Fraction	----	100	mg/kg		<100	**380**	----	----	----
C29 - C36 Fraction	----	100	mg/kg		<100	**380**	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		<50	**760**	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	<10	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	<10	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	<50	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		<100	**620**	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		<100	**190**	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		<50	**810**	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	<50	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	<0.2	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	<0.5	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	<0.5	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	<0.5	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	<0.5	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	<0.2	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	<0.5	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	<1	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		**93.2**	**64.8**	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		**93.1**	**69.8**	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		**87.0**	**60.1**	----	----	----

Page : 14 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	BH08 1.4-1.5	Duplicate	----	----	----
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	----	----	----
Compound	CAS Number	LOR	Unit		EM1908628-016	EM1908628-017	--------	--------	--------
					Result	Result	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		103	105	----	----	----
Anthracene-d10	1719-06-8	0.5	%		123	107	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		114	107	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		62.9	66.9	----	----	----
Toluene-D8	2037-26-5	0.2	%		60.1	58.9	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		73.9	68.6	----	----	----

Page : 15 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)				Client sample ID	Rinsate	----	----	----	----
				Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		EM1908628-018	--------	--------	--------	--------
					Result	----	----	----	----
EG020F: Dissolved Metals by ICP-MS									
Arsenic	7440-38-2	0.001	mg/L		<0.001	----	----	----	----
Boron	7440-42-8	0.05	mg/L		<0.05	----	----	----	----
Barium	7440-39-3	0.001	mg/L		<0.001	----	----	----	----
Beryllium	7440-41-7	0.001	mg/L		<0.001	----	----	----	----
Cadmium	7440-43-9	0.0001	mg/L		<0.0001	----	----	----	----
Cobalt	7440-48-4	0.001	mg/L		<0.001	----	----	----	----
Chromium	7440-47-3	0.001	mg/L		<0.001	----	----	----	----
Copper	7440-50-8	0.001	mg/L		<0.001	----	----	----	----
Manganese	7439-96-5	0.001	mg/L		<0.001	----	----	----	----
Nickel	7440-02-0	0.001	mg/L		<0.001	----	----	----	----
Lead	7439-92-1	0.001	mg/L		<0.001	----	----	----	----
Selenium	7782-49-2	0.01	mg/L		<0.01	----	----	----	----
Vanadium	7440-62-2	0.01	mg/L		<0.01	----	----	----	----
Zinc	7440-66-6	0.005	mg/L		<0.005	----	----	----	----
EG035F: Dissolved Mercury by FIMS									
Mercury	7439-97-6	0.0001	mg/L		<0.0001	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons									
Naphthalene	91-20-3	1.0	µg/L		<1.0	----	----	----	----
Acenaphthylene	208-96-8	1.0	µg/L		<1.0	----	----	----	----
Acenaphthene	83-32-9	1.0	µg/L		<1.0	----	----	----	----
Fluorene	86-73-7	1.0	µg/L		<1.0	----	----	----	----
Phenanthrene	85-01-8	1.0	µg/L		<1.0	----	----	----	----
Anthracene	120-12-7	1.0	µg/L		<1.0	----	----	----	----
Fluoranthene	206-44-0	1.0	µg/L		<1.0	----	----	----	----
Pyrene	129-00-0	1.0	µg/L		<1.0	----	----	----	----
Benz(a)anthracene	56-55-3	1.0	µg/L		<1.0	----	----	----	----
Chrysene	218-01-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(k)fluoranthene	207-08-9	1.0	µg/L		<1.0	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	µg/L		<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	1.0	µg/L		<1.0	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	1.0	µg/L		<1.0	----	----	----	----
Benzo(g.h.i)perylene	191-24-2	1.0	µg/L		<1.0	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	µg/L		<0.5	----	----	----	----

Page : 16 of 18
Work Order : EM1908628
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: WATER (Matrix: WATER)			Client sample ID	Rinsate	----	----	----	----
			Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	EM1908628-018	--------	--------	--------	--------
				Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued								
^ Benzo(a)pyrene TEQ (zero)	----	0.5	µg/L	<0.5	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons								
C6 - C9 Fraction	----	20	µg/L	<20	----	----	----	----
C10 - C14 Fraction	----	50	µg/L	<50	----	----	----	----
C15 - C28 Fraction	----	100	µg/L	<100	----	----	----	----
C29 - C36 Fraction	----	50	µg/L	<50	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	µg/L	<50	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions								
C6 - C10 Fraction	C6_C10	20	µg/L	<20	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	20	µg/L	<20	----	----	----	----
>C10 - C16 Fraction	----	100	µg/L	<100	----	----	----	----
>C16 - C34 Fraction	----	100	µg/L	<100	----	----	----	----
>C34 - C40 Fraction	----	100	µg/L	<100	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	100	µg/L	<100	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	100	µg/L	<100	----	----	----	----
EP080: BTEXN								
Benzene	71-43-2	1	µg/L	<1	----	----	----	----
Toluene	108-88-3	2	µg/L	<2	----	----	----	----
Ethylbenzene	100-41-4	2	µg/L	<2	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	2	µg/L	<2	----	----	----	----
ortho-Xylene	95-47-6	2	µg/L	<2	----	----	----	----
^ Total Xylenes	----	2	µg/L	<2	----	----	----	----
^ Sum of BTEX	----	1	µg/L	<1	----	----	----	----
Naphthalene	91-20-3	5	µg/L	<5	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates								
Phenol-d6	13127-88-3	1.0	%	27.9	----	----	----	----
2-Chlorophenol-D4	93951-73-6	1.0	%	59.5	----	----	----	----
2.4.6-Tribromophenol	118-79-6	1.0	%	89.4	----	----	----	----
EP075(SIM)T: PAH Surrogates								
2-Fluorobiphenyl	321-60-8	1.0	%	83.6	----	----	----	----
Anthracene-d10	1719-06-8	1.0	%	87.1	----	----	----	----
4-Terphenyl-d14	1718-51-0	1.0	%	89.2	----	----	----	----

Page	: 17 of 18
Work Order	: EM1908628
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: **WATER** (Matrix: **WATER**)				Client sample ID	**Rinsate**	----	----	----	----
				Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EM1908628-018**	--------	--------	--------	--------
					Result	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	2	%		**97.0**	----	----	----	----
Toluene-D8	2037-26-5	2	%		**98.4**	----	----	----	----
4-Bromofluorobenzene	460-00-4	2	%		**102**	----	----	----	----

Surrogate Control Limits

Sub-Matrix: SOIL		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	54	125
2-Chlorophenol-D4	93951-73-6	65	123
2.4.6-Tribromophenol	118-79-6	34	122
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	61	125
Anthracene-d10	1719-06-8	62	130
4-Terphenyl-d14	1718-51-0	67	133
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	51	125
Toluene-D8	2037-26-5	55	125
4-Bromofluorobenzene	460-00-4	56	124

Sub-Matrix: WATER		Recovery Limits (%)	
Compound	CAS Number	Low	High
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	10	46
2-Chlorophenol-D4	93951-73-6	23	104
2.4.6-Tribromophenol	118-79-6	28	130
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	36	114
Anthracene-d10	1719-06-8	51	119
4-Terphenyl-d14	1718-51-0	49	127
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	129
Toluene-D8	2037-26-5	70	125
4-Bromofluorobenzene	460-00-4	71	129

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **ES1917553**	Page	: 1 of 6
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Sydney
Contact	: DR JOHN PAUL CUMMING	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 277-289 Woodpark Road Smithfield NSW Australia 2164
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 06-Jun-2019 13:00
Order number	:	Date Analysis Commenced	: 11-Jun-2019
C-O-C number	: ----	Issue Date	: 14-Jun-2019 19:45
Sampler	: JPC		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 1		
No. of samples analysed	: 1		

ilac-MRA NATA

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

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

RIGHT SOLUTIONS | RIGHT PARTNER

Page	:	2 of 6
Work Order	:	ES1917553
Client	:	GEO-ENVIRONMENTAL SOLUTIONS
Project	:	Building 3

General Comments

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

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

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

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

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

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

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

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

Page : 3 of 6
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)			Client sample ID	INTER LAB SPLIT	----	----	----	----
			Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit	ES1917553-001	--------	--------	--------	--------
				Result	----	----	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	1.0	%	**16.6**	----	----	----	----
EG005(ED093)T: Total Metals by ICP-AES								
Arsenic	7440-38-2	5	mg/kg	**20**	----	----	----	----
Barium	7440-39-3	10	mg/kg	**70**	----	----	----	----
Beryllium	7440-41-7	1	mg/kg	<1	----	----	----	----
Boron	7440-42-8	50	mg/kg	<50	----	----	----	----
Cadmium	7440-43-9	1	mg/kg	<1	----	----	----	----
Chromium	7440-47-3	2	mg/kg	**18**	----	----	----	----
Cobalt	7440-48-4	2	mg/kg	**6**	----	----	----	----
Copper	7440-50-8	5	mg/kg	**179**	----	----	----	----
Lead	7439-92-1	5	mg/kg	**191**	----	----	----	----
Manganese	7439-96-5	5	mg/kg	**213**	----	----	----	----
Nickel	7440-02-0	2	mg/kg	**25**	----	----	----	----
Selenium	7782-49-2	5	mg/kg	<5	----	----	----	----
Vanadium	7440-62-2	5	mg/kg	**28**	----	----	----	----
Zinc	7440-66-6	5	mg/kg	**112**	----	----	----	----
EG035T: Total Recoverable Mercury by FIMS								
Mercury	7439-97-6	0.1	mg/kg	<0.1	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons								
Naphthalene	91-20-3	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthylene	208-96-8	0.5	mg/kg	<0.5	----	----	----	----
Acenaphthene	83-32-9	0.5	mg/kg	<0.5	----	----	----	----
Fluorene	86-73-7	0.5	mg/kg	<0.5	----	----	----	----
Phenanthrene	85-01-8	0.5	mg/kg	<0.5	----	----	----	----
Anthracene	120-12-7	0.5	mg/kg	<0.5	----	----	----	----
Fluoranthene	206-44-0	0.5	mg/kg	<0.5	----	----	----	----
Pyrene	129-00-0	0.5	mg/kg	<0.5	----	----	----	----
Benz(a)anthracene	56-55-3	0.5	mg/kg	<0.5	----	----	----	----
Chrysene	218-01-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(b+j)fluoranthene	205-99-2 205-82-3	0.5	mg/kg	<0.5	----	----	----	----
Benzo(k)fluoranthene	207-08-9	0.5	mg/kg	<0.5	----	----	----	----
Benzo(a)pyrene	50-32-8	0.5	mg/kg	<0.5	----	----	----	----
Indeno(1.2.3.cd)pyrene	193-39-5	0.5	mg/kg	<0.5	----	----	----	----
Dibenz(a.h)anthracene	53-70-3	0.5	mg/kg	<0.5	----	----	----	----

Page : 4 of 6
Work Order : ES1917553
Client : GEO-ENVIRONMENTAL SOLUTIONS
Project : Building 3

Analytical Results

Sub-Matrix: SOIL (Matrix: SOIL)				Client sample ID	INTER LAB SPLIT	----	----	----	----
				Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	CAS Number	LOR	Unit		ES1917553-001	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)B: Polynuclear Aromatic Hydrocarbons - Continued									
Benzo(g.h.i)perylene	191-24-2	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of polycyclic aromatic hydrocarbons	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (zero)	----	0.5	mg/kg		<0.5	----	----	----	----
^ Benzo(a)pyrene TEQ (half LOR)	----	0.5	mg/kg		0.6	----	----	----	----
^ Benzo(a)pyrene TEQ (LOR)	----	0.5	mg/kg		1.2	----	----	----	----
EP080/071: Total Petroleum Hydrocarbons									
C6 - C9 Fraction	----	10	mg/kg		<10	----	----	----	----
C10 - C14 Fraction	----	50	mg/kg		<50	----	----	----	----
C15 - C28 Fraction	----	100	mg/kg		220	----	----	----	----
C29 - C36 Fraction	----	100	mg/kg		220	----	----	----	----
^ C10 - C36 Fraction (sum)	----	50	mg/kg		440	----	----	----	----
EP080/071: Total Recoverable Hydrocarbons - NEPM 2013 Fractions									
C6 - C10 Fraction	C6_C10	10	mg/kg		<10	----	----	----	----
^ C6 - C10 Fraction minus BTEX (F1)	C6_C10-BTEX	10	mg/kg		<10	----	----	----	----
>C10 - C16 Fraction	----	50	mg/kg		<50	----	----	----	----
>C16 - C34 Fraction	----	100	mg/kg		360	----	----	----	----
>C34 - C40 Fraction	----	100	mg/kg		120	----	----	----	----
^ >C10 - C40 Fraction (sum)	----	50	mg/kg		480	----	----	----	----
^ >C10 - C16 Fraction minus Naphthalene (F2)	----	50	mg/kg		<50	----	----	----	----
EP080: BTEXN									
Benzene	71-43-2	0.2	mg/kg		<0.2	----	----	----	----
Toluene	108-88-3	0.5	mg/kg		<0.5	----	----	----	----
Ethylbenzene	100-41-4	0.5	mg/kg		<0.5	----	----	----	----
meta- & para-Xylene	108-38-3 106-42-3	0.5	mg/kg		<0.5	----	----	----	----
ortho-Xylene	95-47-6	0.5	mg/kg		<0.5	----	----	----	----
^ Sum of BTEX	----	0.2	mg/kg		<0.2	----	----	----	----
^ Total Xylenes	----	0.5	mg/kg		<0.5	----	----	----	----
Naphthalene	91-20-3	1	mg/kg		<1	----	----	----	----
EP075(SIM)S: Phenolic Compound Surrogates									
Phenol-d6	13127-88-3	0.5	%		81.7	----	----	----	----
2-Chlorophenol-D4	93951-73-6	0.5	%		81.5	----	----	----	----
2.4.6-Tribromophenol	118-79-6	0.5	%		60.1	----	----	----	----

Page	: 5 of 6
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)				Client sample ID	**INTER LAB SPLIT**	----	----	----	----
				Client sampling date / time	31-May-2019 00:00	----	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**ES1917553-001**	--------	--------	--------	--------
					Result	----	----	----	----
EP075(SIM)T: PAH Surrogates									
2-Fluorobiphenyl	321-60-8	0.5	%		**104**	----	----	----	----
Anthracene-d10	1719-06-8	0.5	%		**87.2**	----	----	----	----
4-Terphenyl-d14	1718-51-0	0.5	%		**110**	----	----	----	----
EP080S: TPH(V)/BTEX Surrogates									
1.2-Dichloroethane-D4	17060-07-0	0.2	%		**104**	----	----	----	----
Toluene-D8	2037-26-5	0.2	%		**98.6**	----	----	----	----
4-Bromofluorobenzene	460-00-4	0.2	%		**76.4**	----	----	----	----

Page	: 6 of 6
Work Order	: ES1917553
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP075(SIM)S: Phenolic Compound Surrogates			
Phenol-d6	13127-88-3	63	123
2-Chlorophenol-D4	93951-73-6	66	122
2.4.6-Tribromophenol	118-79-6	40	138
EP075(SIM)T: PAH Surrogates			
2-Fluorobiphenyl	321-60-8	70	122
Anthracene-d10	1719-06-8	66	128
4-Terphenyl-d14	1718-51-0	65	129
EP080S: TPH(V)/BTEX Surrogates			
1.2-Dichloroethane-D4	17060-07-0	73	133
Toluene-D8	2037-26-5	74	132
4-Bromofluorobenzene	460-00-4	72	130

ALS Environmental

CERTIFICATE OF ANALYSIS

Work Order	: **EM1909096**	Page	: 1 of 5
Client	: **GEO-ENVIRONMENTAL SOLUTIONS**	Laboratory	: Environmental Division Melbourne
Contact	: SARAH JOYCE	Contact	: Shirley LeCornu
Address	: 29 KIRKSWAY PLACE BATTERY POINT TASMANIA, AUSTRALIA 7004	Address	: 4 Westall Rd Springvale VIC Australia 3171
Telephone	: +61 03 6223 1839	Telephone	: +6138549 9630
Project	: Building 3	Date Samples Received	: 04-Jun-2019 09:35
Order number	:	Date Analysis Commenced	: 14-Jun-2019
C-O-C number	: ----	Issue Date	: 20-Jun-2019 18:46
Sampler	: ----		
Site	: ----		
Quote number	: EN/222		
No. of samples received	: 3		
No. of samples analysed	: 3		

ilac-MRA NATA

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

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

This Certificate of Analysis contains the following information:

- General Comments
- Analytical Results
- Surrogate Control Limits

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

Signatories

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

Signatories	*Position*	*Accreditation Category*
Dilani Fernando	Senior Inorganic Chemist	Melbourne Inorganics, Springvale, VIC
Nancy Wang	2IC Organic Chemist	Melbourne Inorganics, Springvale, VIC
Nancy Wang	2IC Organic Chemist	Melbourne Organics, Springvale, VIC

RIGHT SOLUTIONS | RIGHT PARTNER

Page	:	2 of 5
Work Order	:	EM1909096
Client	:	GEO-ENVIRONMENTAL SOLUTIONS
Project	:	Building 3

General Comments

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

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

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

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

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

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

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

Page	: 3 of 5
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: **SOIL** (Matrix: **SOIL**)			Client sample ID	**BH01 1.4-1.5**	**BH07 0.5-0.6**	**BH03 0.5-0.6**	----	----
			Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	31-May-2019 00:00	----	----
Compound	*CAS Number*	*LOR*	*Unit*	**EM1909096-001**	**EM1909096-002**	**EM1909096-003**	--------	--------
				Result	Result	Result	----	----
EA055: Moisture Content (Dried @ 105-110°C)								
Moisture Content	----	0.1	%	**45.1**	**25.8**	----	----	----
EK026SF: Total CN by Segmented Flow Analyser								
Total Cyanide	57-12-5	1	mg/kg	<1	**2**	----	----	----
EN33: TCLP Leach								
Initial pH	----	0.1	pH Unit	----	**7.1**	**8.0**	----	----
After HCl pH	----	0.1	pH Unit	----	**1.1**	**1.1**	----	----
Extraction Fluid Number	----	1	-	----	**1**	**1**	----	----
Final pH	----	0.1	pH Unit	----	**5.0**	**5.3**	----	----
EP066: Polychlorinated Biphenyls (PCB)								
Total Polychlorinated biphenyls	----	0.1	mg/kg	<0.1	<0.1	----	----	----
EP066S: PCB Surrogate								
Decachlorobiphenyl	2051-24-3	0.1	%	**94.4**	**97.7**	----	----	----

Page	: 4 of 5
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Analytical Results

Sub-Matrix: **TCLP LEACHATE** (Matrix: **WATER**)				Client sample ID	**BH07 0.5-0.6**	**BH03 0.5-0.6**	----	----	----
				Client sampling date / time	31-May-2019 00:00	31-May-2019 00:00	----	----	----
Compound	*CAS Number*	*LOR*	*Unit*		**EM1909096-002**	**EM1909096-003**	--------	--------	--------
					Result	Result	----	----	----
EG005(ED093)C: Leachable Metals by ICPAES									
Arsenic	7440-38-2	0.1	mg/L		----	<0.1	----	----	----
Copper	7440-50-8	0.1	mg/L		**0.3**	----	----	----	----

Page	: 5 of 5
Work Order	: EM1909096
Client	: GEO-ENVIRONMENTAL SOLUTIONS
Project	: Building 3

Surrogate Control Limits

Sub-Matrix: **SOIL**		Recovery Limits (%)	
Compound	*CAS Number*	*Low*	*High*
EP066S: PCB Surrogate			
Decachlorobiphenyl	2051-24-3	36	140